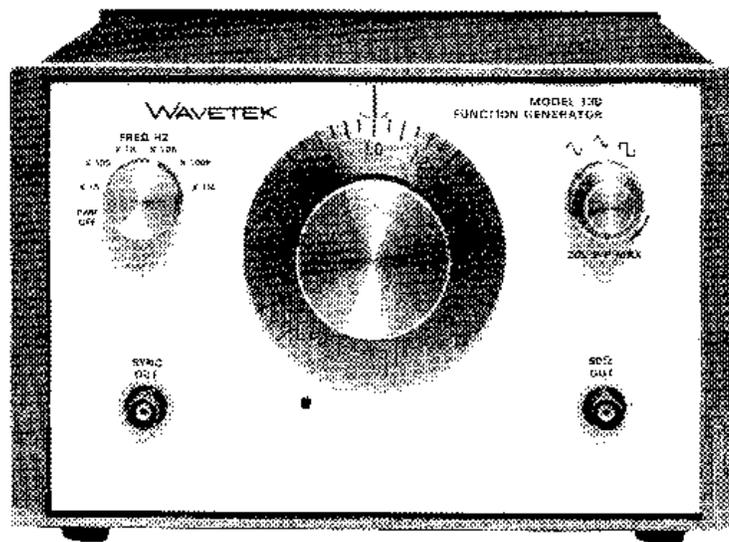


INSTRUCTION MANUAL

MODEL 130 FUNCTION GENERATOR



WAVETEK

Product Improvement Notice

Wavetek maintains a continuing program to make improvements to their instruments that will take advantage of the latest electronic developments in circuitry and components.

Due to the time required to document and print instruction manuals, it is not always possible to incorporate these changes in the manual.

Wavetek has manufactured your instrument, using metal film 1% tolerance resistors in place of 5% carbon resistors, wherever practical. This results in a substantial improvement in the overall performance of your instrument. Therefore, there may exist a discrepancy between the resistor used to manufacture your instrument and the resistor called out in the Parts List and Schematic Diagrams in this manual.

If field replacement of an affected resistor does become necessary, replacement may be made in accordance with the manual call outs. Wavetek, however, recommends replacement with the same type of resistor used in the manufacture of your instrument, whenever possible.

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.

This warranty does not apply to any products repaired or altered by persons not authorized by Wavetek, or not in accordance with instructions furnished by Wavetek. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

Wavetek assumes no responsibility for its product being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. High voltage used in some instruments may be dangerous if misused. Special disclaimers apply to these instruments. Wavetek assumes no liability for secondary charges or consequential damages and, in any event, Wavetek's liability for breach of warranty under any contract or otherwise, shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.

Any recommendations made by Wavetek for use of its products are based upon tests believed to be reliable, but Wavetek makes no warranty of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Wavetek any liability in connection with the sale of our products other than set forth herein.

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SCOPE OF MANUAL

This manual contains instructions for operating, testing, and maintaining the Wavetek Model 130 Function Generator. The Wavetek product-improvement program ensures that the latest electronic developments are incorporated into the Wavetek instruments by the addition of circuit and component changes as rapidly as development and testing permit. Due to the time required to document and print these Instruction Manuals, it is not always possible to get

these changes incorporated into the manual. In this case, data will be found on engineering change sheets at the back of the manual.

SCOPE OF EQUIPMENT

The Model 130 is a precision source of sine, square, and triangle waveforms, with selectable and variable outputs over a dynamic frequency range of 0.2 Hz to 2 MHz.

SECTION 1

SPECIFICATIONS

SPECIFICATIONS

VERSATILITY

Waveforms

Sine , square , and triangle .

Dynamic Frequency Range

0.2 Hz to 2 MHz

Ranges

X10	0.2 Hz to 20 Hz
X100	2 Hz to 200 Hz
X1K	20 Hz to 2 kHz
X10K	200 Hz to 20 kHz
X100K	2 kHz to 200 kHz
X1M	20 kHz to 2 MHz

Outputs

Sine , square , and triangle , selectable; amplitude variable over 40 dB; 50Ω output impedance (600Ω available); 20 V p-p into open circuit and 10 V p-p into 50Ω load.

Sync Output

Greater than 1 V p-p square wave into open circuit at 600Ω output impedance.

DC Offset

±5 V offset (+2.5 V offset into 50Ω load) controlled from rear panel; peak amplitude limited by the dynamic range of the amplifier output.

Stability

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

HORIZONTAL PRECISION

Dial Accuracy

±2% of full scale, 1 Hz to 2 MHz.

Time Symmetry

±1% through X100K range.

VERTICAL PRECISION

Sine Wave Frequency Response

Amplitude change with frequency less than:

0.1 dB from 0.2 Hz to 200 kHz

0.5 dB from 0.2 Hz to 2 MHz

PURITY

Sine Wave Distortion

Less than:

0.5% on X10, X100, X1K, X10K ranges

1.0% on X100K range

2.0% on X1M range

Square Wave Rise and Fall Time

Less than 100 nsec.

ENVIRONMENTAL

Temperature

All specifications listed, except stability, are for 25°C ±5°C. For operation from 0°C to 55°C, derate all specifications by factor of 2.

MECHANICAL

Dimensions

8½ inches wide, 5¼ inches high, 11½ inches deep.

Weight

7 lb net, 10 lb shipping.

Power

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

NOTE

All specifications apply for frequencies obtained when dial is between 0.1 and 2 and at 10 V p-p into a 50Ω load.

SECTION 2 OPERATION

INSPECTION

The following procedures should be performed to assure the user that the instrument has arrived at its destination in proper operating condition. Complete calibration and checkout instructions are provided in Section 4 for determining if the instrument is within electrical specifications.

Checking Visually

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

Checking Electrically

NOTE

Instruments are normally shipped connected for 115 V power unless 230 V power is ordered. Refer to the end of this section for conversion instructions.

The procedural steps in this paragraph provide a quick checkout of instrument operation. If electrical deficiencies exist, refer to the *Warranty* in the front of this manual. The following test equipment, or equivalent, is recommended for performing this electrical inspection. (Refer to Operating Controls and Figure 2-1 for operating control descriptions.)

Name	Required Characteristics
Oscilloscope	30 MHz, or higher
Plug-in	Dual channel
Plug-in	Peak mV measuring capability
Counter-Timer	10 MHz (4 digits)

1. Turn **FREQ HZ** selector to the X1K position. (This connects ac power to the unit and establishes the frequency multiplier.)
2. Connect oscilloscope to the 50 Ω OUT connector with 50-ohm terminator.
3. Set frequency dial to the 1.0 mark.
4. Set function selector to .

5. Rotate 20 V P-P MAX control to its maximum clockwise position.
6. Check for 1-kHz sine wave with greater than 10 V p-p amplitude on oscilloscope.
7. Select  and  with function selector and check for 10 V p-p amplitude on oscilloscope.
8. Turn frequency dial from maximum counterclockwise to maximum clockwise positions and check for frequency change.
9. Rotate 20 V P-P MAX control from maximum clockwise to maximum counterclockwise positions and check for decreasing amplitude.

OPERATING CONTROLS

The operating controls and electrical connections for the Model 130 are shown in Figure 2-1. The listing below discusses each control and its function. The paragraph numbers correspond to the numbers in Figure 2-1.

