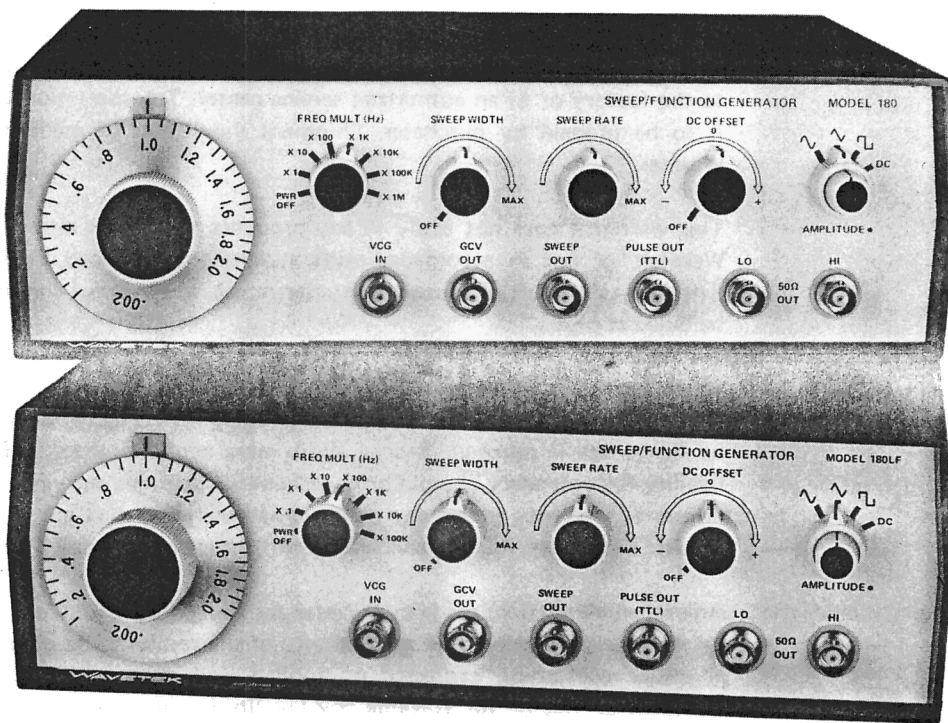


INSTRUCTION MANUAL

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

CONTENTS

SECTION 1	GENERAL DESCRIPTION	
	1.1 THE MODELS 180 AND 180LF	1-1
	1.2 SPECIFICATIONS	1-1
SECTION 2	INITIAL PREPARATION	
	2.1 UNPACKING INSPECTION	2-1
	2.2 PREPARATION FOR USE	2-1
	2.3 ELECTRICAL ACCEPTANCE CHECK	2-1
	2.4 CHANGING THE OUTPUT IMPEDANCE	2-1
SECTION 3	OPERATION	
	3.1 CONTROLS AND CONNECTORS	3-1
	3.1.1 Power/Frequency Controls	3-1
	3.1.2 Amplitude Controls	3-1
	3.1.3 Function Selections	3-2
	3.1.4 Sweep Controls	3-2
	3.2 OPERATION	3-2
	3.2.1 Signal Termination	3-2
	3.2.2 Manually Controlled Operation	3-3
	3.2.3 Voltage Controlled Operation	3-3
	3.2.4 Sweep Generator Operation	3-4
SECTION 4	CIRCUIT DESCRIPTION	
	4.1 VOLTAGE CONTROLLED GENERATOR (VCG)	4-1
	4.2 FREQUENCY CONTROL	4-1
	4.3 WAVEFORM OUTPUT	4-2
	4.4 SWEEP CIRCUITS	4-2
	4.5 CRYSTAL CONTROL	4-2
SECTION 5	CALIBRATION	
	5.1 FACTORY REPAIR	5-1
	5.2 REQUIRED TEST EQUIPMENT	5-1
	5.3 REMOVING GENERATOR COVER	5-1
	5.4 CALIBRATION	5-1
SECTION 6	TROUBLESHOOTING	
	6.1 FACTORY REPAIR	6-1
	6.2 TROUBLESHOOTING CHART	6-1
	6.3 TROUBLESHOOTING INDIVIDUAL COMPONENTS	6-1
SECTION 7	PARTS AND SCHEMATICS	
	7.1 DRAWINGS	7-1
	7.2 ORDERING PARTS	7-1
	7.3 ADDENDA	7-1

1

SECTION

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:

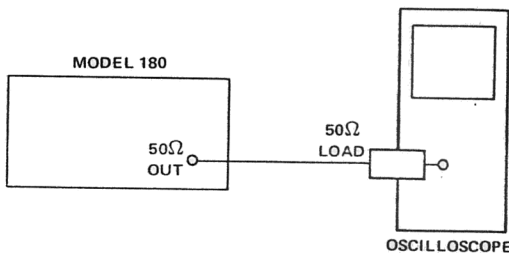


Figure 2-1. Acceptance Check Setup

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

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

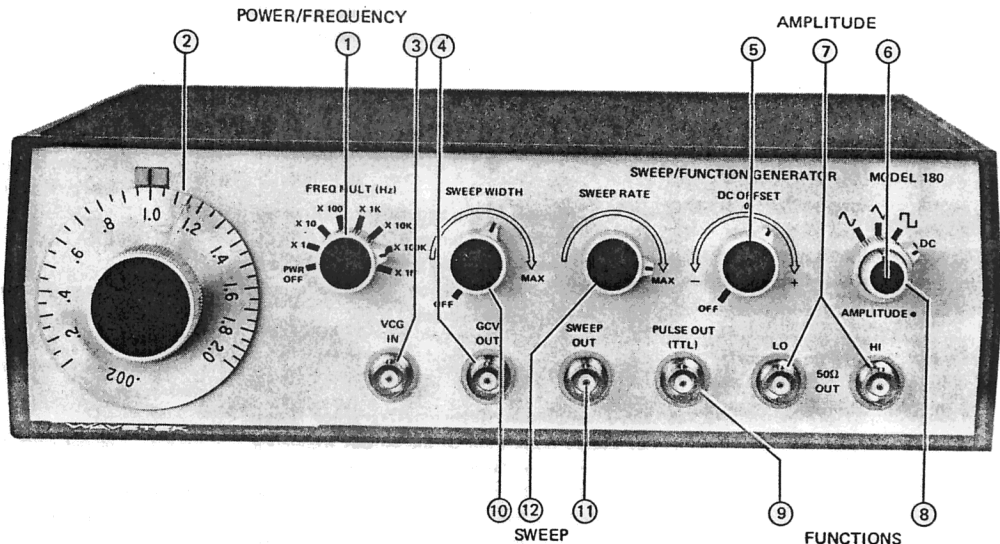


Figure 3-1. Model 180 Controls and Connectors

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

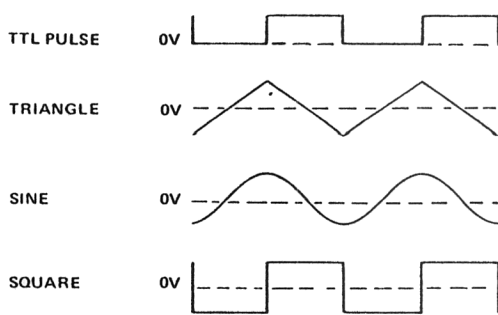


Figure 3-2. Output Waveforms

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.

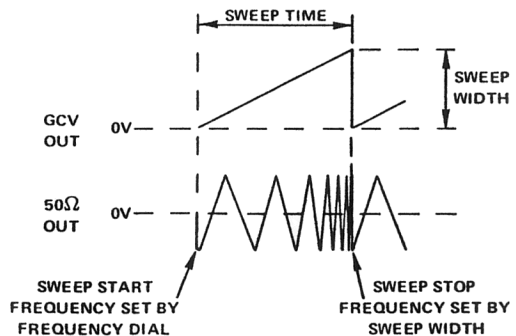


Figure 3-3. Effect of Sweep on Output Frequency

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.

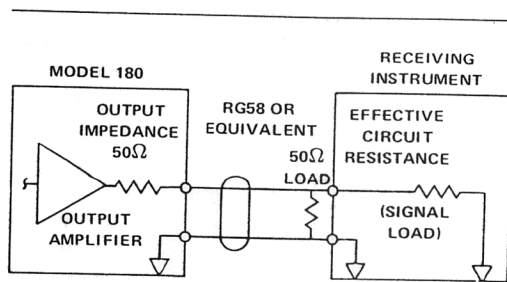


Figure 3-4. Signal Termination

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.

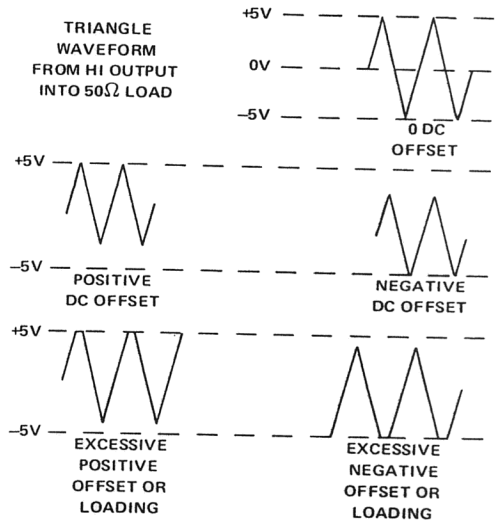


Figure 3-5. DC OFFSET Control

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.)

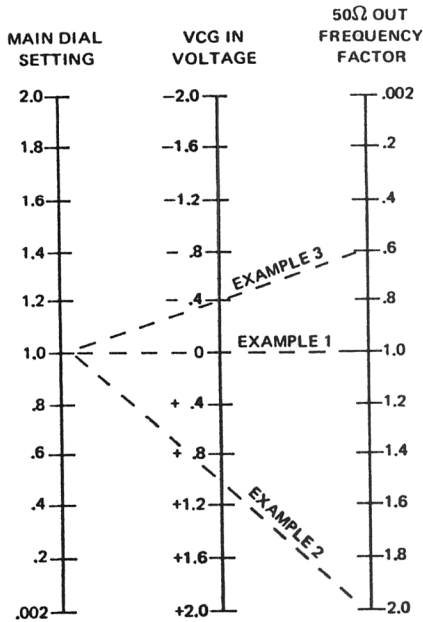


Figure 3-6. VCG Voltage-to-Frequency Nomograph

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.

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.

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.

