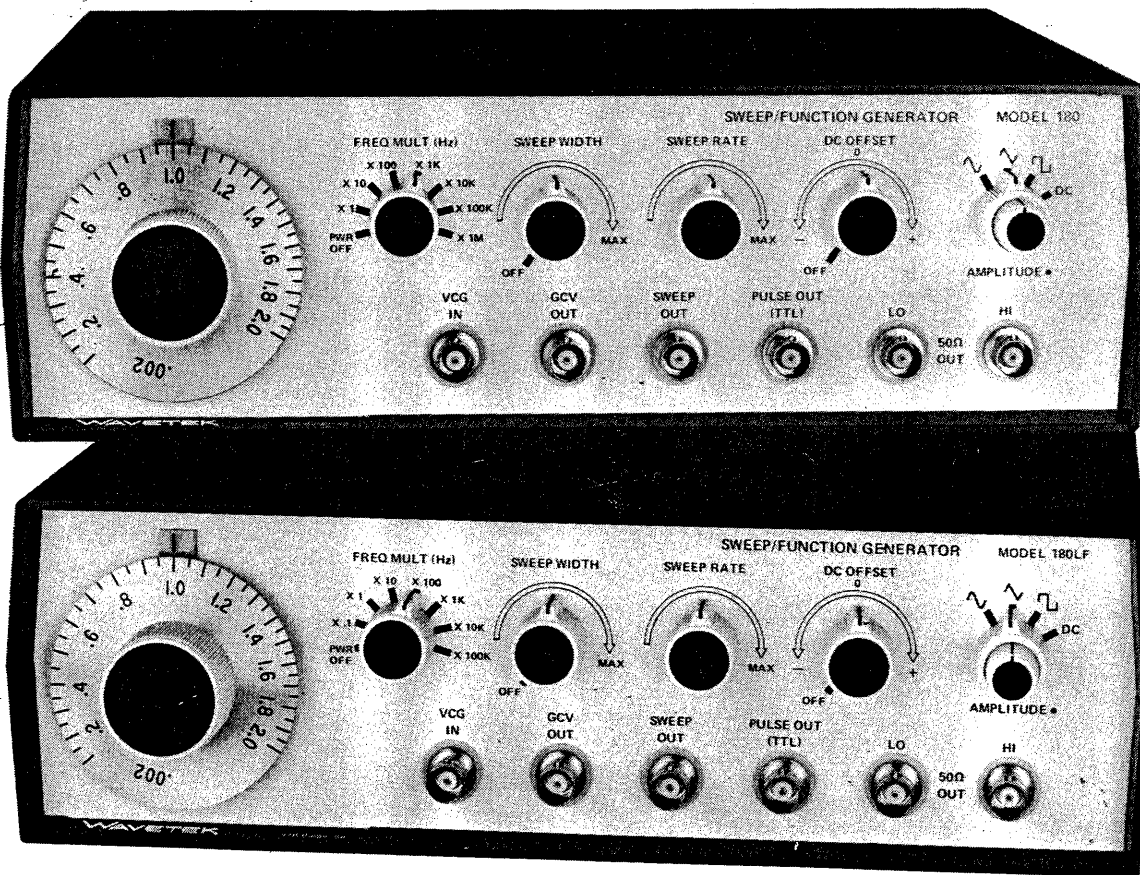


INSTRUCTION MANUAL

MODELS 180 AND 180 LF SWEEP/FUNCTION GENERATORS



WAVETEK

WARRANTY

All Wavetek instruments are warranted 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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INSTRUCTION MANUAL

**MODELS 180 AND 180 LF
SWEEP/FUNCTION
GENERATORS**

WAVETEK

Box 651, San Diego, Calif., 714-279-2200

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SECTION 1

GENERAL DESCRIPTION

1.1 THE MODELS 180 AND 180LF

The Wavetek Model 180 Sweep/Function Generator is a precision source of sine, triangle, and square waveforms. Frequency of the waveforms is manually and remotely variable from 0.1 Hz to 2 MHz. The generator can repetitively sweep from one frequency to a higher frequency, with controllable rate and range of sweep. Amplitude of the waveforms is variable from 10V peak-to-peak into 50Ω down to 30 mV p-p. DC reference of the waveforms can be offset positively and negatively.

A voltage representing generator frequency, a fixed amplitude pulse train of that frequency, and a voltage ramp representing frequency sweep rate are provided as front panel outputs.






The Wavetek Model 180LF (Low Frequency) Sweep/Function Generator is identical to the Model 180 except for frequency range: 0.01 Hz to 200 kHz.

1.2 SPECIFICATIONS

The specifications (available waveforms, frequencies, and amplitudes), operating modes, precision (accuracy), and purity (quality) are listed in the following paragraphs.

1.2.1 Versatility

Output Signals

Sine , triangle , square , TTL pulse , ramp  and DC.

Control

Generator operates in continuous and sweep modes. Frequency controlled manually or with external voltage.

Frequency Range

0.1 Hz to 2 MHz (180); 0.01 Hz to 200 kHz (180LF).

Operating Frequency Ranges

Model 180:

X 1	0.1 Hz to 2 Hz
X 10	0.1 Hz to 20 Hz
X 100	0.2 Hz to 200 Hz
X 1K	2 Hz to 2 kHz

X 10K	20 Hz to 20 kHz
X 100K	200 Hz to 200 kHz
X 1M	2 kHz to 2 MHz
Model 180LF:	
X .1	0.01 Hz to 0.2 Hz
X 1	0.01 Hz to 2 Hz
X 10	0.02 Hz to 20 Hz
X 100	0.2 Hz to 200 Hz
X 1K	2 Hz to 2 kHz
X 10K	20 Hz to 20 kHz
X 100K	200 Hz to 200 kHz

Main Output

Sine, triangle and square waveforms and DC are selectable. HI (0 dB) and LO (-20 dB) BNC outputs are available for simultaneous usage; outputs may be varied to HI (-30 dB) and LO (-50 dB) by amplitude control. HI output provides 20V peak-to-peak max open circuit (10V peak-to-peak max into 50Ω load). LO output provides 1V peak-to-peak max into 50Ω load. Both output impedances are 50Ω.

DC Offset and DC Output

DC offset of waveform and DC output selectable and variable through HI and LO BNC outputs. HI output ±10V max (±5V into 50Ω load) as offset or Vdc output. LO output ±1V max into 50Ω load as offset or Vdc output. Waveform offset limited to ±10 Vp HI and ±1 Vp LO (both open circuit voltages).

Pulse Output

TTL pulse (50% duty cycle) at generator frequency. Drives up to 20 TTL loads.

GCV Output

0 to +2V (nominal, open circuit) proportional to frequency of main generator. Output impedance 600Ω.

VCG - Voltage Controlled Generator Input

VCG voltage as well as control settings select generator frequency. Frequency may be dc-programmed or ac-modulated by external 0 to 2V signal. Input impedance is 2 kΩ. VCG input can change generator output 1000:1 on all ranges except X 10 Hz and X 1 Hz ranges (Model 180) and X 1 Hz and X .1 Hz (Model 180LF).

VCG Input Signal Bandwidth: 100 kHz.

VCG Slew Rate: 0.1V/μs.

Sweep Output

Ramp waveform output with 5V peak into open circuit.
Output impedance 600Ω.

1.2.2 Operating Modes

Continuous

Operates as standard VCG. Frequency of main generator determined by dial/range setting and VCG input voltage.

Sweep

Main generator is frequency modulated by internal sweep generator. When swept, main generator frequency rises from frequency set by the dial and range setting to a frequency set by sweep width control.

Sweep Rate: 30 ms to 20s (nominal) continuously adjustable by single turn control on front panel.

Sweep Width: Up to 1:1000 adjustable on all ranges except X 1 Hz and X 10 Hz ranges (Model 180) and X .1 Hz and X 1 Hz (Model 180LF).

1.2.3 Horizontal Precision

Dial Accuracy

Model 180: ±3% of full scale for 0.1 Hz to 2 MHz.

Model 180LF: ±3% of full scale for 0.01 Hz to 200 kHz.

Time Symmetry

Models 180 and 180LF, as applicable: ±1% on all but X 1M range.

1.2.4 Vertical Precision

Amplitude Change With Frequency (Sine)

Models 180 and 180LF, as applicable:

Less than ±0.1 dB on all ranges thru X 100K.

Less than ±0.5 dB on X 1M range.

1.2.5 Waveform Purity

(Models 180 and 180LF, as applicable)

Sine Distortion

Less than 0.5% on X 100, X 1K, X 10K ranges (typically 0.2%).

Less than 1.0% on X 1, X 10, X 100K ranges (typically 0.5%).

All harmonics 30 dB down on X 1M range.

Square Wave Rise and Fall Time

Less than 75 nanoseconds.

Triangle Linearity

Greater than 99% to 200 kHz.

1.2.6 Environmental

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

1.2.7 Mechanical

Dimensions

11¼ in./28.6 cm wide; 4 in./10.2 cm high; 10½ in./26.7 cm deep.

Weight

6.5 lb/2.9 kg net; 9.5 lb/4.3 kg shipping.

1.2.8 Power

105 to 125V or 200 to 250V, 50 Hz to 400 Hz. Less than 15 watts.

NOTE

All specifications apply when frequency dial is between 0.1 and 2.0, amplitude is at 10V p-p and output is from HI BNC into 50Ω load.

SECTION 2

INITIAL PREPARATION

2.1 UNPACKING INSPECTION

After carefully unpacking the instrument, inspect the external parts for damage to knobs, dials, indicators, surface areas, etc. If there is damage, file a claim with the carrier who transported the instrument. Retain the shipping container and packing material for use in case reshipment is required.

2.2 PREPARATION FOR USE

Before connecting the instrument to line power, check that the rear panel 115/230V switch is set to the value nearest the line voltage and that the fuse is correct for the switch setting. Check that the plug on the power cord is the mate for the line receptacle.

2.3 ELECTRICAL ACCEPTANCE CHECK

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

An oscilloscope, 50Ω coax cable, and a 50Ω feedthru are needed for this procedure (figure 2-1). Preset the generator front panel controls as follows:

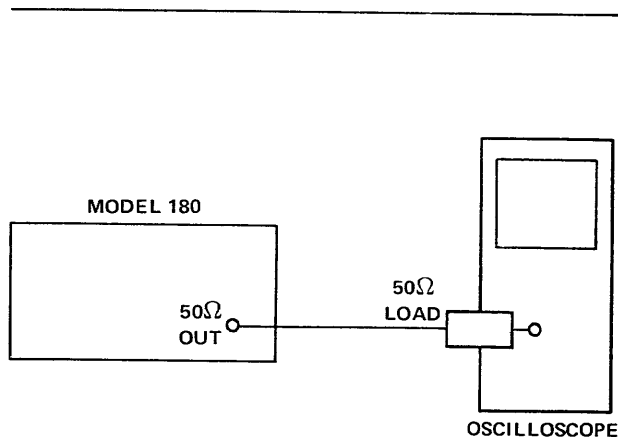


Figure 2-1. Acceptance Check Setup

Control	Position
FREQ MULT	PWR OFF
Frequency Dial	1.0
Function	~
AMPLITUDE	Full clockwise
DC OFFSET	OFF
SWEEP WIDTH	OFF
SWEEP RATE	9 o'clock

Perform the steps in table 2-1; monitor the 50Ω OUT HI connector at the oscilloscope.

2.4 CHANGING THE OUTPUT IMPEDANCE

The output impedance is normally:

- HI 50Ω @ 10V p-p
- LO 50Ω @ 1V p-p

Attenuation is normally 0 - 30 dB. Lowest possible amplitude is -50 dB.

If simultaneous 600Ω and 50Ω output impedances are desired:

1. Change value of R145 from 499Ω to 604Ω.
2. Remove R147.

The result is:



- HI 50Ω @ 10V p-p
- LO 600Ω @ 10V p-p (low power)

Attenuation is 0 - 30 dB. Lowest possible amplitude is -30 dB. Square wave rise and fall is < 150 ns.

If 50Ω and any other impedance greater than 600Ω are desired. replace R145 with resistor of that value.

If 50 dB of attenuation control is desired in a modified instrument, change R121 from 33.2Ω to 1.8Ω. Waveform quality above 20 kHz will be considerably impaired at -50 dB compared to a standard instrument.

Table 2-1. Acceptance Check

Step	Control	Position/Operation	Observe at 50Ω OUT
1	FREQ MULT	X 1 (Model 180) X .1 (Model 180LF)	1 Hz, 10V p-p sine wave (Model 180) 0.1 Hz, 10V p-p sine wave (Model 180LF)
2	FREQ MULT	X 1, X 10, X 100, --- X 1M (as applicable)	Frequency increases by a decade for every change of switch position
3	FREQ MULT	X 1K	---
4	Function		Triangle wave
5	Function		Square wave
6	AMPLITUDE	ccw	Decrease in waveform amplitude
7	DC OFFSET	cw	Positive slew of waveform from full negative offset
8	DC OFFSET	ccw	Negative slew of waveform
9	DC OFFSET	OFF	---
10	AMPLITUDE	Full cw	---
11	Dial	Full cw	---
12	SWEEP WIDTH	Full cw	Frequency of waveform repetitively sweeps

SECTION 3

OPERATION

3.1 CONTROLS AND CONNECTORS

The generator front panel controls and connections shown in figure 3-1 are keyed by circled numbers to the following descriptions.

3.1.1 Power/Frequency Controls

① FREQ MULT/PWR OFF

Power is turned on when frequency range is selected at the FREQ MULT (Hz) control. The ranges multiplied by frequency dial ② settings determine output frequency. The frequency dial index lights when power is turned on.

② Frequency Dial

Frequency dial settings multiplied by frequency range ① determine output frequency.

③ VCG IN Connector

Voltage controlled generator input (VCG IN) dc excursions proportionally control frequency within a selected range. Positive inputs increase frequencies set by the frequency dial and range control; negative inputs decrease the frequencies.

④ GCV OUT Connector

Generator controlled voltage output (GCV OUT) dc excursions of 0V to about 2V proportionally represent output frequency within a given range.