1. **FREQ HZ/Power Switch** — This 7-position switch selects the generator frequency range. The extreme counter-clockwise position is the power off position.
2. **FREQUENCY DIAL** — The main frequency control. The setting on this dial multiplied by the frequency range setting (above) equals the output frequency of the generator.
3. **FREQUENCY INDEX** — The scribe line indicates the frequency dial setting. The index is illuminated when the unit is on.
4. **FUNCTION SELECTOR** — This selects the waveform that appears at the 50 Ω OUT connector. The waveforms are sine , triangle  and square .
5. **AMPLITUDE VERNIER** — A vernier control of the output amplitude. Maximum clockwise position gives the full output amplitude of 20 V peak-to-peak into an open circuit or 10 V p-p into a 50 Ω load. Counter-clockwise rotation will continuously reduce the output amplitude. The control gives a minimum of 40 dB variation

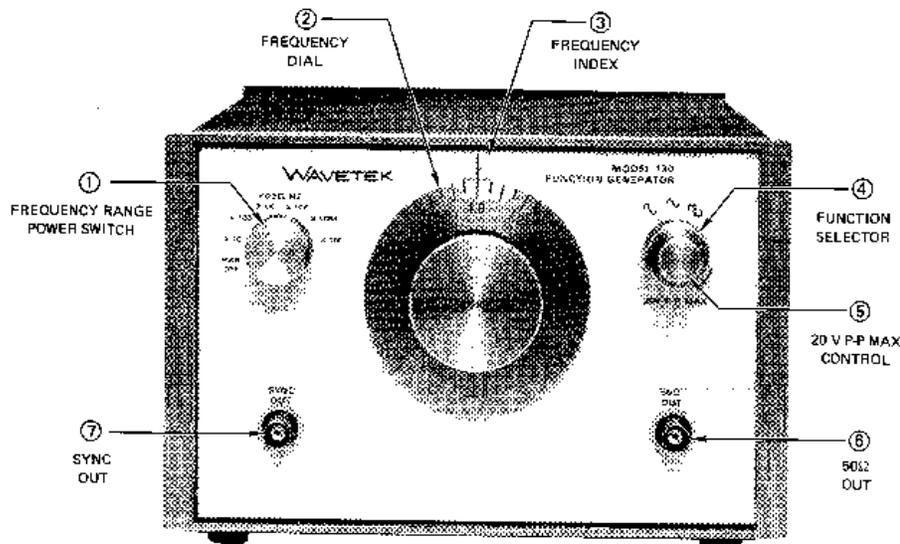


Figure 2-1. Operating Controls

(100:1). For maximum output amplitude this vernier must be full clockwise.

6. **50 Ω OUT** — This connector provides the selected generator output function. The generator may operate into an open circuit providing 20 V peak-to-peak maximum, or into a 50 Ω load providing a 10 V peak-to-peak output.
7. **SYNC OUT** — This rear panel output provides a synchronizing wave output at the same frequency of the main generator. The output amplitude is greater than 1 V p-p into open circuit at 600 Ω output impedance.

GENERAL NOTES

One-half hour warmup is required for generator to stabilize at specified accuracies.

A 50-ohm termination results in 10 V p-p maximum output level. Open circuit termination gives 20 V p-p. Loads between these limits provide intermediate maximum output levels.

OPERATION

The Model 130 provides a fixed-frequency output for the selected frequency, amplitude, and waveform. The output frequency is determined by the FREQ HZ range selector and frequency dial settings. Output

amplitude is controlled with the 20 V P-P MAX continuously-variable potentiometer, and the waveform is selected by the function selector. Operate as follows:

1. Properly terminate the 50 Ω OUT connector. A 50 Ω termination results in 10 V peak-to-peak maximum output level, and optimum waveform performance. Open circuit termination gives a maximum output of 20 V peak-to-peak. Loads between these limits provide intermediate output levels. When operating into other than a 50 Ω load, slight degradation of the output waveform may be noted particularly at higher frequencies.
2. Select the desired waveform (\sim , \square , \wedge) with the function selector switch.
3. Select the operating frequency by setting the frequency range selector to the proper multiplier and adjusting the frequency dial to the desired setting.
4. Adjust the output level voltage with the 20 V p-p max control.
5. If dc offset is required, switch the rear panel control from the detent position and rotate the control until the required amount of positive or negative offset is obtained. Note: The output of the generator is peak limited and it is possible to obtain distorted waveforms by an excessive amount of signal amplitude and dc offset. When terminated into 50 Ω the maximum output is 10 V peak-to-peak or ± 5 V about signal ground. When dc offset is used, the ± 5 V cannot be exceeded in either direction by the sum of dc offset and signal peak.

Converting to 230-Volt Line Power

Instruments are shipped from the factory with the power transformer connected for 115-volt line power, unless ordered for 230-volt use. Converting a 115-volt unit for 230-volt operation is a simple matter.

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel and remove panel.
3. The conversion switch is located on the chassis. Use a thin-bladed screwdriver to move the 115-230 switch to the 230 position.
4. Replace ¼-ampere fuse with a 1/8-ampere fuse of the same type.

Connecting Signal and Chassis Grounds

The instrument is shipped from the factory with the signal ground floating above chassis ground, unless otherwise specified. A common signal/chassis ground can be obtained as follows:

1. Remove power cord.
2. Loosen two captive thumb screws on rear panel and remove panel.
3. Solder a jumper wire between the ground lugs (green wires) of the SYNC OUT connector and the power connector (Figure 2-2).

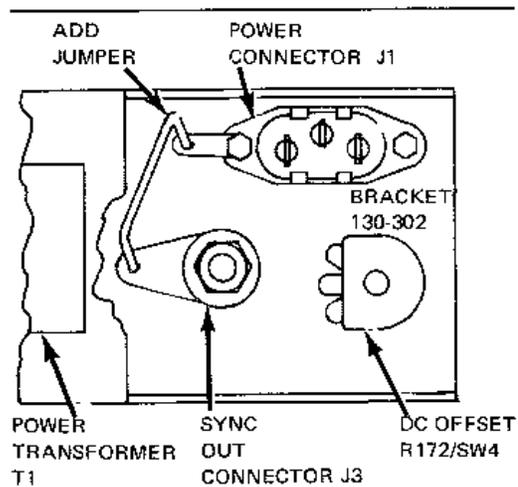


Figure 2-2. Common Ground Connection Diagram

Converting Output Impedance to 600 Ohms

Unless otherwise specified, the instrument was shipped with 50 ohm output impedance. If the application calls for a 600 ohm output, follow these steps for converting:

1. Remove and Discard:
R165 -R166 -R167 -R168 -R169 and C67
2. Replace R165 with 1000 ohms and Jumper R166.
R167 with 1500 ohms and Jumper R168.
(Parallel equivalent is 600 ohms).
3. Let R169 and C67 remain vacant.
4. Use 1% resistors.

SECTION 3

CIRCUIT DESCRIPTION

GENERAL DESCRIPTION

Refer to the block diagram of the Model 130 Function Generator, Figure 3-1.

A square wave is applied to the input of an integrator. The output of the integrator, a triangle wave is fed into a hysteresis switch. The hysteresis/output switch functions like a Schmitt trigger with the limit points set at the waveform extremes, firing when the triangle wave reaches +1.25 volts and -1.25 volts. The firing sets the hysteresis and the output switches which reverse the square wave fed into the integrator, causing the triangle wave to reverse direction. The result is simultaneous generation of a square wave and triangle wave of the same frequency with the positive half cycle of the square wave coincident with the negative slope of the triangle wave.

