TM 11-6625-2955-14&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT

AND

GENERAL SUPPORT MAINTENANCE MANUAL

FOR

SWEEP GENERATOR SG-677A/U

(NSN 6625-01-074-4337)

H E A D Q U A R T E R S, D E P A R T M E N T O F T H E A R M Y

22 JANUARY 1980

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Dangerous potentials exist at several points throughout this equipment. When the equipment is operated with the cover removed, DO NOT touch exposed connections or components. Disconnect power before cleaning the equipment or replacing parts.

DON'T TAKE CHANCES!

WARNING

Adequate ventilation should be provided while using TRICHI.OROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating, Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 January 1989

Operator's, Organizational, Direct Support and General Support Maintenance Manual Sweep Generator SG-677A/U (NSN 6625-01-074-4337)

TM 1l-6625-2955-14&P, 22 January 1980, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

Remove pages	Insert pages
1-1 and 1-2	1-1 and 1-2
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5-11 and 5-12	5-11 and 5-12

2. File this change sheet in front of the publication for reference purposes.

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To be distributed in accordance with DA Form 12-36 Operator, Unit, and DS/GS requirements for SG-677A/U.

TECHNICAL MANUAL
NO. 11-6625-2955-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, *DC 22 JANUARY 1980*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS FOR

SWEEP GENERATOR SG-677A/U (NSN 6625-01-074-4337)

REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028 located in the back of the manual. Simply tear out the self addressed form, fill it out as shown on the sample, fold it where shown, and drop it in the mail.

If there are no blank DA Form 2028-2 in the back of your manual, use the standard DA Form 2028 (Recommended Changes to Publications and Blank forms) and forward to the COMMANDER, US Army Communications and Electronics Readiness Command, ATTN:DRSEL–ME-MQ, Fort Monmouth, NJ 07703

In either case a reply will be furnished direct to you.

CONTENTS

CONTENTS continued

CONTENTS continued

LIST OF ILLUSTRATIONS

SECTION 1
GENERAL INFORMATION

1.1.0 SCOPE

This manual describes Sweep Generator **SG-677A/U** (hereinafter referred to as "instrument"). It covers the purpose, use, instructions for installation and operation, and the technical characteristics of the SG-677A/U. The following maintenance categories are covered: operator/crew (C), organization (O), direct support (F), and general support (H).

1.1.1 Consolidated Index Of Army Publications And Blank Forms

Refer to the latest issue of DA Pam 25-30 to etermine whether there are new editions, changes or additional publications pertaining to the equipment.

1.1.2 Maintenance Forms, Records And Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maitenance will be those prescribed by DA Pam 738-750, as contained in Maintenance Management Update.

b. Report of Item Packaging Discrepancies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-1l-2/DLAR 4140.55/SECNAVINST 4355. 18/AFR 400-54/MCO4430.3J.

c. Transportation Discrepancy Report (TDR) (SF 361). Fill out and forward Transportation Discrepancy Report (TDR) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1.1.3 Reporting Equipment Improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to: Commander, U.S. Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey, 07703-5000. We'll send you a reply.

1.1.4 ADMINISTRATIVE STORAGE

There is no special procedures for preparing this equipment for limited storage. Place all ancillary items in a bag and tie or tape the bag to the quipment. Place equipment in limited storage, ie, organizational storage room. Protect equipment from dust, humidity, and extreme temperature changes.

1.1.5 DESTRUCTION OF ARMY MATERIEL

Instructions for destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1.2 DESCRIPTION AND DATA

1.2.0 PURPOSE AND USE

Sweep Generator SG-677A/U is a rugged, compact, all-solid-state sweep/signal generator covering the 1-1400 MHz frequency range in three bands. It is well adapted to both sophisticated laboratory applications and automated testing procedures.

Each of the three frequency range bands (1-500, 450-950, and 900-1400 MHz) may be used in C W, Δf, S/S or manual mode. Sweep triggering may be internal (recurring), external, or manual. Sweep repetition rate ranges from 1 swp/ 100 sec to 50 swp/sec. Provision is made for remote programming of center frequency, sweep width, and 20 dB of attenuation.

Three crystal-controlled harmonic birdy markers (1, 10, 50 MHz) are included in the instrument, with provision made for three more (single frequency or harmonic), if desired. Marker size, width, tilt, and shape (rectified for X-Y plotter applications or non-rectified for normal viewing) are all controlled from the instrument front panel. Each marker has its own individual front-panel on/off switch.

1.2.1 RF SPECIFICATIONS

Frequency Range	1 to 1400 MHz in three overlapping bands Band 1 1 to 500 MHz Band 2 450 to 950 MHz Band 3 900 to 1400 MHz
Frequency Dial Calibration	10 MHz intervals
Accuracy	1 to 500 MHz 10 MHz 450 to 1400 MHz ± 2% of selected freq.
Drift	100 kHz/5 minutes - 2 MHz/8 hours (after 1/2 hour warm-up at a constant ambient, and allowing a 5 minute stabilizing period after a frequency change).
Impedance	50 ohms
RF Output Amplitude	Continuously adjustable from +10 to – 80 dBm; 70 dB in 10 dB steps, plus a 20 dB vernier, calibrated in 1 dB increments. Step attenuator and vernier attenuator accuracy: Up to 500 MHz ±0.5 dB Up to 1000 MHz ±dB Up to 1400 MHz ±2 dB

Flatness at +10 dBm	±0.5 dB from 1 to 1400 MHz
Residual FM	Less than 15 kHz
Spurious and Harmonic Signals	1 to 10 MHz, 20 dBc 10 to 1400 MHz, 26 dBc
Blanking	Retrace blanking of the RF output provided for sweep operation. Removed for CW operation.
SWR	Less than 1.5

1.2.2 SWEEP SPECIFICATIONS

Operating Modes	S/S, Δf, CW
Sweep Modes	Repetitive sweep Single sweep Externally triggered sweep Manual sweep Line lock sweep
Sweep Width	100 kHz to 500 MHz calibrated in 10 MHz intervals
Accuracy	Band 1 ±10 MHz Band 2 ±20 MHz Band 3 ±20 MHz
Sweep Time	Continuously variable from less than 10 ms to more than 100 seconds in 4 decade steps plus vernier.
Display Linearity	2%
Horizontal Output	0 to 10 V sawtooth

1.2.3 REMOTE PROGRAMMING

A Rear Panel REMOTE Jack provides necessary connections for Remote Control of frequency, sweep width and the 0 to 20 dB vernier OUTPUT control. This jack also provides connections for external AM and FM.

Center Frequency	May be remotely programmed within the selected band by a ±16 V signal. (-16 volts corresponds to LOW frequency band end and +16 volts to HIGH frequency band end) Tuning sensitivity: 16 MHz/volt (approx.)
Sweep Width	May be controlled by a remote potentiometer. (Input and output connection provided in Rear Panel REMOTE jack)
Vernier 0-20 dB Output	May be remotely programmed over a 20 dB range with a 0 to -18 volt signal (-18 volts corresponds to maximum output)

External AM	External AM signals are applied to same connections as for vernier 0-20 dB control. Therefore, vernier range must be restricted so the 0 to -18 volt range is not exceeded or distortion will occur. With average voltage set to mid-range, 100% modulation is possible to 1 kHz, 40% modulation possible to a 40 kHz rate.

1.2.4 EXTERNAL LEVELING

External Monitor (ALC)	An external negative signal, between 0.2 and 2 volts, may be used to level the RF output.

1.2.5 MARKER SPECIFICATIONS

Type	Birdy by-pass, single frequency or harmonic (comb).
Frequency	1, 10, 50 MHz harmonic intervals standard. Provision for three additional (single frequency or harmonic) is included.
Accuracy	0.005%
Marker Width	Adjustable from (approx.) 15 to 400 kHz in four steps
Marker Size	
Large	Adjustable from (approx.) 12 V to 15 mV peak-to-peak
Small	Adjustable from (approx.) 50 mV to 100 μV peak-to-peak
Rectified Birdy (for X-Y plotters)	Size varies with detector's impedance. Adjustable from (approx.) 6 V to 1 mV with detector impedance of 1 meg ohm, or from 0.5 V to 1 mV with detector impedance of 0 ohms. Rectified birdy is positive polarity.
Marker Tilt	Provides horizontal markers which have a size equal to approximately 10% of horizontal display. Adjustment of marker size vectorily adds the normal vertical marker to the horizontal marker, causing the resulting marker to vary from a horizontal position toward a vertical position.

1.2.6 GENERAL

Power Requirements	1 15/230 VAC ±10% (approximately 20 W) 50 to 400 Hz
Dimensions (including screw heads, knobs, and feet)	14.3 cm (5 5/8) in. high 34.9 cm (13 3/4) in. deep 20.1 cm (8 1/4) in. wide
Weight	20 Ibs net 25 Ibs. shipping

SECTION 2
INSTALLATION

2.1 MECHANICAL INSTALLATION

2.1.1 Initial Inspection

After unpacking the instrument, visually inspect the external parts for damage to knobs, connectors, surface areas, etc. The shipping container and packing material should be saved in case it is necessary to reship the unit.

2.1.2 Rack Mounting

The instrument is 1/2 rack size and two rack mounting kits are available. The K103 kit provides the necessary hardware to mount the unit to either the right or left of a standard 5 1/4" x 19" opening. The K104 kit provides the necessary hardware to rack mount two instruments. This provides a 7" x 19" package. Facilities are provided for Front Panel mounting of instrument Rear Panel connectors.

2.1.3 K103 Rack Mounting Kit (Refer to Figure 2-1)

CONTENTS

Item	Qty .	Part No.
A (Side)	1 ea.	B000-608
B (Side)	1 ea.	C000-691
C (screw)	8 ea.	HS101-806

Procedure:
Remove the screws from one side panel at a time. Mount item A or B against the side panel of the instrument and secure with screws provided (item C). Repeat operation for other side. NOTE: Items A & B may be interchanged to position the unit to the side of the rack desired.

2.1.4 K104 Rack Mounting Kit (Refer to Figure 2-2)

CONTENTS

Items	Qty.	Part No.
A (Tray)	2 ea.	C000-729
B (Side)	2 ea.	A500-230
C (Screw)	12 ea.	HS106-905

Procedure:
Install both sides (item B) to one tray (item A) using 10-32 x 5/16" screws (item C). Position the intrument on the tray so that the feet extend into the provided holes. Other instruments not exceeding 5¼" x 8" may also be mounted by drilling additional holes for their feet.

When one or both instruments are properly seated, install the other item "A" and secure with the remaining screws (item C).

NOTE: If the instrument has been supplied with a bail, it must be removed before installing in the K104 rack mounting kit.

2.2 ELECTRICAL INSTALLATION

2.2.1 Primary Power Requirements

These instruments operate from either 115 VAC or 230 VAC supply mains as selected by a Slide Switch located on the Rear Panel. Before operating the instrument, check that the fuse mounted in the Rear Panel Fuse Holder corresponds to the correct value for the selected voltage; i.e., 0.5 amp for a 115 VAC, and 0.25 amp for 230 VAC.

The power supply has been designed to operate from 50 to 400 Hz supply mains, however, the line operated sweep rate function must be adjusted to the line frequency.

Instruments are shipped from the factory for operation at 115 VAC, 60 Hz unless otherwise specified.

2.2.2 Performance Checks

The electrical performance of this instrument should be verified. Performance checks for incoming inspection are given in Section 5, Maintenance.

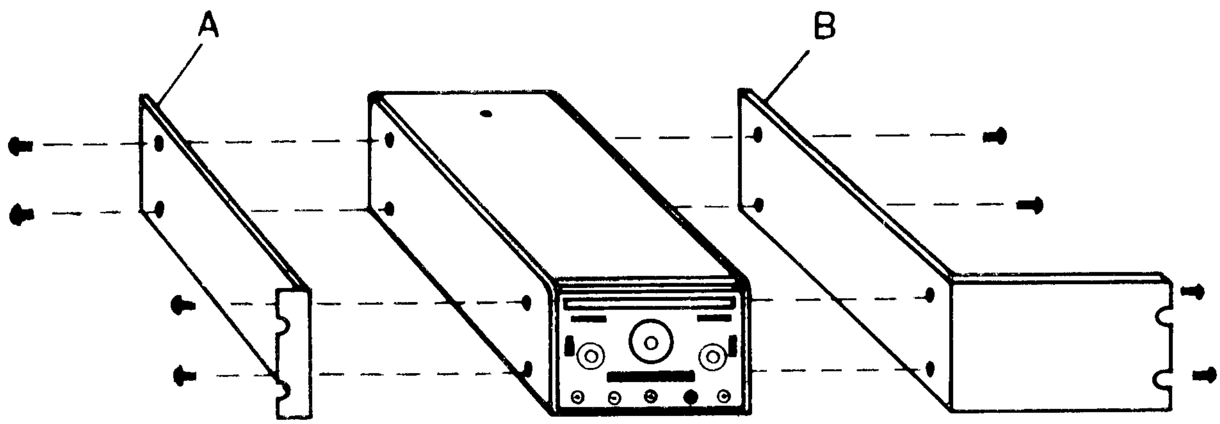


Figure 2-1. K-103 Rack Mounting

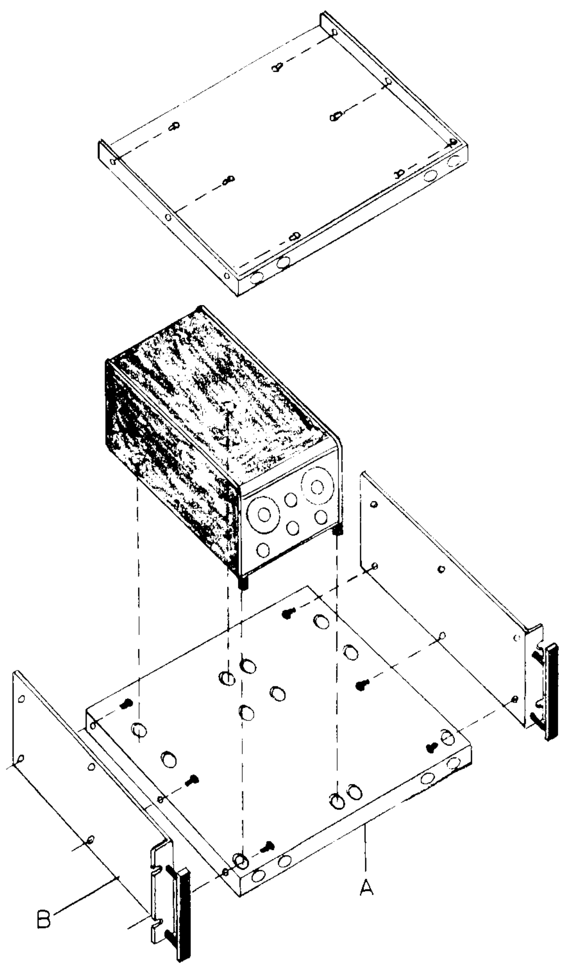


Figure 2-2. K-104 Rack Mounting

SECTION 3
OPERATING INSTRUCTIONS

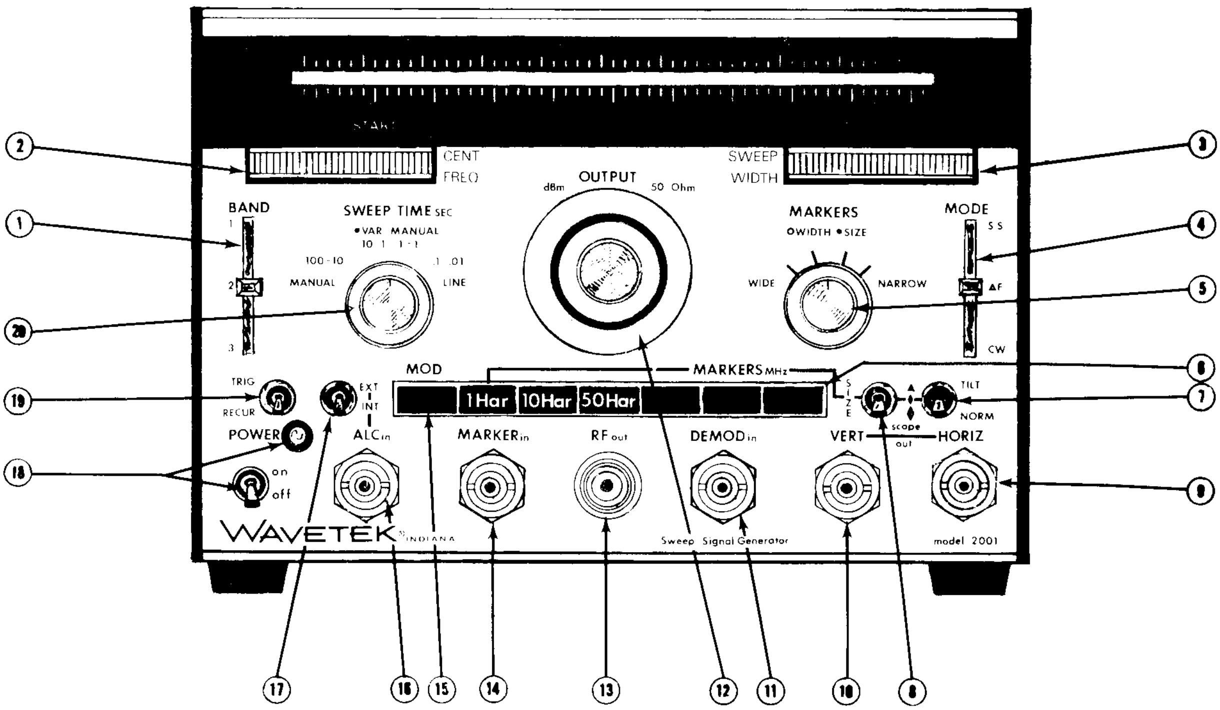


Figure 3-1. Front Panel

3.1 INTRODUCTION

This section provides complete functional control description, operating instructions, and programming instructions for the instrument.

In addition, special operating notes cover sweep rate errors, overloading, low level measurements and operation with networks analyzers and X-Y plotters.

3.2 DESCRIPTION OF FRONT PANEL (Refer to Figure 3-1 for control location)

(1) BAND switch-	Selects band 1 (1-500 MHz), band 2 (450-950 MHz), or band 3 (900-1400 MHz).
(2) START/CENTER FREQ.-	Controls start frequency when MODE switch is set to S/S (start/stop) or center frequency when MODE switch is set to AF and CW.
(3) STOP/SWEEP WIDTH-	Controls stop frequency when MODE switch is set to S/S (start/stop) or sweep width when MODE switch is set to ΔF.
(4) MODE switch-	Selects S/S (start/stop), ΔF, or CW (continuous wave) operation.

(5) MARKERS O WIDTH • SIZE - Dual concentric control; outer knob adjusts marker width from 15 to 400 kHz in four steps; inner knob controls marker size.

(6) MARKERS MHz - Six push button switches control Al and A2 marker options (marker frequency is engraved on push button) (i.e. 1 Har, 10 Har, 50 Har...).

(7) TILT/NORM switch- Provides vertical markers in the NORM (down) position. In the TILT (up) position, provides horizontal markers having a fixed amplitude of approximately 10% of the horizontal display when MARKER SIZE is set to minimum.
NOTE: Increasing the marker size will cause the horizontal marker to tilt toward a vertical position. This feature is used to identify frequencies on steep response skirts.

(8) MARKER–SIZE switch- This three position switch provides: large markers in its lower position (12 V to 50 mV peak-to-peak), small markers in its center position (50 mV to 100 UV volts peak-to-peak) and rectified positive markers in its up position. These rectified markers are for use with X-Y recorders.

(9) HORIZ. SCOPE OUT- BNC connector provides a 16 volt peak-to-peak triangle wave, symmetrical about ground, to drive the Horizontal (x) axis of the oscilloscope or other indicating device. (An alternate connection is available at the real panel.)

(10) VERT SCOPE OUT- BNC connector provides the combined markers and demodulated RF (when DEMOD in is connected) for connection to the oscilloscope Vertical (y) axis input.

(11) DEMOD IN- BNC connector accepts the demodulated, swept, signal from the device under test so RF markers may be added. (The combined signal is available at the VERT. SCOPE OUTPUT connector).

(12) OUTPUTdBm-50 ohm- Attenuator; outer knob provides calibrated adjustment of the RF output in 10 dB increments from O dBm to -70 dBm, inner knob provides calibrated vernier adjustment of the RF output from +10 dBm to -10 dBm.

(13) RF OUT- “N” connector provides a connection for RF output signal.

(14) MARKER in – BNC connector accepts an externally generated continuous wave signal to produce a frequency marker on the display.

(15)MOD- Not used.

(16) ALC IN - BNC connector accepts an automatic leveling control signal from a remote monitor when EXT/INT switch is in the EXT (up) position.

(17) EXT/INT switch - Closes the internal automatic leveling loop when in INT (down) position. NOTE: When this switch is in the EXT position, and no external monitor is in use, the RF output is unleveled and not controlled by the 20 dB vernier attenuator.

(18) POWER - Switch applies AC power to power supply. Green LED indicates operation.

(19) TRIG/RECUR switch - Selects recurring sweep of the time selected by SWEEP TIME control when in RECUR (down) position and with MODE switch in either S/S or Δf. When TRIG/RECUR switch is in the center position, the sweep may be triggered for single sweep operation by momentarily contacting the TRIG (up) position.

(20) SWEEP TIME Sec.
VA R/MANUAL control – This is a six position switch control. The outer knob provides selection of MANUAL, LINE or four decade ranges of variable sweep time. The inner knob provides manual frequency sweep when SWEEP TIME Sec. switch is set to MANUAL, and variable adjustment of sweep time in each of the four decade ranges. (The sweep may be triggered in the four decade ranges only.)

3.3 DESCRIPTION OF REAR PANEL (Refer to Figure 3-2 for location)

(1) AC LINE SWITCH 115V/230V Selects 115 or 230 V line voltage

(2) AC LINE INPUT 50/60 Hz — 3 prong plug provides connection to AC mains.

(3) AC LINE FUSE- .5A 115V
.25A 230 V — 0.5 A for 115 VAC or 0.25 A for 230 VAC.

(4) REMOTE jack- — Provides connection for programming of frequency, sweep width and R F output level. (See Section 3-6 for detailed instructions.) This jack is supplied with a mating "jumpered plug" which provides front-panel control.

(5) SCOPE HORIZ. jack- — BNC jack provides connection to (X) axis of oscilloscope or plotter. This connector is in parallel with the SCOPE HORIZ. connector located on the front panel.

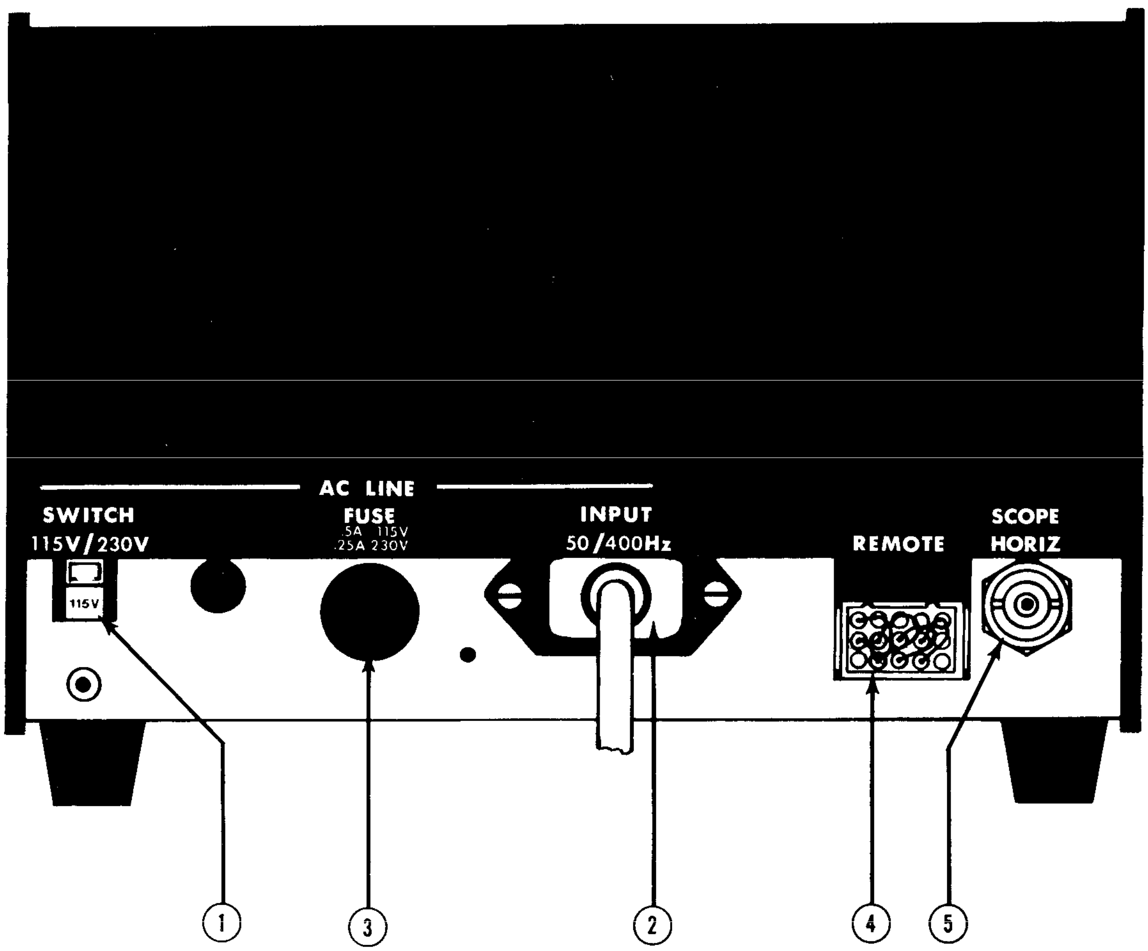


Figure 3-2. Rear Panel

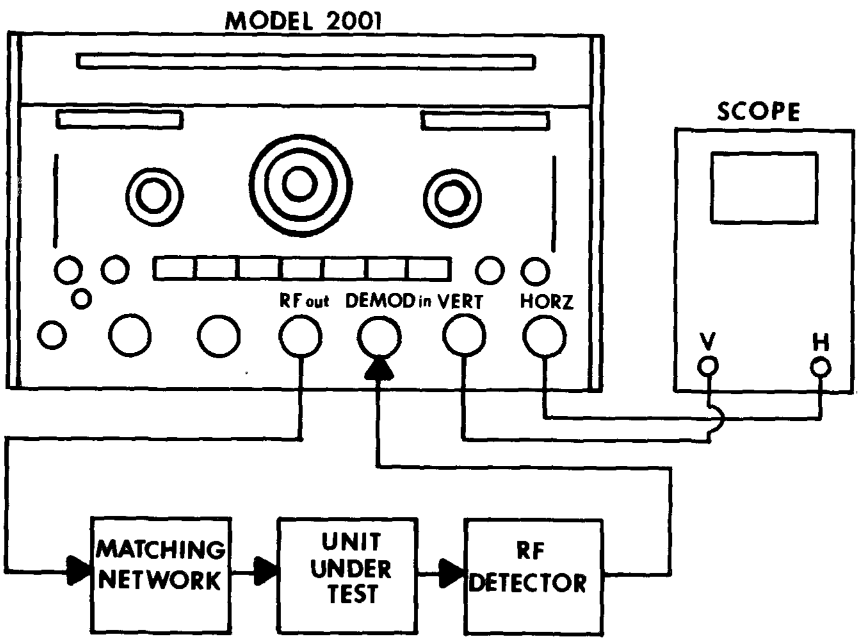


Figure 3-3. Typical Operating Set-up

3.4 TYPICAL OPERATING SET-UP

When initially setting up instrument, first check rear panel AC LINE VOLTAGE selector switch and fuse to ensure the instrument is set for operation with the available AC mains.

Make connections between the instrument, the unit under test, and the oscilloscope as shown in Figure 3-3. Since hum, RF leakage, and spurious signal pick-up must be kept to a minimum, it is essential that good connections and grounds be maintained throughout the entire setup. Use coaxial cables with BNC connectors wherever possible. The RF output cable is especially critical. It should have a characteristic impedance of 50 ohms, and should be kept as short as practical (under 3 feet). If the input impedance of the unit under test is not 50-ohms, a matching network, as shown in Figure 3-3, should be used to ensure a constant amplitude input signal to the unit under test.

After the RF signal passes through the RF circuit of the unit under test, it must be demodulated before being connected to the DEMOD IN of the instrument. If a demodulator is not a part of the unit under test, one must be added externally. (See Figure 3-3.) The input impedance of the demodulator must present the proper load to the RF circuit being tested. The Wavetek Model D151A RF Dectector (included with the instrument) is recommended.

Turn the POWER switch on. The green LED should light, indicating an operating condition.

(Note: This instrument does not require a warmup period unless it is to be used at the extreme limits of its specifications.)

After completing the set-up, adjust the instrument controls for the required center frequency, sweep width, output amplitude, and sweep rate. Turn the desired markers on, and adjust their size and width.

3.5 SPECIAL OPERATING NOTES

3.5.1 Errors From Sweep Rate Effects

When sweeping RF circuits having rapid amplitude changes, errors may occur, due mainly to detector delays. Decreasing the detector output time constant will minimize this effect. Figure 3-4 Illustrates sweep rate effect.

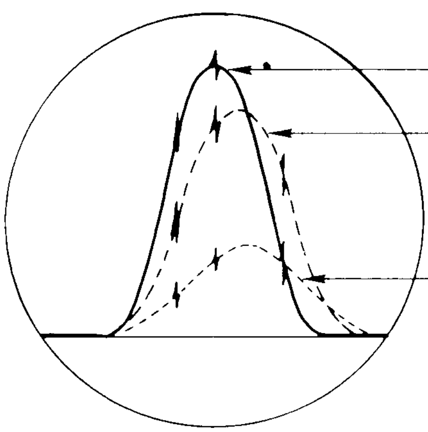


Figure 3-4. Sweep Rate Effects

To check for sweep rate effect, first set the sweep width to its lowest practical amount, then reduce sweep time while closely observing the swept output response. Any change in the response indicates the sweep rate is too fast for a true response. When a further reduction of sweep time does not change the response, a true response has been obtained.