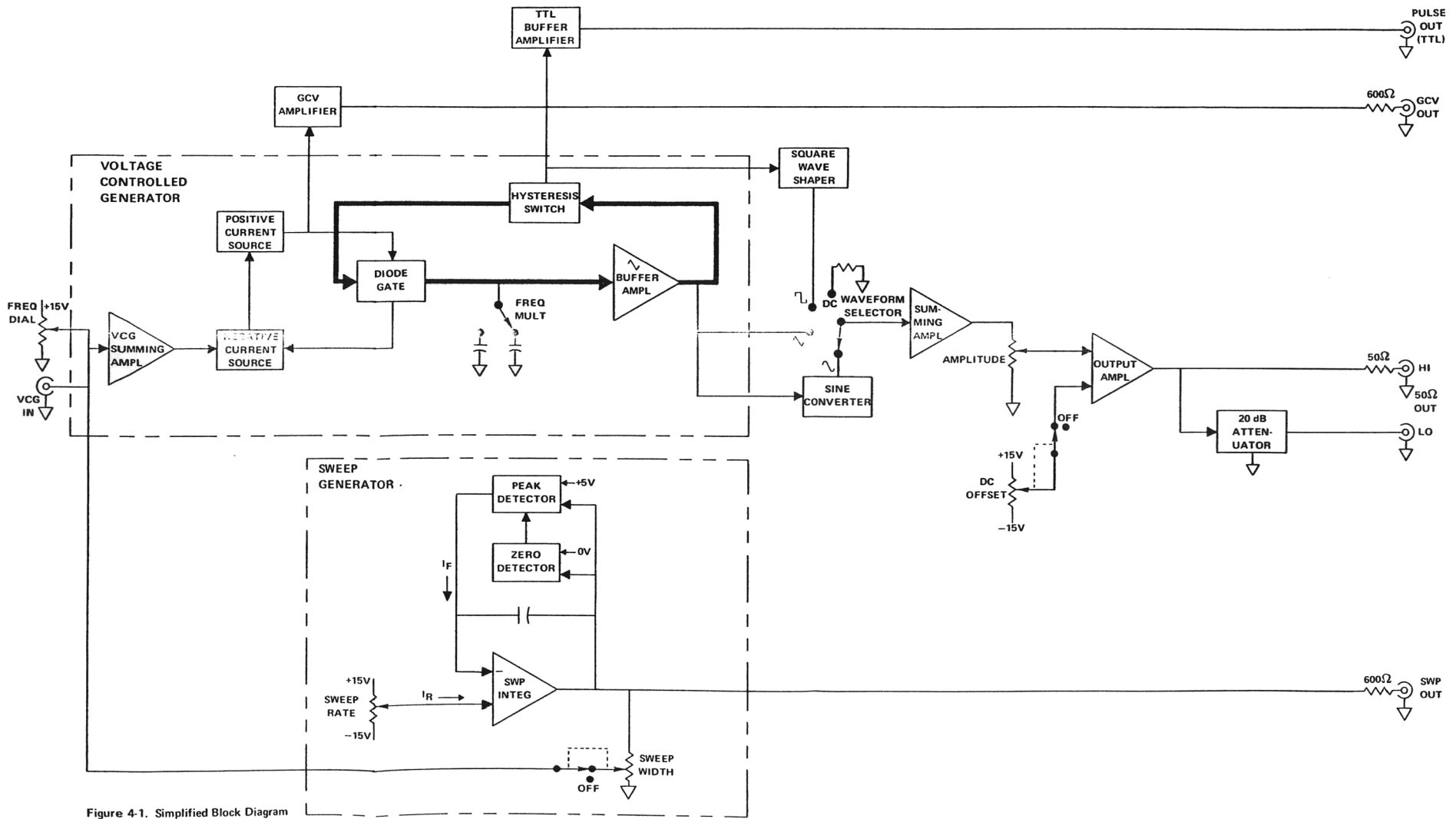


Figure 4-1. Simplified Block Diagram

4

SECTION

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.

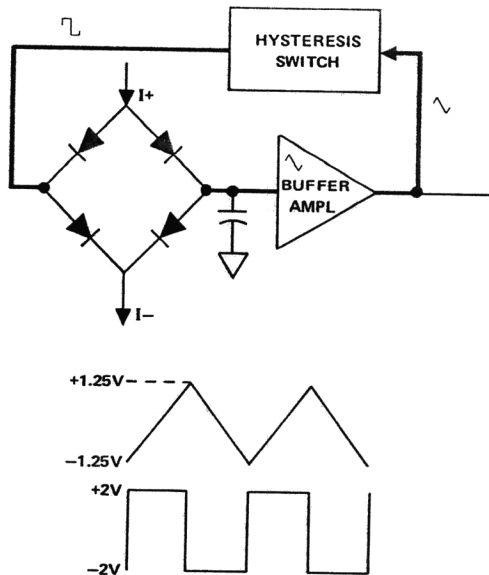


Figure 4-2. Simplified Timing Diagram

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 in to 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.

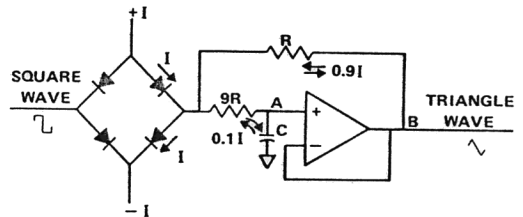


Figure 4-3. Current Divider

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 wave 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

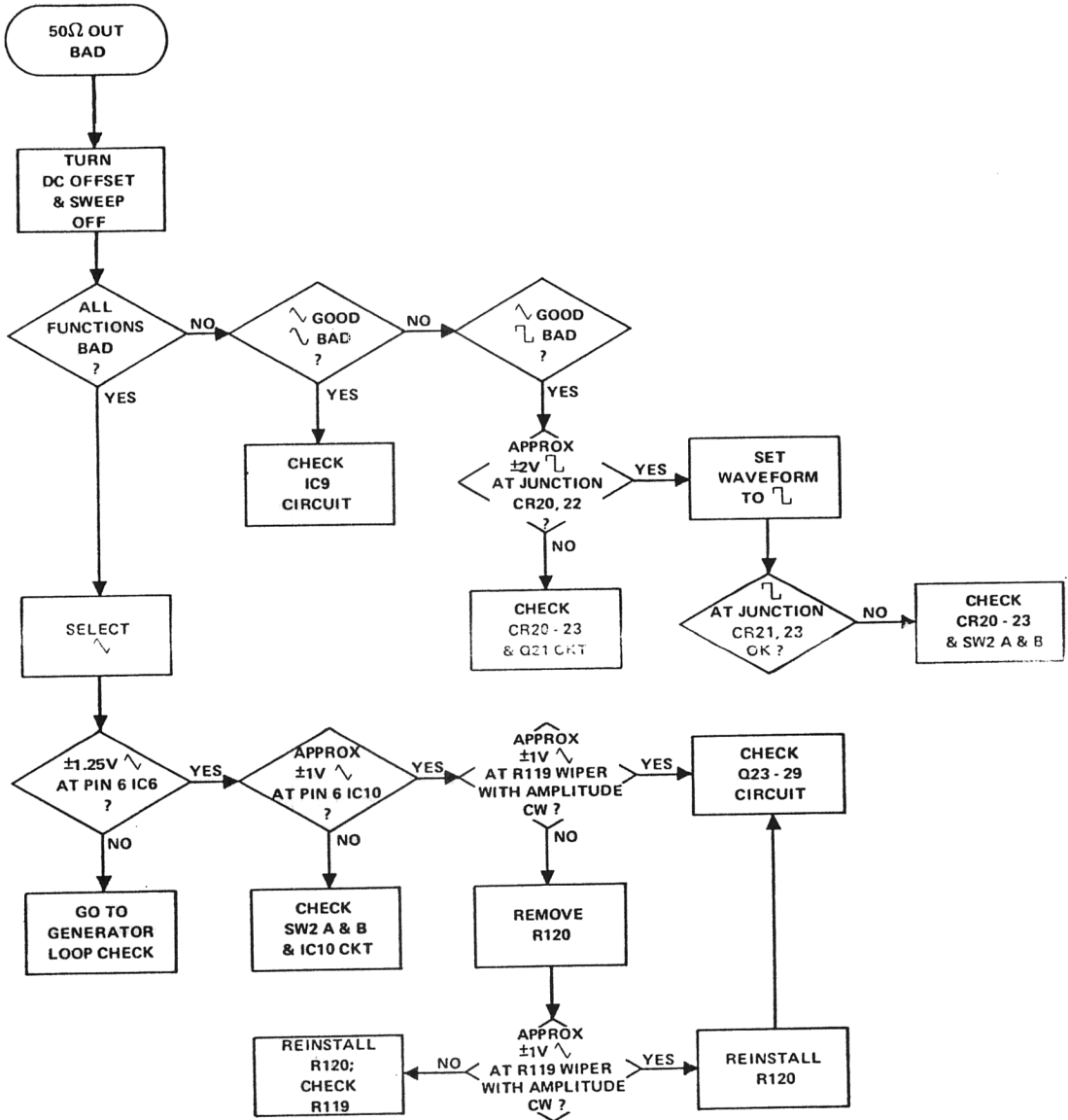


Figure 6-1. Troubleshooting Chart (Sheet 1 of 4)