3.1.2 Amplitude Controls

⑤ DC OFFSET

Rotating the DC OFFSET control clockwise offsets dc center reference of waveform positive; when

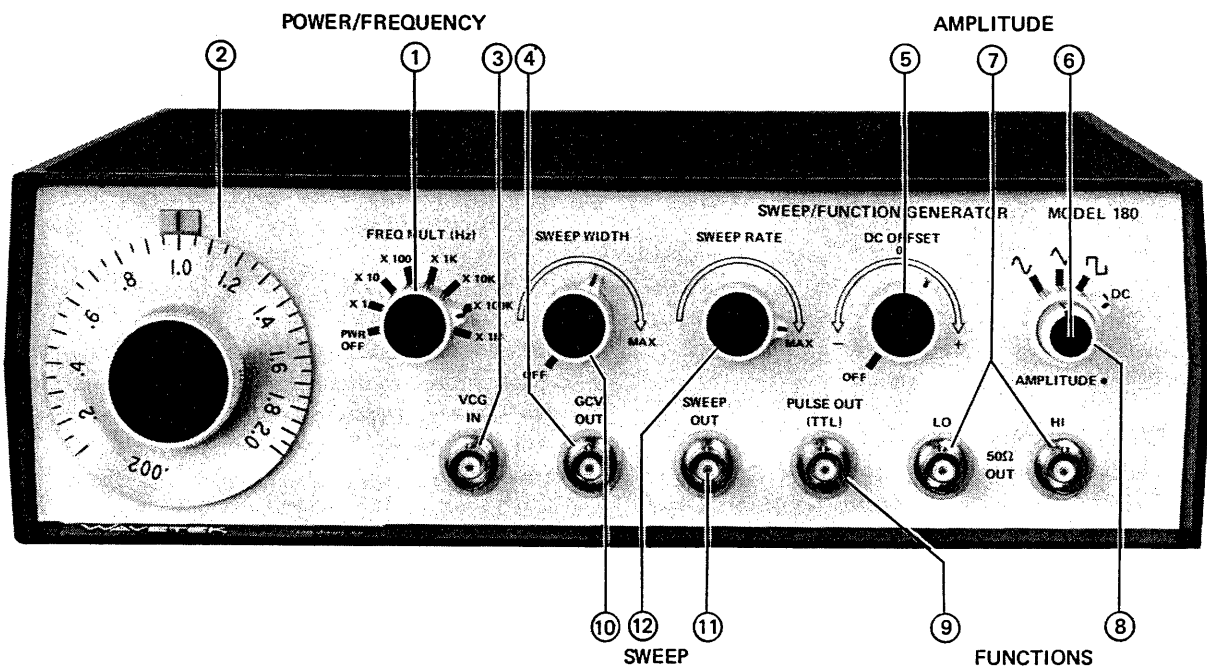


Figure 3-1. Model 180 Controls and Connectors

counterclockwise, negative. When OFF, the waveform is balanced around signal ground (figure 3-2).

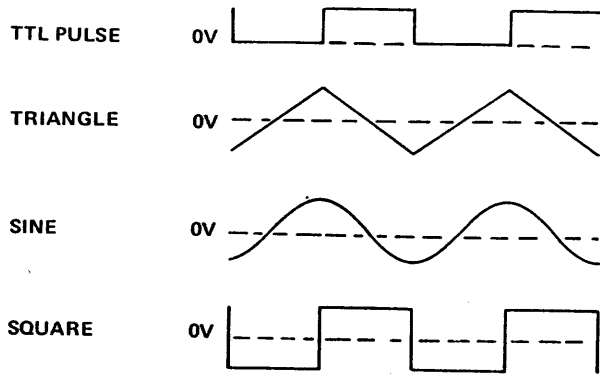


Figure 3-2. Output Waveforms

⑥ AMPLITUDE

Rotating the AMPLITUDE control fully clockwise provides maximum peak-to-peak output at the 50Ω OUT connectors; counterclockwise for up to 30 dB attenuation of output amplitude.

⑦ 50Ω OUT Connectors

Maximum output of 10V p-p signals into a 50Ω load (20V p-p open circuit) is provided at the 50Ω OUT HI connector, and 20 dB below (1/10 or a 1V p-p maximum) of that level at the 50Ω OUT LO connector.

3.1.3 Function Selections

⑧ \sim , \wedge , \square , and DC (Waveforms)

Sine \sim , triangle \wedge , and square \square waveforms are selected by the larger of the two concentric controls; the DC position provides a dc voltage output of the waveform center reference level at the 50Ω OUT ⑦ connectors.

⑨ TTL PULSE OUT Connector

A fixed amplitude Transistor-Transistor Logic (TTL) square pulse train of the output frequency is provided at the PULSE OUT (TTL) connector. (TTL levels are 0V to 0.4V for a logic low and 2.4V to 5V for a logic high.) The output can drive up to 20 TTL loads. The pulse train can also be used as a synchronizing reference for the main output ⑦. Phase of the waveforms relative to the TTL pulse is shown in figure 3-2.

3.1.4 Sweep Controls

⑩ SWEEP WIDTH/OFF

Main output (at 50Ω OUT HI or LO) frequency sweep is turned on when SWEEP WIDTH is rotated past OFF. Rotation of the control varies the peak amplitude of an internal ramp signal (seen at GCV OUT) whose voltage controls the frequency of the main generator (seen at 50Ω OUT). See figure 3-3.

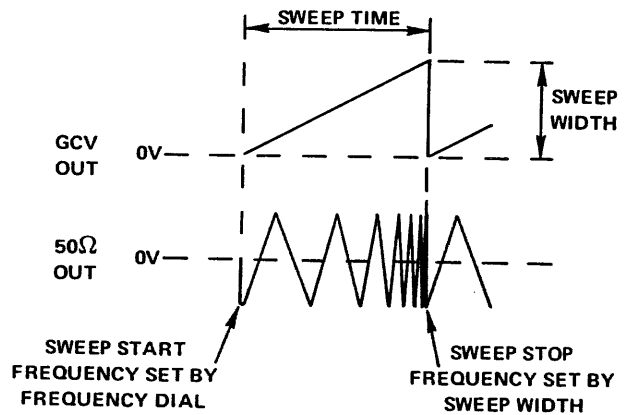


Figure 3-3. Effect of Sweep on Output Frequency

⑪ SWEEP OUT Connector

The sweep generator ramp is available at the SWEEP OUT connector. Amplitude is 0V to 5V peak (600Ω source impedance).

⑫ SWEEP RATE

Rotation of SWEEP RATE controls duration of the sweep voltage ramp, and thus frequency of sweep repetition.

3.2 OPERATION

Operation can be quite varied but is described here as manual, voltage controlled or sweep controlled. The generator is ready to operate as soon as a frequency multiplier is selected; however, when output is critical, allow ½ hour warm up.

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 3-4. Placing the 50 ohm terminator, or 50 ohm 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.

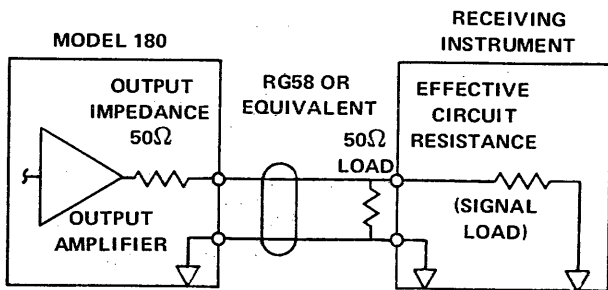


Figure 3-4. Signal Termination

The input and output impedances of the generator connectors are listed below:

Connector	Impedance
50Ω OUT HI	50Ω
50Ω OUT LO	50Ω
PULSE OUT (TTL)	*
SWEEP OUT	600Ω
VCG IN	2 kΩ
GCV OUT	600Ω

*The PULSE OUT connector can drive up to 20 Transistor-Transistor Logic (TTL) loads (low level between 0V and 0.4V, and high level between 2.4V and 5V).

3.2.2 Manually Controlled Operation

For basic operation, select the waveform to be output, and set the output signal frequency and amplitude. The following steps demonstrate manual control of the function generator:

Step	Control/Connector	Setting
1	50Ω OUT	Connect circuit to either HI or LO output (Ref: paragraph 3.2.1).
2	FREQ MULT	Set to desired range of frequency.
3	Frequency Dial	Set to desired frequency.
4	Waveform Selector	Set to desired waveform.
5	DC OFFSET	See figure 3-5.
6	AMPLITUDE	Select desired amplitude.

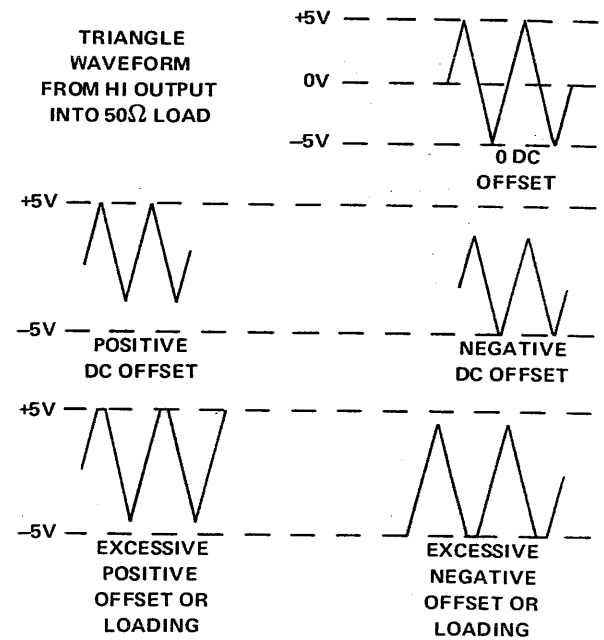


Figure 3-5. DC OFFSET Control

3.2.3 Voltage Controlled 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 ($\pm 2V$ excursions) injected at the VCG IN connector. Perform the steps given in paragraph 3.2.2, only set the frequency dial to determine 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, center the dial at the desired center frequency. Do not exceed the maximum dynamic range of the selected frequency range.

Figure 3-6 is a nomograph with examples of the frequency dial effect as a reference for VCG IN voltages. Example 1 shows that with 0V VCG input, frequency is as determined by the main dial setting, 1.0 in this 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 50Ω OUT Frequency Factor column value must be multiplied by a frequency range multiplier to give the actual 50Ω OUT frequency.)

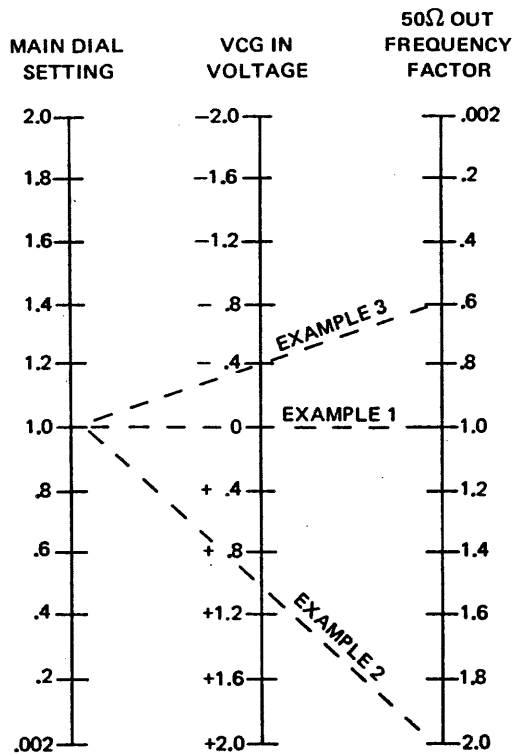


Figure 3-6. VCG Voltage-to-Frequency Nomograph

NOTE

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.

NOTE

To monitor the ramp generator, use the SWEEP OUT connector. To monitor the frequency of the main generator, use the GCV OUT connector, which is a voltage proportional to the generator frequency.

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.

3.2.4 Sweep Generator Operation

Operation as a sweep generator is like operation as a manual function generator, only the frequency is automatically and repetitively swept from the set frequency to a higher frequency. Actually, an internally generated positive-going voltage ramp (available at the SWEEP OUT connector) can be modified in amplitude and used like a VCG input voltage to sweep the output frequency (see figure 3-3). Perform the steps in paragraph 3.2.1 and the following steps for use as a sweep generator:

Step	Control/Connector	Setting
1	SWEEP WIDTH	As desired. This determines the upper frequency of the sweep.
2	SWEEP RATE	As desired. This determines the speed of the sweep.

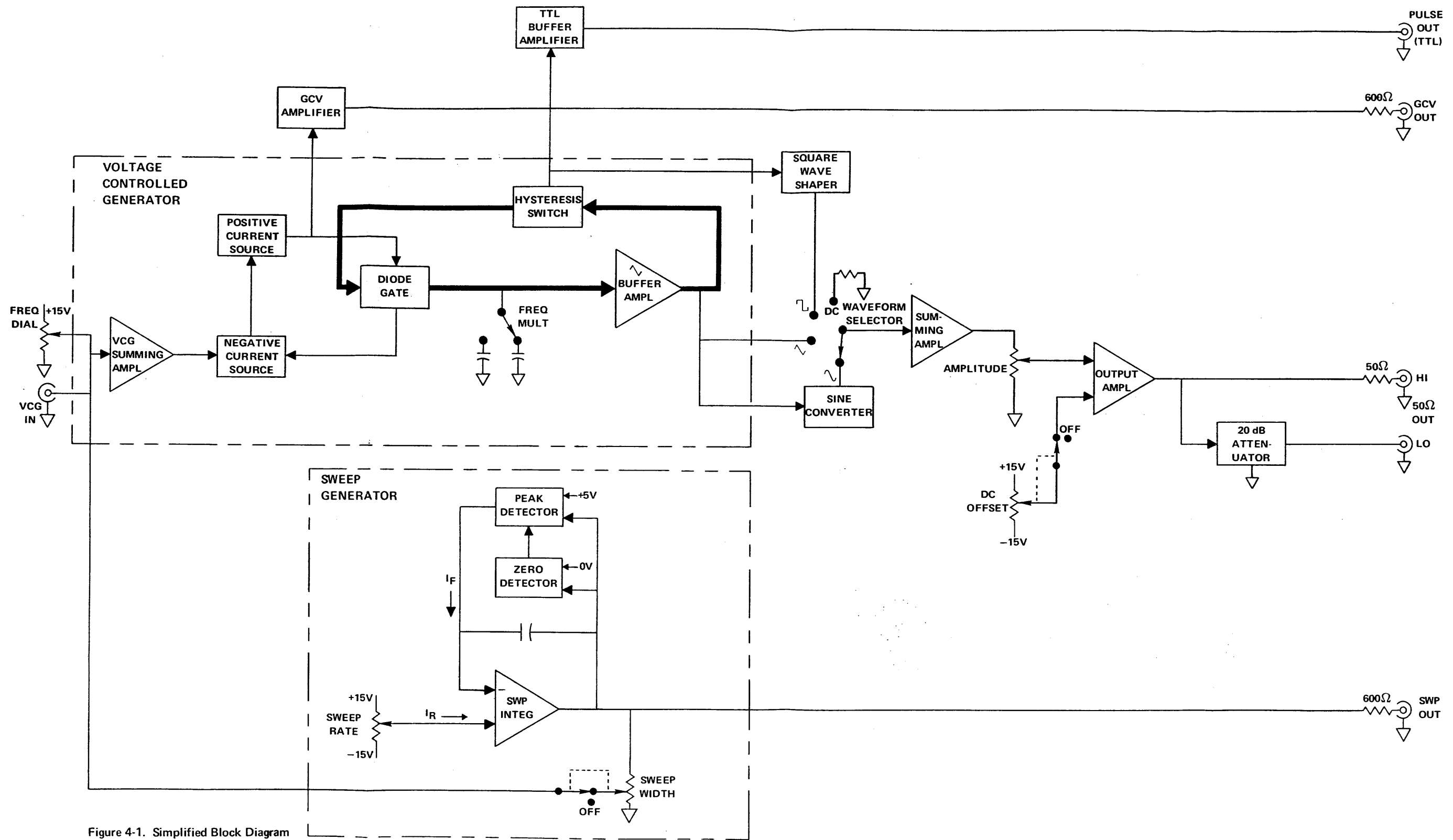


Figure 4-1. Simplified Block Diagram

SECTION 4

CIRCUIT DESCRIPTION

4.1 VOLTAGE CONTROLLED GENERATOR (VCG)

As shown in figure 4-1, the VCG summing amplifier sums the currents from the frequency dial, sweep generator, crystal control and VCG input connector. The VCG summing amplifier is an inverting amplifier whose output current is used to control a positive current source and a negative current source. The currents from the two current sources are equal and opposite polarity and the magnitudes are directly proportional to the current of the VCG summing amplifier output. The diode gate, which is controlled by the hysteresis switch, is used to switch the positive current or the negative current to the integrating capacitor selected by the frequency multiplier. If the positive current is switched into the capacitor, the voltage across the capacitor will increase linearly to generate the positive slope of the triangle wave. If the current is negative, the voltage across the capacitor will decrease linearly to produce the negative slope.