3.5.2 Effects From Overloading

The use of excessive signal from the instrument can overload the receiver circuits. To assure that this condition is not present, and that the response is a true representation of the unit under test, turn the OUTPUT controls to minimum output amplitude. Gradually increase the output amphtude until a response is obtained. Further increase of the output amplitude should not change the configuration of the response envelope except in amplitude. If the response envelope does change, such as flattening at the top, decrease the output just far enough to restore the proper configuration.

353 Making Measurements At Low Levels

When making measurements at low levels, radiation and ground loops become problems. Using double shielded cables for cables carrying RF signals helps minimize the radiation problem. Ground loops causing hum pick-up can sometimes be eliminated by completing only one ground connection between each instrument. This applies particularly to the scope horizontal input. If the ground connection is made at the vertical input terminal, an additional ground at the horizontal input terminal will often result in hum pickup.

35.4 Operation With Network Analyzers

To operate properly with certain network analyzers several modifications might be required. Some analyzers require the removal of the blanking signal during the sweep return trace. This can be accomplished by disconnecting the single wire connected to pin 10 of the MIH Module.

Section 3.5.5 is deleted.

3.5.6 Operation With An External Monitor

Operation with an external monitor can produce a flatter (less amplitude variation) input signal to the unit under test than is obtainable with the internal monitor, since the monitor point is located atthepoint where greatest flatness is desired, and is not affected by cable VSWR or input impedance of the unit under test. Another application is to level at the output point of a wide band power amplifier, in order to increase the output power capability of the instrument.

To operate with an external monitor, first set the OUTPUT controls for maximum, +10 dBm. Next, connect the output from the external monitor to the Front Panel BNC jack labeled ALC IN and set the ALC EXT/INT Switch to the EXT position. The signal from the external monitor must be of a negative polarity between 0.2 and 2 volts. If the signal is larger than 2 volts, use a resistive divider to obtain the less than 2 volts signal. While observing the output from the monitor on an oscilloscope, adjust the vernier OUTPUT control until the monitor signal becomes beveled. (Refer to Figure 3-5.)

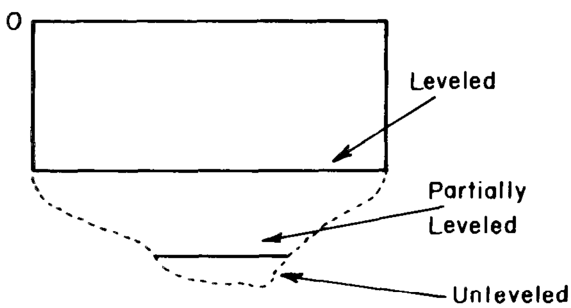


Figure 3-5. External Monitor Output Signal

3.6 PROGRAMMING

Connections for remote operation of output, amplitude, frequency, and sweep width plus external AM and triggering of the sweep circuit are provided by a rear-panel REMOTE programming connector. The programming jack and its pin functions are shown in Figure 3-6.

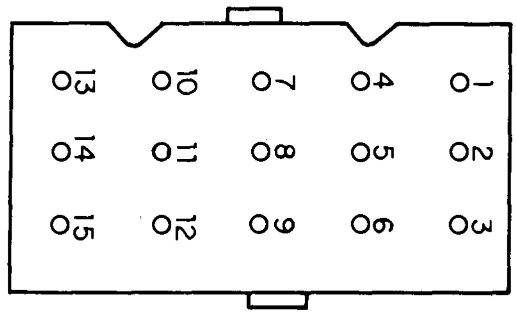


Figure 3-6. Rear Panel REMOTE Jack

VOLTAGE AND SIGNAL SOURCES

Pin 1 – Ground
Pin 2 – +16 volts
Pin 3 – -16 volts
Pin 4 – -18 volts
Pin 10 – Ramp for Driving Sweep Width Control
Pin 15 – Same as Pin 10 Except Inverted

CONTROL INPUTS

Pin 6 – Output Level Control (AM Modulation)
Pin 7 – Sweep Time Trigger Input
Pin 9 – Frequency Control
Pin 12 – Sweep Width Control (FM Modulation)

INTERNAL CONTROL

Pins 5, 8 and 11 are used to program internal operation of Output, Frequency and Sweep Width.

UNUSED

Pins 13 and 14 are unused

3.6.1 OUTPUT AMPLITUDE CONTROL (AM MODULATION)

Normal internal control is provided by a jumper wire connected between pins 5 and 6 of the REMOTE plug as shown below.

To provide external control, remove jumper wire and connect an external OUTPUT Control as shown below. The RF OUTPUT is a linear function of the programming voltage as shown in Figure 3-9.

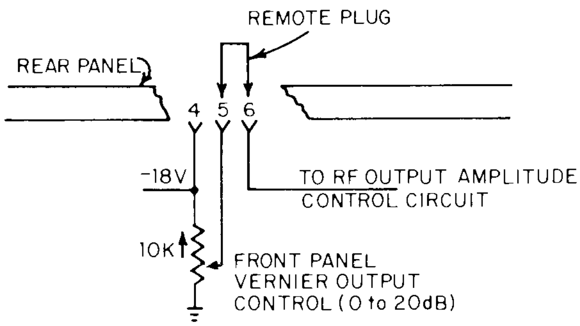


Figure 3-7. Normal Output Control

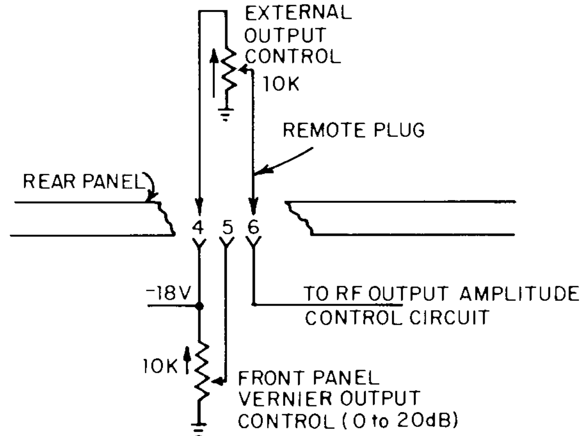


Figure 3-8. External Output Control

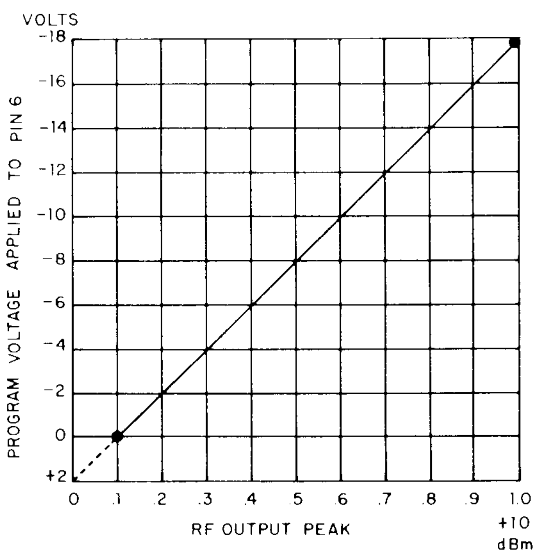


Figure 3-9. Program Voltage/RF Output

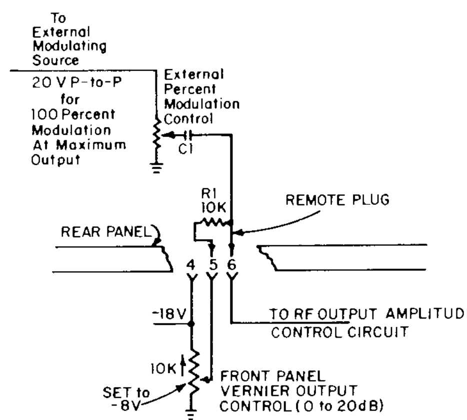


Figure 3-10. External AM

To provide external AM, connect as shown in Figure 3-10. The low frequency modulation will be limited by the reactance of capacitor C1. Lower frequency modulation, down to DC, can be provided with a modulating source having a DC offset. In this case, resistor RI is omitted. In all cases, the peak modulating voltage plus the DC offset must be within the limits of -18 to +2 volts, as shown in Figure 3-9, or distortion will occur. The modulation frequency limits the maximum useable percentage of modulation as shown in Figure 3-11. This graph was obtained with the DC level set to -8 volts.

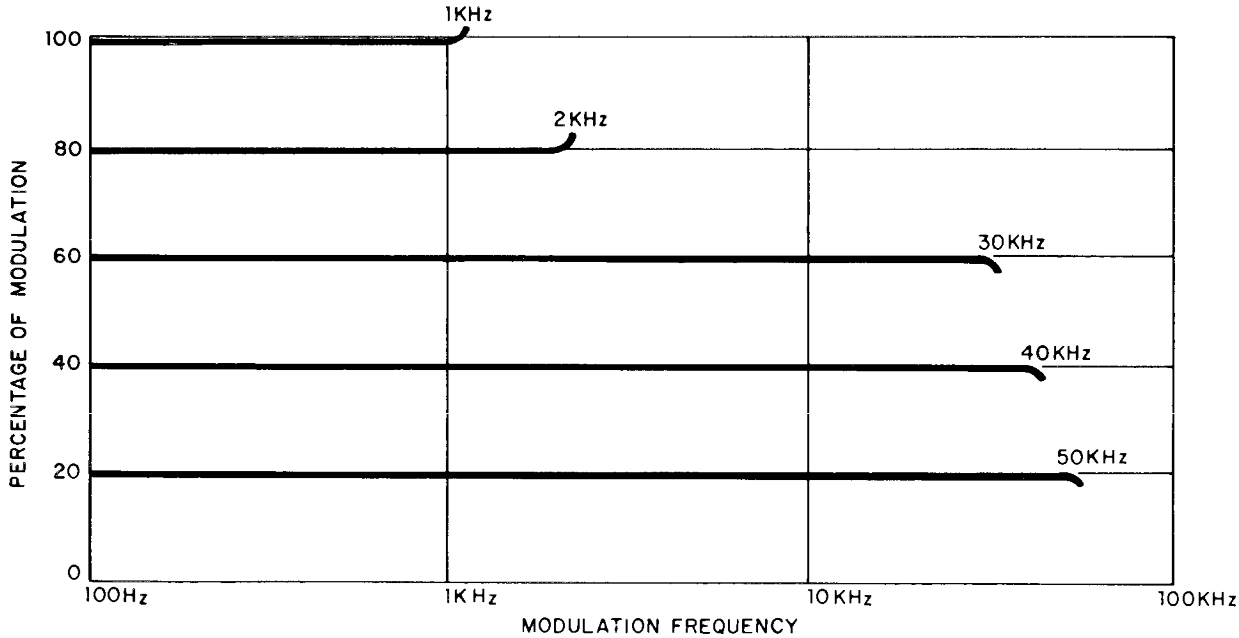


Figure 3-11. Percentage Modulation/Modulating Frequency

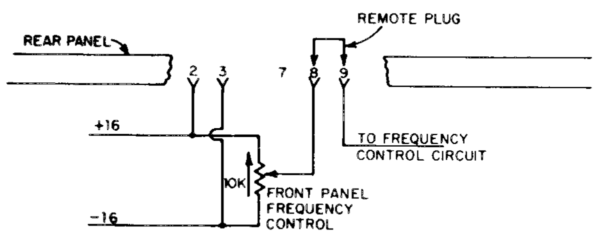


Figure 3-12. Normal Frequency Control

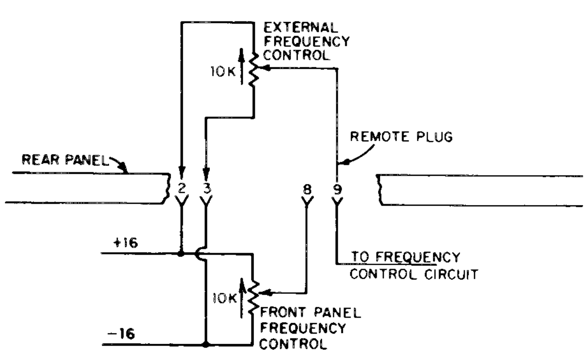


Figure 3-13 External Frequency Control

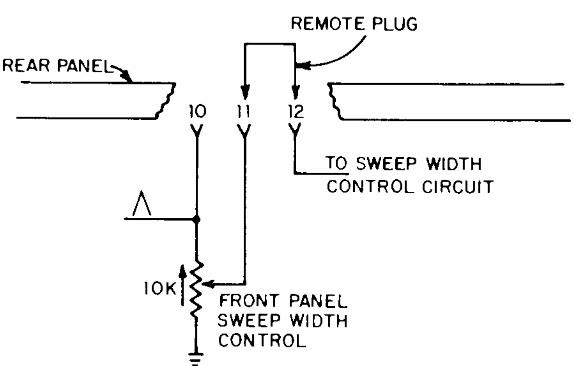


Figure 3-14. Normal Sweep Width Control

3.6.2 FREQUENCY CONTROL

Normal internal control of frequency is provided by a jumper wire connected between pins 9 and 8 of the REMOTE plug as shown in Figure 3-12.

To provide external control, remove the jumper and connect pin 9 to an external Frequency control as shown in Figure 3-13. Tuning sensitivity, which is approximately 16 MHz/volt, is shown graphically in Figure 3-17.

3.6.3 SWEEP WIDTH CONTROL

Normal internal control of sweep width is provided by a jumper wire between pins 11 and 12 of the REMOTE plug as shown in Figure 3-14.

To provide external control, remove the jumper and connect pin 12 to an external Sweep Width control as shown in Figure 3-15.

3.6.4 REMOTE TRIGGERING OF SWEEP TIME CIRCUIT

The sweep time circuit can be remotely triggered by applying a 10 volt positive pulse to pin 7 of the REMOTE plug. For proper operation, the front-panel SWEEP TIME selector must be set for one of the four variable sweep time positions, and the TRIG/RECUR switch set to the TRIG position. The repetition rate of the external trigger should be slower than the frequency running rate set by the front-panel SWEEP TIME selector and VA R/MANUAL control.

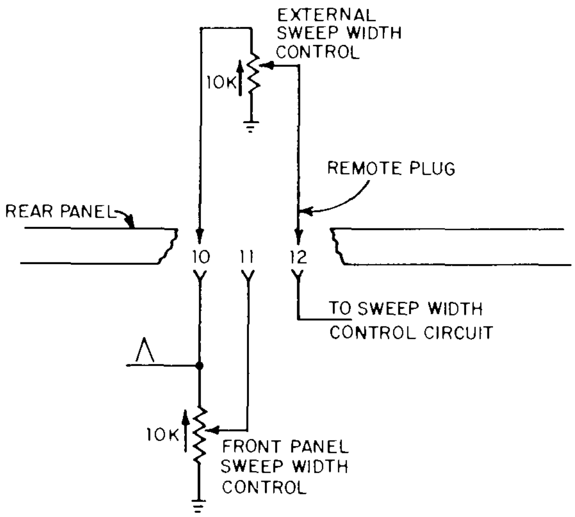


Figure 3-15 External Sweep Width Control

Figures 3-16 and 3-18 are deleted.

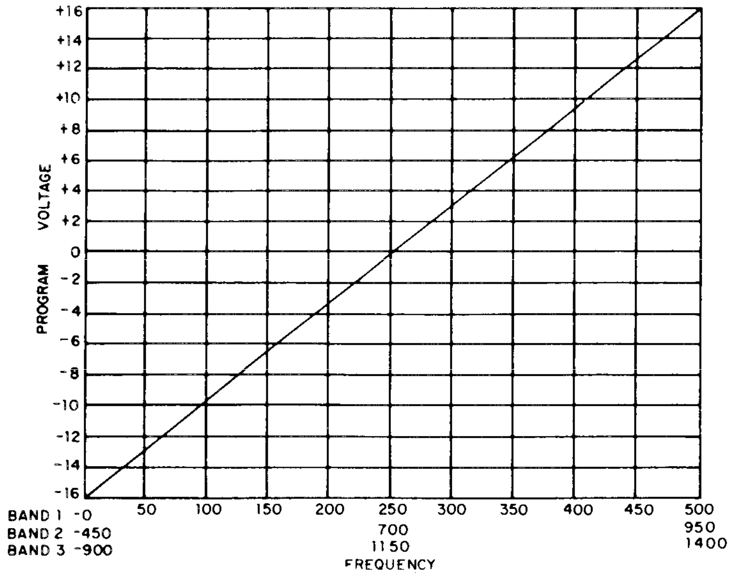


Figure 3-17. Program Voltage (pin 9 or 12) Frequency

3.7 PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurence of trouble, to reduce downtime, and to maintain the equipment in serviceable condition. Defects that cannot be corrected must be reported to personnel at a higher maintenance category.

Routine checks like: cleaning, dusting, washing, checking for frayed cables, storing items not in use, covering unused receptacles, and checking for loose nuts and bolts are not listed as preventive maintenance checks or services. They are things that you should do anytime you see they must be done.

Preventive maintenance checks and services for the instrument are required before use and annually. These checks must be performed during the specified interval.

OPERATOR/CREW PREVENTATIVE MAINTENANCE CHECKS AND SERVICES

B-Before
D-During
A-After
W-Weekly
M-Monthly
Q-Quarterly

Item No.	Interval B	D	A	W	M	Q	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary
1.	•						Physical Condition	Check for physical damage to instrument
2.	•	•					Mechanical Operation	Check mechanical operation of all switches and controls
3.	•	•					Electrical Operation	Check for suitable detected output using oscilloscope

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

B-Before　　A-After　　M-Monthly
D-During　　W-Weekly　　Q-Quarterly

Item No.	Interval B	D	A	W	M	Q	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary
1.						•	Publications	See that all publications are complete, serviceable, and current
2.						•	Knobs and Bulbs	Check condition of knobs and bulbs-replace if necessary
3.						•	Operation	Perform Performance Checks given in Section 5.3

3.8 CLEANING

Inspect the exterior surfaces of the signal generator; exterior surfaces should be clean, free of dust, grease and fungus.

a. Remove dust and loose dirt with a clean, soft cloth.

WARNING

Adequate ventilation should be provided while using TRICHLOROTR IF LOUROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUORO-ETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary use gloves which the solvent cannot penetrate. If the solvent is taken internally, consults physician immediately.

b. Remove grease, fungus, and ground-in dirt from the case; use a cloth dampened (not wet) with trichloroethane NSN 685-00-984-5853.

c. Remove dust or dirt from connectors with a brush,

d. Clean the front panel and control knobs; use a soft, clean cloth. If dirt is difficult to remove, dampen the cloth with water; use mild soap if necessary.

3.9 TOUCH UP PAINTING

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to applicable cleaning and refinishing practices specified in TB43-0118.

SECTION 4
CIRCUIT DESCRIPTION

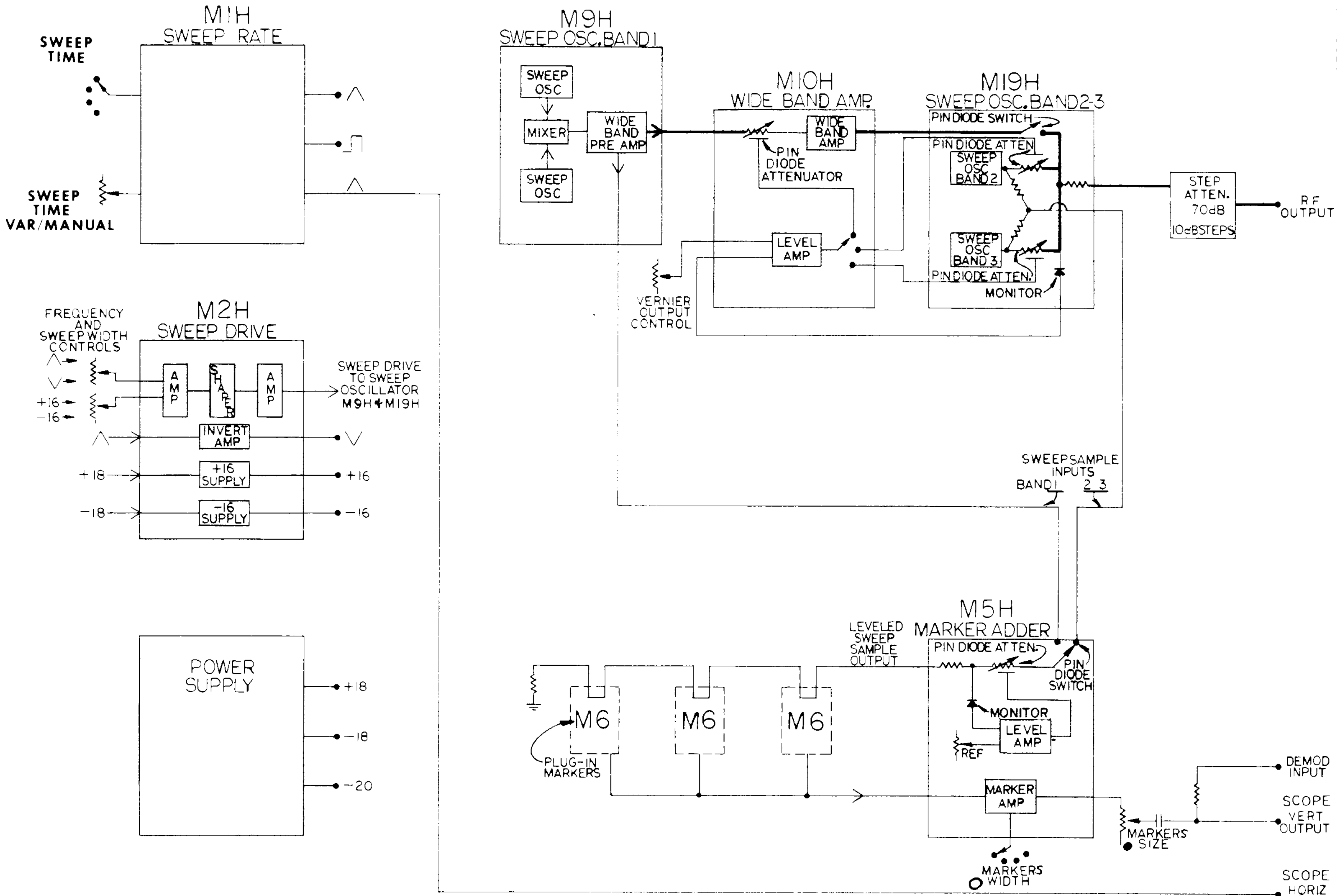


Figure 4-1. Simplified Block Diagram

4.1 MECHANIC ARRANGEMENT

Before beginning the actual circuit description, it would be well to consider the mechanical arrangement of the instrument. This will enable the following block diagram and circuit description to be associated with its physical position, thereby, providing a better understanding of the overall instrument. The mechanical arrangement can be seen by referring to Figure 5-17 in the Maintenance section. This top view shows the front-panel, plug-in module and the rear chassis Power Supply sections.

4.2 SIMPLIFIED BLOCK DIAGRAM

The block diagram in Figure 4-1 contains both block and module information. The blocks contained within each module are indicated by the module outl inc.

The Power Supply provides three regulated voltage sources of +18, -18, and -20 volts for connections to the plug-in modules.

The M1H module generates the sweep ramp, blanking and scope horizontal voltages.

The M2H module contains four distinct circuits; a -16 volt reference supply, a +16 volt reference supply, an inverted sweep ramp supply, and the sweep drive circuits.

The two reference supplies and the two sweep ramp voltages provide the signals to the front-panel frequency and sweep width controls. The signal from these controls is then fed to the M2H Sweep Drive module, where they are combined into a single signal which drives the Sweep Oscillator modules. Necessary level shifting, shaping, and amplitude control are provided by the sweep drive circuit.

The RF signal for band 1 (1 to 500 MHz) is generated in the M9H module where the signals from two sweep oscillators are combined in a diode mixer. The resultant difference signal is fad to a wide band pre-amplifier and then to the M10H module. This module contains a PIN diode attenuator and the final wide band amplifier. The output from this amplifier is then fed to the M19H module where a PIN diode switch completes the circuit to the RF output.

Leveling of the R F output is accomplished by a monitor diode (located in module M19H) which measures the RF voltage and compares it to a reference voltage supplied by the vernier OUTPUT control. Any error between the RF voltage and reference voltage is amplified in the level amplifier located in the M10H module. The error voltage is then connected to the PIN diode attenuator at the input of the wide band amplifier. This closed loop system maintains a constant-amplitude RF signal at the monitor point, which compensates for amplitude variation in the sweep oscillator, mixer, and amplifier circuit, and also creates a zero impedance at the monitor point. In order to create a 50 ohm source impedance, a 50 ohm resistor is connected between the zero impedance point and the RF output system.

The sweep oscillators for bands 2 & 3 are located in the M19H module. The RF output from the oscillators is fed through PIN diode attenuators directly to the RF output circuit without amplification. Leveling for bands 2 & 3 is accomplished in the same manner as for band 1.

The marker circuit is comprised of the Marker Adder module M5H, and the individual marker generators, M6's. In addition to the marker adding function of the M5H module, it also provides for selection and leveling of the sweep sample signal in the same manner as the main RF output signal was leveled. This provides a constant amplitude sweep sample signal to the individual marker modules which is extremely important to obtain a "flat comb" output from the harmonic generating marker modules. It also standardizes the sweep sample amplitude, which insures proper operation of field installed markers.

This leveled sweep sample output is then fed to the individual M6 Marker modules where it is combined in a mixer with a crystal controlled CW signal. The resultant difference signals, which are the birdy markers, are then fed back to the Marker Adder module where they are combined, amplified, and shaped into a single composite signal. This signal is then fed through the control and to the front-panel VERT SCOPE OUT connector.

The following circuit descriptions are referenced to the schematics appearing in Section 6.

4.3 POWER SUPPLY (PS6A) (F02)

The PS6A Power Supply provides three regulated voltages.

AC POWER & RECTIFIER CIRCUITS
A dual-primary transformer allows operation at a line voltage of 115 or 230 volts. AC power is supplied through J201 and POWER switch S201. The transformer is located away from the Sweep Drive module to reduce magnetically coupled line ripple. Unregulated plus and minus voltages are supplied by the bridge rectifier circuit and filtered by CI and C7. P2 provides access to three unregulated voltages as well as the regulated +18, -18, and -20V. This plug also accepts a scope horizontal signal for connection to a rear-panel connector.

+18 VOLT SERIES REGULATOR
Regulation is provided by 1C1 which contains its own internal reference supply. R9 provides an adjustment to +18.00 volts. An external pass transistor, Q2, boosts the current capability, and Q1 improves the current limiting characteristics of 1C1 by providing amplification before limiting. The +18 volt supply is protected against reverse voltage by CR7.

-18 VOLT SERIES – SHUNT REGULATOR
The voltage reference for this supply is obtained from the +18 volt supply through R20, and R19 provides the feedback which is applied to IC2 which provides high gain forcing Q5 to maintain a shunt regulated voltage across R13. Q3 and Q4 provide the series pass element and are connected as a compound emitter follower so that the voltage across R 13 is not loaded heavily. Short circuit protection of Q5 is provided by CR8. Current limiting is provided by Q5 when Q6 conducts sufficiently to forward bias CR9 and CR10. Reverse voltage protection is provided by CR12.

–20 VOLT SERIES REGULATOR
The reference voltage for the –20 V supply is applied to a differential amplifier, Q9 and Q10, which in conjunction with Q8 provides a compound emitter following action similar to the pass element of the –18V supply.

CR 17 provides reverse voltage protection. Current limiting is provided by shutting down of the –18 volt supply by Q7 through CR 14 to the base of Q5, reducing the reference voltage the the base of Q9. This action is helped along by the conduction of CR13 if the -20 volt supply drops below -18 volts.

4.4 SWEEP RATE (MODULE MIH) (F03)

MIH SWEEP RATE GENERATOR
This module generates a variable rate square and triangular waveform. Front-panel switching provides recurring, triggered, or manual modes. The triangular waveform is a 32 volt peak-to-peak signal with a sweep time variable from 10 ms to 100 seconds in four steps. Retrace time is held constant at the fastest sweep time of each range. The triangular waveform is used to provide the sweep drive and the scope horizontal signals.

The square wave (blanking) output is a –1 to +14 volt signal whose –1 volt level corresponds to the sweep time and whose 14 volt level corresponds to the retrace time. The square wave is used to provide blanking of the RF output during retrace time.

Triangular waveforms are generated in an integrator (Q1, Q2, Q3, and Q4) by applying positive and negative voltage levels to the integrator input. When the integrator positive ramp output exceeds a threshold voltage, a hi-stable hysteresis switch is switched, reversing the polarity of the integrator dc input, causing the triangular waveform to start down toward another threshold. If the module is programmed in a recurring mode, the negative ramp will trip the hysteresis switch producing continuous oscillations. The hysteresis switch output is clipped on the negative polarity and is used for blanking (pin 10).

The symmetrical square wave output from the hysteresis switch (pin 9) is connected, through the front-panel SWEEP TIME vernier and one of the range determining resistors of the SWEEP TIME selector switch, to the integrator input (pin 7). Since the integrator output voltage change is proportional to the input voltage level, the SWEEP TIME vernier provides a sweep time increase by reducing the hysteresis switch output if the polarity is negative. If the polarity is positive, full output is retained (a diode opens the vernier ground connection) producing a nearly constant retrace time.

For triggered modes, the negative threshold of the hysteresis switch is shifted out fo the way by a diode and resistor connected through Q14 or through section d of SWEEP TIME switch S102 when in LINE position. The integrator will now continue its negative reamp until it is stopped by a clamp circuit turned on by a comparator. The integrator output is now held at this level unless a trigger is applied to the hysteresis switch. A trigger cannot flip the hysteresis switch until this clamp level is reached because the triggers must pass through an amplifier which is gated off until the clamp comparator (Q9) conducts.