GENERATOR LOOP CHECK

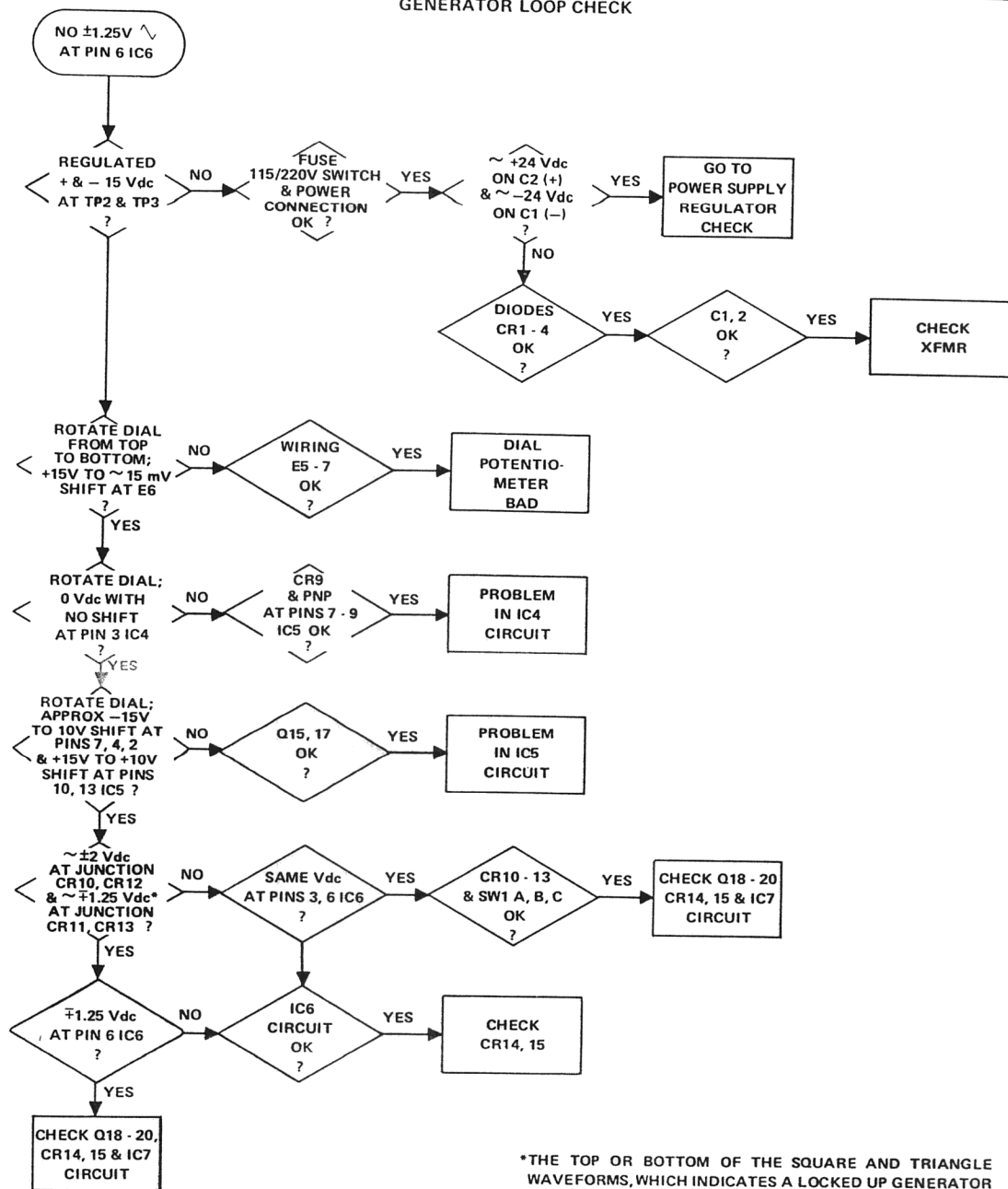


Figure 6-1. Troubleshooting Chart (Sheet 2 of 4)

POWER SUPPLY REGULATOR CHECK

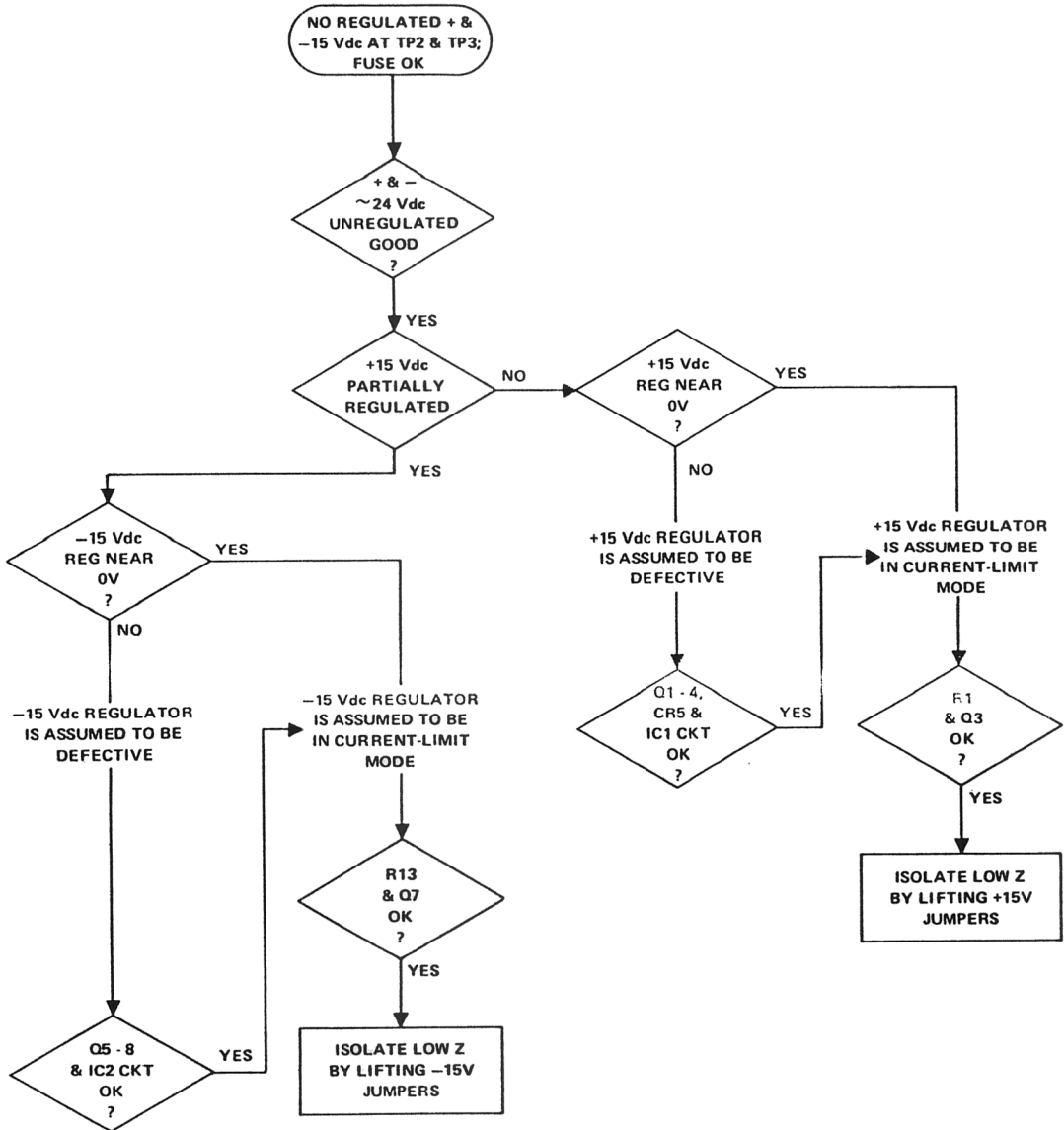


Figure 6-1. Troubleshooting Chart (Sheet 3 of 4)

SWEEP CHECK

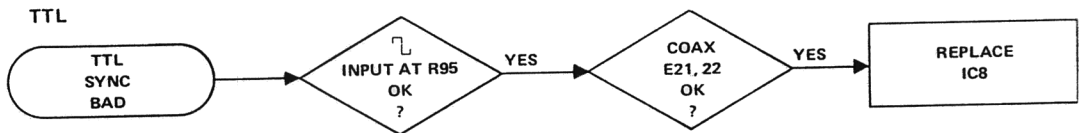
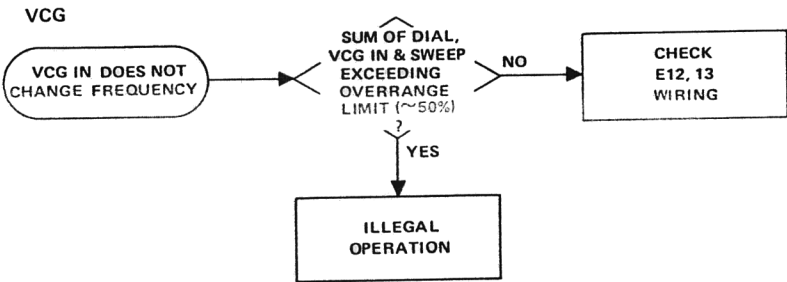
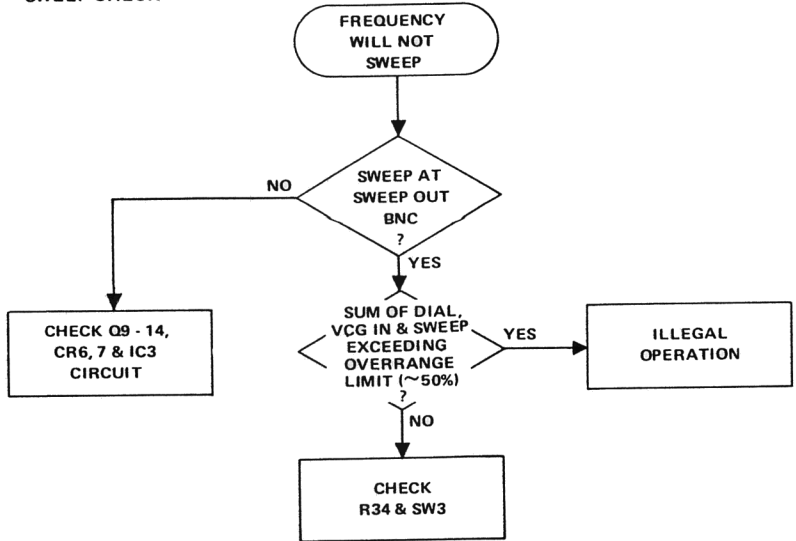


Figure 6-1. Troubleshooting Chart (Sheet 4 of 4)

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.