The frequency of oscillation is determined by the magnitude of capacitor C selected with the FREQ HZ switch and by the amplitude of the square wave fed into the integrating resistor R. The ± 5 volt square wave is fed to the frequency dial potentiometer. Setting the potentiometer for maximum voltage, and thus maximum integrating current, produces an output at maximum frequency. Frequency is directly proportional to the square wave amplitude appearing on the arm of the frequency dial potentiometer.

The sine wave is produced by shaping the triangle wave. The triangle wave is fed into a shaping network composed of resistors and diodes. As the triangle wave voltage passes through zero, loading of the triangle wave is minimal and thus the slope is maximum. As the triangle wave voltage increases, diodes with current limiting resistors conduct, successively, causing the slope of the output to be less.

Since the diode break points are mathematically computed and fitted to the true sine shape, the resultant waveform is an almost pure sine wave. The circuitry is completely symmetrical about ground, using a complimentary pair of diodes on each break point. The sine wave produced by shaping is considerably less in amplitude than the triangle wave input and is thus amplified to be equal to the triangle wave.

The triangle wave output of the integrator, the sine wave output, and the square wave coupled through a divider are fed to the function selector switch. The switch is coupled to the attenuator which in turn drives the output power amplifier.

All instrument circuits, except the switch set and the power amplifier output stage, operate with regulated ± 15 volt supplies. The switch set requires regulated ± 6 volts. The power amplifier output stage requires unregulated ± 22 volts.

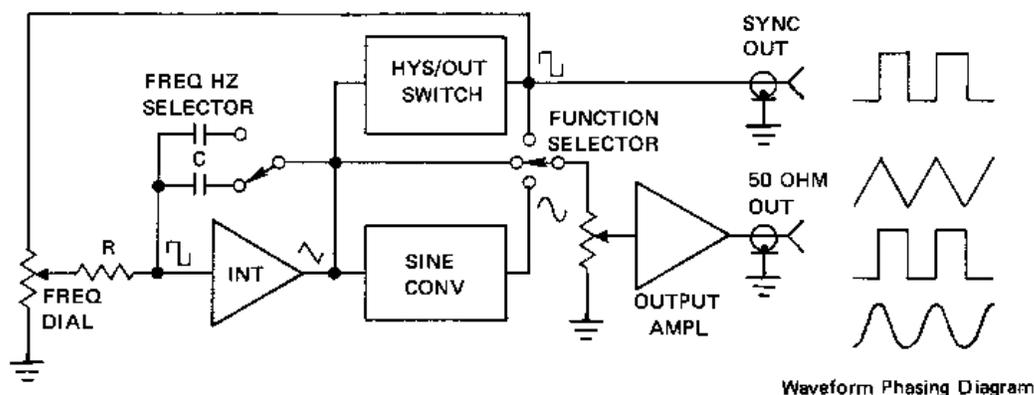


Figure 3-1. Function Block Diagram

SECTION 4

MAINTENANCE

INTRODUCTION

This section provides instructions for testing, calibrating, troubleshooting, and repairing the Model 130. The instructions are concise and for the experienced electronics technician or field engineer. 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 facilitate the turnaround time. Test point and adjustment locations are illustrated in the Data Package.

RECOMMENDED TEST EQUIPMENT

Table 4-1 contains a list of recommended test equipment. Any test equipment having equivalent accuracies may be substituted for those listed.

Table 4-1. TEST EQUIPMENT

Name	Required Characteristics	Recommended Manufacturer	Model
Oscilloscope	To 30 MHz	Tektronix	544
Plug-In	Dual Channel	Tektronix	1A1
Plug-In	Peak mV measuring capability	Tektronix	1A5
Distortion Analyzer	To 600 kHz	Hewlett-Packard	334A
Spectrum Analyzer Display	To 50 MHz	Hewlett Packard	141S
IF Section		Hewlett-Packard	8552A
RF Section		Hewlett-Packard	8553L
Voltmeter	Millivolt dc measurement	.01 Accuracy	
Counter	to 10 MHz	0.1% of reading accuracy	

CHECKOUT AND CALIBRATION

The following paragraphs provide complete sequential calibration procedures for the Model 130. Instrument checkout procedures are indicated by a checkmark (✓) following the procedure title. A quick checkout of the instrument can be performed by comparing the indicated parameters with the tolerances given in the Specifications of Section 1.

NOTE

The entire calibration procedure *must* be read first to determine initial control settings and test equipment connections before attempting checkout.

Preliminary Procedures

1. Set **FREQ HZ** selector to the X1K position.
2. Allow one-half hour for warmup.

Removal of Dust Cover

To gain access for calibration or maintenance, proceed as follows:

- a. Remove power cord.
- b. Loosen the two knurled captive screws on the rear panel.
- c. Pull off the rear panel.
- d. Remove the cover.

Power Supply Regulation

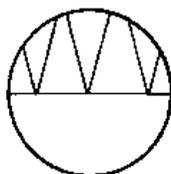
1. Connect voltmeter between TP1 (common) and TP2(+) on Main Board. Adjust R104 for +15 Vdc ± 100 mV.
2. Connect voltmeter between TP1 (common) and 1P3(-). Since the negative supply is referenced to the +15-volt supply, the voltmeter should indicate -15 Vdc ± 100 mV.

Square Wave Amplitude Symmetry

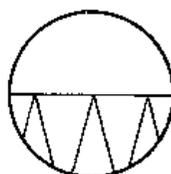
1. Set function selector to \square .
2. Connect oscilloscope, with 1A5 plug-in, to coaxial-wire lug on function switch.
3. Adjust R121 until square wave negative peak is equal to amplitude to positive peak ± 5 mV.

Triangle Amplitude

1. Set frequency dial for 2.0 (X1K range) and function selector to ∇ .
2. Connect oscilloscope, with 1A5 plug-in, to red-wire lug on function switch.
3. Adjust R56 on main board for positive peak at +1.25 volts ± 5 mV (see sketch).
4. Adjust R59 for negative peak at -1.25 volts ± 5 mV.



Negative Peak



Positive Peak

Output Amplifier \checkmark

1. Connect oscilloscope to 50 Ω OUT connector with 50-ohm terminator (\square function).
2. Set FREQ HZ selector for X1K (VERNIER full cw) and frequency dial at 2.0.
3. Turn 20 V P-P MAX control fully ccw.
4. Adjust R150 for amplitude symmetry about ground.
5. Set FREQ HZ selector for X1M (2.0 dial setting).
6. Turn 20 V P-P MAX control fully cw.
7. Adjust C64 for best square-wave response without peaking.

Time Symmetry \checkmark

1. Connect unit and oscilloscope, with 1A1 plug-in set for alternate display, as shown in Figure 4-1.

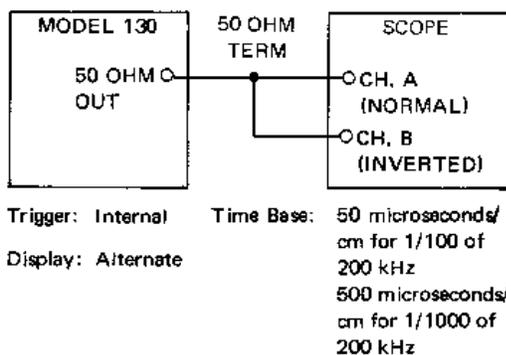


Figure 4-1.

Time Symmetry Measurement for Test Setup

2. Set FREQ HZ selector for X100K (\square function).
3. Set frequency dial for 2 kHz on oscilloscope (1/100 dial FS).
4. Adjust R28 for time symmetry at 100:1 frequency ratio.
5. Check for waveform time symmetry at the .2 and 2 frequency-dial settings.

