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

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.

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CONTENTS

Section One	SPECIFICATIONS	
	Specifications	1
Section Two	OPERATION	
	Inspection	2
	Operating Controls	2
	Operation	3
Section Three	CIRCUIT DESCRIPTION	
	General Description	5
Section Four	MAINTENANCE	
	Introduction	6
	Recommended Test Equipment	6
	Checkout and Calibration	6
	Troubleshooting	8
	Replacement of Switch Wafers and Potentiometers	10
	Replacement of Sine Converter	10
	Frequency Dial Alignment Procedure	10
Section Five	DATA PACKAGE	
	Introduction	11
	Recommended Spare Parts List	11

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 50Ω 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 50Ω 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 50Ω load. Counter-clockwise rotation will continuously reduce the output amplitude. The control gives a minimum of 40 dB variation

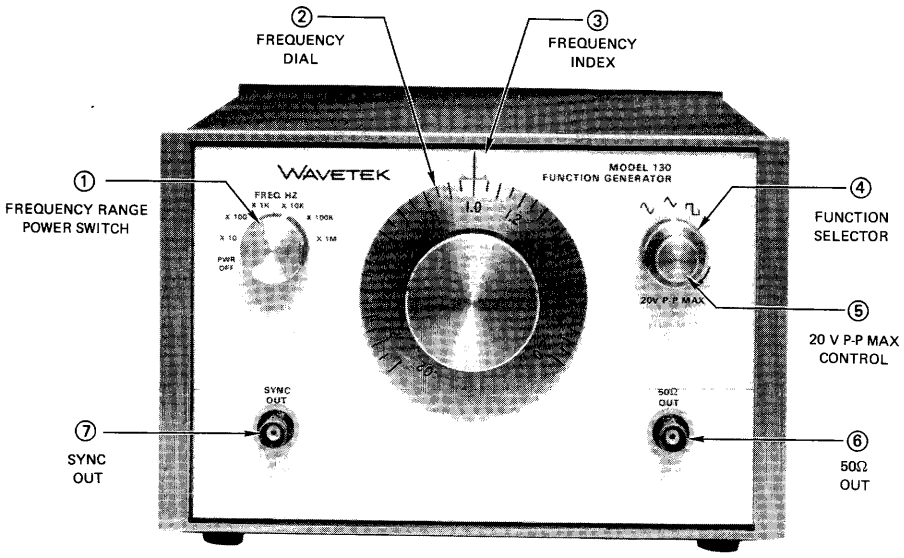


Figure 2-1. Operating Controls

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

6. **50Ω 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 50Ω 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 600Ω 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 50Ω OUT connector. A 50Ω 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 50Ω load, slight degradation of the output waveform may be noted particularly at higher frequencies.
2. Select the desired waveform (∿ , ⊓ , ◺) 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 50Ω 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).

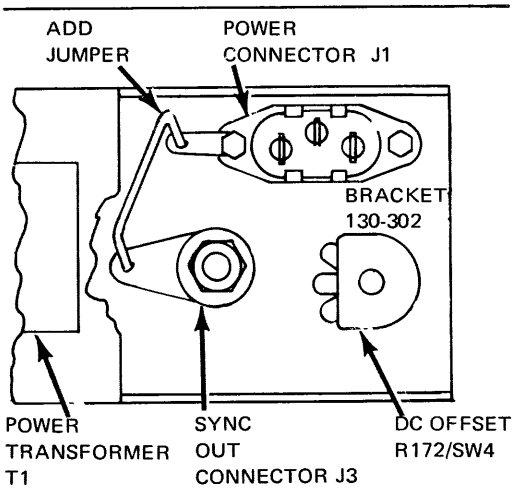


Figure 2-2. Common Ground Connection Diagram

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.