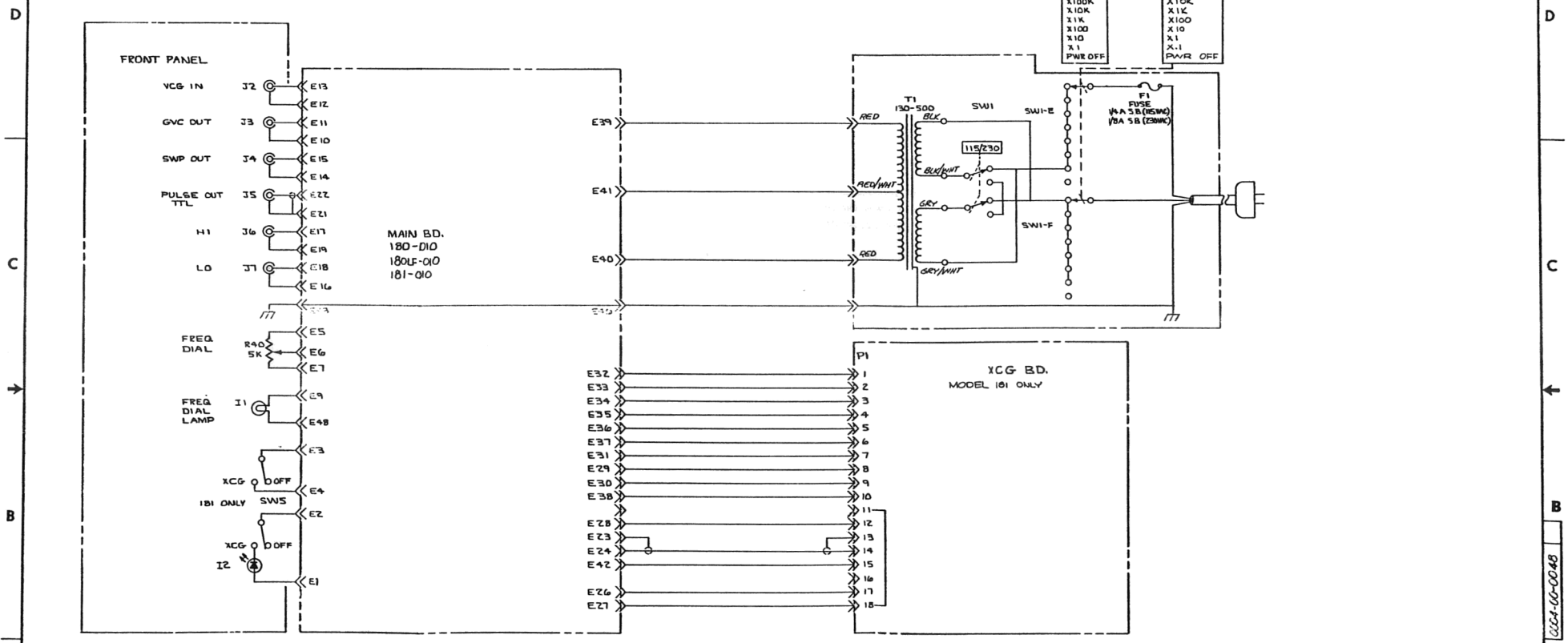
7.3 ADDENDA

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



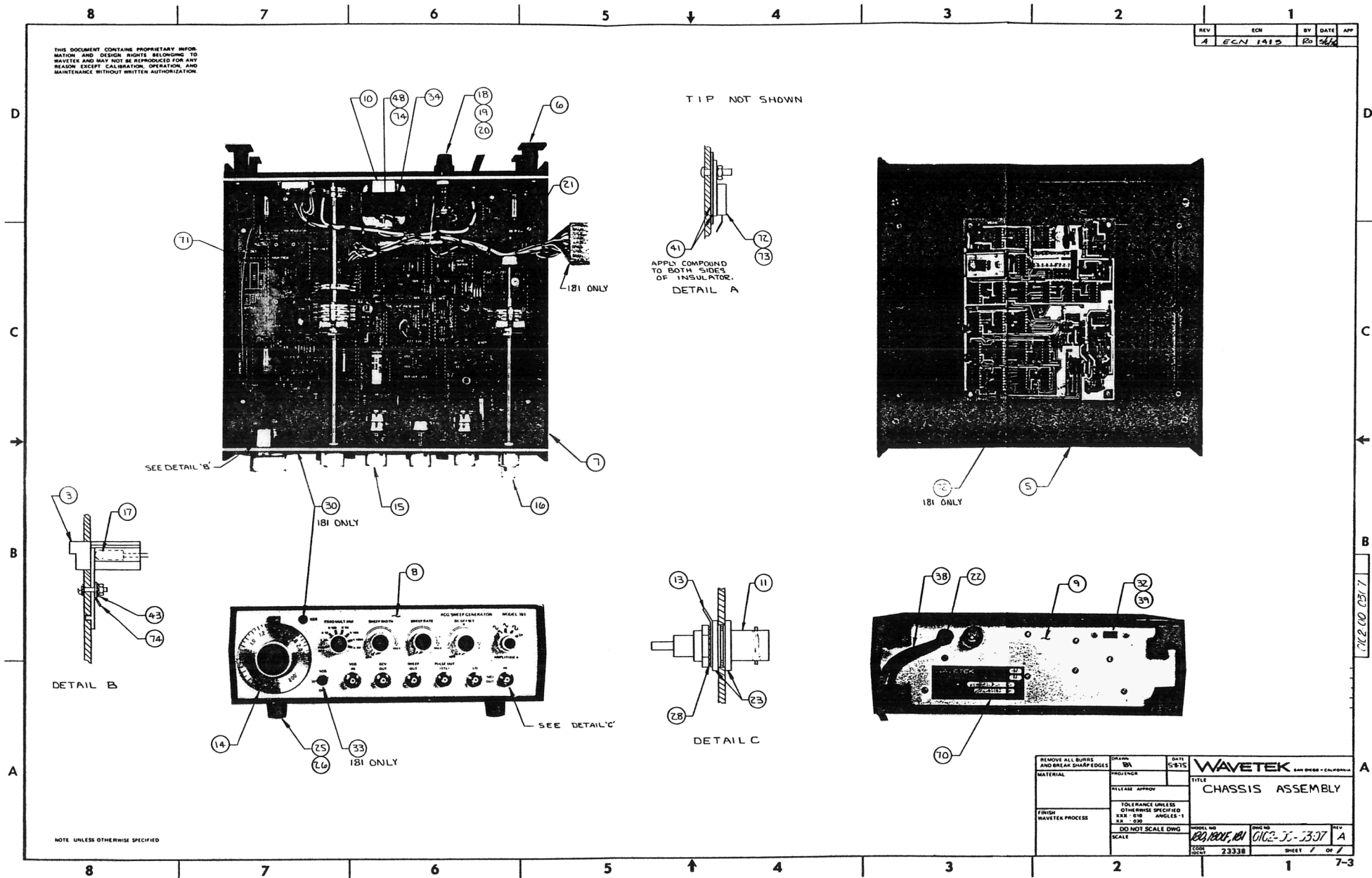
NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN ESP	DATE 5/13/75	<p>WAVETEK SAN DIEGO • CALIFORNIA</p>
MATERIAL	DESIGNED		
FINISH WAVETEK PROCESS	RELEASE APPROV		TOLERANCE UNLESS OTHERWISE SPECIFIED DIM - 0.005 ANGLES 1:1 XX - 0.030
	DO NOT SCALE DWG		SCALE
			MODEL NO 180-181-180LF
			DWG NO 0004 00-0048
			REV 23338
			SHEET 1 OF 2

0004-00-0048

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REV	ECN	BY	DATE	APP
1	ECN 1415	Ro	3/84	



NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRW NO 30A	DATE 5-81C	WAVETEK SAN DIEGO - CALIFORNIA
MATERIAL	PROFINGER	TITLE CHASSIS ASSEMBLY	
FINISH WAVETEK PROCESS	RELEASE APPROV	TOLERANCE UNLESS OTHERWISE SPECIFIED HRR - 0.10 ANGLES - 1 X - 45°	MODEL NO 602100F, RN
	DO NOT SCALE DWG	SCALE	DWG NO 0102-JJ-5337
			REV A
			CODE 23338
			SHEET / OF

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REV ECH DP DATE APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-WFGR-PART-NO	WFGR	WAVTEK NO.	QTY/PT
NONE	DIAL ASSY	1201-00-0027	WVTK	1201-00-0027	1
NONE	TRANSFORMER	130-500	WVTK	1200-00-0003	1
NONE	SPACER	8480	WVTK	1400-00-0053	2
NONE	INSULATOR, MICA	142-311	WVTK	1400-00-2080	2
NONE	PLATE, NAME	139-305	WVTK	1400-00-2180	1
NONE	INDICATOR, DIAL	100-303	WVTK	1400-00-4976	1
NONE	COVER, TOP	100-300-1	WVTK	1400-00-5000	1
NONE	POST	100-302	WVTK	1400-00-5020	4
NONE	COVER, BOTTOM	100-300-2	WVTK	1400-00-5030	1
NONE	PANEL, FRONT FROM 1400-00-5042	100-305-1	WVTK	1400-00-5059	1
NONE	PANEL, REAR	100-306	WVTK	1400-00-5073	1
NONE	BLOCK, MFG	100-309	WVTK	1400-00-5083	2
NONE	TAG, SERIAL	100-310	WVTK	1400-00-5390	1
NONE	CORD HOLDER	1400-00-5409	WVTK	1400-00-5409	1
J2 J3 J4 J5 J6 J7	BNC CONN	KC-7946	KING	2100-01-0002	6
NONE	TERM, LOCK LUG	1414-8	SMITH	2100-00-0008	2
NONE	SOLDER LUG	1497	SMITH	2100-00-0012	6

WAVETEK PARTS LIST	TITLE STD CHASSIS	ASSEMBLY NO. 1101-00-0048 PAGE 1	REV
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DATE: 08/20/88 BY: JAMES W. HARRIS

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-WFGR-PART-NO	WFGR	WAVTEK NO.	QTY/PT
NONE	STD ANDB	RB-07-1-50-H	HOGAN	2400-01-0000	4
NONE	COAX ANDB SET	RB-07-1-50+0-H-0	HOGAN	2400-01-0000	1
NONE	LAMP	CW7-7076	CHML	2400-02-0011	1
NONE	FUSE, 125V, 1/8A, 50	313,250	LITFU	2400-05-0000	1
NONE	FUSE HOLD	345001	LITFU	2400-05-0012	1
NONE	BUSHING NYLINER	4L2FF	TUHQ	2400-01-0002	3
NONE	STANDOFF	1403-003-705-000	UNICP	2400-02-0000	4
NONE	RAIL ASSY W/FT	100-500	WVTK	2400-00-0010	1
NONE	SPEEDNUT, SELF RETAIN	C7090-632-0	TINW	2400-00-0003	6
NONE	FAST, CHASSIS	1501-C11	URCCO	2400-00-0022	2
NONE	HASHER, SHOULDER	2688	SMITH	2400-07-0000	10
NONE	STAIN WELIF BUSH	S46-1	HEYCO	2400-07-0003	1
NONE	WAFER	130-SN-1-3	WVTK	3100-02-0002	2
NONE	SWITCH ASSY SLIDE	04250-LF	SCCPT	3100-00-0002	1
NONE	SOLDER GUARD	04250-LF-36	SCCPT	3100-00-0001	1
NONE	PWM CORD	0-7700-000-07	PACRO	0001-00-0000	1

WAVETEK PARTS LIST	TITLE STD CHASSIS	ASSEMBLY NO. 1101-00-0048 PAGE 2	REV
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NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK <small>San Diego - California</small>
MATERIAL	PROFESSOR		
RELEASE APPROV			STD CHASSIS MODEL 180
FINISH WAVETEK PROCESS			TOLERANCE UNLESS OTHERWISE SPECIFIED: 3 DEC 1 0.010 ANGLES 11° 25 1/32
DO NOT SCALE DWG			MODEL NO. 180
SCALE			DWG NO. 1101-00-0048
CODE 23338			REV OP

