INSTRUCTION MANUAL

MODEL 143
20 MHz FUNCTION GENERATOR

WAVETEK

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20 MHz FUNCTION GENERATOR

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WARRANTY

All Wavetek instruments are warranteed against defects in material and workmanship for a period of one year after date of manufacture. Wavetek agrees to repair or replace any assembly or component (except batteries) found to be defective, under normal use, during this period. Wavetek's obligation under this warranty is limited solely to repairing any such instrument which in Wavetek's sole opinion proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Transportation to the factory or service center is to be prepaid by purchaser. Shipment should not be made without prior authorization by Wavetek.

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CONTENTS

SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.

SECTION 1
GENERAL DESCRIPTION

1.1 THE MODEL 143

The Model 143 20 MHz Function Generator is a precision source of sine, triangle and square waveforms, negative and positive pulses and dc levels. All are front panel and external control variable from 0.0001 Hz to 20 MHz and can be modulated, swept or dc controlled over a 1000:1 range by an external voltage. Output can be continuous or the generator can be triggered or gated by an external voltage or front panel switch.

The waveform amplitude can be varied up to 30 volts peak-to-peak (open circuit) and attenuated up to 80 dB. Pulse amplitude can be varied from ±15 volts peak (open circuit). DC voltage or dc offset of signal is variable by front panel control and by external control between ±15 volts (open circuit). Waveform symmetry is variable from 19:1 to 1:19 for control of duty cycle and ramp rise/fall times. Triggered waveform start/stop point is adjustable for creation of special waveforms such as the haversine. A voltage representing generator frequency and a TTL level sync pulse at the frequency of the generator are auxiliary outputs.

1.2 SPECIFICATIONS

1.2.1 Versatility

Waveforms
Selectable sine ∿, square ⊓, triangle △, positive square ⎍, negative square ⎌, TTL sync pulse and dc. Symmetry of waveforms may be varied for sawtooth and variable duty cycle pulses.

Operational Modes
Continuous: Generator oscillates continuously at selected frequency.

Triggered: Generator is quiescent until triggered by an external signal or manual trigger, then generates one cycle at selected frequency.

Gated: As triggered mode, except generator oscillates for the duration of the gate signal.

Frequency Range
0.0001 Hz to 20 MHz in 10 overlapping ranges with 1% vernier control.

Function Output
∿, ⊓, △ selectable and variable to 30V p-p (15V p-p into 50Ω). ⎍, ⎌, to 15 Vp (7.5 Vp into 50Ω). All waveforms and dc can supply 150 mA peak current and may be attenuated to 60 dB in 20 dB steps with an additional 20 dB vernier.

DC Output and DC Offset
Selectable thru FUNCTION OUT output. Controlled by front panel control or by applying an external voltage. Adjustable between ±15 Vdc (±7.5 Vdc into 50Ω) with signal peak plus offset limited to ±15 Vdc (±7.5 Vdc into 50Ω). External offset sensitivity approximately −1 V/V with output into open circuit. DC offset and output waveform attenuated proportionately by the 60 dB output attenuator.

Sync Output
A TTL level pulse. Will drive 50Ω termination.

GCV — Generator Controlled Voltage
At GCV OUT connector, a 0 to +2V signal proportional to generator frequency. 600Ω source impedance.

VCG — Voltage Controlled Generator
Up to 1000:1 frequency change with external 0 to 2 volt signal to VCG IN connector. Upper and lower frequencies limited to maximum and minimum of selected range.
Slew rate: 2% of range per μs.
Linearity:
±0.2% for 10 Hz to 100 kHz.
±0.75% for 0.001 Hz to 2 MHz.
Input Impedance: 2 kΩ.

Trigger and Gate
Input Range: 1V p-p to ±10V.
Impedance: 10 kΩ, 33 pF.
Pulse Width: 25 ns minimum.
Repetition Rate: 10 MHz maximum.
Adjustable Triggered Signal Start/Stop Point (sine and triangle only): Approximately −90° to +90° to 2 MHz.

Symmetry
Symmetry of all waveform outputs is continuously adjustable from 1:19 to 19:1. Varying symmetry provides variable duty cycle pulses, sawtooth ramps and distorted sine waves.

NOTE

When SYMMETRY control is used, indicated frequency is divided by approximately 10.

1.2.2 Frequency Precision

Dial Accuracy
±3% of full range from X .01 Hz to X 1 MHz.
±5% of full range on X 10 MHz.

Time Symmetry
Square wave variation less than:
±1% from 0.001 Hz to 200 kHz
±0.5% from 20 Hz to 20 kHz

1.2.3 Amplitude Precision

Amplitude Change With Frequency
Sine variation less than:
0.1 dB for 0.001 Hz to 200 kHz
0.5 dB for 200 kHz to 2 MHz
3.0 dB for 2 to 20 MHz

Step Attenuator Accuracy
0.3 dB per 20 dB step at 2 kHz.

1.2.4 Waveform Characteristics

Sine Distortion
< 0.5% on X 100 Hz to X 10 kHz.
< 1.0% on X .01 to X 10 Hz and X 100 kHz.
All harmonics 34 dB below fundamental on X 1 MHz.
All harmonics 26 dB below fundamental on X 10 MHz.

Square Wave Rise/Fall Times
At FUNCTION OUT < 20 ns for 15V p-p output into 50Ω load.

1.2.5 General

Stability
Short Term: ±0.05% for 10 minutes.
Long Term: ±0.25% for 24 hours.
Percentages apply to amplitude, frequency and dc offset.

Environmental
Specifications apply at 25°C ±5°C. Instrument will operate from 0°C to 50°C ambient temperatures.

Dimensions
28.6 cm (11¼ in.) wide; 13.3 cm (15¼ in.) high; 27.3 cm (10¾ in.) deep.

Weight
5 kg (11 lb) net; 6.6 kg (14½ lb) shipping.

Power
90 to 105V, 108 to 126V, 198 to 231V and 216 to 252V selectable; 48 to 400 Hz; less than 30 watts.

NOTE

All specifications apply from 10 to 100% of a selected frequency range, when FUNCTION OUT is at maximum and 50Ω terminated, with SYMMETRY control at OFF. Symmetry and vernier affect frequency calibration. Maximum possible asymmetry is a function of frequency setting.

SECTION 2
INSTALLATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

WARNING

To preclude injury or death due to shock, the third wire earth ground must be continuous to the facility power outlet. Before connecting to the facility power outlet, examine extension cords, autotransformers, etc., between the instrument and the facility power outlet for a continuous earth ground path. The earth ground path can be identified at the plug on the instrument power cord; of the three terminals, the earth ground terminal is the nonmatching shape, usually cylindrical.

CAUTION

To prevent damage to the instrument, check for proper match of line and instrument voltage and proper fuse type and rating.

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 108 to 132 Vac line supply and with a 0.5 amp slow blow fuse.

Conversion to other input voltages requires a change in rear panel fuse-holder voltage card position and slow blow fuse according to the following table and procedure.

Card Position	Input Vac	Fuse
100	90 to 105	0.5 amp
120	108 to 126	0.5 amp
220	198 to 231	0.25 amp
240	216 to 252	0.25 amp

1. Open fuse holder cover door and rotate fuse pull to left to remove the fuse.
2. Select operating voltage by orienting the printed circuit board to position the desired voltage on the top left side. Push the board firmly into its module slot.
3. Rotate the fuse-pull back into the normal position and insert the correct fuse into the fuse holder. Close the cover door.
4. Connect the ac line cord to the mating connector at the rear of the unit and the power source.

2.2.2 Signal Connections

Use 3 foot RG58U 50Ω shielded cables equipped with female BNC connectors to distribute all input and output signals.

2.3 ELECTRICAL ACCEPTANCE CHECK

This checkout procedure is a general verification of generator operation. Should a malfunction be found, refer to the warranty in the front of this manual.

A two channel oscilloscope, four 3 foot 50Ω coax cables with female BNC connectors, a coax tee connector and a function generator are required for this procedure.

Preset the generator front panel controls as follows:

Control	Position
Dial	1.0
GENERATOR MODE	CONT
TRIGGER LEVEL	9 o'clock
TRIGGER START/STOP	0° CAL
ATTENUATION	0
ATTENUATION VERNIER	Full cw
FUNCTION	⊓
DC OFFSET	OFF
SYMMETRY	OFF
FREQUENCY MULT	1K
VERNIER	Full cw

Set up the oscilloscope, Model 143 and external generator as shown in figure 2-1.

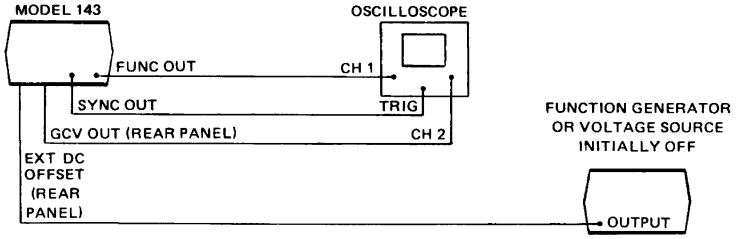


Figure 2-1. Initial Setup

Table 2-1. Acceptance Procedure

Step	Control	Position/Operation	Observe
1	POWER	ON	1 kHz square wave.
2	Dial	Rotate dial. Return to 1.0.	Rotation ccw increases frequency of square on one channel and dc level on other channel; cw decreases frequency and dc level.
3	FREQUENCY MULT	Rotate switch. Return to 1K.	Rotation cw increases frequency; ccw decreases frequency (dc level not affected).
4	VERNIER	Rotate ccw. Return to CAL.	Rotation ccw gives a small decrease in frequency.
5	ATTENUATION	Rotate ccw. Return to 0.	Rotation ccw reduces square wave amplitude.
6	ATTENUATION VERNIER	Rotate ccw.	Square wave amplitude decreases.
7	DC OFFSET	Rotate cw. Return to OFF.	Square wave is immediately offset below previous level; then waveform moves up to a positive level. OFF returns waveform to original position. (Clipping occurs at ±15V.)
8	Function Generator or Voltage Source	Vary input voltage.	Waveform dc level varies.
	Remove EXT DC OFFSET IN cable and connect to VCG IN connector. Remove GCV OUT cable.		
9	Function Generator or Voltage Source	Vary input voltage; then disconnect input.	Frequency increases with increased voltage, decreases with decreased voltage.
10	ATTENUATION VERNIER	Rotate cw.	– – –
11	FUNCTION	Rotate to DC, ∿ , ∿ , ⊓ , ⊓ , ⊔ , then ∿ .	Note dc level on scope. ∿ , ∿ and ⊓ should be centered on dc level. ⊓ should rest on dc level, ⊔ should rise to dc level.
12	SYMMETRY	Rotate cw, then to OFF.	Waveform changes from ∿ to ⩘ to ⩙ and frequency decreases, then to ∿ at original frequency.

Table 2-1. Acceptance Procedure (Continued)

Step	Control	Position/Operation	Observe
13	GENERATOR MODE	GATE	A dc level.
14	MANUAL TRIG	Press down.	A series of sine waves.
	Set up a trigger source as shown in figure 2-2. Trigger on triangle waveform. Set trigger source at 100 Hz ∿ .		
15	TRIGGER LEVEL	Rotate knob. Set for several cycles.	Knob varies number of cycles gated.
16	GENERATOR MODE	TRIG	One cycle per trigger cycle.
17	TRIGGER START/STOP	Rotate knob, then to 0° CAL.	CW starts sine wave at +90°; ccw starts sine wave at −90°. Fully cw gives continuous sine waves.

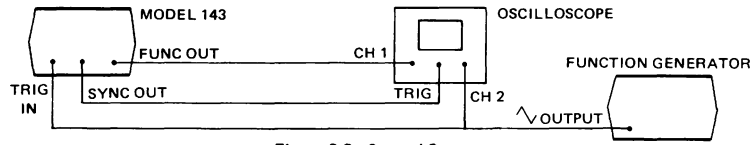


Figure 2-2. Second Setup

as a trigger or gate in the trigger and gate modes. The trigger level can be varied from fully cw, where a positive-going excursion thru approximately −10V is a trigger, to fully ccw, where a positive-going excursion thru approximately +10V level is a trigger.

④ **MANUAL TRIGGER Switch**

Triggers or gates the output signal when GENERATOR MODE switch ③ is at TRIG or GATE. In trigger mode, one cycle is output when the switch is pressed. In gate mode, cycles are continuously output as long as the switch is held down.

NOTE

Set TRIGGER LEVEL ③ fully ccw.

⑤ **TRIGGER START/STOP Control**

Sets the start and stop point of the sine or triangle waveform appearing at ⑦. Usually used in the trigger mode and in combination with ⑩ to create desired waveforms. 0° CAL position ensures conventional waveforms symmetrical about 0 Vdc.

⑥ **ATTENUATION Control**

Outer knob reduces output voltage level of all output at FUNCTION OUT with increasing steps of attenuation.

VERNIER Control

Inner knob is a 20 dB vernier which controls the output within the steps of the outer knob. DC and offset voltages are not affected by this control.

⑦ **FUNCTION OUT Connector**

The main output of the generator. The output of the function selected.

⑧ **SYNC OUT Connector**

Furnishes a TTL pulse for each cycle or period of the generator. To be used for scope or similar synchronization.

⑨ **FUNCTION Switch**

Selects one of six output signals: dc, waveforms or pulses.

⑩ **DC OFFSET Control**

Offsets the waveform or dc level at ⑦ from −15V to +15V (open circuit; ±7.5V into 50Ω). An OFF position ensures no offset.

⑪ **SYMMETRY Control**

Normal symmetrical output results when SYMMETRY is set to OFF; an asymmetrical, or unbalanced, waveform results when SYMMETRY is set between ⎍⎍ and ⎍⎍ . (Asymmetrical operation reduces generator frequency to approximately 1/10th the normal output.) Figure 3-2 shows the effect of SYMMETRY control on the waveforms.

NOTE

When SYMMETRY control is used, the output frequency is different from the dial indicated frequency. The maximum symmetry ratio obtainable also depends on the frequency dial setting.

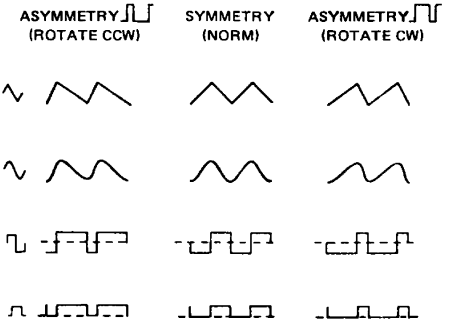


Figure 3-2. Effect of SYMMETRY Control

⑫ **TRIG IN Connector**

Accepts a 1V p-p to ±10V external signal to trigger the generator. (Up to ±50V will not damage circuitry.) Triggers on rising edge of input which crosses TRIGGER LEVEL ③ setting from negative to positive.

⑬ **VCG IN Connector**

Accepts 0 to +2V ac or dc voltages to vary up to 1000:1 the frequency and period of the outputs.

The upper and lower limits are defined by the maximum and minimum dial (2) settings multiplied by (14) . VCG input will not drive the generator beyond the normal dial limits of a range.

(14) FREQUENCY MULT Switch

The outer knob selects one of ten frequency multipliers for the dial (2) setting.

VERNIER Control

A fine adjustment of the frequency dial (2) setting.

Not Shown **GCV OUT Connector (Rear Panel)**

This connector gives a 0 to +2V signal proportional to the frequency of the generator within any given range. The signal can be used as the X drive for X-Y recorders.

Not Shown **EXT DC OFFSET IN Connector (Rear Panel)**

Applied voltage offsets the selected waveform linearly. Offset is 1V for each −1V applied with output connected into an open circuit. Maximum input is ±15V. Offset is affected by the attenuator (6)

3.2 OPERATION

Perform the initial checkout in Section 2 for the feel of the instrument. Any questions concerning individual controls and connectors may be answered in paragraph 3.1.

3.2.1 Signal Termination

Proper signal termination, or loading, of the generator connectors is necessary for its specified operation. For example, the proper termination of the main output is shown in figure 3-3. Placing the 50Ω terminator, or 50Ω resistance, in parallel with a higher impedance matches the receiving instrument input impedance to the generator output impedance, thereby minimizing signal reflection or power loss on the line due to impedance mismatch.

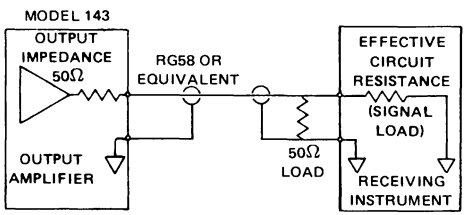


Figure 3-3. Signal Termination

3.2.2 Voltage Controlled Function Generator Operation

Operation as a voltage controlled function generator (VCG) is as for a manually controlled function generator, only the frequency within particular ranges is additionally controlled with dc levels (±2V excursions) injected at the VCG IN connector. Set the frequency dial to a reference from which the frequency is to be voltage controlled.

1. For frequency control with positive dc inputs at VCG IN, set the dial for a lower frequency limit.
2. For frequency control with negative dc inputs at VCG IN, set the dial for an upper frequency limit.
3. For modulation with an ac input at VCG IN, set the dial at the desired center frequency. Do not exceed the maximum dial range of the selected frequency range.

Figure 3-4 is a nomograph with examples of dial and voltage effects. Example 1 shows that with 0V VCG input, frequency is as determined by the main dial setting, 1.0 in this

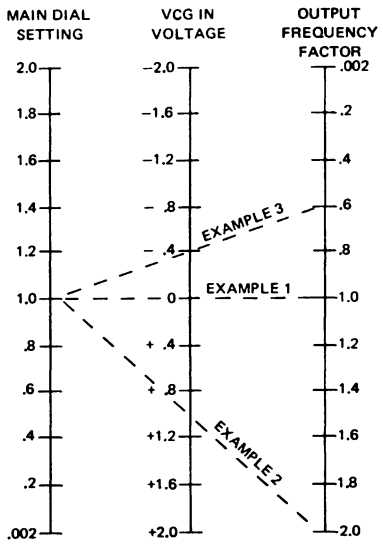


Figure 3-4. VCG Voltage-to-Frequency Nomograph

example. Example 2 shows that with a positive VCG input, output frequency is increased. Example 3 shows that with a negative VCG input, output frequency is decreased. (Note that the Output Frequency Factor column value must be multiplied by a frequency range multiplier to give the actual output frequency.)

NOTE

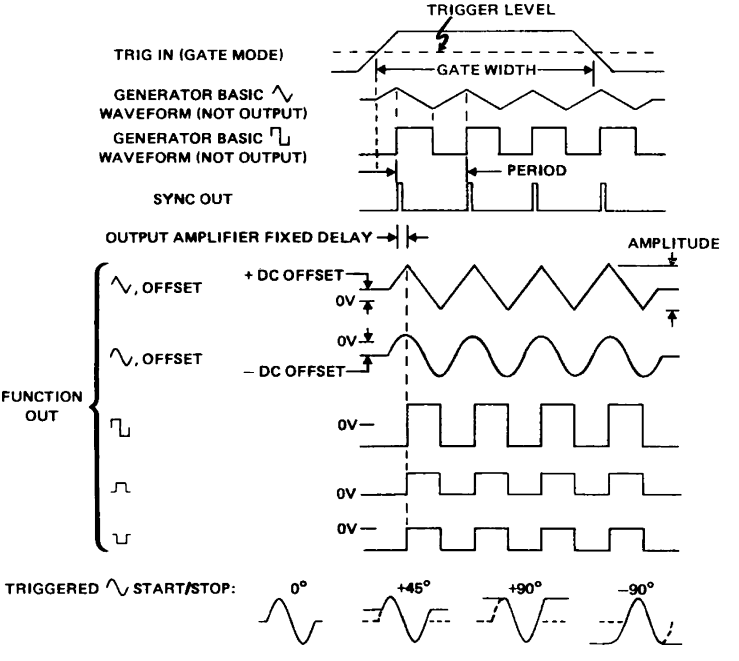
The frequency vernier must be rotated fully ccw for 1000:1 range.

Nonlinear operation results when the VCG input voltage is excessive; that is, when the attempted generator frequency exceeds the range setting (2 times the multiplier setting) or in the other direction, 1/1000th of the range setting.

The up to 1000:1 VCG sweep of the generator frequencies available in each range results from a 2V excursion at the VCG IN connector. With the frequency dial set to 2.0, excursions between −2V and 0V at VCG IN provide the up to 1000:1 frequency sweep. With the dial set to .002, excursions between 0V and +2V at VCG IN provide the up to 1000:1 sweep within the set frequency range.

3.2.3 Waveforms

See figure 3-5 for definition of controllable waveform characteristics.



NOTES

1. *Period is controlled by the generator frequency setting.*
2. *In trigger mode, just one period is generated for each trigger pulse.*
3. *DC offset plus peak waveform voltage > | 7.5V | causes waveform clipping.*

Figure 3-5. Waveform Characteristics

SECTION 3
OPERATION

3.1 CONTROLS AND CONNECTIONS

The generator front panel controls and connectors are shown in figure 3-1 and keyed to the following descriptions.

(1) POWER Switch

Turns generator on and off.

(2) Frequency Dial

Settings under the dial index mark multiplied by (14) determine the output signal frequency. The frequency can be varied by the vernier (14) and the VCG signal (13)

(3) GENERATOR MODE Switch

Selects one of the following three modes.

CONT – Continuous output at FUNCTION OUT, and SYNC OUT connectors.