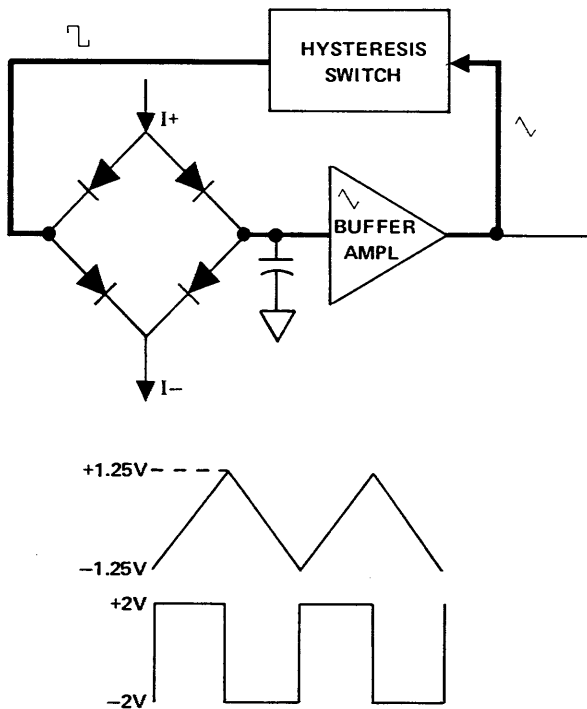


Figure 4-2. Simplified Timing Diagram

The triangle buffer amplifier is a unity gain amplifier whose output is fed to the hysteresis switch as well as to the sine converter. The hysteresis switch has two voltage limit points (+1.25V and -1.25V). (See figure 4-2.)

During the time the output voltage of the triangle buffer amplifier is increasing, the output voltage of the hysteresis switch is positive, but when the output voltage of the triangle amplifier reaches +1.25V, it triggers the hysteresis switch causing the switch output to become negative. Once the control voltage into the diode gate becomes negative, it will switch the positive current out and switch the negative current into the integrating capacitor, starting a linear decrease of the voltage across the capacitor. 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 triangle wave at the same frequency.

4.2 FREQUENCY CONTROL

The output frequency is determined by the magnitude of the integrating capacitor selected by the frequency multiplier and the magnitude of the positive and negative current sources (figure 4-1). Since the current magnitudes are linearly proportional to the sum of the VCG current, the output frequency will also be linearly proportional to the current sum.

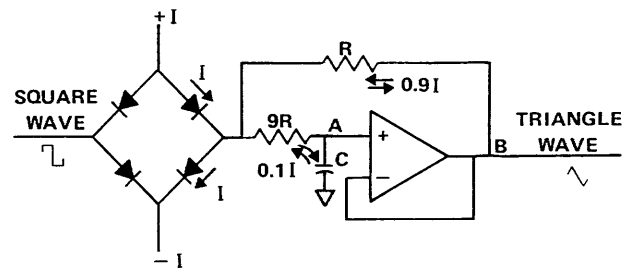


Figure 4-3. Current Divider

By using current division, the magnitude of the capacitor is effectively increased, allowing the generation of lower frequencies. Figure 4-3 is the simplified diagram showing current divider operation. By reducing integration current precisely by a factor of 10 while holding triangle wave amplitude constant, it is possible to extend the lower frequency range by a factor of 10 with fixed capacitance C . Since points A and B are at the equipotential points, constant current output I can be divided by resistance ratio of R and $9R$. Then, integration current of capacitor C is reduced to $0.1 I$. The lower current extends the frequency range of the function generator by a factor of 10. The same theory is applied to extend the frequency range by a factor of 100.

4.3 WAVEFORM OUTPUT

The inverted output of the hysteresis switch is fed to the TTL buffer amplifier and also the square wave shaper (figure 4-1). The square wave shaper consists of a shaping circuit which limits the output swing to ± 1.25 volts.

The output signal from the triangle buffer amplifier is applied to the sine converter, which uses a diode-resistor network with linear sections to shape a sine wave.

The sine, triangle or square waveform is fed to the summing amplifier through the waveform selector switch. The output of summing amplifier is fed through the amplitude control to the output amplifier. The output amplifier is an inverting amplifier whose output is capable of driving 10V p-p into 50Ω load from 50Ω source impedance.

4.4 SWEEP CIRCUITS

Sweep rate control determines the amount of integrating current fed to the positive input of the sweep integrator (figure 4-1). The output voltage increases linearly as the sweep circuit capacitor is charged to form the positive slope of the ramp. As the ramp output reaches the preset level of +5V, the peak detector turns on while the positive feedback circuit holds the positive output state. The large flyback current I_F is fed to the negative input of the sweep integrator while overcoming minute integrating current I_R . Thus, the ramp output decreases rapidly toward the negative voltage, forming the negative slope of the ramp. When the negative slope reaches zero volts, the zero detector turns on, the peak detector is unlatched and the flyback current source is turned off, allowing the output voltage to increase linearly.

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
- Distortion Analyzer
- Oscilloscope
- 50Ω (±0.1%) Load
- Counter (6 digit)

5.3 REMOVING GENERATOR COVER

Remove the four screws in the lower cover, place the instrument on its feet and lift off the top cover.

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.

1. Unless otherwise noted, all measurements made at the 50Ω OUT connector should be terminated into a 50Ω (≤1%, 1W) load.
2. Before connecting the unit to an ac source, check the ac line circuit to make sure the 115/230 volt switch is set at the correct position (see paragraph 2.2).
3. Start the calibration by setting the front panel switches as follows:

```

Dial . . . . . 2.0
FREQ MULT . . . . . X 1K
SWEEP WIDTH . . . . . OFF
SWEEP RATE . . . . . ccw
DC OFFSET . . . . . OFF
Function . . . . . 
AMPLITUDE . . . . . cw
  
```

4. Allow the unit to warm up at least 30 minutes for final calibration.

Table 5-1. Calibration Chart

Step	Check	Tester	Cal Points	Control Setting	Adjust	Desired Results	Remarks
1	Power supply regulation	Voltmeter	TP2 (TP1 ground)		R9	+15 ±0.01V	
2			TP3			-15 ±0.05V	
3	Distortion	Distortion analyzer (50Ω terminated)	50Ω OUT HI		R78 R103	Minimum distortion	

Table 5-1. Calibration Chart (Continued)

Step	Check	Tester	Cal Points	Control Setting	Adjust	Desired Results	Remarks
4	VCG null	Scope (50Ω terminated)		FREQ MULT X 100K Function \square Dial full cw Scope vert 2V/div Scope horiz .5 ms/div	R43	Minimum frequency shift	Adjust generator dial for 1 full square on scope. Alternately short and open VCG IN BNC while adjusting R43.
5	Horizontal symmetry			Scope X 10 on	R47	Maximum symmetry	Alternately switch scope triggering from positive to negative slope while adjusting R47.
6				Dial 0.1 FREQ MULT X 10 Scope sweep 0.1s/div DC triggering	R66	Maximum symmetry	For 180LF, FREQ MULT X 1. Scope sweep 1s/div.
7	Frequency accuracy	Counter (50Ω terminated)		Dial 2.0 FREQ MULT X 1 thru X 10K	R39	Best frequency accuracy over X 1 thru X 10K	
8				FREQ MULT X 1M Function $\sim \sim \square$	C19	Best frequency accuracy for all waveforms	
9	DC level	Voltmeter (50Ω terminated)		FREQ MULT X 1K Function DC Amplitude ccw	R125	0 ±20 mVdc	

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 CHART

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

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.
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., UA741C, LM318)

1. The "+" and "-" inputs of an operational amplifier will have less than 15 mV voltage difference when operating under normal conditions.
2. If the output voltage stays at maximum positive, its "+" input voltage should be more positive than its "-" input voltage, or vice versa; 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.

SYSTEM CHECK

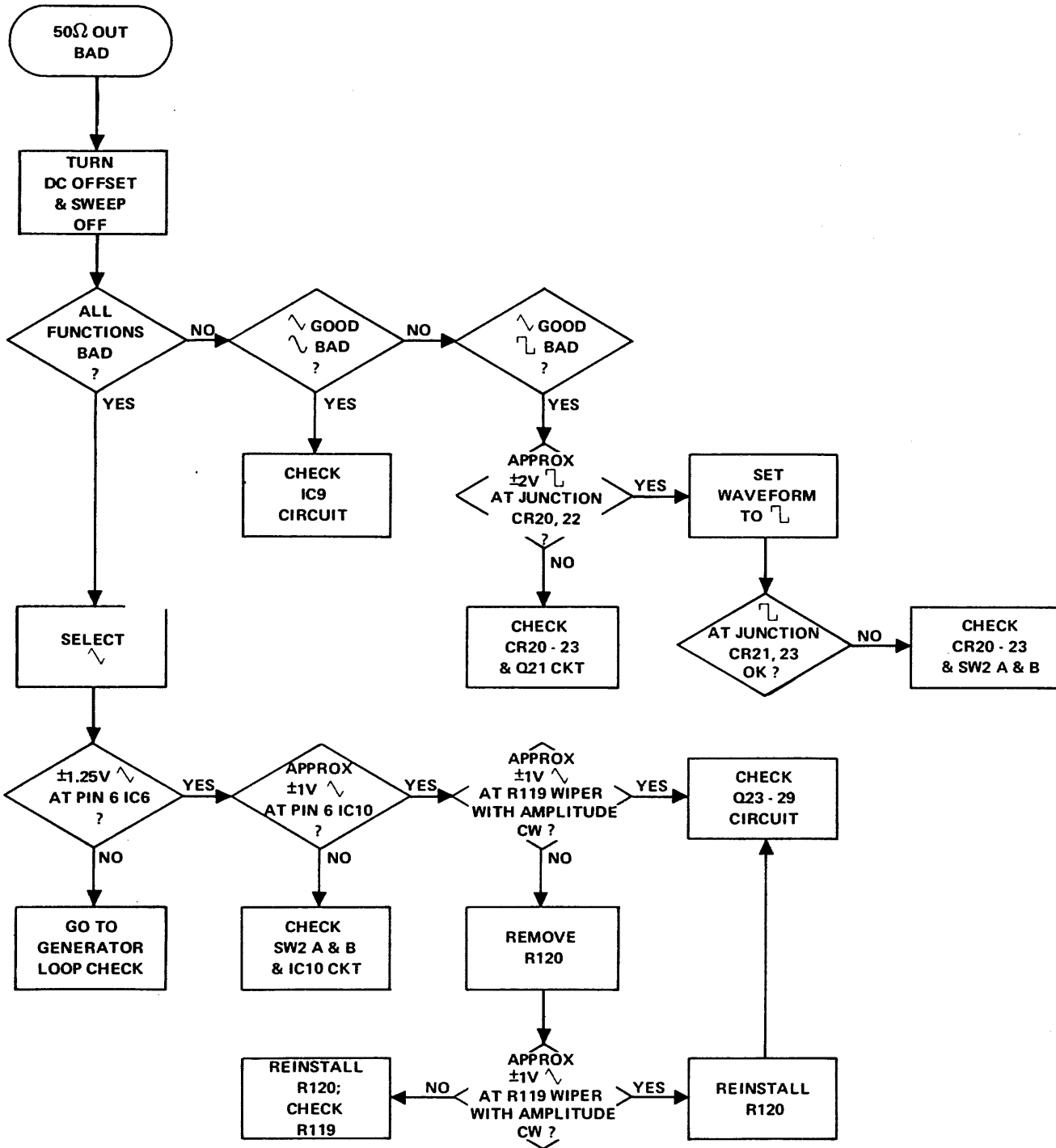


Figure 6-1. Troubleshooting Chart (Sheet 1 of 4)

GENERATOR LOOP CHECK

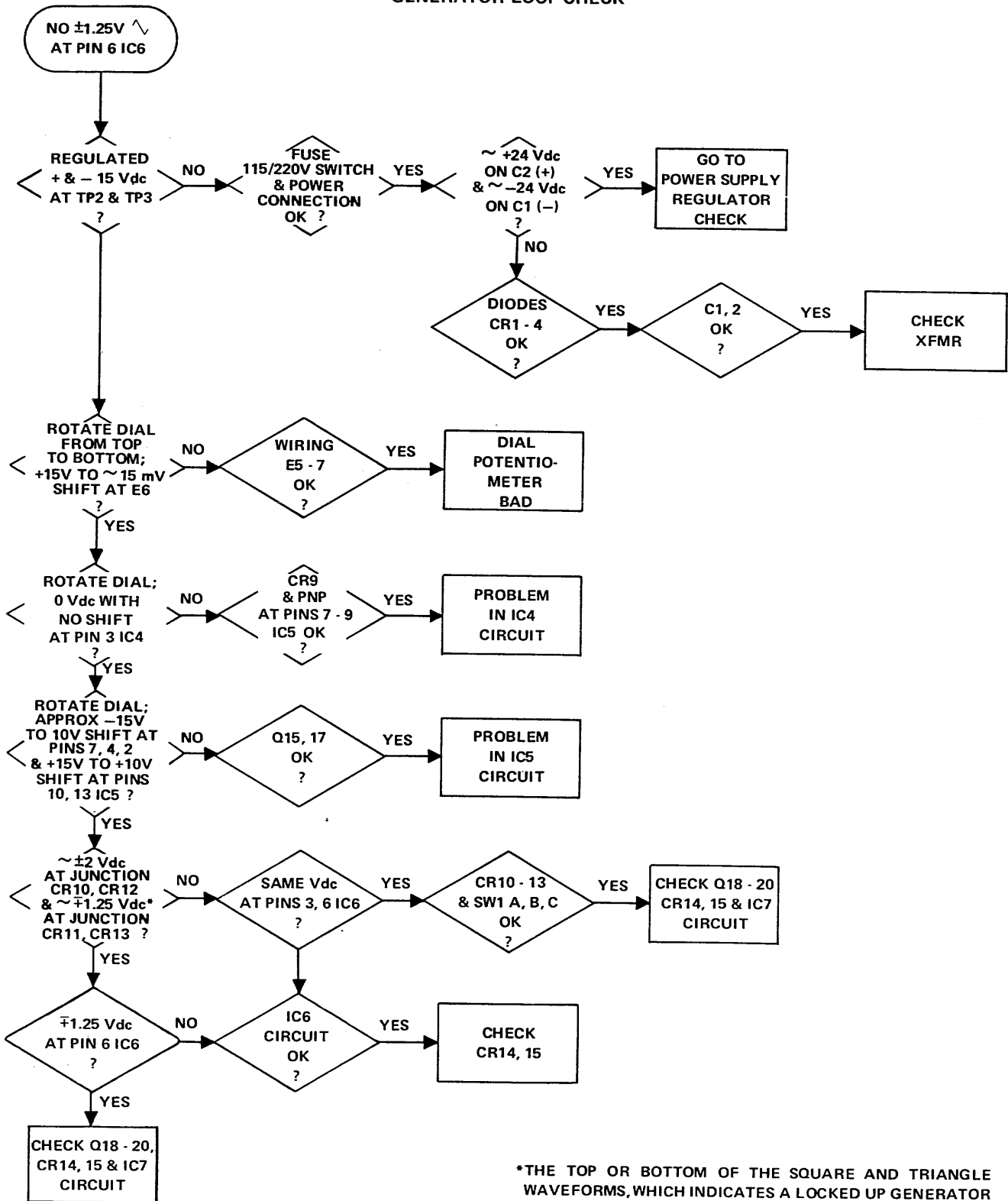


Figure 6-1. Troubleshooting Chart (Sheet 2 of 4)