Frequency Calibration

1. Connect counter to 50 Ω OUT connector.
2. Set FREQ HZ selector to X10K.
3. Align 2.0 dial mark with the dial indicator index and adjust R173 to obtain maximum dial accuracy on X10K and X1K ranges.
4. Set FREQ HZ selector to X100K and dial at 2.0.
5. Adjust C16 to obtain 200.0 kHz on counter display.
6. Set FREQ HZ selector to X1M. Adjust C12 to obtain 2.00 MHz on counter display $\pm 2\%$ full scale.
7. Dial alignment — No alignment is necessary if the dial is the push-on type. If it has a set screw, consult the dial alignment procedure at the end of this section.

Sine Distortion, Amplitude, and Balance \checkmark

1. Set FREQ HZ selector for X1K, function selector to ∇ , and frequency dial at 2.0.
2. Connect oscilloscope, with 1A5 plug-in, to orange wire on function switch.
3. Adjust R133 to obtain 2.5 V p-p ± 25 mV output.
4. Adjust R128 to balance output.
5. Connect the unit, distortion analyzer, and oscilloscope as shown in Figure 4-2.

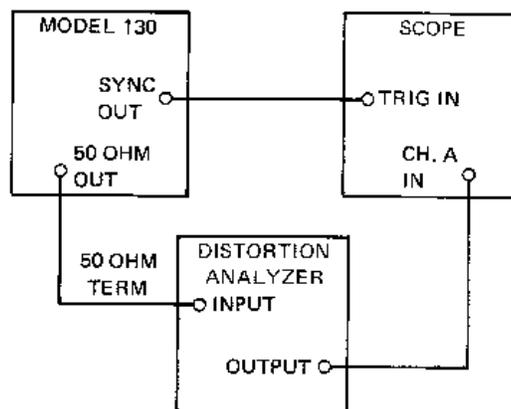
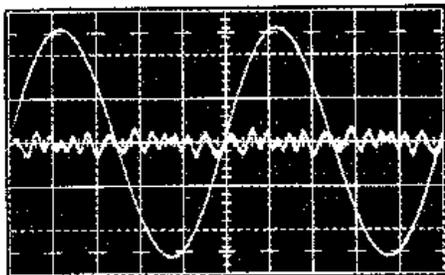


Figure 4-2. Distortion Analysis Test Setup

6. Adjust R126 and R127 for minimum sine distortion (see photo).



7. Set FREQ HZ selector by X10K.
8. Repeat Step 6 to obtain least distortion at both X1K and X10K ranges.
9. Repeat Steps 3 and 4.
10. Connect spectrum analyzer to unit and check sine distortion at 2 MHz.

TROUBLESHOOTING

Basic Techniques

Troubleshooting the Model 130 requires no special technique. Listed below are a few reminders of basic electronics fault isolation.

1. Check control settings carefully. Many times an incorrect control setting, or a knob that has loosened on its shaft, will cause a false indication of a malfunction.
2. Check associated equipment connections. Make sure that all connections are properly connected to the correct connector.
3. Visually check the interior of the instrument. Look for such indications as broken wires, charred components, loose leads, etc.
4. Perform the checkout procedure. Many out-of-specification indications can be corrected by performing specific calibration procedures.

Troubleshooting Chart

Table 4-2 provides a list of possible malfunction symptoms, their probable causes, and the prescribed remedies. Also listed in this table are the test points at which measurements are to be made and the parameter tolerances at these points. To use the troubleshooting chart, locate the symptom listed in Column 1 and follow the corresponding procedures. Localize the fault to a specific stage by checking the parameters given for the major test points then, check the dc operating voltages at the pins of solid-state devices. Check associated passive elements with a high input

impedance ohmmeter (power off) before replacing a suspected semiconductor element.

Troubleshooting Hints

The interactive nature of a closed loop presents a somewhat special problem when approached from a troubleshooting standpoint. The simplest way to reduce problem complexity is to open the loop, thereby removing the interaction. The basic units of the loop can then be tested individually. The following step-by-step procedure describes how this is done.

1. Set instrument controls for 20 V p-p, 2 kHz sine-wave output.
2. Check at coaxial-wire lug of function selector switch for a 2.5 V p-p square wave. If normal, check output amplifier (Q34-Q40).
3. Unsolder and lift the end of R51 (TP7). This is the output of the integrator and input to the hysteresis switch. The generator loop has now been opened.
4. Inject a 2.5 V p-p triangle waveform into the hysteresis switch input lead (TP7).
5. Check at the coaxial-wire lug of the function selector switch for a 2.5 V p-p square wave at the injected frequency.
 - a. If present, hysteresis and output switches are okay. Proceed to Step 6.
 - b. If abnormal, check Q6-Q16 stages.
6. Vary frequency dial from ccw to cw while observing TP11 with a scope. Voltage at this point should remain at 0 volts throughout dial rotation. If a voltage variation is observed, check IC1 stage.
7. Vary frequency dial from ccw to cw while observing TP4. Voltage reading should vary from 0 to approximately -6 volts. If voltage does not vary, check IC2 stage and IC1 stage.
8. Vary frequency dial from ccw to cw while observing TP9. Voltage reading should remain at 0 volts. If voltage varies check IC3 stage.
9. Vary frequency dial from ccw to cw while observing TP10. Voltage should vary from 0 volts to approximately +6 volts. If voltage does not vary, check IC2 stage and IC1 stage.
10. Vary frequency dial from ccw to cw while observing TP8. Voltage reading should remain at 0 volts. If voltage varies, check IC4 and IC5 stages.
11. Re-install R51.

Removal of Front and Back Panels

1. To gain access to any part mounted on bracket assembly behind rear panel, proceed as follows:

SECTION 5

DATA PACKAGE

INTRODUCTION

This section contains data packages for the Model 130. Each data package is a quick-access document, containing maintenance data arranged for convenient viewing of the schematic diagram and all supporting data. Each data package includes a parts-location illustration, a replaceable parts list, voltage/waveform data, and a schematic diagram. Voltage and waveform data are provided on the diagrams at indicated test

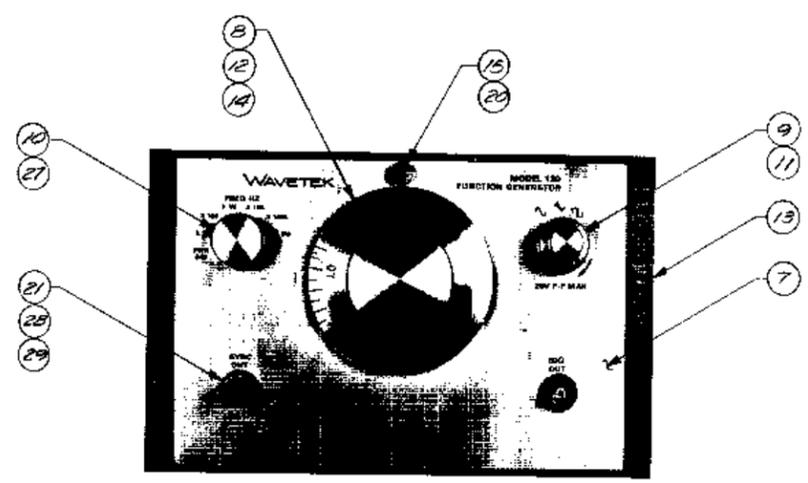
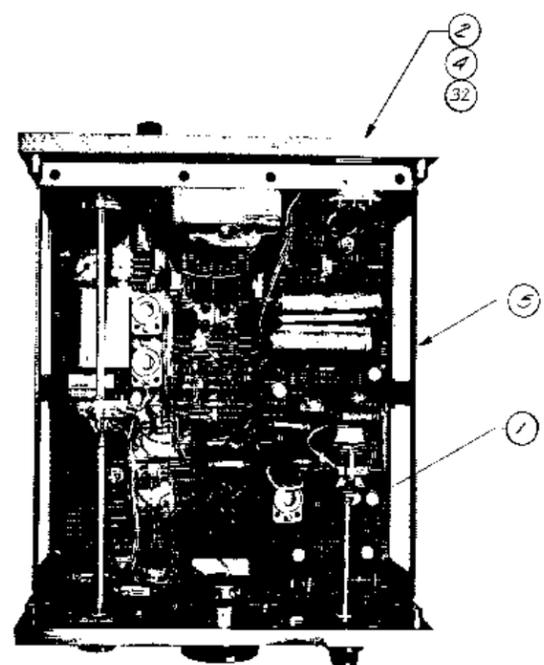
points as an aid to troubleshooting. Also, a list of manufacturers is included in this section.