TRIG – DC level output at both output connectors until the generator is triggered by MANUAL TRIGGER switch or with a signal at the TRIG IN connector. When triggered, the generator output is one cycle of waveform or one pulse period followed by a dc level.

GATE – As for TRIG except the output is continuous for the duration of the trigger signal at TRIG IN. The last cycle or period started is completed.

TRIGGER LEVEL Control

Determines the level at which the input trigger signal at the TRIG IN connector (12) is accepted

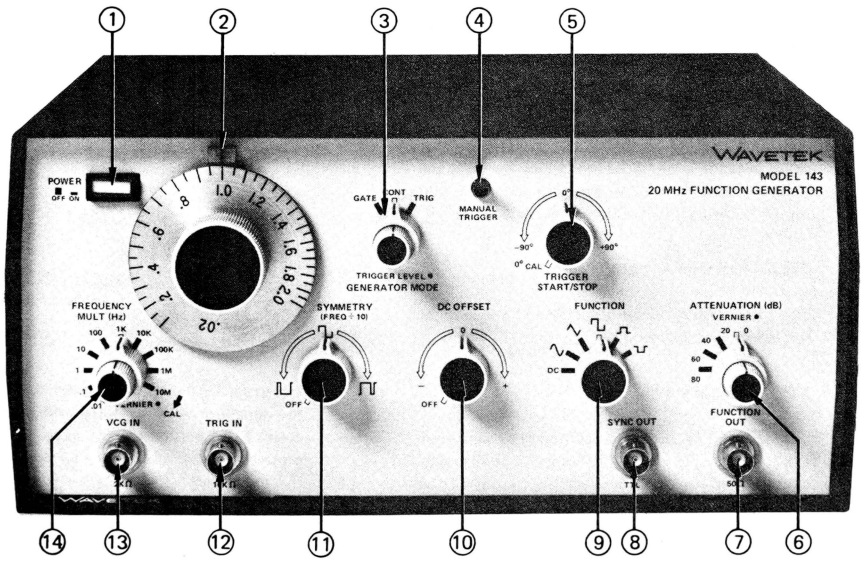


Figure 3-1. Controls and Connectors

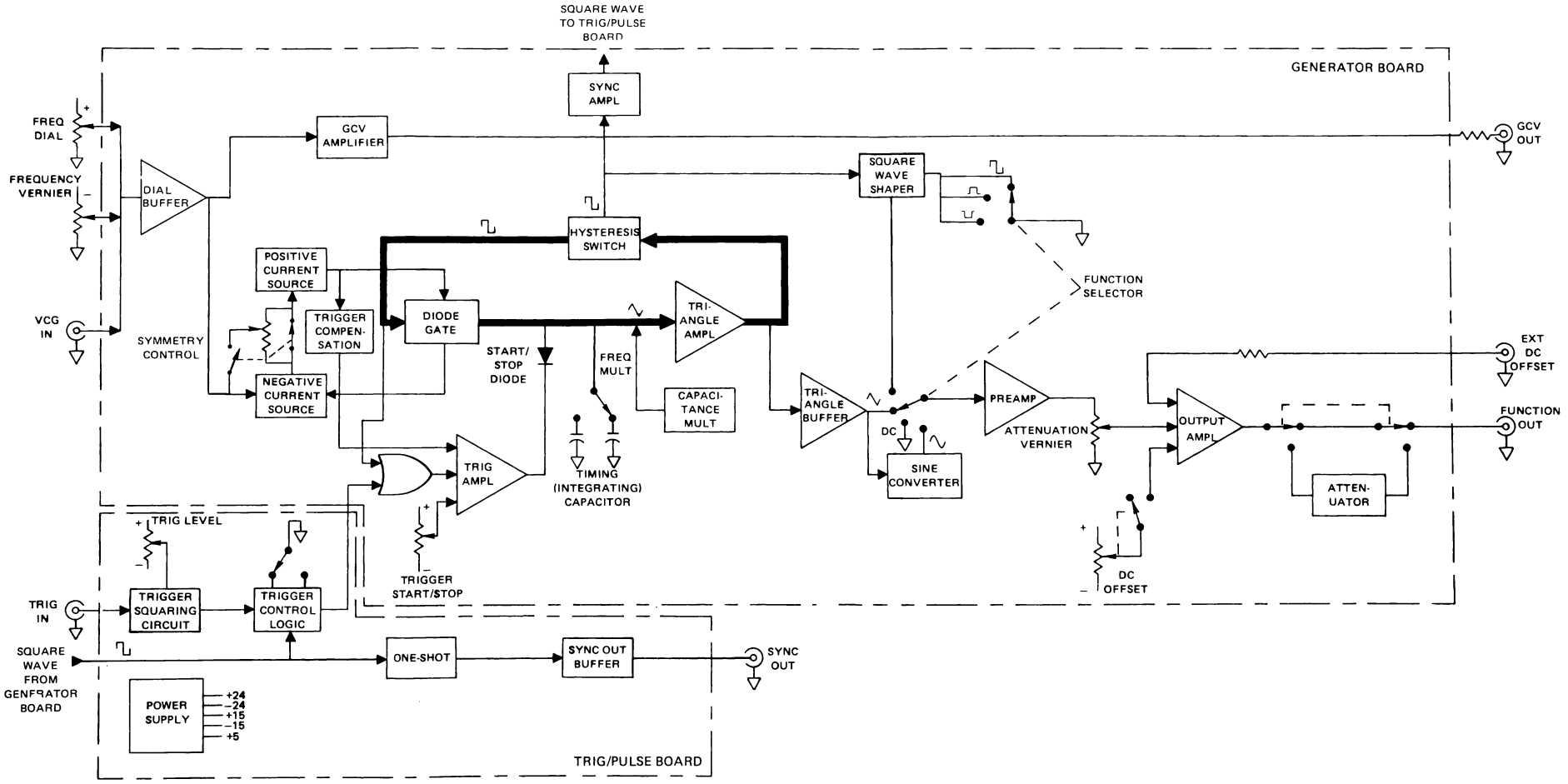


Figure 4-1. Overall Block Diagram

SECTION 4
CIRCUIT DESCRIPTION

4.1 BASIC WAVEFORM DEVELOPMENT

The heart of the generator (the bold path in figure 4-1) is a triangle and square wave generator. The triangle waves are developed by capacitor charging ramps that are alternately reversed in polarity. The polarity reversal is caused by a flip-flop circuit, or hysteresis switch, that in turn produces the square waves. The flip-flop changes states upon detecting amplitude limits of the charging ramps through the triangle amplifier.

As shown in figure 4-1, the VCG dial buffer sums the currents from the frequency dial, frequency vernier and VCG in connector. The VCG dial buffer is an inverting amplifier whose output voltage is used to control a positive current source and a negative current source. For symmetrical output waveforms, the currents from the two current sources are equal and directly proportional to the voltage of the VCG dial buffer output. The diode gate, which is controlled by the hysteresis switch, is used to switch the positive or the negative current to the integrating capacitor selected by the frequency multiplier. If the positive current is switched into the integrating capacitor, the voltage across the capacitor will rise linearly to generate the triangle rise transition. If the current is negative, the voltage across the integrating capacitor will fall linearly to produce the fall transition.

The triangle amplifier is a unity gain amplifier whose output is fed to the hysteresis switch. The hysteresis switch has two voltage limit points (+1.25 aand −1.25V) at its input.

During the time the output voltage of the triangle amplifier is rising, the output voltage of the hysteresis switch is positive, but when the output voltage of the triangle reaches +1.25V, it triggers the hysteresis switch causing the output to switch negative. Once the control voltage into the diode gate becomes negative, it will switch the positive current out and switch the negative current in to the integrating capacitor, so that the voltage across the capacitor will reverse, starting a linear decrease of the waveform. When the decreasing voltage reaches −1.25V, the output of the hysteresis switch will switch back to positive, reversing the process. This action generates the triangle waveform as shown in figure 4-2. Since the output of the hysteresis switch is a square wave, the result is simultaneous generation of a square wave and a triangle wave at the same frequency.

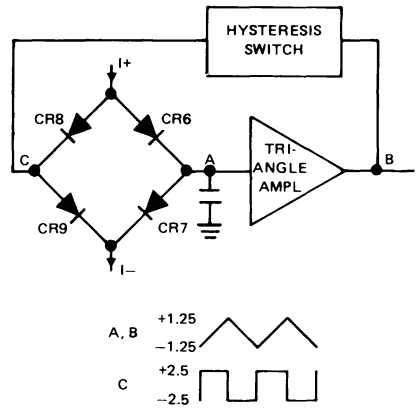


Figure 4-2. Basic Generator and Timing Diagram

The output frequency is determined by the magnitude of the capacitor selected by the frequency multiplier and the magnitude of the positive and negative current sources. Since the current sources are linearly proportional to the control voltage of the VCG circuit, the output frequency will also be linearly proportional to the control voltage.

When the symmetry control is turned on, the current of the negative current source is decreased by 19 times, and the fall time of the triangle is 19 times longer than the rise time of the triangle, resulting in an unsymmetrical waveform and a division of the frequency by a factor of 10. Gradually increasing the current from the negative current source and decreasing the current from the positive current source causes the time for the triangle to complete one cycle to remain constant, while the symmetry of the output waveform is continuously varied.

The output of the hysteresis switch is fed to the sync amplifier and also the square wave shaper. The square wave shaper consists of a shaping circuit which limits the square wave output swing to ±1.25V. For positive pulse outputs, it limits the output voltage swing from −1.25 to 0V; and for negative pulse outputs, it limits the output swing from 0 to +1.25V.

The triangle wave from the triangle amplifier is coupled through a buffer amplifier and made available to the function selector switch. The buffer amplifier provides a low impedance to drive the sine converter circuit. The sine converter, using the nonlinear characteristics of its diodes, converts the triangle wave into a sine wave.

The square wave from the sync amplifier, processed through a one-shot and the sync out buffer, is externally available at the sync out connector. The sync pulse, then, is a TTL level pulse output of the generator frequency.

4.2 AMPLITUDE OFFSET AND ATTENUATION

The selected waveform is inverted and amplified in the preamplifier. The preamplified waveform is sent to the output amplifier.

The output amplifier is an inverting amplifier with a current limiting output stage for short circuit protection. The dc offset control provides the offset to the selected waveforms center reference. The dc offset can be set by voltage at the external dc offset connector. The output amplifier establishes the generator 0 dB attenuation reference. An output attenuator decreases this reference amplitude in operator selected 20 dB steps. The attenuator consists of three voltage dividers. Attenuation between the steps is provided by the attenuation vernier.

4.3 TRIGGER AND GATE CONTROL

Generator operation is controlled by allowing or preventing the timing capacitor to charge. For figure 4-3 shows in detail this portion of the circuit. For continuous operation, the trigger amplifier maintains a positive level above the positive peak developed by the charging capacitors. This reverse biases (turns off) the start/stop diode, and the trigger amplifier does not interfere with continuous operation.

When the trigger amplifier outputs some level below the positive peak charging level, the diode is forward biased (turned on) to sink the integrating current from the current source, preventing the capacitors from charging to the positive peak. This stops waveform generation and holds the triangle output at some dc level called the trigger baseline. The trigger baseline is the level where a triangle waveform cycle starts and where it stops. This baseline is directly applicable to the triangle waveform and thus affects the sine wave. The square wave levels, output via the hysteresis switch, are not affected by the triangle baseline levels.

The normal trigger baseline is zero volts, analogous to 0° phase of a sine or triangle waveform. The trigger start/stop control offsets the trigger amplifier output and can change the baseline for starting and stopping a sine or triangle waveform from its negative peak (−90°) to its positive peak (+90°) range. At the extreme positive peak level setting, though, the diode is again reverse biased and generator operation goes continuous.

When charging level is being held, the positive current generator still varies its output with corresponding frequency control inputs. These varying currents must be sunk through the diode to keep the timing capacitors from varying their charge, and thus varying the trigger baseline. The baseline compensation circuit monitors the output from the positive current generator to control the trigger amplifier and thus control the necessary compensating current through the diode.

The trigger control logic determines that after a waveform starts, it always stops at a complete cycle and at the same phase at which it started. The trigger control logic latches the trigger amplifier for an enabling output from the time the cycle starts to when the negative peak of the last cycle is reached (just one cycle in the trigger mode). Upon reaching the negative peak, the timing capacitor continues charging positive again, but stops upon reaching the trigger baseline. A square wave from the hysteresis switch synchronizes the last negative peak time for unlatching the trigger amplifier for its trigger baseline output.

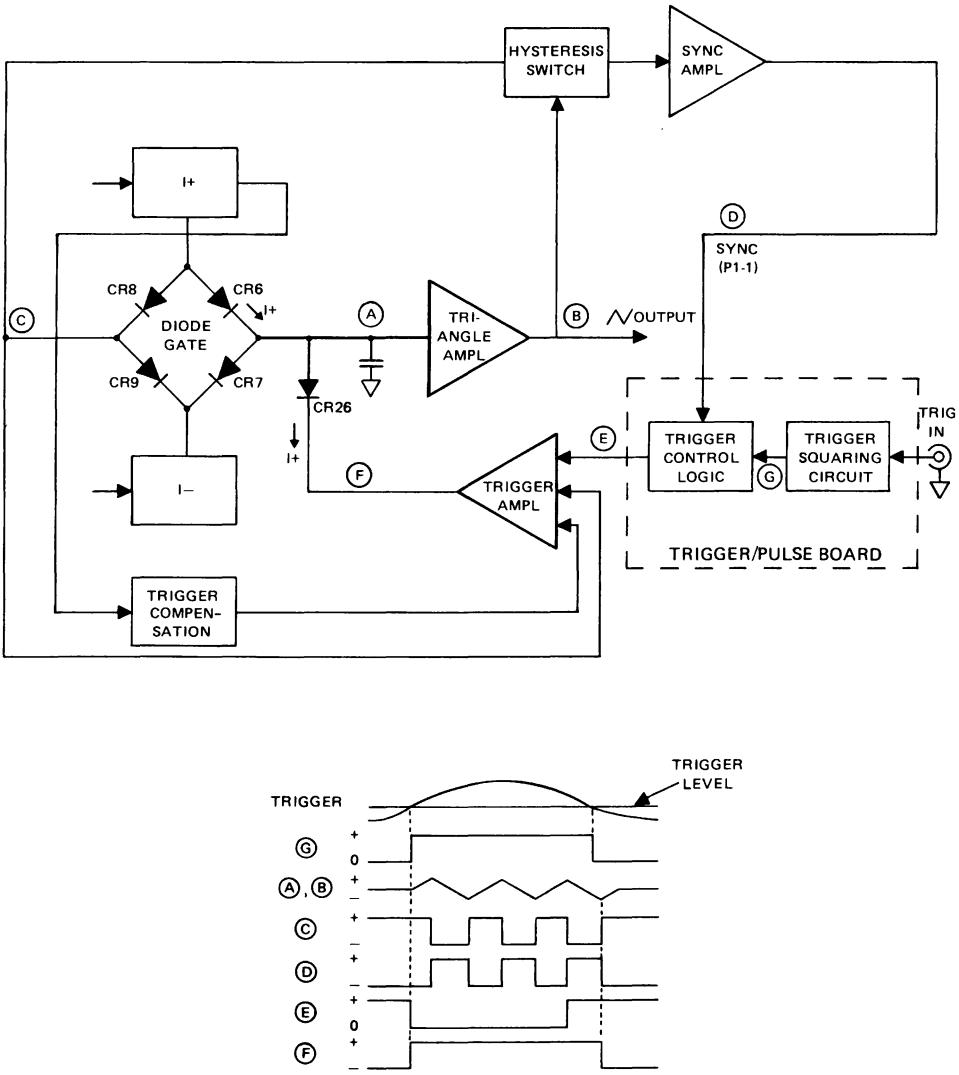


Figure 4-3. Trigger Circuit and Timing

SECTION 5
CALIBRATION

5.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

5.2 REQUIRED TEST EQUIPMENT

Voltmeter . . . . . 0.1 mVdc resolution (0.1% accuracy)
Oscilloscope, Dual Channel . . . . . ⩾ 150 MHz bandwidth
Distortion Analyzer . . . . . To 600 kHz
Counter . . . . . To 20 MHz (0.1% accuracy)
50Ω Load . . . . . ±0.1% accuracy, 2W
Generator . . . . . 200 kHz signal, 2 to 20V p-p

5.3 REMOVING GENERATOR COVERS

1. Invert the instrument, remove the four screws in the cover.

2. Turn the instrument upright, remove the top cover, and remove the four screws securing the bottom cover.

3. Replace the top cover and turn the instrument upside down.

NOTE

Remove the bottom cover only when it is necessary to make adjustments or measurements.

5.4 CALIBRATION

After referring to the following preliminary data, perform calibration, as necessary, per table 5-1. If performing partial calibration, check previous settings and adjustments for applicability. See figures 5-1 and 5-2 for calibration point location.

1. Unless otherwise noted, all measurements made at the 50Ω OUT connector should be terminated into a 50Ω (±0.1%) load.

2. Verify operation in TRIG and GATE modes by connecting an external generator to the TRIG IN BNC and observing proper operation of TRIGGER LEVEL and TRIGGER START/STOP controls (paragraph 3.1).

3. Verify SYNC OUT is an approximate 30 ns positive pulse into 50Ω and that GCV OUT is a voltage proportional to dial position with a 2V max (open circuit).

4. Start the calibration by connecting the unit to an ac source and setting the front panel switches as follows:

Dial 02
FREQ MULT 100K
FREQ VERNIER . . . . . Full cw
GENERATOR MODE . . . . . CONT
TRIGGER LEVEL . . . . . Full ccw
TRIGGER START/STOP . . . . . 0° CAL
SYMMETRY . . . . . OFF
DC OFFSET . . . . . OFF
FUNCTION . . . . . DC
ATTENUATION . . . . . 20 ▮ 0
ATTENUATION VERNIER . . . . . Full ccw
POWER . . . . . ON

5. Allow the unit to warm up at least 30 minutes for final calibration. Keep the instrument covers on to maintain heat. Remove covers only to make adjustments or measurements.

Table 5-1. Calibration Chart

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
1	Power Supply	DVM	C111			+15 ±0.05 Vdc	If voltage is incorrect, proceed to step 3.
2			C112			−15 ±0.05 Vdc	If voltage is correct, proceed to step 9.

Steps 3 - 7 are on the trig/pulse board. Place the cover on the generator and turn it upright. Remove the top cover for access to the trig/pulse board.

3	Power Supply	DVM	TP1 (COM) TP2 (±15 Vdc)		R27	+15 ±0.02 Vdc	
4			TP3			−15 ±0.05 Vdc	
5			TP4			+24 ±1 Vdc	
6			TP5			−24 ±1 Vdc	
7			TP6			+5 ±0.2 Vdc	

If steps 3 - 7 were performed, place the cover on, invert the generator and warm up the generator for ½ hour. Remove the uppermost cover for generator board access when required.

8	Cap Mult Balance	DVM (DCV)	TP5 (COM) TP1		R55	< 5 mV	
9	Power Ampl Balance		FUNC-TION OUT		R181	0 ±0.01 Vdc	Terminate with 50Ω load.
10	Preamp Balance			ATTENUATION VERNIER: full cw	R252	0 ±0.01 Vdc	
11	VCG Null	Scope		FUNCTION: ⌜⌞	R12	Minimum frequency shift	Observe one cycle at 50μs/div. Alternately short and open VCG IN BNC while adjusting R12.
12	1000:1 Freq			FREQ VERNIER: full ccw	R13 BOD Freq Adj	< 1 cycle (< 200 Hz)	Scope on .5 ms/div.