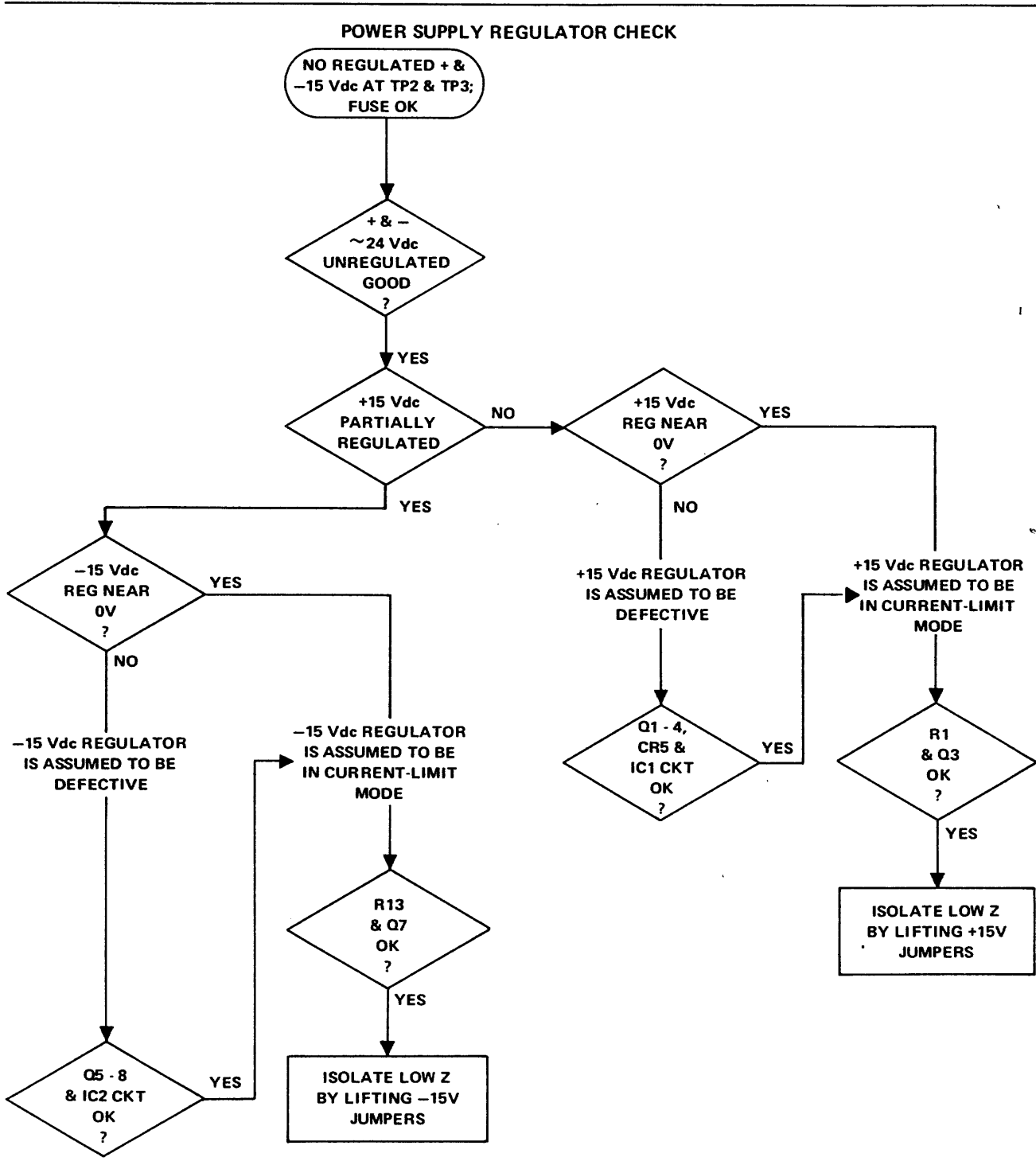
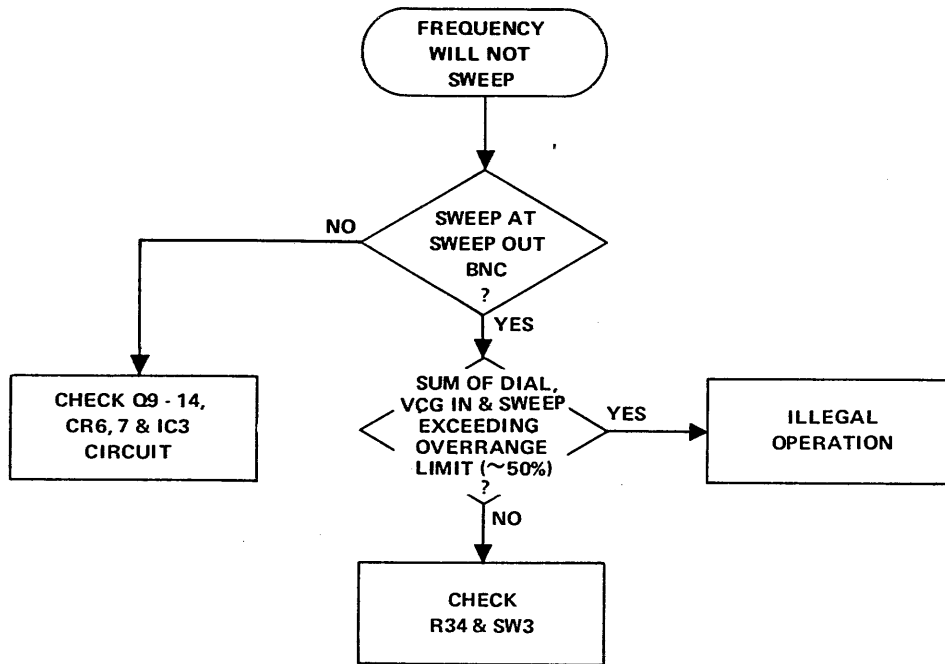
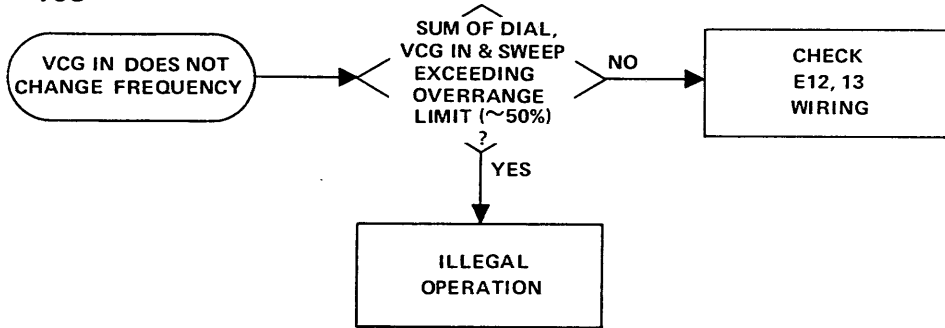


Figure 6-1. Troubleshooting Chart (Sheet 3 of 4)

SWEEP CHECK



VCG



GCV



TTL

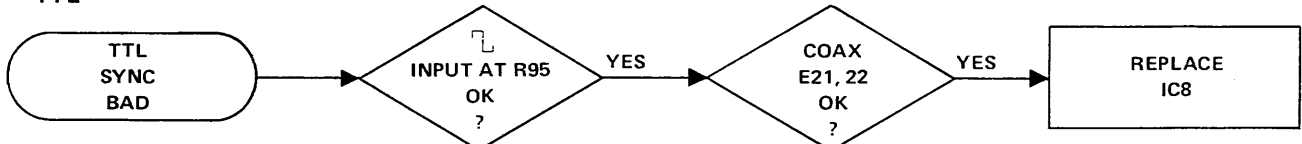


Figure 6-1. Troubleshooting Chart (Sheet 4 of 4)

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.

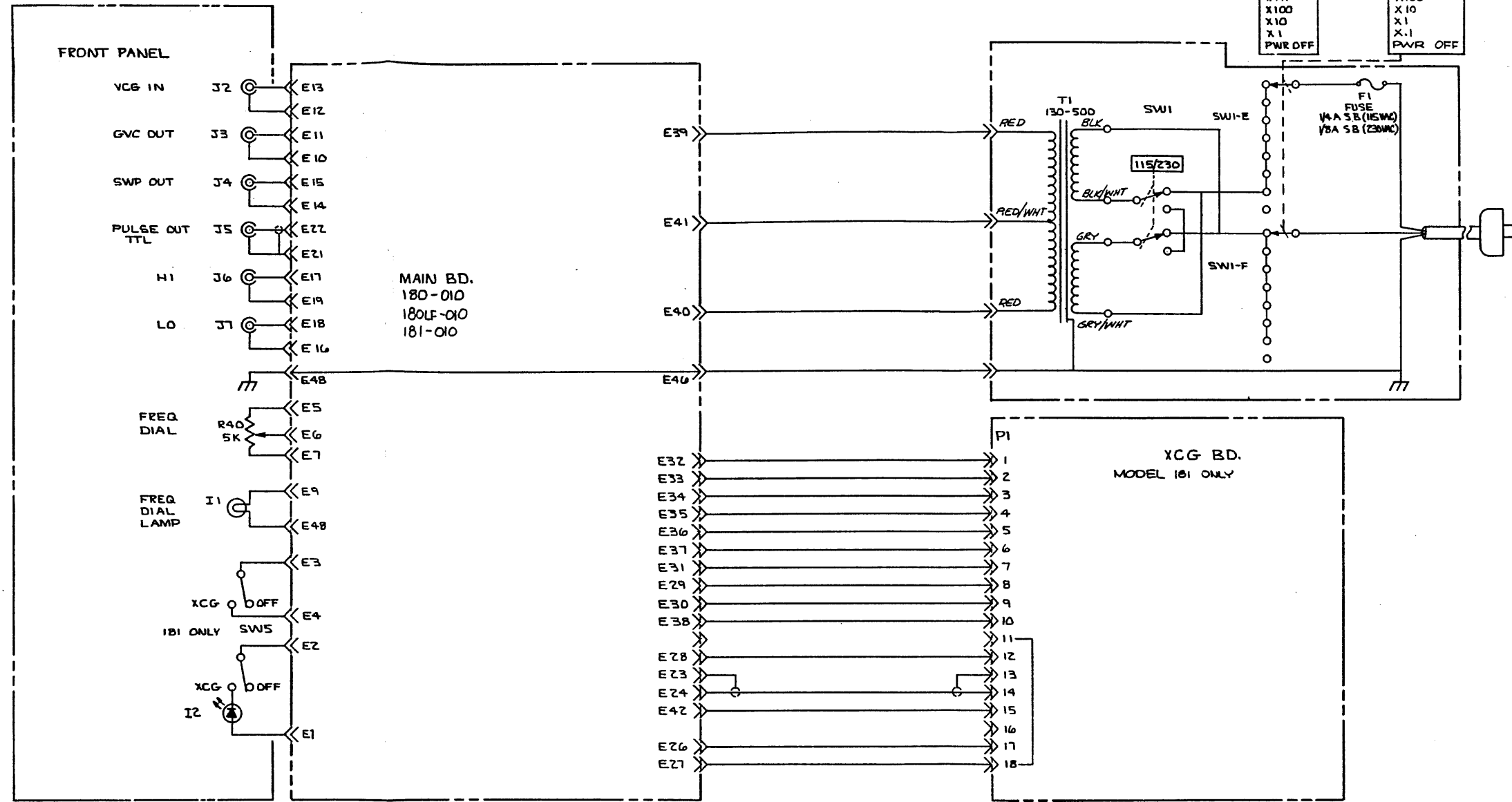
7.3 ADDENDA

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.