Triggers are prevented from reaching the hysteresis switch (pin 6) by a voltage at pin 1, which causes comparator Q8 to open FET switch Q14. The primary function of the voltage at pin 1 is to shift the clamp comparator input out of the way to allow free-running oscillations.

Since the integrator is an inverting amplifier, and both input (Pin 7) and output (pin 8) are available, a feedback resistor (R102 through R110 on the SWEEP TIME switch) network allows the SWEEP TIME vernier, R 102, to be used as a dc level shifter in the manual mode. A non-inverting amplifier consisting of Q6, Q7 and Q19, with a gain of 2, provides a 32 volt peak-to-peak wave output which is used for sweep drive. This output is divided by RI 8 and R53 and shifted by the 56 kohm resistor mounted between pins 2 and 11 under the instrument chassis to provide a horizontal drive of O to 10 V at an impedance of about 16 kohms. A centering adjustment (R41) provides a dc level adjustment of the integrator and horizontal outputs (pin 8, pin 12, and pin 11) by shifting both positive and negative thresholds of the hysteresis switch. A size adjustment (R45) provides an amplitude adjustment by effectively varying the size of the hysteresis window. Symmetry of trace and retrace time (for equal positive and negative input voltages to the integrator) is established by adjusting the integrator balance control R7. This adjustment also affects the manual mode centering and the sweep period for fully counterclockwise rotation of the SWEEP TIME vernier.

The five sections of the SWEEP TIME selector switch program the Ml H module. The functions of each section are listed below:

Section a	Integrator input selector
Section b	Clamp level shift and routing switch disconnect
Section c	Trigger source selector
Section d	Line trigger routing, and hysteresis switch hold
Section e	Not used

Circuit operation as modified by the switch positions may be understood by considering the MANUAL, VARIABLE RATE, and LINE positions one at a time. (Refer to FO-I.)

MANUAL POSITION

Section a. A feedback resistor R113 is connected from output (pin 8) to input (pin 7) of the M1H Sweep Rate module converting it to an inverting dc amplifier. Resistor R114 shifts the amplifier output dc level to -8 volts for zero input voltage to R 104. When the SWEEP TIME vernier control R102 is fully clockwise, the negative input voltage to R 104 is sufficient to shift the output voltage to +8 volts dc.

Section b. The clamp is disabled in this position by applying +18 V to pin 1, causing the hysteresis switch input to be disconnected from any internal source of triggers by opening the routing switch Q14 (since Q8 is turned off). The shift bias is disconnected when Q14 is open.

Section c. The trigger input point pin 4 is grounded.

Section d. The hysteresis switch is held in one state by applying -18 volts to its input through a 33 kohm resistor. This causes the output to be negative (this bistable circuit is a positive feedback amplifier) providing the proper polarity to R 102 and preventing blanking of the RF output.

VARIABLE RATE POSITIONS (100-10, 10-1, 1-.1, .1-.01)

Section a. Proper integrator input resistors are selected in decade increments in these positions, R 105-R108.

Section b. The clamp is disabled and triggers are held off unless the “pull trigger” switch is opened, removing +18 volts.

Section c. Two trigger sources are connected to pin 4; an external trigger from REMOTE jack J101-7 and triggers from the front-panel monentary TRIG switch S103.

Section d. No connection is made to pin 6 in any of the four variable rate positions.

LINE POSITION

Section a. The proper value integrating resistor is selected, by-passing the SWEEP TIME vernier, to produce equal sweep and retrace perios.

Section b. Clamping works in this position independently of the “pull trig” switch.

Section c. The line rate square wave from the power supply is connected to the trigger input.

Section d. Amplified triggers are routed into the hystersis switch independently of the internal routing transistor, providing additional (redundant) line rate reliability.

4.5 SWEEP DRIVE (MODULE M2H) (F04)

The M2H module provides the correct sweep drive voltage required by each oscillator as programmed by the front-panel tuning controls, SWEEP WIDTH controls, and the MODE switch.

These programs are summed to a standard voltage level and then fed to shaping cirucuits for each band which are enabled by the B-1 and B-2 voltages and by a synthezied B-3 voltage.

The shaping diodes (CR3-CR17) conduct at levels determined by a resistor network (R35-R38) driven by a constant current source, Q7. As each diode conducts, an additional current is fed into the summing junction of the output amplifier consisting of Q12, Q13, and Q14.

The output waveform amplitude is controlled by R72, R76, and R80 which are connected by switch transistors Q15, Q16, and Q17 into the feedback path to the summing junction.

This module also provides two regulated voltages for use primarily as programming voltages and an inverting amplifier to furnish an inverted triangle wave for use in the start/stop mode of programming.

4.6 SWEEP OSCILLATOR, BAND 1 (MODULE M9H) (F06)

The RF sweep signal for band 1 is developed by the hetrodyne method which utilizes two UHF sweep oscillators, a diode mixer, and a wide-band RF preamplifier.

Sweep oscillator, Q2, sweeps from approximately 1.4 to 1.65 GHz. The average frequency is adjusted by R2 which controls the average bias on the varactor diodes, CR1, CR2, and CR3. The sweep drive voltage from pin 9 of the module is connected to the opposite side of these diodes causing the frequency to vary above and below this average frequency in a low-to-high frequency direction.

Sweep oscillator, Q5, is similar to the Q2 circuit, however, the varactor diodes have been reversed, and the polarity of the bias voltage supplied by R12 and R13 has been changed. These changes cause the oscillator frequency to vary from a high to low frequency. The approximate output frequency is 1.4 and 1.15 GHz. This out of phase sweep technique has several advantages. First, larger sweep widths are obtainable and second, the nonlinearity (frequency verses time) of one oscillator is cancelled by the nonlinearity of the second oscillator. R9, which is a linearity adjustment, optimizes this canceling process by controlling the sweep drive ratio between the oscillators.

The two sweep signals are combined in a single balance diode mixer comprised of L4, L5, CR8 and CR9. The resultant, difference frequency, of 0 to 500 MHz, is then amplified in the wide band amplifier consisting of transistor stages Q11, Q12, and Q13.

Transistor stages Q6 and Q7 supply the blanking voltage to the wide band amplifier and causes it to be shut off during the sweep retrace time, The output from the wide band amplifier is connected to J1, which in turn is connected to the output wide band amplifier located In module M10H. A second output is also obtained from this amplifier and is coupled, via R45, to a similar wide band amplifier consisting of transistor stages Q14, Q15, and Q16. The output from this amplifier is connected to J2 which in turn is connected to the marker generating circuits

Transistors Q8, Q9, and Q10 provide a - 15 volt supply to operate the sweep oscillators. This improves stability and provides isolation between the oscillators and the - 18 volt supply.

4.7 OUTPUT AMPLIFIER, BAND 1 (MODULE M10H) (F07)

The M10H module contains a wide band amplifier, an electronic attenuator, and a leveler amplifier.

WI DE BAND AMPLIFIER

This amplifier provides 2 stages of RF amplification to increase the RF input level present at Q1 by about 40dB.

The frequency responce of this amplifier is reduced for frequencies near 0.5 MHz or lower and above 500 MHz

The input amplifier stage consisting of Q1, Q2, and Q3 is enabled by the B + 1 switching voltage, and the output stage, consisting of Q4, Q5, and Q6 by the 20 voltage, when the front-panel BAND switch is in the band 1 position. The -20 voltage also provides current through R30 and the RF output cable to turn on a pin diode, located in the M19H module, which couples the band 1 RF output into the RF output system.

ELECTRONIC ATTENUATOR

Ahead of the first amplifier stage is an electronic attenuator consisting of PIN diodes, CR1, CR2, and CR3 which provides variable RF conductance proportional to the positive current supplied through the switching transistor Q7.

LEVELER OUTPUT (PIN 6)

The leveler amplifier (Q9, Q10, and 011) provides leveling of the RF output for Bands 1, 2 and 3 by supplying a positive current to the electronic attenuator system for each band as directed by the band switching voltages (B-1, B-2, and B-3) which turn on the correct switching transistor for that band (in the M10H module or the M19H module).

A positively increasing output voltage from the leveler amplifier will increase the RF output level. RF blanking is effected by a positive input voltage (pin 4) to switching transistor Q8 which causes the leveler output (pin 6) to go negative during sweep retrace time shutting off the electronic attenuator.

LEVELER INPUTS (Pin 5 and Pin 7)

A monitor diode, located external to the MI OH, provides a negative DC voltage related to the RF output level present in the output system. The output system and monitor diode is located in the M19H module or in an external monitor circuit. This negative voltage is connected to one input of the operational amplifier, consisting of Q9, Q10, and Q11.

Since an increasingly negative voltage at the input will reduce the positive current supplied to each electronic attenuator, the RF output level is held constant, by negative feedback, at a level determined by a reference voltage. This reference voltage varies under control of the LEVEL PROGRAM input voltage at pin 7 of the M10H module. The magnitude of this negative voltage is determined by the MAX pot which sets the maximum RF level when the program voltage is maximum (-18 volts). The MIN pot provides a small negative reference voltage which determines the minimum RF Ievel when the level program voltage at pin 7 is zero.

4.8 SWEEP OSCILLATOR, BANDS 2 & 3 (MODULE M19H) (F08)

This module contains two separate sweep oscillators, each with itsvoltage variable attenuator and the necessary switching circuitry to connect either band 1, band 2, or band 3 to the common monitor and RF output connector.

Band 1 is connected to the RF output circuit by PIN diode CR9. The control current for switching this diode is contained in the M10H module.

Band 2 oscillator, consisting of Q6 and its associated circuitry, is a common base oscillator varactor-tuned by CR2, CR3, CR4 and CR5. Biasing of the varactor diodes is provided by Q1 and Q2. Q3 is a switching transistor which disconnects the bias voltage from the varactors when the unit is operated on band 1 or band 3. The B- voltage for the oscillator is modulated by the blanking signal, from pin 4, in transistor stages Q4 and Q5. This modulation causes the oscillator to be cut off during the sweep retrace period, thereby providing a zero RF output level during the retrace time. The RF signal is coupled fram the oscillator, by L9, to a voltage variable attenuator consisting of CR6, CR7 and CR8. This attenuator is part of the closed loop leveling system consisting of the monitor diode CR20, the leveler amplifier, (located in the M10H module) and the voltage variable attenuator. The operation of this circuit maintains a constant amplitude RF signal at the monitor point and also allows adjustment of this signal over a 20dB range. Since the effective impedance at the monitor point is zero ohms, R46 establishes the output impedance at approximately 50 ohms.

Band 3 oscillator is almost identical to band 2. The os cillator tank inductance has been decreased and the oscillator transistor, Q14, is operated at a slightly higher current. The varactor bias is provided by Q9 and Q10 and the B- blanking IS provided by Q11 and Q12. Current during the sweep retrace time is not completely remaved but is steered by Q13 through CR 12. This current will not cause oscillation since L15 has been bypassed. It does, however, provide better frequency stability in the oscillator, The RF signal is coupled from the oscillator, by L20, through the voltage variable attenuator consisting of CR 17, CR18 and CR19 and to the RF output.

Q7 and Q8 help provide the proper bias to the shunt diades in the voltage variable attenuators, in arder to maintain a constant load for the oscillator, thus minimizing the frequency pulling effects of the attenuator.

Transistors Q15 and Q16 are switching transistors which connect the output of the leveling amplifier to the voltage variable attenuator associated with the operating band.

4.9 MARKER ADDER (MODULE M5H) (FO5)

The main funciton of this module is adding together and amplifing the Individual marker signals from the M6 marker modules. It also contains the external marker mixer circuit and the sweep sample selection and leveling circuits.

The desired sweep sample signal (band 1 or band 2 and band 3) is selected by the PIN diode switch CR4 and CR5. The sweep sample signal is then leveled in the same manner as the main RF output signal. The voltage from the monitor, CR7, and the reference voltage from R46 is fed to the leveling amplifier consisting of transistor stages Q12 and Q13. Q11 provides blanking of the leveling amplifier. Any error between the two input signals is amplifier and fed to the voltage variable attenuator CR6. The operation of this circuit produces a constant amplitude signal at the momtor point.

The leveled sweep sample signals is connected to the external marker mixer, CR1 and CR2, and to the sweep sample output connector, J4. A 47 ohm resistor which is connected between J4 and the monitor point, establishes the source Impedance at approximately 50 ohm. The signals is then routed to each M6 marker module.

The marker output signals from the individual M6 marker modules are connected to the input pins 1, 2, 3, and 4 of the M5H module. One or two M6 outputs are connected to each input. The signals are then amplified in the input stages (Q2, Q3, Q4, and Q5) and combined in the common collector load. The collector load is an external 10mH choke when the Front Panel MARKER WIDTH Selector is set to “WIDE”, or a 3.3k ohm resistor, R21, when the Width Selector is set to “NARROW.” The combined marker signals are then amplified in transistor stages Q6, Q7 and Q8. The Front Panel Marker WIDTH Selecter also varies the high frequency gain of the amplifier by connecting capacitance across R27, the feedback resistor. The amplified signal is then fed to the complimentary output stage, Q9 and Q10, which is baised so that input signals less than 0.5 volts are not amplified. This eliminates most spurious markers and noise from tlhe output. The output is then connected to the Front Panel MARKER SIZE Control and finally to the Front Panel SCOPE VERT. connector.

4.10 MARKERS (MODULE M6’s) (F09, F010)

Each marker module Contains a crystal oscillator, a tuned or untuned mixer and birdy amplifier. Harmonic generator mdrker modules also includes one or more harmonic generating stages.

Several types of marker modules are required to cover the wide frequency range and to produce both single frequency and harmonic type rmarkers A single frequency marker generator produces a marker at a single frequency while the harmonic marker generator produces markers at harmonically related frequencies of the crystal oscillator.

The model number for single frequency markers is MGS followed by the marker frequency. The model number for harmonic markers is M6H followed by the harmonic marker frequency.

The Crystal Oscillator operates between the frequencies of 100 kHz dnd 55 MHz. Several different types of oscillators are required to cover this range of frequencies. The 100 kHz oscillators use a tuned oscillator with the crystal operating at its fundamental frequency in a serious resonant mode. The 1 to 17 MHz crystal oscillators are either tuned series resonant mode oscillators or untuned pierce type oscillators The 17 to 55 MHz oscillators use a tuned Colpits oscillator with the crystal operating at its third overtone frequency in a series resonant mode. The tuning supresses the crystal fundamental and higher order resonant frequencies. The crystal and marker frequency are the same for frequencies between 100 kHz dnd 55 MHz. The markers above 55 MHz use harmonic generating techniques.

The output from the crystal oscillator (or harmonic generator) is combined with the sweep sample in the mixer stage. In the case of single frequency markers, the mixer includes a tuned circuit which selects the desired crystal or crystal-harmomc frequency and the sweep sample frequency. In the case of a harmonic marker, the mixer is untuned The mixer circuit is generally a diode mixer, although transistor mixers are sometimes used. The fundamental and product signals are filtered from the mixer output, leaving the “difference signal” which is applied to the marker amplifier stage.

The marker amplifier is a single stage amplifier having a frequency response of several kHz to approximately 500 kHz. The output of the marker amplifier is connected through the SIZE Control to the output pin of the module.

SECTION 5

MAINTENANCE

5.1 INTRODUCTION

This section provides information for testing, aligning, and trouble shooting the instrument. The performance test is designed for incoming inspection and periodic evaluation. If performance is not to specifications, refer to the calibration and trouble shooting sections.

5.2 SERVICE INFORMATION

5.2.1 DISASSEMBLY INFORMATION

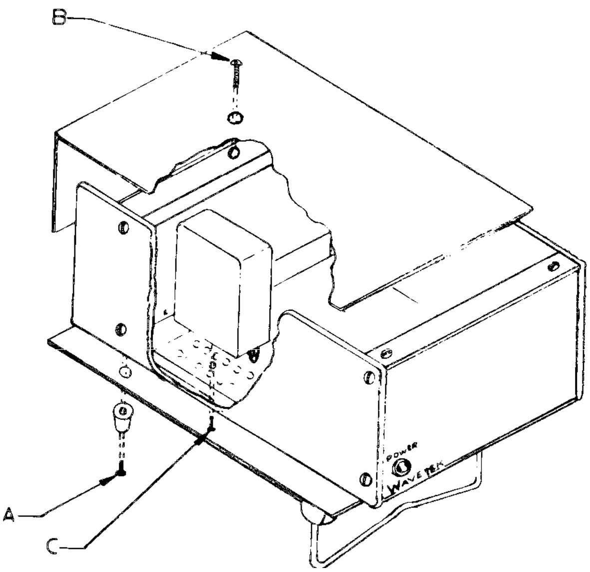


Figure 5-1. Disassembly

REMOVAL OF BOTTOM COVER – Remove the two rear feet (A) and lift cover off with a slight rear movement.

REMOVAL OF TOP COVER – Remove the single screw (B) from the top and lift off cover with a slight rear movement.

REMOVAL OF SIDE PANEL – Either side panel can be removed to provide better access by removing the four screws holding the side panel to the instrument. The Front Panel/Module Section can be removed from the power supply section by removing two screws holding the sections together and by disconnecting the electrical connectors between the two sections. NOTE: The separation of the two sections performs no useful purpose during normal service procedures.

5.2.2 MODULE SERVICING

SERVICE KIT K102 – This service kit contains a module extender and RF extension cables which enables the module to be electrically operated while physically located above the rest of the modules, thereby making all parts easily accessible.

REMOVAL OF MODULE – Modules may be removed by removing any cables attached to the top of the module and removing the hold-down screw (C) from the bottom.

REMOVAL OF MODULE COVER – Remove all nuts and screws from the top of the module and slide the cover off.

REINSTALLING MODULE – Before reinstalling the module, check the module pins for proper alignment, then carefully seat the module pins into the chassis socket and replace the hold-down screw (C) to insure a good ground connection between module and chassis.

MODULE PIN NUMBERING SYSTEM – The module pins are numbered as shown in Figure 5-2. The index studs for the circuit modules are located off center to prevent the module's being plugged in backwards. This off-center stud location also provides a method for locating pin #l.

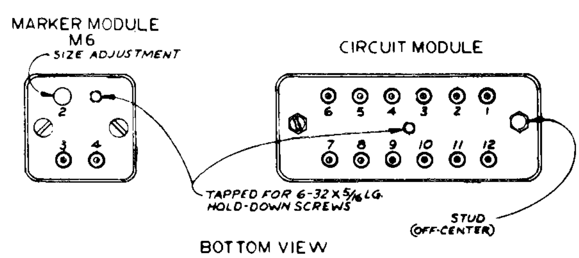


Figure 5-2. Module Pin Numbering System

5.2.3 TRANSISTOR LEAD CONFIGURATION –Transistor lead configurations are shown in Figure 5-3.

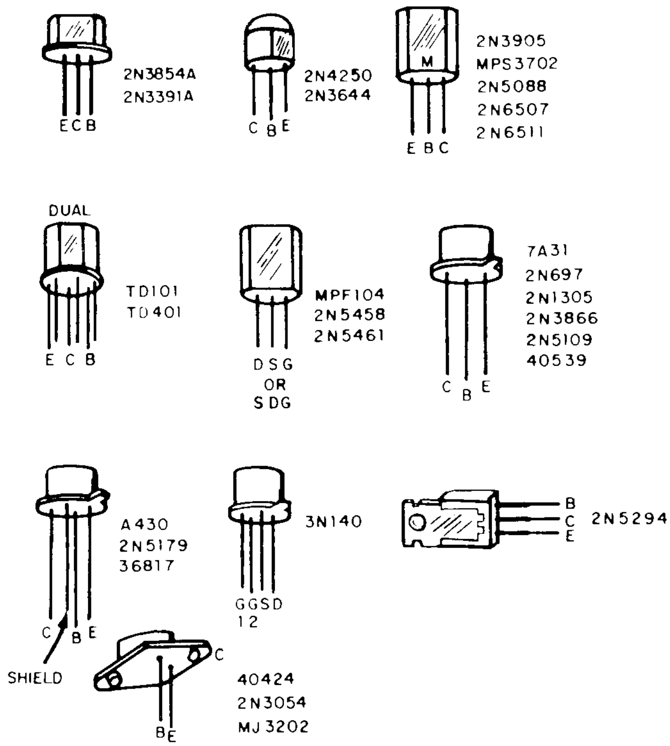


Figure 5-3. Transistor Lead Configuration

TABLE 5-1. TEST EQUIPMENT

NAME OR NOMENCLATURE	NSN
Oscilloscope AN/USM281C TEK 7603N opt 11s	6625-00-106-9622
Digital Multimeter AN/USM 451 Ballantine 9632M	
Power Meter AN/USM 260A HP 432A	6625-00-917-3099
Spectrum Analyzer IP 1216 Main Frame HP 141T	6626-004244370
Spectrum Analyzer PL 1400 Tuning Unit Plug-In HP 8555A	6626-004224314
Spectrum Analyzer PL 1388 IF Section Plug-In HP 8552B	6625-00431-9339
Signal Generator SG-1112 (1)/U HP 8640B opt 001	6625-00-500-6525
Signal Generator AN/USM-213 HP 8614A	6626-00-872-3215
Attenuator Pads 10,20,40 dB Wienchel 50-10, 50-20, 5040	------------------------------

5.3 PERFORMANCE CHECKS

The following procedure is intended to ensure that the instrument meets its published specifications. For a list of recommended test equipment, refer to Table 5-1.

5.3.1 PRELIMINARY CHECK

Rotate both START and STOP thumb wheels to their lowest frequency position (turn full left). Both frequency indicators must read O MHz, ± 2MHz when read on the SWEEP WIDTH frequency scale. (Interpolation on the SWEEP WIDTH scale between O and 10 MHz is necessary to locate +2 MHz.)

Preset controls as follows: BAND to 1; SWEEP TIME Sec to LINE: OUTPUT to +10 dBm; MARKERS WIDTH to WIDE; MODE to CW; the four paddle switches to their extreme down position; 50 MHz HAR markers on (push-button in), and the remaining markers off. Set the CENT FREQ (left thumb wheel) to 250 MHz and connect the power meter to the RF OUT connector. (Ensure the power meter is set to the +10 dBm scale.)

urn AC power on and allow the instrument to stabilize for 5 minutes. The power meter shall read between +9.5 and + 10.5 dBm. The alignment procedure calls for +10 dBm adjustment at 300 MHz. However, some error must be allowed for changes due to ambient operating temperature and variations between power meters.

5.3.2 FREQUENCY CHECKS

Connect the instrument to the RF detector and scope as shown in typical setup Figure 5-4. Set the SWEEP WIDTH control (right thumb wheel) to 520 MHz and the MODE switch to F. Leave the rest of the controls as previously set in step 5.3.1. Adjust the MARKERS SIZE, the scope vertical, and scope horizontal controls to obtain a pattern as shown in Figure 5-5. Use DC coupling on both the vertical and horizontal scope inputs. The output voltage from the detector will be approximately 0.8 volts. A detected output less than 0.7 volts indicates a defective detector or an uncalibrated scope. Each 50 MHz marker must fall within 0.2 cm of its line on the scope graticule. This is equivalent to a display linearity of 2%. This 2% specification is extremely important since all dial accuracy specification are directly related to it. Repeat check on BANDS 2 and 3. In order to identify absolute frequencies on bands 2 and 3, an external CW signal can be connected to the MARKER IN connector to identify one of the 50 MHz harmonic markers. This also verifies the operation of the external marker circuit.

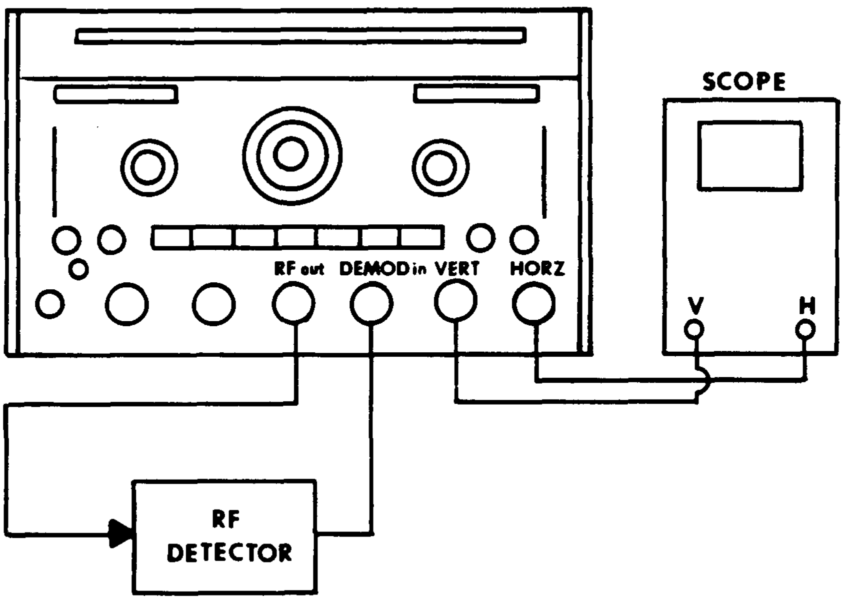


Figure 5-4. Typical Set-Up

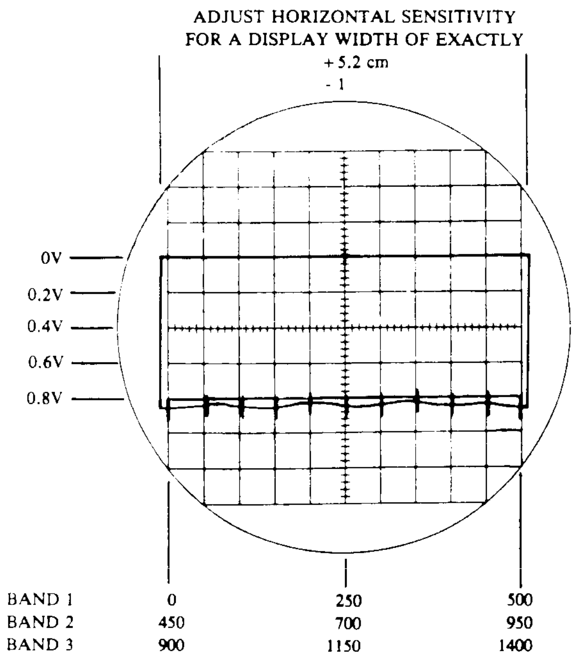


Figure 5-5. RF Detector Display

To check the minimum frequency band 1, set BAND to 1 and frequency dials (use either S/S or A F MODE) to sweep approximately O to 10 MHz. Turn on the 10 MHz harmonic marker and locate the first marker on the right of zero lock-in point. Turn on the 1 MHz harmonic marker and count down to 1 MHz. The detected output must be leveled down to the 1 MHz marker at all settings of the OUTPUT vernier.

5.3.3 MINIMUM SWEEP WIDTH CHECK

Set MODE TO A F and adjust SWEEP WIDTH to exactly 1 MHz (use 1 MHz markers). Adjust the MARKERS WIDTH to produce a marker approximately 200kHz wide. Next, adjust the SWEEP WIDTH to minimum. The 200kHz wide marker should cover the entire scope display. Repeat the above check for bands 2 and 3, readjusting sweep width and center frequency as required. The minimum sweep width is less than 200kHz on all bands.

5.3.4 RESIDUAL FM CHECK

Readjust SWEEP WIDTH to produce a calibrated frequency display of exactly 1 MHz full scale. Adjust CENT FREQ control to center one of the 1 MHz harmonic markers on the scope display. Residual FM can be read directly on the scope display by noting the amount of jitter of the marker. (A jitter of 0.2cm would be equal to 20 kHz).

Change SWEEP TIME selector from LINE to the 0.1-0,01 position and again read the marker jitter. The additional jitter in this position represents the line related residual. Maximum allowable jitter is 15 kHz Alternate Method to read residual FM is with a spectrum analyzer,

5.3.5 FREQUENCY DRIFT

Return SWEEP TIME selector to LINE and again calibrate the display's sweep width to 1 MHz. Position the marker to the exact center of the oscilloscope display and read frequency drift directly from the scope display by noting the change in the marker position with time. Each centimeter represents 100 kHz. When reading drift over long periods of time, calibrate the display sweep width to 5 MHz, using the 1 MHz harmonic marker. Next turn off the 1 MHz marker and turn on the 50 or 10 MHz harmonic markers. Center a marker on the scope display and read drift as before, except each centimeter now represents 500 kHz.

Maximum allowable drift is 100 kHz per 5 minutes or 2 MHz per 8 hours, after a one hour warm-up at a constant ambient temperature, and allowing a 5 minute stabilizing period after a frequency change.

5.3.6 DIAL ACCURACY CHECK

AF Mode: Set MODE to A F; BAND to l; MARKERS WIDTH to wide. Turn on the 1 and 50 MHz harmonic markers (10 MHz marker off). Set SWEEP WIDTH to approximately 1 to 2 MHz and adjust CENT FREQ control until the zero frequency lock-in point is exactly centered on the scope display. Turn off the 1 MHz harmonic marker. Read the error on the FREQUENCY scale. Repeat at each 50 MHz harmonic interval across the band. The allowable error is ±10 MHz.

Repeat check on bands 2 and 3. An additional frequency error is produced by the pulling effect of the OUTPUT vernier on bands 2 and 3, therefore, rotate the OUTPUT vernier thru its entire range at each 50 MHz check point. Increasing the SWEEP WIDTH to approximately 5 MHz will simplify reading. The allowable error on band 2 and 3 is 2070 of the indicated frequency.

The accuracy of the SWEEP WIDTH scale can be checked with the 50 MHz harmonic marker in a similar manner. Set the actual sweep width to 50, 100, 150, etc., and read the error on the SWEEP WIDTH scale. Accuracy on band 1 is ±10 MHz, and on band 2 and 3

20 MHz. Again, accuracy on band 2 and 3 is affected by the OUTPUT vernier control.

Start/Stop Mode: Set the BAND switch to 1 and the MODE switch to S/S (Start/Stop). Set START to -10 Hz and STOP to 510 MHz. A pattern similar to figure 5-5 should be present on the scope display. Reduce STOP control until the 500 MHz marker just disappears from the right side of the scope display. Read the error of the STOP frequency indicator (red). Repeat at each 50 MHz interval.