RECOMMENDED SPARE PARTS LIST

Information is provided to maintain the instrument on a component level. Price and delivery information should be obtained from the Wavetek representative in your area or directly from the factory.

DESCRIPTION	MANUFACTURER	PART NO.	QTY
DIODE	FAIRCHILD	FD6666	2
DIODE	SEMTECH	SCE-1	1
DIODE	WAVETEK	130-506	1
FUSE 1/8A 230 V	LITTELFUSE	313-125	1
FUSE 1/4A 115 V	LITTELFUSE	313-250	1
IC	RCA	*CA3030 (-15)	1
IC	RCA	*CA3030 (-16)	1
IC	RCA	*CA3036 (-17)	1
IC	FAIRCHILD	* μ A709C (-14)	1
LAMP	MURA	L28/40	1
SINE MODULE	WAVETEK	130-011	1
TRANSISTOR	FAIRCHILD	2N2905	1
TRANSISTOR	FAIRCHILD	2N3299	1
TRANSISTOR	FAIRCHILD	2N3646	2
TRANSISTOR	FAIRCHILD	2N3638	1
TRANSISTOR	MOTOROLA	MPS3640	1
TRANSISTOR	MOTOROLA	2N3903	1
TRANSISTOR	MOTOROLA	2N3905	1
TRANSISTOR	SPRAGUE	TD101	1
TRANSISTOR	FAIRCHILD	MPS L08	1
TRANSISTOR	FAIRCHILD	2N2369	1
TRANSISTOR	TEXAS INST	*TIP 29	1
TRANSISTOR	TEXAS INST	*TIP 30	1
MATCHED			
TRANSISTOR	FAIRCHILD	*2N2905 (-8)	2
MATCHED			
TRANSISTOR	FAIRCHILD	*2N3646 (-11)	2
MATCHED			
TRANSISTOR	FAIRCHILD	*2N3638 (-9)	2

* Denotes special parts that should be ordered from Wavetek. These parts have been tested or selected by Wavetek for optimum performance.



QTY	REF DES	DESCRIPTION	MFR	MFR NO.	QTY
1		CHASSIS ASSY	WAVETEK	D130-010	1
2		CASTING		B134-300	1
3		COVER		C130-353	1
4		REAR PANEL		B130-303	1
5		SIDE PLATE		C130-304	2
6		MOUNTING BRCK		A130-305	2
7		FRONT PANEL		B130-307-1	1
8		DIAL KNOB		B130-308	1
9		CO-AXIAL KNOB		B130-309	1
10		STANDARD KNOB		B130-314	1
11		SMALL KNOB		B130-310	1
12		DIAL		B130-353	1
13		CASTING MODIFICATION		B130-313-2	1
14	R175	POT, MODIFIED 1K		A130-315	1
15		INDICATOR LEUS		A41-317	1
16		BAIL KIT		B130-507	1
17					
18					
19					
20		RETAINER	TRUMEC	5305-31	1
21	J3, J4	BNC CONNECTOR	KING	KC 7946	2
22		POWER CORD	BELDEN	1725A-S	1
23					
24		CAPTIVE SCREW	DEUTSCH	7000-10-B-2	2
25		CLIP NUT	TINBERMAN	C8091-632-4	4
26		CHASSIS FASTENER	USBCO	1591B	4
27		BUSHING	THOMPSON	422FF	2
28		SHOULDER WASHER	SMITH	266B	6
29		SOLDER LUB	SMITH	1497	3
30					
31		FASTENER	TINBERMAN	C7494-632-4	6
32		FASTENER	CARR	PC47231	2
33					
34					
35					

1. * INDICATES ITEMS NOT SHOWN
NOTES:

rev	by	date	app.
C	ECN 447	8/1/77	
B	REDRAWN	2/82	TJD
A	ECN 685	6/73	WJC

tolerance unless otherwise specified
XXX & 010
XX & 030

WAVETEK san diego, calif

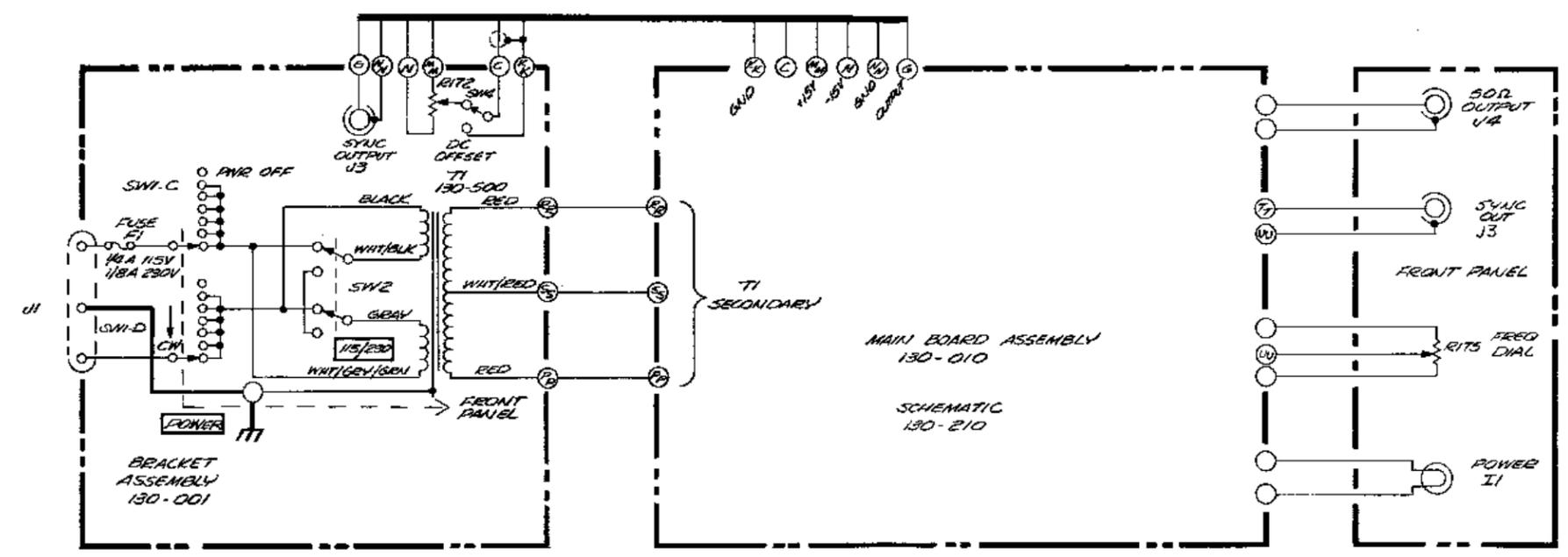
scale N/A by GRAY date 7-21-77 app. T.C.