Table 5-1. Calibration Chart (Continued)

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
13	1000:1 Sym-metry	Scope	FUNC-TION OUT		R16 BOD Sym	Symmetrical wave-form	*NOTE: Steps 13 and 14 are interactive.*
14	Main Sym-metry			FREQ VERNIER: full cw Dial: 2.0 FREQ MULT: 1K	R35 TOD Sym	Symmetrical wave-form	
15	Sine Distor-tion	Distortion Analyzer, Scope		FUNCTION: ∿	R120 Triangle Balance	Symmetrical residue	Connect FUNCTION OUT to distortion analyzer and distor-tion analyzer output to scope. Set scope to .1V/div. Sync scope to SYNC OUT BNC loaded into 50Ω.
16					R93, R107 Triangle Peaks	Minimum sine distortion	If either adjustment is going near a stop, re-center both pots and return to step 15.
17	Main Freq	Frequency Counter/ Timer		FUNCTION: ⊓	R4 TOD Freq Adj	2000 ±10 Hz	Remove SYNC OUT cable.
18	Cap Mult Freq			FREQ MULT: 10	R48	20 ±0.1 Hz	
19	X 10M Freq			FREQ MULT: 10M Dial: Vary	C40	Best frequency tracking over X 10M range	
20	X 1M Freq			FREQ MULT: 1M Dial: Vary	C34	Best frequency tracking over X 1M range	This adjustment must be made each time step 20 is done.
21	Trigger Baseline	Scope		FUNCTION: ∿ GENERATOR MODE: TRIG Dial: Vary	R162	Minimum shift of baseline around 0 Vdc	

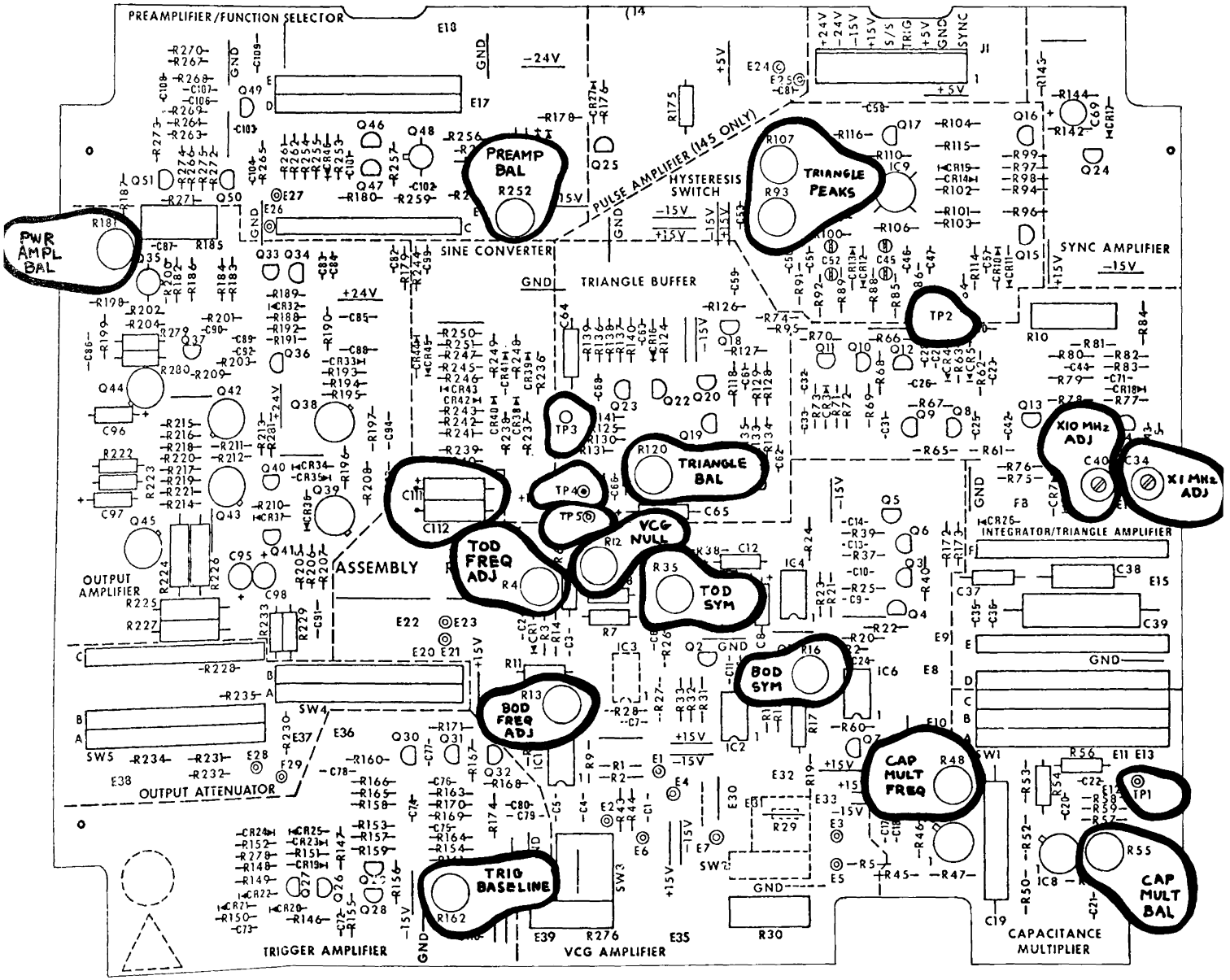


Figure 5-1. Generator Board

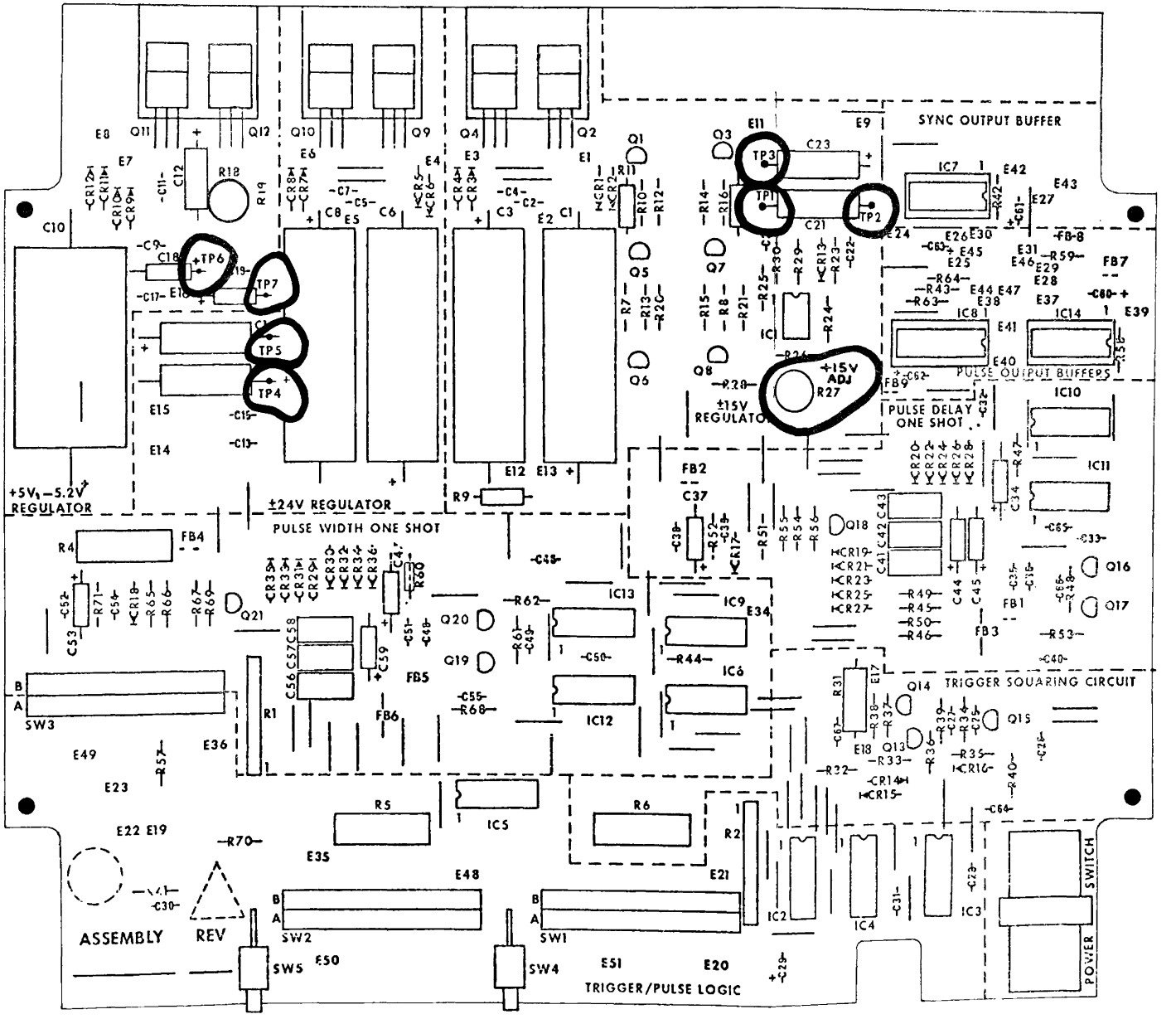


Figure 5-2. Trig/Pulse Board

SECTION 6
TROUBLESHOOTING

6.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

6.2 TROUBLESHOOTING CHARTS

Troubleshooting charts are given in figures 6-1 thru 6-9. The charts do not cover every possible trouble, but will be an aid in systematically isolating faulty components.

Figure 6-1. Initial Checks, Generator Board
Figure 6-2. Generator Loop Checks, Generator Board
Figure 6-3. VCG Checks, Generator Board
Figure 6-4. Generator Output Checks
Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board
Figure 6-6. Power Supply Checks, Trig/Pulse Board
Figure 6-7. Generator Input and Output Checks

6.3 TROUBLESHOOTING INDIVIDUAL COMPONENTS

6.3.1 Transistor

1. A transistor is defective if more than one volt is measured across its base emitter junction in the forward direction.

2. A transistor when used as a switch may have a few volts reverse bias voltage across base-emitter junction.

3. If the collector and emitter voltages are the same, but the base emitter voltage is less than 500 mV forward voltage (or reversed bias), the transistor is defective.

4. A transistor is defective if its base current is larger than 10% of its emitter current (calculate currents from voltage across the base and emitter series resistors).

5. In a transistor differential pair (common emitter stages), either their base voltages are the same in normal operating condition, or the one with less forward voltage across its base emitter junction should be off (no collector current); otherwise, one of the transistors is defective.

6.3.2 Diode

1. A diode is defective if there is greater than one volt (typically 0.7 volt) forward voltage across it.

6.3.3 Operational Amplifier (e.g., 741, 1458)

1. The "+" and "−" inputs of an operational amplifier will have less than 15 mV voltage difference when operating under normal conditions.

2. When the output of the amplifier is connected to the "−" input (voltage follower connection), the output should be the same voltage as the "+" input voltage; otherwise, the operational amplifier is defective.

6.3.4 Capacitor

1. Shorted capacitors have zero volts across their terminals.

2. Opened capacitor can be located (but not always) by using a good capacitor connected in parallel with the capacitor under test and observing the resulting effect.

6.3.5 Digital TTL IC's (e.g. 7400 Series)

1. The device is operating correctly if the output high state is $> +2.4V$ and low state is $< +0.5V$.

2. The input must show the same two levels as in step 1. If the levels are between +0.8V and +2.0V, the connection to the driving circuit output is open.

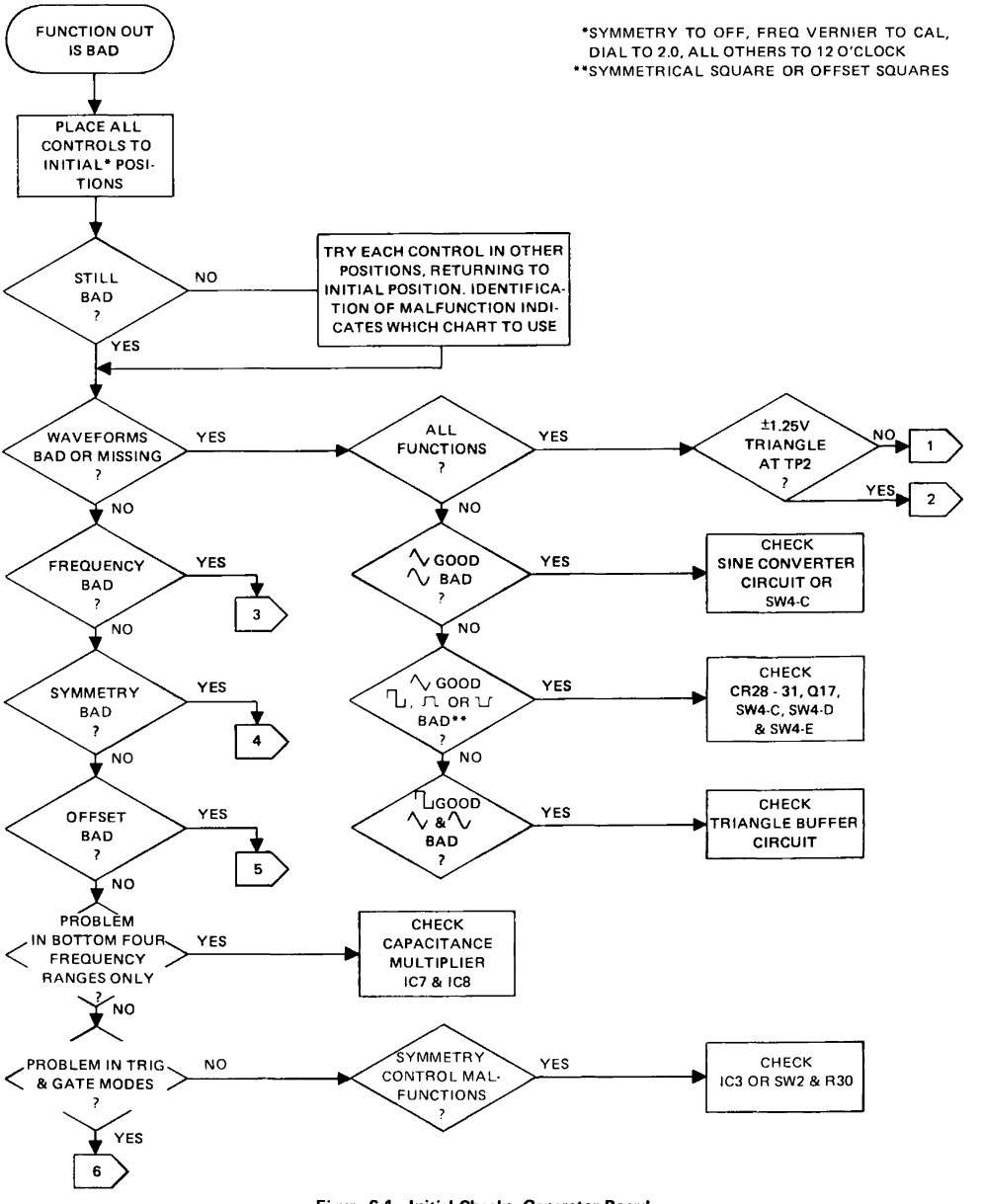
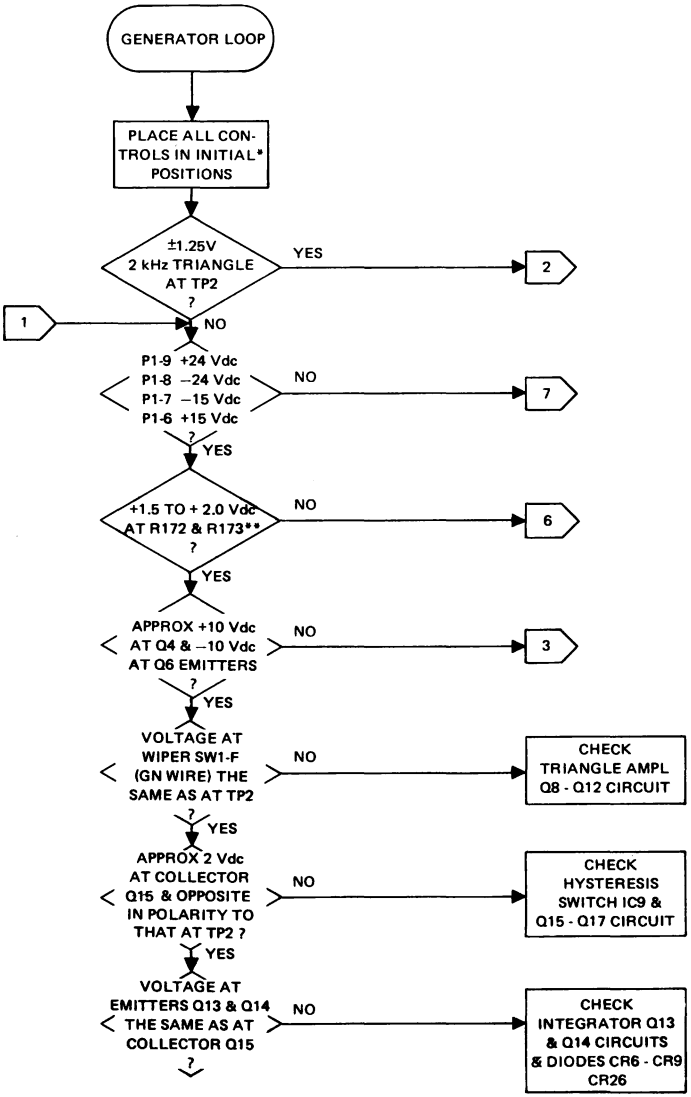


Figure 6-1. Initial Checks, Generator Board

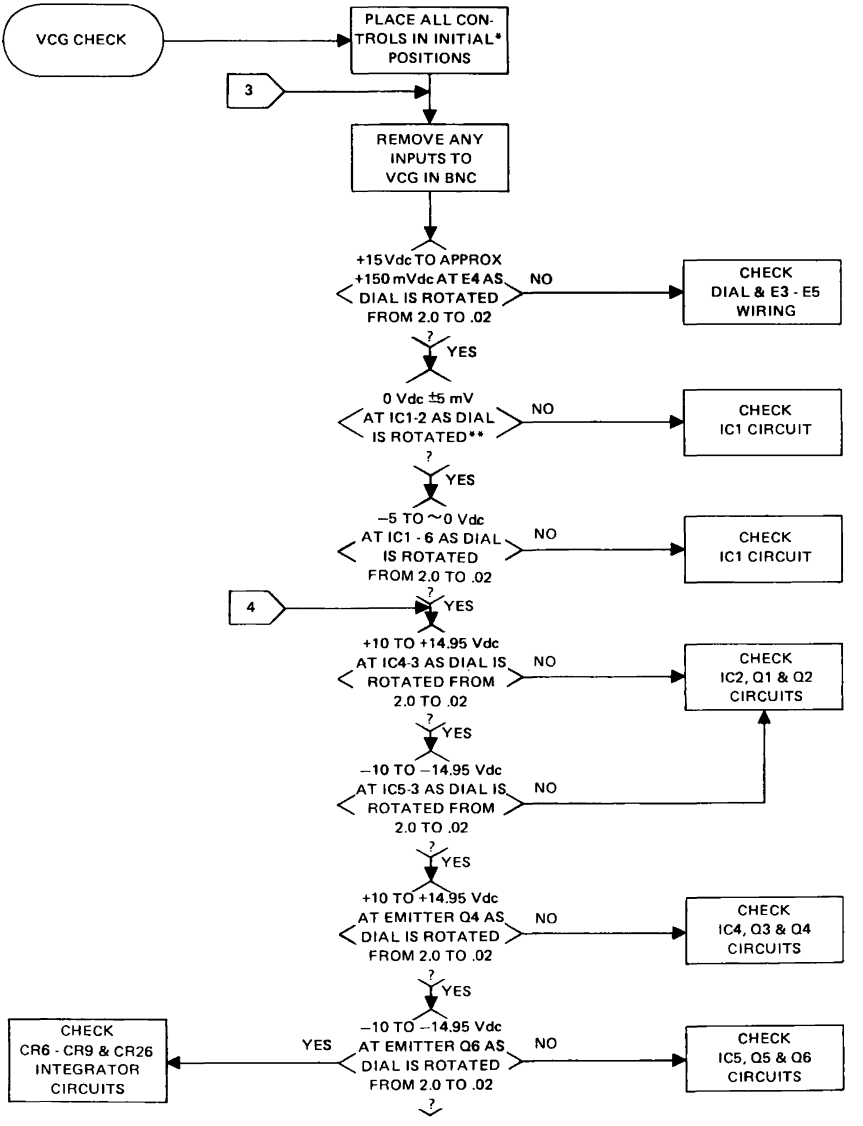


*SYMMETRY TO OFF, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK

**A NEGATIVE VOLTAGE HERE STOPS GENERATOR FOR TRIGGERED OPERATION

***USE SCOPE AND HIGH IMPEDANCE PROBE

Figure 6-2. Generator Loop Checks, Generator Board



*SYMMETRY TO OFF, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK
**USE SCOPE AND HIGH IMPEDANCE PROBE FOR THIS AND SUBSEQUENT VCG MEASUREMENTS

