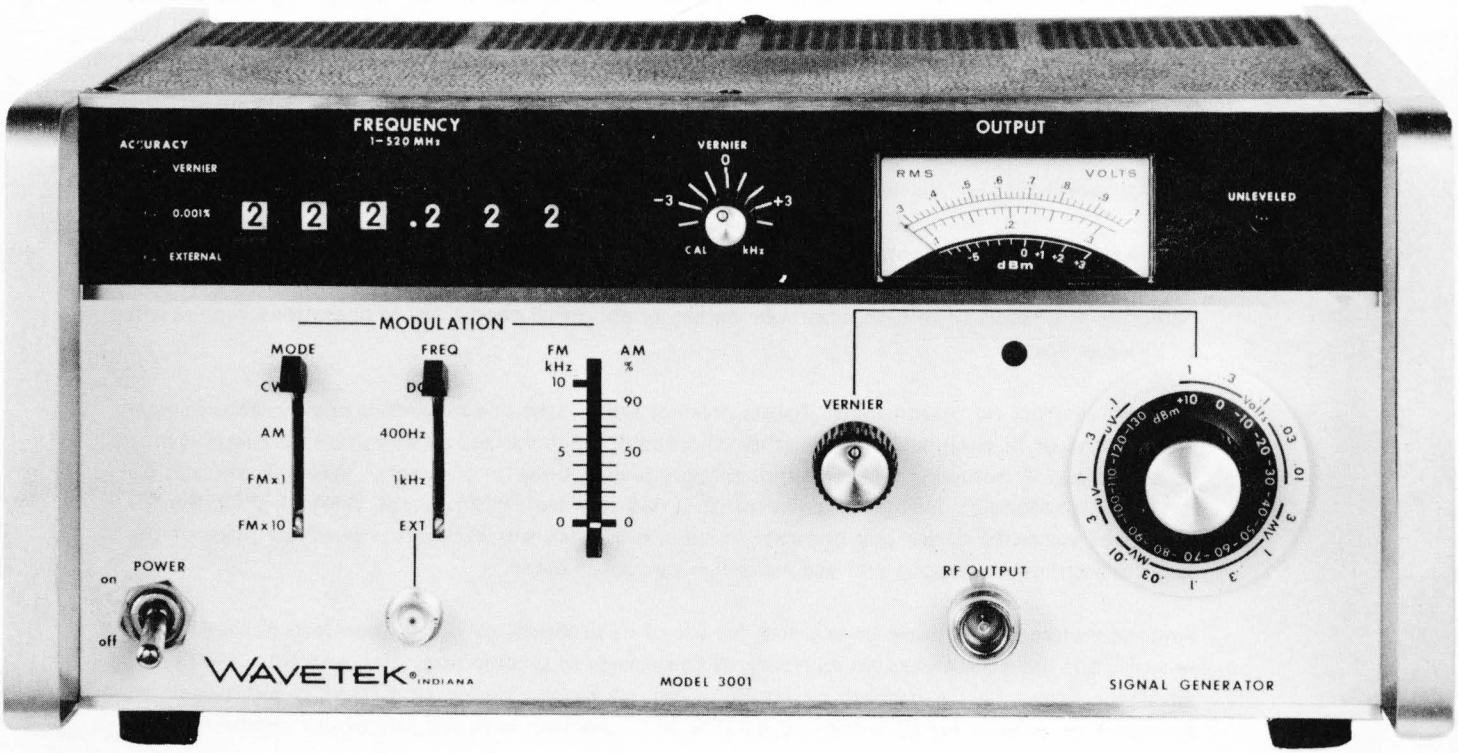
Serial No._____

INSTRUCTION MANUAL

MODEL 3001 SIGNAL GENERATOR



WAVETEK® INDIANA INC.

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BEECH GROVE, INDIANA 46107

317—783-3221

SCOPE OF THIS MANUAL

This manual provides descriptive material and instructions for the installation, operation, maintenance, and repair of the WAVETEK Model 3001 Signal Generator.

WARRANTY

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

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

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

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CONTENTS

CONTENTS CONTINUED

SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

The Model 3001 is a rugged, completely solid-state Signal Generator covering the frequency range of 1 to 520 MHz. The output can be amplitude or frequency modulated and the level can be set between +13 and -137 dBm.

1.1.1 Frequency Characteristics

The frequency of the unit is set via 6 front-panel lever/indicator switches which yield a resolution of 1 kHz. In addition, remote frequency programmability is standard. Series 3900 programmers are available to facilitate semi-automatic programming of both frequency and output level.

The accuracy of the instrument is based on a crystal-controlled oscillator that serves as a stable frequency reference that enables the Model 3001 to provide high stability signals to an accuracy of 0.001% over its specified 1 MHz to 520 MHz range. This accuracy includes possible errors due to short term drift, long term drift, incidental FM and variations due to line voltage changes and temperature changes. With the frequency VERNIER out of the CAL position, the frequency is accurate to 0.001% ±10 kHz.

The accuracy of the instrument can be improved by using either the optional external reference input or the optional high stability internal reference. An auxiliary RF output option is also available to drive a counter.

1.1.2 Modulation

The Model 3001 also features both internal and external amplitude and frequency modulation capabilities. Internal modulation frequencies of 400 Hz and 1 kHz are available. In the FM mode of operation, peak deviations up to 100 kHz are atainable. In the AM mode, amplitude modulation to 90% is attainable.

With the MODULATION MODE switch in the AM position and the MODULATION FREQUENCY switch in the DC position the output amplitude can be varied by the MODULATION FM/AM control. This provides a reference attenuator for variation of a signal level around a specific point of interest. This operation can also enable the user to obtain greater than 20 milliwatts of power over portions of the band. The frequency can also be continuously varied with this control over a 100 kHz range.

1.1.3 Output Level Features

The output power is indicated on a front-panel meter calibrated in both dBm and VRMS. A fifteen-position, 10 dB/step Attenuator used in conjunction with an 11 dB VERNIER control provides the user with a range of +13 dBm to -137 dBm. Two programmable attenuator options are available: 109.9 dB in 0.1 dB steps and 90 dB in 10 db steps.

The calibrated output of the Model 3001 is leveled to within ±0.75 dB across the complete frequency range of the instrument.

Reverse power protection is also available as an option.

1.2 SPECIFICATIONS

1.2.1 Frequency

RANGE	1 MHz to 520 MHz selectable in 1 kHz steps.
READOUT	6 digit lever/indicator switches
RESOLUTION	1 kHz
ACCURACY	All modes (CW, AM and FM) ±0.001% (±0.001% ±10 kHz when frequency VERNIER is not in CAL position. Frequency VERNIER range is ±5 kHz.)
STABILITY	All modes (CW, AM and FM) <0.2 ppm/hour (500 Hz per 10 min when frequency VERNIER is not in CAL position.)
PROGRAMMABILITY	Frequency is programmable via rear-panel input connector using BCD-coded TTL voltages or BCD-coded contact closures (Negative true logic).

1.2.2 RF Output

POWER LEVEL RANGE	+13 dBm to -137 dBm (1 V to .03 μV)
LEVEL CONTROL	Continuously adjustable in 10 dB steps and with an 11 dB VERNIER. Output level is indicated on a front-panel meter calibrated in volts RMS and dBm.
TOTAL LEVEL ACCURACY	+13 to -7 dBm ±1.25 dB -7 to -77 dBm ±1.95 dB -77 to -137 dBm ±2.75 dB
Accuracy Breakdown	Flatness (+13 to -7 dBm) ±0.75 dB Output Meter ±0.5 dB Step Attenuator ±0.5 dB to 70 dB (±0.2 dB calibration error) ±1.0 dB to 130 dB (±0.5 dB calibration error)
IMPEDANCE	50 ohms
SWR	<1.2 at RF output levels below 0.1 V
OUTPUT CONNECTOR	Type N
LEAKAGE	<1 μV is induced in a two-turn, one-inch diameter loop which is held one inch away from any surface. Loop feeds a 50 ohm receiver.

1.2.3 Spectral Purity

HARMONIC OUTPUT

>30 dB below fundamental from 10 to 520 MHz
>20 dB below fundamental from 1 to 10 MHz

SUB-HARMONICS

None detectable

NON-HARMONICS

Fundamental (MHz)	Non-Harmonic (MHz)	Non-Harmonic Level (dB below fundamental)
1 to 3	1 to 3	>60
3 to 250	3 to 250	>65
3 to 350	3 to 350	>55
3 to 520	3 to 1000	>35

RESIDUAL AM

>55 dB below carrier in a 50 Hz to 15 kHz post-detection bandwidth.

RESIDUAL FM

<200 Hz in a 50 Hz to 15 kHz post-detection bandwidth. (Typically 100 Hz.)

1.2.4 Amplitude Modulation

NOTE: These specifications apply for a carrier level $\leq$+3 dBm. AM is possible above +3 dBm if the peak output does not exceed +13 dBm.

FREQUENCY

Internal: 400 Hz and 1 kHz $\pm$5% (typically $\pm$3%)

External: DC to 20 kHz, (3 dB bandwidth), input level required = 10 volts pp into 600 ohm to provide calibrated % modulation control.