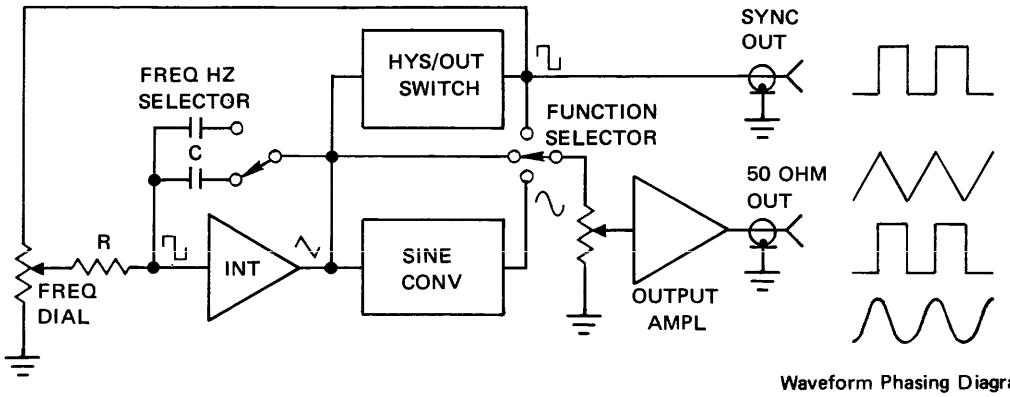


Figure 3-1. Function Block Diagram

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

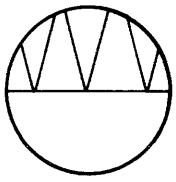
1. Connect voltmeter between TP1 (common) and TP2(+) on Main Board. Adjust R104 for +15 Vdc ±100 mV.
2. Connect voltmeter between TP1 (common) and TP3(−). Since the negative supply is referenced to the +15-volt supply, the voltmeter should indicate −15 Vdc ±100 mV.

Square Wave Amplitude Symmetry

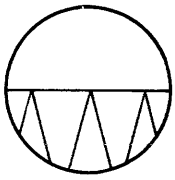
1. Set function selector to ⊓⊔ .
2. Connect oscilloscope, with 1A5 plug-in, to coaxial-wire lug on function switch.
3. Adjust R121 until square-wave negative peak is equal to amplitude to positive peak ±5 mV.

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



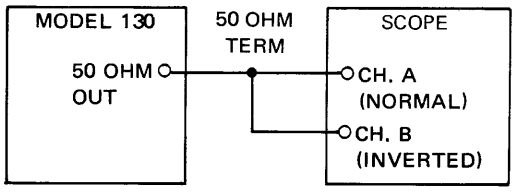
Positive Peak

Output Amplifier √

1. Connect oscilloscope to 50Ω OUT connector with 50-ohm terminator (⊓⊔ 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 √

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



Trigger: Internal

Display: Alternate

Time Base: 50 microseconds/cm for 1/100 of 200 kHz
500 microseconds/cm for 1/1000 of 200 kHz

Figure 4-1.
Time Symmetry Measurement for Test Setup

2. Set FREQ HZ selector for X100K (⊓⊔ 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 50Ω 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 ±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 √

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.

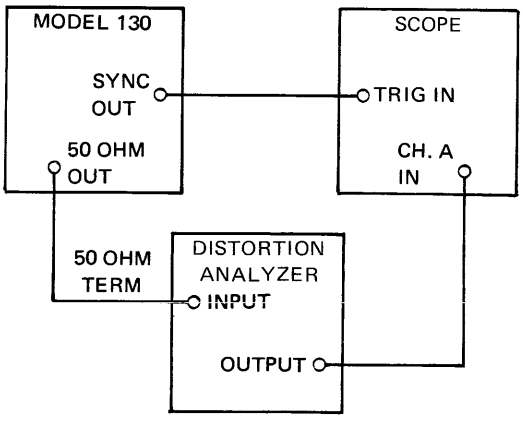
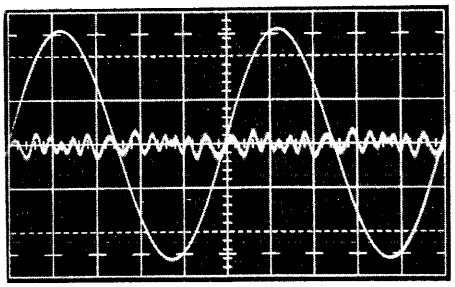


Figure 4-2. Distortion Analysis Test Setup

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

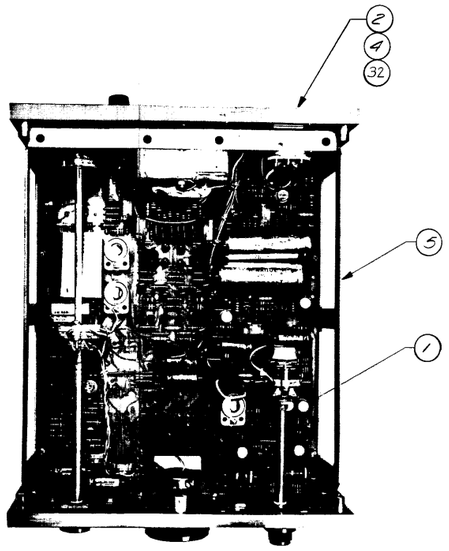
This section contains data packages for the Model 130. Each data package is a quick-access document, containing maintenance data arranged for convenient viewing of the schematic diagram and all supporting data. Each data package includes a parts-location illustration, a replaceable parts list, voltage/waveform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