Return STOP dial to 510 MHz and adjust START control until the zero lock-in point just disappear from the left side of the scope display; read error of the START frequency indicator (green), repeat at each 50 MHz interval. Allowable error is the same as band 1 in the Δ f mode, ± 10 MHz.

Recheck for bands 2 and 3, vary OUTPUT vernier at each 50 MHz check point. Allowable error is 2% of indicated frequency.

5.3.7 CW MODE CHECK

Set the MODE switch to CW and the CENT FREQ to 10 MHz. The scope pattern will be a negative voltage ıal in magnitude to that in the A F and S/S mode ıecks. Slowly adjust the CENT FREQ toward 50 MHz. As the instrument center frequency approaches to MHz, the scope pattern will widen, then narrow to a line again (this is the center of the 50 MHz marker). Check the dial accuracy at the narrow-pattern point. Repeat for all multiples of 50 MHz up to 1400 MHz. Allowable error is ±10 MHz for band 1, ± 2% for bands 2 and 3 of the selected frequency.

Checking for spurious signal content is not normally required for periodic calibration, only for initial incoming inspection. The only practical way to measure the spurious signal content is with a high quality spectrum analyzer covering the frequency range of 10 MHz to 3 GHz. The spurious check is made in accordance to the instructions furnished with the particular spectrum analyzer.

The main spurious signals on all three bands are the second and third harmonics of the output signal. These could be at least -26 dBc from 10 to 1400 MHz, and -20 Be from 1 to 10 MHz. NOTE: An increase of the second harmonic to approximately -22 dBc in the 450 to 500 MHz area of band 2 is normal.

. addition to the harmonically related spurious signals, non-harmonics will also appear on band 1. These non-harmonics are typically-40 dBc from 10 to 400 MHz and at least -26 dBc over the entire band.

5.3.9 RF OUTPUT FLATNESS (Amplitude/Frequency)

Flatness can be checked with a negative-polarity RF detector (Wavetek Model D151A, included with instrument). A 0.5 dB detector flatness is typical.

To check flatness, set the BAND switch to 1; the MODE switch to S/S; the START to O MHz, the STOP to 500 MHz, the OUTPUT controls for +10 dBm. Connect the equipment as shown in Figure 5-4, and adjust the oscilloscope controls for a detected display approximately 8 divisions below the baseline. Check bands 1, 2, and 3, and adjust the oscilloscope controls such that the point of greatest output is exactly 8 divisions below the baseline.

Check bands 1,2, and 3 again, this time noting the point of minimum output. This point shall be at least 7 divisions below the baseline.

5.3.10 RF OUTPUT LEVEL

The maximum RF output level is set to exactly +10 dBm at 300 MHz. This produces minimum error over the greatest frequency range. Check this with a power meter while the instrument is operating in CW mode.

5.3.11 ATTENUATORS

20dB Vernier: The accuracy of the 20dB vernier can be checked using the power meter while operating the instrument in the CW mode. The vernier dial is calibrated at 300 MHz. Dial accuracy is ±0.5dB to 500 MHz, ±ldB to 1000 MHz, and ±2dB to 1400 MHz. This error is contributed by the vernier and does not include the basic flatness error at + 10dBm.

70dB Attenuator: The accuracy of the step attenuator can be measured by using a suitable Attenuation Test Set or by directly substituting precision RF attenuator pads for each 10dB step of the attenuator. The difference between the two outputs represents the attenuator error. An RF detector can be used to recover the signal at levels down to approximately -40dBm. Below this level an RF amplifier or sensitive receiver (spectrum analyzer) must be used. Allowability error is ±0.5dB to 500 MHz, + ldb to 1000 MHz, and +2dB to 1400 MHz. This error is that produced by the step attenuator alone and does not include the basic flatness or the vernier attenuator error.

5.3.12 SWEEP TIME CHECK (Horizontal Output Check)

Connect the HORIZ SCOPE OUT of the instrument to the oscilloscope vertical input. Adjust the oscilloscope controls for an internally generated, automatic, line-triggered sweep of 2 ins/cm and a vertical sensitivity of 2 V/cm. Adjust the instrument SWEEP TIME selector to LINE lock and ensure that the TRIG/RECUR switch is in the RECUR position. Adjust the oscilloscope vertical position, horizontal position, and trigger level to obtain the wave-form shown in Figure 5-6.

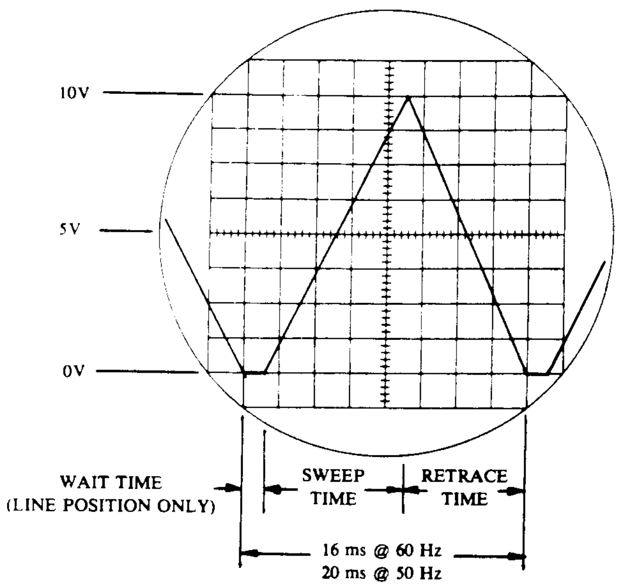


Figure 5-6. Scope Horizontal Output

Adjust the instrument SWEEP TIME selector to the .1-.01 position. Ensure that the VAR/MANUAL control is fully clockwise. The wait time should disappear and the sweep time should be less than 10 ms with approximately equal sweep time and retrace time periods. Adjust the oscilloscope time base to 20 ins/cm. Adjust the instrument VAR/MANUAL control fully counterclockwise. The sweep time should be more than 100 ms with approximately a 10:1 ratio between the sweep and retrace time periods.

NOTE: The retrace time period remains constant within any one SWEEP TIME range setting, and the VAR/MANUAL control varies the sweep time period With the VAR/MANUAL control fully clockwise, the sweep and retrace times are both approximately 0.01 seconds. With the control fully counterclockwise, the sweep time becomes approximately 0.1 seconds and the retrace time remains 0.01 seconds. On the next lower range (1-. 1), the retrace time would remain 0.1 sec and the sweep time would vary from 0.1 to 1 second.

Repeat these checks for the 1-.1, 10-1, and 100-10 sec positions of SWEEP TIME selector switch. Adjust oscilloscope time base as necessary to ensure that the VAR/MANUAL control will adjust the sweep time from faster than the maximum to slower than the minimum specifications for each range.

Adjust the SWEEP TIME selector to MANUAL and adjust the VAR/MANUAL throughout its range. A DC voltage should be present that is variable from less than O V with the control fully counterclockwise, to more than 10 V with the control fully clockwise.

NOTE: The triggered mode of operation is only possible in the variable rate positions and will not operate in the LINE iock position of the SWEEP TIME selector.

5.3.13 MARKER SYSTEM CHECK

Connect the equipment as shown in Figure 5-4. Adjust the instrument and oscilloscope controls to obtain the display shown in Figure 5-5. The actual control settings would be the same as in Section 5.3.2.

NOTE: The following performance check is for a 50 MHz harmonic marker. Specifications, with the exception of spurious markers, are the same for either single frequency or harmonic type markers and the procedure for verification of performance does not differ.

Single frequency markers should have no spurious markers throughout the swept range. Harmonic type markers may or may not have small spurious markers at one half or one third the specified marker interval.

MARKER SIZE

Observe the markers and ensure they are of equal amplitude throughout the range. Repeat this check for bands 2 and 3.

Set the oscilloscope vertical gain to 5 V/cm and adjust the MARKERS SIZE control fully clockwise. The markers should be approximately 12 V peak-to-peak in amplitude. Set the MARKERS SIZE switch to mid-position and adjust the oscilloscope vertical gain to 50 mV/cm. The markers should be approximately 50 mV peak-to-peak in amplitude. Adjust the MARKERS SIZE control fully counterclockwise and set the oscilloscope vertical gain to 500 uV/cm. The markers should be less than 100 UV peak-to-peak in amplitude. Set the MAR KERS SIZE switch to the down position and adjust the oscilloscope vertical gain to 50 mV/cm. The markers should be approximately 15 mV peak-to-peak in amplitude. Set the MARKERS SIZE switch to the up position. Positive rectified markers should be present for use with X-Y recording instruments. The ampli-tude will be dependent on the output impedance of the RF detector being used. The amplitude should be adjustable from approximately 6 V maximum to 1 mV minimum with a detector impedance of 1 megohm, or from 0.5 V to 1 mV with a detector impedance of 0 ohms. NOTE: The sweep width must be decreased or the sweep time increased to observe the rectified marker.

MARKER TILT

Set the MARKERS SIZE switch to the down position and and the MARKERS TILT switch to the up position.

While adjusting the MARKER SIZE control throughout its range, note that the birdy marker is adjustable from a 12V peak-to-peak vertical marker to a horizontal marker approxi mately equal to 10% of the horizontal deflections (1 cm on a 10cm deflection).

MARKER WIDTH

Return the MARKER TILT switch to the down position. Turn on the 1 MHz markers and adjust the MARKER SIZE control for approximately a 4 cm marker. Adjust the CENT FREQ and SWEEP WIDTH controls to calibrate the oscilloscope for a 1 MHz sweep width.

Adjust the CENTER FREQUENCY to center the birdy zero beat on the oscilloscope center graticule line and note that the marker width is approximately 400 KHz wide (each cm equals 100 kHz). Decrease the MARKER WIDTH switch one position and note that the marker is approximately 200 kHz wide. Decrease the MARKER WIDTH switch one position and note that the marker is approximately 100 kHz wide. Decrease the MARKER WIDTH switch to the most narrow position. The marker is now approximately 15 kHz wide.

MARKER ACCURACY

NOTE: Test equipment for the marker accuracy check is not listed in the recommended test equipment chart since the requirements vary with the method and the specific markers installed in the unit. Also, the inheritent stability of the quartz crystal makes a marker accuracy check unnecessary in all but the most critical applications.

Marker accuracy may be verified by one of several methods. The first method requires a signal generator and a frequency counter covering the desired marker frequency. First, adjust the sweep generator's center frequency to the marker's frequency and the sweep width to approximately 2 MHz. Connect the output from the signal generator to the MARKER IN jack, located on the front panel, and carefully adjust the signal generator for a zero beat with the internally generated birdy marker. Next, connect the signal generator's output to the counter and read the signal generator frequency which is now identical to the internal marker's frequency. Allowable error is 0.005% of the marker frequency. The second method uses the counter only, but requires the removal of the instrument and marker module covers. Probe the marker box with the input lead from the counter until sufficient signal is picked up to provide a counter reading. The highest crystal frequency used is 50 MHz. Markers above this frequency use harmonics of the crystal frequency. Again, the allowable error is 0.005% of the crystal frequency.

5.3.14 EXTERNAL PROGRAMMING

External programming inputs are not normally checked on incoming inspection unless these special functions are to be used in a particular application. The program input signals, external controls necessary, and input pin connectors are covered in Section 3 under Operating Instructions. If it is necessary to check these functions at incoming inspection, reference can be made to that section of the manual for complete set-up instructions.

Section 5.4 is deleted.

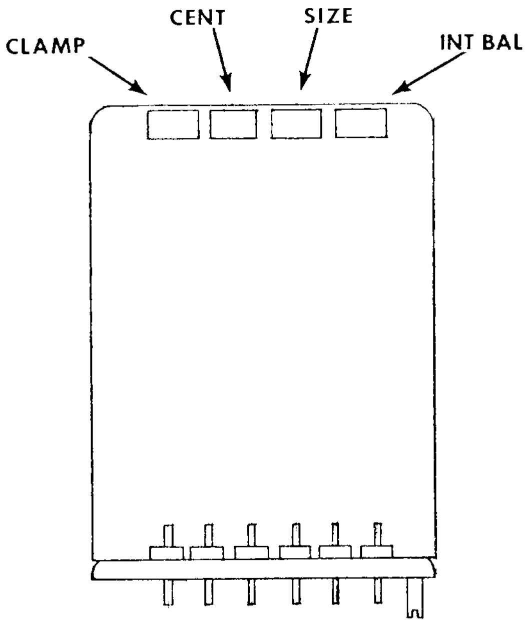


Figure 5-7. M1H Module

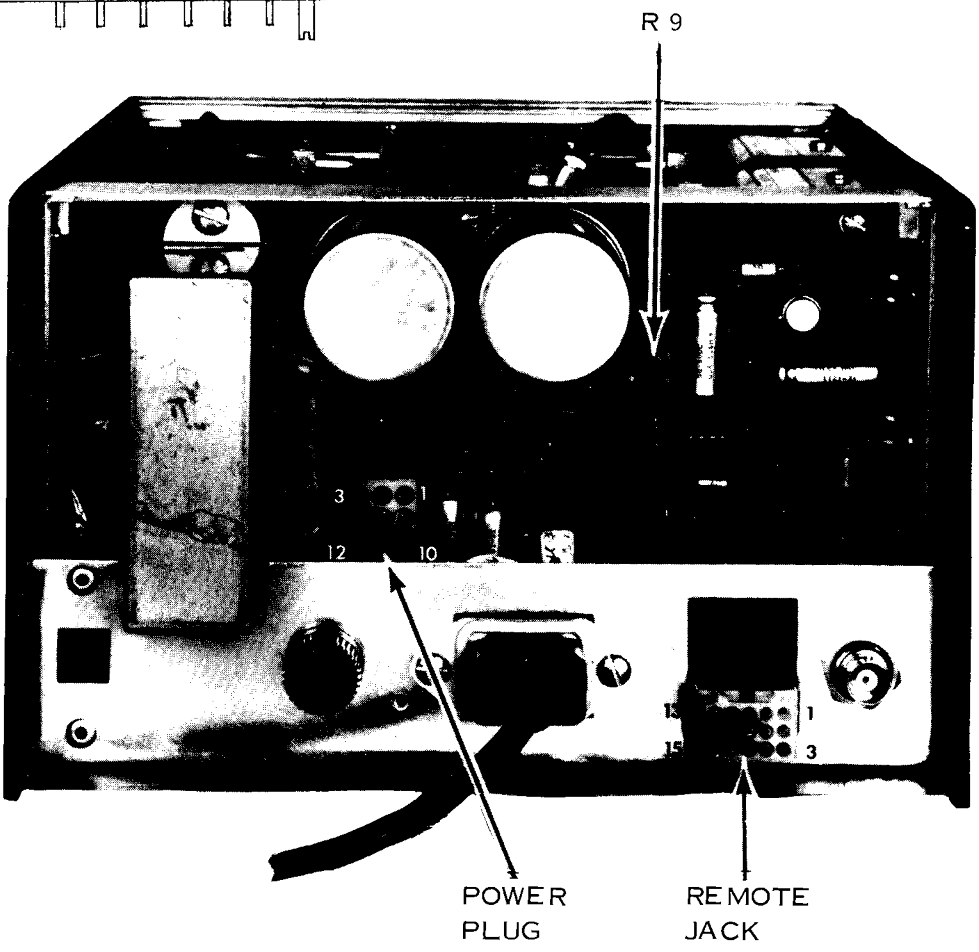


Figure 5-8. Power Supply

5.5 ALIGNMENT PROCEDURE

Remove top cover, bottom cover, left side panel, M1H and M2H module covers. Allow a 15 minute warm-up period before aligning. Ingeneral, alignment must be performed in the sequence given. Refer to Figures 5-7, 5-8, 5-9, and 5-17 for adjustment and test point location.

5.5.1 +18 VOLT ADJUSTMENT

Connect the digital voltmeter to the +18 volt supply, pin 6 on the power plug and adjust R9 to produce +18V ±10mV. (See Figure 5-8).

5.5.2 -18 VOLT CHECK

Connect the digital voltmeter to the -18 volt supply, pin 4 on power plug. The reading must be -18 volts ±50mV.

5.5.3 -20 VOLT CHECK

Connect the digital voltmeter to the 20 volt supply, pin 5 on the power plug. The reading must be -20 volts ±0.3V.

5.5.4 -16 VOLT CHECK

CAUTION: The + and – 16 volt supplies are not short circuit protected.

Connect the digital voltmeter to the -16 volt supply. pin 3 of the REMOTE jack. It must read -16 volts ±0.1 volt. (Record reading.)

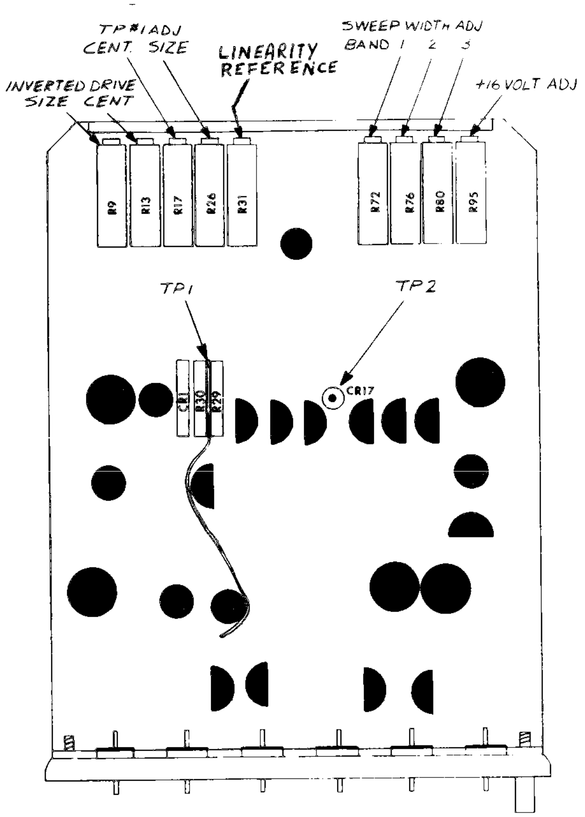


Figure 5-9. M2H Module

5.5.5 + 16 VOLT ADJUSTMENT

Connect the digital voltmeter to the +16 volt supply, pin 2 of the REMOTE jack. Remove M2H module cover and adjust R95 (see Figure 5-9) to obtain exactly the same voltage, but opposite polarity, as recorded for the -16 volt supply in Section 5.5.4.

See Figure 5-17 for location of M1H module and adjustment. Set front-panel controls as follows: TRIG/RECUR switch to RECUR, SWEEP TIME switch to .1-.01 see, and VAR/MANUAL control completely cockwise. Connect the scope vertical input to the output of Sweep Rate module Ml H, pin 10 of the REMOTE jack, and adjust the scope vertical and horizontal time base controls to produce a stable pattern similar to Figure 5-10. Adjust Ml H Cent control to obtain an output symmetrical about zero volts and the Ml H Size control to obtain the 32 volt peak-to-peak amplitude. This is a preliminary adjustment, final adjustment will be covered in Section 5.5.7.

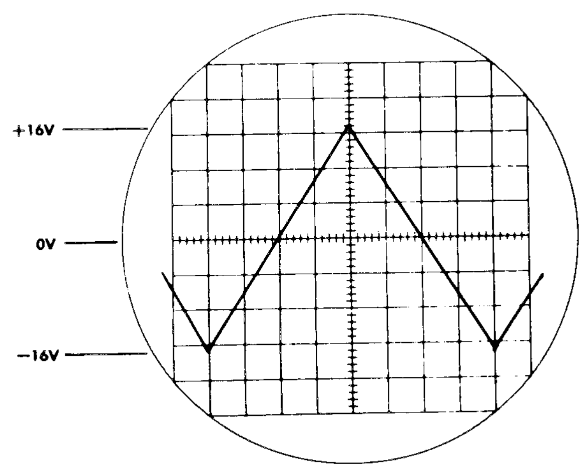


Figure 5-10. Sweep Ramp (MIH Output)

Next set the front-panel VAR/MANUAL control fully CCW and adjust the M1H INT/BAL to produce a sweep time of 0.12 seconds. See Figure 5-11.

Then set the front-panel SWEEP TIME to LINE and adjust the M1H CLAMP control to clamp the negative going peak of the M1H output to -16 volts. See Figure 5-12.

Finally adjust the WAIT control mounted on rear of the SWEEP TIME switch assembly, see Figure 5-17, until the wait time as shown in Figure 5-12 is approximately 1 millisecond.

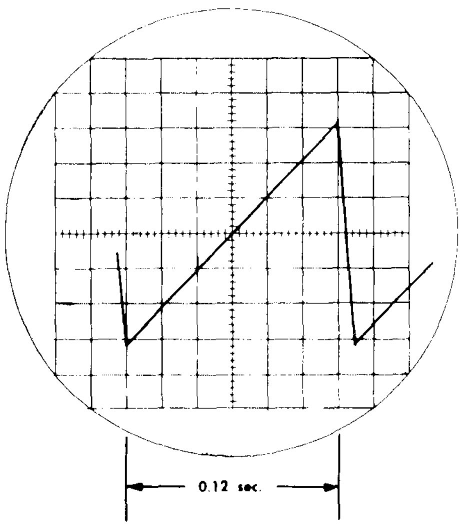


Figure 5-11. M1H Bal Adjustment

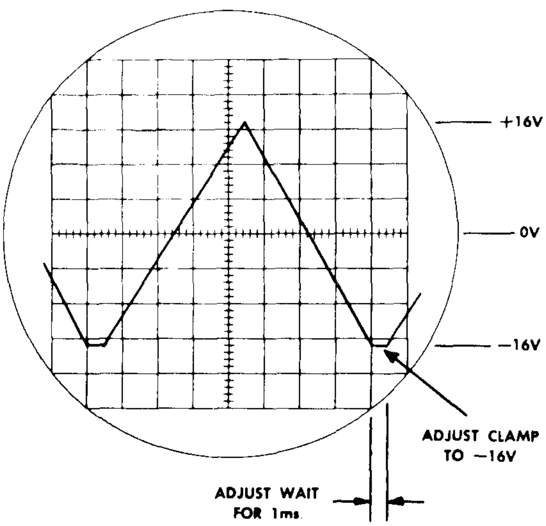


Figure 5-12. Sweep Ramp

5.5.7 SWEEP RAMP ADJUSTMENTS

NOTE: This step is possibly the most critical to the overall performance of the instrument.

Before making the adjustments, a zero suppressing probe must be constructed. This probe is simply two 12 V Zener diodes connected as shown in Figure 5-14. This probe is then connected between the oscilloscope vertical lead and the circuit point being measured.

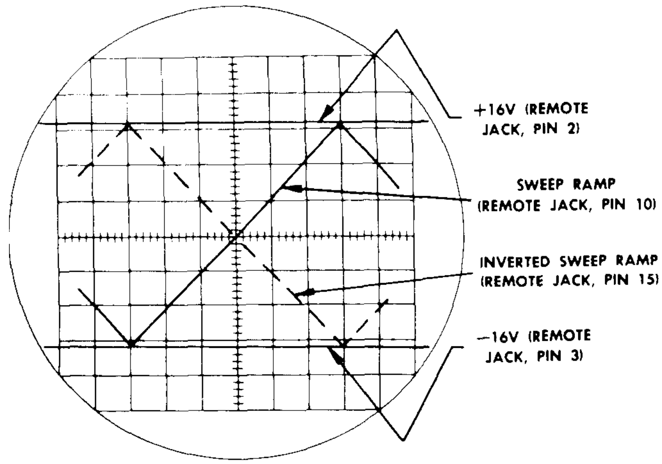


Figure 5-13. Relationship Between Sources

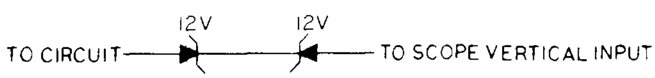


Figure 5-14. Zero Suppressing Probe

.epeat the Sweep Rate Adjustment procedure outlined in Section 5.5.6 with the zero suppressing probe. However, this time set the scope vertical sensitivity to 1 ·'olt/cm. The waveform shown in Figure 5-15 should be :sent.

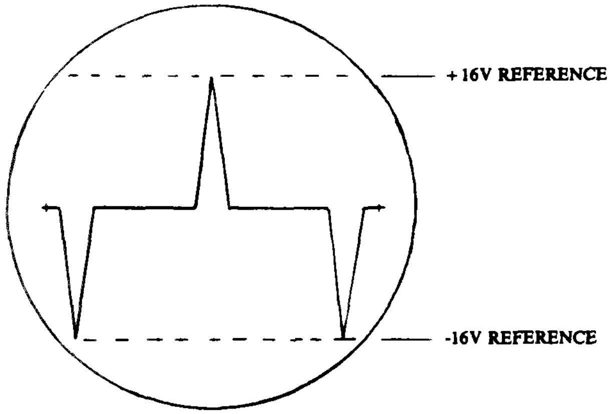


Figure 5-15. Sweep Ramp (Probe)

Adjust the display by connecting the probe to +16 lts, and then to -16 volts. Mark these points on the ›pe face or record the exact amplitude of the 16 volt . eferences. Next, connect the probe to the sweep ramp, REMOTE plug pin 10, and adjust the M1H CENT and SIZE controls until the positive and negative peaks agree precisely with the + and -16 volt calibration points. Repeat the adjustment to check for scope drift while the adjustments were being made.

Next, adjust the inverted sweep ramp in the same manner by comecting the probe to REMOTE Plug, pin 15, and adjusting M2H, R9 (SIZE), and M2H, R13 (CENT). See Figure 5-9.

5.5.8 SWEEP DRIVE ADJUSTMENT-MODULE M2H

Connect the scope vertical input (straight connection, do not use the zero suppressing probe) to test point 1 (R29 or R30) in the M2H module (see Figure 5-9). Set the front-panel MODE switch to Δ F, SWEEP WIDTH control for minimum, and the CENT FREQ control to indicate a dial frequency of 250 MHz on band 1, then adjust M2H, R17 for zero volts at TP1.

Next, adjust the front-panel SWEEP WIDTH control to MAXIMUM sweep width. Do not move the front-panel CENT FREQ control. Adjust M2H, R26, for a 28 volt peak-to-peak signal at test point 1.

Without disturbing the front panel CENT FREQ or SWEEP WIDTH adjustment, return the scope to an X-Y operating mode with the HORIZ OUTPUT of the instrument driving the scope X input. Set the SWEEP TIME to. 1-.01 sec and adjust the scope display width to 10 divisions (see Figure 5-16a).

Connect the scope Y input to M2H TP2, which is the top side of any of the three diodes adjacent to Q7. (Linearity correcting resistors may or may not be connected to the diodes, depending on the inherent linearity of the sweep oscillator.) Adjust M2H, R31, to position the "knee" to 9 cm, as shown in Figure 5-16b.

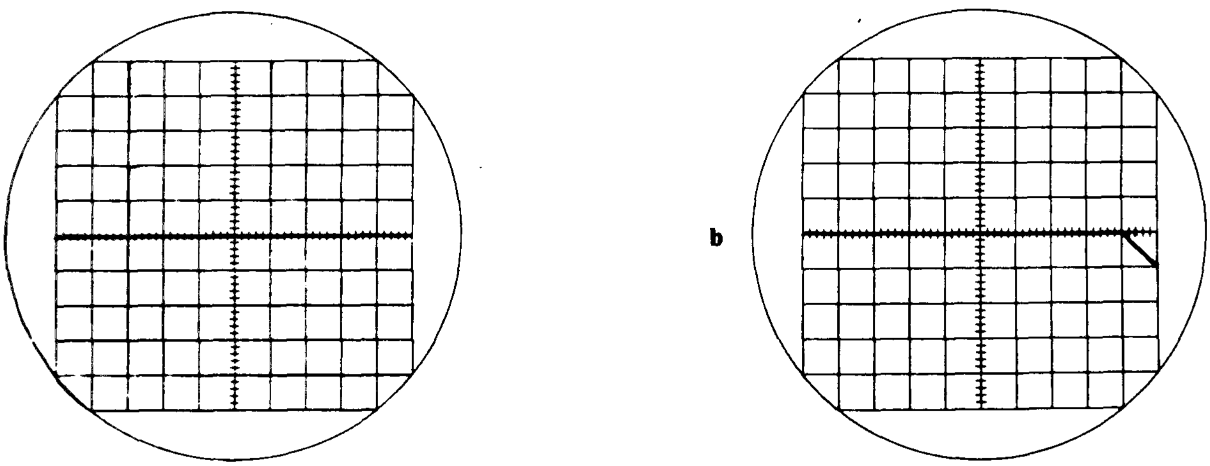


Figure 5-16. M2H Linearity Ref Adj

5.5.9 OUTPUT LEVEL MIN AND MAX ADJUSTMENT - MODULE M1OH

Preset the front-panel controls as follows:

BAND Switch	1
MODE Switch	CW
CENT FREQ Control	300 MHz
OUTPUT Control	+ 10dBm
ALC Switch	INT

Set the power meter to read +10 dBm and connect the thermistor mount to the instrument RF OUT connector. Adjust the M10H Level Max control to produce a power meter reading of exactly + 10 dBm. Turn the front-panel vernier OUTPUT control to -10 dBm (completely counterclockwise), change the power meter scale to read -10 dBm, and adjust the M10H Level Min control to produce a power meter reading of exactly -10 dBm. Some interaction exists between the Level Min and Level Max controls, so repeat the adjustment until both the + 10 and -10 dBm readings are obtained.

5.5.10 CENTER FREQUENCY AND SWEEP WIDTH ADJUST - Bands 1, 2 and 3

Connect equipment as shown in Typical Set-Up, Figure 5-4. Set:

BAND Switch	1
MODE Switch	AF
CENTER FREQ Control	250 MHz
SWEEP WIDTH Control	520 MHz
OUTPUT Control	+ 10 dBm
SWEEP TIME Switch	1-.01 sec
Four Paddle Switches	down
50 HAR MARKER Switch	on
MARKERS WIDTH Switch	WIDE
MARKERS SIZE	for display similar to Figure 5.5.