RANGE

0 to 90%

DISTORTION

3% distortion to 70% AM (5% to 90% AM) at a frequency of 1 kHz

MODULATION CONTROL

Calibrated from 0 to 90%

ACCURACY

$\pm$(5% of reading +5%) at a frequency of 1 kHz

1.2.5 Frequency Modulation

FREQUENCY

Internal: 400 Hz and 1 kHz, $\pm$5%

External: 50 Hz to 25 kHz, (1 dB bandwidth), input level required = 10 volts pp into 600 ohms to provide calibrated deviation control.
(DC to 25 kHz when frequency VERNIER is not in CAL position.)

DEVIATION PEAK

Two bands, 0 to 10 kHz, and 0 to 100 kHz

DEVIATION CONTROL	Calibrated from 0 to 10 kHz, x1 and x10
ACCURACY	±500 Hz on x1 range ±5 kHz on x10 range
DISTORTION	4% (3 to 100 kHz deviation) at a frequency of 1 kHz

1.2.6 General

OPERATING TEMPERATURE	25°C±5°C, all specifications apply 25 ±15°C, with slight degradation of specifications
POWER	115/230 V ±10%, 50 to 400 Hz, 40 VA
DIMENSIONS	30.3 cm wide x 13.4 cm high x 34.9 cm long (12" x 5¼" x 13 3/4").
WEIGHT	11.4 kg (25 lb) net 13.6 kg (30 lb) shipping

1.3 OPTIONS

Options 1A, 1B, 4 and 7 are factory installed; Options 3, 5 and 6 are either factory or field installed. Maximum number of options per instrument is five (1A or 1B or 3) +4 +5 +6 +7. Request individual specifications for each option for a complete description of each and how it affects the instrument specifications.

1.3.1 RF Level Programming

For both Options 1A and 1B, the instruments are calibrated for +13 dBm at 50 MHz like a standard unit, but due to greater losses in Programmable Attenuators, a calibrated output is only guaranteed to +12 dBm.

Option 1A Program Level Range: 0 to 109.9 dB in .1 dB steps (programmed via rear-panel plug). 0 dB reference is +13 dBm. Front-panel level range: Continuously adjustable from +13 dBm to -97 dBm in 10 dB steps and an 11 dB VERNIER. Reverse power protection is also provided by this option.

Option 1B Program Level Range: 0 to 90 dB in 10 dB steps (programmed via rear-panel plug). 0 dB reference set by front-panel attenuators. Remote control of CW/AM mode is also provided.
Front-panel Level Range: See Section 1.2.2.
Reverse power protection is also provided by this option.

1.3.2 Reverse Power Protection

Option 3 prevents damage to the instrument if DC (100 V max) or RF (50 W max)voltages are accidentally applied to the RF output connector. (This option is not required when using option 1A or 1B).

1.3.3 Auxiliary RF Output

Option 4 provides a leveled (-10 dBm) signal available from a rear-panel BNC connector (normally used to drive a frequency counter).

1.3.4 External Reference

Option 5 provides a rear panel BNC input for accepting an external frequency reference. This input is used to improve the accuracy of the instrument from 10 ppm to that of the external source. The external source frequency can be 1, 2, 2.5, 5 or 10 MHz with an accuracy of 1 ppm or better with a minimum level of 50 mV into a 1 kΩ load.

1.3.5 High Stability Reference (Option 5 is necessary for driving model 3001 with Option 6.)

Option 6 provides a high stability rear panel output which can be used to drive the rear-panel input of option "5". This high stability TTL output can also be used to drive other devices which require a high stability reference input. Maximum fan-out is four.

Output Frequency	5 MHz
Accuracy after 1 hour warm-up	
Aging	.005 ppm/day
	.05 ppm/month
	.3 ppm/year
Temperature 25 ±15°C	.05 ppm

Typical overall accuracy (within 3 months of calibration) .2 ppm, 25 ±15°C.

1.3.6 LOW LEAKAGE

Option 7 reduces the leakage specification of Section 1.2.2 by a factor of 10.

1.4 ACCESSORIES

Furnished with instrument

Instruction Manual
Rear-panel PROGRAMMING plug and pins

Additional Accessories

Rack Mount Kit, K108
Programmers for single push-button or GPIB control of selected frequencies and output levels, Series 3900.

SECTION 2
OPERATION

2.1 INTRODUCTION

This section provides complete installation and operating instructions for the Wavetek Model 3001 signal generator. The instructions consist of mechanical installation, electrical installation, front and rear panel features, installation checks and operating procedures.

2.2 MECHANICAL INSTALLATION

2.2.1 INITIAL INSPECTION

After unpacking the instrument, visually inspect 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.

2.2.2 DAMAGE CLAIMS

If instrument received has been damaged in transit, notify carrier and either the nearest Wavetek area representative or the factory in Indiana.

Retain shipping carton and packing material for the carrier's inspection.

The local representative or the factory will immediately arrange for either replacement or repair of your instrument without waiting for damage claim settlements.

2.2.3 RACK MOUNTING (K108)

CONTENTS (See Figure 2-1).

Item	QTY	Part No.
A (Insert)	2 ea	B001-145
B (Side)	2 ea	C001-146
C (Screw)	8 ea	HS101-808
D (Screw)	4 ea	HS101-810

PROCEDURE

Remove the screws from one side panel. Mount items A and B against side panel of the instrument and secure with screws provided. (Screws D are longer than screws C.) Repeat operation for the other side of unit.

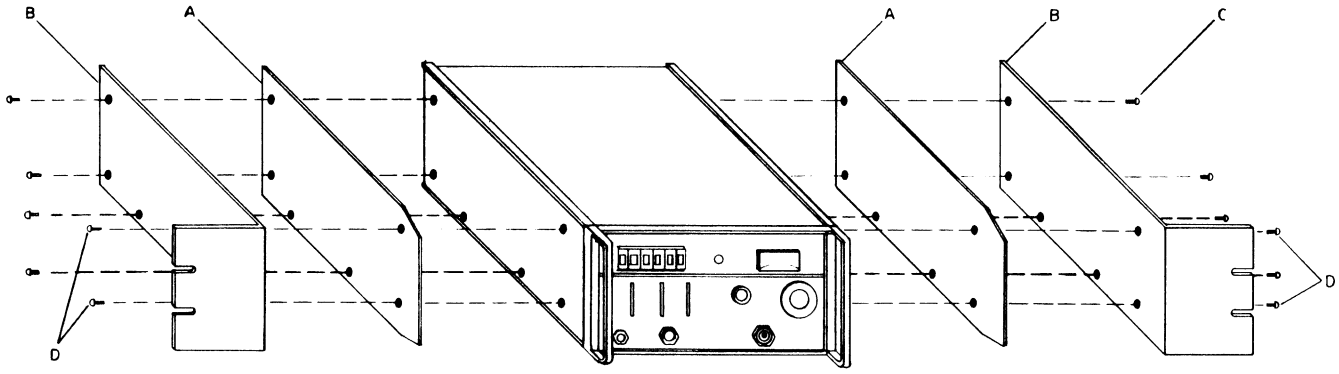


Figure 2-1. K108 Rack Mount

2.3 ELECTRICAL INSTALLATION

The instrument operates from either 115-volt or 230-volt AC supply mains as selected by a Slide Switch located on rear panel. Before operating the instrument, check that fuse mounted in the rear-panel fuseholder corresponds to correct value for selected voltage, i.e., 1.0 amp for 115 volt AC and 0.5 amp for 230 volt AC.

The power supply has been designed to operate over an AC-input range of 50 to 400 Hz.

Instruments are shipped from the factory for operation at 115-volt AC - unless specified for 230-volt AC operation.