	Page No.
CHASSIS	
Schematic	7-2
Assembly Drawing	7-3
Model 180 Parts List	7-4
Model 180LF Parts List	7-5
MAIN BOARD	
Schematic	7-6
Assembly Drawing	7-7
Model 180 Parts List	7-8
Model 180LF Parts List	7-10

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MODEL 180-181 MODEL 180LF



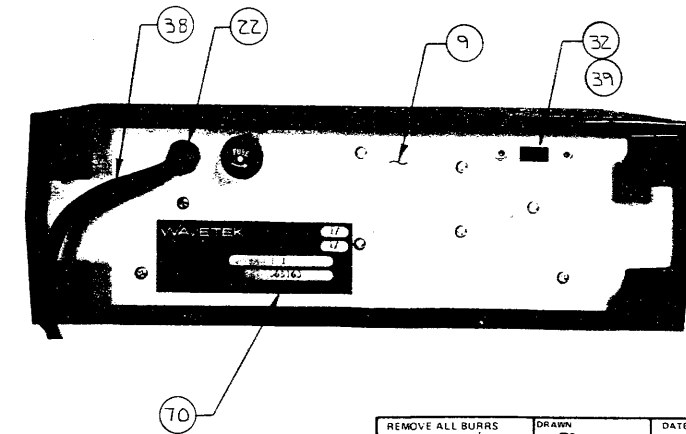
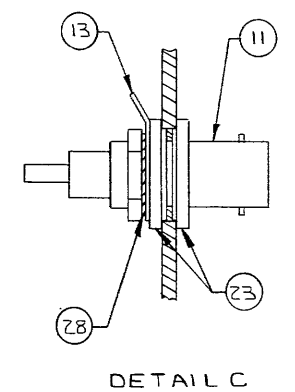
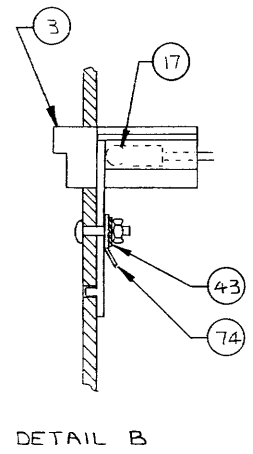
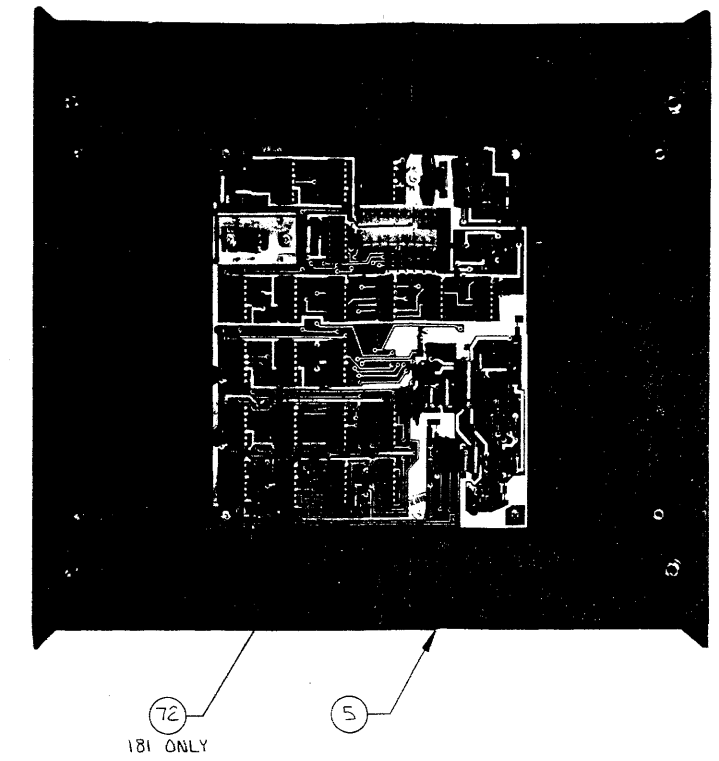
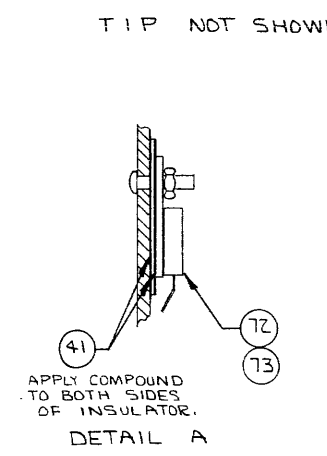
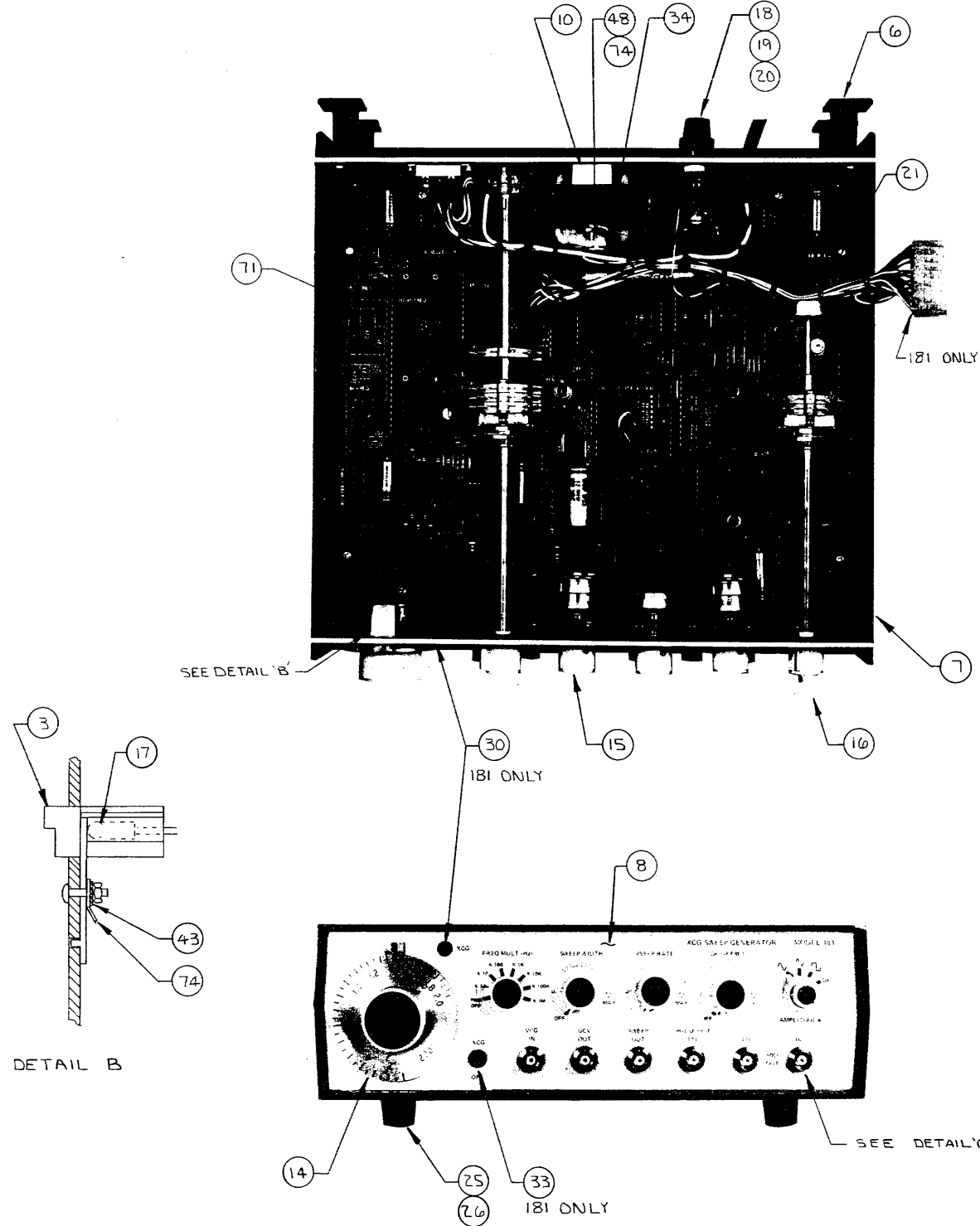
NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DATE 5-13-75	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR	TITLE	
	RELEASE APPROV	SCHEMATIC CHASSIS	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± 0.10 ANGLES ± 1° .XX ± 0.20	MODEL NO.	DWG NO.
	DO NOT SCALE DWG	180-181-180LF	0005-00-0066
SCALE		CODE IDENT 23338	REV SHEET 1 OF 1

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D
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A



NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN BA	DATE 5-8-75	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR	RELEASE APPROV	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES 1 XX .030		MODEL NO 180, 180F, 181
	DO NOT SCALE DWG		DWG NO 0004-CJ-0065
SCALE		CODE IDENT 23338	REV SHEET 1 OF 1

ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
1		SCHEMATIC CHASSIS	180-200	WVTK	0005-00-0066			
2		SPACER 8480	8480	WVTK	1400-00-0653	2		
3		DIAL INDICATED	180-303	WVTK	1400-00-4970	1		
4		CHASSIS ASSEMBLY	180-000	WVTK	0004-00-0066			
5		CHASSIS TOP	180-300-1	WVTK	1400-00-5000	1		
6		POST	180-302	WVTK	1400-00-5020	4		
7		CHASSIS BOTTOM	180-300-2	WVTK	1400-00-5030	1		
8		FRONT PANEL	180-305-1	WVTK	1400-00-5050	1		
9		REAR PANEL	180-306	WVTK	1400-00-5073	1		
10		TRANSFORMER BLOCKS	180-309	WVTK	1400-00-5083	2		
11	J2-J7	BNC's	KC7946	KING	2100-01-0002	6		
12								
13		SOLDER LUG	1497	SMITH	2100-04-0012	6		
14		DIAL ASSY		WVTK	1400-00-5358	1		
15		KNOB	RB67-1-SB-M	ROGAN	2400-01-0008	4		
16		KNOB SET	RB67-1-SB+O-M-9	ROGAN	2400-01-0009	1		
17		LAMP	L28-40	MURA	2400-02-0013	1		
18		FUSE 230V	313-125	LFUSE	2400-05-0001	1		
19		FUSE 115V	313-250	LFUSE	2400-05-0008	1		
20		FUSE HOLDER	345001	LFUSE	2400-05-0012	1		
21		CABLE TIES	TYB-23M-6	T+BENGN	2800-00-0006	7		
22		STRAIN RELIEF	SR5P-4	HEYCO	2800-00-0015	1		
23		NYLINERS	4L2FF	TMPSN	2800-01-0002	5		
24		STANDOFFS (MALE-FEMALE)	1443-M03-F05-4-40	UNICORD	2800-02-0009	4		
25		RAIL KIT	180-500	WVTK	2800-08-0010	1		
26		FASTENER (FEET)	C7494-632-4	TINN	2800-09-0003	6		
27		CHASSIS BLOCKS	1591C-11	USECO	2800-09-0022	2		
28		SHOULDER WASHER	2668	SMITH	2800-27-0004	12		
29								
30								
31		SWITCH 115/230 (SOLDER SHIELD)	SW422/SG	UID	5105-00-0001	1		
32								
33		TRANSFORMER	130-500	WVTK	5600-00-0005	1		
34		SHRINK TUBING	FIT-221-1/8	ECC	6001-20-2000	AR		
35		SHRINK TUBING	FIT-221-3/16	ECC	6001-20-3000	AR		
36		SHRINK TUBING	FP-301-1/2	ECC	6001-20-8000	AR		
37		POWER CORD	17237	BELDEN	6001-80-0001	1		
38		POP RIVETS	4 X 641	DAYTON		2		
39		POWER WAFER	130-SW1-3	WVTK	5104-02-0007	2		

WAVETEK® PARTS LIST	TITLE	CHASSIS ASSEMBLY	DRAWN BY	NO. 1704-00-0066	REV
	MODEL	180	APPROVAL	180-000	SH 1 OF 2

Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
40		THERMAL COMPOUND	120-2	WKFLD		AR		
41		NUT #4				7		
42		LOCK WASHER #4				7		
43		4 X 40 X 1/4				4		
44		4 X 40 X 1/4				6		
45		4 X 40 X 3/8				3		
46		4 X 40 X 7/8				2		
47		4 X 40 X 1-1/2				2		
48		4 X 40 X 1/4 FILISTER HD.				4		
49		LOCK WASHER #6				10		
50		LOCK WASHER #8				4		
51		6 X 32 X 3/4				6		
52		6 X 32 X 5/8 SELF TAPING				4		
53		8 X 32 X 2-1/4 BLK OXIDE				4		
54		WIRE BLACK			6000-32-2001			
55		GREEN			6000-32-2005			
56		BLUE			6000-32-2006			
57		VIOLET			6000-32-2007			
58		WHITE			6000-32-2009			
59		BLACK/WHITE			6000-32-2090			
60		RED/WHITE			6000-32-2092			
61		ORANGE/WHITE			6000-32-2093			
62		YELLOW/WHITE			6000-32-2094			
63		GREEN/WHITE			6000-32-2095			
64		BLUE/WHITE			6000-32-2096			
65		VIOLET/WHITE			6000-32-2097			
66		GREY/WHITE			6000-32-2098			
67		COAX	RG/741V		6001-40-0001			
68								
69		POWER CORD HOLDER		WVTK	1400-00-5400	1		
70		SERIAL TAG	180-318	WVTK	1400-00-5390	1		
71		MAIN BD. ASSY	180-010	WVTK	1700-00-0178	1		
72		WAVETEK LOGO	139-305	WVTK	1400-00-2180	1		
73								
74		SOLDER LUG	1414-4	SMITH	2100-04-0008	2		