NOTE: The instrument should be thoroughly stabilized by operating approximately one hour.

Adjust the scope for display as shown in Figure 5-5. Adjust the M9H Cent Band 1 control to position the 250 MHz marker at the exact center of the scope display. Adjust the M2H Sweep Width 1 control to position the 0 and 500 MHz markers as shown in Figure 5-5.

Set BAND switch to 2, wait 5 minutes, then adjust the M19H Cent Band 2, to position the 700 MHz marker * the exact center of the display. Adjust the M2H Swe Width 2 to position the 450 and 950 MHz markers a shown in Figure 5-5.

Set BAND switch to 3, wait 5 minutes, then adjust the M19H Cent Band 3 to position the 1150 MHz marker to the exact center of the display. Adjust the M2H Sweep Width 3 to position the 900 and 1400 MHz markers as shown in Figure 5-5.

5.5.11 FINAL ADJUSTMENT OF MIH CLAMP

While operating the sweep generator as set up in paragraph 5.5.10, carefully note the extreme left side of the scope display. The trace should extend 0.2cm beyond the first graticule line, as shown in Figure 5-5.

Switch SWEEP TIME from .1-.01 sec to LINE, and adjust the M1H CLAMP for the identical display width.

5.5.12 SWEEP SAMPLE ADJUSTMENT M5H

Connect the RF detector to the SWEEP SAMPLE OL Jack of the M5H module, using the adapter cable supplied in the service kit, and adjust the M5H SWEEP SAMPLE ADJ. to produce a detected output of 35 millivolts when the front-panel BAND switch is set to band 1.

5.5.13 MARKER SIZE ADJUSTMENT

Each marker module has a Size control accessible from the under side of the instrument chassis (see Figure 5-2). To adjust the marker size, center the desired marker in the oscilloscope display (use the setup of Figure 5-4), and reduce the sweep width until the marker birdy fills approximately half the scope display. Turn the marker module Size control full ccw. The marker will disappear. Gradually turn the marker module Size control cw until a further increase in the Size control setting ceases to increase the marker amplitude on the scope display. Increasing the Size control setting beyond this point will result in spurious markers heir produced.

5.6 TROUBLESHOOTING

Trouble shooting is generally a systematic procedure of “divide and conquer.” A thorough understanding of the block diagram and circuit description located in Section 4 of this manual will enable the trouble symptom to be associated with a particular module. Once this has been accomplished the module can be replaced. A problem in a power supply often causes many symptcms pointing to other areas and should be checked when the symptom does not clearly indicate a specific problem. The +18, -18, and -20V supplies are located on the rear chassis printed circuit board and the +16 and -16 reference voltage supplies are located in the M2H module. Performance of these supplies are indicated in the alignment procedure.

5.6.1 TROUBLE SHOOTING SYMPTOMS

The following is a list of several typical symptoms followed by the probable cause or a trouble shooting procedure.

INTERMITTENT OPERATION OF ANY TYPE - Defective module pin sockets or loose RF cables.

NO RF OUTPUT

ALL THREE BANDS - Defective attenuator or RF cables connecting to the input or output of the attenuator.

SINGLE BAND ONLY **-** Check for the presence of the band switching voltages B-1, B-2, and B-3 at module M9H, M10H, and M19H as shown on the Module Wiring Diagram.

RF OUTPUT NOT FLAT - Most common cause is the external RF detector being defective. Another is the monitor diode located in the M19H module. This is a point contact diode and can be damaged if the RF output is momentarily connected to a B+ voltage. A good monitor diode will produce a negative detected voltage (pin 8 of M19H) approximately twice the amplitude of the external detector. For example, at an RF output of +l0d Bm an external RF detector will read approximately 0.8V. The internal monitor, pin 8 of M19H, will read approximately -1.6V.

FREQUENCY UNSTABLE (JITTER) - Check all modules for loose hold-down screws, especially module M2H. Check the + and -16V reference supplies. Operating the unit in a strong magnetic field, such as setting on top of or adjacent to another instrument containing a large power transformer, can produce 60Hz HUM modulation.

SWEEP RATE PROBLEM - Probable cause is a defective MIH module or wiring to the Front Panel SWEEP TIME selector switch. See the alignment procedure for verifying proper operation.

NO RF SWEEP - First check pin 12 of the M1H module for the presence of a 32V ramp. This ramp indicates proper operation of the M1H. Next check for the ramp at the input of the M2H pin 7 (AF mode). Finally check the output of the M2H at pin 9. It should be similar to the input except it will be lower in amplitude, approximately 12V peak-to-peak, and will have an average value of OV when the Front Panel center frequency control is set to mid-band. If the M2H output is correct the trouble would probably be in the M9H or M19H sweep oscillator module.

MARKER PROBLEMS

To isolate the cause of a marker problem when the symptom does not clearly indicate a specific circuit or component, first check the sweep sample output at the M5H Sweep Sample Out connector. It should be a detected signal between 30 to 50 mV. If the proper sweep sample signal is not present it indicates that the trouble is in the sweep oscillator module or connecting sweep sample cables. Next connect the detector in place of the terminating plug P102.

A signal at this point indicates all jumper cables and RF jacks on the M6 modules are intact. Then check for the birdy output at pin 3 of the marker module. A 10 to 15mV peak-to-peak birdy is sufficient to drive the M5H module and indicates the M6 module is operating properly. With the 15mV peak-to-peak birdy present at the input of the M5H, pins 1, 2, 3, or 4, a 32V peak-to-peak signal will be produced at the output pin 7. This indicates proper operation of the M5H, This output signal at pin 7 is controllable in width by the Front Panel MARKER WIDTH control. The signal is now routed through the Front Panel **MARKER SIZE control and to the Front Panel SCOPE** VERTICAL connector. A 12V peak-to-peak signal is normally at this point when the Front Panel SIZE control is set to maximum. A common marker problem is that caused by one of the interconnecting cables between the M6 modules being loose, This causes a notch in the sweep sample input to the module causing uneven harmonics or weak output.

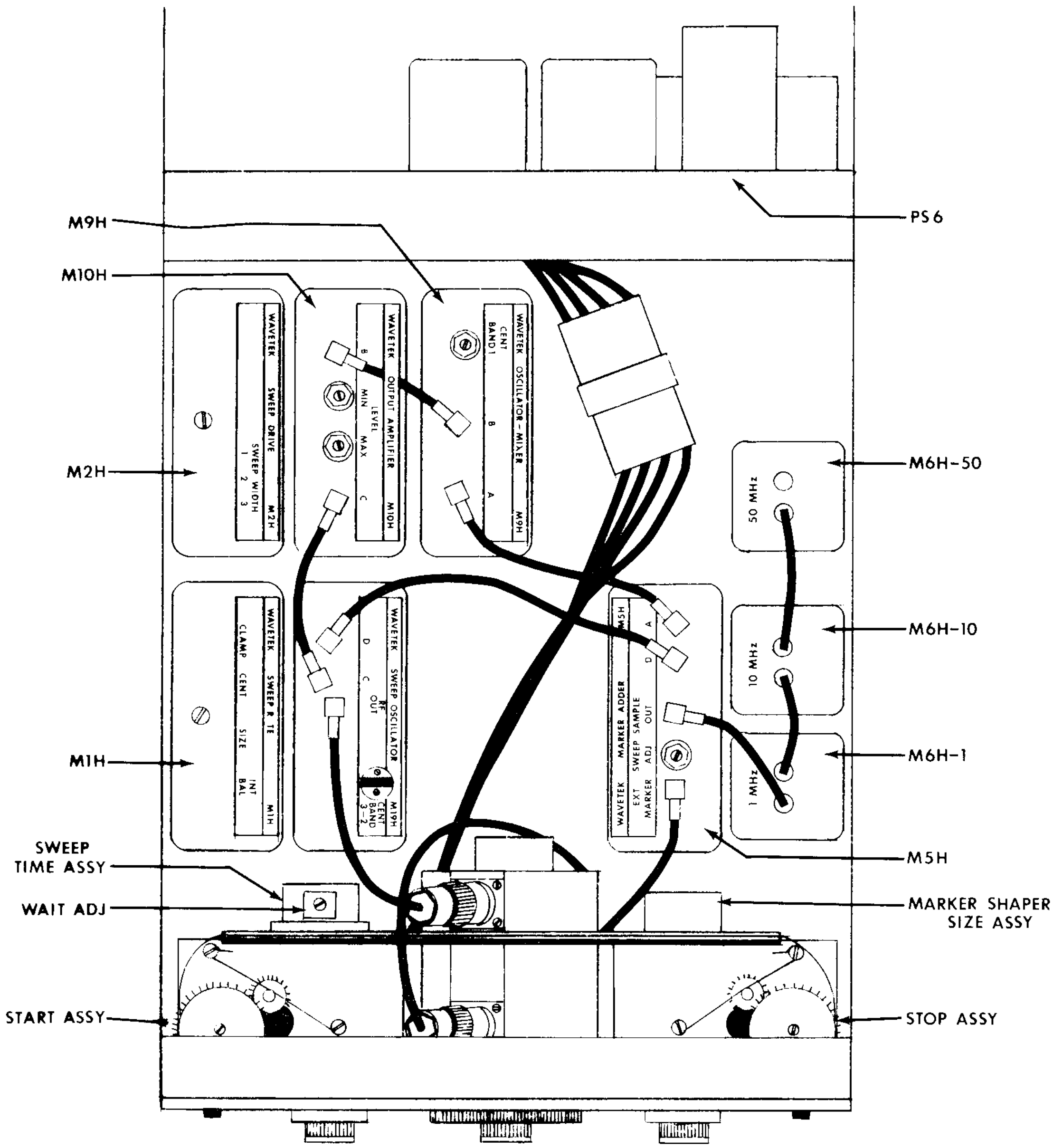


Figure 5-17. SG-677A/U Top View

SECTION 6
SCHEMATICS

6.1 INTRODUCTION

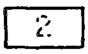
This section contains all schematics for the instrument.

6.2 SCHEMATIC NOTES

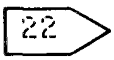
The following notes and abbreviations pertain to all schematics. Additional notes pertaining to specific schematics are included on each schematic if required.

All values are shown in the following units unless otherwise specified.

Components	Units
Resistor	ohms
Capacitor	picofarads
Inductor	microhenries



Denotes DC voltage reading in volts unless otherwise specified.

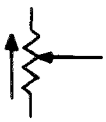


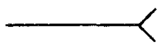
Denotes high impedance crystal detector reading in volts unless otherwise specified.

Denotes 50 ohm crystal detector reading in volts unless otherwise specified.

Signal or voltage source.

Connects to indicated signal or voltage source.


Arrow indicates clockwise rotation of wiper.


Coaxial jack


Coaxial plug

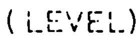

Coaxial cable


Factory adjusted part.

Denotes a front-panel device.

Denotes a rear-panel device.

Denotes a PC board adjustment or accessible module adjustment.



Denotes an internal module adjustment not accessible without removing module cover.

6.3 ABBREVIATION CODE

A	Assembly	IF	intermediate frequency	Ω	ohm
A	ampere	J	jack	OC	opto coupler
AC	alternating current	K	relay	P	plug
C	capacitor	kHz	kilohertz	P-P	peak-to-peak
CR	diode	kΩ	kilohm	pF	picofarad
CW	continuous wave	kV	kilovolt	Q	transistor
CW	clockwise	kW	kilowatt	R	resistor
dB	decibel	L	inductor	RF	radio frequency
dBc	dB referred to carrier	MHz	megahertz	RMS	root-mean-square
dBm	dB referred to 1 mW	MΩ	megohm	R.P.	rear panel
DC	direct current	µF	microfarad	S	switch
DS	indicating device, lamp	µA	microampere	T	transformer
F	farad	µH	microhenry	T.P.	test point
F.P.	front panel	M	meter	V	volt
H	henry	mA	milliampere	VA	voltampere
Har	harmonic	mH	millihenry	W	watt
Hz	hertz	mV	millivolt	X	crystal
IC	integrated circuit	mW	milliwatt		

APPENDIX A
REFERENCES

DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins and Lubrication Orders.
DA PAM 310-7	US Army Equipment Index of Modification Work Orders.
SB 38-100	Preservation, Packaging, Packing and Marking Materials.
TB 43-180	Calibration Requirements for the Maintenance of Army Material.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 37-750	The Army Maintenance Management System (TAMIS).
TM 11-6625-1577-15	Operators, Organizational, DS, GS and Depot Maintenance: Signal Generator AN/USM-213 (Hewlett-Packard Model 8614A).
TM 11-6625-2658-14	Operators, Organizational, Direct Support and General Support Maintenance Manual for Oscilloscope AN/USM-281C.
TM 11-6625-2781-14+P	Operators, Organizational, Direct Support and General Support Maintenance Manual for Spectrum Analyzer IP-1216(P)/GR (Hewlett-Packard 14lT).
TM 11-6625-2781-14-1	Operators, Oganizational, Direct Support and General Support Maintenance Manual for Plug-In Unit Electronic Test Equipment PL-1388/U (Hewlett-Packard Model 8552B).
TM 11-6625-2953-14	Operators, Organizational, Direct Support and General Support Maintenance Manual for Multimeter AN/USM-451.

APPENDIX B

COMPONENTS OF END ITEM LIST

Section 1. INTRODUCTION

B-1. Scope

This appendix lists integral components of and basic issue items for the SG677A/U to help you inventory items required for safe and efficient operation.

B-2. General

This Components of End Item List is divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the SG677A/U and must accompany it whenever it is transferred or turned in. The illustrations will help you identify these items.

b. Section Ill. Basic Issue Items.

NOT APPLICABLE

B-3. Explanation of Columns

a. Illustration. This column is divided as follows:

(1) Figure number. Indicates the figure number of the illustration on which the item is shown.

(2) Item number. The number used to identify item called out in the illustration.

b. National Stock Number. Indicates the National stock number assigned to the item and which will be used for requisitioning.

c. Description. Indicates the Federal item name and, if required, a minimum description to identify the item. The part number (when applicable) indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. Following the part number, the Federal Supply Code for Manufacturers (FSCM) (as applicable) is shown in parentheses.

d. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

e. Usable on Code. "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in these lists are:

Not applicable

f. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

g. Quantity. This column is left blank for use during an inventory. Under the Rcvd column, list the quantity you actually received on your major item. The Date columns are for your use when you inventory the major item.

SECTION II INTEGRAL COMPONENTS OF END ITEM

SECTION III BASIC ISSUE ITEMS (NOT APPLICABLE)

(1) ILLUSTRATION (A) FIG NO.	(B) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION PART NUMBER (FSCM)	(4) LOCATION	(5) USABLE ON CODE	(6) QTY REQD	(7) QUANTITY RECD	(8) DATE
	1	6625-01-074-4337	SWEEP GENERATOR SG-677A/U, WAVETEK 2001			1		
	2		RF DETECTOR WAVETEK, D151			1		

APPENDIX C

ADDITIONAL AUTHORIZATION LIST

Section 1. INTRODUCTION

NOT APPLICABLE

APPENDIX D

MAINTENANCE ALLOCATION

Section 1. INTRODUCTION

D-1. General.

This appendix provides a summary of the maintenance operations for Sweep Generator SG677A/V. It authorizes categories of maintenance for specific maintenance functions or repairable items and components and the tools and equipment required to perform each function. This appendix may be used as as aid in planning maintenance operations.

D-2. Maintenance Function.

Maintenance functions will be limited to and defined as follows:

a Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluid, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhall is normally the highest degree of maintenance performed by the Army. Overhall does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army components.

D-3. Column Entries.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. *Column 3, Maintenance Functions.* Column 3 lists the fuctions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group nunbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a “work time” figure in the appropriate subcolumn (s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate “work time” figures will be shown for each category. The number of task-hours specified by the “work time” figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C - Operator/Crew
O - Organizational
F - Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tools sets (not individual tools) and special tools, test, and support equipment required to perform the designated fuctions.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

D-4. Tool and Test Equipment Requirements (Sect.lll).

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer’s part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

D-5. Remarks (Sect. IV).

a. Reference Code. This code refers to the appropriate item in Section ll, columm 6.

b. Remarks. This column provides the required explanatory information to clarify items appearing in section ll.

SECTION II MAINTENANCE ALLOCATION CHART
FOR
SWEEP GENERATOR SG-677A/U

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
00	SWEEP GENERATOR SG-677A/U	Inspect						Visual	
		Test				2.0		1 thru '	
		Service				1.0		1 thru '	
		Align				2.0		1 thru '	
		Repair					1.0	1 thru '	
		Repair		0.5				9	A
		Overhaul					3.0	1 thru	
01	MODULE M1H	Align				0.5		1,9	
		Replace				0.1		9	
02	MODULE M2H	Align					1.0	1,2,9	
		Replace					0.1	9	
03	MODULE M5H	Align				0.1		1,9	
		Replace				0.1		9	
04	MODULE M6H-1	Align				0.1		1,9	
		Replace				0.1		9	
05	MODULE M6H-1 0	Align				0.1		1,9	
		Replace				0.1		9	
06	MODULE M6H-50	Align				0.1		1,9	
		Replace				0.1		9	
07	MODULE M9H	Align				0.1		1,9	
		Replace				0.1		9	
		Repair					2.0	1 thru '	
08	MODULE M1 0H	Align				0.2		1,9	
		Replace				0.1		9	
		Repair					2.0	1 thru	
09	MODULE M19H	Align				0.2		1,9	
		Replace				0.1		9	
		Repair					2.0	1 thru	
10	P.S. PS6	Align				0.1		2,9	
		Replace					1.0	9	
		Repair					1.0	1 thru	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
SHELTER, ELECTRICAL EQUIPMENT, S-318/G AND S-318A/G

TOOLS OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	H, D	OSCILLOSCOPE AN/USM-281C TEK 7603N OPT 11S	6625-00-106-9622	
2	H, D	DIGITAL MULTIMETER AN/USM-451 BALLANTINE 9632M		
3	H, D	POWER METER AN/USM-260A HP 432A	6625-00-917-3099	
4	H, D	SPECTRUM ANALYZER IP 1216 MAIN FRAME HP 141T	6626-00-424-4370	
5	H, D	SPECTRUM ANALYZER PL 1400 TUNING UNIT, PLUG-IN, HP 8555A	6626-00-422-4314	
6	H, D	SPECTRUM ANALYZER PL 1388 IF SECTION, PLUG-IN HP 8552B	6625-00-431-9339	
7	H, D	SIGNAL GENERATOR SG-1112(1)/U HP 864OB OPT 001	6625-00-500-6525	
8	H, D	SIGNAL GENERATOR AN/USM-213 HP 8614A	6626-00-872-3215	
9	0	TOOLS AND TEST EQUIPMENT AVAILABLE TO THE REPAIR PERSON FOR HIS/HER ASSIGNED MISSION.		

REFERENCE CODE	REMARKS
A	REPLACE KNOBS, FUSES AND BULBS.

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section 1. INTRODUCTION

NOT APPLICABLE

SECTION F

REPLACEABLE PARTS

F.1 INTRODUCTION

This section contains lists of all replaceable parts for the instrument.

For an assembly containing one or more subassemblies, the assembly list appears first, and is followed by the subassembly list.

The lists appear in the following order.

PARTS LIST	ASSEMBLY
1010-00-0011	2001
1111-00-0007	SWEEP - 2001
1112-00-0008	SWEEP TIME - 2001
1112-00-0005	MKR SHPR/SZ - 2001
1118-00-0001	REMOTE PLUG - 2001
1219-00-0005	HARNESS - 2001
1115-00-0001	PS6
1218-00-0012	PC - PS6
1114-00-0002	M1H
1114-00-0029	M2H
1114-00-0027	M5H
1114-00-0003	M9H
1114-00-0004	M1OH
1114-00-0005	M19H
1114-00-0050	M6H-1
1114-00-0099	M6H-10
1114-00-0100	M6H-50
1114-00-0045	M6S-3
1114-00-0150	M6Z-1

F.2 MANUFACTURERS CODE

The following code is used on the parts lists to identify the manufacturer.

ABBRV	NAME	CITY	ST
A-B	ALLEN-BRADLEY	MILWAUKEE	WI
A-D	ANALOG DEVICES	CAMBRIDGE	MA
A-H	ARROW HART, INC.	KETTERING	OH
A-I	ALAN INDUSTRIES	COLUMBUS	IN
A-M	AMERICAN MAGNETICS	CARTERVILLE	IL
A-P	AMERICAN PLASTICRAFT CO.	CHICAGO	IL
ABAC	ABACUS PACKAGING CO.	CHICAGO	IL
ACI	ADVANCE COMPONENTS, INC.	CENTERBROOK	CT
AER	AVX CERAMICS	MYRTLE BEACH	SC
AERTK	AERTECH INDUSTRIES	SUNNYVALE	CA
AHAM	AHAM COMPANY	AZUSA	CA
AIN	ALPHA INDUSTRIES, INC.	WOBURN	MA
ALC	ALCO ELECTRONICS PRODUCTS	NORTH ANDOVER	ME
ALLPL	ALL PLASTICS, INC.	INDIANAPOLIS	IN
AMP	AMP, INC.	HARRISBURG	PA
APL	AMPHENOL CONNECTOR SYSTEMS	BROADVIEW	IL
APX	AMPEREX ELECTRONIC CORP.	SLATERSVILLE	RI
ARC	ARCO ELECTRIC PRODUCTS	SHELBYVILLE	IN
ASC	ASSOCIATED SPRING	BRISTOL	CT
ASE	AIRCO SPEER ELECTRONICS	ST. MARYS	PA
AT/IN	ATLANTIC INDIA RUBBER COMPANY	CHICAGO	IL
ATC	AMERICAN TECHNICAL CERAMICS	HUNTINGTON STATIO	NY
ATR	ATR COIL CO.	BLOOMINGTON	IN
AUGAT	AUGAT, INC.	ATTLEBORO	MA
AVT	AVANTEK, INC.	SANTA CLARA	CA
AWC	ALPHA WIRE	ELIZABETH	NJ
B-T	BEK-TEK, INC.	READING	PA
BEK	BECKMAN INSTRUMENTS, INC.	FULLERTON	CA
BEL	BELDEN CORP.	GENEVA	IL
BER	BERG ELECTRONICS	NEW CUMBERLAND	PA
BGH	BEECH GROVE HARDWARE	BEECH GROVE	IN
BOU	BOURNS, INC.	RIVERSIDE	CA
BREZ	BREEZE CORPORATIONS, INC.	UNION	NJ
BUCK	BUCKEYE STAMPING CO.	COLUMBUS	OH
BUD	BUD RADIO, INC.	WILLOUGHBY	OH
BURND	BURNDY CORP.	NORWALK	CT
BUS	BUSSMAN MFG.	ST. LOUIS	MO
C-D	CORNELL DUBILIER ELECT. DIV.	NEWARK	NJ
C-E	CLINTON ELECTRONICS	ROCKFORD	IL
C-H	CUTLER-HAMMER, INC.	MILWAUKEE	WI
C-I	COMPONENTS, INC.	BIDDEFORD	ME
C-J	TRW/CINCH	ELK GROVE VILLAGE	IL
C-K	C & K COMPONENTS, INC.	WATERTOWN	MA
C-L	CENTRALAB DIV.	MILWAUKEE	WI
C-W	C-W INDUSTRIES	WARMINSTER	PA
CAM	CAMBION	CAMBRIDGE	MA
CAR	CARLING ELECTRIC, INC.	WEST HARTFORD	CT
CDC	COMPONENT DEVELOPMENT CORP.	CARSON	CA
CECO	CENTRAL COIL CO.	BRAZIL	IN
CGW	CORNING GLASS WORKS	CORNING	NY
CHE	CHERRY ELECTRICAL PRODUCTS	WAUKEGAN	IL
CIMCO	CIMCO WIRE AND CABLE INC.	ALLENDALE	NJ
CKI	CTS KNIGHTS, INC.	SANDWICH	IL
CLA	CLAIREX CORP.	MT. VERNON	NY
CLAR	CLAROSTAT MFG. CO	DOVER	NH

ABBRV	NAME	CITY	ST
CLFX	COLE-FLEX CORP.	BABYLON	NY
CPKG	CREATIVE PACKAGING DIV.	INDIANAPOLIS	IN
CTS	CHICAGO TELEPHONE SYSTEMS	CHICAGO	IL
CTS-E	CTS OF ELKHART	ELKHART	IN
CTSBR	CTS OF BERNE	BERNE	IN
CTSBV	CTS OF BROWNSVILLE	BROWNSVILLE	TX
DAL	DALE TECHNOLOGY CORP.	HARTSDALE	NY
DAV	HARRY DAVIES MOLDING CO.	CHICAGO	IL
DEL	DELEVAN DIV.	EAST AURORA	NY
DEW	DEWIRE FABRICATING CORP.	LOWELL	MA
DIO	DIODES, INC.	CHATSWORTH	CA
DRA	DRAKE MANUFACTURING CO.	HARWOOD HEIGHTS	IL
E-C	ELECTRONIC CRYSTALS	KANSAS CITY	MO
E-M	ELECTRA/MIDLAND CORP.	MINERAL WELLS	TX
ELCO	ELCO INDUSTRIES	ROCKFORD	IL
ELFX	ELECTRO-FLEX HEAT INC.	BLOOMFIELD	CT
EPITK	EPITEK ELECTRONICS	KANATA, ONT., CAN.	**
ETP	ERIE TECHNOLOGICAL PRODUCTS	ERIE	PA
EXAR	EXAR INTEGRATED SYSTEMS	SUNNYVALE	CA
F-K	FROST-KING	****	CT
F-S	FEDERAL SCREW	CHICAGO	IL
FAN	FANCOURT & CO.	GREENSBORO	NC
FCD	FAIRCHILD	MOUNTAIN VIEW	CA
FRTE	FAIR RITE PRODUCTS CORP.	WALLKILL	NY
FRXC	FERROXCUBE DIVISION	SAUGERTIES	NY
G-E	GENERAL ELECTRIC	INDIANAPOLIS	IN
G-H	GRAYHILL, INC.	LA GRANGE	IL
G-I	GEN'L INSTRUMENT SEMICONDUCTOR	HICKSVILLE	NY
GAL	GALILEO ELECTRO-OPTICS	CARMEL	IN
GRIES	GRIES REPRODUCER	NEW ROCHELLE	NY
GRIP	GRIPMASTER CO.	MARLBORO	NJ
GUDL	GUDEBROD BROS. SILK CO.	CHICAGO	IL
H-P	HEWLETT-PACKARD	INDIANAPOLIS	IN
HEL	HELIPOT	ANAHEIM	CA
HEY	HEYMAN MFG. CO.	WAUKESHA	WI
HHS	HERMAN H. SMITH, INC.	BROOKLYN	NY
HIT	HITACHI AMERICA, LTD.	SAN FRANCISCO	CA
HOLUB	HOLUB DISTRIBUTING CO.	NEWPORT	KY
HUD	HUDSON TOOL & DIE CO.	NEWARK	NJ
HY/PL	HYDRO PLASTICS INC.	GEORGETOWN	KY
HYT	HYTRONICS	PINELLAS PARK	FL
INT	INTERSIL, INC.	CUPERTINO	CA
IRC	INTERNATIONAL RESISTANCE CO.	PHILADELPHIA	PA
ITT	INT'L TELEPHONE & TELEGRAPH	W. PALM BEACH	FL
JAN	JAN HARDWARE MFG. CO.	LONG ISLAND CITY	NY
JEF	JEFFERS	DUBOIS	PA
JEFWC	JEFFERSON WIRE AND CABLE	WORCHESTER	MA
JEW	JEWELL ELECTRICAL INSTRUMENTS	MANCHESTER	NH
JHSN	JOHANSON MANUFACTURING CORP.	BOONTON	NJ
JON	E.F. JOHNSON CO.	WASECA	MN
K-L	KERRIGAN LEWIS MFG.	CHICAGO	IL
K-S	K & S ENGINEERING CO.	CHICAGO	IL
KEENE	KEENE CORP.	NEWARK	DE
KEM	KEMTRON ELECTRON PRODUCTS	NEWBURYPORT	MA