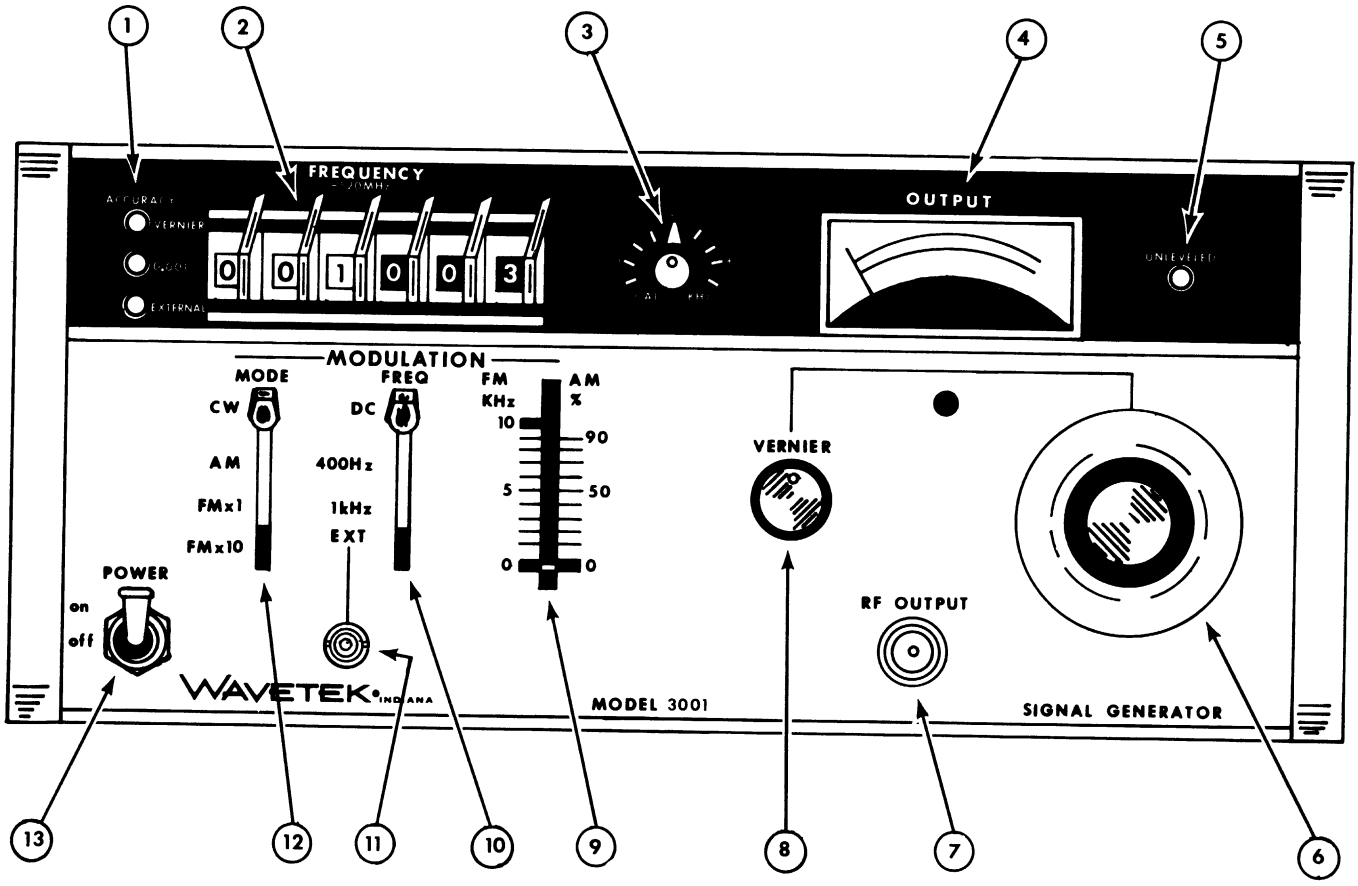


Figure 2-2. Front Panel

2.4 DESCRIPTION OF FRONT PANEL

(1) Accuracy Lamps

Indicate frequency accuracy as follows:
Vernier - lamp indicates that freq

(1) Accuracy Lamps (continued)	VERNIER is not in CAL position; accuracy is ±(0.001% +10 kHz) in all modes. 0.001% - lamp indicates that freq VERNIER is in CAL position; accuracy in all modes (CW, AM, FM) is ±0.001% External - lamp indicates that external freq reference is being used; accuracy is that of the external reference source. Typically, the lamp will flash for a few seconds after power is turned on. Normally, a steady light indicates that unit is phase - locked and frequency accuracy indication is valid; however, a continuously flashing light indicates that one or more of the phase-lock loops is open. (The open loop can be identified by removing unit top cover, and looking for the corresponding "module-fault" light.)
(2) Lever Indicator Switches	Select and indicate desired output frequency from 1 to 520 MHz with a 1 kHz resolution.
(3) Freq Vernier	In its CAL position, accuracy in all modes (CW, AM, FM) is ±0.001% as indicated by steady lighting of 0.001% Accuracy lamp. When VERNIER is out of CAL position, accuracy in all modes is ±(.001% +10 kHz) as indicated by steady lighting of "Vernier" accuracy lamp. The frequency VERNIER can shift output frequency over a 10 kHz range (-5 kHz to +5 kHz).
(4) Output Level Meter	Indicates output level over a 10 dB range in VRMS and dBm. (See section 2.7.3).
(5) Unlevel Lamp	Indicates that the output-level-meter reading is not valid when the lamp is on.
(6) Attenuator	Controls the output level over a 140 dB range from +10 to -130 dBm. The Attenuator dial is calibrated in dB and VRMS. (See section 2.7.3).
(7) RF out	Type N connector provides the RF-output signal from the instrument.
(8) Output Level Vernier	Controls the output level over an 11 dB range.

(9) Modulation FM/AM Slider

Is calibrated from 0 to 10 kHz FM peak deviation, and from 0 to 90% AM. This control permits precise AM or FM settings with mode switch in AM, FM x 1, or FM x 10 respectively and with frequency switch in 400 Hz, 1 kHz, or Ext. This control also serves as a manual amplitude control (AM mode) or manual frequency control (FM modes) with frequency switch in DC. The slider can also enable the user to obtain more than 20 milliwatts of power over portions of the band when mode switch is in AM mode; in FM modes, the frequency can be continuously varied with this control over a 10 kHz or a 100 kHz range. In CW mode, the FM/AM slider has no function.

(10) Modulation Frequency Switch

Selects DC (used for manual amplitude or frequency control), 400 Hz or 1 kHz internal modulation, or external modulation.

(11) Ext Modulation Input

BNC connector accepts external modulating signals as follows:

AM = DC to 20 kHz
FM (Freq VERNIER in CAL) =50 Hz to 25 kHz
FM (Freq VERNIER not in CAL) = DC to 25 kHz

A 10 Vpp signal into 600 ohms is required for FM/AM slider calibration to be correct. A lesser input voltage will result in proportional calibration of the FM/AM slider; thus, a 1 volt pp signal into 600 ohms will result in a full-scale calibration of 1 kHz peak deviation in FM x 1, a 10 kHz peak deviation in FM x 10, or 10% amplitude modulation in AM.

(12) Mode Switch

Selects CW, AM, FMx1 or FMx10 operation.

(13) Power Switch

Provides AC power to the power supply.

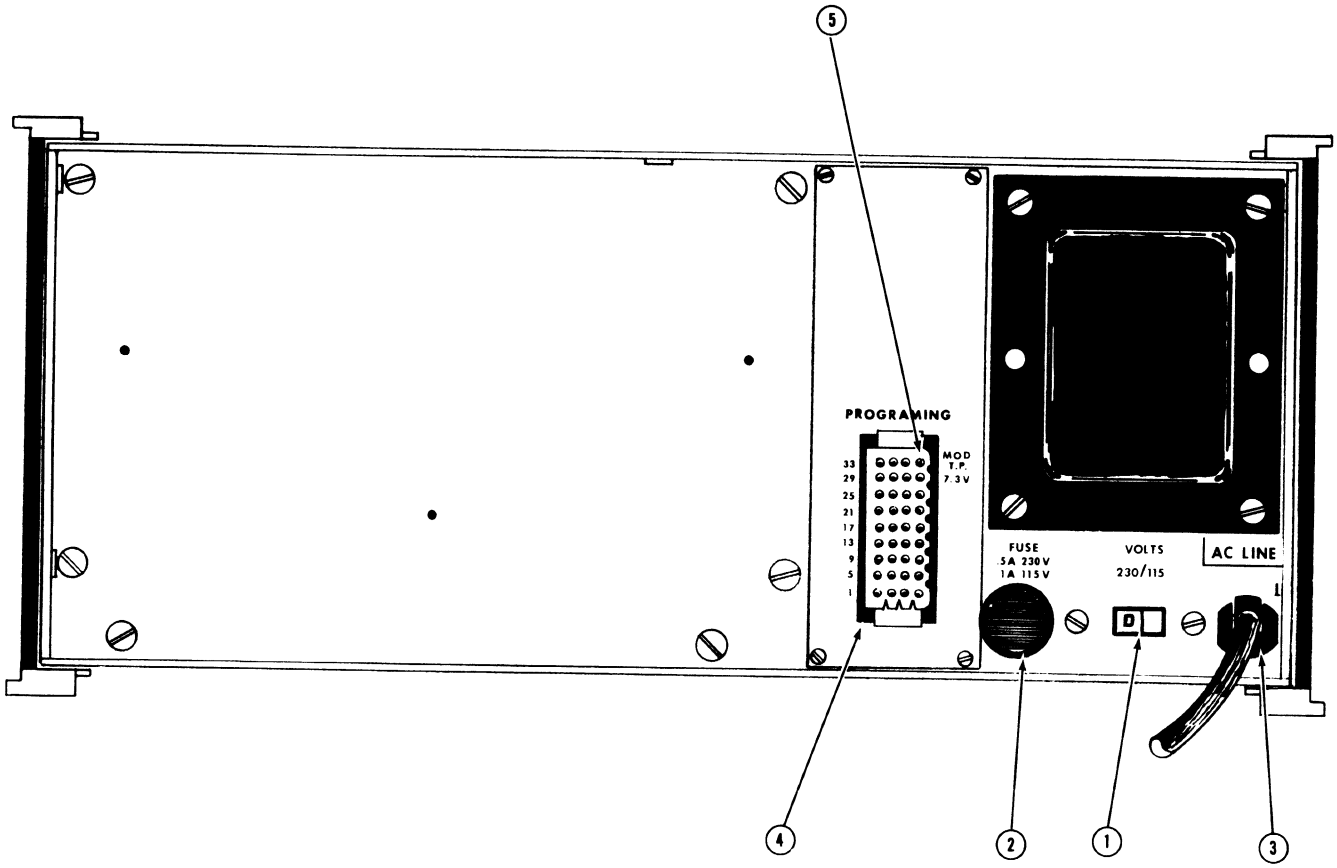


Figure 2-3. Rear Panel

2.5 DESCRIPTION OF REAR PANEL

(1) Switch 115/230 V	Selects either 115-volt AC or 230 volt AC supply mains. Before operating instrument, check that fuse mounted in Rear-Panel Fuseholder corresponds to the correct value for selected voltage.
(2) AC Line Fuse	1.0 amp for 115-volt AC, or 0.5 amp for 230-volt AC.
(3) Input 50-400 Hz	3-prong AC plug provides connection to AC mains.
(4) Programming	Provides remote connection for programming of frequency.
(5) Modulation Test Point	Provides convenient connection for monitoring amplitude or frequency of internal or external modulating signal.