material N/A title CHASSIS ASSY

model no. 130 dwg no. D130-000 rev C

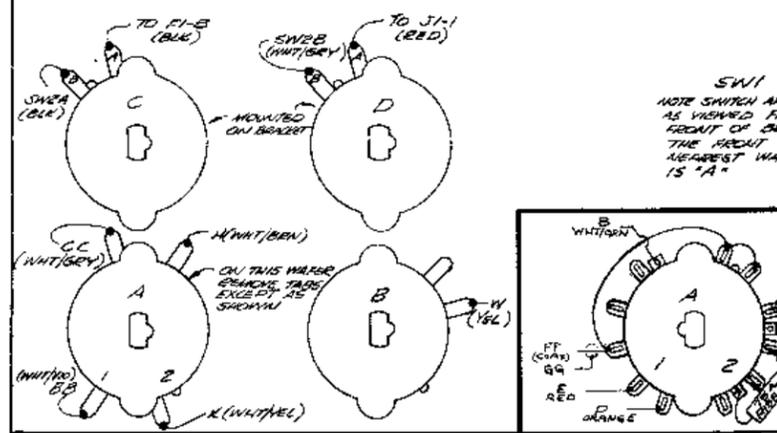
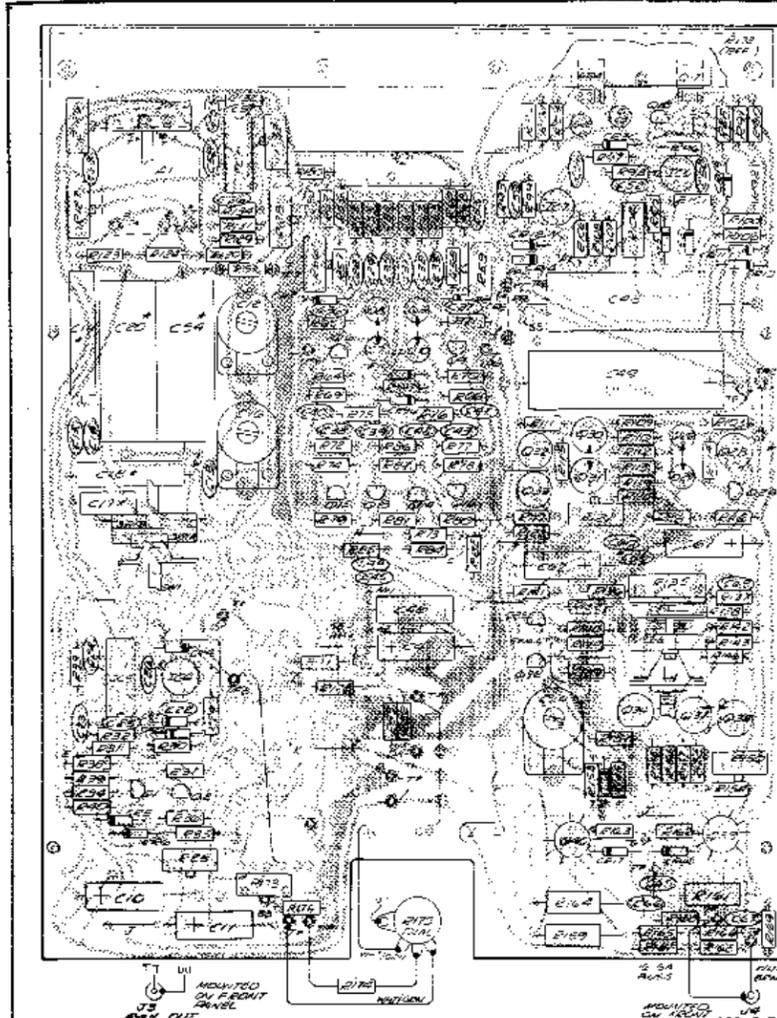
finish N/A

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NOTES: UNLESS OTHERWISE SPECIFIED
 I, LETTER DESIGNATIONS ARE INTERCONNECTION POINTS

tolerance unless otherwise specified	rev	encl	by	date	app.
.XX ± .010 .XX ± .030					
scale	WAVETEK see drawing call				
N/A	by BEAV date 7.14.71 app.				
material	title				
N/A	SCHEMATIC, CHASSIS				
model no.	diag no.				rev
130	D130-210				
<small>This document contains proprietary information and design rights belonging to WAVETEK and may not be used or reproduced for any reason except calibration, operation and maintenance without written authorization.</small>					