ABBRV	NAME	CITY	ST
KEY	KEYSTONE ELECTRONIC CORP.	NEW YORK	NY
KID	KIDCO, INC.	MEDFORD	NJ
KIN	KINGS ELECTRONICS	TUCKAHOE	NY
KSTR	KESTER SOLDER DIV.	CHICAGO	IL
KSW	KSW ELECTRONICS	INDIANAPOLIS	IN
LEYSE	LEYSE ALUMINUM CO.	KEWANEE	WI
LIT	LITTELFUSE, INC.	DES PLAINES	IL
LRC	LRC ELECTRONICS, INC.	HORNELL	NY
M-A	MICROWAVE ASSOCIATES	BURLINGTON	MA
M-D	MILLER DIAL & NAMEPLATE CO.	EL MONTE	CA
M-E	MEPCO ELECTRA, INC.	MORRISTOWN	NJ
M-O	ILLUMINATED PRODUCTS INC.	SANTA ANA	CA
MAL	MALLORY CONTROLS CO.	FRANKFORT	IN
MAND	MANDEX	CHICAGO	IL
MDC	MAIDA DEVELOPMENT CO.	HAMPTON	VA
MILN	MILLEN MFG. CO.	NEW YORK	NY
MMM	3M COMPANY	ST. PAUL	MN
MOL	MOLEX PRODUCTS	LISLE	IL
MOT	MOTOROLA SEMI. PROD.DIV.	INDIANAPOLIS	IN
MSP	MICRO SEMICONDUCTOR CORP.	SANTA ANA	CA
MYERS	MYERS SPRING CO.	LOGANSPORT	IN
N-T	NATIONAL TEL-TRONICS	LAREDO	TX
NAT	NATIONAL SEMICONDUCTOR CORP.	SANTA CLARA	CA
NEC	NIPPON ELECTRIC CO.	TOKYO, JAPAN	**
NEW	NEWARK ELECTRONICS	INDIANAPOLIS	IN
NYLO	NYLOMATIC	MORRISVILLE	PA
O-G	OPTI-GAGE INC.	DAYTON	OH
O-S	OMNI SPECTRA INC.	FARMINGTON	MI
OAK	OAK INDUSTRIES INC.	CRYSTAL LAKE	IL
OHM	OHMITE MFG. CO.	SKOKIE	IL
OMEGA	OMEGA WIRE & CABLE	HARLEYSVILLE	PA
OPTRN	OPTRON INC.	CARROLLTON	TX
P-B	POTTER AND BRUMFIELD	PRINCETON	IN
P-C	POWER COMPONENTS	WOODLAND HILLS	CA
P-K	PARKER KALON CORP.	CLIFTON	NJ
P-T	PENN TUBE PLASTICS CO.	CLIFTON HEIGHTS	PA
PAND	PANDUIT CORP.	TINLEY PARK	IL
PARA	PARAMETRIC INDUSTRIES	NORTHFIELD	IL
PEC	PACIFIC ELECTRICORD CO.	GARDENA	CA
PEC	PACIFIC ELECTRICORD CO.	GARDENA	CA
PHC	PHILADELPHIA HANDLE CO.	CAMDEN	NJ
PLSSY	PLESSEY ENG.	SCHILLER PARK	IL
POM	POMONA ELECTRONICS CO., INC.	POMONA	CA
PRMD	PYRAMID INDUSTRIES, INC.	PHOENIX	AZ
PRSN	PRECISION TUBE CO., INC	NORTH WALES	PA
PTN	PENNTRAN CORP.	BELLEFONT	PA
PYRO	PYROFILM CORP.	WHIPPANY	NY
PYTT	PYTTRONICS INDUSTRIES, INC.	MONTGOMERYVILLE	PA
Q-C	QUALITY COMPONENTS	ST. MARYS	PA
RAY	RAYTHEON	INDIANAPOLIS	IN
RCA	RCA	CAMDEN	NJ
REL	RELIANCE MICA CO.	BROOKLYN	NY
RICH	RICHCO PLASTIC CO.	CHICAGO	IL
RMC	RADIO MATERIALS CORP.	CHICAGO	IL
ROGAN	ROGAN CORP.	NORTHBROOK	IL

ABBRV	NAME	CITY	ST
S-C	SPECIALTY CONNECTOR	INDIANAPOLIS	IN
S-G	STANDARD GRIGSBY	AURORA	IL
S-I	SWITCHCRAFT, INC.	CHICAGO	IL
S-S	SERVICE SUPPLY	INDIANAPOLIS	IN
S-T	SARKES TARZIAN	BLOOMINGTON	IN
SCBE	SCANBE DIVISION	EL MONTE	CA
SCC	STACKPOLE CARBON CO.	ST. MARYS	PA
SEAST	SEASTROM MFG. CO.	GLENDALE	CA
SEL	SEALECTRO CORP.	MAMARONECK	NY
SEM	SEMTECH	NEWBURY PARK	CA
SGM	SIGMA INSTRUMENTS	BRAINTREE	MA
SHAM	SHAMROCK PLASTICS & RUBBER CO.	INDIANAPOLIS	IN
SIEM	SIEMENS	ISELIN	NJ
SIG	SIGNETICS CORPORATION	SUNNYVALE	CA
SOUTH	SOUTHCO FASTENERS	LESTER	PA
SPE	SPECTROL	DAYTON	OH
SPEC	SPECTRUM CONTROL. INC.	FAIRVIEW	PA
SPR	SPRAGUE ELECTRIC CO.	INDIANAPOLIS	IN
SSS	SOLID STATE SCIENTIFIC	MONTGOMERYVILLE	PA
STR	STETTNER TRUSH CO.	CAZENOVIA	NY
STSA	STEEL SALES	INDIANAPOLIS	IN
SYL	GTE SYLVANIA	WALTHAM	MA
SYS	SYSCON INTERNATIONAL, INC.	SOUTH BEND	IN
T-I	TEXAS INSTRUMENTS	DALLAS	TX
TCPL	TACONIC PLASTIC	PETERSBURG	NY
TEK	TEKTRONIX	INDIANAPOLIS	IN
TELE	TELETYPE CORP.	ELK GROVE VILLAGE	IL
THR	THERMALLOY CO.	DALLAS	TX
TIMES	TIMES WIRE AND CABLE	CINCINNAI	OH
TIN	TINNERMAN PRODUCTS, INC.	CLEVELAND	OH
TKN	TECHNICAL WIRE	CRAWFORD	NJ
TLNC	TELONIC ALTAIR	LAGUNA BEACH	CA
TORCO	TOR CORP.	VAN NUYS	CA
TRU	WALDES TRUARC	LONG ISLAND CITY	NY
TRW	TRW CAPACITOR DIV.	OGALLALA	NB
U-C	UNIVERSAL COMPONENTS	LOS ANGELES	CA
UNIC	UNICORP	ORANGE	NJ
UNIT	UNITRODE CORP.	WATERTOWN	MA
USECO	USECO DIV.	VAN NUYS	CA
VAC	VACTEC INC.	MARYLAND HEIGHTS	MO
VAR	VARADYNE CAPACITOR DIV.	SANTA MONICA	CA
VARIL	VARI-L CO.	DENVER	CO
VLIER	VLIER ENGINEERING CORP.	BURBANK	CA
VONGT	VONNEGUT HARDWARE	INDIANAPOLIS	IN
W-E	WELLS ELECTRONICS	SOUTH BEND	IN
W-I	WAVETEK INDIANA, INC.	BEECH GROVE	IN
WAG	WAGNER ELECTRIC CORP.	ST. LOUIS	MO
WECK	WECKESSER CO., INC.	CHICAGO	IL
WKFLD	WAKEFIELD ENGINEERING	WAKEFIELD	MA
WSD	WAVETEK	SAN DIEGO	CA
WSR	WAVETEK	SANTA ROSA	CA
ZEN	ZENITH RADIO CORP.	CHICAGO	IL
ZERO	ZERO MANUFACTURING CO.	BURBANK	CA
ZPT	ZIPPERTUBING, CO.	LOS ANGELES	CA

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	ATTEN, 5070-01	5070-01	W-I	1113-30-0024	1
2	MKR SHPR/SZ ASSY B500-224	B500-224	W-I	1112-00-0005	1
3	SWEEP TIME SW ASSY B500-225	8500-225	W-I	1112-00-0008	1
4	REMOTE JUMPER PLUG A500-223	A500-233	W-I	1118-00-0001	1
5	POWER SUPPLY, PS6	PS6	W-I	1115-00-0001	1
12	SWP RATE,M1H	M1H	W-I	1114-00-0002	1
7	SWP DRIVE,M2H	M2H	W-I	1114-00-0029	1
10	MKR ADDER,M5H	M5H	W-I	1114-00-0027	1
9	SWP OSC,M9H	M9H	W-I	1114-00-0003	1
8	OUTPUT AMP,M10H	M10H	W-I	1114-00-0004	1
11	SWP OSC,M19H	M19H	W-I	1114-00-0005	1
A1	CABLE ASSY,2-1/4 IN	WX2000-A1	W-I	1217-00-0022	1
A2	CABLE ASSY,3-1/4 IN	WX3001-W7	W-I	1217-00-0032	1
A3	CABLE ASSY,3-1/2 IN	WX2001-A3	W-I	1217-80-0008	1
A4	CABLE ASSY,10-1/2 IN	WX2001-A4	W-I	1217-80-0009	1

WAVETEK PARTS LIST	TITLE SWP GEN,2001	ASSEMBLY NO. 1010-00-0011 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A5	CABLE ASSY,3-3/4 IN	WX2000-A5	W-I	1217-00-0036	1
A6	CABLE ASSY,5 IN	WX3000-200-W18	W-I	1217-00-0050	1
A7	CABLE ASSY, 2-3/4 IN	WX2001-A7	W-I	1217-02-0026	1
A8	CABLE ASSY,8-1/2 IN	WX2001-A8	W-I	1217-80-0010	1
P102	SMC TERM,50 A500-267	A500-267	W-I	1118-00-0007	1
13	HARNESS ASSY	WY2001	W-I	1219-00-0005	1

WAVETEK PARTS LIST	TITLE SWP GEN,2001	ASSEMBLY NO. 1010-00-0011 PAGE: 2	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C105	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	1
C106	CAP,CER,20PF,1KV CD101-020	60C0G200J	MDC	1510-10-0200	1
C108	CAP,CER,360PF,1KV CD102-136	60U361M	MDC	1510-10-1361	1
CR102	DIODE DG100-341	1N34A	HIT	4807-01-0034	1
J103 J105 J106 J107	CONN,UG911A/U JB109-111	KC79-146	KIN	2110-01-1013	4
L103 L104	CHOKE, 10,OMH,10% LA005-010	08N100K	ASE	1810-03-0100	2
R101	RES,C,1/4W/5%,68K RC103-368	CF1/4-68K	ASE	4700-15-6802	1
R115 R116	POT,CONT,10K RV103-310	534	SPE	4610-20-1103	2
R122	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R123	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
S101	SWITCH,PILOT LIGHT SZ000-003	616-6-1-A1H	M-O	5102-00-0001	1
S103	SWITCH,TOGGLE ST002-006	7107PN-BLK	C-K	5106-00-0011	1

WAVETEK PARTS LIST	TITLE SWEEP, A500-222	ASSEMBLY NO. 1111-00-0007 PAGE: 1	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
S106 S110	SWITCH,TOG,BLK ANOD. ST001-006	7101PN	C-K	5106-00-0009	2
S107	SWITCH,PB,SZ001-004	2KCB070000-304BL	C-L	5110-00-0006	1
S109	SWITCH,TOGGLE ST000-006	7103PN-BLK	C-K	5106-00-0004	1

WAVETEK PARTS LIST	TITLE SWEEP, A500-222	ASSEMBLY NO. 1111-00-0007 PAGE: 2	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
CR101	DIODE DR000-001	1N4004	P-C	4806-01-4004	1
R103	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R104 R111	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	2
R105	RES,C,1/4W,5%,47M RC103-647	CB4765	A-B	4700-15-4705	1
R106	RES,C,1/4W,5%,4,7W RC103-547	CB4755	A-B	4700-15-4704	1
R107	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R108	RES,MF,1/8W,1%,47,5K RF213-475	MF55K-47.5K	ASE	4701-03-4752	1
R109	POT,50K,RP129-350	360S503B	CTS	4610-00-1503	1
R110 R113	RES,C,1/4W,5%,39K RC103-339	CF1/4-39K	ASE	4700-15-3902	2
R112	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R114	RES,C,1/4W,5%,75K RC103-375	CF1/4-75K	ASE	4700-15-7502	1
S102	SWITCH ASS, ROTARY SR000-017	SR000-017	W-I	5104-00-0005	1

WAVETEK PARTS LIST — TITLE: SWEEP TIME SW ASSY B500-225 — ASSEMBLY NO. 1112-00-0008 — REV A

PAGE: 1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101	CAP,CER,002MF,1KV CD102-220	5GAD20	SPR	1510-10-1202	1
C102	CAP,CER,02UF,50V	TG-S20	SPR	1510-10-2203	1
C103	CAP,CER,68PF,1KV CD104-068	68U2J680J	MDC	1510-10-3680	1
C104	CAP,CER,150PF,1KV CD102-115	60U151M	MDC	1510-10-1151	1
C107	CAP,CER,10PF,1KV CD101-010	10TCC-Q10	SPR	1510-10-0100	1
L101 L102	CHOKE,10MILH,10% LA004-310	15S103K	ASE	1810-02-1001	2
R118	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	1
R120	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1
R121	RES,C,1/4W,5%,2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1
S108	SWITCH ASSY, ROTARY SR000-016	SR000-016	W-I	5104-00-0004	1

WAVETEK PARTS LIST — TITLE: MKR SHPR/SZ ASSY B500-224 — ASSEMBLY NO. 1112-00-0005 — REV

PAGE: 1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
J101	PLUG,MC000-017	03-06-2151	MOL	2113-04-0001	1
2	TERMINAL,MALE MC000-019	1854	MOL	2113-05-0002	8

WAVETEK PARTS LIST	TITLE REMOTE JUMPER PLUG A500-223	ASSEMBLY NO. 1118-00-0001 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	PLUG MC000-035	03-06-2042	MOL	2113-04-0002	1
2	TERMINAL,MALE MC000-019	1854	MOL	2113-05-0002	4
3	RECEPTACLE,MCOOO-030	03-09-1121	MOL	2113-08-0001	1
4	TERM,MALE MC000-033	02-09-2143	MOL	2113-09-0002	1
5	TERMINAL,FEMALE MCOOO-032	02-09-1143	MOL	2113-09-0001	6
6	RECEPTACLE,MC000-016	03-06-1151	MOL	2113-03-0001	1
7	TERMINAL,FEMALE MC000-018	1855	MOL	2113-05-0001	13

WAVETEK PARTS LIST	TITLE HARNESS ASSY	ASSEMBLY NO. 1219-00-0005 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
F1	FUSE,S.B.,.5 AMP MF000-007	MDL 1/2	BUS	2410-05-0004	1
J1	RECEPTACLE MC000-034	03-06-1041	MOL	2113-03-0002	1
J4	CONN,UG911A/U JB109-111	KC79-146	KIN	2110-01-1013	1
P3	POWER CORD,WL002-088	17237SVT	BEL	6011-80-0001	1
Q2 Q3 Q8	TRANS QA052-940	2N5294	RCA	4901-05-2940	3
S1	SWITCH,DPDT,LOCKING SS000-003	46256LFE	S-I	5105-00-0003	1
T1	XFMR,PWR,TT000-022	TT000-022	W-I	5610-00-0006	1
13	TERMINAL,FEMALE MC000-018	1855	MOL	2113-05-0001	3
17	TERM,FEMALE MC000-042	02-06-1103	MOL	2113-05-0004	1
19	POWER SUPPLY BOARD	PS6 CARD	W-I	1218-00-0012	1
WAVETEK PARTS LIST	TITLE POWER SUPPLY, PS6	ASSEMBLY NO. 1115-00-0001 PAGE: 1			REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C07	CAP,ELECT,1250MF,50V CE114-212	1510-20-7122	MAL	1510-20-7122	2
C02	CAP,ELECT,50MF,50V CE107-050	TE1307	SPR	1510-20-5500	1
C03 C06 C10 C11	CAP,ELECT,100MF,25V CE105-110	TE1211	SPR	1510-20-4101	4
C04 C12	CAP,CER,100PF,1KV CD102-110	60U101M	MDC	1510-10-1101	2
C05	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	1
C08	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	1
C09	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
CR01 CR02 CR03 CR04 CR05 CR06 CR07 CR08 CR09 CR10 CR11 CR12 CR13 CR14 CR15 CR16 CR17	DIODE DR000-001	1N4004	P-C	4806-01-4004	17
IC01	IC,IC000-001	LM723CH	NAT	7000-17-2300	1
IC02	IC,IC000-002	N5741CV	SIG	7000-57-4100	1
P02	WAFERCON,MC000-031	1840-12-2	MOL	2112-09-0001	1
WAVETEK PARTS LIST	TITLE POWER SUPPLY BOARD	ASSEMBLY NO. 1218-00-0012 PAGE: 1			REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q01 Q04 Q05 Q09 Q10	TRANS QA036-440	2N3644	FCD	4901-03-6440	5
Q06 Q07 Q11 Q12	TRANS QA038-541	2N3854A	G-E	4901-03-8541	4
R01	RES,C,1/4W,5%,270 RC103-127	CF1/4-270	ASE	4700-15-2700	1
R02	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1
R03 R11 R22	RES,1/2W,1%,5 RD01R-050	K20-5	KID	4701-23-0050	3
R04 R14 R21	RES, MF,1/8W,1%,1K RF212-100	MF55K-1K	ASE	4701-03-1001	3
R05	RES,MF,1/8W,1%,12.1K RF213-121	MF55K-12.1K	ASE	4701-03-1212	1
R06	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R07	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	1
R08	RES,C,1/4W,5%,3.9K RC103-239	CF1/43.9K	ASE	4700-15-3901	1
R09	POT,1K,RP131-210	360T102B	CTS	4610-00-3102	1
R10	RES,C,1/4W,5%,2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1

WAVETEK PARTS LIST	TITLE POWER SUPPLY BOARD	ASSEMBLY NO. 1218-00-0012 PAGE: 2	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R12 R25	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	2
R13	RES,C,1/2W,5%,2.7K RC105-227	CF1/2-2.7K	ASE	4700-25-2701	1
R15 R24	RES,MF,1/8W,1%,15K RF213-150	MF55K-15K	ASE	4701-03-1502	2
R16 R17	RES2C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	2
R18	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	1
R19 R20	RES,SET,2-10K,1/8W QTY:2:4701-03-1002	RX000-003	W-I	4789-00-0004	1
R23 R29	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R26	RES,C,1/2W,5%,2.2K RC105-222	CF1/2-2.2K	ASE	4700-25-2201	1
R27	RES,MF,1/8W,1%,825 RF211-825	MF55K-825	ASE	4701-03-8250	1
R28	RES,MF,1/8W,1%,6.81K RF212-681	MF55K-6.81K	ASE	4701-03-6811	1
R30	RES,C,1/2W,5%,470 RC105-147	CF1/2-470	ASE	4700-25-4700	1
R31	RES,C,1/2W,5%,220	CF1/2-220	ASE	4700-25-2200	1

WAVETEK PARTS LIST	TITLE POWER SUPPLY BOARD	ASSEMBLY NO. 1218-00-0012 PAGE: 3	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C07 C08 C09 C12 C14 C15 C16 C17 C20	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-8	1510-30-1689	10
C02 C06 C11	CAP,CER,470PF,1KV CD102-147	60U471M	MDC	1510-10-1471	3
C03	CAP,FILM,.15MF,100V	60C154K100	PLSSY	1510-60-7154	1
C04	CAP,CER,10PF,1KV CD101-010	10TCC-Q10	SPR	1510-10-0100	1
C05	CAP,CER,001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C10	CAP,CER,02UF,50V	TG-S20	SPR	1510-10-2203	1
C13	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	1
C18 C19	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	2
C21	CAP,CER,01MF,100V CD103-310	68U103M	MDC	1510-10-2103	1
CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9	DIODE DR000-001	1N4004	P-C	4806-01-4004	9
Q01 Q02	TRANS,1/PR,2N5458 QTY:2:4901-05-4580	Q8000-014	W-I	4998-00-0002	1
Q03 Q04 Q07 Q08 Q09 Q11 Q16 Q17 Q19	TRANS QBOOO-009	MPS3702	MOT	4902-03-7020	9

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q05 Q14	TRANS QA054-580	2N5458	MOT	4901-05-4580	2
Q06 Q15	TRANS QB000-010	TD101	SPR	4902-00-1010	2
Q10 Q12 Q13 Q18	TRANS QA038-541	2N3854A	G-E	4901-03-8541	4
R01 R09	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	2
R02 R03 R05 R11 R14 R37	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	6
R04 R13 R18 R33 R38 R39 R53	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	7
R06	RES,C,1/4W,5%.180K RC103-418	CF1/4-180K	ASE	4700-15-1803	1
R07 R20 R41 R45	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	4
R08 R26 R27 R36	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	4
R10	RES,C,1/4W,10%,5.6W RC104-556	CB5651	A-B	4700-16-5604	1
R12 R57	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	2
R15	RES,C,1/4W,5%,68K RC103-368	CF1/4-68K	ASE	4700-15-6802	1
R16 R51	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R17 R30 R31 R48	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	4
R19 R24 R28 R29	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	4
R21	RES,C,1/4W,5%,18K RC103-318	CF1/4-18K	ASE	4700-15-1802	1
R22	RES,C,1/4W,5%,62K RC103-362	CF1/4-62K	ASE	4700-15-6202	1
R23	RES,C,1/4W,5%,560K RC103-456	CF1/4-560K	ASE	4700-15-5603	1
R25	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R32	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R34	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	1
R35 R43 R52	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	3
R40 R47	RES,C1/4W,5%,220K RC103-422	CF1/4220K	ASE	4700-15-2203	2
R42 R55	RES,C,1/4W,5%,6.8K RC103-268	CF1/4-6.8K	ASE	4700-15-6801	2

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	SWP RATE,M1H	1114-00-0002 PAGE: 3	B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R44	RES,C,1/4W,5%,12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1
R46	RES,C,1/4W,5%,39K RC103-339	CF1/4-39K	ASE	4700-15-3902	1
R49	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R50	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R54 R56	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	2

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	SWP RATE,M1H	1114-00-0002 PAGE: 4	B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C04 C05 C06 C07 C14	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	6
C02	CAP,CER,120PF,1KV CD102-112	60U121M	WDC	1510-10-1121	1
C03	CAP,CER,10PF,1KV CD101-010	10TCC-Q10	SPR	1510-10-0100	1
C08	CAP,CER,15PF,1KV CD101-015	10TCC-Q15	SPR	1510-10-0150	1
C09	CAP,Q-C,2.4PF,10% CG101-224	QC-2.4PF	Q-C	1510-40-0249	1
C10 C11 C15 C18 C19 C22	CAP,F.T.,47OPF CF101-147	FASC-4712	A-B	1510-30-0471	6
C12	CAP,CER,25PF,1KV CD101-025	60C0G250J	MDC	1510-10-0250	1
C13	CAP,Q-C,10PF,10%, CG101-310	QC-10PF	Q-C	1510-40-0100	1
C16 C20	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
C17 C21	CAP,CER,470PF,1KV CD102-147	60U471M	MDC	1510-10-1471	2
C23 C24	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	2

WAVETEK PARTS LIST | TITLE SWP DRIVE,M2H | ASSEMBLY NO. 1114-00-0029 PAGE: 1 | REV H

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C25 C26	CAP Q.C.,3.9PF CG101-239	QC-3.9PF	Q-C	1510-40-0399	2
C27 C28	CAP,ELECT,1MF,25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	2
CR01 CR02 CR03 CR04 CR06 CR07 CR09 CR10 CR13 CR14 CR15 CR16 CR17 CR18 CR19 CR20 CR21 CR22	DIODE DR000-001	1N4004	P-C	4806-01-4004	18
Q01 Q04 Q18	TRANS QR000-010	TD101	SPR	4902-00-1010	3
Q02 Q03 Q05 Q06 Q07 Q19	TRANS-QA042-500	2N4250	FCD	4901-04-2500	6
Q08	TRANS QA036-440	2N3644	FCD	4901-03-6440	1
Q09 Q10 Q11 Q15 Q16 Q17	TRANS QA054-610	2N5461	MOT	4901-05-4610	6
Q12 Q21	TRANS 0B000-011	TD401	SPR	4902-00-4010	2
Q13 Q14 Q20 Q22	TRANS QA050-880	2N5088	MOT	4901-05-0880	4
Q23	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
R01 R29 R54 R55	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	4
R02 R19 R32 R33 R34 R62 R71 R75 R79	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	9

WAVETEK PARTS LIST | TITLE SWP DRIVE,M2H | ASSEMBLY NO. 1114-00-0029 PAGE: 2 | REV H

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R03 R63	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	2
R04 R21 R57 R64	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	4
R06 R08 R23 R25	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	4
R07 R10 R24 R27 R66	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	5
R09 R13 R17 R26 R31 R72 R76 R80 R95	POT,20K,RR130-320	89PR20K	BEK	4610-00-2203	9
R11	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1
R12 R18	RES,C1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	2
R14 R15 R16	RES,SET,3-178K,1/8W QTY:3:4701-03-1783	RX000-002	W-I	4789-00-0001	1
R20 R83 R89	RES,C,1/4,5%,8.2K RC103-282	CF1/4-8.2K	ASE	4700-15-8201	3
R28	RES,C,1/4W,5%,82K RC103-382	CF1/4-82K	ASE	4700-15-8202	1
R30 R81 R87	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	3

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R35 R36 R37 R38	RES,C,1/4,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	4
R56	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R58 R59 R60 R69 R73 R77	RES,C,1/4W,5%,10M RC103-610	CB1065	A-B	4700-15-1005	6
R61 R67	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	2
R68	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	1
R70 R74 R78	RES,C,1/4W,5%,18K RC103-318	CF1/4-18K	ASE	4700-15-1802	3
R82 R88	RES,C,1/4W,5%,560 RC103-156	CF1/4-560	ASE	4700-15-5600	2
R84 R92	RES,C,1/4W,5%,4.7 RC103-R47	CF1/4-4.7	ASE	4700-15-4708	2
R85 R86	RES,SET,2-10K,1/8W QTY:2:4701-03-1002	RX000-003	W-I	4789-00-0004	1
	RES,MF,SET,MATCHED CONSIST:4799-00-0001 THRU:0002	RX000-004	W-1	4789-00-0003	1
R91	RES,MF,1/8W,1%,19.1K PART OF 4789-00-0003 QTY:1:4701-03-1912	4799-00-0001	W-I	4799-00-0001	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R90	RES,MF,1/8W,1%,21.5K PART OF 4789-00-0003 QTY:1:4701-03-2152	4799-00-0002	W-I	4799-00-0002	
R93 R94	RES,C,1/4W,5%,15R RC103-315	CF1/4-15K	ASE	4700-15-1502	2
R96	RES,C,1/4W,5%,1.2M RC103-512	CF1/4-1.2M	ASE	4700-15-1204	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C21 C22	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	3
C02	CAP,CER,.025MF,50V CD103-325	TG-S25	SPR	1510-10-2253	1
C03 C04 C05 C06 C09 C10 C11 C13 C18	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	9
C07	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
C08 C14 C15 C19	CAP,CER,.05MF,100V CD103-350	TG-S50	SPR	1510-10-2503	4
C12 C24 C26	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	3
C16 C17	CAP,ELECT,100MF,25V CE105-110	TE1211	SPR	1510-20-4101	2
C20	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	1
C23	CAP,CER,470PF,1KV CD102-147	60U471M	MDC	1510-10-1471	1
C25	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	1
CR02 CR07	DIODE DG100-821	1N82AG	G-I	4807-01-0082	2
CR03	DIODE DR000-001	1N4004	P-C	4806-01-4004	1

WAVETEK PARTS LIST | TITLE MKR ADDER,M5H | ASSEMBLY NO. 1114-00-0027 | REV E

PAGE: 1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
CR04 CR05 CR06	DIODE DP000-040	MA47980	M-A-	4805-02-0001	3
Q01 Q02 Q03 Q04 Q05	TRANS QA050-880	2N5088	MOT	4901-05-0880	5
Q06 Q12	TRANS Q8000-010	TD101	SPR	4902-00-1010	2
Q07 Q08 Q09 Q13	TRANS Q8000-009	MPS3702	MOT	4902-03-7020	4
Q10	TRANS QA038-541	2N3854A	G-E	4901-03-8541	1
Q11	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
R01 R32 R33 R48	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	4
R02	RES,C,1/4W,5%,180 RC103-118	CF1/4-180	ASE	4700-15-1800	1
R03 R35 R36	RES,C,1/4W,5%,680 RC103-168	CF1/4-680	ASE	4700-15-6800	3
R04 R05	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	2
R06 R08 R10 R13 R16 R19	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	6
R07 R11 R14 R17 R20	RES,C,14W,5%,270 RC103-127	CF1/4-270	ASE	4700-15-2700	5
R09 R12 R15 R18	RES,C,1/4W,5%,5.6K RC103-256	CF1/4-5.6K	ASE	4700-15-5601	4

WAVETEK PARTS LIST | TITLE MKR ADDER,M5H | ASSEMBLY NO. 1114-00-0027 | REV E

PAGE: 2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R21 R29	RES,C,1/4W,5%,3.3K RC103-233	CF1/4-3.3K	ASE	4700-15-3301	2
R22 R23 R28 R31 R34 R51 R52	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	7
R24 R38 R50	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	3
R25 R54 R55 R56	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	4
R26 R40	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	2
R27	RES,C,1/4W,5%,220K RC103-422	CF1/4220K	ASE	4700-15-2203	1
R30	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1
R37 R39 R49	RES,C,1/4W,5%.2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	3
R42	RES,C,1/2W,5%,47 RC105-047	EB4705	A-B	4705-25-4709	1
R43	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	1
R44	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	MKR ADDER,M5H	1114-00-0027 PAGE: 3	E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R45	RES,C,1/4W,10%,2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1
R46	POT,20K RP124-320	WA2G032S-203MA	A-B	4610-10-7203	1
R47	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R53	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	1
41	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	1

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	MKR ADDER,M5H	1114-00-0027 PAGE: 4	E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C03 C07 C08 C09 C11 C14 C18 C19 C25 C27	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	11
C02 C10	CAP,CER,100PF,1KV CD108-110	CN1500	RMC	1510-10-5101	2
C04 C05 C12	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	3
C06 C13	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	2
C15 C28 C29 C30	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	4
C16	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	1
C17 C33 C34	CAP,TANT,47MF,50V CE113-447	935	TRW	1510-21-9470	3
C20	CAP,Q.C.,.75PF CG101-175	QC-.75PF	Q-C	1510-40-0758	1
C21 C24	CAP,VALUE DETERMINED IN CALIBRATION	CAP, TRIM	W-I	1519-99-9999	2
C22	CAP,Q-C,2.4PF,10% CG101-224	QC-2.4PF	Q-C	1510-40-0249	1
C23 C26	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	2

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	SWP OSC,M9H	1114-00-0003 PAGE: 1	I

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C31	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
C32	CAP,CER,05MF,100V CD103-350	TG-S50	SPR	1510-10-2503	1
C35	CAP,CER,.001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C36	CAP,Q.C.,3.9PF CG101-239	QC-3.9PF	Q-C	1510-40-0399	1
21	CAP,M.C.,.47PF CG102-147	MC-.47PF	Q-C	1510-40-1478	1
CR01 CR02 CR03 CR04 CR05	DIODE DC000-005	BB141A	ITT	4889-00-0001	5
CR08 CR09	DIODE DG100-823	1N82A	S-T	4807-03-0002	2
J01 J02	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01 L03	CHOKE,22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	2
L02 L04 L05 L07 L08	RF CHOKE	CHOKE	W-I	1819-99-9999	5
L06	CHOKE,1MH, 10% LA005-R10	08N1R0K	ASE	1810-03-0010	1
L09 L10	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	2