2.6 INSTALLATION CHECKS

The following procedure is used to determine that the instrument is operating properly. Performance testing and calibration procedures for the instrument are contained in other sections of this manual. If it is determined that the unit is not operating properly refer to these sections.

2.6.1 TURN ON

Verify that the power-transformer primary is matched to the line voltage available, and that the proper fuse is installed. (See Section 2.3 Electrical Installation). Turn the front-panel power switch to its "ON" position. One of the front panel accuracy lights will be illuminated indicating an operating condition. No warmup is needed for the following checks.

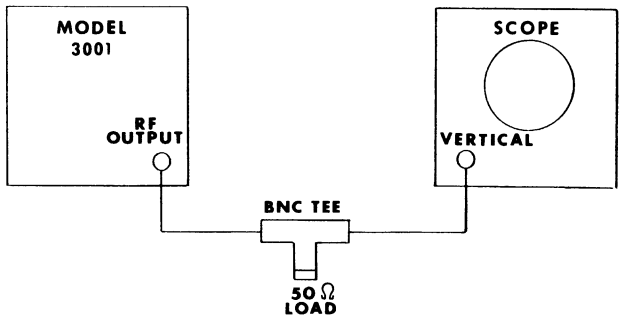
2.6.2 CONTROL ADJUSTMENT

Set the Model 3001 front-panel controls as follows:

(2)	Output Frequency	10 MHz (Lever-indicator switches to 010.000).
(3)	Freq Vernier	CAL
(12)	Mode Switch	CW
(10)	Frequency Switch	1 kHz
(9)	FM/AM Slider	0
(8)	Level Vernier	Full cw
(6)	Attenuator	+10 dBm

2.6.3 RF OUTPUT CHECK

Connect the equipment as shown in Figure 2-4. The 10 MHz signal must be at least 2.8 Vpp (a high frequency oscilloscope must be used for these checks).



NOTE: MUST BE HIGH-FREQUENCY OSCILLOSCOPE (GREATER THAN 10 MHz)

Figure 2-4. Test Setup

2.6.4 AM MODULATION CHECK (1000 Hz)

Switch the MODE switch to AM. Move FM/AM slider up to the 50% modulation point. Verify that AM envelope displayed on oscilloscope shows a peak-to-valley voltage difference of about 1.4 V and a period of 1 ms. (See Figure 2-5).

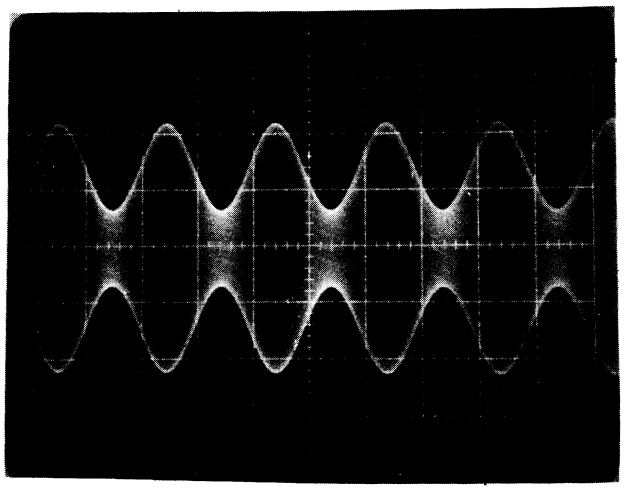


Figure 2-5. Amplitude Modulation

2.6.5 AM MODULATION CHECK (400 Hz)

Move frequency switch to its 400 Hz position. Verify that AM envelope period is 2.5 ms.

2.6.6 FMx1 CHECK

Switch the MODE switch to FMx1. Move FM/AM slider up and down. Verify that oscilloscope shows an FM display (See Figure 2-6).

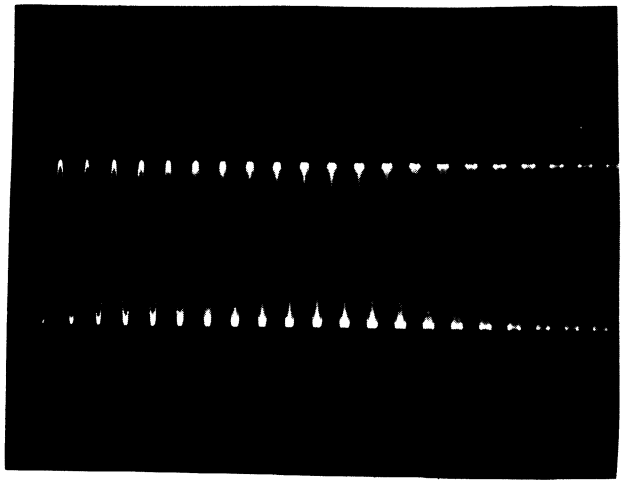


Figure 2-6. Frequency Modulation

2.6.7 FMx10 CHECK

Switch MODE switch to FMx10 and repeat above check.

2.6.8 FM/AM SLIDER CHECK (FREQ.)

Leaving MODE switch in the FMx10 position, place frequency switch in the DC position. Verify that moving FM/AM slider from 0 to 10 kHz shows an increase in frequency on the oscilloscope.

2.6.9 FM/AM SLIDER CHECK (OUTPUT)

Switch MODE switch to the AM position. Verify that moving FM/AM slider from 0 to 50 shows an increase in output amplitude. (NOTE: The unlevel light may come on during this test.)

2.6.10 ATTENUATION CHECK

Switch mode switch to CW. Verify that Output VERNIER and Attenuator controls change amplitude of signal displayed on the oscilloscope.

2.6.11 FREQ VERNIER CHECK

Switch Freq VERNIER out of CAL position. The .001% lamp should go out, and the Vernier lamp should light. Moving the VERNIER from -5 kHz to +5 kHz should show a slight change in frequency on oscilloscope. The instrument is now ready for use.

2.7 OPERATING PROCEDURE

No preparation for operation is required beyond completion of the initial installation checks contained in Section 2.6. To insure that the Model 3001 will perform as stated in the specifications, the instrument should have a two-hour warmup before using.

2.7.1 TURN ON

Turn front-panel switch "ON". One of front-panel accuracy lights will be illuminated indicating an operating condition.

NOTE

A flashing light indicates an unlocked condition. This should cease in a matter of seconds.

If the unit is not going to be used to the extreme limits of its specifications, it can be used immediately.

CAUTION

When working with active circuits, transceivers, etc., care must be used to keep DC voltage or RF power from being applied to the RF-output connector, otherwise damage may occur to the output Attenuator circuitry of the Model 3001.

2.7.2 FREQUENCY SELECTION

Select the frequency desired with the six Lever - Indicator switches on the

front panel. A frequency between 1 and 520 MHz can be selected with a 1 kHz resolution.

2.7.3 OUTPUT LEVEL SELECTION

Set output Attenuator and VERNIER to the desired level. The output is continuously adjustable over a +13 to -137 dBm range. The RF output equals the level shown on the Attenuator algebraically added to the meter indication.

2.7.4 AMPLITUDE MODULATION - INTERNAL

Set MODE switch to AM and the frequency switch to either 400 or 1000 Hz modulation rate. Adjust FM/AM slider to indicate desired modulation depth.

2.7.5 AMPLITUDE MODULATION - EXTERNAL

CAUTION

Input voltages greater than ±10 VDC or 10 VRMS should not be applied to the External modulation-input connector or damage may occur to the Model 3001.

Set MODE switch to AM and the frequency switch to external. Apply a 10 Vpp signal into 600 ohms to the External modulation-input connector. This calibrates the FM/AM slide control. The desired modulation depth can then be set. The upper frequency limit of this input is 20 kHz.

NOTE

When AM modulating, care must be taken not to exceed the +13 dBm maximum level or excessive distortion and an unlevel condition can exist. In some cases, a high % of AM modulation may cause the unlevel light to come on when output VERNIER control is at minimum. This is caused by "bottoming" of the PIN diode leveler which, in turn, can cause an increase in distortion. If this is the case, add 10 dB of fixed attenuation, and turn Output VERNIER control toward maximum. The unlevel light should then go out.

2.7.6 FREQUENCY MODULATION - INTERNAL

Set MODE switch to FMx1 or FMx10 and the frequency switch to 400 or 1000 Hz. Adjust FM/AM slider to desired peak deviation.