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REFERENCE DESIGNATORS	PART DESCRIPTION	UNIC-#FGH-PART-NO	PLG#	WAVETEK NO.	QTY/PI
NONE	DIAL ASSY	1201-00-0027	NYTK	201-00-0027	1
NONE	TRANSFORMER	130-500	NYTK	204-00-0003	1
NONE	SPACEH	0460	NYTK	400-00-0053	2
NONE	PLATE, NAME	150-305	NYTK	400-00-2100	1
NONE	INDICATOR, DIAL	100-305	NYTK	400-00-4970	1
NONE	COVER, TOP	100-300-1	NYTK	400-00-5000	1
NONE	POST	100-302	NYTK	400-00-5020	4
NONE	COVER, BOTTOM	100-300-2	NYTK	400-00-5050	1
NONE	PANEL, FRONT FH0M1800-00-5042	100-505-2	NYTK	400-00-5009	1
NONE	PANEL, REAR	100-506	NYTK	400-00-5073	1
NONE	BLUCK, MTG	100-509	NYTK	400-00-5065	2
NONE	TAG, SERIAL	100-510	NYTK	400-00-5390	1
NONE	CORU MULDEN	1400-00-5409	NYTK	400-00-5409	1
J2 J3 J4 J5 J6 J7	5MC CUNN	KE-7940	AING	2100-01-0002	4
NONE	TELK, LOCK LUG	1414-4	SMITH	2100-04-0000	2
NONE	SOLDER LUG	1497	SMITH	2100-04-0012	4
NONE	STD KNUB	RB-07-1-50-H	HUGAN	2400-01-0000	4

ASSEMBLY NO.
1101-00-0050
PAGE: 1

REFERENCE DESIGNATORS	PART DESCRIPTION	UNIC-#FGH-PART-NO	PLG#	WAVETEK NO.	QTY/PI
NONE	COAX KNOB SET	RB-07-1-50-H-V	ROGAN	2400-01-0009	1
NONE	LAMP	LM7-7070	CHNIN	2400-02-0013	1
NONE	FUSE, 125V, 1/4A, 50	313-250	LIFU	2400-05-0000	1
NONE	FUSE HOLD	345001	LIFU	2400-05-0012	1
NONE	BUSHING NYLON	4L2FF	THUMH	2400-01-0002	5
NONE	STANDOFF	1443-003-F05-440	UNICP	2400-02-0009	4
NONE	BAIL ASSY 4/FF	100-500	NYTK	2400-04-0010	1
NONE	SPEEDNUT, SELF HELD	C/494-032-H	IINN	2400-09-0003	4
NONE	FAST, CHASSIS	1591-C11	USLCO	2400-09-0024	2
NONE	WASHER, SHOULDER	2600	SMITH	2400-27-0004	12
NONE	STRAIN RELIEF BUSH	3060-1	MEYCO	2400-37-0003	1
NONE	WAFER	130-501-3	NYTK	2400-02-0007	2
NONE	SWITCH ASSY SLIDE	40250-LF	SCHFT	2400-00-0002	1
NONE	SOLDER GUARD	40250-LF-SG	SCHFT	2400-00-0001	1
NONE	PWR CORD	0-7789-000-6Y	PACWD	2401-00-0004	1

ASSEMBLY NO.
1101-00-0050
PAGE: 2

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA
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			REV 1101-00-0050
			COOR 23338
			SHEET OF

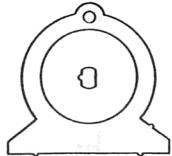
NOTE: UNLESS OTHERWISE SPECIFIED

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D
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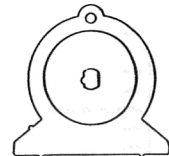
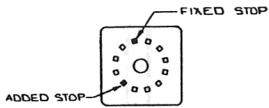
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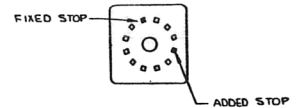
SW 1

DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION.

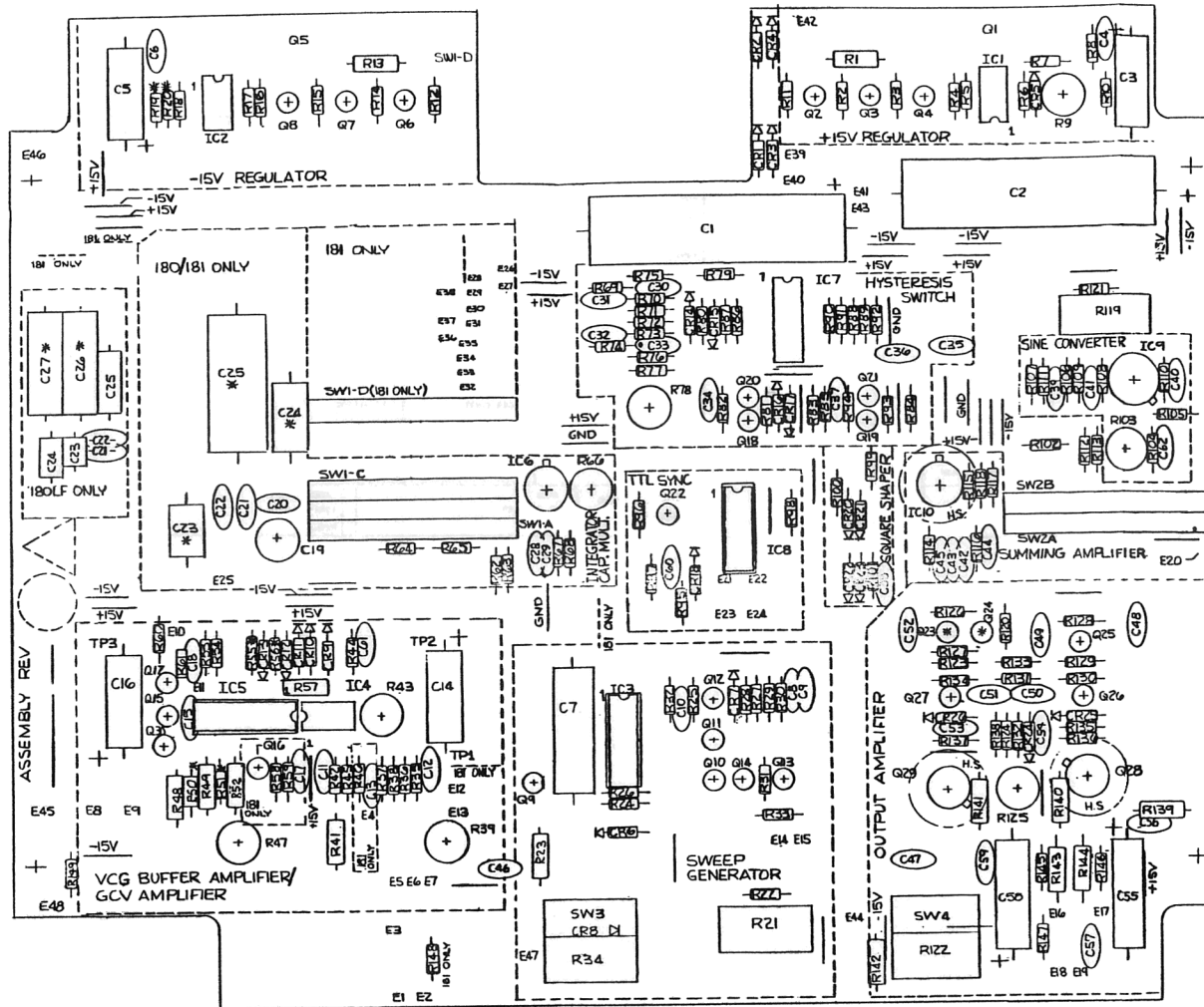


SW 2

DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION.



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



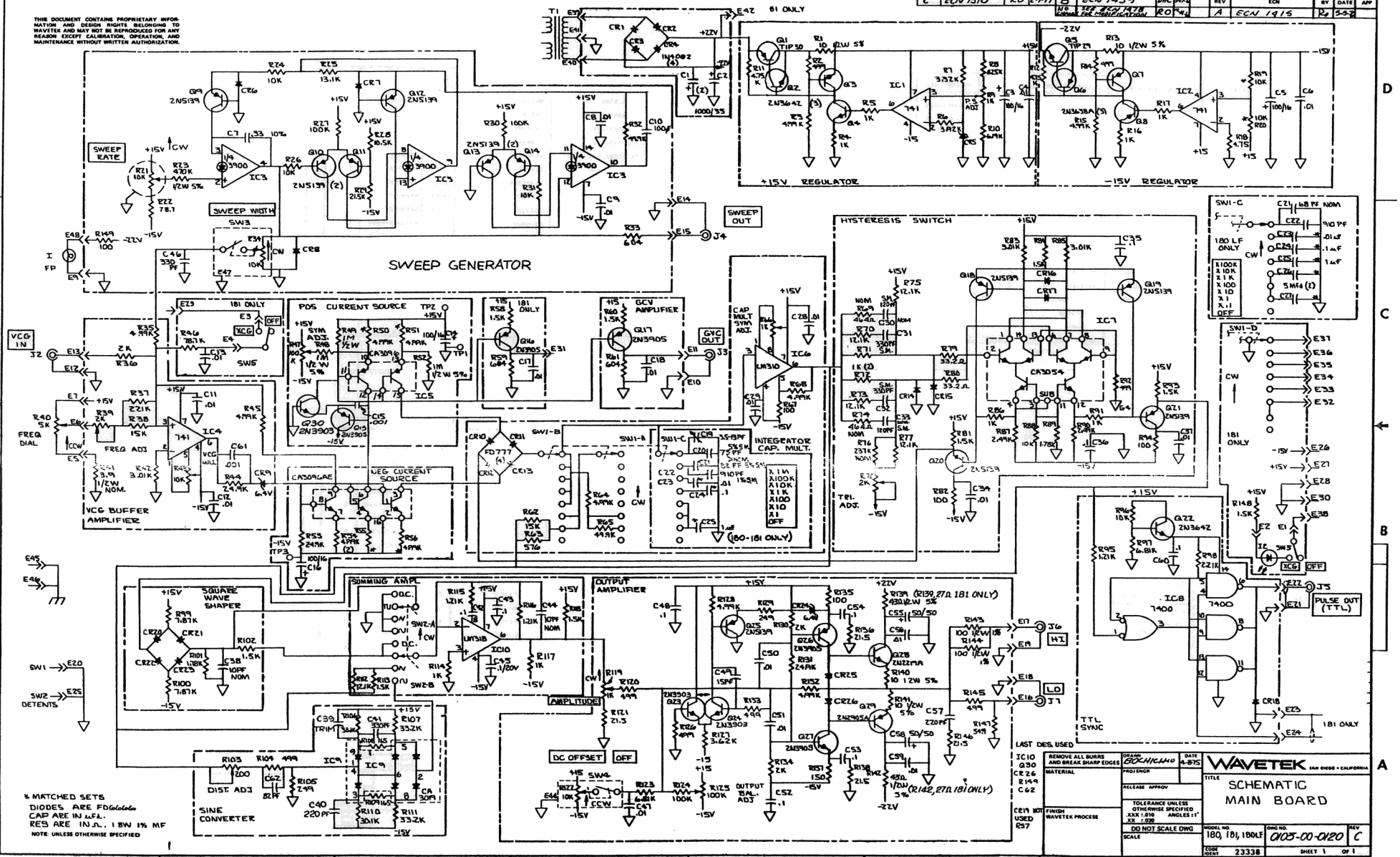
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ECN 1915	ECO 10-14-76
ECN 1915	ECO 5-2-76