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	SWP OSC,M9H	1114-00-0003 PAGE: 2	I

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
20	FERR. BEAD,LC000-009	K5-001-00/3B	FRXC	1813-00-0007	2
Q01 Q04 Q07 Q09	TRANS QB000-009	MPS3702	MOT	4902-03-7020	4
Q02	TRANS QB000-013	A430	APX	4902-00-4300	1
Q03	TRANS QA050-880	2N5088	MOT	4901-05-0880	1
Q05 Q14 Q16	TRANS QA051-790	2N5179	RCA	4901-05-1790	3
Q06 Q10	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
Q08	TRANS Q8000-011	TD401	SPR	4902-00-4010	1
Q11 Q12 Q13 Q15	TRANS QA050-530	2N5053	APX	4901-05-0530	4
Q17	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
R01	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	1
R02 R12	POT,10K,RP129-310	360S103B	CTS	4610-00-1103	2
R03 R14 R17 R24	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	4
R04 R19 R39 R40 R47 R48	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	6
R05 R06 R15 R20 R21 R41 R49	RES,C1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	7
R07 R22	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R08 R29	RES,C,1/4W,5%.5.6K RC103-256	CF1/4-5.6K	ASE	4700-15-5601	2
R09	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	1
R11	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE3	4700-15-4702	1
R13	POT,20K RP124-320	WA2G032S-203MA	A-H	4610-10-7203	1
R16 R30 R33	RES,C,1/4W,5%.33K RC103-333	CF1/4-33K	ASE	4700-15-3302	3
R18	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	1
R25	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R26 R32	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	2
R28	RES,C,1/4W,5%.39K RC103-339	CF1/4-39K	ASE	4700-15-3902	1
R31	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R34	RES,C,1/4W,5%.12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R36	RES,C,1/4W,5%.4.7 RC103-R47	CF1/4-4.7	ASE	4700-15-4708	1
R37	RES,C,1/4W,5%,390 RC103-139	CF1/4-390	ASE	4700-15-3900	1
R38 R43 R45 R46 R51	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	5
R42 R44 R50	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	3
R52	RES,C,1/4W,5%,22 RC103-022	CF1/4-22	ASE	4700-15-2209	1
R53	RES,C,1/4W,5%,150 RC103-115	CF1/4-150	ASE	4700-15-1500	1
R54	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	1
18	RES,C,1/4W,10%,4.7K RC104-247AB	CB4721	A-B	4705-16-4701	2
22	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	3

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C17 C28 C30	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	5
C02 C27 C29 C31	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	4
C03 C04	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	2
C05	CAP,CER,.025MF,50V CD103-325	TG-S25	SPR	1510-10-2253	1
C06 C07 C08 C15	CAP,TANT,47MF,50V CE113-447	935	TRW	1510-21-9470	4
C09 C13 C14 C23	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	4
C10	CAP,CER,15PF,1KV CD101-015	10TCC-Q15	SPR	1510-10-0150	1
C11	CAP,CER,4.7PF,1KV CD101-R47	10TCC-V47	SPR	1510-10-0479	1
C12	CAP,CER,10PF,1KV CD101-010	10TCC-Q10	SPR	1510-10-0100	1
C16	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	1
C18 C19 C24 C32 C33	CAP,F.T.,6,8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	5

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10H	ASSEMBLY NO. 1114-00-0004 PAGE: 1	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C20	CAP,CER,.001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C21	CAP,CER,360PF,1KV CD102-136	60U361M	MDC	1510-10-1361	1
C22	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	1
C25	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	1
C34 C35	CAP,CER,200PF,1KV CD102-120	5GA-T20	SPR	1510-10-1201	2
C36	CAP,CER,47PF,1KV CD104-047	60U2J470J	MDC	1510-10-3470	1
CR01 CR02 CR03	DIODE DP000-050	5082-3080	H-P	4805-02-0002	3
CR04 CR05 CR06 CR07	DIODE DC000-008	BB205	APX	4803-02-0004	4
CR08	DIODE DG000-007	5082-2800	H-P	4809-02-0001	1
CR09 CR10	DIODE DR000-001	1N4004	P-C	4806-01-4004	2
J01 J02	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01 L04 L05 L09 L11	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	5
L06 L07 L08 L10	FERRITE CHOKE LA0009-004	T1255-1	HYT	1810-05-0001	4

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10H	ASSEMBLY NO. 1114-00-0004 PAGE: 2	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L12	CHOKE,10MILH,10% LA004-310	158103K	ASE	1810-02-1001	1
Q01 Q02	TRANS QA050-530	2N5053	APX	4901-05-0530	2
Q03 Q05 Q06	TRANS Q8000-018	SD1006	SSS	4902-01-0060	3
Q04	TRANS QB000-013	A430	APX	4902-00-4300	1
Q07 Q10 Q11	TRANS QB000-009	MPS3702	MOT	4902-03-7020	3
Q08	TRANS QA054-580	2N5458	NOT	4901-05-4580	1
Q09	TRANS QB000-010	TD101	SPR	4902-00-1010	1
R01 R05 R26	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	3
R02	RES,C,1/4W,5%,330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R03 R33 R46	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	3
R06	RES,C,1/4W,5%,150 RC103-115	CF1/4-150	ASE	4700-15-1500	1
R07	RES,C,1/4W,5%,820 RC103-182	CF1/4-820	ASE	4700-15-8200	1
R08 R50	RES,C,1/4W,10%,100 RC104-110AB	CB1001	A-B	4705-16-1000	2

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10H	ASSEMBLY NO. 1114-00-0004 PAGE: 3	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R09	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	1
R10	RES,C,1/4W,5%,560 RC103-156	CF1/4-560	ASE	4700-15-5600	1
R11 R44 R52	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	3
R12 R21	RES,C,1/4,5%,27 RC103-027	CF1/4-27	ASE	4700-15-2709	2
R13 R30	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	2
R14 R17 R22 R25	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	4
R15 R19 R20	RES,C,1/4W,5%,82 RC103-082	CF1/4-82	ASE	4700-15-8209	3
R16	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R18	RES,C,1/4W,5%,22 RC103-022	CF1/4-22	ASE	4700-15-2209	1
R23	RES,C,1/2W,5%,360 W-I/RC105-136AB	EB3615	A-B	4705-25-3600	1
R24	RES,C,1W,5%,150 RC107-115	GB1515	A-B	4700-35-1500	1

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10H	ASSEMBLY NO. 1114-00-0004 PAGE: 4	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R27 R28 R31	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	3
R29	RES,C,1W,5%,100 RC107-110	GB1015	A-B	4700-35-1000	1
R32	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R34 R47	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R35	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R36	RES,C,1/4W,10%,2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1
R37 R39	POT,20K RP124-320	WA2G032S-203MA	A-B	4610-10-7203	2
R38	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R40	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R41	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
R42	RES,C,1/4W,5%,680K RC103-468	CF1/4-680K	ASE	4700-15-6803	1

WAVETEK PARTS LIST — TITLE: OUTPUT AMP,M10H — ASSEMBLY NO. 1114-00-0004 — PAGE: 5 — REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R43	RES,C,1/4W,5%,2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1
R45 R51	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	2
R49	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
20	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	2

WAVETEK PARTS LIST — TITLE: OUTPUT AMP,M10H — ASSEMBLY NO. 1114-00-0004 — PAGE: 6 — REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C13 C24 C25 C26	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	5
C02 C04 C05 C06 C10 C11 C12 C14 C15 C16 C17 C18 C22 C23 C33	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	14
C03 C08 C09 C19 C20 C21	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	6
C07 ML32	CAP,Q.C,.75PF CG101-175	QC-.75PF	Q-C	1510-40-0758	2
C27 C28 C29 C30 C31	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	5
C39	CAP,VALUE DETERMINED IN CALIBRATION	CAP,TRIM	W-I	1519-99-9999	1
33	CAP,Q-C,2.0PF,10% CG101-220	QC-2.0PF	Q-C	1510-40-0020	1
34	CAP,M.C.,.47PF CG102-147	MC-.47PF	Q-C	1510-40-1478	2
CR01 CR10 CR11 CR21	DIODE DR000-001	1N4004	P-C	4806-01-4004	4
CR02 CR03 CR04 CR05 CR13 CR14 CR15 CR16	DIODE DC000-008	BB205	APX	4803-02-0004	8
CR20	DIODE DG100-821	1N82AG	G-I	4807-01-0082	1
J01 J02 J03	CONN JF000-005	37JR116-1	S-C	2110-03-0002	3

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	SWP OSC,M19H	1114-00-0005 PAGE: 1	J

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L01 L02 L10 L11 L12 L13 L21 L22	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	8
L03 L05 L14 L16	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	4
L24	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
L25 L26	FERRITE CHOKE,4 TURN FROM:1813-00-0007	LA007-004	W-I	1210-30-0005	2
Q01 Q04 Q07 Q08 Q09 Q11 Q15 Q16	TRANS QB000-009	MPS3702	MOT	4902-03-7020	8
Q02 Q05 Q10 Q12 Q13	TRANS QA038-541	2N3854A	G-E	4901-03-8541	5
Q03	TRANS QA054-610	2N5461	MOT	4901-05-4610	1
Q06	TRANS QA051-090	2N5109	SSS	4901-05-1090	1
Q14	TRANS QB000-015	2N5947	MOT	4901-05-9470	1
R01 R30	RES,C,1/4W,5%,7.5K RC103-275	CF1/4-7.5K	ASE	4700-15-7501	2
R02 R07 R31 R39 R40	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	5
R03	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	1
R04 R22	RES,VAL DET IN CALIB	RES,TRIM	W-I	4799-99-9999	2

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	SWP OSC,M19H	1114-00-0005 PAGE: 2	J

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R05 R19 R24 R28 R33	RES,C,1/W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	5
R06 R23 R34	RES,C,1/4W,5%,68K RC103-368	CF1/4-68K	ASE	4700-15-6802	3
R08 R17 R18 R35 R49 R50	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	6
R09 R10	RES,C,1/2W,5%,220 RC105-122	CF1/2-220	ASE	4700-25-2200	2
R11	RES,C,1/4W,5%,390 RC103-139	CF1/4-390	ASE	4700-15-3900	1
R12 R15 R36	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	3
R14 R16	POT,CONT,10K RV102-310	3067P-10K	BOU	4610-20-0103	2
R20	RES,C,1/4W,5%,39K RC103-339	CF1/4-39K	ASE	4700-15-3902	1
R21	RES,C,1/4W,5%,91K RC103-391	CF1/4-91K	ASE	4700-15-9102	1
R25 R29	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2
R26 R27	RES,C,1/4W,5%,220K RC103-422	CF1/4220K	ASE	4700-15-2203	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R32	RES,C,1/4W,5%,6.8K RC103-268	CF1/4-6.8K	ASE	4700-15-6801	1
R37	RES,C,1W,5%,160 RC107-116	GB1615	A-B	4700-35-1600	1
R38	RES,C,1/2W,5%,82 RC105-082	CF1/2-82	ASE	4700-25-8209	1
R41	RES,C,1W,10%,470 RC108-147	GB4711	A-B	4700-36-4700	1
R42	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	1
R43	RES,C,1/4W,5%,330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R44	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R45 R48	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	2
R46	RES,L-A,1/4W,1%,49.9 RF404-990	SPS-N-347-49.9	IRC	4741-49-9007	1
R47	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	1
28	RES,C,1/4W,10%,4.7K RC104-247AB	CB4721	A-B	4705-16-4701	8
30	RES,C,1/4W,10%,2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP,VALUE DETERMINED IN CALIBRATION	CAP,TRIM	W-I	1519-99-9999	1
C02	CAP,CEP,33PF,1KV CD104-033	10TU-Q33	SPR	1510-10-3330	1
C03 C14	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	2
C04	CAP,CER,.025MF,50V CD103-325	TG-S25	SPR	1510-10-2253	1
C05	CAP,CER,68PF,1KV CD104-068	68U2J680J	MDC	1510-10-3680	1
C06	CAP,CER,100PF,1KV CD104-110	10TCU-T10	SPR	1510-10-3101	1
C07	CAP,VAR,3.5-13PF250V CV101-013	7S-TR1KO-02-3.5-13	STR	1510-70-0130	1
C08	CAP,CER,15PF,1KV CD101-015	10TCC-Q15	SPR	1510-10-0150	1
C09	CAP,CER,47PF,1KV CD104-047	60U2J470J	MDC	1510-10-3470	1
C10 C13	CAP,CER,.001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	2
C11	CAP,TANT,.47MF,50V CE113-447	935	TRW	1510-21-9470	1
C12	CAP,CER,470PF,1KV CD102-147	60U471M	MDC	1510-10-1471	1

WAVETEK PARTS LIST	TITLE 1 MHZ HARMONIC MARKER, M6H-1	ASSEMBLY NO. 1114-00-0050	REV E
		PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C15	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
C16	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	1
C17	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	1
C18	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
CR1 CR2	DIODE DG100-821	1N82AG	G-I	4807-01-0082	2
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L1 L2 L3	RF CHOKE	CHOKE	W-I	1819-99-9999	3
L4	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	1
Q1 Q3	TRANS QB000-009	MPS3702	MOT	4902-03-7020	2
Q2	TRANS QA038-541	2N3854A	G-E	4901-03-8541	1
Q4	TRANS QA051-790	2N5179	RCA	4901-05-1790	1
Q5	TRANS QB000-013	A430	APX	4902-00-4300	1
Q6	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
Q7	TRANS QA050-880	2N5088	MOT	4901-05-0880	1
R01 R16	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	2

WAVETEK PARTS LIST	TITLE 1 MHZ HARMONIC MARKER, M6H-1	ASSEMBLY NO. 1114-00-0050	REV E
		PAGE: 2	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R02 R05 R12	RES,C,1/4W,5%,3.9K RC103-239	CF1/43.9K	ASE	4700-15-3901	3
R03 R04	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	2
R06	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	1
R07 R09 R13	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	3
R08 R20	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R10 R24	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	2
R11	RES,C,1/4W,5%,75 RC103-075	CB1/4-75	ASE	4700-15-7509	1
R14	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1
R15	RES,C,1/4W,5%,K RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R17	RES,C,1/4W,5%,8.2K RC103-282	CF1/4-8.2K	ASE	4700-15-8201	1
R18	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASF	4700-15-1502	1
R19	RES,C,1/4W,5%,1.5M RC103-515	CF1/4-1.5M	ASE	4700-15-1504	1

WAVETEK PARTS LIST — TITLE: 1 MHZ HARMONIC MARKER, M6H-1 — ASSEMBLY NO. 1114-00-0050 — REV E

PAGE: 3

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R21	POT,20K RP124-320	NA2G032S-203MA	A-B	4610-10-7203	1
R22 R23	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	2
X1	CRYSTAL X25W XX000-251	X25W-00.00000	W-I	2310-00-0251	1

WAVETEK PARTS LIST — TITLE: 1 MHZ HARMONIC MARKER, M6H-1 — ASSEMBLY NO. 1114-00-0050 — REV E

PAGE: 4

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C07	CAP,CER,47PF,1KV CD104-047	60U2J470J	MDC	1510-10-3470	2
C02	CAP,CER,330PF,1KV CD104-133	10TCU-T33	SPR	1510-10-3331	1
C03	CAP,CER,120PF,1KV CD104-112	10TCU-T12	SPR	1510-10-3121	1
C04	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
C05	CAP,VAR,3.5-13PF250V CV101-013	7S-TRIKO-02-3.5-13	STR	1510-70-0130	1
C06	CAP,CER,15PF,1KV CD101-015	10TCC-Q15	APR	1510-10-0150	1
C08 C09	CAP,CER,.001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	2
C10	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	1
C11	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	1
C12	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	1
C13	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
CR1	DIODE DG100-821	1N82AG	G-I	4807-01-0082	1

WAVETEK PARTS LIST	TITLE 10 MHZ HARMONIC MARKER, M6H-10	ASSEMBLY NO. 1114-00-0099 PAGE: 1	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L1 L3	RF CHOKE	CHOKE	W-I	1819-99-9999	2
L2	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
L4	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	1
Q1	TRANS QA038-541	2N3854A	G-E	4901-03-8541	1
Q2	TRANS QB000-013	A430	APX	4902-00-4300	1
Q3	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
Q4	TRANS QA050-880	2N5088	MOT	4901-05-0880	1
R01	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R02	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	1
R03	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R04 R17	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	2
R05	RES,C,1/4W,5%,75 RC103-075	CR1/4-75	ASE	4700-15-7509	1
R06	RES,C,1/4W,5%,3.9K RC103-239	CF1/43.9K	ASE	4700-15-3901	1

WAVETEK PARTS LIST	TITLE 10 MHZ HARMONIC MARKER, M6H-10	ASSEMBLY NO. 1114-00-0099 PAGE: 2	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R07	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R08	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1
R09	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R10	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R11	RES,C,1/4W,5%,8.2K RC103-282	CF1/4-8.2K	ASE	4700-15-8201	1
R12	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R13	RES,C,1/4W,5%,1.5M RC103-515	CF1/4-1.5M	ASE	4700-15-1504	1
R14	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1
R15	POT,20K RP124-320	WA2G032S-203MA	A-B	4610-10-7203	1
R16	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
X1	CRYSTAL,XX000-321	X32W-00.00000	W-I	2310-00-0321	1

WAVETEK PARTS LIST	TITLE 10 MHZ HARMONIC MARKER, M6H-10	ASSEMBLY NO. 1114-00-0099 PAGE: 3	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP,CER,20PF,1KV CD101-020	60C0G200J	MDC	1510-10-0200	1
C02	CAP,CER,120PF,1KV CD104-112	10TCU-T12	SPR	1510-10-3121	1
C03 C07	CAP,CER,47PF,1KV CD104-047	60U2J470J	MDC	1510-10-3470	2
C04	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
C05	CAP,VAR,3.5-13PF250V CV101-013	7S-TRIKO-02-3.5-13	STR	1510-70-0130	1
C06	CAP,CER,15PF,1KV CD101-015	10TCC-Q15	SPR	1510-10-0150	1
C08 C09	CAP,CER,.001MFD,1KV CD102-210	SGAD10	SPR	1510-10-1102	2
C10	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	1
C11	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	1
C12	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	1
C13	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
CR1	DIODE DG100-821	1N82AG	G-I	4807-01-0082	1

WAVETEK PARTS LIST	TITLE 50 MHZ HARMONIC MARKER, M6H-50	ASSEMBLY NO. 1114-00-0100 PAGE: 1	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L1 L3	RF CHOKE	CHOKE	W-I	1819-99-9999	2
L2	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
L4	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	1
R01	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R02	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	1
R03	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R04 R17	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	2
R05	RES,C,1/4W,5%,75 RC103-075	CR1/4-75	ASE	4700-15-7509	1
R06	RES,C,1/4W,5%,3.9K RC103-239	CF1/43.9K	ASE	4700-15-3901	1
R07	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R08	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	50 MHZ HARMONIC MARKER, M6H-50	1114-00-0100	C
		PAGE: 2	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R09	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R10	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R11	RES,C,1/4W,5%,8.2K RC103-282	CF1/4-8.2K	ASE	4700-15-8201	1
R12	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R13	RES,C,1/4W,5%,1.5M RC103-515	CF1/4-1.5M	ASE	4700-15-1504	1
R14	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1
R15	POT,20K RP124-320	WA2G032S-203MA	A-B	4610-10-7203	1
R16	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
X1	CRYSTAL,XX000-331	X33W-00.00000	W-I	2310-00-0331	1

WAVETEK	TITLE	ASSEMBLY NO.	REV
PARTS LIST	50 MHZ HARMONIC MARKER, M6H-50	1114-00-0100	C
		PAGE: 3	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP,CER,47PF,1KV CD104-047	60U2J470J	MDC	1510-10-3470	1
C02	CAP,CER,20PF,1KV CD101-020	60C0G200J	MDC	1510-10-0200	1
C03	CAP,CER,120PF,1KV CD104-112	10TCU-T12	SPR	1510-10-3121	1
C04 C09	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	2
C05	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	1
C08	CAP,VALUE DETERMINED IN CALIBRATION	CAP,TRIM	W-I	1519-99-9999	1
C10	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	1
C11	CAP,CER,.05MF,100V CD103-350	TG-S50	SPR	1510-10-2503	1
C12	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	1
CR1A	DIODE DG000-007	5082-2800	H-P	4809-02-0001	1
CR2	DIODE DG100-821	1N82AG	G-I	4807-01-0082	1
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L2	CHOKE,2.2MH,10% LA005-R22	08N2R2K	ASE	1810-03-0229	1

WAVETEK PARTS LIST	TITLE SING FREQ MKR M6S-3	ASSEMBLY NO. 1114-00-0045 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q1 Q2	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
R1	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R2	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	1
R3 R4	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	2
R5	RES,C,1/4W,5%,180K RC103-418	CF1/4-180K	ASE	4700-15-1803	1
R6	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R7 R9	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R8	POT,20K RP124-320	WA2G032S-203MA	A-B	4610-10-7203	1
X1	CRYSTAL,XX000-331	X33W-00.00000	W-I	2310-00-0331	1

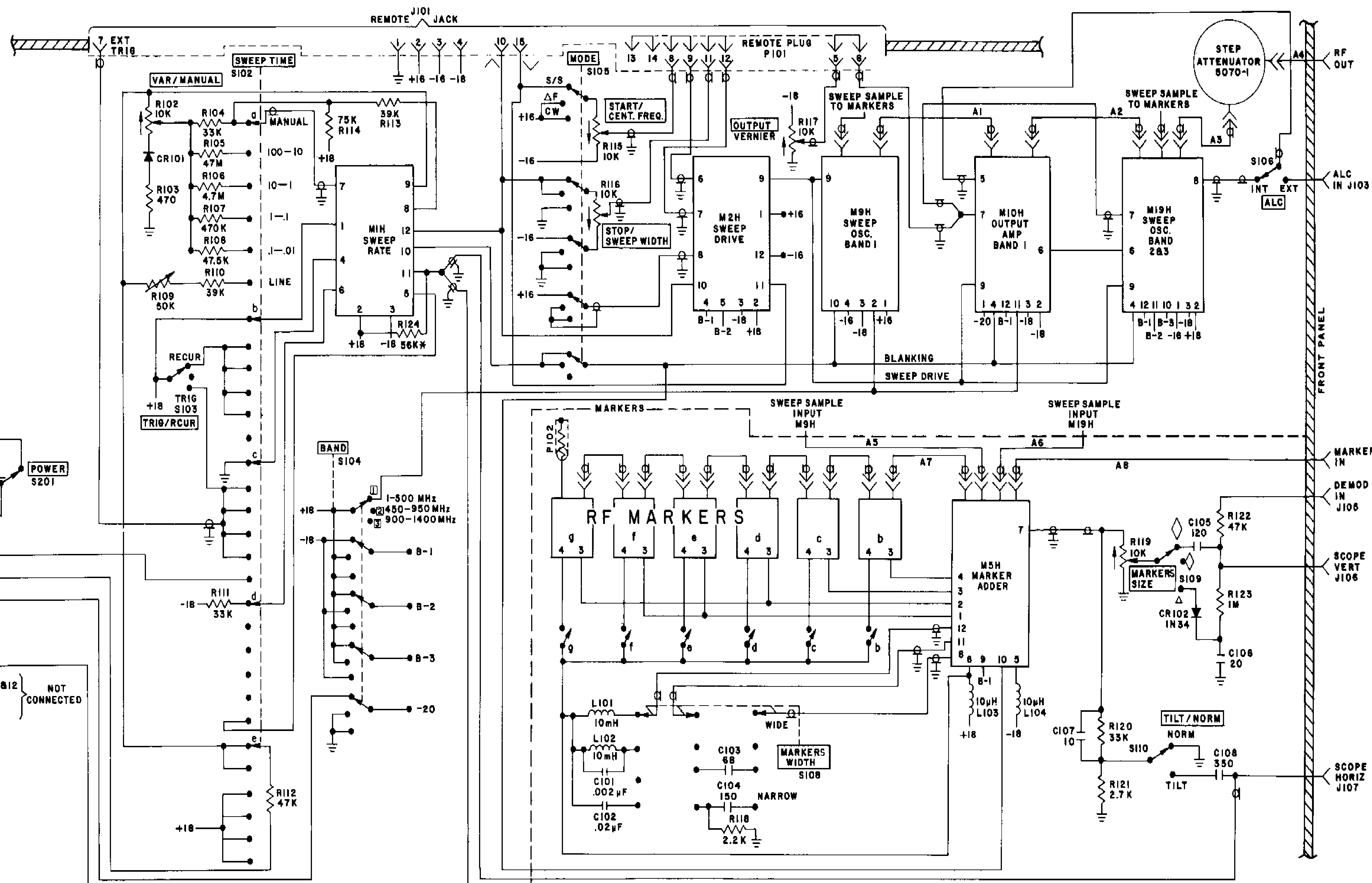
WAVETEK PARTS LIST	TITLE SING FREQ MKR M6S-3	ASSEMBLY NO. 1114-00-0045 PAGE: 2	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1	CAP,FILM,10KPF,160V CP105-310	SXM110	MAL	1510-60-5103	1
C2	CAP,CER,10PF,1KV CD101-010	10TCC-Q10	SPR	1510-10-0100	1
C3	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	1
C4	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-H	1510-30-1689	1
CR1 CR2 CR3	DIODE DG109-140	1N4148	FCD	4807-01-0914	3
IC1	IC,8 PIN,IC000-008	LM301-AN	NAT	7000-03-0100	1
R1	POT,20K RP124-320	WA2G032S-203MA	A-B	4610-10-7203	1
R2	RES,C,1/4W,5%,56K RC103-356	CF1/4-56K	ASE	4700-15-5602	1
R3	RES.C.1/4W,5%.150 RC103-115	CF1/4-150	ASE	4700-15-1500	1
R4	RES,MF,1/8W,1%,47.5K RF213-475	MF55K-47.5K	ASE	4701-03-4752	1
R5	RES,MF,1/8W.1%,47.7K RF213-487	MF55K-48.7K	ASE	4701-03-4872	1
R6	RES,MF,1/8W,1%,46.4K RF213-464	MF55K-46.4K	ASE	4701-03-4642	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	1 KHZ SQR WAVE MODULATOR, M6Z-1	1114-00-0150 PAGE: 1	

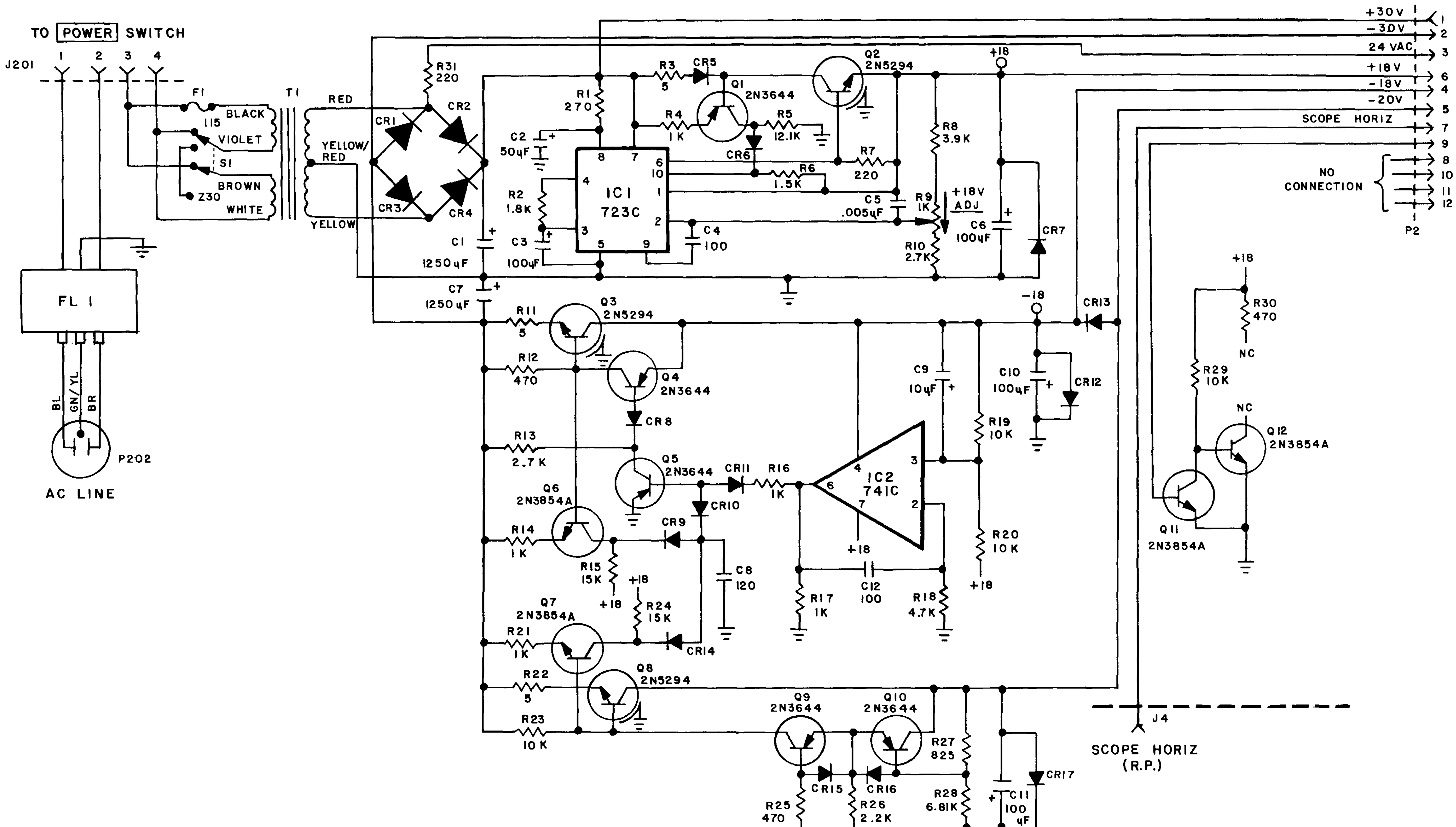
CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
A430	25403	5961-00-139-2398			
CB1001	01121	5905-00-107-0656			
CB1031	01121	5905-00-755-2613			
CB1061	01121	5905-00-497-5613			
CB2251	01121	5905-00-004-4164			
CB4721	01121	5905-00-809-8029			
CB4755	01121	5905-00-498-6062			
CB4765	01121	5905-00-905-6631			
EB3615	01121	5905-00-807-7504			
K5-001-00/3B	02114	5950-00-813-0567			
LM723CH	27014	5962-00-403-4534			
02-06-1103	27264	5999-00-338-9879			
03-06-1041	27264	5935-00-026-9402			
03-06-1151	27264	5935-00-372-0549			
03-06-2042	27264	5935-00-482-2278			
03-06-2151	27264	5935-01-017-8170			
2N3644	07263	5961-00-103-3981			
2N4250	07263	5961-00-021-7849			