2.7.7 FREQUENCY MODULATION - EXTERNAL

CAUTION

Input voltages greater than ±10 VDC or 10 VRMS should not be applied to the External modulation-input connector or damage may occur to the Model 3001.

Set MODE switch to FMx1 or FMx10 and the frequency switch to external. Apply a 10 Vpp signal to the External modulation-input connector (600 ohms). This calibrates the FM/AM slide control. The desired peak deviation can now be set. For FM modulation, the upper frequency limit is 25 kHz; the lower limit is 50 Hz with Freq VERNIER in CAL, or DC with Freq VERNIER not in CAL position.

2.7.8 FM/AM SLIDER - FM POSITION

Switch MODE switch to FMx1 or FMx10 position and the frequency switch to DC. Using FM/AM slide control, frequency can be increased up to 10 kHz in the x1 position or 100 kHz in the x10 position.

2.7.9 FM/AM SLIDER - AM POSITON

Switch MODE switch to AM postion and the frequency switch to DC. Using FM/AM slide control, the output amplitude can be varied. It also enables more than 20 mW of power to be obtained over portions of the band.

2.7.10 FREQ VERNIER

In the CAL position, output frequencies having an accuracy or +0.001% may be

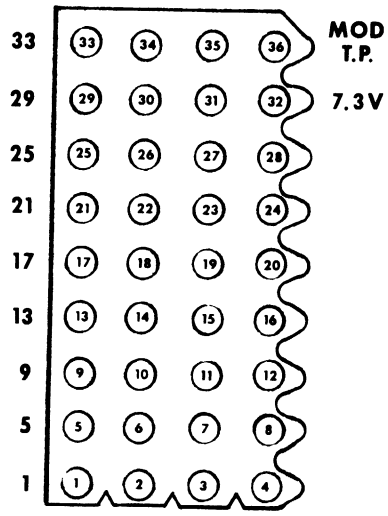
selected by the lever switches with a resolution of 1 kHz. When Freq. VERNIER is out of CAL position, the selected output frequency can be shifted ±5 kHz with Freq. VERNIER control. The output frequency at the "0" kHz position of VERNIER corresponds closely to the output frequency in CAL.

2.7.11 PROGRAMMING

Frequency is programmable via a rear-panel input connector, using standard 8-4-2-1 BCD contact closures. The rear-panel frequency connections are in parallel with front-panel Lever-Indicator switches; thus, if rear-panel programming is used, front-panel switches must indicate all zeros. A mating rear-panel connector is supplied with each unit - see Figure 2-7 for pin location and identification. Rear - panel BCD programming can be implemented by referring to Table 2-1.

For example, to program a frequency of 130.150 MHz, the following rear-panel connector pins would be grounded:

FREQ DIGITS	CONN. PINS GROUNDED
1	4
3	7 & 8
0	none
1	16
5	18 & 20
0	none



PIN	CONNECTION	
1	N.C.	
2	400	100's
3	200	
4	100	
5	80	
6	40	10's
7	20	
8	10	
9	8	
10	4	1's
11	2	
12	1	
13	.8	
14	.4	.1's
15	.2	
16	.1	
17	.08	
18	.04	.01's
19	.02	
20	.01	
21	.008	
22	.004	.001's
23	.002	
24	.001	
25	ground	
26 - 31	N.C.	
32	7.3V	
33 - 35	N.C.	
36	MOD. T.P.	

Figure 2-7. Pin Identification

TABLE 2-1. PROGRAMMING

	Switch	TTL
Logic "0"	Open	≥2.2V
Logic "1"	Ground	≤0.4V

SECTION 3
THEORY OF OPERATION

3.1 INTRODUCTION

Section 3.2 presents a block diagram analysis to enable the reader to get a brief overall view of the operation of the entire instrument. Sections 3.3 - 3.15 contain more detailed descriptions of each subassembly.

For actual wiring of the chassis and subassemblies, refer to the schematics in Section 7 of the manual.

3.2 OVERALL BLOCK DIAGRAM

The Model 3001 is essentially a voltage controlled oscillator to which phase-locked loops and a crystal reference have been added for the high frequency resolution.

The discussion will first deal with the basic signal generator then it will describe how the phase-locked loops provide the additional accuracy.

The numbers within the block diagram symbols refer to the particular assembly in which the circuit is located.

3.2.1 BASIC SIGNAL GENERATOR

This discussion briefly describes how the RF is generated and how its frequency is controlled, also how the signal is amplified, leveled and amplitude modulated.

Refer to Figure 3-1 for a block diagram of the basic signal generator without phase locking.

RF GENERATION

The RF output frequency is generated by two UHF oscillators and a mixer. The outputs of the two oscillators are heterodyned in the mixer. The difference frequency is amplified and fed to the output amplifier.

The frequencies of these oscillators are controlled by DC voltages applied to their varactor diodes. The Narrow Oscillator yields a single frequency. The Wide Oscillator can be programmed over a range which extends from the frequency of the Narrow Oscillator to 520 MHz higher than the Narrow Oscillator frequency.

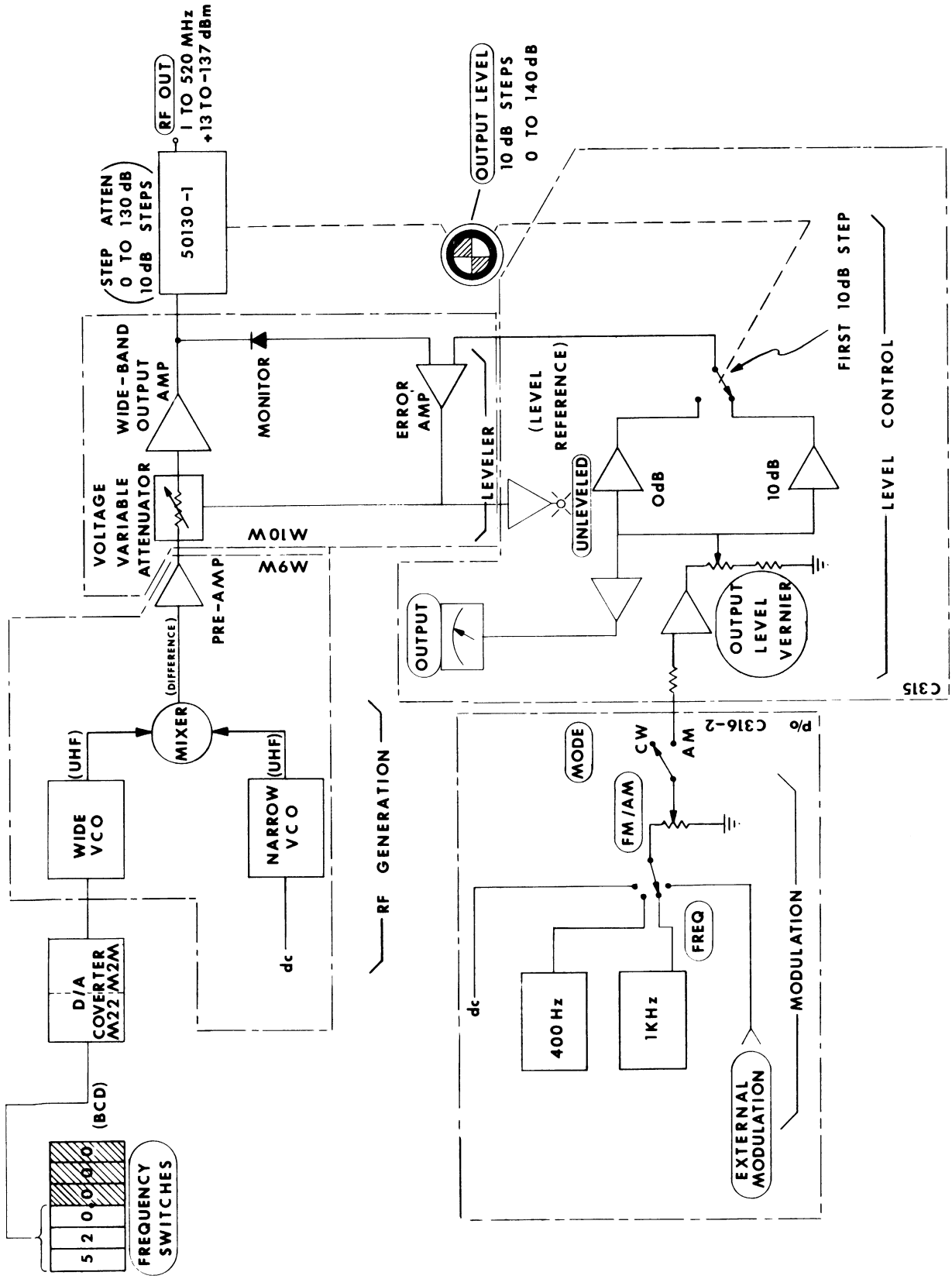
RF FREQUENCY CONTROL

The RF output frequency is determined by programming the frequency of the Wide Oscillator. The Wide Oscillator is ultimately controlled by the front-panel FREQUENCY switches. The BCD output of these switches is converted to an analog voltage which programs the oscillator in 1 MHz steps. This analog signal can provide approximately 3 MHz accuracy.