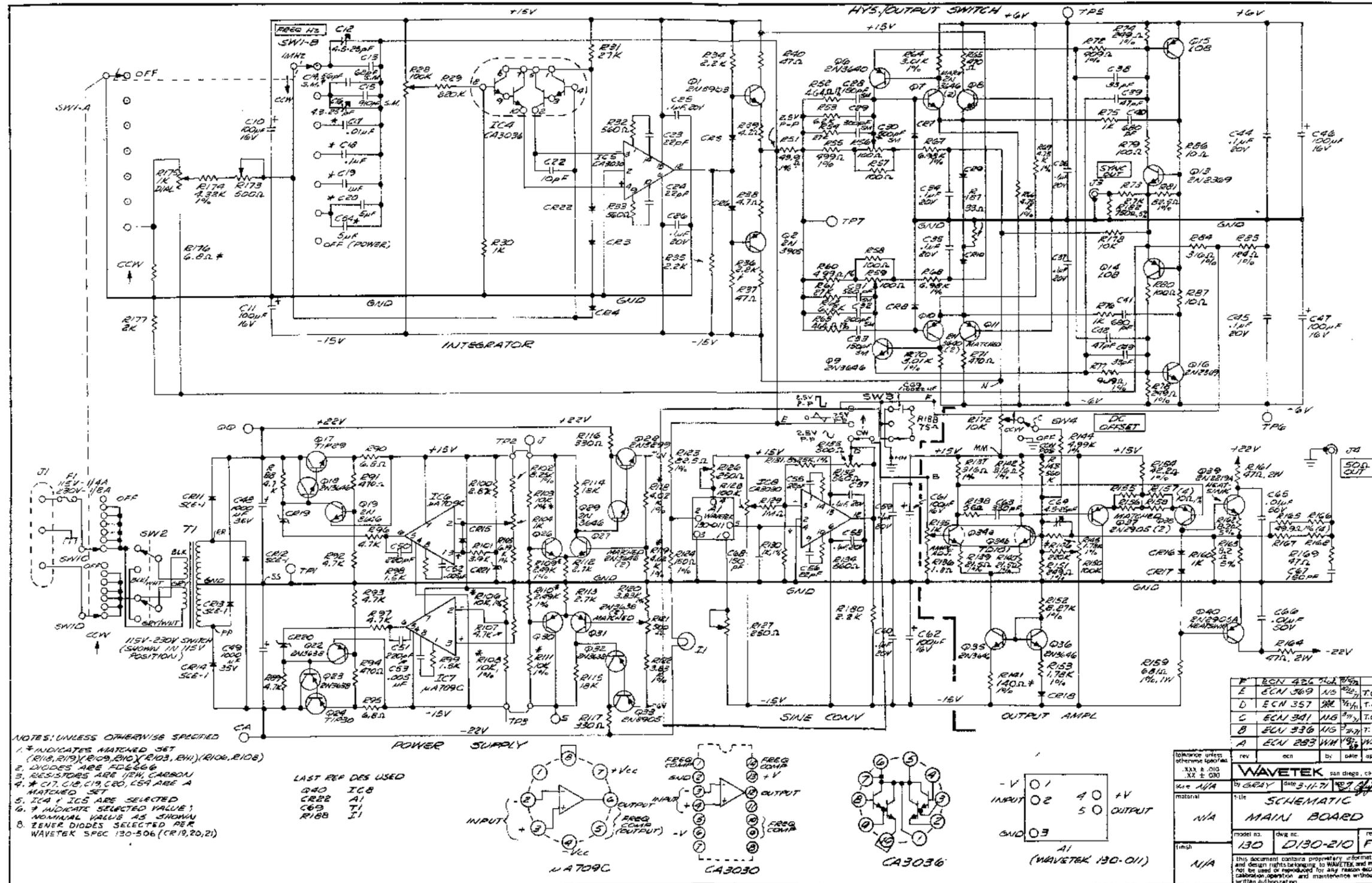
REF DES	DESCRIPTION	QTY	MANUFACTURER	QTY
CAPACITORS				
1	C1A * SILVER METALIZED 5% 500P	1	ARRD DWG-500J	1
2	C1B 5% 500P	1	600T	1
3	C1C 150P	2	150J	2
4	C1D, C1E 3000P	2	300J	2
5	C1F, C1G 3000P	2	300J	2
6	C1H, C1I 1% 900P	1	912	1
7	C1J CERAMIC DISC 1000P 50V	1	CRL DD-100	1
8	C1K, C1L 300P	4	-300	4
9	C1M, C1N 300P	2	-300	2
10	C1O, C1P 470P	2	-470	2
11	C1Q, C1R 150P	2	-150	2
12	C1S, C1T 220P	2	-220	2
13	C1U, C1V 330P	1	-330	1
14	C1W, C1X 200P	2	-200	2
15	C1Y, C1Z 50V 0.005F	2	CK-502	2
16	C20, C21 0.1uF	2	UKR0-104	2
17	C22 POLY 100V 1% 0.1uF	1	WAVETEK 100-501-6	1
18	C23 100V 1% 0.1uF	1	-100	1
19	C24 100V 1% 0.1uF	1	-100	1
20	C25, C26 100V 1% 0.1uF	2	-100	2
21	C27, C28 100V 1% 0.1uF	2	-100	2
22	C29, C30 100V 1% 0.1uF	2	-100	2
23	C31, C32 100V 1% 0.1uF	2	-100	2
24	C33, C34 100V 1% 0.1uF	2	-100	2
25	C35, C36 100V 1% 0.1uF	2	-100	2
26	C37, C38 100V 1% 0.1uF	2	-100	2
27	C39, C40 100V 1% 0.1uF	2	-100	2
28	C41, C42 100V 1% 0.1uF	2	-100	2
29	C43, C44 100V 1% 0.1uF	2	-100	2
30	C45, C46 100V 1% 0.1uF	2	-100	2
31	C47, C48 100V 1% 0.1uF	2	-100	2
32	C49, C50 100V 1% 0.1uF	2	-100	2
33	C51, C52 100V 1% 0.1uF	2	-100	2
34	C53, C54 100V 1% 0.1uF	2	-100	2
35	C55, C56 100V 1% 0.1uF	2	-100	2
36	C57, C58 100V 1% 0.1uF	2	-100	2
37	C59, C60 100V 1% 0.1uF	2	-100	2
38	C61, C62 100V 1% 0.1uF	2	-100	2
39	C63, C64 100V 1% 0.1uF	2	-100	2
40	C65, C66 100V 1% 0.1uF	2	-100	2
41	C67, C68 100V 1% 0.1uF	2	-100	2
42	C69, C70 100V 1% 0.1uF	2	-100	2
43	C71, C72 100V 1% 0.1uF	2	-100	2
44	C73, C74 100V 1% 0.1uF	2	-100	2
45	C75, C76 100V 1% 0.1uF	2	-100	2
46	C77, C78 100V 1% 0.1uF	2	-100	2
47	C79, C80 100V 1% 0.1uF	2	-100	2
48	C81, C82 100V 1% 0.1uF	2	-100	2
49	C83, C84 100V 1% 0.1uF	2	-100	2
50	C85, C86 100V 1% 0.1uF	2	-100	2
51	C87, C88 100V 1% 0.1uF	2	-100	2
52	C89, C90 100V 1% 0.1uF	2	-100	2
53	C91, C92 100V 1% 0.1uF	2	-100	2
54	C93, C94 100V 1% 0.1uF	2	-100	2
55	C95, C96 100V 1% 0.1uF	2	-100	2
56	C97, C98 100V 1% 0.1uF	2	-100	2
57	C99, C100 100V 1% 0.1uF	2	-100	2

REF DES	DESCRIPTION	QTY	MANUFACTURER	QTY
RESISTORS				
1	R1C, R1D 1% 100K	1	CRL BANGS-001	1
2	R1E, R1F 1% 100K	2	-100K	2
3	R1G, R1H 1% 100K	2	-100K	2
4	R1I, R1J 1% 100K	2	-100K	2
5	R1K, R1L 1% 100K	2	-100K	2
6	R1M, R1N 1% 100K	2	-100K	2
7	R1O, R1P 1% 100K	2	-100K	2
8	R1Q, R1R 1% 100K	2	-100K	2
9	R1S, R1T 1% 100K	2	-100K	2
10	R1U, R1V 1% 100K	2	-100K	2
11	R1W, R1X 1% 100K	2	-100K	2
12	R1Y, R1Z 1% 100K	2	-100K	2
13	R20, R21 1% 100K	2	-100K	2
14	R22, R23 1% 100K	2	-100K	2
15	R24, R25 1% 100K	2	-100K	2
16	R26, R27 1% 100K	2	-100K	2
17	R28, R29 1% 100K	2	-100K	2
18	R30, R31 1% 100K	2	-100K	2
19	R32, R33 1% 100K	2	-100K	2
20	R34, R35 1% 100K	2	-100K	2
21	R36, R37 1% 100K	2	-100K	2
22	R38, R39 1% 100K	2	-100K	2
23	R40, R41 1% 100K	2	-100K	2
24	R42, R43 1% 100K	2	-100K	2
25	R44, R45 1% 100K	2	-100K	2
26	R46, R47 1% 100K	2	-100K	2
27	R48, R49 1% 100K	2	-100K	2
28	R50, R51 1% 100K	2	-100K	2
29	R52, R53 1% 100K	2	-100K	2
30	R54, R55 1% 100K	2	-100K	2
31	R56, R57 1% 100K	2	-100K	2
32	R58, R59 1% 100K	2	-100K	2
33	R60, R61 1% 100K	2	-100K	2
34	R62, R63 1% 100K	2	-100K	2
35	R64, R65 1% 100K	2	-100K	2
36	R66, R67 1% 100K	2	-100K	2
37	R68, R69 1% 100K	2	-100K	2
38	R70, R71 1% 100K	2	-100K	2
39	R72, R73 1% 100K	2	-100K	2
40	R74, R75 1% 100K	2	-100K	2
41	R76, R77 1% 100K	2	-100K	2
42	R78, R79 1% 100K	2	-100K	2
43	R80, R81 1% 100K	2	-100K	2
44	R82, R83 1% 100K	2	-100K	2
45	R84, R85 1% 100K	2	-100K	2
46	R86, R87 1% 100K	2	-100K	2
47	R88, R89 1% 100K	2	-100K	2
48	R90, R91 1% 100K	2	-100K	2
49	R92, R93 1% 100K	2	-100K	2
50	R94, R95 1% 100K	2	-100K	2
51	R96, R97 1% 100K	2	-100K	2
52	R98, R99 1% 100K	2	-100K	2
53	R100 1% 100K	1	-100K	1