Figure 6-3. VCG Checks, Generator Board

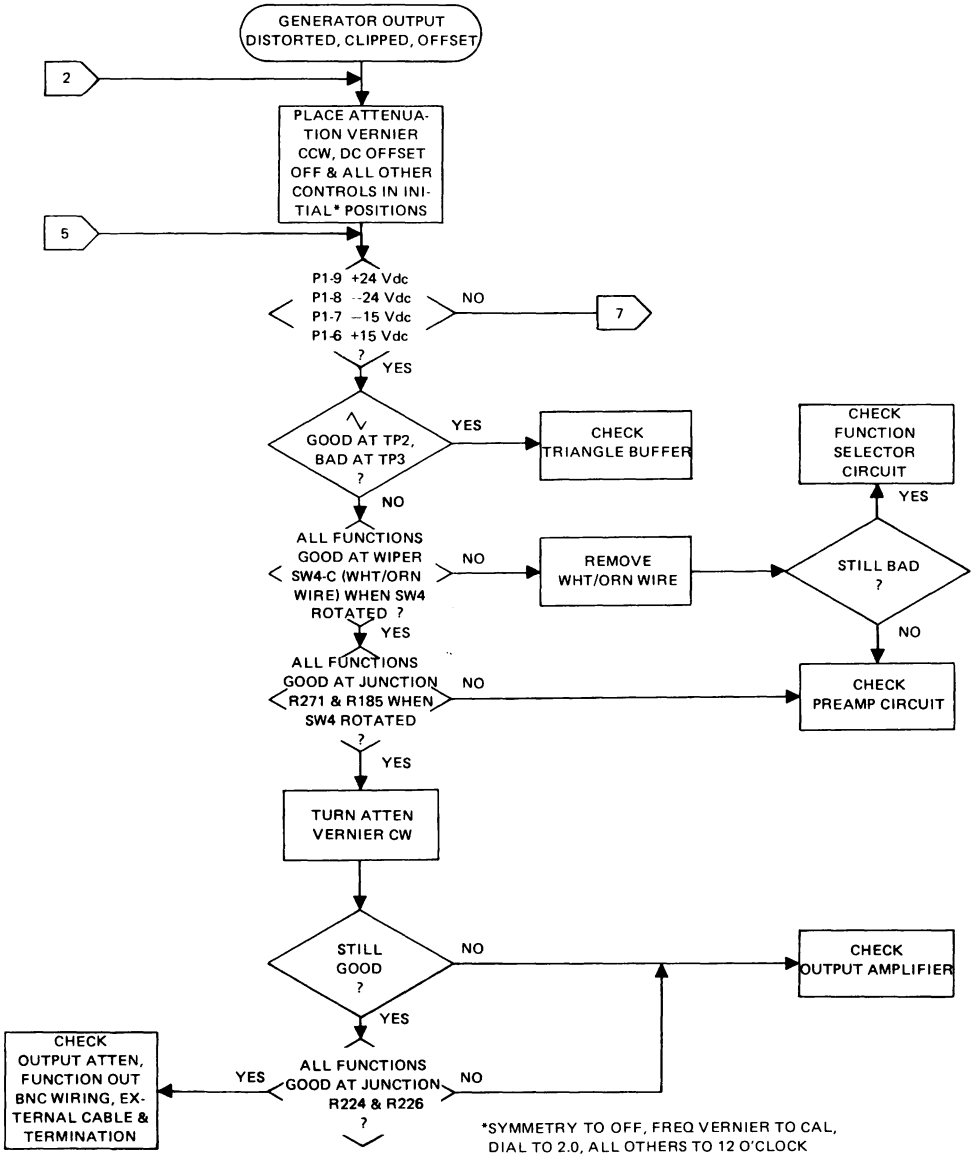
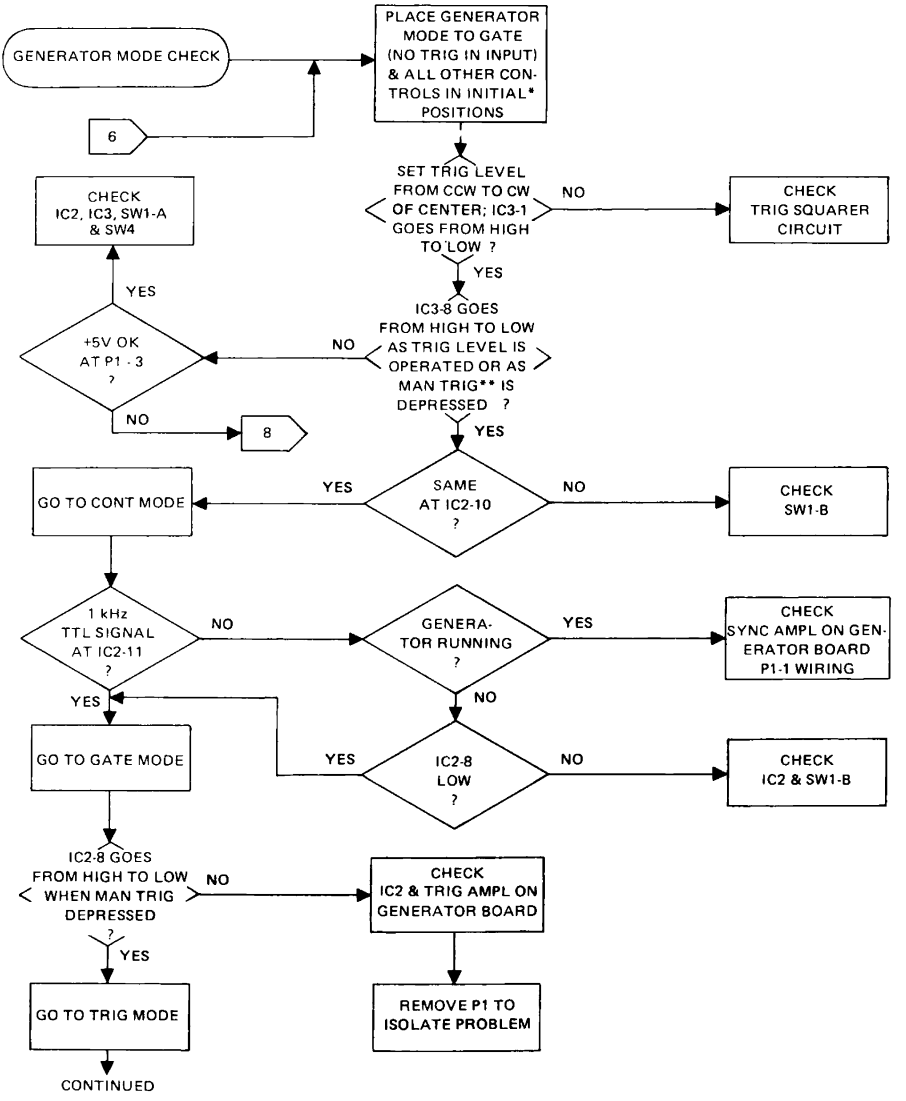


Figure 6-4. Generator Output Checks, Generator Board



*SYMMETRY TO OFF, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK
**RETURN TRIG LEVEL CCW TO OPERATE MANUAL TRIGGER

Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board (Page 1 of 2)

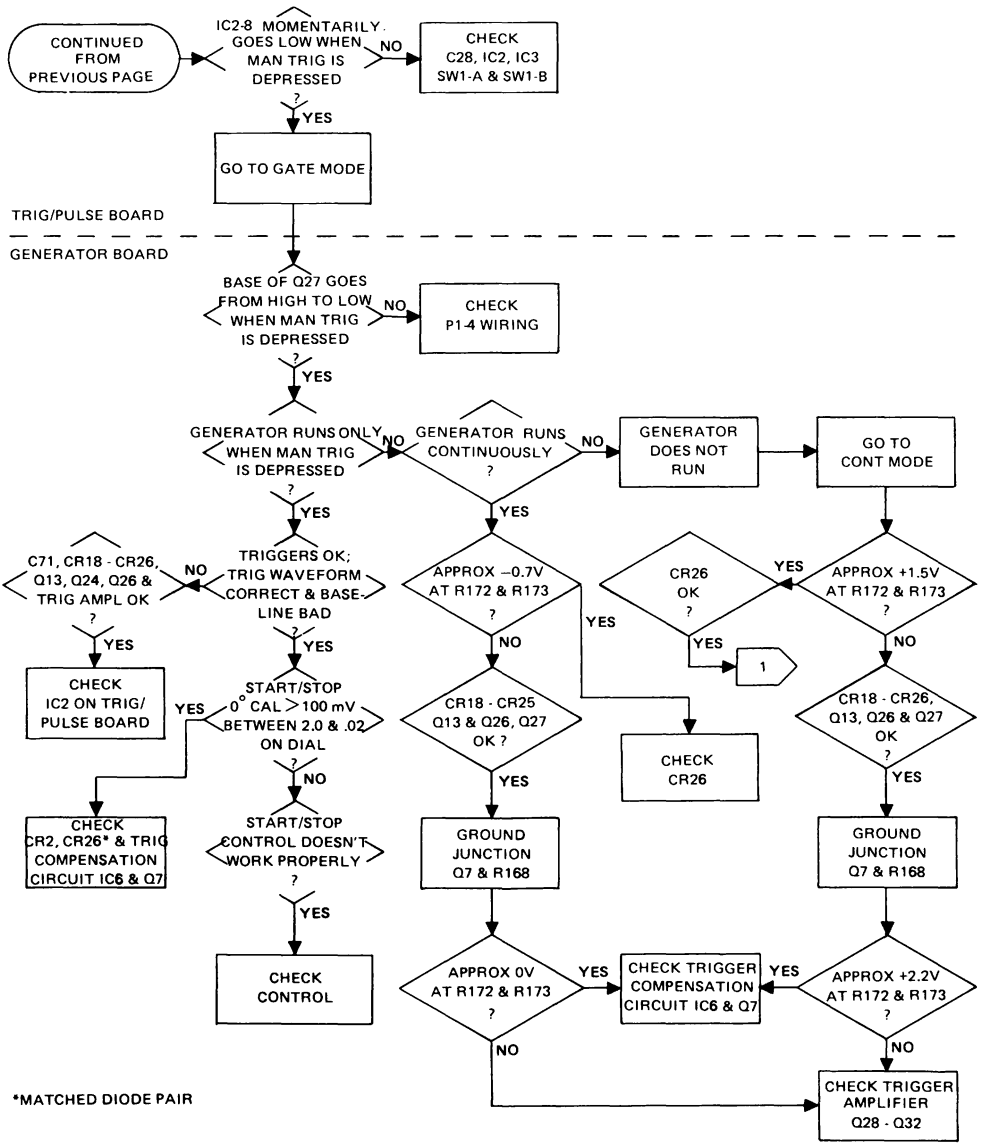


Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board (Page 2 of 2)

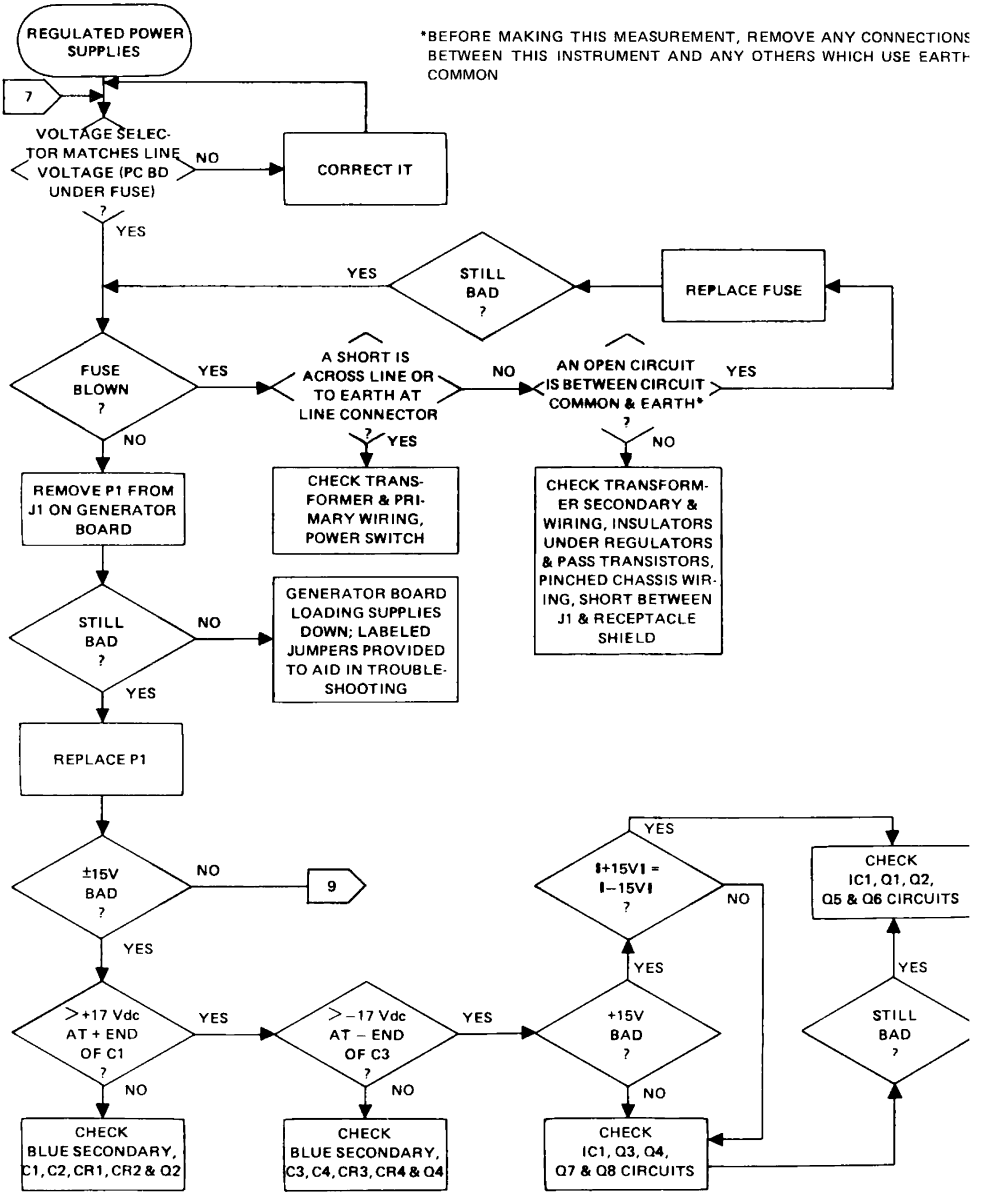


Figure 6-6. Power Supply Checks, Trig/Pulse Board (Page 1 of 2)

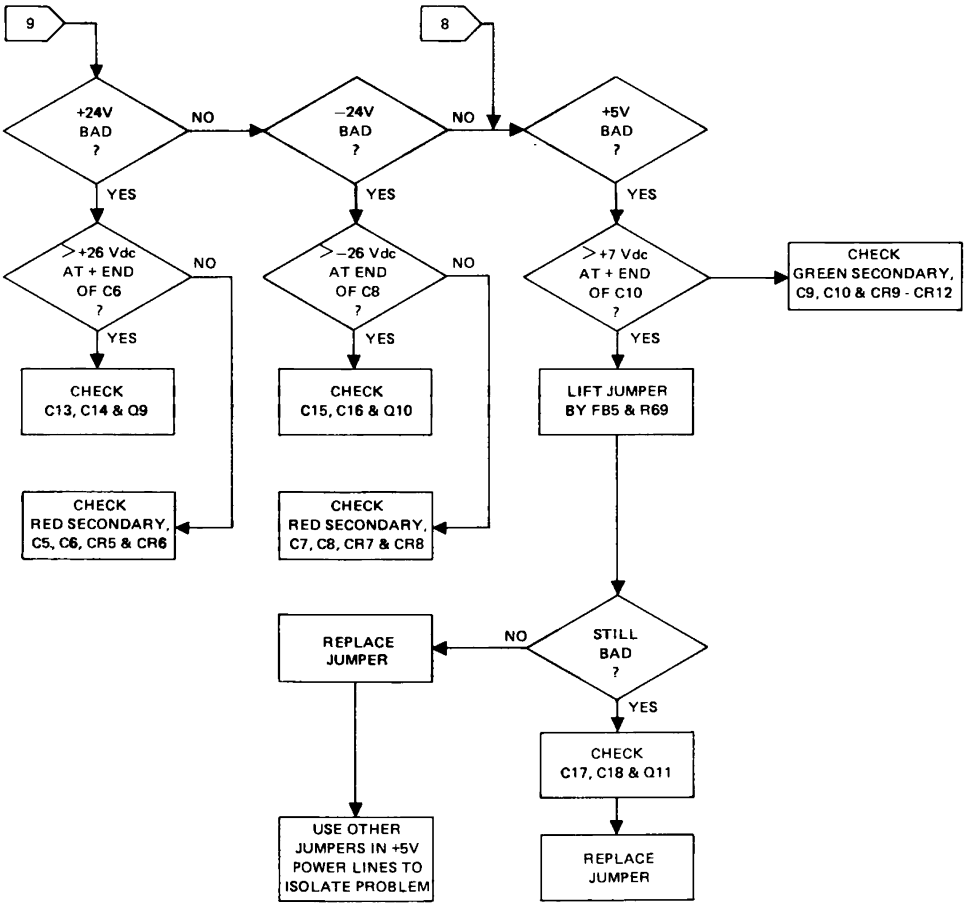


Figure 6-6. Power Supply Checks, Trig/Pulse Board (Page 2 of 2)

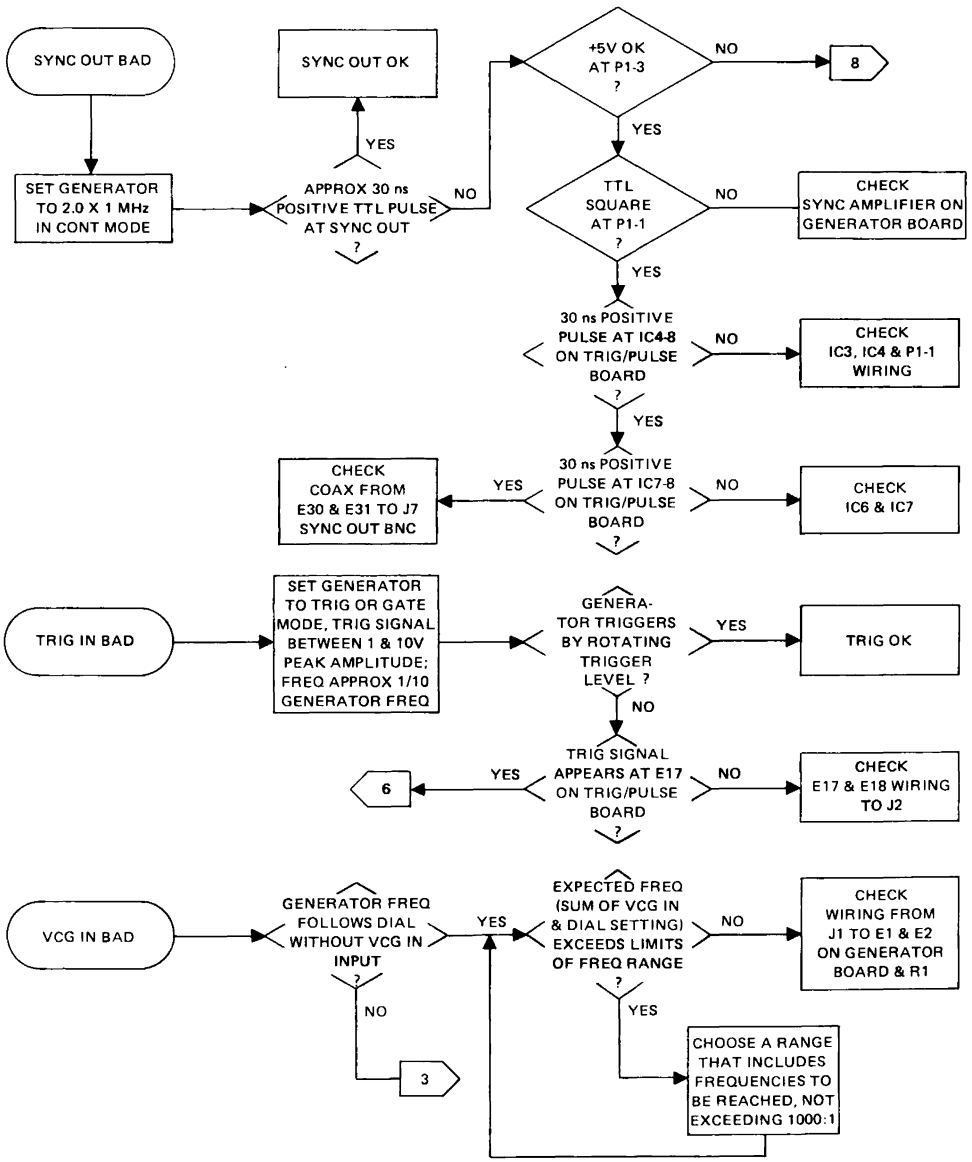


Figure 6-7. Generator Input and Output Checks (Page 1 of 2)

SECTION 7
PARTS AND SCHEMATICS

7.1 DRAWINGS

The following assembly drawings (with parts lists) and schematics are in the arrangement shown below.

7.2 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference, board, serial number of unit and, if applicable, the function performed.

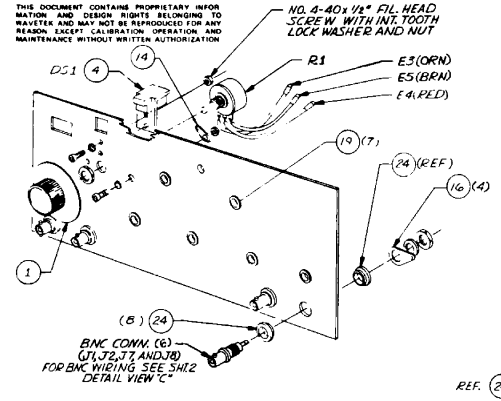
7.3 ADDENDA

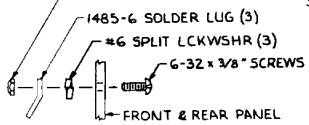
Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the rear cover. If no such pages exist, the manual is correct as printed.

Drawings	Drawing No.
CHASSIS	
Assembly Drawing	0102-00-0589
Schematic	0004-00-0101
Parts List	1101-00-0589
GENERATOR BOARD	
Parts Locater Drawing	0100-00-0556
Assembly Drawing (Sheet 2 of 2 only)	0101-00-0584
Schematic	0103-00-0556
Parts List	1100-00-0584
TRIG/PULSE BOARD	
Parts Locater Drawing	0100-00-0565
Assembly Drawing (Sheet 2 of 2 only)	0101-00-0585
Schematic	0103-00-0565
Parts List	1100-00-0585

REV	ECN	BY	DATE	APP
B	ECN 1800	JRM	9-5-8	
C	ECN 1801	JRM	9-18	
D	# 883			

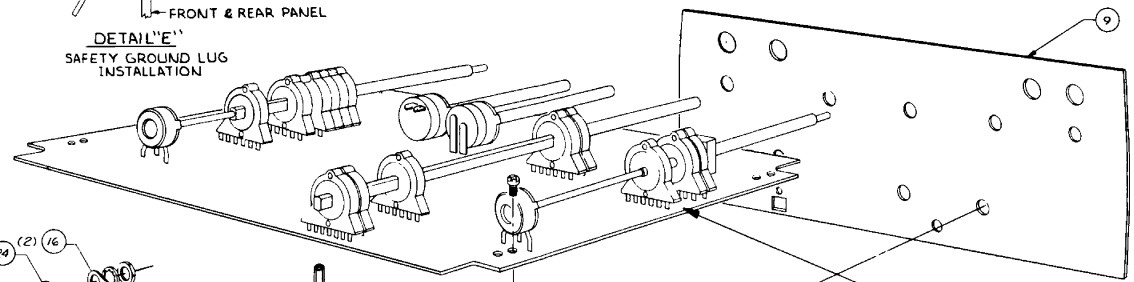
NOTE: ALL CONNECTIONS TO BE MECHANICALLY SECURE PRIOR TO SOLDERING GROUND WIRES TO LUGS.