RF AMPLIFICATION AND LEVELING

The RF power is amplified by a multi-stage, wide-band amplifier. The flat output is maintained by a closed-loop leveling system around this Output Amplifier.

The Leveler includes a Monitor Diode, an Error Amplifier and a Voltage Variable



3-1. Basic Signal Generator

Attenuator. The Monitor detects the peak of the output of the Output Amp. This detected level is compared to a DC reference by the Error Amp. The output of the Error Amp is fed to a PIN diode (voltage variable) attenuator, which changes the input level to the Output Amp until the monitored signal produces a DC level equal to the reference level.

LEVEL CONTROL AND AM

The circuitry for controlling the RF output level is directly related to the above leveling system because changing the DC level reference changes the RF output level.

Of the 150 dB output range, 130 dB is passive attenuation. The remaining 20 dB is controlled by changing the level reference. The output level VERNIER has a 10 dB range. The remaining 10 dB is provided by switching the level reference range. This range switch is provided so that when AM is not required the output amp can provide a carrier at the highest possible power.

Since the RF level can be voltage controlled, AM can be accomplished by applying the modulating signal to the output level VERNIER. This causes the reference voltage to the Error Amp to change at the frequency of the modulating signal. The modulating signal is taken from one of two internal oscillators, a DC voltage or from an external source.

3.2.2 PHASE-LOCKED LOOPS

The basic signal generator discussed in Section 3.2.1 has a frequency range of 1 to 520 MHz, has an output voltage which is leveled and adjustable and has the ability to be amplitude modulated. With the above circuitry, however, the

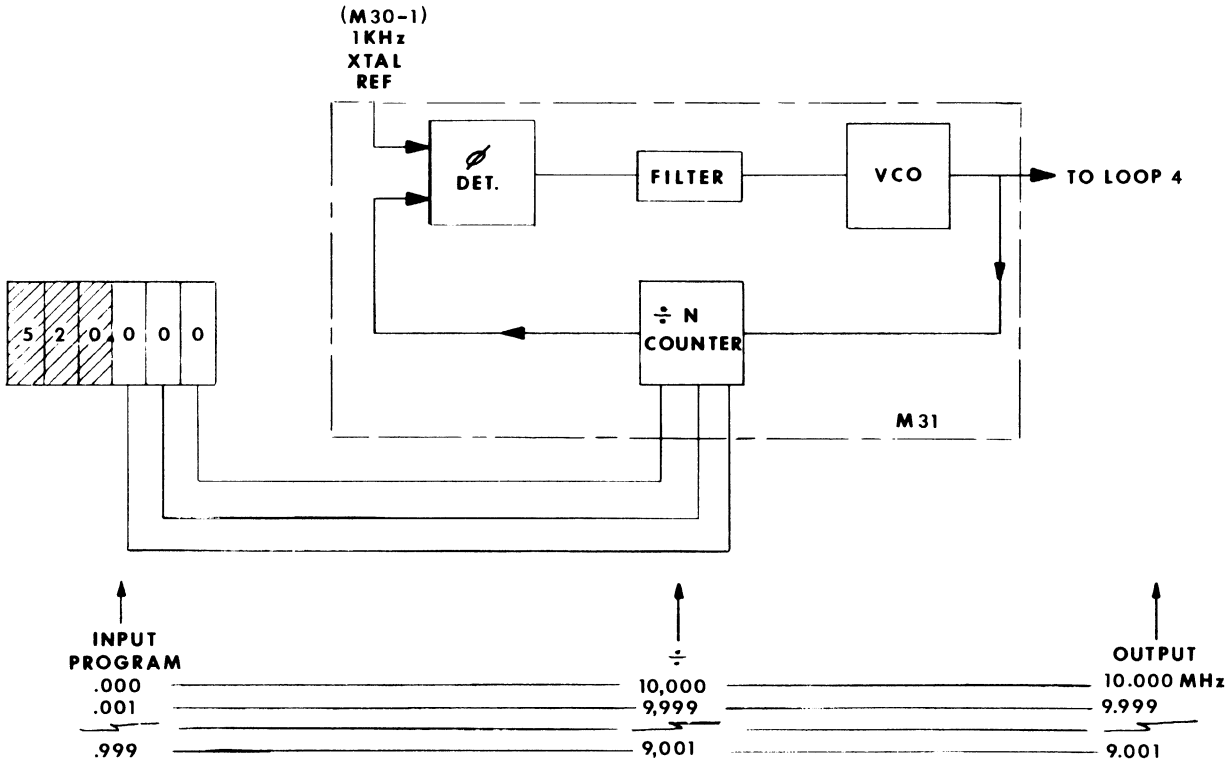


Figure 3-2. PLL #1

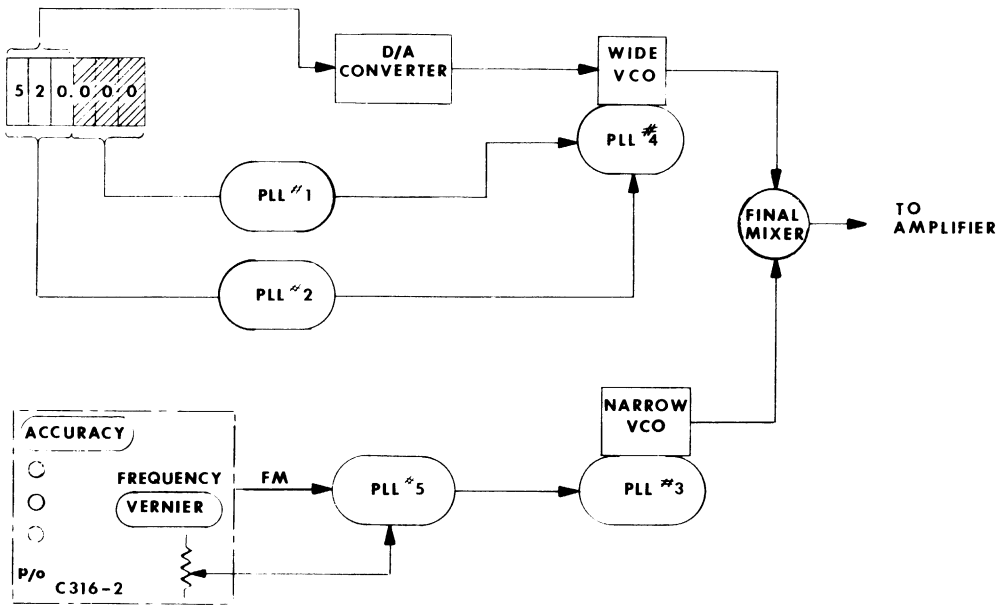


Figure 3-3. Phase Locked Loops

frequency accuracy is only 3 MHz with 1 MHz resolution. To achieve the desired 1 kHz resolution and .001% accuracy, the instrument includes five phase-locked loops.

Figure 3-3 illustrates the relationship between the five numbered loops and the "basic signal generator".

PLL #1, #2 and #4 are used to stabilize the Wide Oscillator and tune it in 1 kHz steps. The Wide VCO is part of PLL #4. PLL #1 and #2 convert the FREQUENCY switch setting to reference frequencies for PLL #4.

PLL #3 and #5 provide stabilization and allow FM operation. The Narrow VCO is part of PLL #3. PLL #5 converts a modulating signal (if present) to a reference frequency for PLL #3.

PLL #1

The purpose of PLL #1 is to generate a CW signal which changes in 1 kHz steps from 10.000 to 9.001 MHz as the front panel frequency selector is switched from .000 MHz to .999 MHz. This signal will be used as a reference signal for PLL #4.

Figure 3-2 shows a simplified block diagram of PLL #1. It includes a voltage controlled oscillator capable of frequencies from 9 to 10 MHz, a phase detector and a ÷N counter. A sample of the output signal from the VCO is fed to a programmable counter. The divisor of the counter is controlled by the three front panel kHz selector switches. The output from the counter is fed to a phase detector where it is compared to a 1 kHz crystal reference signal. If the two input signals to the phase detector are not the same frequency, an error signal is produced. This error voltage corrects the frequency of the VCO until the phase detector input from the counter is exactly 1 kHz. See section 3.12 for a more detailed explanation.

PLL #2

The purpose of PLL #2 is to generate a CW signal which changes in 1 MHz steps from 1448 to 1487 MHz when the front panel frequency selector is switched from 000. to 039. MHz. These CW steps are then repeated every 40 MHz throughout the entire 0 to 520 MHz range. Use of this signal to control the Wide Oscillator will be discussed in the description of PLL #4.

Figure 3-4 shows a simplified block diagram of PLL #2. PLL #2 operates in the same manner as PLL #1 with one exception. The circuit includes a mixer and band-pass amplifier. The purpose of this additional circuit is to offset the 1448 to 1487 MHz output from the VCO to 8 to 47 MHz. This offset is necessary in order to make the frequency compatible with the programmable counter and phase detector circuits. The other circuits in this loop operate the same as those in PLL #1. In this case the programmable counter is controlled by the three "MHz" selector switches and the loop reference frequency is 1 MHz. For a more complete description see section 3-13.