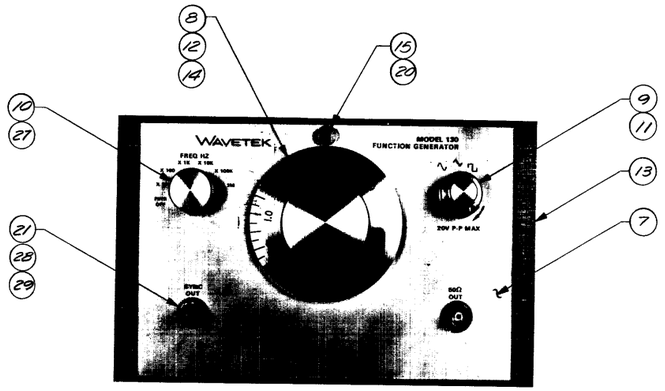
RECOMMENDED SPARE PARTS LIST

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	
IC	RCA	*CA3030 (–15)	1
IC	RCA	*CA3030 (–16)	1
IC	RCA	*CA3036 (–17)	1
IC	FAIRCHILD	*μA709C (–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.





PARTS LIST

	ITEM	REF DES	DESCRIPTION	MFGR	MFGR NO.	QTY
	1		MAINBOARD 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 BLOCK		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		B130-310	1
	11		SMALL KNOB		B130-310	1
	12		DIAL		B130-333	1
	13		CASTING MODIFICATION		B130-313-2	1
	14	R175	POT. MODIFIED IK		A130-315	1
	15		INDICATOR LENS		A141-317	1
*	16		BAIL KIT		B130-507	1
	17					
	18					
	19					
*	20		RETAINER	TRIARC	5303-31	1
	21	J3, J4	BNC CONNECTOR	KING	KC 7946	2
*	22		POWER CORD	BELDEN	17258-S	1
	23					
*	24		CAPTIVE SCREW	DEUTSCH	7900-10-8-2	2
*	25		CLIP NUT	TINNERMAN	C8091-632 TYPE U	4
*	26		CHASSIS FASTENER	USECO	1591 B	4
	27		BUSHING	THOMPSON	462FF	2
	28		SHOULDER WASHER	SMITH	2668	6
	29		SOLDER LUG	SMITH	1497	3
	30					
*	31		FASTENER	TINNERMAN	C7494-632-4	6
	32		FASTENER	CARR	PC47291	2
	33					
	34					
	35					

NOTES:
1. * INDICATES ITEMS NOT SHOWN

rev	ecn	by	date	app.
C	ECN 447	SL	7/24/72	
B	REDRAWN	JMS	7/24/72	T.O
A	ECN 283	BW	7/23/71	M.C

tolerance unless otherwise specified: .XXX ± .010, .XX ± .030

WAVETEK san diego, calif

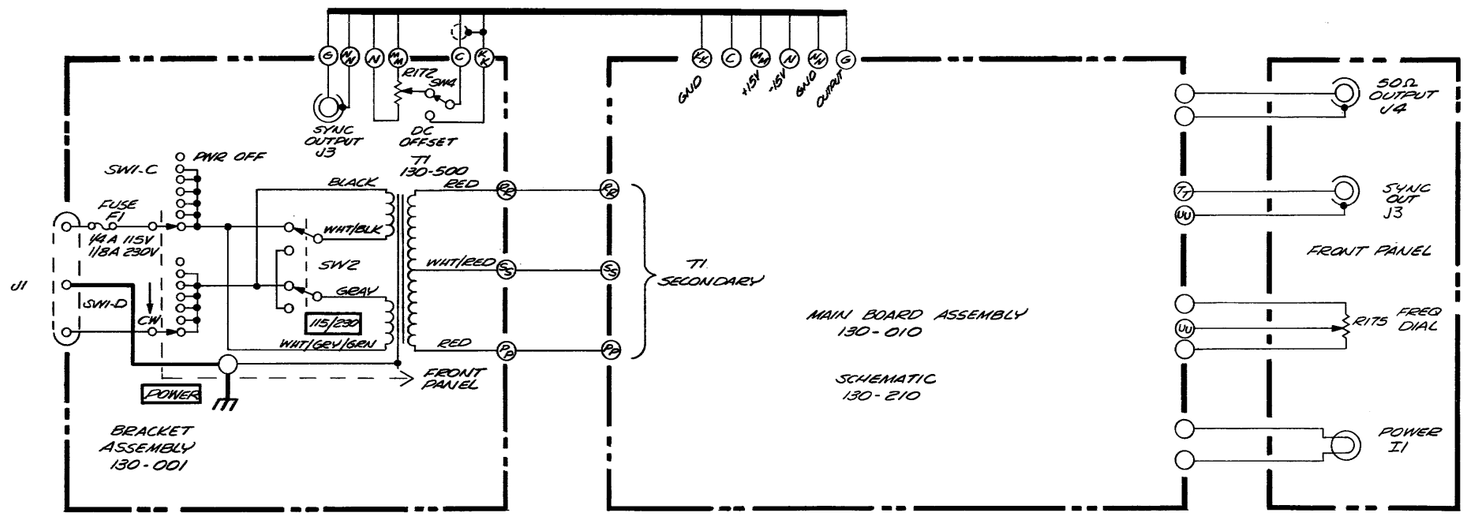
scale N/A | by GRAY | date 7-21-71 | app. T.O.