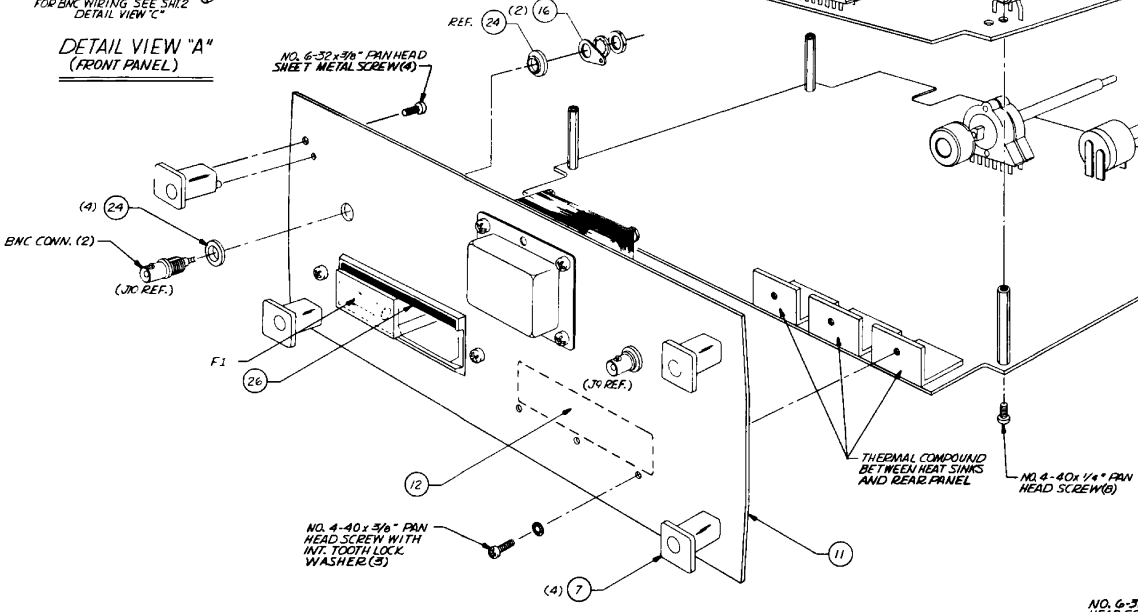


DETAIL "E"
SAFETY GROUND LUG INSTALLATION

SEE DETAIL VIEW "A" (FOR FRONT PANEL)

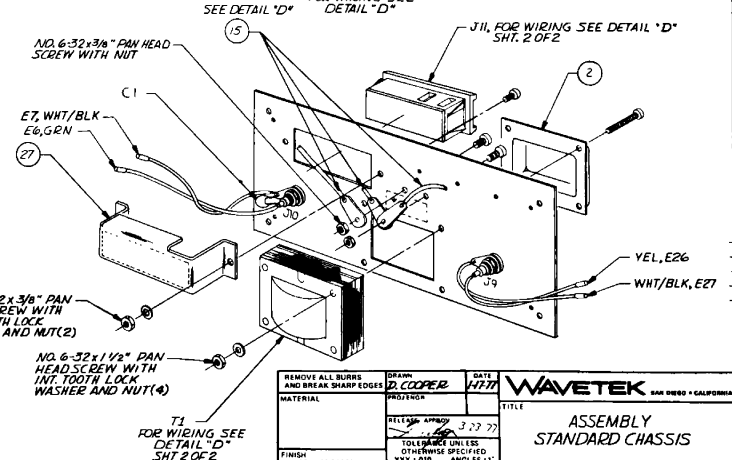


DETAIL VIEW "A" (FRONT PANEL)



SEE DETAIL VIEW "B" (FOR REAR PANEL)

DETAIL VIEW "B" REAR PANEL FOR WIRING SEE DETAIL "D"



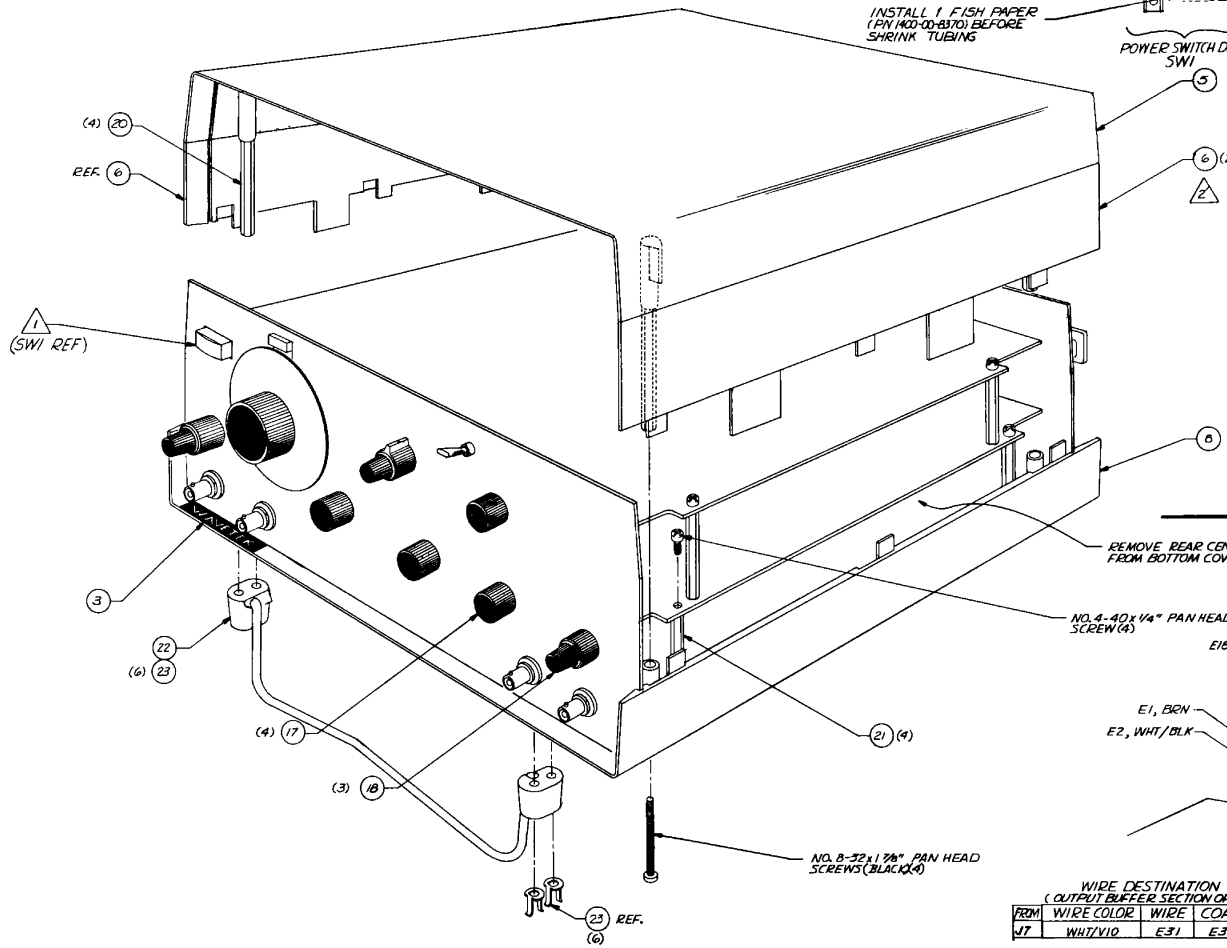
NOTE UNLESS OTHERWISE SPECIFIED

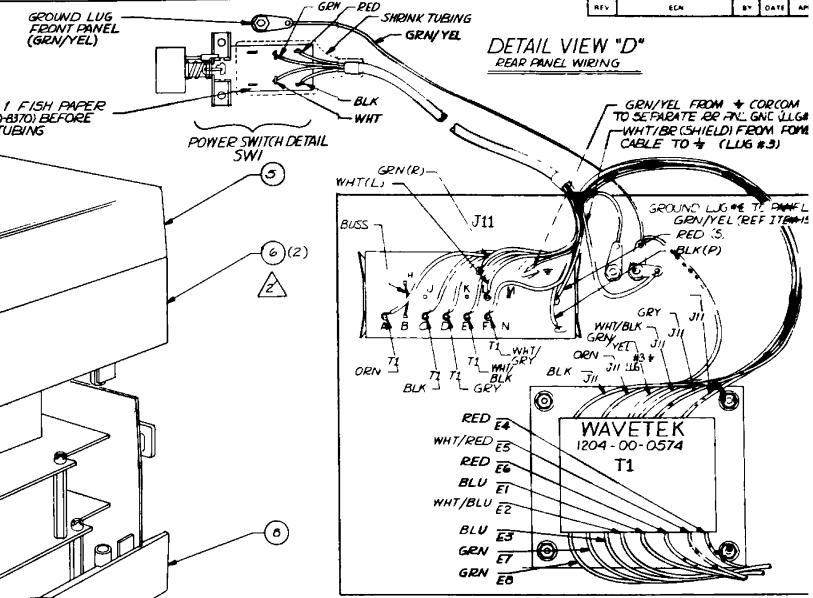
REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D. COOPER 11-7-7
PROJENGR
RELEASE APPROV 3-22-77
TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± 010 ANGLES ± 1° XX ± 030
DO NOT SCALE DWG
SCALE

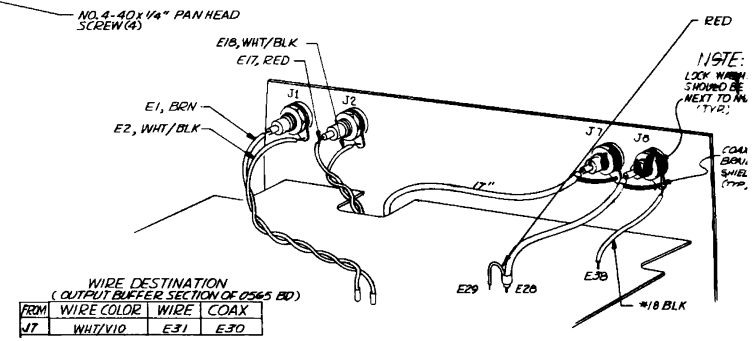
WAVETEK SAN DIEGO, CALIFORNIA

TITLE
ASSEMBLY STANDARD CHASSIS

MODEL NO	DWG NO	REV
143	0102-00-0589	D
CODE IDENT 23338	SHEET 1 OF 2	







WIRE DESTINATION
(OUTPUT BUFFER SECTION OF 0565 BD)

FROM	WIRE COLOR	WIRE	COAX
J7	WHT/V10	E31	E30

2 CEMENT ITEM 6(2) TO ITEM 5 (TYP. BOTH SIDES)

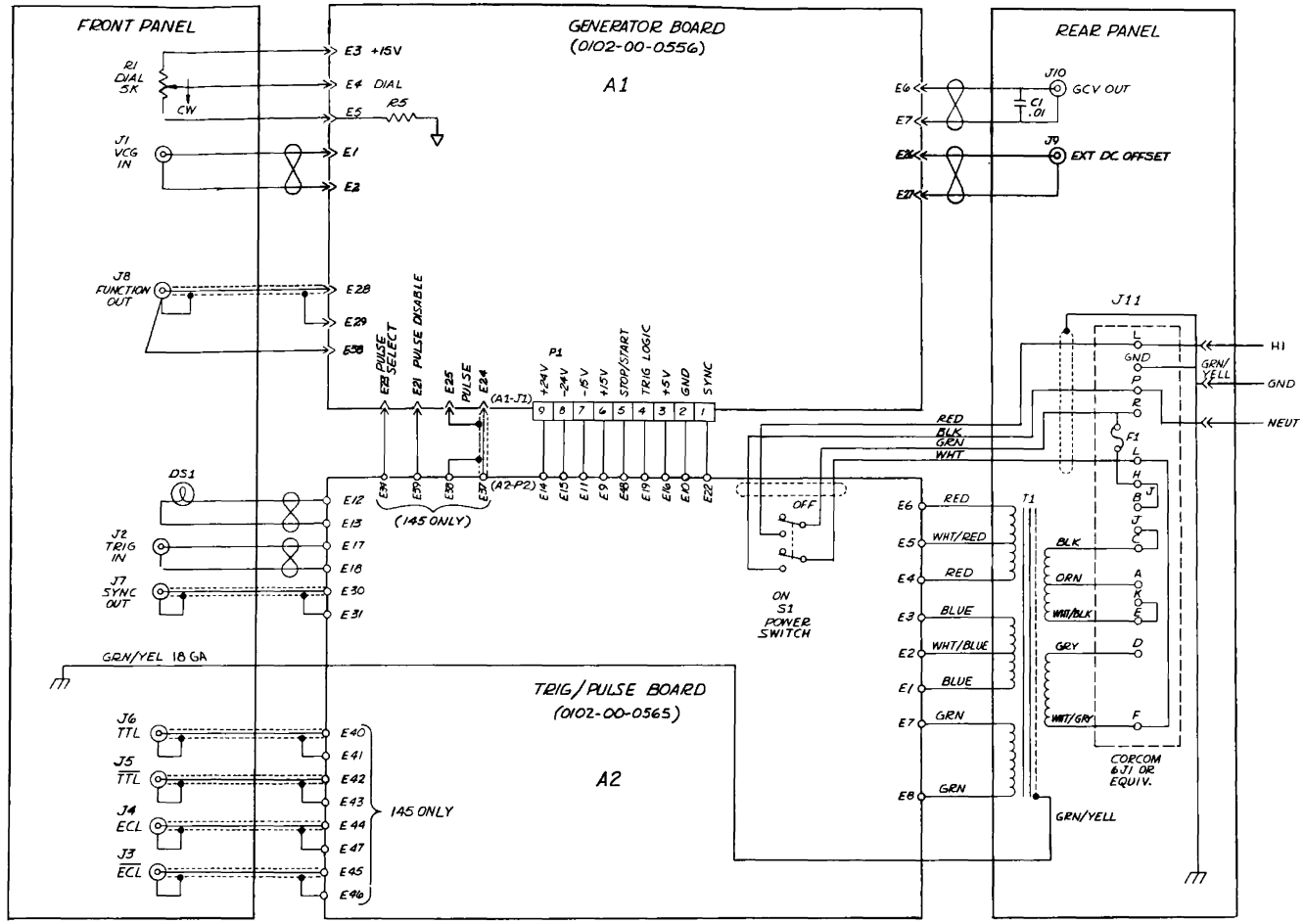
1 MOUNT SWITCH TO P.C. BOARD PRIOR TO INSTALLING FRONT PANEL, USE NO. 2-56 x 1/4" PAN HEAD SCREW WITH NUT (2)

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D. COOPER 1/8/77
PROJ ENGR
RELEASE APPD 3-28-77
TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 XX ± .020 ANGLES ±1°
DO NOT SCALE DWG
SCALE

WAVETEK
TITLE
ASSEMBLY STANDARD CHASSIS
MODEL NO. 143
DWG NO. 0102-00-0589
CODE IDENT 23338
SHEET 2 OF

REV	ECN	BY	DATE	APP
B	ECN 1800	JRM	9-5-8	
C	ECN 1801	JRM	9-6-8	

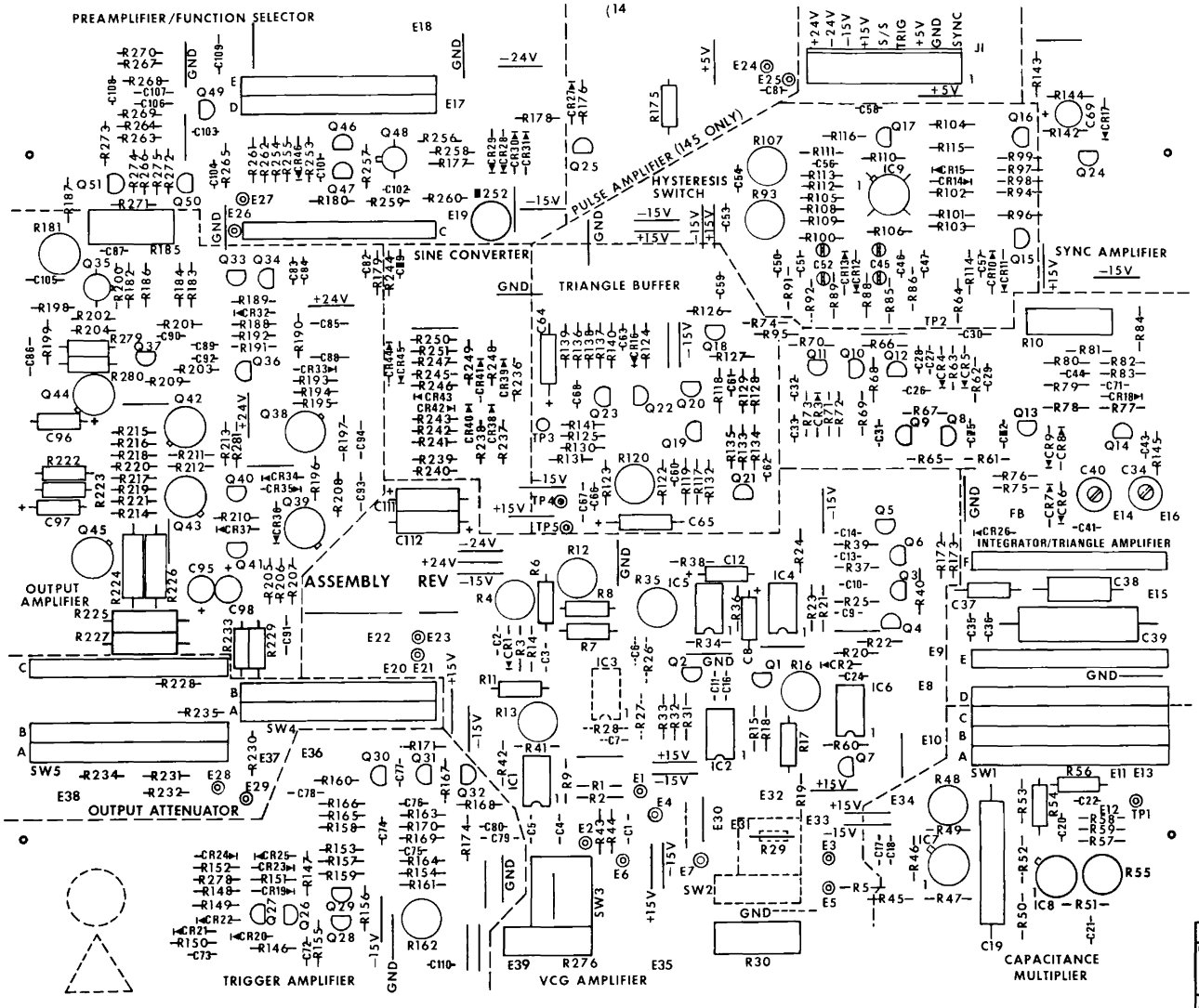


3/16A 220-240VAC
I. F1 - 3/8A 100-120 VAC

NOTE: UNLESS OTHERWISE SPECIFIED

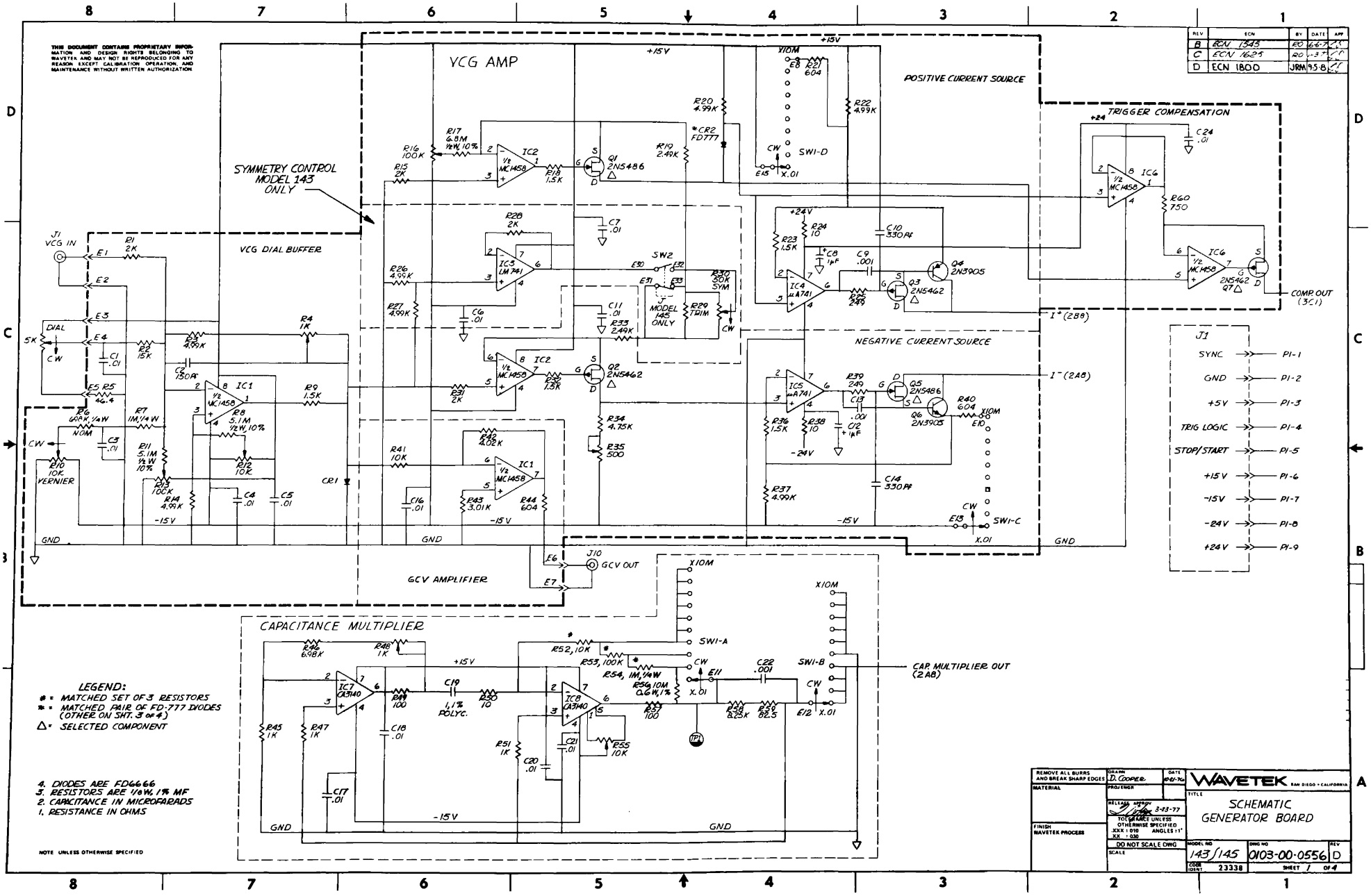
REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 11976	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJENGR	3-23-77	TITLE
	RELEASE APPROV	3-23-77	INSTRUMENT SCHEMATIC
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES 1° XX ± .030		
	DO NOT SCALE DWG	MODEL NO 143/145	DWG NO 0004-00-0101 REV C
	SCALE	CODE IDENT 23338	SHEET 1 OF 1