PLL #4

The purpose of PLL #4 is to adjust the Wide Oscillator in 1 kHz steps from 1198 MHz to 1718 MHz as the front-panel frequency selector is adjusted from 0 to 520.000.

The Wide Oscillator frequency is offset by Mixers #1 and #2 and compared to the

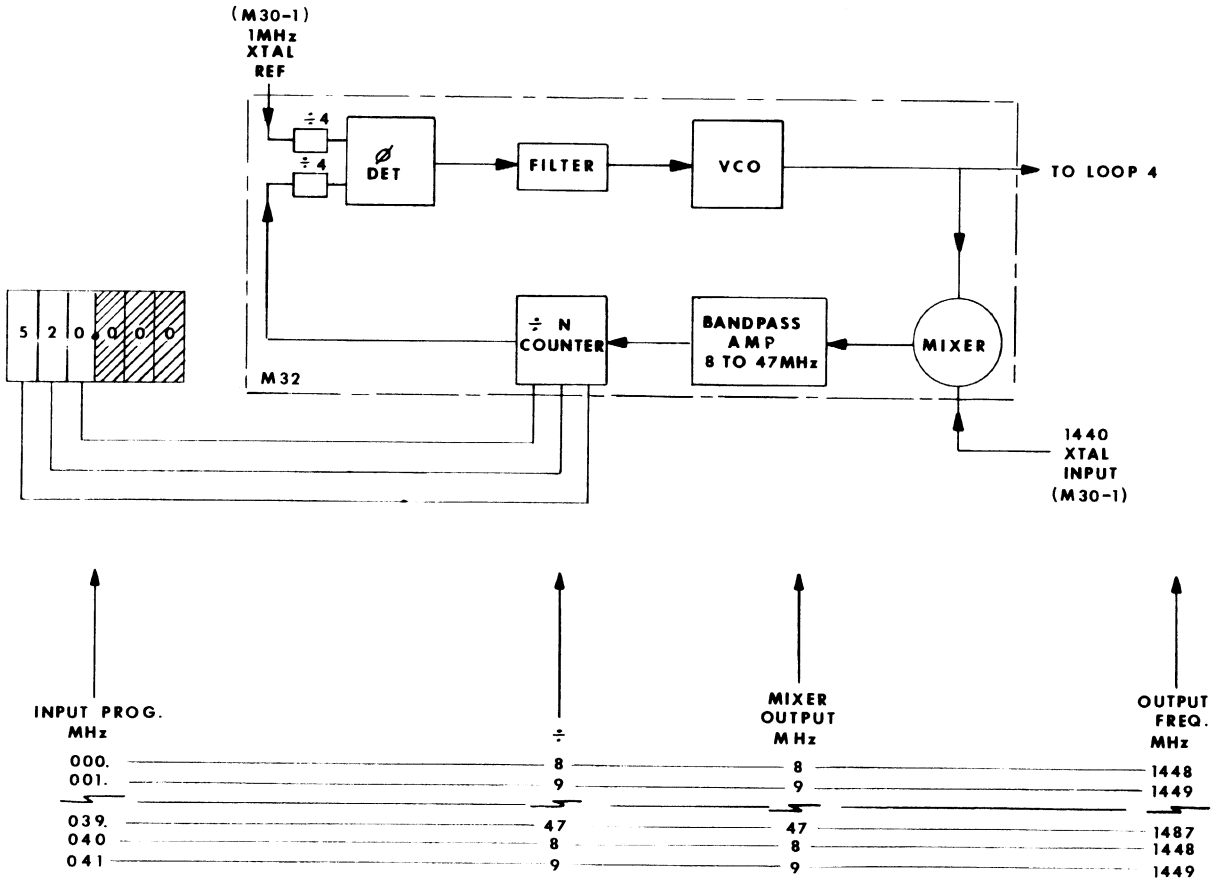
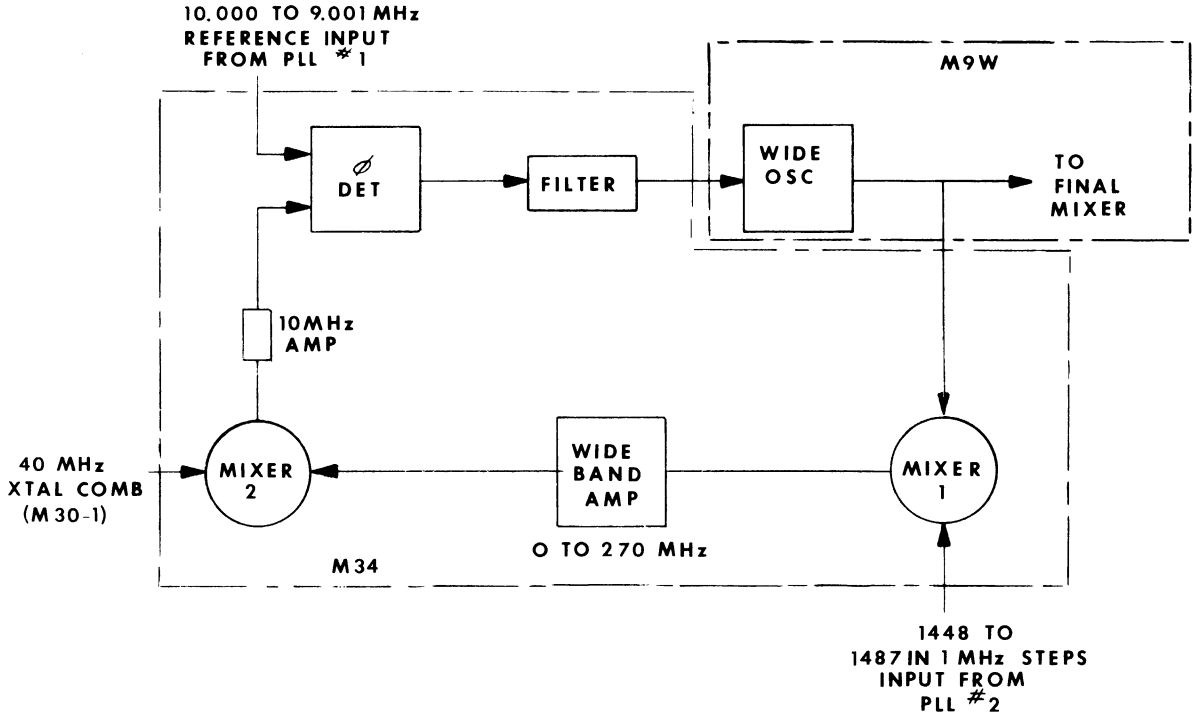


Figure 3-4. PLL #2



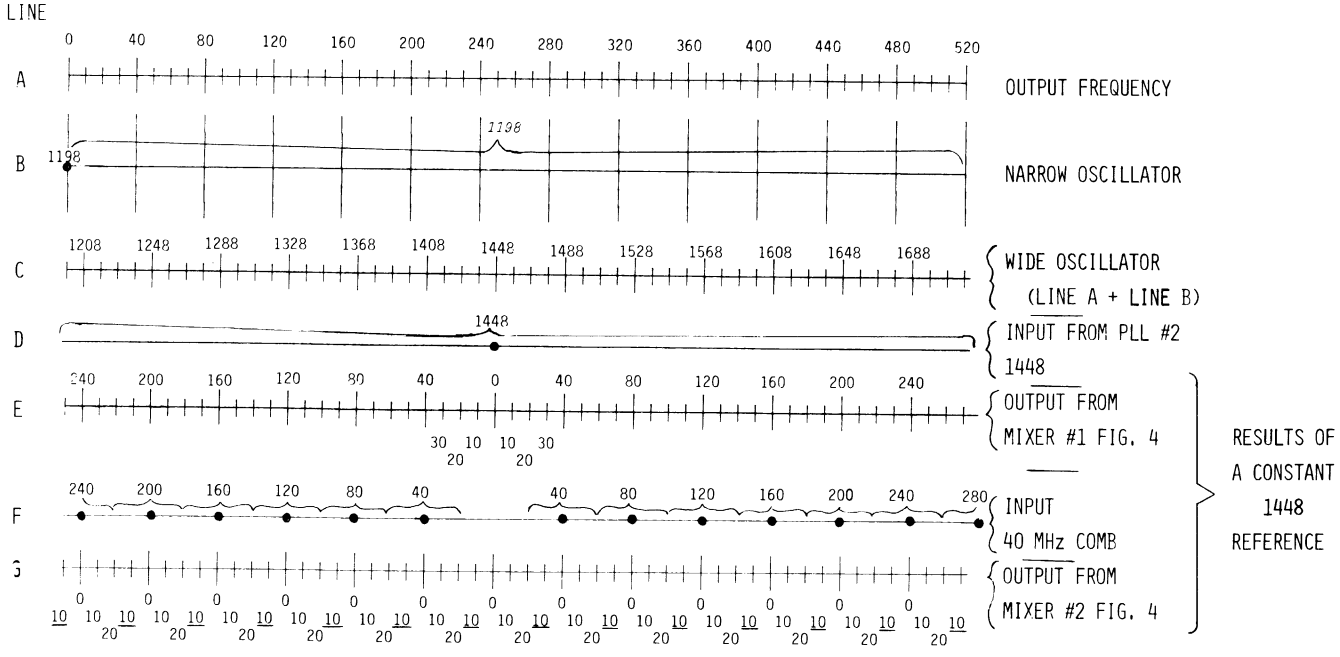


Figure 3-5. PLL #4

reference (from PLL #1) by the phase detector. A difference in phase or frequency causes an error signal to tune the Wide Oscillator until both phase detector inputs are identical. How this loop locks on a particular frequency can best be explained in three steps: 1) phase locking at 40 MHz intervals across the band, 2) phase locking at 1 MHz intervals, 3) phase locking at 1 kHz intervals. Figure 3-5 is a simplified block diagram of PLL #4.