material: N/A

title: CHASSIS ASSY

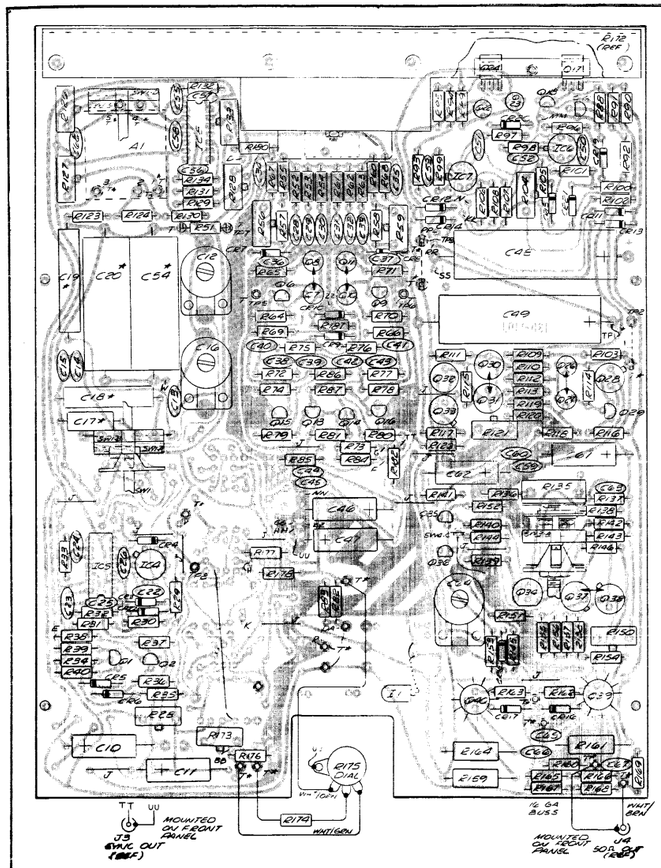
finish: N/A

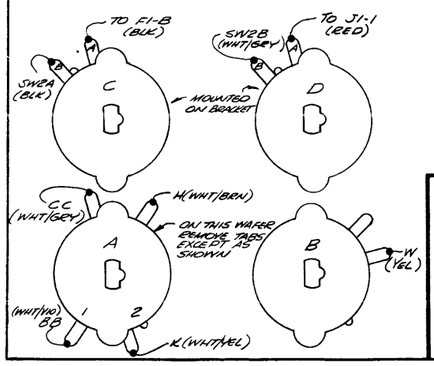
model no. 130 | dwg no. D130-000 | rev C



NOTES: UNLESS OTHERWISE SPECIFIED
1. LETTER DESIGNATIONS ARE INTERCONNECTION POINTS

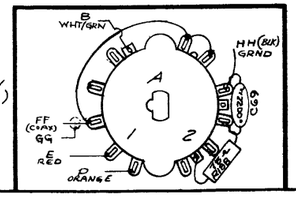
tolerance unless otherwise specified .XXX ± .010 .XX ± .030	rev	ecn	by	date	app.
	WAVETEK san diego, calif				
scale N/A	by GRAY	date 7-14-71	app.		
material N/A	title SCHEMATIC, CHASSIS				
finish N/A	model no. 130	dwg no. 0130-200	rev		





SW1

NOTE SWITCH APPEARS AS VIEWED FROM FRONT OF BOARD THE FRONT OF NEAREST WAFER IS "A"