WAVETEK® PARTS LIST	TITLE	CHASSIS ASSEMBLY	DRAWN BY	NO. 1704-00-0066	REV
	MODEL	180	APPROVAL	180-000	SH 2 OF 2

Form 102

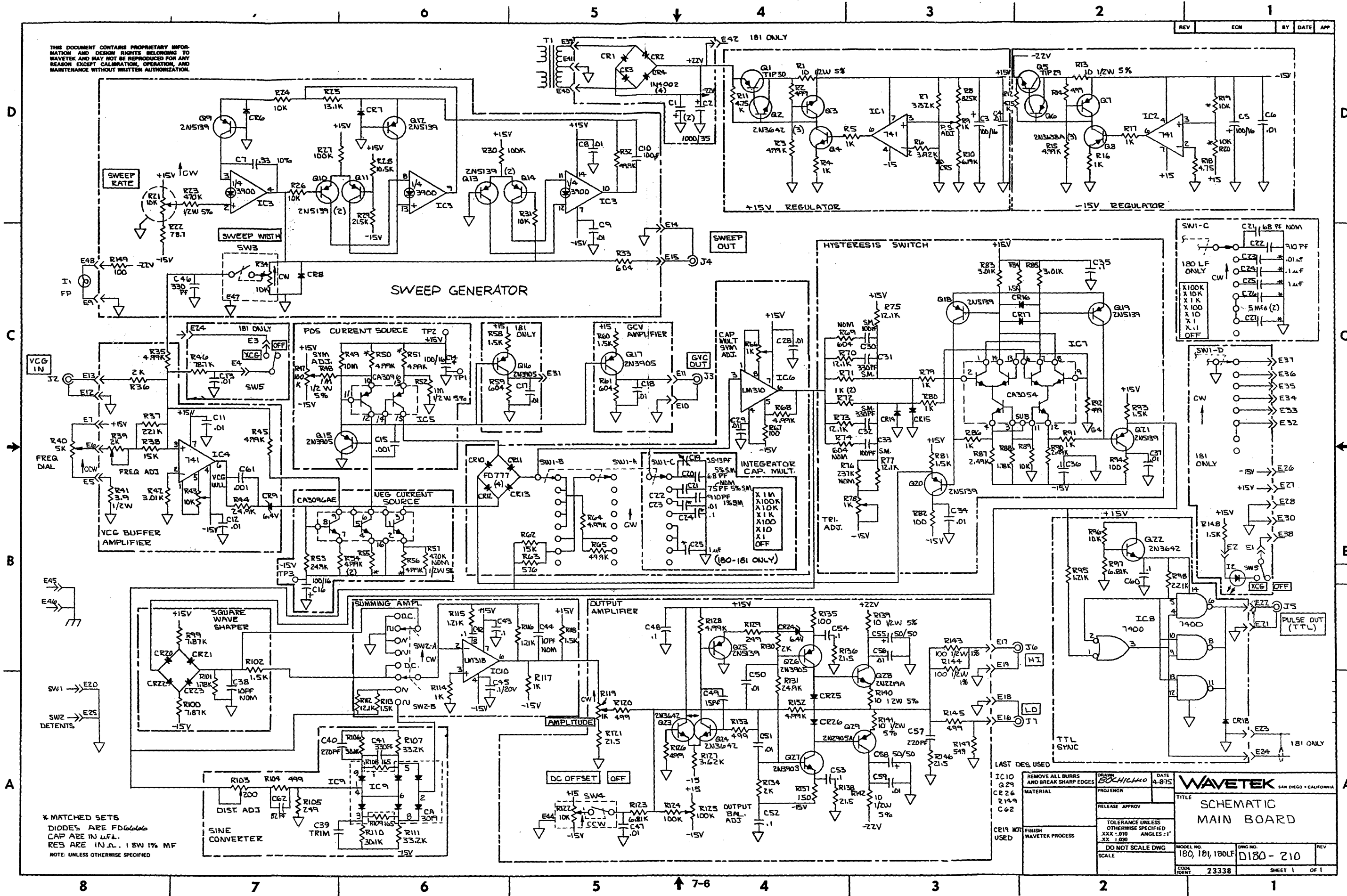
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1		SCHEMATIC CHASSIS	180-200	WVTK	0005-00-0066			
2		SPACER 8480	8480	WVTK	1400-00-0653	2		
3		DIAL INDICATED	180-303	WVTK	1400-00-4970	1		
4		CHASSIS ASSEMBLY	180-000	WVTK	0004-00-0066			
5		CHASSIS TOP	180-300-1	WVTK	1400-00-5000	1		
6		POST	180-302	WVTK	1400-00-5020	4		
7		CHASSIS BOTTOM	180-300-2	WVTK	1400-00-5030	1		
8	180LF	FRONT PANEL	180-305-2	WVTK	1400-00-5060	1		
9		REAR PANEL	180-306	WVTK	1400-00-5073	1		
10		TRANSFORMER BLOCKS	180-309	WVTK	1400-00-5083	2		
11	J2-J7	BNC's	KC7946	KING	2100-01-0002	6		
12								
13		SOLDER LUG	1497	SMITH	2100-04-0012	6		
14		DIAL ASSY		WVTK	1400-00-5358	1		
15		KNOB	RB67-1-SB-M	ROGAN	2400-01-0008	4		
16		KNOB SET	RB67-1-SB+0-M-9	ROGAN	2400-01-0009	1		
17		LAMP	L28-40	MURA	2400-02-0013	1		
18		FUSE 230V	313-125	LFUSE	2400-05-0001	1		
19		FUSE 115V	313-250	LFUSE	2400-05-0008	1		
20		FUSE HOLDER	345001	LFUSE	2400-05-0012	1		
21		CABLE TIES	TYB-23M-6	T+BENGN	2800-00-0006	7		
22		STRAIN RELIEF	SR5P-4	HEYCO	2800-00-0015	1		
23		NYLINERS	4L2FF	TMPSN	2800-01-0002	5		
24		STANDOFFS (MALE-FEMALE)	1443-M03-F05-4-40	UNICORD	2800-02-0009	4		
25		BAIL KIT	180-500	WVTK	2800-08-0010	1		
26		FASTENER (FEET)	C7494-632-4	TINN	2800-09-0003	6		
27		CHASSIS BLOCKS	1591C-11	USECO	2800-09-0022	2		
28		SHOULDER WASHER	2668	SMITH	2800-27-0004	12		
29								
30								
31		SWITCH 115/230 (SOLDER SHIELD)	SW422/SG	UID	5105-00-0001	1		
32								
33		TRANSFORMER	130-500	WVTK	5600-00-0005	1		
34		SHRINK TUBING	FIT-221-1/8	ECC	6001-20-2000	AR		
35		SHRINK TUBING	FIT-221-3/16	ECC	6001-20-3000	AR		
36		SHRINK TUBING	FP-301-1/2	ECC	6001-20-8000	AR		
37		POWER CORD	17237	BELDEN	6001-80-0001	1		
38		POP RIVETS	4 X 641	DAYTON		2		
WAVETEK®		TITLE CHASSIS ASSEMBLY	DRAWN BY		NO. 1704-00-0067	REV		
PARTS LIST		MODEL 180LF	APPROVAL		180LF-000	SH 1 OF 2		

Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
39		POWER WAFER	130-SW1-3	WVTK	5401-02-0007	2		
40		THERMAL COMPOUND	120-2	WKFLD		AR		
41		NUT #4				7		
42		LOCK WASHER #4				7		
43		4 X 40 X 1/4				4		
44		4 X 40 X 1/4				6		
45		4 X 40 X 3/8				3		
46		4 X 40 X 7/8				2		
47		4 X 40 X 1-1/2				2		
48		4 X 40 X 1/4 FILISTER HD.				4		
49		LOCK WASHER #6				10		
50		LOCK WASHER #8				4		
51		6 X 32 X 3/4				6		
52		6 X 32 X 5/8 SELF TAPING				4		
53		8 X 32 X 2-1/4 BLK OXIDE				4		
54		WIRE BLACK			6000-32-2001			
55		WIRE GREEN			6000-32-2005			
56		WIRE BLUE			6000-32-2006			
57		WIRE VIOLET			6000-32-2007			
58		WIRE WHITE			6000-32-2009			
59		WIRE BLACK/WHITE			6000-32-2090			
60		WIRE RED/WHITE			6000-32-2092			
61		WIRE ORANGE/WHITE			6000-32-2093			
62		WIRE YELLOW/WHITE			6000-32-2094			
63		WIRE GREEN/WHITE			6000-32-2095			
64		WIRE BLUE/WHITE			6000-32-2096			
65		WIRE VIOLET/WHITE			6000-32-2097			
66		WIRE GRAY/WHITE			6000-32-2098			
67		COAX	RG/741V		6001-40-0001			
68								
69		POWER CORD HOLDER		WVTK	1400-00-5400	1		
70		SERIAL TAG	180-318	WVTK	1400-00-5390	1		
71		MAIN BD. ASSY	180LF-010	WVTK	1700-00-0179	1		
72		WAVETEK LOGO	139-305	WVTK	1400-00-2180	1		
73								
74		SOLDER LUG	1414-4	SMITH	2100-04-0008	2		
WAVETEK®		TITLE CHASSIS ASSEMBLY	DRAWN BY		NO. 1704-00-0067	REV		
PARTS LIST		MODEL 180LF	APPROVAL		180LF-000	SH 2 OF 2		

Form 102

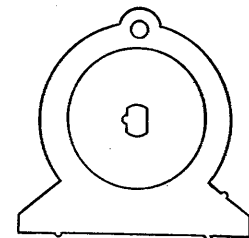
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* MATCHED SETS
 DIODES ARE FD010/10
 CAP ARE IN MFD.
 RES ARE IN Ω. 1.5W 1% MF
 NOTE: UNLESS OTHERWISE SPECIFIED

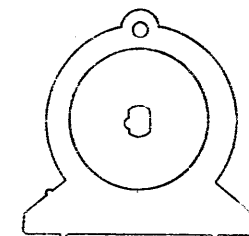
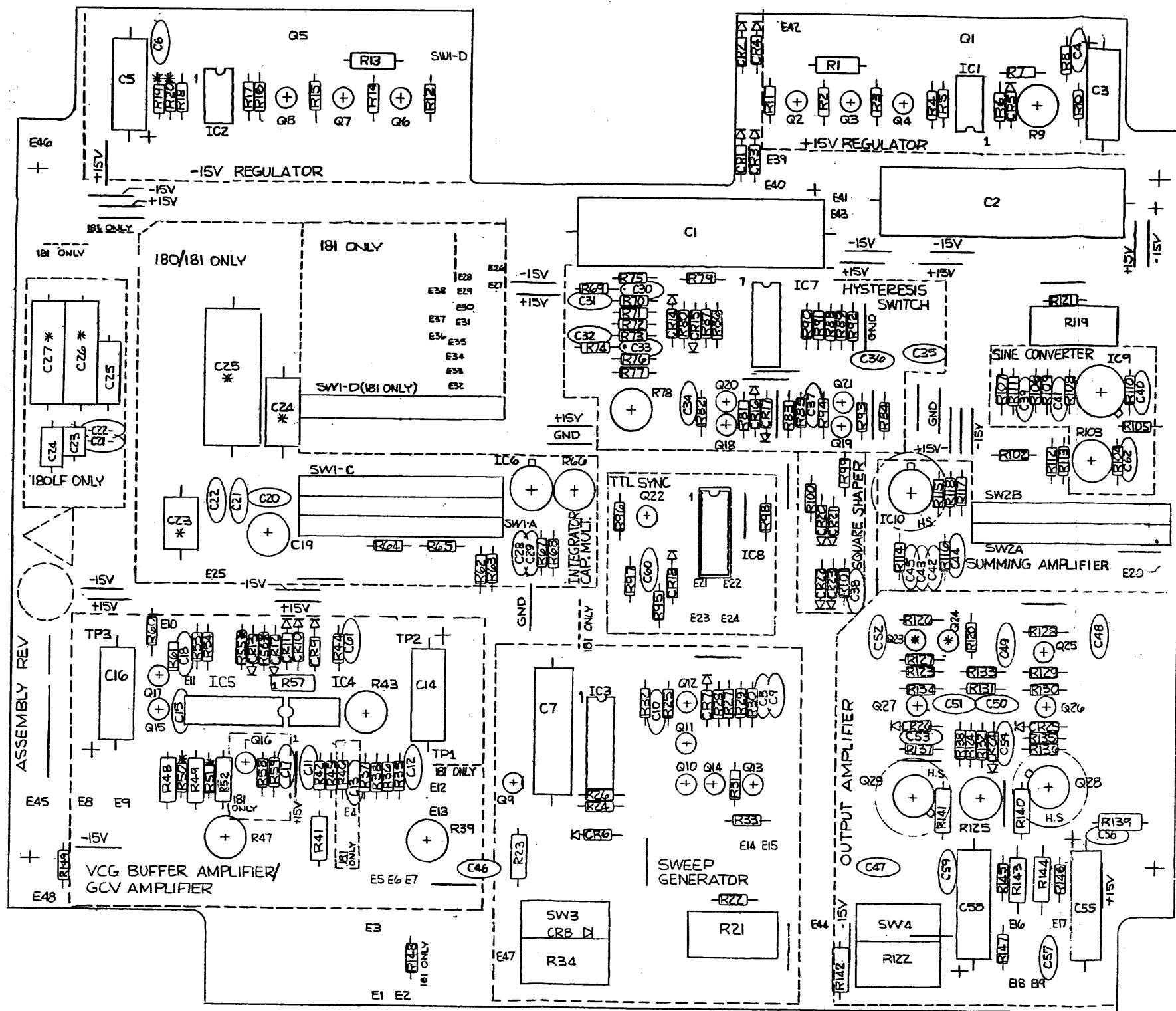
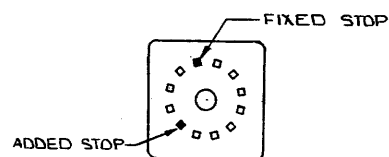
REMOVE ALL BURRS AND BREAK SHARP EDGES		DATE	4-875
DRAWN		BOCHICHO	
PROFESSOR			
RELEASE APPROV			
TOLERANCE UNLESS OTHERWISE SPECIFIED		ANGLES: 1°	
XXX: .010		XX: .030	
DO NOT SCALE DWG			
SCALE			
IC10	NOT USED	MODEL NO.	180, 181, 180LF
Q29	USED	DWG NO.	D180-210
CR26	USED	REV	
R149	USED	CODE IDENT	23338
C62	USED	SHEET 1 OF 1	

WAVETEK SAN DIEGO • CALIFORNIA
SCHMATIC MAIN BOARD



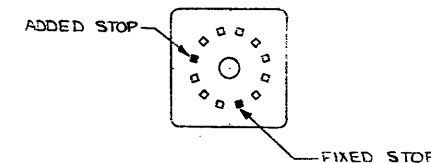
SW 1

DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION.



SW 2

DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION.



NOTE: FOR SILKSCREEN MASTER DIGITIZE ALL BLACK NOMENCLATURE AND OUTLINES WITHIN BOARD OUTLINE

DRAWN	DATE	WAVETEK	
PROTENG	5-7-75	TITLE	
RELEASE	APPROV	SILKSCREEN ASSEMBLY PRINT	
TOLERANCE UNLESS OTHERWISE SPECIFIED XXX±0.05 ANGLES 2° P XX° ±0.50			
DO NOT SCALE DWG	MODEL NO.	DWG NO.	REV
SCALE	180 181 180LF	0001-00-0178	
2/1	23538	SHEET 1 OF 1	

NO.	REF DESIG	DESCRIPTION	MFR PART NO.	MFR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.	
1		SILKSCREEN ASSY PRINT	180-010	WVTK	0001-00-0178				
2		PRINTED CIRCUIT BOARD	180-110	WVTK	1703-00-0178	1			
3		SCHEMATIC	180-210	WVTK	0002-00-0178				
7		CAPACITORS							
8	C38, C44	CERAMIC DISC	1000V, 10PF	DD100	CRI	2	3-50, 5-5	C4	
9	C49	CERAMIC DISC	1000V, 15PF	DD150	CRI	1	5-9	C4	
10	C62	CERAMIC DISC	1000V, 82PF	DD820	CRI	1	2-50	C4	
11	C10	CERAMIC DISC	1000V, 100PF	DD101	CRI	1	4-38	C4	
12	C39, C57	CERAMIC DISC	1000V, 220PF	DD221	CRI	2	2-43, 5-48	C4	
13	C41, C46	CERAMIC DISC	1000V, 330PF	DD331	CRI	2	2-38, 4-28	C4	
14	C15, C61	CERAMIC DISC	1000V, .001µf	DD102	CRI	2	3-41, 4-1	C4	
15	C4, C6, C8	CERAMIC DISC	50V, .01µf	CK103	CRI	17	1-1, 1-32, 2-8 2-27, 3-5, 3-21 3-22, 3-28, 4-16 4-26, 4-46, 4-47 5-21, 5-22, 5-40 5-41, 5-50	C4	
16	C35, C42, C43 C45, C48, C52 C53, C54, C36	CERAMIC DISC	20V, .1µf	UK20-104	CRI	9	2-22, 2-23, 3-46 3-47, 3-48, 5-6 5-11, 5-25, 5-31	C4	
17									
18									
19	C20	SILVER MICA	5%, 68PF	DM15-680J	SAGMO	1	1-36	C4	
20	C21	SILVER MICA	5%, 75PF	DM15-750J	SAGMO	1	1-35	C4	
21	C30, C33	SILVER MICA	5%, 100PF	DM15-101J	SAGMO	2	1-43, 1-48	C4	
22	C31, C32	SILVER MICA	5%, 330PF	DM15-331J	SAGMO	2	1-39, 1-40	C4	
23	C22	SILVER MICA	1%, 910PF	DM15-911F	SAGMO	1	1-34	C4	
24									
25	C19	VARICAP	3.5/13PF	7S-TRIKO-02-3.5/13	STETNR	1	1-37		
26									
27	C7	MYLAR	100V, .33µf	WMP-1P33	CDE	1	B1.3, C8		
28	C55, C58	ELECTROLYTIC	50V, 50µf	500D506G050DD7	SPRAG	2	DIE 1830		
29	C3, C5, C14, C16	ELECTROLYTIC	16V, 100µf	500D107G016DC7	SPRAG	4	B1, C8		
30	C1, C2	ELECTROLYTIC	35V, 1000µf	39D108G035GL4	SPRAG	2	B2.4, C8		
31									
WAVETEK PARTS LIST		TITLE P/C MAIN BOARD	DRAWN BY		NO. 1700-00-0178	REV			
		MODEL 180	APPROVAL		180-010		SH 1 OF 5		

Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFR PART NO.	MFR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.	
32		CAPACITOR SET				1 set	Bag and ID		
33	C23	METAL POLYCARBON	100V, .01µf	180-501-101	WVTK				
34	C24	METAL POLYCARBON	100V, .1µf						
35	C25	METAL POLYCARBON	100V, 1µf						
36									
37	CR1, CR2, CR3	DIODE	1N4002	1N4002	SMTH	4	1-13, 1-14, 1-15	.4	
38	CR4	DIODE, ZENER	1N4581	1N4581	MICRO	3	1-29, 3-12, 5-30	.4	
39	CR6, CR7, CR8	DIODE, ZENER	FD6666	FD6666	FCHLD	14	2-2, 2-4, 2-13 2-14, 3-30, 3-36 3-37, 3-38, 3-39 4-35, 4-36, 4-41 5-24, 5-32	.4	
40	CR10, CR11 CR12, CR13	DIODE	FD7777	FD7777	FCHLD	4	3-8, 3-9, 3-10 3-11	.4	
41									
42									
43		INTEGRATED CIRCUITS							
44	IC1, IC2, IC4	OPERATIONAL AMPLIFIER	µA741	NAT	7000-07-4100	3	1-3, 1-26, 4-5		
45	IC6	OPERATIONAL AMPLIFIER	180-501-103	WVTK		1	3-17	C4	
46	IC10	OPERATIONAL AMPLIFIER	LM-318	NAT	7000-03-1800	1	3-41	C4	
47	IC9	QUAD DIODE ARRAY + 2 DIODES	CA3019	RCA	7000-30-1900	1	2-40/41	BC2	
48	IC7	QUAD DIODE ARRAY + 2 DIODES	CA3054	FCHLD	7000-30-5400	1	2-15/16		
49	IC5	QUAD DIODE ARRAY + 2 DIODES	CA3096AE	FCHLD	7000-30-9600	1	4-3/4		
50	IC3	QUAD 2 INPUT NAND GATE	LM3900	FCHLD	7000-39-0000	1	4-30/31		
51	IC8	QUAD 2 INPUT NAND GATE	7400	FCHLD	8000-74-0000	1			
52									
53									
54									
55		TRANSISTOR							
56	Q5	WITH MTG KIT-TIP29	TIP29	T.I.	4902-00-0290	1			
57	Q1	WITH MTG KIT-TIP30	TIP30	T.I.	4902-00-0300	1			
58	Q28		2N2219A	MOT	4901-02-2191	1	5-39	C2A	
59	Q29		2N2905A	FCHLD	4901-02-9050	1	5-35	C2A	
60	Q6, Q7, Q8		MPS3638A	FCHLD	4901-03-6420	3	1-6, 1-8, 1-11	C2	
61	Q2, Q3, Q4 Q22		2N3642	FCHLD	4901-03-6420	4	1-19, 1-21, 1-23 3-26	C2	
WAVETEK PARTS LIST		TITLE P/C MAIN BOARD	DRAWN BY		NO. 1700-00-0178	REV			
		MODEL 180	APPROVAL		180-010		SH 2 OF 5		

Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFR PART NO.	MFR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.	
62	Q27	TRANSISTOR	2N3903	2N3903	FCHLD	1	5-20	C2	
63	Q15, Q17, Q26	TRANSISTOR	2N3905	2N3905	FCHLD	3	3-2, 3-3, 5-23	C2	
64	Q9, Q10, Q11 Q12, Q13, Q14 Q18, Q19, Q20 Q21, Q25	TRANSISTOR	2N5139	2N5139	FCHLD	11	2-10, 2-11, 2-29 2-30, 4-29, 4-40 4-48, 4-49, 4-50 5-2, 5-12	C2	
65									
66		MATCHED TRANSISTOR							
67	Q23, Q24	MATCHED TRANSISTOR	2N3642	180-501-102	WVTK	1 set	Bag and ID	C2	
68									
69		RESISTORS							
70	R69, R74	METAL FILM	1/8W, 1%, 464Ω	RN55D4640F	CRNG	2	1-38, 1-41	.4	
71	R41	CARBON	1/2W, 5%, 3.9Ω	RC20GF3R9J	STKPL	1	4-17	.5	
72	R1, R3, R139 R140, R141, R142 R121, R136, R138 R146	METAL FILM	1/2W, 5%, 10Ω	RC20GF100J	STKPL	6	1-9, 1-18, 5-36 5-38, 5-42, 5-49 2-24, 5-27, 5-34 5-47	.5	
73	R147	METAL FILM	1/8W, 1%, 54.9Ω	RN55D549F	CRNG	1	5-45	.4	
74	R22	METAL FILM	1/8W, 1%, 78.7Ω	RN55D787F	CRNG	1	5-4	.4	
75	R67, R82, R94 R135, R149	METAL FILM	1/8W, 1%, 100Ω	RN55D1000F	CRNG	5	2-9, 2-28, 3-23 4-7, 5-33	.4	
76	R143, R144	METAL FILM	1/2W, 1%, 100Ω	RN60D1000F	CRNG	2	5-44, 5-46	.7	
77	R137	METAL FILM	1/8W, 1%, 150Ω	RN55D1500F	CRNG	1	5-26	.4	
78	R108, R109	METAL FILM	1/8W, 1%, 165Ω	RN55D1650F	CRNG	2	2-37, 2-39	.4	
79	R105, R129	METAL FILM	1/8W, 1%, 249Ω	RN55D2490F	CRNG	2	2-44, 5-18	.4	
80	R2, R14, R92 R104, R120, R126 R133, R145	METAL FILM	1/8W, 1%, 499Ω	RN55D4990F	CRNG	8	1-10, 1-20, 2-21 2-49, 5-7, 5-8 5-16, 5-43	.4	
81	R63	METAL FILM	1/8W, 1%, 576Ω	RN55D5760F	CRNG	1	3-20	.4	
82	R33, R61,	METAL FILM	1/8W, 1%, 604Ω	RN55D6040F	CRNG	2	5-3, 3-4	.4	
83									
84	R4, R5, R16 R17, R71, R72 R79, R80, R86 R91, R114, R117	METAL FILM	1/8W, 1%, 1K	RN55D1001F	CRNG	12	1-4, 1-5, 1-24 1-25, 1-45, 1-46 2-1, 2-3, 2-6 2-18, 3-44, 3-45	.4	
85									
86									
87	R95, R115, R116	METAL FILM	1/8W, 1%, 1.21K	RN55D1211F	CRNG	3	3-29, 3-42, 3-49	.4	
WAVETEK PARTS LIST		TITLE P/C MAIN BOARD	DRAWN BY		NO. 1700-00-0178	REV			
		MODEL 180	APPROVAL		180-010		SH 3 OF 5		

Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFR PART NO.	MFR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
88	R60, R81, R84 R93, R102, R113 R118	METAL FILM	1/8W, 1%, 1.5K	RN55D1501F	CRNG	7	2-12, 2-31, 2-32 2-45, 2-47, 3-1 3-43	.4
89	R89, R101	METAL FILM	1/8W, 1%, 1.78K	RN55D1781F	CRNG	2	2-19, 3-40	.4
90	R36, R130, R134	METAL FILM	1/8W, 1%, 2K	RN55D2001F	CRNG	3	4-24, 5-15, 5-19	.4
91	R98	METAL FILM	1/8W, 1%, 2.21K	RN55D2211F	CRNG	1	3-33	.4
92	R87, R90	METAL FILM	1/8W, 1%, 2.49K	RN55D2491F	CRNG	2	2-5, 2-17	.4
93	R42, R83, R85	METAL FILM	1/8W, 1%, 3.01K	RN55D3011F	CRNG	3	2-25, 2-26, 4-18	.4
94	R7	METAL FILM	1/8W, 1%, 2.32K	RN55D3321F	CRNG	1	1-27	.4
95	R127	METAL FILM	1/8W, 1%, 3.65K	RN55D3651F	CRNG	1	5-13	.4
96	R6	METAL FILM	1/8W, 1%, 3.92K	RN55D3921F	CRNG	1	1-28	.4
97	R11, R12, R18	METAL FILM	1/8W, 1%, 4.75K	RN55D4751F	CRNG	3	1-2, 1-12, 1-17	.4
98	R3, R15, R35 R45, R54, R64 R68, R128, R132	METAL FILM	1/8W, 1%, 4.99K	RN55D4991F	CRNG	9	1-7, 1-22, 3-7 3-15, 3-24, 4-25 4-19, 5-10, 5-29	.4
99	R10	METAL FILM	1/8W, 1%, 6.19K	RN55D6191F	CRNG	1	1-33	.4
100	R97, R123	METAL FILM	1/8W, 1%, 6.81K	RN55D6811F	CRNG	2	3-27, 5-14	.4
101	R99, R100	METAL FILM	1/8W, 1%, 7.87K	RN55D7871F	CRNG	2	3-34, 3-35	.4
102	R8	METAL FILM	1/8W, 1%, 8.25K	RN55D8251F	CRNG	1	1-31	.4
103	R24, R26, R31 R88, R96	METAL FILM	1/8W, 1%, 10K	RN55D1002F	CRNG	5	2-20, 3-25, 4-33 4-34, 5-1	.4
104	R28	METAL FILM	1/8W, 1%, 10.5K	RN55D1052F	CRNG	1	4-42	.4
105	R70, R73, R75 R77, R112	METAL FILM	1/8W, 1%, 12.1K	RN55D1212F	CRNG	5	1-44, 1-47, 1-42 1-50, 2-46	.4
106	R25	METAL FILM	1/8W, 1%, 13.1K	RN55D1312F	CRNG	1	4-39	.4
107	R38, R62	METAL FILM	1/8W, 1%, 15K	RN55D1502F	CRNG	2	3-19, 4-23	.4
108	R29	METAL FILM	1/8W, 1%, 21.5K	RN55D2152F	CRNG	1	4-44	.4
109	R44, R53, R131	METAL FILM	1/8W, 1%, 24.9K	RN55D2492F	CRNG	3	3-6, 3-13, 5-17	.4
110	R106, R110	METAL FILM	1/8W, 1%, 30.1K	RN55D3012F	CRNG	2	2-36, 2-42	.4
111	R107, R111	METAL FILM	1/8W, 1%, 33.2K	RN55D3322F	CRNG	2	2-33, 2-34	.4
112	R32, R65	METAL FILM	1/8W, 1%, 49.9K	RN55D4992F	CRNG	2	3-16, 4-37	.4
113	R27, R30, R124	METAL FILM	1/8W, 1%, 100K	RN55D1003F	CRNG	3	4-43, 4-45, 5-28	.4
114	R37	METAL FILM	1/8W, 1%, 221K	RN55D2213F	CRNG	1	4-22	.4
115	R76	METAL FILM	1/8W, 1%, 237K	RN55D2373F	CRNG	1	1-49	.4
116	R23, R57	CARBON	1/					

ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.	
121	R19,R20	METAL FILM	1/8W, 1%, 10K	142-501-64A	WVTK	4789-00-0019	1 set	Bag and ID	.4
122	R103	POTENTIOMETERS	200K	91AR-200	BECK	4600-12-2010	1	2-48	C8
123	R9,R66,R78	POTENTIOMETERS	1K	91AR-1K	BECK	4600-12-1020	3	1-30, 2-7, 3-18	C8
124	R39	POTENTIOMETERS	2K	91AR-2K	BECK	4600-12-2020	1	4-27	C8
125	R43	POTENTIOMETERS	10K	91AR-10K	BECK	4600-12-1030	1	4-6	C8
126	R47,R125	POTENTIOMETERS	100K	91AR-100K	BECK	4600-12-1040	2	4-11, 5-37	C8
127									
128									
129									
130		TRANSIPADS		10160	ROSS	2800-11-0004	2		
131		HEATSINK		NF207	WKFLD	2800-11-0001	3		
132		14 PIN DIP SOCKET		14 DIP	ROBNUG	2100-03-0011	1	3-31/32	
133		SWITCH DETENT (180-400)		180-313	WVTK	5104-99-0022	1		
134		SWITCH DETENT (180-400)		180-314	WVTK	5104-99-0023	1		
135		WAFER		147-400	WVTK	5104-02-0015	5		
136	R21	POT		JK1303	CTS	4600-06-1039	1		
137	R34,R122	POT/SWITCH (GH1879)		180-3	WVTK		2		
138		SOLDER LUG		1497	SMITH	2100-04-0012	2		
139	R119	POT AMPLITUDE		180-401	WVTK	4600-06-1023	1		
140									
141									
142									
143									
144									
145		WIRE							
146		22GA BLACK				6000-32-2000			