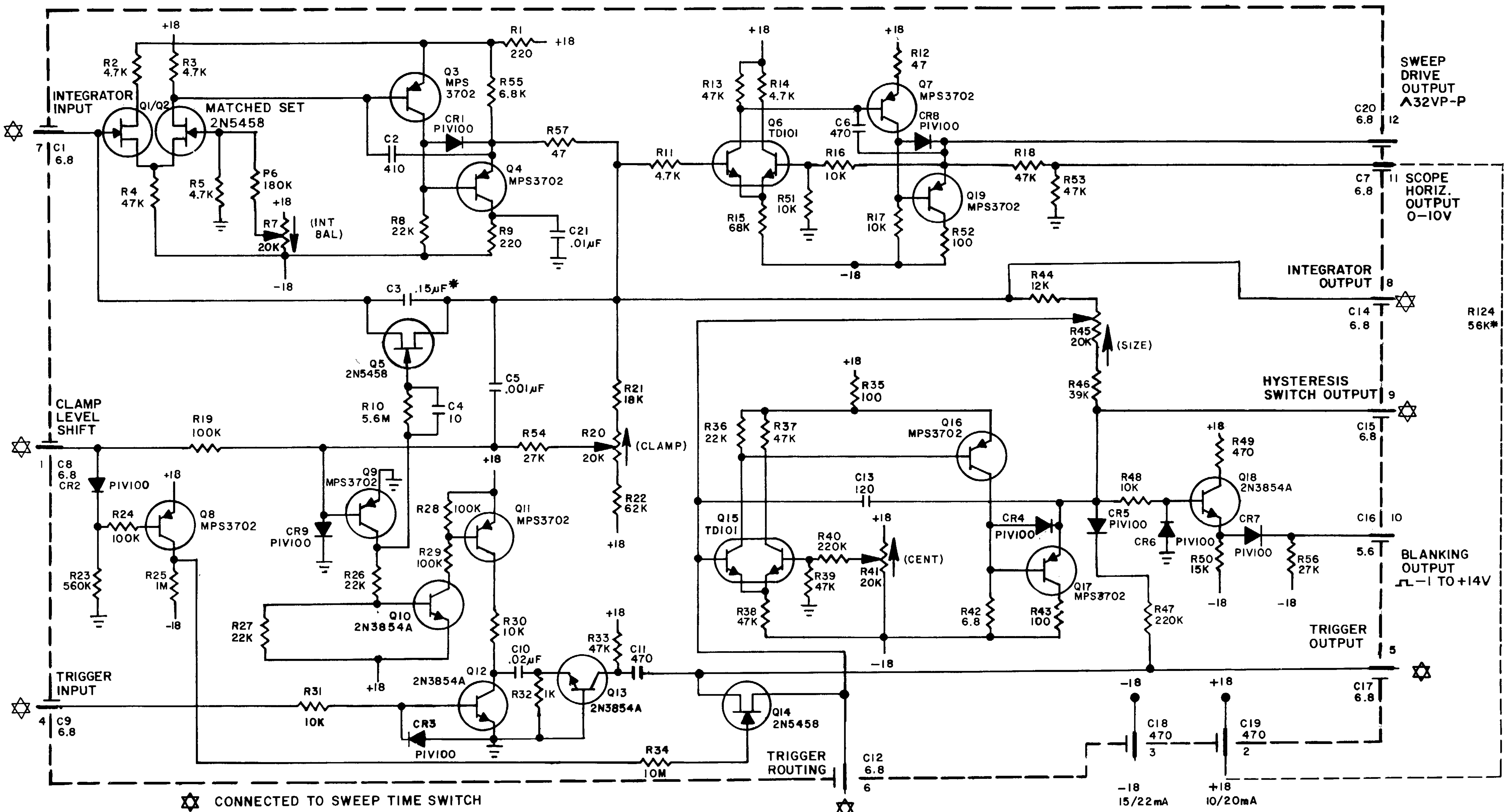
EL5YM001

FIGURE FO-1, WIRING DIAGRAM



EL5YM002

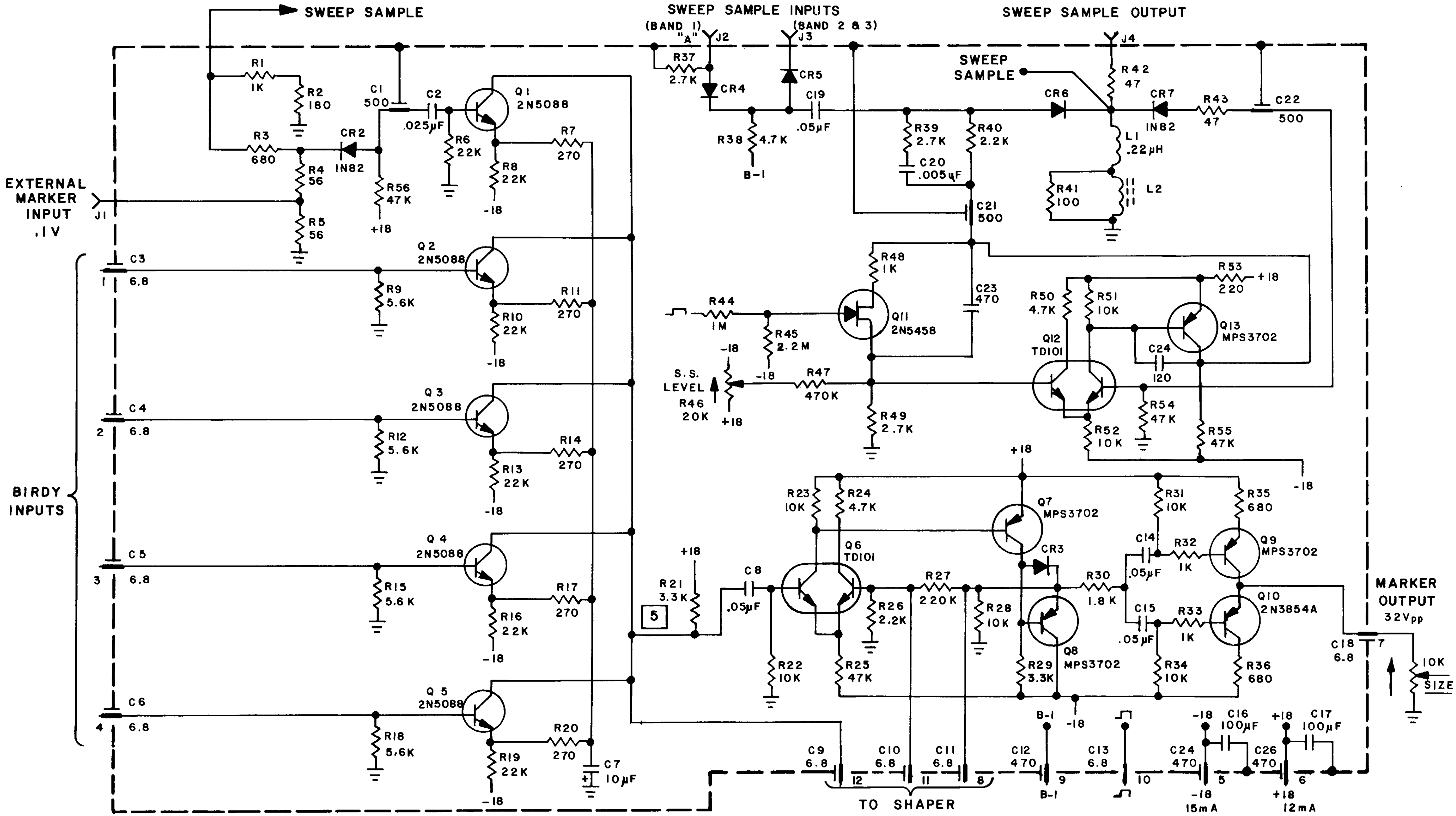
FIGURE FO-2 POWER SUPPLY



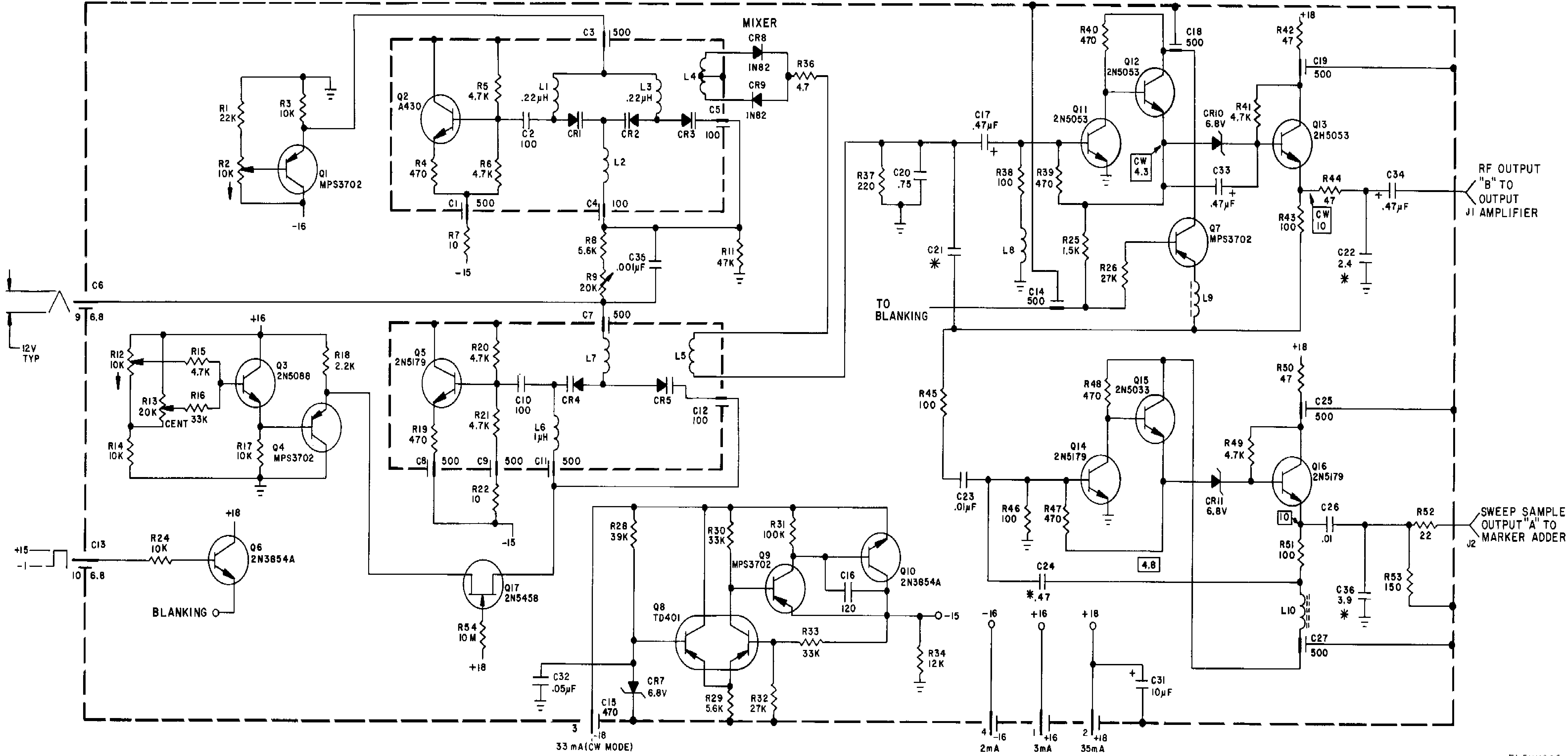
EL5YM003

FIGURE FO-3 SWEEP RATE

FIGURE FO-4 SWEEP DRIVE

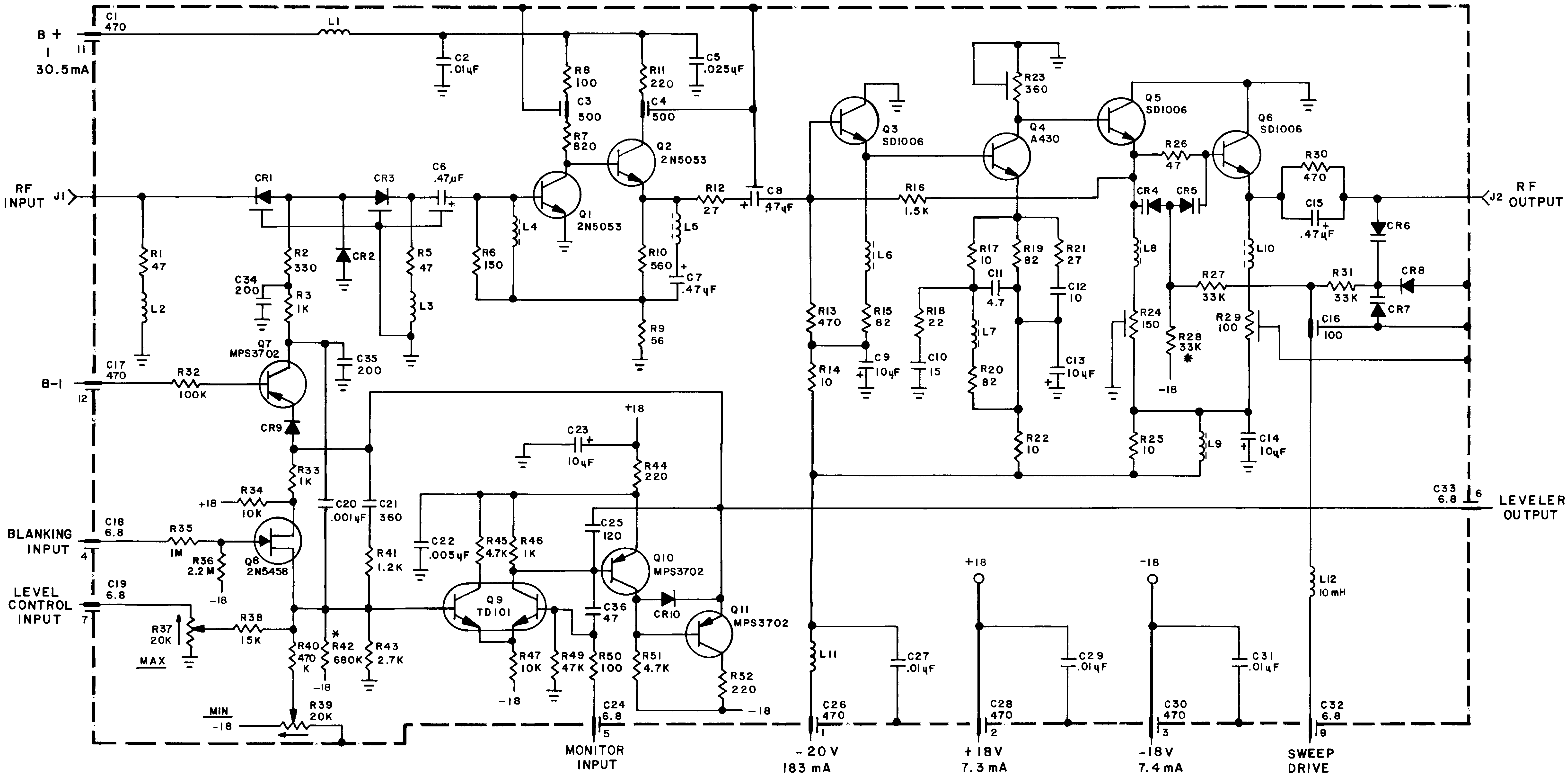


EL5YM005
FIGURE FO-5 MARKER ADDER

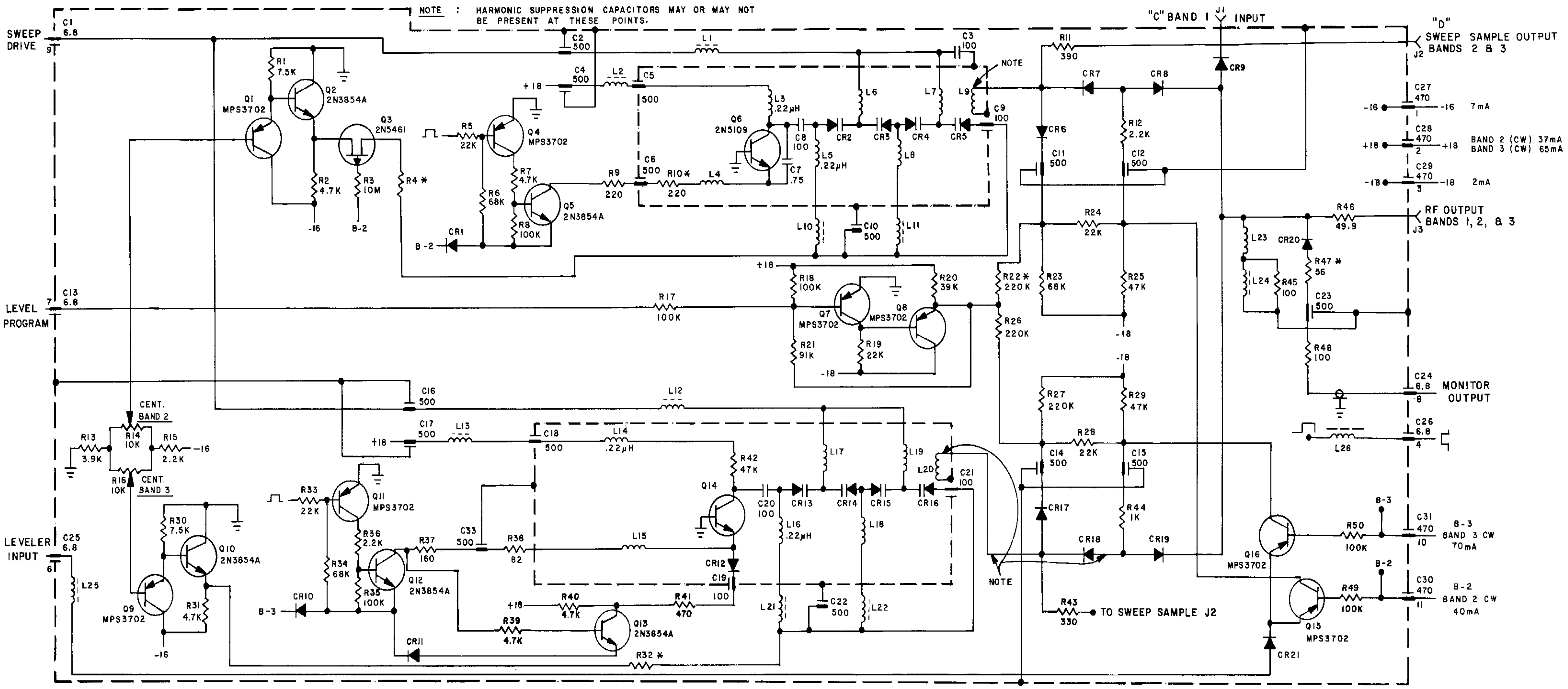


EL5YM006

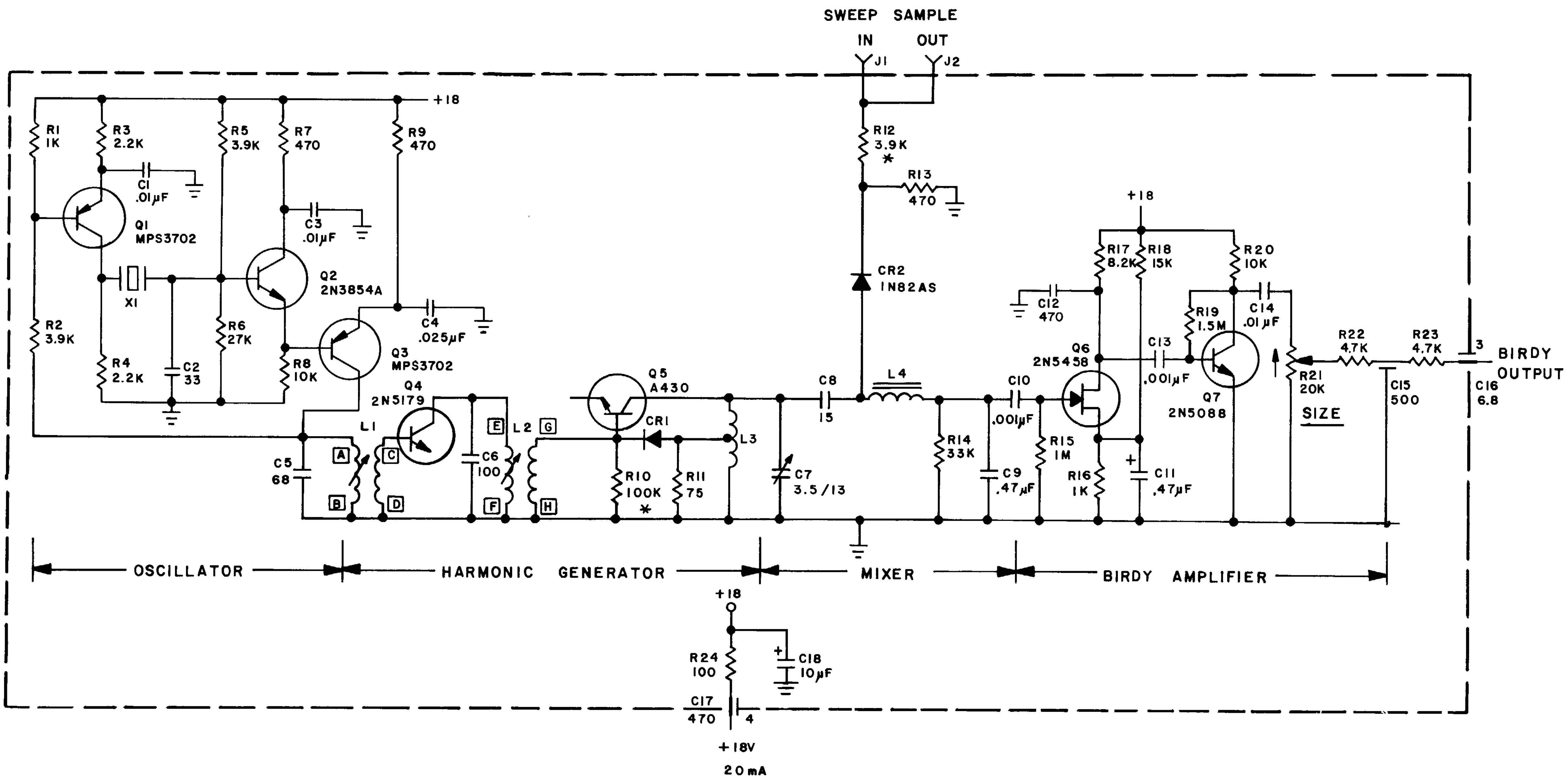
FIGURE FO-6 OSCILLATOR/MIXER



EL5YM007
FIGURE FO-7 OUTPUT AMPLIFIER

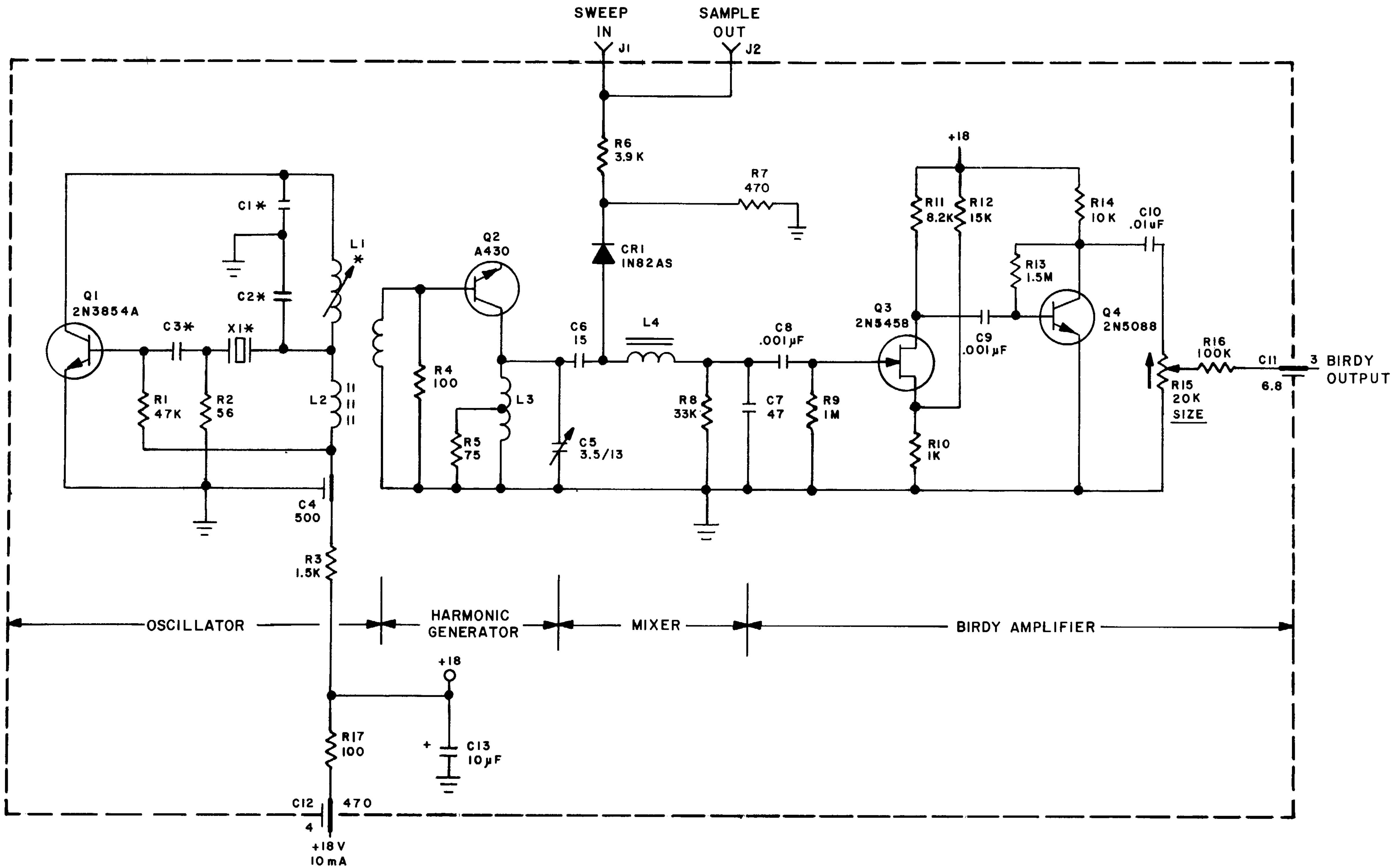


EL5YM008
FIGURE FO-8 SWEEP/OSCILLATOR



EL5YM009

FIGURE FO-9 HARMONIC HARKER (1MHZ)



EL5YM010

FIGURE FO-10 HARMONIC MARKER (5-50 MHZ)

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USA Dep (1)
Sig Sec USA Dep (1)
Ft Richardson (CERCOM Ofc) (2)
Units org under fol TOE:
29-207 (2)
29-610 (2)
NG: NONE
USAR: NONE
For explanations of abbreviations used see AR 310-50.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

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Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703

DATE 10 July 1975

PUBLICATION NUMBER	DATE	TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PPC-76

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. + 24 VDC is the input voltage.

TEAR ALONG DOTTED LINE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:
SSG I. M. DeSpiritof 999-1776	SSG. I.M. DeSpiritof

DA FORM 1 AUG 74 2028-2

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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

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TM 11-6625-2955-14&P	22 JAN 80	Sweep Generator SG-677A/U

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TM 11-6625-2955-14&P	22 JAN 80	Sweep Generator SG-677A/U

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

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DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2955-14&P	22 JAN 80	Sweep Generator SG-677A/U

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

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TEAR ALONG DOTTED LINE

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REVERSE OF DA FORM 2028-2

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'EIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

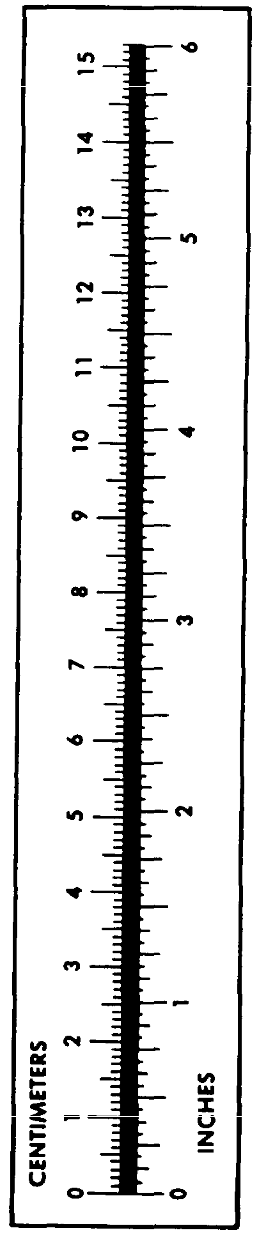
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
'ers	Gallons	0.264
.ms	Ounces	0.035
.ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
'lometers per Liter	Miles per Gallon	2.354
›meters per Hour	Miles per Hour	0.621



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