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

PARTS LIST

ITEM	REF DES	DESCRIPTION	MFGR	MFGR. NO.	QTY
1		CAPACITORS			
2	C14 #	SILVER MICA, 500V, 5% 150pF	ARCO	DM15-560J	1
3	C13	5%, 68pF		680J	1
4	C28, C33	150pF		151J	2
5	C29, C32	300pF		301J	2
6	C30, C31	560pF		561J	2
7	C15	1%, 910pF		9111F	1
8	C22	CERAMIC DISC, 1000V, K20pF	CRL	DD-100	1
9	C23, C24, C35, C56	22pF		-220	4
10	C38, C43	33pF		-330	2
11	C39, C42	47pF		-470	2
12	C61, C68	150pF		-151	2
13	C50, C51	220pF		-221	2
14	C63	330pF		-331	1
15	C40, C41	680pF		-681	2
16	C52, C53	50V, .005μF		CK-502	2
17	C65, C66	.01μF		-103	2
18	C25, C26, C34, C37, C44, C45, C57-C60	20V, .1μF		UK20-104	12
19	C17	POLY 100V, 1%, .01μF	WAVETEK	180-501-6	1
20	C18	.1μF			1
21	C19	MYLAR, 200V, 1μF			1
22	C20, C54	M. MYLAR, 10%, 5μF			2
23	C10, C11, C46, C47, C61, C62	ELECTROLYTIC, 16V, 100μF	SPRAGUE	5000107-G016DC7	6
24	C48, C49	35V, XX2μF		3501X0035EE2	2
25	C12, C13, C64	VARIABLE, 4.5-25pF	ERIE	523-001-37A	3
26	C69	CERAMIC DISC, 1000V, 102pF	CRL	DD 222	1
27					
28					
30	CR3-CR10, CR15-CR18, CR22	DIODE FD6666	FAIRCHILD	FD6666	13
31	CR11-CR14	SCE-1	SEMTECH	SCE-1	4
32	CR19-CR21		WAVETEK	130-506	3
33					
34		TRANSISTORS			
35	Q17	MODIFIED PER 130-316	T.I.	TIP 29	1
36	Q24			TIP 30	1
37	Q33,	2N2905	FAIRCHILD	2N2905	1
38	Q28,	2N3299		2N3299	1
39	Q9, Q18, Q19, Q29, Q35, Q36	2N3646		2N3646	8
40	Q22, Q23, Q32	2N3638		2N3638	3
41	Q10, Q11	MPS3640(10)	MOTOROLA	MPS3640	2
42	Q6	MPS3640	MOTOROLA	MPS3640	3
43	Q1	2N3903		2N3903	1
44	Q2	2N3905		2N3905	1
45	Q34	TD101	SPRAGUE	TD101	1
46	Q37, Q38	MATCHED 2N2905(-8)	FAIRCHILD	2N2905	2
47	Q7, Q8, Q26, Q27	2N3646(-11)		2N3646	4
48	Q30, Q31	2N3638 (-9)		2N3638	2
49	Q14, Q15	MPS L08		MPSL08	2
50	Q13, Q16	2N2369		2N3639	2
51	Q39	2N2219A	MOTOROLA	2N2219A	1
52	Q40	2N2905A	FAIRCHILD	2N2905A	1