REF DES	DESCRIPTION	QTY	MANUFACTURER	QTY
TRANSISTORS				
1	Q17 MODIFIED 100-316	1	T.I. TIP-29	1
2	Q20 2N2905	1	2N2905	1
3	Q21 2N2905	1	2N2905	1
4	Q22 2N2905	1	2N2905	1
5	Q23 2N2905	1	2N2905	1
6	Q24 2N2905	1	2N2905	1
7	Q25 2N2905	1	2N2905	1
8	Q26 2N2905	1	2N2905	1
9	Q27 2N2905	1	2N2905	1
10	Q28 2N2905	1	2N2905	1
11	Q29 2N2905	1	2N2905	1
12	Q30 2N2905	1	2N2905	1
13	Q31 2N2905	1	2N2905	1
14	Q32 2N2905	1	2N2905	1
15	Q33 2N2905	1	2N2905	1
16	Q34 2N2905	1	2N2905	1
17	Q35 2N2905	1	2N2905	1
18	Q36 2N2905	1	2N2905	1
19	Q37 2N2905	1	2N2905	1
20	Q38 2N2905	1	2N2905	1
21	Q39 2N2905	1	2N2905	1
22	Q40 2N2905	1	2N2905	1
23	Q41 2N2905	1	2N2905	1
24	Q42 2N2905	1	2N2905	1
25	Q43 2N2905	1	2N2905	1
26	Q44 2N2905	1	2N2905	1
27	Q45 2N2905	1	2N2905	1
28	Q46 2N2905	1	2N2905	1
29	Q47 2N2905	1	2N2905	1
30	Q48 2N2905	1	2N2905	1
31	Q49 2N2905	1	2N2905	1
32	Q50 2N2905	1	2N2905	1
33	Q51 2N2905	1	2N2905	1
34	Q52 2N2905	1	2N2905	1
35	Q53 2N2905	1	2N2905	1
36	Q54 2N2905	1	2N2905	1
37	Q55 2N2905	1	2N2905	1
38	Q56 2N2905	1	2N2905	1
39	Q57 2N2905	1	2N2905	1
40	Q58 2N2905	1	2N2905	1
41	Q59 2N2905	1	2N2905	1
42	Q60 2N2905	1	2N2905	1
43	Q61 2N2905	1	2N2905	1
44	Q62 2N2905	1	2N2905	1
45	Q63 2N2905	1	2N2905	1
46	Q64 2N2905	1	2N2905	1
47	Q65 2N2905	1	2N2905	1
48	Q66 2N2905	1	2N2905	1
49	Q67 2N2905	1	2N2905	1
50	Q68 2N2905	1	2N2905	1
51	Q69 2N2905	1	2N2905	1
52	Q70 2N2905	1	2N2905	1
53	Q71 2N2905	1	2N2905	1
54	Q72 2N2905	1	2N2905	1
55	Q73 2N2905	1	2N2905	1
56	Q74 2N2905	1	2N2905	1
57	Q75 2N2905	1	2N2905	1
58	Q76 2N2905	1	2N2905	1
59	Q77 2N2905	1	2N2905	1
60	Q78 2N2905	1	2N2905	1
61	Q79 2N2905	1	2N2905	1
62	Q80 2N2905	1	2N2905	1
63	Q81 2N2905	1	2N2905	1
64	Q82 2N2905	1	2N2905	1
65	Q83 2N2905	1	2N2905	1
66	Q84 2N2905	1	2N2905	1
67	Q85 2N2905	1	2N2905	1
68	Q86 2N2905	1	2N2905	1
69	Q87 2N2905	1	2N2905	1
70	Q88 2N2905	1	2N2905	1
71	Q89 2N2905	1	2N2905	1
72	Q90 2N2905	1	2N2905	1
73	Q91 2N2905	1	2N2905	1
74	Q92 2N2905	1	2N2905	1
75	Q93 2N2905	1	2N2905	1
76	Q94 2N2905	1	2N2905	1
77	Q95 2N2905	1	2N2905	1
78	Q96 2N2905	1	2N2905	1
79	Q97 2N2905	1	2N2905	1
80	Q98 2N2905	1	2N2905	1
81	Q99 2N2905	1	2N2905	1
82	Q100 2N2905	1	2N2905	1

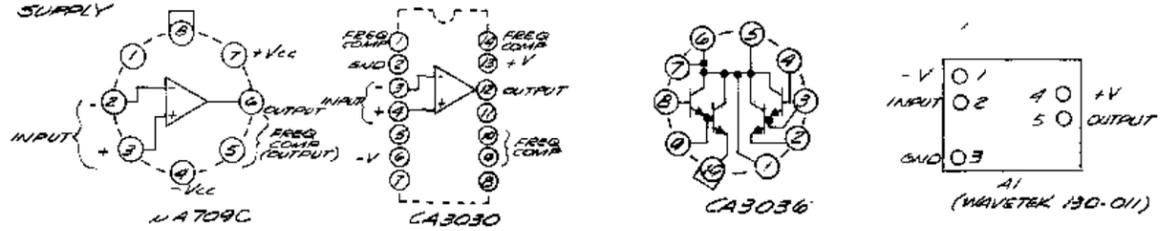
- 1. T - INDICATES TERMINAL ON COMPONENT SIDE
- 2. T* - INDICATES TERMINAL ON CIRCUIT SIDE
- 3. * - INDICATES MATCHED SET
- 4. - - - INDICATES MATCHED PAIRS
- 5. # - INDICATES SELECTED VALUE, NOMINAL VALUE AS SHOWN

REF DES	DESCRIPTION	QTY	MANUFACTURER	QTY
1	R101 1% 100K	1	-100K	1
2	R102 1% 100K	1	-100K	1
3	R103 1% 100K	1	-100K	1
4	R104 1% 100K	1	-100K	1
5	R105 1% 100K	1		



NOTES: UNLESS OTHERWISE SPECIFIED
 1. * INDICATES MATCHED SET (R18, R19) (R109, R110) (R103, R104) (R106, R108)
 2. DIODES ARE FD666
 3. RESISTORS ARE 1% CARBON
 4. * C17, C18, C19, C20, C54 ARE A MATCHED SET
 5. ICA & IC5 ARE SELECTED
 6. ? INDICATE SELECTED VALUE; NOMINAL VALUE AS SHOWN
 8. ZENER DIODES SELECTED PER WAVETEK SPEC 130-306 (CR19, 20, 21)

LAST REF DES USED
 Q40 IC8
 CR22 A1
 C69 T1
 R188 J1



F	ECN 426	N/S	1/80	T.O.
E	ECN 369	N/S	1/78	T.O.
D	ECN 357	N/S	1/78	T.O.
C	ECN 341	N/S	1/78	T.O.
B	ECN 336	N/S	1/77	T.O.
A	ECN 283	N/S	1/76	T.O.

WAVETEK sun diego, calif			
rev	ocn	by	date
XXX	010		
XX	030		
date 3-11-77			
SHEMATIC			
MAIN BOARD			
model no.	130	eng no.	D130-210 F
rev			
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