REV	ECN	BY	DATE	APP



NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: GENERATOR BOARD PARTS LOCATER
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 XX ± .030 ANGLES ±1°		
	DO NOT SCALE DWG		
	SCALE	MODEL NO 143/145	0100-00-0556 REV C
		CODE IDENT 23338	SHEET OF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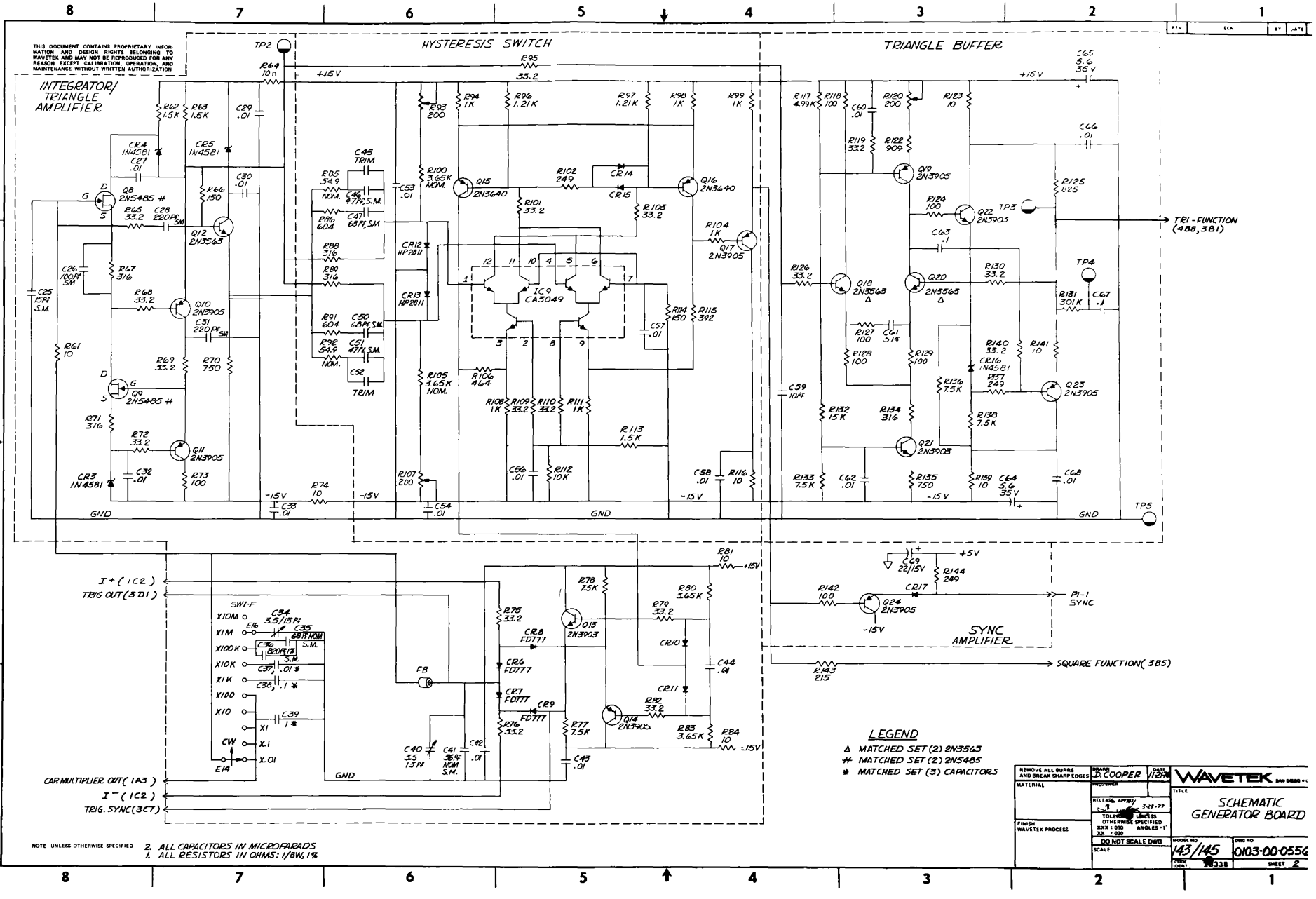
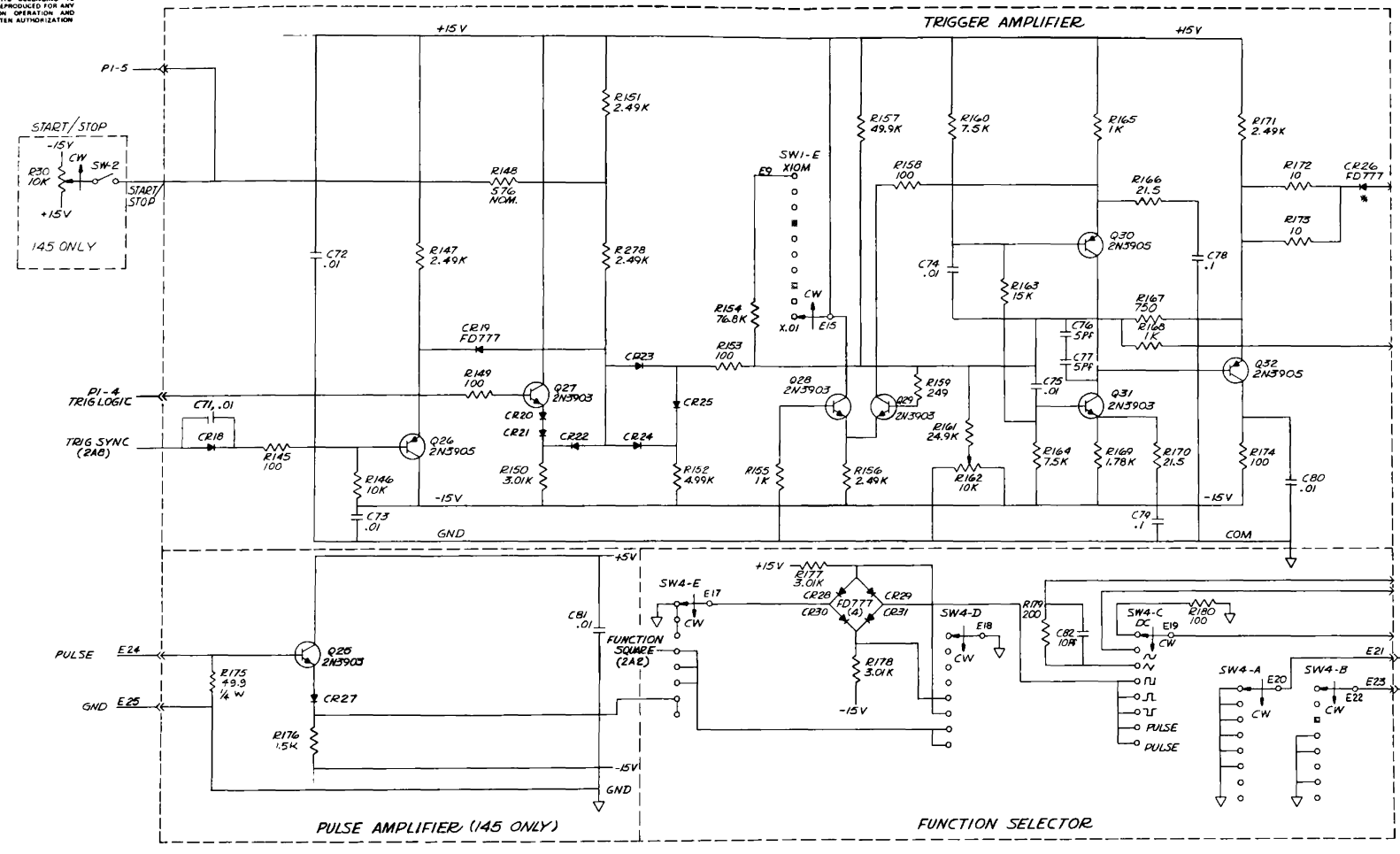
REV | ECN | BY | DATE | APP
B | ECN 1345 | EO | 6-6-7
C | ECN 1625 | RO | 1-3-7
D | ECN 1800 | JRM | 9-5-8
VCG AMP
+15V
POSITIVE CURRENT SOURCE
TRIGGER COMPENSATION
SYMMETRY CONTROL MODEL 143 ONLY
VCG DIAL BUFFER
J1 VCG IN
DIAL
5K
CW
R1 2K
R2 15K
R3 4.99K
R4 1K
C1 .01
C2 150PF
R5 4.99K
R6 66.4K 1/4W NOM
R7 1M 1/4 W
R8 5.1M 1/2W 10%
R9 1.5K
R10 10K VERNIER
R11 5.1M 1/2W 10%
R12 10K
R13 100K
R14 4.99K
C3 .01
C4 .01
C5 .01
IC1 1/2 MC1458
-15V
GND
CR1
R15 2K
R16 100K
R17 6.8M 1/2W 10%
IC2 1/2 MC1458
R18 1.5K
Q1 2N5486
*CR2 FD777
R19 2.49K
R20 4.99K
R21 604
X10M
E8
SW1-D
E15
X.01
R22 4.99K
R23 1.5K
R24 10
+24V
C8 1μF
C9 .001
C10 330PF
Q4 2N3905
Q3 2N5462
IC4 μA741
R25 249
IC6 1/2 MC1458
R60 750
C24 .01
2N5462 Q7
COMP OUT (3C1)
I+ (2B8)
R26 2K
C7 .01
IC3 LM 741
R26 4.99K
R27 4.99K
C6 .01
SW2
E30
E32
E31
E33
R30 50K SYM
MODEL 145 ONLY
R29 7.81M
CW
C11 .01
R33 2.49K
NEGATIVE CURRENT SOURCE
IC2 1/2 MC1458
R32 1.5K
Q2 2N5462
R31 2K
R34 4.75K
R35 500
I- (2A8)
IC5 μA741
R39 249
Q5 2N5486
C13 .001
Q6 2N3905
R40 604
R36 1.5K
R38 10
C12 1μF
-24V
R37 4.99K
C14 330PF
SWI-C
E13
X.01
J1
SYNC P1-1
GND P1-2
+5V P1-3
TRIG LOGIC P1-4
STOP/START P1-5
+15V P1-6
-15V P1-7
-24V P1-8
+24V P1-9
R41 10K
R42 4.02K
IC1 1/2 MC1458
R43 3.01K
R44 604
C16 .01
J10
GCV OUT
E6
E7
GCV AMPLIFIER
CAPACITANCE MULTIPLIER
R46 6.98K
R48 1K
IC7 CA3140
R49 100
C19 1.1% POLYC.
R50 10
IC8 CA3140
R51 1K
C20 .01
R45 1K
R47 1K
C18 .01
C17 .01
R52, 10K
R53, 100K
R54, 1M, 1/4W
R56, 10M C.C. 1%
R57 100
C21 .01
R55 10K
SWI-A
SWI-B
E11
E12
C22 .001
R58 8.25K
R59 82.5
TP1
CAP MULTIPLIER OUT (2A8)
LEGEND:
= MATCHED SET OF 3 RESISTORS
* = MATCHED PAIR OF FD-777 DIODES (OTHER ON SHT. 3 of 4)
△ = SELECTED COMPONENT
4. DIODES ARE FD6666
3. RESISTORS ARE 1/8W, 1% MF
2. CAPACITANCE IN MICROFARADS
1. RESISTANCE IN OHMS
NOTE UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D. COOPER
DATE 10-6-76
PROJ/ENGR
RELEASED 3-23-77
TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 XX ± .030 ANGLES ±1°
DO NOT SCALE DWG
SCALE
WAVETEK SAN DIEGO • CALIFORNIA
TITLE
SCHEMATIC GENERATOR BOARD
MODEL NO 143/145
DWG NO 0103-00-0556
REV D
CODE IDENT 23338
SHEET 1 OF 4

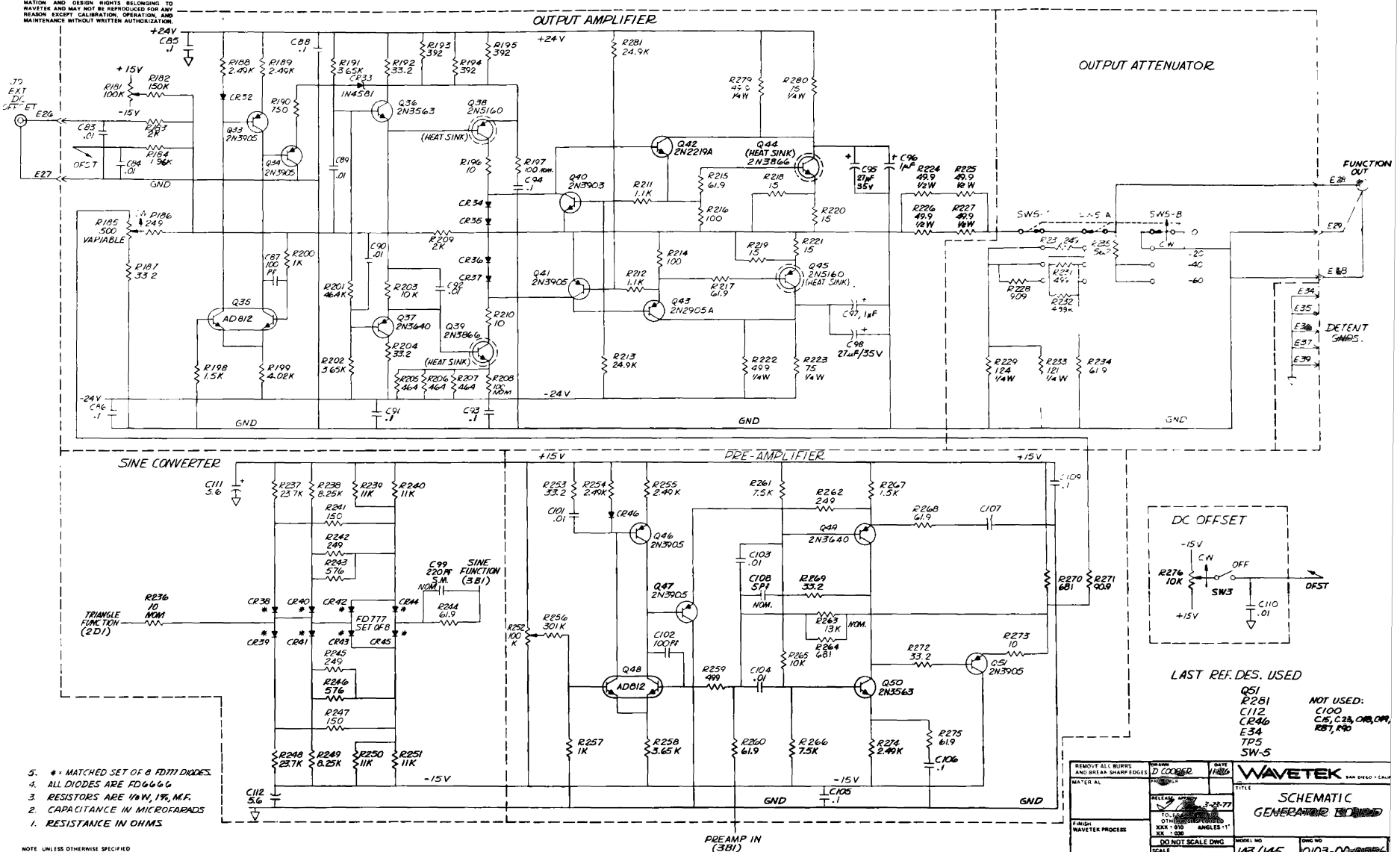

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND DESIGN RIGHTS BELONGING TO WAVETEK AND MAY NOT BE REPRODUCED FOR ANY REASON EXCEPT CALIBRATION, OPERATION, AND MAINTENANCE WITHOUT WRITTEN AUTHORIZATION
INTEGRATOR/ TRIANGLE AMPLIFIER
HYSTERESIS SWITCH
TRIANGLE BUFFER
SYNC AMPLIFIER
TRI-FUNCTION (488,381)
SQUARE FUNCTION(385)
P1-1 SYNC
I+(IC2)
TRIG OUT(3D1)
CAR MULTIPLIER OUT(1A3)
I-(IC2)
TRIG. SYNC(3C7)
+15V
-15V
+5V
GND
IC9 CA3049
SWI-F
X10M
X1M
X100K
X10K
X1K
X100
X10
X1
X.1
X.01
CW
LEGEND
Δ MATCHED SET (2) 2N3563
MATCHED SET (2) 2N5485
* MATCHED SET (5) CAPACITORS
NOTE UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS IN MICROFARADS
1. ALL RESISTORS IN OHMS: 1/8W, 1%
REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D. COOPER
DATE 1/12/78
PROD ENGR
RELEASE APPROV
DO NOT SCALE DWG
SCALE
WAVETEK SAN DIEGO
TITLE
SCHEMATIC GENERATOR BOARD
WORK NO 143/145
DWG NO 0103-00-0556
SHEET 2



5. DIODES ARE FD6666
4. RESISTORS ARE 1/8W, 1%, MF.
3. CAPACITANCE IN MICROFARADS
2. RESISTANCE IN OHMS
1. * MATCHED PAIR OF FD777 (OTHER ON SHT. 1)

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D COOPER	DATE 4-8-76	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE SCHEMATIC GENERATOR BOARD
FINISH WAVETEK PROCESS	RELEASE APPROV 3-28-77		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ± 1° XX ± .030		
	DO NOT SCALE DWG	MODEL NO 143/145	DWG NO 0103-00-0556 REV D
	SCALE	CODE IDENT 23338	SHEET 3 OF 4



TITLE	SCHEMATIC GENERATOR BOARD
DRAWN	J. COOPER
DATE	1/11/77
RELEASED	3-23-77
MODEL NO	143/145
DWG NO	0103-00-0556
SHEET	4 OF
23338	

WAVETEK SAN DIEGO, CALIF.

REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY ORNG GENERATOR	0101-00-0584	WVTK	0101-00-0584	1
NONE	SCHEMATIC GENERATOR	0103-00-0556	WVTK	0103-00-0556	1
C180T C61 C76 C77	CAP,CER,5PF,1KV	DD-050	CRL	1500-00-5011	4
C59 C82	CAP,CER,10PF,1KV	DD-100	CRL	1500-01-0011	2
C102 C87	CAP,CER,100PF,1KV	DD-101	CRL	1500-01-0111	2
C13 C22 C9	CAP,CER,.001MF,1KV	DD-102	CRL	1500-01-0211	3
C1 C101 C103 C104 C11 C110 C16 C17 C18 C20 C21 C24 C27 C29 C3 C30 C32 C53 C6 C62 C63 C64 C5 C53 C54 C56 C57 C58 C6 C60 C62 C66 C68 C7 C71 C72 C73 C74 C75 C80 C83 C84 C89 C90 C92	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	45
C105 C106 C107 C109 C63 C67 C78 C79 C85 C86 C88 C91 C93 C94	CAP,CER,.1MF,50V	CK-104	CRL	1500-01-0410	14
C2	CAP,CER,150PF,1KV	DD-151	CRL	1500-01-5111	1
C10 C14	CAP,CER,330PF,1KV	DD-331	CRL	1500-03-3111	2
C24	CAP,MICA,100PF,500V	DM15-101J	AMCO	1500-11-0100	1
C25	CAP,MICA,15PF,500V	DM15-150J	AMCO	1500-11-5000	1
C28 C31 C99T	CAP,MICA,220PF,500V	DM15-221J	AMCO	1500-12-2100	3

WAVETEK PARTS LIST — TITLE: PCA,GENERATOR — ASSEMBLY NO. 1100-00-0584 — PAGE: 1 — REV U

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
	CAP,SET,POLYC CONSIST|1509-90-0005 THRU|0007			1509-80-0008	
C39	CAP,POLYC,1MF,100V PART OF 1509-80-0008 QTY|0111500-41-0504				
1	GENERATOR	1700-00-0556	WVTK	1700-00-0556	1
2	CONN,9PIN	09-60-1091	MOLEX	2100-02-0052	1
3	BOLDEM LUG	1497	BMITH	2100-04-0012	5
4	TERM	200081	USECO	2100-05-0004	8
5	PIN,MALE	61182-2	AMP	2100-05-0020	16
6	HEAT SINK	NF-207	WAKE	2800-11-0001	2
7	THANBIPAD	10160	METRS	2800-11-0004	4
8	HEATSINK	NF-209	WAKE	2800-11-0008	2
FB1	FERRITE BEAD	56-590-65/3B	FERRX	3100-00-0001	1
R4 R48	POT,TRIM,1K	91AW1K	BECK	4600-01-0209	2
R12 R162 R55	POT,TRIM,10K	91AW10K	BECK	4600-01-0315	3
R13 R16 R181 R252	POT,TRIM,100K	91AR100K	BECK	4600-01-0402	4
R107 R120 R93	POT,TRIM,200	91AR200	BECK	4600-02-0101	3
R35	POT,TRIM,500	91AW500	BECK	4600-05-0104	1

WAVETEK PARTS LIST — TITLE: PCA,GENERATOR — ASSEMBLY NO. 1100-00-0584 — PAGE: 3 — REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R239 R240 R250 R251	RES,MF,1/8W,1%,11K	RN55D-1102F	TRW	4701-03-1102	4
R96 R97	RES,MF,1/8W,1%,1.21K	RN55D-1211F	TRW	4701-03-1211	2
R263T	RES,MF,1/8W,1%,13K	RN55D-1302F	TRW	4701-03-1302	1
R114 R241 R247 R66	RES,MF,1/8W,1%,150	RN55D-1500F	TRW	4701-03-1500	4
R113 R18 R198 R23 R267 R32 R36 R62 R63 R9	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	10
R132 R163 R2	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	3
R102	RES,MF,1/8W,1%,150K	RN55D-1503F	TRW	4701-03-1503	1
R218 R219 R220 R221	RES,MF,1/8W,1%,15	RN55D-15R0F	TRW	4701-03-1509	4
R169	RES,MF,1/8W,1%,1.78K	RN55D-1781F	TRW	4701-03-1781	1
R184	RES,MF,1/8W,1%,1.96K	RN55D-1961F	TRW	4701-03-1961	1
R179	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	1
R1 R15 R183 R209 R28 R31	RES,MF,1/8W,1%,2K	RN55D-2001F	TRW	4701-03-2001	6
R143	RES,MF,1/8W,1%,215	RN55D-2150F	TRW	4701-03-2150	1
R166 R170	RES,MF,1/8W,1%,21.5	RN55D-21R5F	TRW	4701-03-2159	2
R237 R246	RES,MF,1/8W,1%,23.7K	RN55D-2372F	TRW	4701-03-2372	2
R102 R137 R184 R159	RES,MF,1/8W,1%,249	RN55D-2490F	TRW	4701-03-2490	11

WAVETEK PARTS LIST — TITLE: PCA,GENERATOR — ASSEMBLY NO. 1100-00-0584 — PAGE: 5 — REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
C41T	CAP,MICA,36PF,500V	DM15-360J	AMCO	1500-13-6000	1
C46 C51	CAP,MICA,47PF,500V	DM15-470J	AMCO	1500-14-7000	2
C35T C67 C50	CAP,MICA,68PF,500V	DM15-680J	AMCO	1500-16-8000	3
C36	CAP,MICA,820PF,300V	DM15-821F	AMCO	1500-18-2101	1
C19	CAP,POLYC,1MF,100V	210-81C-105F	INB	1500-41-0504	1
C38 C40	VARI,3.5-13PF,250V	73-1R1K0-02 3.5/13PF	TRIKO	1500-51-3000	2
C12 C8 C96 C97	CAP,TANT,1MF,35V	150D105X9035A2	SPRAG	1500-71-0502	4
C69	CAP,TANT,.22MF,15V	196D226X9015KA1	SPRAG	1500-72-2601	1
C95 C98	CAP,TANT,.27MF,35V	196D276X0035FB	SPRAG	1500-72-7602	2
C111 C112 C64 C65	CAP,TANT,5.6MF,35V	150D565X9035B2	SPRAG	1500-75-6502	4
	CAP,SET,POLYC CONSIST|1509-90-0005 THRU|0007	180-501-101	WVTK	1509-80-0008	1
C37	CAP,POLYC,.01MF,100V PART OF 1509-80-0008 QTY|0111500-41-0304				
C36	CAP,POLYC,.1MF,100V PART OF 1509-80-0008 QTY|0111500-41-0404				

WAVETEK PARTS LIST — TITLE: PCA,GENERATOR — ASSEMBLY NO. 1100-00-0584 — PAGE: 2 — REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R27b	POT,SWITCH,10K	GM-1879	CTS	4602-01-0300	1
R30	POT,SWITCH,50K	LM-4909	CTS	4602-05-0301	1
R10	POT,CONT,10K FHUM|8600-01-0312	8609-71-0301	WVTK	4609-71-0301	1
R185	POT,CONT,500 FHUM|8600-05-0105	8609-75-0101	WVTK	8609-75-0101	1
R11 R8	RES,C,1/2W,10%,5.1M	RC20GF-515	STKPL	4700-25-5108	2
R17	RES,C,1/2W,10%,6.8M	RC20GF-685	STKPL	4700-25-6804	1
R118 R124 R127 R128 R129 R142 R145 R149 R153 R158 R174 R180 R197T R200T R214 R216 R49 R57 R73	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	19
R104 R108 R111 R159 R165 R168 R220 R257 R45 R67 R91 R94 R98 R99	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	14
R112 R146 R203 R265 R41	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	5
R116 R123 W139 W141 R172 R173 R196 R210 R23a R24 R273 R38 R50 R61 R66 R74 R81 R84	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	18
R211 R212	RES,MF,1/8W,1%,1.1K	RN55D-1101F	TRW	4701-03-1101	2

WAVETEK PARTS LIST — TITLE: PCA,GENERATOR — ASSEMBLY NO. 1100-00-0584 — PAGE: 4 — REV D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R18a R230 R242 R245 R25 R262 R39					
R147 R151 R15a R171 R188 R189 R19 R254 R255 R274 R278 R33	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	12
R161 R213 R281	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW	4701-03-2492	3
R150 R177 R178 R43	RES,MF,1/8W,1%,3.01K	RN55D-3011F	TRW	4701-03-3011	4
R131 R256	RES,MF,1/8W,1%,301K	RN55D-3013F	TRW	4701-03-3013	2
R134 R67 R71 R88 R89	RES,MF,1/8W,1%,316	RN55D-3160F	TRW	4701-03-3160	5
R101 R103 R109 R110 R119 R126 R130 R140 R187 R192 R204 R253 R269 R272 R65 R68 R69 R72 R75 R76 R79 R82 R95	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW	4701-03-3329	23
R100T R105T R191 R202 R258 R80 R83	RES,MF,1/8W,1%,3.65K	RN55D-3651F	TRW	4701-03-3651	7
R115 R193 R194 R195	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	4701-03-3920	4
R199 R42	RES,MF,1/8W,1%,4.02K	RN55D-4021F	TRW	4701-03-4021	2
R10b R205 R20a R207	RES,MF,1/8W,1%,464	RN55D-4640F	TRW	4701-03-4640	4
R201	RES,MF,1/8W,1%,46.4K	RN55D-4642F	TRW	4701-03-4642	1
R5	RES,MF,1,8W,1%,46.4	RN55D-46R4F	TRW	4701-03-4649	1

WAVETEK PARTS LIST — TITLE: PCA,GENERATOR — ASSEMBLY NO. 1100-00-0584 — PAGE: 6 — REV U

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJENGR		TITLE: GENERATOR
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ±1 XX ± .030		
	DO NOT SCALE DWG	MODEL NO 143	DWG NO 1100-00-0594 REV D
	SCALE	CODE IDENT 23338	SHEET 1 OF 2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R30	RES,MF,1/8W,1%,4.75K	RN55D-4751F	TRW	4701-03-4751	1
R231 R259	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	2
R117 R14 R152 R20 R22 R232 R26 R27 R3 R37	RES,MF,1/8W,1%,4,99K	RN55D-4991F	TRW	4701-03-4991	10
R157	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
R057 R92T	RES,MF,1/8W,1%,54,9	RN55D-54R9F	TRW	4701-03-5499	2
R235	RES,MF,1/8W,1%,56,2	RN55D-56R2F	TRW	4701-03-5629	1
R140T R243 R246	RES,MF,1/8W,1%,576	RN55D-5760F	TRW	4701-03-5760	3
R21 R40 R48 R86 R91	RES,MF,1/8W,1%,604	RN55D-6040F	TRW	4701-03-6040	5
R215 R217 R234 R244 R260 R268 R275	RES,MF,1/8W,1%,61,9	RN55D-61R9F	TRW	4701-03-6199	7
R264 R270	RES,MF,1/8W,1%,681	RN55D-6810F	TRW	4701-03-6810	2
R46	RES,MF,1/8W,1%,6,98K	RN55D-6981F	TRW	4701-03-6981	1
R135 R167 R190 R60 R70	RES,MF,1/8W,1%,750	RN55D-7500F	TRW	4701-03-7500	5
R133 R136 R138 R160 R164 R261 R266 R77 R78	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	9
R154	RES,MF,1/8W,1%,76,8K	RN55D-7682F	TRW	4701-03-7682	1
R125	RES,MF,1/8W,1%,825	RN55D-8250F	TRW	4701-03-8250	1

WAVETEK PARTS LIST | TITLE PCA,GENERATOR | ASSEMBLY NO. 1100-00-0584 | REV D | PAGE: 7

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
	RES,MF,BET,MATCHED CONSIST:4799-00-0043 THRU:0045			4789-00-0043	
R52	RES,MF,1/4W,1%,1M PART OF 4789-00-0043 QTY:01:4701-13-1004				
R56	RES,MF,,6W,1%,10M	ML-181	CADDO	4799-00-0003	1
CR16 CR3 CR33 CR4 CR5	DIODE	1N4581	MICRO	4801-01-4581	5
CR19 CR28 CR29 CR30 CR31 CR6 CR7 CR8 CR9	DIODE	FD-777	FAIR	4807-02-0777	9
CR1 CR10 CR11 CR14 CR15 CR17 CR18 CR20 CR21 CR22 CR23 CR24 CR25 CR32 CR34 CR35 CR36 CR37 CR46	DIODE	FD-6666	FAIR	4807-02-6666	19
CR12 CR13	DIODE	5082-2811	HP	4809-02-2811	2
CR2 CR26	DIODE,M/PR,FD=777 QTY:2:4807-02-0777	104-501-93	MVTK	4898-00-0004	1
CR38 CR39 CR40 CR41 CR42 CR43 CR44 CR45	DIODE,BEL,8=FD-777 QTY:8:4807-02-0777	182-500-98	MVTK	4898-00-0010	1
Q42	TRANS	2N2219A	FAIR	4901-02-2191	1
Q43	TRANS	2N2905A	FAIR	4901-02-9051	1
Q12 W36 Q50	TRANS	2N3563	FAIR	4901-03-5630	3

WAVETEK PARTS LIST | TITLE PCA,GENERATOR | ASSEMBLY NO. 1100-00-0584 | REV D | PAGE: 9

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
SW5	DETENT MOD FROM:5104-01-0010	5104-99-0029	MVTK	5104-99-0029	1
SW4	DETENT MOD FROM:5104-01-0010	5104-99-0030	MVTK	5104-99-0030	1
NONE	WIRE,MU,22GA	150-BLACK	GAVTT	6000-32-2000	1
NONE	WIRE,MU,22GA	150-BROWN	GAVTT	6000-32-2001	1
NONE	WIRE,MU,22GA	150-RED	GAVTT	6000-32-2002	1
NONE	WIRE,MU,22GA	150-ORANGE	GAVTT	6000-32-2003	1
NONE	WIRE,MU,22GA	150-YELLOW	GAVTT	6000-32-2004	1
NONE	WIRE,MU,22GA	150-GREEN	GAVTT	6000-32-2005	1
NONE	WIRE,MU,22GA	150-BLUE	GAVTT	6000-32-2006	1
NONE	WIRE,MU,22GA	150-VIOLET	GAVTT	6000-32-2007	1
NONE	WIRE,MU,22GA	150-GRAY	GAVTT	6000-32-2008	1
NONE	WIRE,MU,22GA	150-WHITE/BLACK	GAVTT	6000-32-2090	1
NONE	WIRE,MU,22GA	150-WHITE/BROWN	GAVTT	6000-32-2091	1
NONE	WIRE,MU,22GA	150-WHITE/RED	GAVTT	6000-32-2092	1
NONE	WIRE,MU,22GA	150-WHITE/ORANGE	GAVTT	6000-32-2093	1
NONE	WIRE,MU,22GA	150-WHITE/YELLOW	GAVTT	6000-32-2094	1

WAVETEK PARTS LIST | TITLE PCA,GENERATOR | ASSEMBLY NO. 1100-00-0584 | REV D | PAGE: 11

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R238 R249 R58	RES,MF,1/8W,1%,8,25K	RN55D-8251F	TRW	4701-03-8251	3
R59	RES,MF,1/8W,1%,82,5	RN55D-82R5F	TRW	4701-03-8259	1
R122 R228	RES,MF,1/8W,1%,909	RN55D-9090F	TRW	4701-03-9090	2
R271	RES,MF,1/8W,1%,90,9	RN55D-90R9F	TRW	4701-03-9099	1
R7	RES,MF,1/4W,1%,1M	RN60D-1004F	TRW	4701-13-1004	1
R233	RES,MF,1/4W,1%,121	RN60D-1210F	TRW	4701-13-1210	1
R229	RES,MF,1/4W,1%,124	RN60D-1240F	TRW	4701-13-1240	1
R222 R279	RES,MF,1/4W,1%,49,9	RN60D-49R9F	TRW	4701-13-4999	2
R6T	RES,MF,1/4W,1%,698K	RN60D-6983F	TRW	4701-13-6983	1
R223 R280	RES,MF,1/4W,1%,75	RN60D-75R0F	TRW	4701-13-7509	2
R224 R225 R226 R227	RES,MF,1/2W,1%,49,9	RN65D-49R9F	TRW	4701-23-4999	4
	RES,MF,BET,MATCHED CONSIST:4799-00-0043 THRU:0045	4789-00-0043	MVTK	4789-00-0043	1
R52	RES,MF,1/8W,1%,10K PART OF 4789-0043 QTY:01:4701-03-1002				
R53	RES,MF,1/8W,1%,100K PART OF 4789-00-0043 QTY:01:4701-03-1003				

WAVETEK PARTS LIST | TITLE PCA,GENERATOR | ASSEMBLY NO. 1100-00-0584 | REV D | PAGE: 8

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q15 Q16 Q37 Q49	TRANS	2N3640	FAIR	4901-03-6400	4
Q39 Q48	TRANS	2N3866	MOT	4901-03-8660	2
Q13 Q21 U22 Q27 U28 Q29 Q31 Q40 Q6	TRANS	2N3903	FAIR	4901-03-9030	9
Q10 Q11 Q14 Q17 Q19 Q23 Q24 Q2c Q30 Q32 Q33 Q34 Q4 Q41 Q46 Q47 Q51	TRANS	2N3905	FAIR	4901-03-9050	17
Q38 Q45	TRANS	2N5160	MOT	4901-05-1600	2
Q1 Q5	TRANS	2N5486	NEC	4901-05-4860	2
Q18 U20	TRANS,M/PR,2N3563 QTY:2:4901-03-5630	142-501-52	MVTK	4998-00-0004	1
Q2 Q3 Q7	TRANS,BEL,2N5462 QTY:1:4901-05-4620	142-501-55	MVTK	4998-00-0008	3
Q8 Q9	TRANS,M/PR,2N5485 QTY:2:4901-05-4850	142-501-53	MVTK	4998-00-0009	1
NONE	WAFER	147-400	MVTK	5104-02-0015	10
NONE	SWITCH STOP	211-33-001	CTS	5104-07-0001	1
NONE	SWITCH STOP	215-33-001-01-22	CTS	5104-07-0003	3
SW1	DETENT MOD FROM:5104-01-0010	5104-99-0028	MVTK	5104-99-0028	1

WAVETEK PARTS LIST | TITLE PCA,GENERATOR | ASSEMBLY NO. 1100-00-0584 | REV D | PAGE: 10

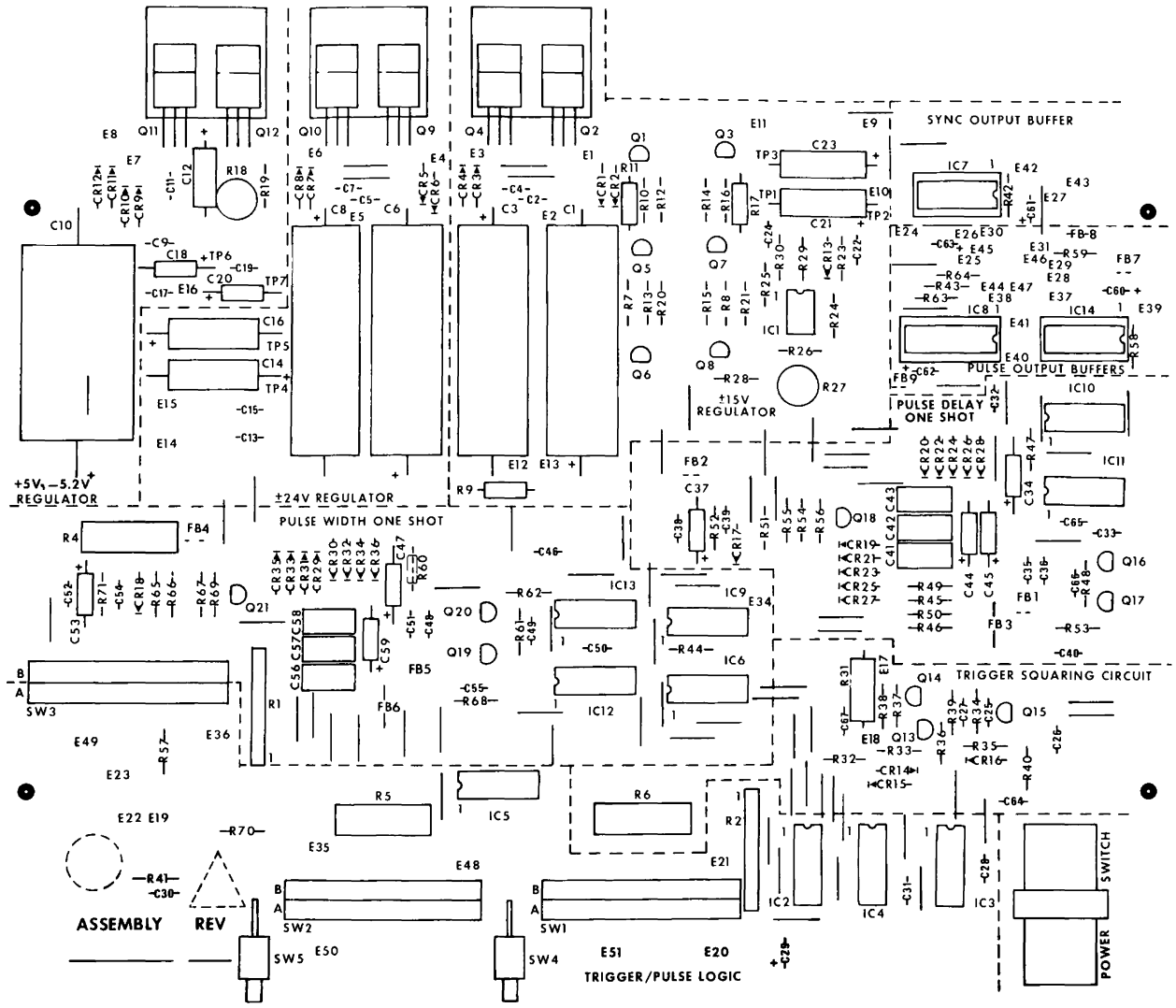
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	WIRE,MU,22GA	150-WHITE/GREEN	GAVTT	6000-32-2095	1
IC3 IC4 IC5	IC	MA-741	FAIR	7000-07-4100	3
Q35 Q48	IC	AD 812	ANDEV	7000-08-1200	2
IC1 IC2 IC6	IC	MC1458P	MOT	7000-14-5800	3
IC9	IC	CA-3049	RCA	7000-30-4900	1
IC7 IC8	IC	CA3140B	RCA	7000-31-4001	2