PARTS LIST

ITEM	REF DES	DESCRIPTION	MFGR	MFGR. NO.	QTY
53		INTEGRATED CIRCUIT			
54	IC5	LINEAR (-15)	RCA	CA3030	1
55	IC8	(-16)		CA3030	1
56	IC4	(-17)		CA3086	1
57	IC6, IC7	(-18)	FAIRCHILD	μA709C	2
58					
59					
60		POTENTIOMETER			
61	R56, R59	100Ω	CRL	BA1603-801	2
62	R126, R127	250Ω		-021	2
63	R121 R133, R113	500Ω		-802	3
64	R135	1K	CTS	IN ASSY SW3	1
65	R104	1K	CRL	BA1603-803	1
66	R28, R128, R150	100K		-819	3
67					
68					
69		RESISTORS			
70	R162, R163	CARBON, ½W, 5%, 8.2Ω	STACKPOLE	RC20GF8R2T	2
71	R38, R39,	CARBON, 1/2W, 5%, 4.7Ω	STACKPOLE	RC20GF4R7T	2
72	R90, R95 R176*	6.8Ω		6R8J	3
73	R86, R87	10Ω		100J	2
74	R138	56Ω		560J	1
75	R37, R40, R169	47Ω		470J	3
76	R57, R58 R79, R80	100Ω		101J	4
77	R116, R117	10%, 330Ω		331K	2
78	R188	5% 75Ω		750K	1
79	R65, R71, R91, R94	10%, 470Ω		471K	4
80	R232, R233 R232, R234	560Ω		561K	4
81	R182	5%, 750Ω		751J	1
82	R30, R75, R76, R160	10%, 1K		102K	4
83	R98, R99	1.5K		152K	2
84	R177	5%, 2K		202J	1
85	R34, R36 R180	10%, 2.2K		222K	4
86	R112, R113, R73	2.7K		272K	3
87	R101	3.9K		392K	1
88	R88, R89, R92, R93 R96, R97, R107	4.7K		472K	7
89	R53, R62	5%, 6.2K		622J	2
90	R178	10%, 10K		103K	1
91	R114, R115	18K		183K	2
92	R31, R54, R61	27K		273K	3
93	R146 #	220K		224K	1
94	R143	560K		564K	1
95	R29	820K		824K	1
96	R129	1MΩ		105K	1
97	R161, R164	2W, 10%, 47Ω		RA2GE470K	2
98	R187	1/8W, 5% 33Ω		RC07GF330J	1
99	R136	1.8Ω		1R8J	1
100					
101	R52 # R63	METALFILM, 1/4W, 1%, A6A Ω	CORNING	RN60D	2
102	R155-R158	METALFILM, 1/4W, 1%, 10Ω	CORNING	RN60D	4
103	R139, R140	1% 215Ω			2
104	R51, R165-R168	49.9Ω			5
105	R154	42.2Ω			1
106	R81, R123	82.5Ω			2
107	R85	124Ω			1
108	R124	150Ω			1
109	R74, R78 R151	249Ω			3
110	R84, R137, R142	316Ω			3
111	R55, R60	499Ω			2
112	R72, R77	909Ω			2
113	R130	1K			1
114	R145, R153	1.78K			2
115	R100	2.87K			1
116	R64, R70	3.01K			2

PARTS LIST

ITEM	REF DES	DESCRIPTION	MFGR	MFGR. NO	QTY
117	R120, R122	METALFILM, 1/4W, 1%, 3.83K	CORNING	RN60D	2
118	R174	4.32K			1
119	R66, R69	4.75K			2
120	R144	4.99K			1
121	R67, R68	6.98K			2
122	R102, R131	8.25K			2
123	R152	8.87K			1
124	R183	6.19K			1
125	R159	1W, 1% 681Ω	IRC	MEC EN70D	1
126	R105	1/4W, 1% 6.19K	CORNING	RN60D	1
127	R141 #	140Ω			1
128					
129		MATCHED RESISTORS			
130	R109, R110	METALFILM, 1/4W, 1% 249K (-1)	CORNING	RN60D	2
131	R118, R119	(-2) 4.02K			2
132	R103, R106 R108, R111	(-4) 10K			4
133					
134					
135					
136	SW1-C, -D	WAFER	WAVETEK	130-SW1-3	2
137	SW1-A		CTS	T106	
138	SW1	DETENT	WAVETEK	130-SW1	1
139	SW1-B	WAFER		-2	1
140	SW3	SWITCH		130-400	1
141					
142					
143	A1	SINE MODULE	WAVETEK	B130-011	1
144		BRACKET ASSY		D130-001	1
145		HEATSINK		A130-311	1
146		SUPPORT BLOCK		A130-328	1
147		TRANSFORMER BRKT.		A130-306	2
148		CIRCUIT BD		130-110J	1
149					
150					
151					
152		TRANSISTOR HEATSINK	WAKEFIELD	NF-207	2
153					
154		TRANSIPAD	M. ROSS	10123N	13
155				10160	2
156	T, T*	TERMINAL			AR
157					
158		SOLDER LUG	SMITH	1497	1
159					
160	I1	LAMP	MURA	L28/40	1
161					
162					

	rev	ecn	by	date	app.
J		ECN 446	DJ	7/19/72	
H		ECN 426	Sand	4/24/72	
G		ECN 369	NG	1/28/72	T.O.
F		ECN 357	JAE	11/21/71	T.O.
E		ECN 341	NG	9/24/71	T.O.
D		ECN 336	NG	8/24/71	T.O.
C		ECN 300	NG	6/14/71	WO
B		ECN 300	NG	3/9/71	WO
A		ECN 283	BB	11/16/70	WO