DRAWN	BR	DATE	5-4-76
PROFNGR	T.D.		
RELEASE	APPROV		
TOLERANCE	UNLESS		
OTHER	NOTED		
300 ± 0.00	ANGLE		
30 ± 0.00			

WAVETEK	
SILKSCREEN ASSEMBLY PRINT MAIN BOARD	
DO NOT SCALE DIMS	SCALE 2/1
MODEL NO. 180 181 180LF	DWG NO. 001-00-0120
ISS 23338	REV B
SHEET 1 OF 1	

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C	ECN 1510	RD 2771	B	ECN 1439	DHC 524	REV	ECN	BY	DATE	APP
				WOM THE ASSOCIATED	RO 74	A	ECN 1415	PL	5-82	



4. MATCHED SETS
 DIODES ARE FD150
 CAP ARE IN U.F.L.
 RES ARE IN Ω, 1 BW 1/2 MF
 NOTE UNLESS OTHERWISE SPECIFIED

IC10 Q30 CR24 R149 C62	REMOVE ALL BURRS AND BREAK SHARP EDGES MATERIAL	DATE 05/14/80 BY JH/MSO	WAVETEK SAN DIEGO • CALIFORNIA SCHMATIC MAIN BOARD
IC11 Q17 Q27 Q28 Q29 Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q41 Q42 Q43 Q44 Q45 Q46 Q47 Q48 Q49 Q50 Q51 Q52 Q53 Q54 Q55 Q56 Q57 Q58 Q59 Q60 Q61 Q62 Q63 Q64 Q65 Q66 Q67 Q68 Q69 Q70 Q71 Q72 Q73 Q74 Q75 Q76 Q77 Q78 Q79 Q80 Q81 Q82 Q83 Q84 Q85 Q86 Q87 Q88 Q89 Q90 Q91 Q92 Q93 Q94 Q95 Q96 Q97 Q98 Q99 Q100	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX: 010 ANGLES 1:1 XX: 1:20 DO NOT SCALE DIMS SCALE		
IC11 NOT USED Q57	FINISH WAVEK PROCESS	MODEL NO 180, 181, 180LF PART NO 003-00-0120 REV C DATE 23338 SHEET 1 OF 1	

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REFERENCE DESIGNATORS	PART DESCRIPTION	OHIG-MGR-PART-NO	MGR	WAVETEK NO.	QTY/PT
NONE	ASSY, DRNG MAIN	0101-00-0120	WVTK	0101-00-0120	1
NONE	SCHEMATIC MAIN	0103-00-0120	WVTK	0103-00-0120	1
NONE	DA PROC. MAIN	0107-00-0120	WVTK	0107-00-0120	1
C38 C44	CAP, CER., 10PF., 1KV	DD-100	CHL	1500-01-0011	2
C10	CAP, CER., 100PF., 1KV	DD-101	CHL	1500-01-0111	1
C15 C01	CAP, CER., .001MF., 1KV	DD-102	CHL	1500-01-0211	2
C11 C12 C18 C28 C29 C34 C37 C4 C8 C7 C50 C51 C56 C59 C6 C68 C8 C9	CAP, CER., .01MF., 50V	CK-103	CML	1500-01-0310	17
C35 C36 C42 C43 C45 C48 C52 C53 C54	CAP, CER., .1MF., 20V	UA20-104	AMCO	1500-01-0413	9
C49	CAP, CER., 15PF., 1KV	DD-150	CHL	1500-01-0511	1
C40 C57	CAP, CER., 220PF., 1KV	DD-221	CHL	1500-02-2111	2
C41 C46	CAP, CER., 550PF., 1KV	DD-551	CHL	1500-03-3111	2
C62	CAP, CER., 82PF., 1KV	DD-820	CHL	1500-08-2011	1
C30 C33T	CAP, MICA, 120PF., 500V	DM15-121J	AMCO	1500-11-2100	2
C31 C32	CAP, MICA, 550PF., 500V	DM15-551J	AMCO	1500-13-5100	2
C20T	CAP, MICA, 75PF., 500V	DM15-750J	AMCO	1500-17-5000	1
C21T	CAP, MICA, 82PF., 500V	DM15-820J	AMCO	1500-18-2000	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0120	REV E		
		PAGE: 1			

REFERENCE DESIGNATORS	PART DESCRIPTION	OHIG-MGR-PART-NO	MGR	WAVETEK NO.	QTY/PT
131	HEAT SINK	HW-207	WAVE	2000-11-0001	3
136	TRANSIPAD	10100	MLHS	2000-11-0004	2
R19	POT, CONT, 1K	100-401	AVTK	4000-01-0207	1
R66 R9	POT, TRIM, 1K	914K1K	PLCA	4000-01-0209	2
R21	POT, CONT, 10K	JK-1303	CTS	4000-01-0302	1
R63	POT, TRIM, 10K	914H10K	HECK	4000-01-0315	1
R125 R67	POT, TRIM, 100K	914H100K	HECK	4000-01-0402	2
R108	POT, TRIM, 200	914R200	HFCR	4000-02-0101	1
R39 R78	POT, TRIM, 2K	914K2K	HECK	4000-02-0201	2
R128 R38	POT, SWTCH, 10K	GH-1879	CIS	4002-01-0300	2
R1 R13 R140 R141	RES, C, 1/2W, 5% 10	HC20GF-100	STKPL	4700-25-0100	4
R41T	RES, C, 1/2W, 5% 3.9	HC20GF-3M9	STKPL	4700-25-0599	1
R139 R142	RES, C, 1/2W, 5% 43	HC20GF-430	STKPL	4700-25-0430	2
R46-R49 R52	RES, C, 1/2W, 5% 1M	HC20GF-105	STKPL	4700-25-1004	3
R149	RES, C, 1/2W, 5% 220	RC20GF-221	STKPL	4700-25-2200	1
R23	RES, C, 1/2W, 10%, 470K	RC20GF-474	STKPL	4700-25-4703	1
R136 R67 R82 R94	RES, HF, 1/8W, 1%, 100	HW550-1000F	THA	4701-03-1000	4
R138 R17 R16 R17 R4	RES, HF, 1/8W, 1%, 1K	RN550-1001F	THA	4701-03-1001	10
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0120	REV E		
		PAGE: 3			

REFERENCE DESIGNATORS	PART DESCRIPTION	OHIG-MGR-PART-NO	MGR	WAVETEK NO.	QTY/PT
C22	CAP, MICA, 910PF., 500V	DM15-911F	AMCO	1500-19-1101	1
C14 C16 C5 C5	CAP, ELECT, 100PF., 10V	5000D1700100C7	SPHAG	1500-31-0101	4
C1 C2	CAP, ELECT, 1000PF., 35V	500100G035GL0	SPHAG	1500-31-0212	2
C55 C58	CAP, ELECT, 50MF., 50V	500D506050007	SPHAG	1500-35-0003	2
C7	CAP, MYLAR, .33MF., 100V	WMP1P33	CDE	1500-43-3404	1
C19	VARI, 3.5-13PF., 250V	75-TK1A0-02 3.5/13PF	TRIKO	1500-51-3000	1
C23	CAP, POLY, .01MF., 100V PART OF 1509-00-0008 QTY1011	180-501-101	WVTK	1509-00-0008	1
C24	CAP, POLY, .1MF., 100V PART OF 1509-00-0008 QTY1011				
C25	CAP, POLY, .1MF., 100V PART OF 1509-00-0008 QTY1011				
2	MAIN	100-110	WVTK	1700-00-0120	1
132	SKT, IC, 14PIN	14-DIP	CINCH	2100-03-0011	2
NONE	SKT, IC, 14PIN	16-DIP	CINCH	2100-03-0022	1
138	SOLDER LUG	1457	SMITH	2100-04-0012	2
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0120	REV E		
		PAGE: 2			

REFERENCE DESIGNATORS	PART DESCRIPTION	OHIG-MGR-PART-NO	MGR	WAVETEK NO.	QTY/PT
R24 R26 R31 R88 R96	RES, HF, 1/8W, 1%, 10K	RN550-1002F	THA	4701-03-1002	5
R124 R27 R30	RES, HF, 1/8W, 1%, 100K	RN550-1003F	THA	4701-03-1003	3
R20	RES, HF, 1/8W, 1%, 10.5K	RN550-1052F	THA	4701-03-1052	1
R115 R116 R95	RES, HF, 1/8W, 1%, 1.21K	RN550-1211F	THA	4701-03-1211	3
R112 R70 R73 R75 R77	RES, HF, 1/8W, 1%, 12.1K	RN550-1212F	THA	4701-03-1212	5
R25	RES, HF, 1/8W, 1%, 13K	RN550-1302F	THA	4701-03-1302	1
R137	RES, HF, 1/8W, 1%, 150	RN550-1500F	THA	4701-03-1500	1
R102 R113 R110 R60 R81 R84 R93	RES, HF, 1/8W, 1%, 1.5K	RN550-1501F	THA	4701-03-1501	7
R38 R62	RES, HF, 1/8W, 1%, 15K	RN550-1502F	THA	4701-03-1502	2
R108 R109	RES, HF, 1/8W, 1%, 165	RN550-1650F	THA	4701-03-1650	2
R101 R89	RES, HF, 1/8W, 1%, 1.70K	RN550-1701F	THA	4701-03-1701	2
R130 R134 R36	RES, HF, 1/8W, 1%, 2K	RN550-2001F	THA	4701-03-2001	3
R29	RES, HF, 1/8W, 1%, 21.5K	RN550-2152F	THA	4701-03-2152	1
R121 R136 R130 R146	RES, HF, 1/8W, 1%, 21.5	RN550-2153F	THA	4701-03-2153	4
R98	RES, HF, 1/8W, 1%, 2.21K	RN550-2211F	THA	4701-03-2211	1
R37	RES, HF, 1/8W, 1%, 221K	RN550-2213F	THA	4701-03-2213	1
R76	RES, HF, 1/8W, 1%, 237K	RN550-2373F	THA	4701-03-2373	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0120	REV E		
		PAGE: 4			