WAVETEK® PARTS LIST	TITLE P/C MAIN BOARD	DRAWN BY	NO. 1700-00-0178	REV
	MODEL 180	APPROVAL	180-010	
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Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFG PART NO.	MFR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
1		SILKSCREEN ASSY PRINT	180-010	WVTK	0001-00-0178			
2		PRINTED CIRCUIT BOARD	180-110	WVTK	1703-00-0178	1		
3		SCHEMATIC	180-210	WVTK	0002-00-0178			
4								
5								
6								
7		CAPACITORS						
8	C38, C44	CERAMIC DISC	1000V, 10PF	DD100		2	3-50, 5-5	C4
9	C49	CERAMIC DISC	1000V, 15PF	DD150		1	5-9	C4
10	C62	CERAMIC DISC	1000V, 82PF	DD820		1	2-50	C4
11	C10	CERAMIC DISC	1000V, 100PF	DD101		1	4-38	C4
12	C39, C57	CERAMIC DISC	1000V, 220PF	DD221		2	2-43, 5-48	C4
13	C41, C46	CERAMIC DISC	1000V, 330PF	DD331		2	2-38, 4-28	C4
14	C15, C61	CERAMIC DISC	1000V, .001µf	DD102		2	3-14, 4-1	C4
15	C4, C6, C8	CERAMIC DISC	50V, .01µf	CK103		17	1-1, 1-32, 2-8	C4
	C9, C11, C12						2-27, 3-5, 3-21	
	C18, C28, C29						3-22, 3-28, 4-16	
	C34, C60, C37						4-26, 4-46, 4-47	
	C47, C50, C51						5-21, 5-22, 5-40	
	C56, C59						5-41, 5-50	
16	C35, C42, C43	CERAMIC DISC	20V, .1µf	UK20-104		9	2-22, 2-23, 3-46	C4
	C45, C48, C52						3-47, 3-48, 5-6	
	C53, C54, C36						5-11, 5-25, 5-31	
17								
18								
19	C20	SILVER MICA	5%, 68PF	DM15-680J	SAGMO	1	1-36	C4
20	C21	SILVER MICA	5%, 75PF	DM15-750J	SAGMO	1	1-35	C4
21	C30, C33	SILVER MICA	5%, 100PF	DM15-101J	SAGMO	2	1-43, 1-48	C4
22	C31, C32	SILVER MICA	5%, 330PF	DM15-331J	SAGMO	2	1-39, 1-40	C4
23	C22	SILVER MICA	1%, 910PF	DM15-911F	SAGMO	1	1-34	C4
24								
25	.C19	VARICAP	3.5/13PF	7STRIKO-02-3.5/13	STETNR	1	1-37	
26								
27	C7	MYLAR	100V, 133µf	WMP-1P33	CDE	1	B1.3, C8	
28	C55, C58	ELECTROLYTIC	50V, 50µf	500D506G050DD7	SPRAG	2	DIE 1830	
29	C3, C5, C14, C16	ELECTROLYTIC	16V, 100µf	500D107G016DC7	SPRAG	4	B1, C8	
30	C1, C2	ELECTROLYTIC	35V, 1000µf	39D108G035GL4	SPRAG	2	B2.4, C8	
31								

WAVETEK
PARTS LIST

TITLE P/C Main Board
MODEL 180LF

DRAWN BY
APPROVAL

NO. 180LF-010
1700-00-0179
SH 1 OF 5

REV

Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFG PART NO.	MFR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
32								
33								
34		CAPACITOR SET						
35	C23	METAL POLY CARBON	100V, .01µf	130-501-6	WVTK	1/set	Bag and ID	
	C24	METAL POLY CARBON	100V, .1µf					
	C25	METAL POLY CARBON	100V, 1µf					
36	C26, C27	METAL POLY CARBON	100V, 5µf					
37	CR1, CR2	DIODE	1N4002	1N4022	SMITH	4	1-13, 1-14, 1-15	.4
	CR3, CR4							
38	CR5, CR9, CR24	DIODE, ZENER	1N4581	1N4581	MICRO	3	1-29, 3-12, 5-30	.4
39	CR6, CR7, CR8		FD6666	FD6666	FCHLD	14	2-2, 2-4, 2-13	.4
	CR14, CR15, CR16						2-14, 3-30, 3-36	
	CR17, CR18, CR20						3-37, 3-38, 3-39	
	CR21, CR22, CR23						4-35, 4-36, 4-41	
	CR25, CR26						5-24, 5-32	
40	CR10, CR11	DIODE	FD7777	FD7777	FCHLD	4	3-8, 3-9, 3-10	.4
	CR12, CR13						3-11	
41								
42								
43		INTEGRATED CIRCUITS						
44	IC1, IC2, IC4	OPERATIONAL AMPLIFIER	µA741		NAT	3	1-3, 1-26, 4-5	
45	IC6		180-501-103		WVTK	1	3-17	C4
46	IC10		LM-318		NAT	1	3-41	C4
47	IC9	QUAD DIODE ARRAY + 2 DIODES	CA3019		FCHLD	1	2-40/41	BC2
48	IC7		CA3054		FCHLD	1	2-15/16	
49	IC5		CA3096AE		FCHLD	1	4-3/4	
50	IC3		LM3900		FCHLD	1	4-30/31	
51	IC8	QUAD 2 INPUT NAND GATE	7400		FCHLD	1		
52								
53								
54								
55		TRANSISTOR						
56	Q5	WITH MTC KIT- TIP29	TIP29		T. I.	1	4902-00-0290	
57	Q1	WITH MTC KIT- TIP30	TIP30		T. I.	1	4902-00-0300	
58	Q28		2N2219A		MOT	1	4901-02-2191	C2A
59	Q29		2N2905A		FCHLD	1	5-35	C2A
60	Q6, Q7, Q8		MPS3638A		FCHLD	3	1-6, 1-8, 1-11	C2

WAVETEK
PARTS LIST

TITLE P/C Main Board
MODEL 180LF

DRAWN BY
APPROVAL

NO. 180LF-010
1700-00-0179
SH 2 OF 5

REV

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Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
61	Q2, Q3, Q4		2N3642	FCHLD	4901-03-6420	4	1-19, 1-21, 1-23	C2
62	Q22		2N3903	FCHLD	4901-03-9030	1	3-26	C2
63	Q15, Q17, Q26		2N3905	FCHLD	4901-03-9050	3	3-2, 3-3, 5-23	C2
64	Q9, Q10, Q11		2N5139	FCHLD	4901-05-1390	11	2-10, 2-11, 2-29	C2
	Q12, Q13, Q14						2-30, 4-29, 4-40	
	Q18, Q19, Q20						4-48, 4-49, 4-50	
	Q21, Q25						5-2, 5-12	
65								
66	Q23, Q24	MATCHED TRANSISTOR	2N3642	WVTK	4998-00-0011	1/set	Bag and ID	C2
67								
68								
69		RESISTORS						
70	R69, R74	METAL FILM	1/8W, 1%, 464Ω	CRNG	4701-03-4640	2	1-38, 1-41	.4
71	R41	METAL FILM	1/2W, 5%, 3.9Ω	STKPL	4700-25-0399	1	4-17	.5
72	R1, R3, R139	CARBON	10Ω	STKPL	4700-25-0100	6	1-9, 1-18, 5-36	.5
	R140, R141, R142						5-38, 5-42, 5-49	
73	R121, R136, R138	METAL FILM	1/8W, 1%, 21.5Ω	CRNG	4701-03-2159	4	2-24, 5-27, 5-34	.4
	R146						5-47	
74	R147	METAL FILM	1/8W, 1%, 54.9Ω	CRNG	4701-03-5499	1	5-45	.4
75	R22	METAL FILM	1/8W, 1%, 78.7Ω	CRNG	4701-03-7879	1	5-4	.4
76	R67, R82, R94	METAL FILM	1/8W, 1%, 100Ω	CRNG	4701-03-1000	5	2-9, 2-28, 3-23	.4
	R135, R149						4-7, 5-33	
77	R143, R144	METAL FILM	1/2W, 1%, 100Ω	CRNG	4701-13-1000	2	5-44, 5-46	.7
78	R137	METAL FILM	1/8W, 1%, 150Ω	CRNG	4701-03-1500	1	5-26	.4
79	R108, R109	METAL FILM	1/8W, 1%, 165Ω	CRNG	4701-03-1650	2	2-37, 2-39	.4
80	R105, R129	METAL FILM	1/8W, 1%, 249Ω	CRNG	4701-03-2490	2	2-44, 5-18	.4
81	R2, R14, R92	METAL FILM	1/8W, 1%, 499Ω	CRNG	4701-03-4990	8	1-10, 1-20, 2-21	.4
	R104, R120, R126						2-49, 5-7, 5-8	
	R133, R145						5-16, 5-43	
82	R63	METAL FILM	1/8W, 1%, 576Ω	CRNG	4701-03-5760	1	3-20	.4
83	R33, R61,	METAL FILM	1/8W, 1%, 604Ω	CRNG	4701-03-6040	2	5-3, 3-4	.4
84	R4, R5, R16	METAL FILM	1/8W, 1%, 1K	CRNG	4701-03-1011	12	1-4, 1-5, 1-24	.4
	R17, R71, R72						1-25, 1-45, 1-46	
	R79, R80, R86						2-1, 2-3, 2-6,	
	R91, R114, R117						2-18, 3-44, 3-45	
85								

WAVETEK
PARTS LIST

TITLE P/C Main Board
MODEL 180LF

DRAWN BY
APPROVAL

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Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
86								
87	R95, R115, R116	METAL FILM	1/8W, 1%, 1.21K	CRNG	4701-03-1121	3	3-29, 3-42, 3-49	.4
88	R60, R81, R84	METAL FILM	1/8W, 1%, 1.5K	CRNG	4701-03-1501	7	2-12, 2-31, 2-32	.4
	R93, R102, R113						2-45, 2-47, 3-1	
	R118						3-43	
89	R89, R101	METAL FILM	1/8W, 1%, 1.78K	CRNG	4701-03-1781	2	2-19, 3-40	.4
90	R36, R130, R134	METAL FILM	1/8W, 1%, 2K	CRNG	4701-03-2001	3	4-24, 5-15, 5-19	.4
91	R98	METAL FILM	1/8W, 1%, 2.21K	CRNG	4701-03-2001	1	3-33	.4
92	R87, R90	METAL FILM	1/8W, 1%, 2.49K	CRNG	4701-03-2491	2	2-5, 2-17	.4
93	R42, R83, R85	METAL FILM	1/8W, 1%, 30.1K	CRNG	4701-03-3011	3	2-25, 2-25, 4-18	.4
94	R7	METAL FILM	1/8W, 1%, 3.32K	CRNG	4701-03-3321	1	1-27	.4
95	R127	METAL FILM	1/8W, 1%, 3.65K	CRNG	4701-03-3651	1	5-13	.4
96	R6	METAL FILM	1/8W, 1%, 3.92K	CRNG	4701-03-3921	1	1-28	.4
97	R11, R12, R18	METAL FILM	1/8W, 1%, 4.75K	CRNG	4701-03-4751	3	1-2, 1-12, 1-17	.4
98	R3, R15, R35	METAL FILM	1/8W, 1%, 4.99K	CRNG	4701-03-4991	9	1-7, 1-22, 3-7	.4
	R45, R54, R64						3-15, 3-24, 4-25	
	R68, R128, R132						4-19, 5-10, 5-29	
99	R10	METAL FILM	1/8W, 1%, 6.19K	CRNG	4701-03-6191	1	1-33	.4
100	R97, R123	METAL FILM	1/8W, 1%, 6.81K	CRNG	4701-03-6811	2	3-27, 5-14	.4
101	R99, R100	METAL FILM	1/8W, 1%, 7.87K	CRNG	4701-03-7871	2	3-34, 3-39	.4
102	R8	METAL FILM	1/8W, 1%, 8.25K	CRNG	4701-03-8251	1	1-31	.4
103	R24, R26, R31	METAL FILM	1/8W, 1%, 10K	CRNG	4701-03-1002	5	2-20, 3-25, 4-33	.4
	R88, R96						4-34, 5-1	
104	R28	METAL FILM	1/8W, 1%, 10.5K	CRNG	4701-03-1052	1	4-42	.4
105	R70, R73, R75	METAL FILM	1/8W, 1%, 12.1K	CRNG	4701-03-1212	5	1-44, 1-47, 1-42	.4
	R77, R112						1-50, 2-46	
106	R25	METAL FILM	1/8W, 1%, 13.1K	CRNG	4701-03-1312	1	4-39	.4
107	R38, R62	METAL FILM	1/8W, 1%, 15K	CRNG	4701-03-1502	2	3-19, 4-23	.4
108	R29	METAL FILM	1/8W, 1%, 21.5K	CRNG	4701-03-2152	1	4-44	.4
109	R44, R53, R131	METAL FILM	1/8W, 1%, 24.9K	CRNG	4701-03-2492	3	3-6, 3-13, 5-17	.4
110	R106, R110	METAL FILM	1/8W, 1%, 30.1K	CRNG	4701-03-3012	2	2-36, 2-42	.4
111	R107, R111	METAL FILM	1/8W, 1%, 33.2K	CRNG	4701-03-3322	2	2-33, 2-34	.4
112	R32, R65	METAL FILM	1/8W, 1%, 49.9K	CRNG	4701-03-4992	2	3-16, 4-37	.4
113	R27, R30, R124	METAL FILM	1/8W, 1%, 100K	CRNG	4701-03-1003	3	4-43, 4-45, 5-28	.4
114	R37	METAL FILM	1/8W, 1%, 221K	CRNG	4701-03-2213	1	4-22	.4
115	R76	METAL FILM	1/8W, 1%, 237K	CRNG	4701-03-2373	1	1-49	.4
116	R23, R57	CARBON	1/2W, 10%, 470K	STKPL	4700-25-4703	2	4-2, 4-32	.5
117	R48, R52	CARBON	1/2W, 5%, 1M	STKPL	4700-25-1004	2	4-8, 4-10	.5

WAVETEK
PARTS LIST

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MODEL 180LF

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ITEM NO.	REF DESIG	DESCRIPTION	MFG PART NO.	MFG	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
118	R49	CARBON	1/2W, 5%, 10M	RC20GF106J	STKPL	4700-25-1005	1 4-9	.5
119		MATCHED RESISTORS						
120	R50,R51,R55,R56	METAL FILM	1/8W, 1%, 4.99K	180-501-1000	WVTK	4789-00-0039	1 set Bag and ID	.4
121	R19,R20	METAL FILM	1/8W, 1%, 10K	142-501-64A	WVTK	4789-00-0019	1 set Bag and ID	.4
122	R103	POTENTIOMETERS	200	91AR-200	BECK	4600-12-2010	1 2-48	C8
123	R9,R66,R78		1K	91AR-1K	BECK	4600-12-1020	3 1-30, 2-7, 3-18	C8
124	R39		2K	91AR-2K	BECK	4600-12-2020	1 4-27	C8
125	R43		10K	91AR-10K	BECK	4600-12-1030	1 4-6	C8
126	R47,R125		100K	91AR-100K	BECK	4600-12-1040	2 4-11, 5-37	C8
127								
128								
129								
130		TRANSIPADS		10160	ROSS	2800-11-0004	2	
131		HEATSINK		NF207	WAKFLD	2800-11-0001	3	
132		14 PIN DIP SOCKET		14 DIP	ROBNUG	2100-03-0011	1 3-31/32	
133		SWITCH DETENT (180-400)		180-313	WVTK	5104-99-0022	1	
134		SWITCH DETENT (180-400)		180-314	WVTK	5104-99-0023	1	
135		WAFER		147-400	WVTK	5104-02-0015	5	
136	R21	POT		JK1303	CTS	4600-06-1039	1	
137	R34,R122	POT/SWITCH (GH1879)		180-3	WVTK		2	
138		SOLDER LUG		1497	SMITH	2100-04-0012	2	
139	R119	POT AMPLITUDE		180-401	WVTK	4600-06-1023	1	
140								

WAVETEK PARTS LIST	TITLE	P/C Main Board	DRAWN BY	NO. 180LF-010 1700-00-0179	REV
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