tolerance unless otherwise specified: XXX ± .010, XX ± .030

WAVETEK san diego, calif

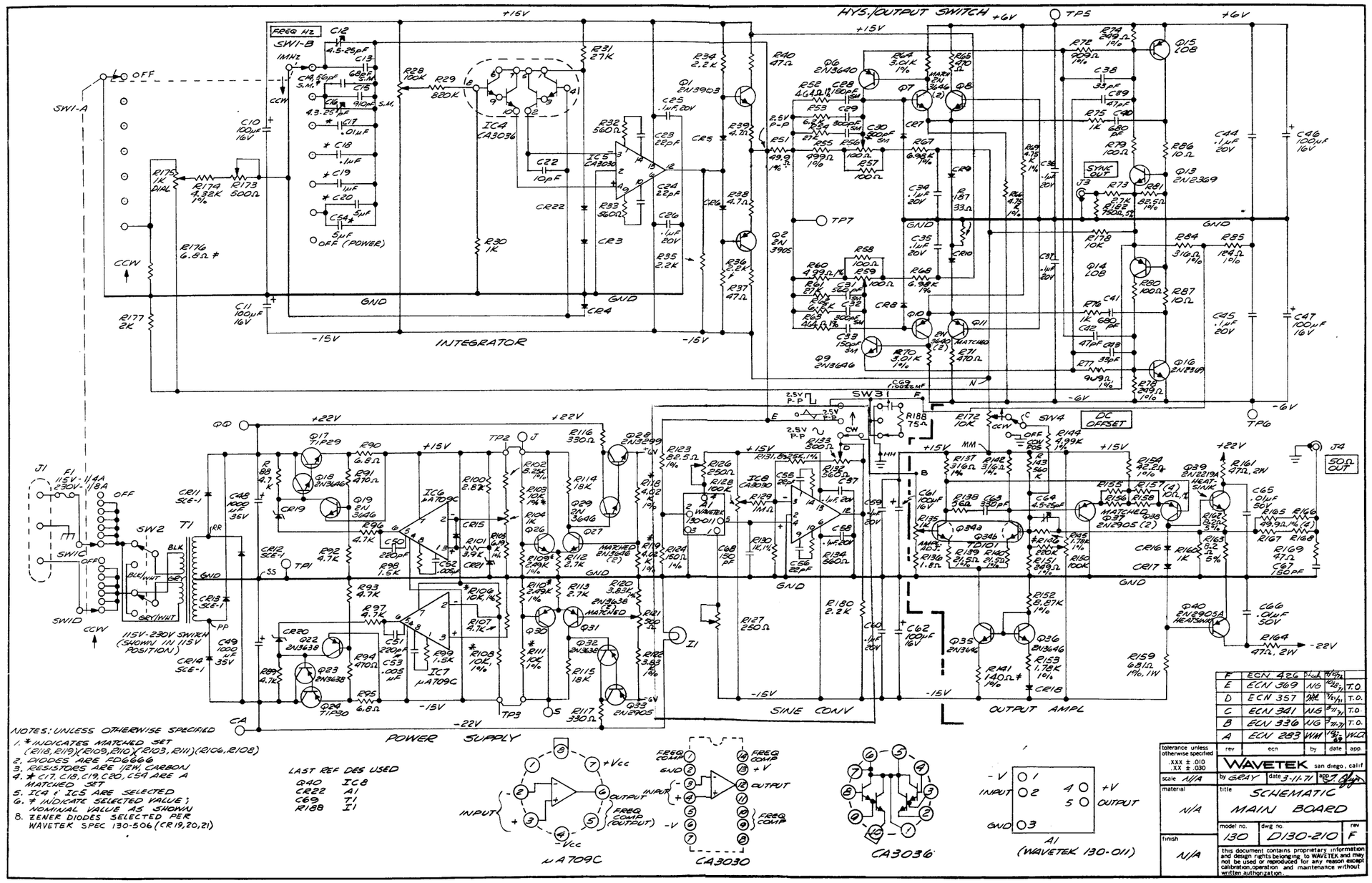
scale N/A | by GRAY | date 5-24-71 | app. J. Olsen