REMOVE ALL BURRS AND BREAK SHARP EDGES	DATE	WAVETEK SAN DIEGO - CALIFORNIA
DRIVER	PROJENGR	
MATERIAL	RELEASE APPROV	TITLE MAIN BD
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED: DIM. ±.030 ANGLES 1:1 DIM. ±.030	MODEL NO. 180
	DO NOT SCALE DIMS	OHG NO. 1100-00-0120
	SCALE	REV E
	CODE POINT 23338	SHEET 1 OF 2

NOTE: UNLESS OTHERWISE SPECIFIED

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-HFGR-PART-NO	HFGR	WAVETEK NO.	QTY/PKT
R105 R129	RES, HF, 1/8W, 1%, 249	RN550-2490F	TRN	4701-03-2490	2
R07 R90	RES, HF, 1/8W, 1%, 2, 49K	RN550-2491F	TRN	4701-03-2491	2
R131 R44 R53	RES, HF, 1/8W, 1%, 24, 9K	RN550-2492F	TRN	4701-03-2492	3
R42 R03 R85	RES, HF, 1/8W, 1%, 3, 01K	RN550-3011F	TRN	4701-03-3011	3
R106 R110	RES, HF, 1/8W, 1%, 30, 1K	RN550-3012F	TRN	4701-03-3012	2
R7	RES, HF, 1/8W, 1%, 3, 32K	RN550-3321F	TRP	4701-03-3321	1
R107 R111	RES, HF, 1/8W, 1%, 33, 2K	RN550-3322F	TRN	4701-03-3322	2
R79 R80	RES, HF, 1/8W, 1%, 33, 2	RN550-3322F	TRN	4701-03-3322	2
R127	RES, HF, 1/8W, 1%, 3, 45K	RN550-3651F	TRN	4701-03-3651	1
R6	RES, HF, 1/8W, 1%, 3, 92K	RN550-3921F	TRN	4701-03-3921	1
R69T R74T	RES, HF, 1/8W, 1%, 4, 46K	RN550-4640F	TRN	4701-03-4640	2
R11 R12 R18	RES, HF, 1/8W, 1%, 4, 75K	RN550-4751F	TRN	4701-03-4751	3
R108 R120 R126 R133 R16 R145 R2 R92	RES, HF, 1/8W, 1%, 4, 99K	RN550-4990F	TRN	4701-03-4990	0
R128 R132 R15 R3 R35 R45 R54 R64 R68	RES, HF, 1/8W, 1%, 4, 99K	RN550-4991F	TRN	4701-03-4991	9
R32 R65	RES, HF, 1/8W, 1%, 4, 9, 9K	RN550-4992F	TRN	4701-03-4992	2
R147	RES, HF, 1/8W, 1%, 5, 4, 9	RN550-5490F	TRN	4701-03-5490	1
R65	RES, HF, 1/8W, 1%, 5, 76K	RN550-5760F	TRN	4701-03-5760	1

ASSEMBLY NO. 1100-00-0120
PAGE 5

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-HFGR-PART-NO	HFGR	WAVETEK NO.	QTY/PKT
Q6 Q7 Q8	TRANS	2N3638A	FAIR	4901-03-5361	3
Q2 Q22 Q3 Q4	TRANS	2N3642	FAIR	4901-03-6420	4
Q27 Q30	TRANS	2N3943	FAIR	4901-03-9030	2
Q15 Q17 Q24	TRANS	2N3905	FAIR	4901-03-9050	3
Q10 Q11 Q12 Q13 Q14 Q16 Q17 Q20 Q21 Q23 Q9	TRANS	2N5139	FAIR	4901-05-1390	11
Q5	TRANS	TIP-29	TI	4902-00-0290	1
Q1	TRANS	TIP-30	TI	4902-00-0300	1
Q23 Q24	TRANS, H/PR/2N3903 QTY: 214901-03-9030	182-505-102	HVTK	4998-00-0015	1
NONE	WAFER	147-000	HVTK	5104-02-0015	5
NONE	DETENT MOD FROM: 5104-01-0009	100-313	HVTK	5104-09-0026	1
NONE	DETENT MOD FROM: 5104-01-0009	100-314	HVTK	5104-09-0025	1
IC6	IC	9C-310T	SILGN	7000-03-1000	1
IC10	IC	LMS16H	NSC	7000-03-1000	1
IC1 IC2 IC4	IC	HA-741	FAIR	7000-07-4100	3
IC9	IC	CA-3019	RCA	7000-30-1900	1

ASSEMBLY NO. 1100-00-0120
PAGE 7

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-HFGR-PART-NO	HFGR	WAVETEK NO.	QTY/PKT
R33 R61	RES, HF, 1/8W, 1%, 600	RN550-6040F	TRN	4701-03-6040	2
R10	RES, HF, 1/8W, 1%, 6, 19K	RN550-6191F	TRN	4701-03-6191	1
R123 R97	RES, HF, 1/8W, 1%, 6, 81K	RN550-6711F	TRN	4701-03-6711	2
R100 R99	RES, HF, 1/8W, 1%, 7, 03K	RN550-7031F	TRN	4701-03-7031	2
R22	RES, HF, 1/8W, 1%, 7, 0, 7	RN550-7077F	TRN	4701-03-7079	1
R8	RES, HF, 1/8W, 1%, 8, 25K	RN550-8251F	TRN	4701-03-8251	1
R143 R144	RES, HF, 1/2W, 1%, 100	RN650-1000F	TRN	4701-23-1000	2
R19 R20	RES, BET, 2-10K, 1/8W QTY: 214701-03-1002	142-501-68A	HVTK	4789-00-0019	1
R50 R51 R55 R56	RES, BET, 6-4, 99K, 1/8W QTY: 414701-03-4991	100-500-100A	HVTK	4789-00-0039	1
CR24 CR5 CR9	DIODE	1N4581	MICRO	4001-01-4581	3
CR1 CR2 CR3 CR4	DIODE	BCE-1	SEHTC	4001-02-0001	4
CR10 CR11 CR12 CR13	DIODE	FD-777	FAIR	4007-02-0777	4
CR14 CR15 CR16 CR17 CR18 CR20 CR21 CR22 CR23 CR25 CR26 CR4 CR7 CR8	DIODE	FD-6666	FAIR	4007-02-6666	14
Q26	TRANS	2N2219A	FAIR	4901-02-2191	1
Q29	TRANS	2N2954A	FAIR	4901-02-9051	1

ASSEMBLY NO. 1100-00-0120
PAGE 6

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-HFGR-PART-NO	HFGR	WAVETEK NO.	QTY/PKT
IC7	IC	CA-3054	RCA	7000-30-5400	1
IC5	IC	CA-3066AE	RCA	7000-30-6600	1
IC3	IC	L-3900	NSC	7000-34-0000	1
IC6	IC	7400	TI	8000-74-0000	1

ASSEMBLY NO. 1100-00-0120
PAGE 8

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DATE	WAVETEK SAN DIEGO - CALIFORNIA
MATERIAL	TITLE	
PROVENANCE	RELEASE APPROV	MAIN 6D
TOLERANCE UNLESS OTHERWISE SPECIFIED: X.XX 1/16 X.X 1/32 X 1/64	DO NOT SCALE DWG	
MODEL NO.	DWG NO.	
SCALE	REV	
CODE	23338	SHEET 2 OF 2

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFG-PART-NO	MFG	WAVETEK NO.	QTY/PT	
NONE	ASSY,DRNG MAIN	0101-00-0120	NVTK	0101-00-0120	1	
NONE	SCHEMATIC MAIN	0103-00-0120	NVTK	0103-00-0120	1	
NONE	DA PROC MAIN	0107-00-0120	NVTK	0107-00-0120	1	
C38 C44	CAP,CER,10PF,1KV	DD-100	CHL	1500-01-0011	2	
C10	CAP,CER,100PF,1KV	DD-101	CHL	1500-01-0111	1	
C15 C61	CAP,CER,1001PF,1KV	DD-102	CHL	1500-01-0211	2	
C11 C12 C14 C26 C29 C38 C37 C4 C47 C50 C51 C56 C59 C6 C66 C8 C9	CAP,CER,101PF,50V	CR-103	CHL	1500-01-0510	17	
C35 C36 C42 C43 C45 C48 C52 C53 C54	CAP,CER,11PF,20V	UK20-104	ANCO	1500-01-0413	9	
C49	CAP,CER,15PF,1KV	DD-150	CHL	1500-01-5011	1	
C40 C57	CAP,CER,20PF,1KV	DD-221	CHL	1500-02-2111	2	
C41 C46	CAP,CER,33PF,1KV	DD-331	CHL	1500-03-3111	2	
C62	CAP,CER,80PF,1KV	DD-820	CHL	1500-08-2011	1	
C301 C331	CAP,MICA,120PF,500V	DM15-121J	ANCO	1500-11-2100	2	
C31 C32	CAP,MICA,330PF,500V	DM15-331J	ARCH	1500-13-3100	2	
C21	CAP,MICA,82PF,500V	DM15-R20J	ANCO	1500-18-2000	1	
C22	CAP,MICA,40PF,500V	DM15-R11J	ANCO	1500-19-1101	1	
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0121	REV F			
		PAGE: 1				

1117 301 11/10/88 09:00 11/10/88 09:00

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFG-PART-NO	MFG	WAVETEK NO.	QTY/PT
131	HEAT SINK	NF-207	HANE	2800-11-0001	3
130	TRANSIPAD	10100	HEPMS	2800-11-0004	2
R119	POT,CONT,1K	100-401	NVTK	4000-01-0207	1
R66 R9	POT,TRIM,1K	91AK1K	BLCK	4000-01-0209	2
R21	POT,CONT,10K	JK-1303	CTS	4000-01-0302	1
R45	POT,TRIM,10K	91AR10K	BLCK	4000-01-0315	1
R125 R67	POT,TRIM,100K	91AH100K	HFEK	4000-01-0402	2
R103	POT,TRIM,200	91AK200	RECK	4000-02-0101	1
R39 R78	POT,TRIM,2K	91AK2K	HELK	4000-02-0201	2
R122 R34	POT,SWITCH,10K	GH-1879	CTS	4002-01-0300	2
R1 R13 R140 R141	RES,C,1/2W,5%10	RC20GF-100	STKPL	4700-25-0100	4
R417	RES,C,1/2W,5%3,9	RC20GF-39K	STKPL	4700-25-0399	1
R139 R142	RES,C,1/2W,5%43	RC20GF-430	STKPL	4700-25-0430	2
R48 R49 R52	RES,C,1/2W,5%1M	RC20GF-105	STKPL	4700-25-1004	3
R149	RES,C,1/2W,5%220	RC20GF-221	STKPL	4700-25-2200	1
R23	RES,C,1/2W,10%470K	RC20GF-47K	STKPL	4700-25-4703	1
R135 R67 R82 R94	RES,MF,1/8W,1%1,100	RN55D-1000F	TW	4701-03-1000	4
R110 R117 R16 R17 R4	RES,MF,1/8W,1%1,10	RN55D-1001F	TW	4701-03-1001	10
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0121	REV F		
		PAGE: 3			