WAVETEK PARTS LIST | TITLE PCA,GENERATOR | ASSEMBLY NO. 1100-00-0584 | REV D | PAGE: 12

NOTE UNLESS OTHERWISE SPECIFIED

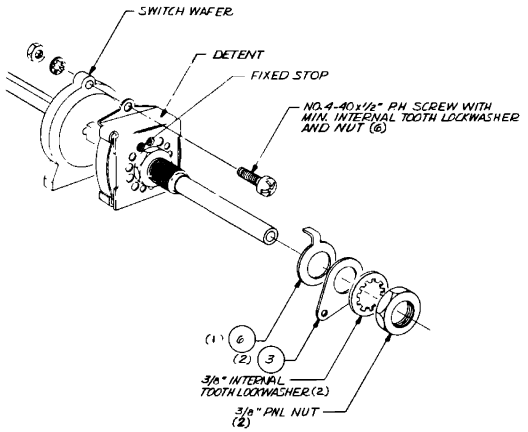
REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CA
MATERIAL	PROJ/ENGR		TITLE: GENERATOR
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.02		
	DO NOT SCALE DWG		MODEL NO: 43
	SCALE		DWG NO: 460-00-0584
			CODE IDENT: 23338
			SHEET 2

REV	ECN	BY	DATE	APP

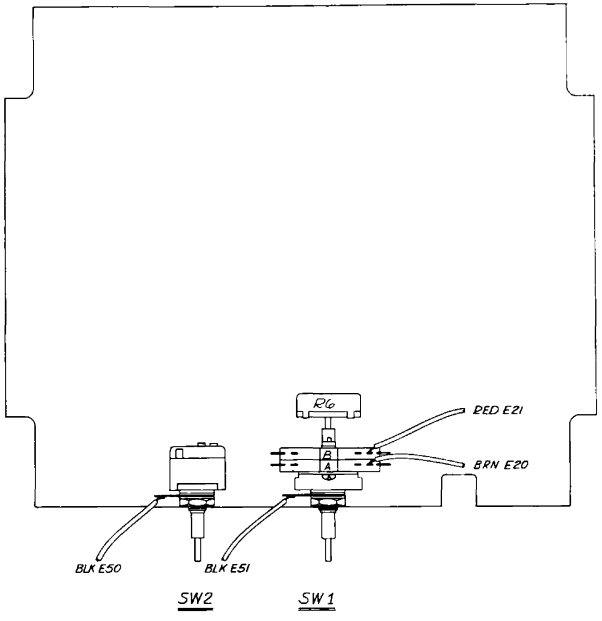


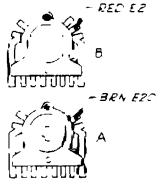
NOTE UNLESS OTHERWISE SPECIFIED

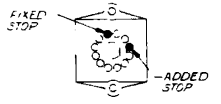
REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: TRIG/PULSE BOARD PARTS LOCATER
FINISH WAVETEK PROCESS	RELEASE APPROV		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± 010 ANGLES ±1° .XX ± 030		
	DO NOT SCALE DWG		MODEL NO 143/145 · DWG NO 0100-00-0565 · REV C
	SCALE		CODE IDENT 23338 · SHEET OF



TYPICAL HARDWARE STACK-UP







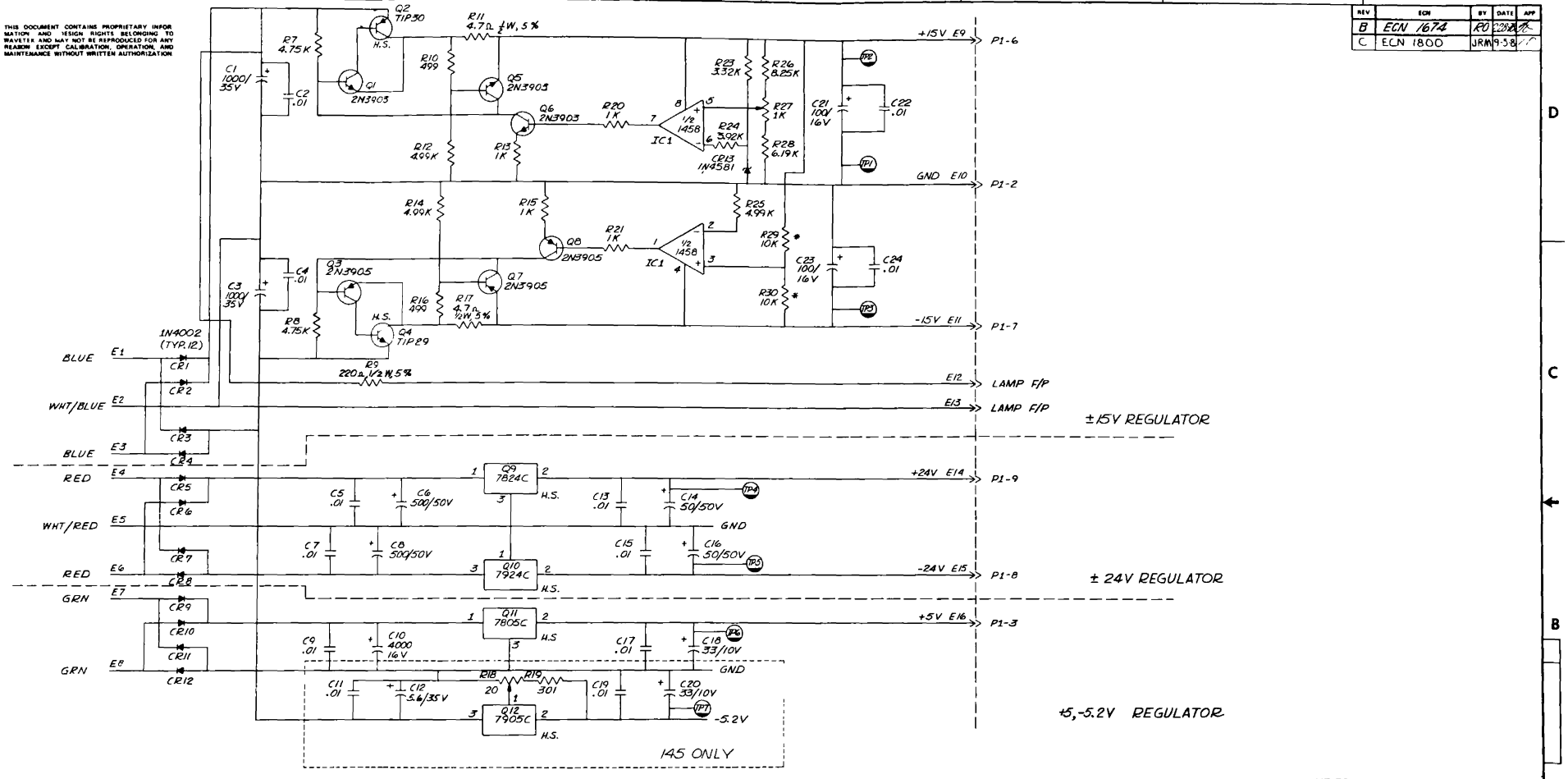
SW 1
WIRING DETAIL

DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN D. COOPER	DATE 12-77	WAVETEK SAN DIEGO, CA
MATERIAL	RELEASE APPROVAL		TITLE ASSEMBLY TRIG/PULSE B.D.
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG	MODEL NO 143	DWG NO 0101-00-0585
	SCALE	CAGE IDENT 23338	SHEET

REV	ECN	BY	DATE	APP
B	ECN 1674	RO	2-28-77	
C	ECN 1800	JRM	9-5-8	

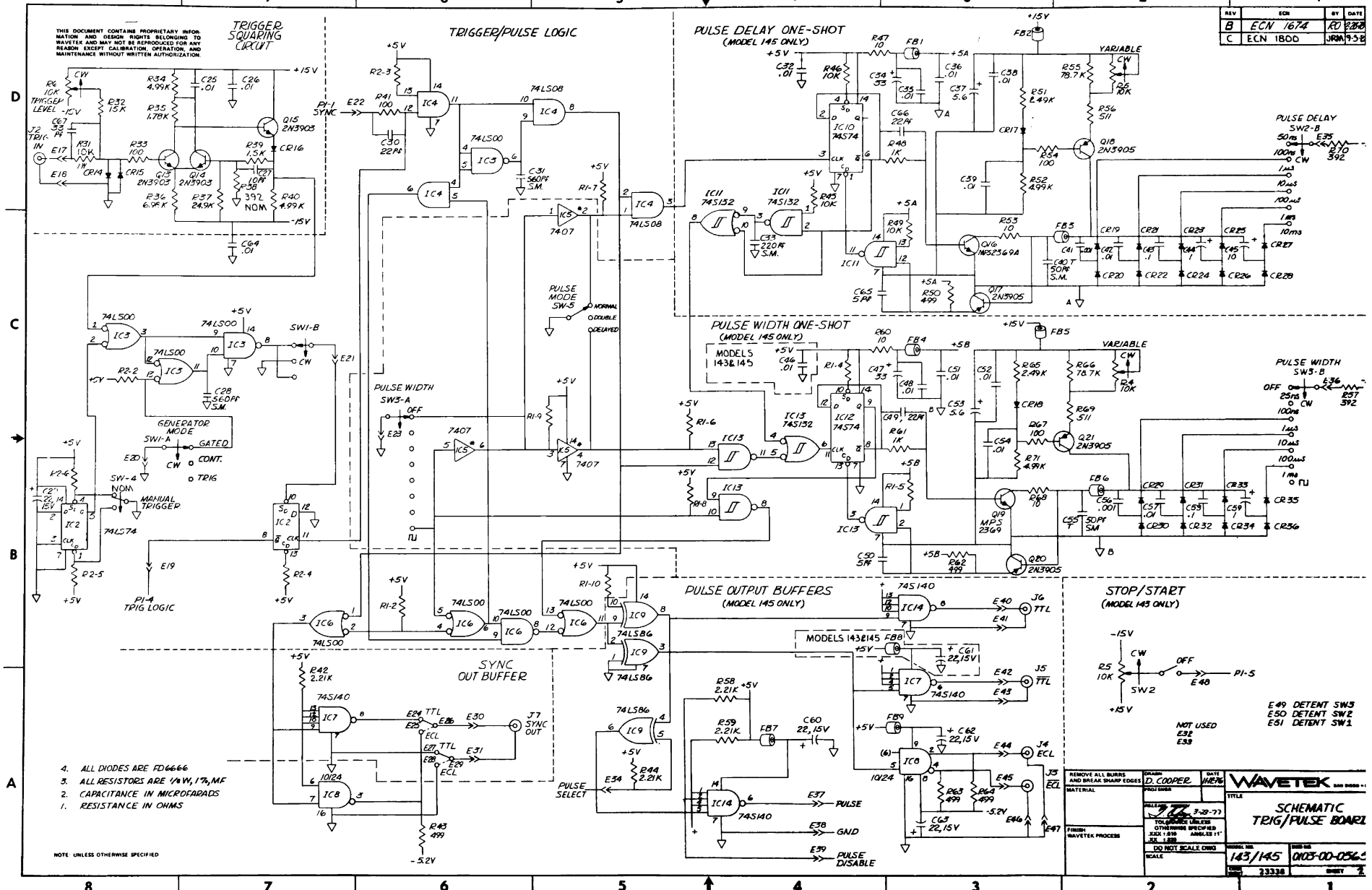


LAST REF DES USED
C67
CR36
FB9
IC14
R71
SW4
Q21

1. RESISTORS ARE 1/8W, 1%, MF
2. CAPACITANCE IN MICROFARADS
3. RESISTANCE IN OHMS
4. * - M.R. 10K RESISTORS

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN J. COOPER	DATE 1-10-77	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENG		TITLE SCHEMATIC TRIG/PULSE BOARD
FINISH WAVETEK PROCESS	RELEASE APPROV 2-22-77		
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 XX ± .030 ANGLES ± 1		
	DO NOT SCALE DWG	MODEL NO 143/145	DWG NO 0103-00-0565 REV C
	SCALE	CODE IDENT 23338	SHEET 1 OF 2


THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND DESIGN RIGHTS BELONGING TO WAVETEK AND MAY NOT BE REPRODUCED FOR ANY REASON EXCEPT CALIBRATION, OPERATION, AND MAINTENANCE WITHOUT WRITTEN AUTHORIZATION.
TRIGGER SQUARING CIRCUIT
TRIGGER/PULSE LOGIC
PULSE DELAY ONE-SHOT
(MODEL 145 ONLY)
PULSE WIDTH ONE-SHOT
(MODEL 145 ONLY)
PULSE OUTPUT BUFFERS
(MODEL 145 ONLY)
SYNC OUT BUFFER
STOP/START
(MODEL 145 ONLY)
REV ECN BY DATE
B ECN 1674 RD 9-28
C ECN 1800 JRM 9-5-8
4. ALL DIODES ARE FD6666
3. ALL RESISTORS ARE 1/8W, 1%, MF
2. CAPACITANCE IN MICROFARADS
1. RESISTANCE IN OHMS
NOTE: UNLESS OTHERWISE SPECIFIED
E49 DETENT SW3
E50 DETENT SW2
E51 DETENT SW1
NOT USED
E32
E33
WAVETEK
SCHEMATIC
TRIG/PULSE BOARD
145/145
0103-00-0564
23330

REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWNG TRIG/PULSE	0101-00-0585	WVTK	0101-00-0585	1
NONE	SCHEMATIC TRIG/PULSE	0103-00-0585	WVTK	0103-00-0585	1
NONE	BRKT,HEAT SINK	182-308	WVTK	1400-00-5143	1
C27	CAP,CER,10PF,1KV	DD-100	CML	1500-01-0011	1
C13 C15 C17 C2 C22 C24 C25 C26 C4 C46 C5 C64 C7 C9	CAP,CER,,01MF,50V	CK-103	CML	1500-01-0310	14
C30	CAP,CER,22PF,1KV	DD-220	CML	1500-02-0011	1
C67	CAP,CER,33PF,1KV	DD-330	CML	1500-03-3011	1
C28 C31	CAP,MICA,360PF,300V	DM15-361J	ARCO	1500-15-6100	2
C21 C23	CAP,ELECT,100MF,16V	500D107G016DC7	SPRAG	1500-51-0101	2
C1 C3	CAP,ELECT,1000MF,35V	39U108G035GL6	SPRAG	1500-31-0212	2
C10	CAP,ELECT,4000MF,15V	TCG402U015N1L	MAL	1500-34-0211	1
C14 C16	CAP,ELECT,50MF,50V	500D506G050DD7	SPRAG	1500-35-0003	2
C6 C8	CAP,ELECT,500MF,50V	39D507G050GL4	SPRAG	1500-35-0103	2
C29 C61	CAP,TANT,22MF,15V	196D226X9015MA1	SPRAG	1500-72-2601	2
C18	CAP,TANT,33MF,10V	150D336X9010B2	SPRAG	1500-73-3001	1
E	THIGGER/PULSE	1700-00-0565	WVTK	1700-00-0565	1
A2P1	CONN,9PIN	09-50-7091	MOLEX	2100-02-0051	1

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO. 1100-00-0585 — PAGE: 1 — REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R37	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW	4701-03-2492	1
R23	RES,MF,1/8W,1%,3.32K	RN55D-3321F	TRW	4701-03-3321	1
R38T	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	4701-03-3920	1
R24	RES,MF,1/8W,1%,3.92K	RN55D-3921F	TRW	4701-03-3921	1
R7 R8	RES,MF,1/8W,1%,4.75K	RN55D-4751F	TRW	4701-03-4751	2
R10 R16	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	2
R12 R14 R25 R36 R40	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	5
R28	RES,MF,1/8W,1%,6.19K	RN55D-6191F	TRW	4701-03-6191	1
R34	RES,MF,1/8W,1%,6.98K	RN55D-6981F	TRW	4701-03-6981	1
R26	RES,MF,1/8W,1%,8.25K	RN55D-8251F	TRW	4701-03-8251	1
R1 R2	RES MODULE	4310R-101-103	BOURN	4770-00-0008	2
R29 R30	RES,SET,2-10K,1/8W QT1121 4701-03-1002	142-501-66A	WVTK	4789-00-0019	1
CR13	DIODE	1N4581	MICRO	4801-01-8581	1
CR1 CR10 CR11 CR12 CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9	DIODE	BCE-1	SEMTC	4801-02-0001	12
CR14 CR15 CR16	DIODE	FD-6666	FAIR	4807-02-6666	3
Q1 Q13 Q14 Q15 Q5 Q6	TRANS	2N3903	FAIR	4901-03-9030	6

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO. 1100-00-0585 — PAGE: 3 — REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	WIRE,MU,22GA	15U-WHITE/BROWN	GAVTT	6000-32-2091	2
NONE	WIRE,MU,22GA	15U-WHITE/RED	GAVTT	6000-32-2092	2
NONE	WIRE,MU,22GA	15U-WHITE/ORANGE	GAVTT	6000-32-2093	1
NONE	WIRE,MU,22GA	15U-WHITE/YELLOW	GAVTT	6000-32-2094	1
NONE	WIRE,MU,22GA	15U-WHITE/GREEN	GAVTT	6000-32-2095	1
NONE	WIRE,MU,22GA	15U-WHITE/BLUE	GAVTT	6000-32-2096	1
NONE	WIRE,MU,22GA	15U-WHITE/VIOLET	GAVTT	6000-32-2097	1
NONE	CABLE,COAX,26AWG	RG 174/U	ITT	6001-60-0001	1
IC1	IC	MC1458P	MOT	7008-14-5800	1
Q9	IC	7824	FAIR	7000-78-2400	1
Q10	IC	7924	FAIR	7000-79-2400	1
IC3 IC6	IC	74L800	TI	8000-74-0010	2
IC4	IC	74L808	TI	8000-74-0810	1
IC2	IC	74L874	TI	8000-74-7410	1
Q11	VOLTAGE REGULATOR	7805393	FAIR	8000-78-0500	1
IC7	IC	748140	TI	8007-41-4001	1

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO. 1100-00-0585 — PAGE: 5 — REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
2	SKT,IC,14PIN	14-D1P	CINCH	2100-03-0011	1
3	SOLDER LUG	1497	SMITH	2100-04-0012	2
4	PIN	08-50-0105	MOLEX	2100-05-0025	9
5	STANDOFF	P-609-M03-F05-468	WVTK	2808-02-0016	4
FB8	FERRITE BEAD	56-590-65/3B	FERRX	3100-00-0001	1
R27	POT,TRIM,1K	91A1K	BECK	4600-01-0209	1
SW2	PUT,SWITCH,10K	SM-1879	CTS	4602-01-0308	1
R6	PUT,CONT,10K FMQM14600-01-0312	4609-71-0303	WVTK	4609-71-0303	1
R11 R17	RES,C,1/2W,5%,4.7	RC20GF-4R7	STKPL	4700-25-0479	2
R9	RES,C,1/2W,5%,220	RC20GF-221	STKPL	4700-25-2200	1
R31	RES,C,1W,10A,10K	RC32GF-103	STKPL	4700-35-1002	1
R33 R41	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	2
R13 R15 R20 R21	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	4
R39	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	1
R32	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	1
R35	RES,MF,1/8W,1%,1.78K	RN55D-1781F	TRW	4701-03-1781	1
R42	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	1

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO. 1100-00-0585 — PAGE: 2 — REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q3 Q7 Q8	TRANS	2N3905	FAIR	4901-03-9050	3
Q4	TRANS	TIP-29	TI	4902-00-0290	1
Q2	TRANS	TIP-30	TI	4902-00-0300	1
SW1-A SW1-B	WAFER	147-480	WVTK	5104-04-0015	2
6	SWITCH STOP	215-33-001-01-2d	CTS	5104-07-0003	1
SW1	DETENT MOD FMQM15104-01-0010	5104-99-0031	WVTK	5104-99-0031	1
SW4	SWITCH,TOGGLE	7108P3Y9AVQ	C&K	5106-00-0020	1
NONE	WIRE,MU,22GA	15U-BROWN	GAVTT	6000-32-2001	1
NONE	WIRE,MU,22GA	15U-RED	GAVTT	6000-32-2002	2
NONE	WIRE,MU,22GA	15U-ORANGE	GAVTT	6000-32-2003	2
NONE	WIRE,MU,22GA	15U-YELLOW	GAVTT	6000-32-2004	2
NONE	WIRE,MU,22GA	15U-GREEN	GAVTT	6000-32-2005	2
NONE	WIRE,MU,22GA	15U-BLUE	GAVTT	6000-32-2006	2
NONE	WIRE,MU,22GA	15U-VIOLET	GAVTT	6000-32-2007	2
NONE	WIRE,MU,22GA	15U-GRAY	GAVTT	6000-32-2008	2
NONE	WIRE,MU,22GA	15U-WHITE	GAVTT	6000-32-2009	2
NONE	WIRE,MU,22GA	15U-WHITE/BLACK	GAVTT	6000-32-2090	2

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO. 1100-00-0585 — PAGE: 4 — REV C

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO, CALIFORNIA
MATERIAL	PROJ ENGR		TITLE: TRIGGER / PULSE
	RELEASE APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		
	DO NOT SCALE DWG		MODEL NO 143 — DWG NO 1100-00-0585 — REV C
	SCALE		CODE IDENT 23338 — SHEET 1 OF 1