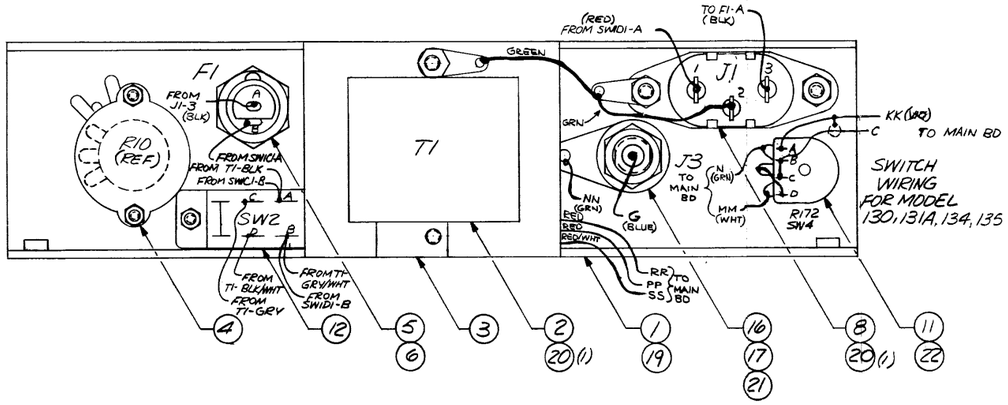
material: N/A

finish: N/A

title: ASSEMBLY, MAIN BOARD

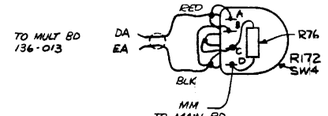
model no. 130 | dwg no. D130-010 | rev J


HYST/OUTPUT SWITCH
INTEGRATOR
SINE CONV
OUTPUT AMPL
POWER SUPPLY
SCHEMATIC
MAIN BOARD
WAVETEK
D130-210
NOTES: UNLESS OTHERWISE SPECIFIED
1. * INDICATES MATCHED SET (R118, R119)(R109, R110)(R103, R111)(R106, R108)
2. DIODES ARE FD666
3. RESISTORS ARE 1/2W, CARBON
4. * C17, C18, C19, C20, C54 ARE A MATCHED SET
5. IC4 & IC5 ARE SELECTED
6. # INDICATE SELECTED VALUE; NOMINAL VALUE AS SHOWN
8. ZENER DIODES SELECTED PER WAVETEK SPEC 130-506 (CR19,20,21)
LAST REF DES USED
Q40 IC8
CR22 A1
C69 T1
R188 I1
μA709C
CA3030
CA3036
A1 (WAVETEK 130-011)
50Ω OUT
DC OFFSET
SYNC OUT
F ECN 426
E ECN 369
D ECN 357
C ECN 341
B ECN 336
A ECN 283



SWITCH WIRING FOR MODEL 130, 131A, 134, 135

PARTS LIST						
ITEM	REF DES	DESCRIPTION	MFGR	MFGR NO	QTY	
1		BRACKET	WAVETEK	B130-302F	1	
2	T1	TRANSFORMER		C130-500	1	
3		TRANSFORMER BRACKET		A130-306	1	
4		STANDOFF (MODEL 130 ONLY)	HH SMITH	2342	2	
5	F1	FUSE, 1/8AMP-115V	LITTELFUSE	313.250	1	FOR 115V MODEL
6		FUSE HOLDER		342012	1	
7		FUSE 1/8AMP, 230V		313.125	1	FOR 230V MODEL
8	J1	POWER RECEPTACLE	SWITCHCRAFT	LAC3-G	1	
9	R76	RESISTOR 1/2W 10% CARBON 24K	STACKPOLE	RC20GF242K	1	MODEL 136 ONLY
10						
11	R172, SW4	DC OFFSET SWITCH 10K/SPST	CTS	UL5186	1	
12	SW2	115-230V SWITCH	SWITCHCRAFT	A6256LF SOLDER GUARD	1	
13						
14						
15						
16	J3	BNC CONNECTOR	KING	KC7946	1	
17		SHOULDER WASHER	SMITH	2668	2	
18						
19		FASTENERS #6-32	SOUTHCO	74-11-106-13	4	
20		SOLDER LUG	H.H.SMITH	1414-4	2	
21		SOLDER LUG		1497	1	
22		KNOB	ELMA	020-222	1	
23		MICA INSULATOR	WAVETEK	A140-307A	1	
24						
25						



SWITCH WIRING FOR MODEL 136

rev	ecn	by	date	app.
D	J1 WAS AC3-G	SL	2/17/72	SL
C	ECN 341	NG	4/18/71	
B	COP 29	NG	2/16/71	
A	ECN 283	BB	11-9-69	WD

tolerance unless otherwise specified .XXX ± .010 .XX ± .030

scale N/A

material N/A

finish N/A

WAVETEK san diego, calif

by BOCHICHIO date 7-21-69 app. J Olds

title ASS'Y, BRACKET

model no. 130-136 | dwg no. D130-001 | rev D

9045 Balboa Ave., San Diego, California Tel. 279-2200, P.O. Box 651, San Diego, California 92112