1117 301 11/10/88 09:00 11/10/88 09:00

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFG-PART-NO	MFG	WAVETEK NO.	QTY/PT
C14 C16 C3 C5	CAP,ELECT,100MF,16V	500D107G01ADC7	SPHAG	1500-31-0101	4
C1 C2	CAP,ELECT,1000PF,35V	340108G035GL6	SPHAG	1500-31-0212	2
C15 C31	CAP,ELECT,100PF,50V	50H50G60500D7	SPHAG	1500-35-0003	2
C7	CAP,MYLN,15PF,100V	ANF1P33	COE	1500-43-3404	1
	CAP,BET,POLYC LUMBI8T1150V-90-0001 THRU1000	130-501-6	NVTK	1500-80-0005	1
C23	CAP,POLYC,10MF,100V PART OF 150V-80-0005 QTY1001				
C24	CAP,POLYC,1MF,100V PART OF 150V-80-0005 QTY1001				
C25	CAP,POLYC,1MF,100V PART OF 150V-80-0005 QTY1001				
C26 C27	CAP,POLYC,5MF,100V PART OF 150V-80-0005 QTY1021				
2	MAIN	100-110	NVTK	1700-00-0120	1
142	SKT,IC,14PIN	14-D1P	CINCH	2100-03-0011	2
NONE	SKT,IC,16PIN	16-D1P	CINCH	2100-03-0022	1
138	SOLDER LUG	1497	SMITH	2100-04-0012	2
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0121	REV F		
		PAGE: 2			

1117 301 11/10/88 09:00 11/10/88 09:00

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFG-PART-NO	MFG	WAVETEK NO.	QTY/PT
R24 R26 R31 R68 R96	RES,MF,1/8W,1%10K	RN55D-1002F	TW	4701-03-1002	5
R124 R27 R30	RES,MF,1/8W,1%100K	RN55D-1003F	TW	4701-03-1003	3
R25	RES,MF,1/8W,1%10.5K	RN55D-1002F	TW	4701-03-1052	1
R115 R116 R95	RES,MF,1/8W,1%1.21K	RN55D-1211F	TW	4701-03-1211	3
R112 R76 R73 R75 R77	RES,MF,1/8W,1%12.1K	RN55D-1212F	TW	4701-03-1212	6
R25	RES,MF,1/8W,1%13K	RN55D-1302F	TW	4701-03-1302	1
R137	RES,MF,1/8W,1%150	RN55D-1500F	TW	4701-03-1500	1
R102 R113 R118 R60 R61 R84 R93	RES,MF,1/8W,1%1.5K	RN55D-1501F	TW	4701-03-1501	7
R38 R62	RES,MF,1/8W,1%15K	RN55D-1502F	TW	4701-03-1502	2
R108 R109	RES,MF,1/8W,1%165	RN55D-1650F	TW	4701-03-1650	2
R101 R89	RES,MF,1/8W,1%1.78K	RN55D-1781F	TW	4701-03-1781	2
R130 R134 R36	RES,MF,1/8W,1%18.2K	RN55D-2001F	TW	4701-03-2001	3
R29	RES,MF,1/8W,1%21.5K	RN55D-2152F	TW	4701-03-2152	1
R121 R136 R138 R146	RES,MF,1/8W,1%21.5	RN55D-21H5F	TW	4701-03-2159	4
R48	RES,MF,1/8W,1%2.21K	RN55D-2211F	TW	4701-03-2211	1
R37	RES,MF,1/8W,1%221K	RN55D-2213F	TW	4701-03-2213	1
R76	RES,MF,1/8W,1%237K	RN55D-2373F	TW	4701-03-2373	1
WAVETEK PARTS LIST	TITLE MAIN	ASSEMBLY NO. 1100-00-0121	REV F		
		PAGE: 4			

1117 301 11/10/88 09:00 11/10/88 09:00

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO - CALIFORNIA
MATERIAL	FIGURING		
FINISH	RELEASE APPROV	TITLE	MAIN BD
WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED HOLE .010 ANGLES 1:1 25 .125 DO NOT SCALE DIMS	MODEL NO.	
	SCALE	180LF	DWG NO. 1100-00-0121
			REV F
		23338	CODE SHEET 1 OF 2

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFR-PART-NO	MFR	WAVETEK NO.	QTY/PT
R105 R129	RES,MF,1/8W,13.249	RN550-2490F	TRN	4701-03-2490	2
R07 R90	RES,MF,1/8W,13.2,49K	RN550-2491F	TRN	4701-03-2491	2
R131 R44 R53	RES,MF,1/8W,13.24,4R	RN550-2492F	TRN	4701-03-2492	3
R42 R03 R05	RES,MF,1/8W,13.3,01K	RN550-3011F	TRN	4701-03-3011	3
R106 R110	RES,MF,1/8W,13.30,1K	RN550-3012F	TRN	4701-03-3012	2
R7	RES,MF,1/8W,13.3,32K	RN550-3321F	TRN	4701-03-3321	1
R107 R111	RES,MF,1/8W,13.33,2K	RN550-3322F	TRN	4701-03-3322	2
R79 R80	RES,MF,1/8W,13.33,2K	RN550-3322F	TRN	4701-03-3322	2
R127	RES,MF,1/8W,13.3,05K	RN550-3651F	TRN	4701-03-3651	1
R6	RES,MF,1/8W,13.3,92K	RN550-3921F	TRN	4701-03-3921	1
R09T R74T	RES,MF,1/8W,13.464	RN550-4640F	TRN	4701-03-4640	2
R11 R12 R10	RES,MF,1/8W,13.4,75K	RN550-4751F	TRN	4701-03-4751	3
R104 R120 R126 R133 R14 R145 R2 R92	RES,MF,1/8,13,499	RN550-4990F	TRN	4701-03-4990	8
R120 R132 R15 R3 R35 R45 R54 R04 R08	RES,MF,1/8W,13.4,99K	RN550-4991F	TRN	4701-03-4991	9
R32 R65	RES,MF,1/8W,13.45,9K	RN550-4992F	TRN	4701-03-4992	2
R147	RES,MF,1/8W,13.54,9	RN550-5490F	TRN	4701-03-5490	1
R63	RES,MF,1/8W,13.576	RN550-5760F	TRN	4701-03-5760	1

WAVETEK PARTS LIST
TITLE MAIN
ASSEMBLY NO. 1100-00-0121
PAGE 5
REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFR-PART-NO	MFR	WAVETEK NO.	QTY/PT
06 07 08	TRANS	2H3438A	FAIR	4901-03-4381	3
02 022 03 04	TRANS	2H3442	FAIR	4901-03-4420	4
027 030	TRANS	2H3903	FAIR	4901-03-9030	2
015 017 026	TRANS	2H3905	FAIR	4901-03-9050	3
010 011 012 013 014 018 019 029 021 025 09	TRANS	2H5139	FAIR	4901-05-1390	11
05	TRANS	TIP-29	TI	4902-06-0290	1
01	TRANS	TIP-30	TI	4902-00-0300	1
023 024	TRANS,M/PR/2H3903 QTY22H4901-03-9030	102-503-102	HVTK	4990-00-0015	1
135	WAFER	147-400	HVTK	5104-02-0015	5
NONE	DETENT HOD FROM:5104-01-0009	100-313	HVTK	5104-99-0024	1
NONE	DETENT HOD FROM:5104-01-0009	100-314	HVTK	5104-99-0025	1
IC4	IC	8G-310T	SILGN	7000-03-1000	1
IC10	IC	LP510H	HSC	7000-03-1000	1
IC1 IC2 IC4	IC	MA-741	FAIR	7000-07-1100	3
IC9	IC	CA-3019	HCA	7000-30-1900	1

WAVETEK PARTS LIST
TITLE MAIN
ASSEMBLY NO. 1100-00-0121
PAGE 7
REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFR-PART-NO	MFR	WAVETEK NO.	QTY/PT
R33 R61	RES,MF,1/8W,13.600	RN550-6040F	TRN	4701-03-6040	2
R10	RES,MF,1/8W,13.6,19K	RN550-6191F	TRN	4701-03-6191	1
R123 R97	RES,MF,1/8W,13.6,01K	RN550-6811F	TRN	4701-03-6811	2
R100 R99	RES,MF,1/8W,13.7,07K	RN550-7071F	TRN	4701-03-7071	2
R22	RES,MF,1/8W,13.70,7	RN550-7077F	TRN	4701-03-7077	1
R0	RES,MF,1/8W,13.6,25K	RN550-8251F	TRN	4701-03-8251	1
R103 R144	RES,MF,1/2W,13,100	RN650-1000F	TRN	4701-23-1000	2
R19 R20	RES,SEI,2-10K,1/8W QTY12H4701-03-1002	142-501-6AA	HVTK	4709-00-0019	1
R50 R51 R55 R56	RES,SEI,4-4,99K,1/8W QTY14H4701-03-4991	100-500-100A	HVTK	4709-00-0039	1
CR24 CR5 CR9	DIODE	1N4501	MICRO	4001-01-4501	3
CR1 CR2 CR3 CR4	DIODE	3EHTC	3EHTC	4001-02-0001	4
CR10 CR11 CR12 CR13	DIODE	FD-777	FAIR	4007-02-0777	4
CR14 CR15 CR16 CR17 CR18 CR20 CR21 CR22 CR23 CR25 CR26 CR4 CR7 CR8	DIODE	FD-4466	FAIR	4007-02-4466	14
Q20	TRANS	2H2219A	FAIR	4901-02-2191	1
Q29	TRANS	2H2955A	FAIR	4901-02-9051	1

WAVETEK PARTS LIST
TITLE MAIN
ASSEMBLY NO. 1100-00-0121
PAGE 6
REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFR-PART-NO	MFR	WAVETEK NO.	QTY/PT
IC7	IC	CA-3054	HCA	7000-30-5400	1
IC5	IC	CA-3096AE	HCA	7000-30-9600	1
IC3	IC	LN3900	HSC	7000-30-0000	1
IC8	IC	7400	TI	9000-74-0000	1

WAVETEK PARTS LIST
TITLE MAIN
ASSEMBLY NO. 1100-00-0121
PAGE 8
REV F

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	DATE	
MATERIAL	PROJ ENGR	
FINISH WAVETEK PROCESS	RELEASE APPROV	TITLE
	SCALE	TOLERANCE UNLESS OTHERWISE SPECIFIED: .005 - .030 ANGLES: 1:1 XX - 1:30
DO NOT SCALE DWG		MODEL NO.
SCALE		DWG NO.
CODE		REV
DATE		SHEET 2 OF 2

180LF 1100-00-0121 F
23338

MAIN BD