To understand locking at 40 MHz intervals, assume temporarily that the reference frequencies from PLL #1 and PLL #2 are fixed (10 MHz and 1448 MHz respectively). Figure 3-5 shows the frequencies throughout the loop for this discussion. This step of the PLL #4 explanation can be described more clearly by considering the entire Wide Oscillator range rather than discussing single frequencies. The Wide Oscillator covers the range of 1198 to 1718 MHz as the Output frequency changes from 0 to 520 MHz. (Figure 3-5, lines A and C.)

When the Wide Oscillator range is heterodyned in Mixer #1 with 1448 MHz the difference frequency which is produced ranges from 250 to 0 to 270 MHz. (Figure 3-5, line E.) This signal is then mixed with a 40 MHz comb (all harmonics of 40 MHz) in Mixer #2. (Figure 3-5, line F.) Taking the difference between line E and F yields the repetitive frequency range from 0 to 20 to 0 MHz as shown in line G. This signal is fed to the phase detector.

The reference to the phase detector is 10 MHz but the loop will not lock on every 10 MHz output of Mixer #2. The only 10 MHz signals which will produce lock are those which would decrease in frequency if the Wide VCO tried to drift higher. Therefore at every 40 MHz interval of the output frequency an input to the phase detector would allow the loop to lock. Section 3.2.1 explains that an analog signal drives the Wide Oscillator to within three MHz of the proper frequency. Therefore, although there are 14 possible lock points on line G, the only one selected will correspond to the analog-tuned frequency of the Wide Oscillator. The unit as described so far is capable of phase locked output at 0, 40, 80. . . 520 MHz. The following is an explanation of locking at 1 MHz intervals.

To allow phase locking at 1 MHz intervals, the reference frequency to Mixer #1 is made adjustable in 1 MHz steps over a 40 MHz range (1448-1487 MHz).

If, for example, this reference frequency to Mixer #1 were 1449 MHz, the input range to the phase detector would look the same except the entire range would be shifted 1 MHz to the right. Lock points would then be possible at output frequencies of 1, 41, 81 MHz, etc.

Being able to change this reference in 1 MHz steps allows phase locking from 0 to 520 MHz in 1 MHz steps.

To provide phase locking in 1 kHz steps, the PLL #4 phase detector's reference from PLL #1 is adjustable in 1 kHz steps (10.000 to 9.001 MHz). This causes the Wide Oscillator frequency to change in 1 kHz steps in order to keep the loop locked.

PLL #3

The purpose of PLL #3 is to stabilize the Narrow Oscillator at a frequency of 1198 MHz.

Figure 3-6 shows a simplified block diagram of PLL #3. This loop operates in the same manner as PLL #1 and PLL #2 except that it does not require the use of a programmable counter. The 1198 MHz output from the Narrow Oscillator is combined in a mixer with a 1200 MHz crystal controlled signal. This produces a 2 MHz difference signal. This signal is fed to a phase detector where it is compared to a 2 MHz reference. Any difference in the input signals will produce an error voltage which is applied to the Narrow Oscillator (VCO) to correct the frequency error.

PLL #5

PLL #5 supplies the reference for PLL 3. Unlike a standard phase-locked loop the VCO can be modulated. In AM and CW the VCO is locked on 2 MHz. In the FM mode the VCO is modulated but the loop ignores modulation which is faster than 50 Hz; thus the center frequency remains locked.

The loop includes a voltage controlled oscillator, a divider for reducing the frequency from 2 MHz to 2 kHz, a phase detector and a filter for the phase detector output. If the variable input to the phase detector deviates from the reference frequency (slower than 50 Hz) the phase detector sends an error signal to the VCO to correct the frequency.

CRYSTAL REFERENCE

All the reference frequencies for the phase-locked loops are derived from a single 40 MHz crystal source by means of appropriate multiplication or division.

3.2.3 SUBASSEMBLY DESCRIPTIONS

The overall block diagram discussed in this section describes basically how the instrument functions as a unit. The unit is made up of ten module assemblies and three printed circuit card assemblies. These can be identified in Figure 5-6. Sections 3.3 thru 3.15 describe the operation of each subassembly. The name of the subassembly describes, to an extent, the primary function it performs.

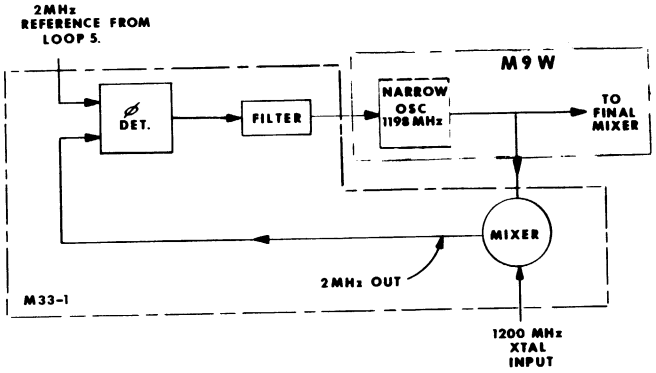


Figure 3-6. PLL #3

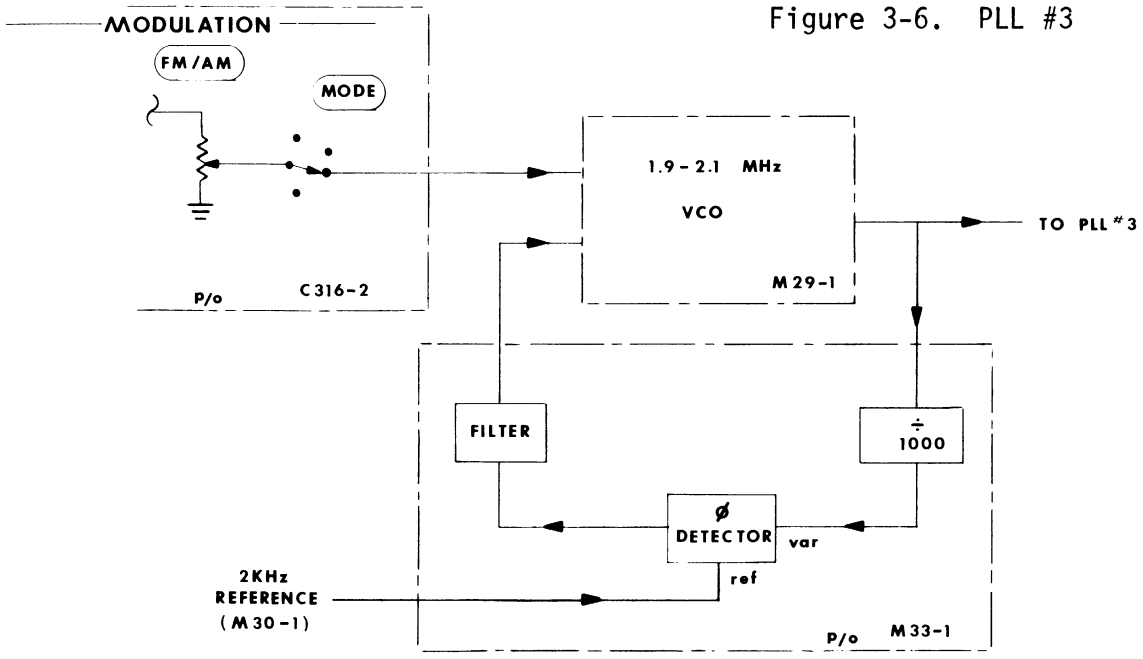


Figure 3-7. PLL #5

3.3 C315 - METER BOARD

The primary function of this assembly is to provide the program voltage to the leveler circuit for the RF amplifier. It also includes the RF output level meter which appears through the instrument front panel. See Figure 3-8.

3.3.1 LEVEL PROGRAM

During CW operation of the instrument, the level program is controlled by the VERNIER on the front panel. The output of this control goes to two range calibration circuits, "High" and "Low". The range calibration circuits convert the voltage from the VERNIER to a voltage level appropriate to drive the leveler circuit in the M10W.

The "Low" circuit provides the program for all ranges of the detented power output dial except +10 dBm. At "+10" the level program is taken from the "High" circuit. The "High" level program enables the full gain capabilities of the M10W to be used when the output is not amplitude modulated.

3.3.2 MODULATION

The modulating signal from assembly C316-2 is applied to the VERNIER which ultimately causes the RF level to change. The leveler in the M10W does not cause the RF level to respond linearly to changes in the level program voltage. To compensate for this, a stage is included in C316-2 to shape the modulation signal before being applied to the VERNIER.

3.3.3 METER

The output level meter (front panel) is controlled by the level program from the

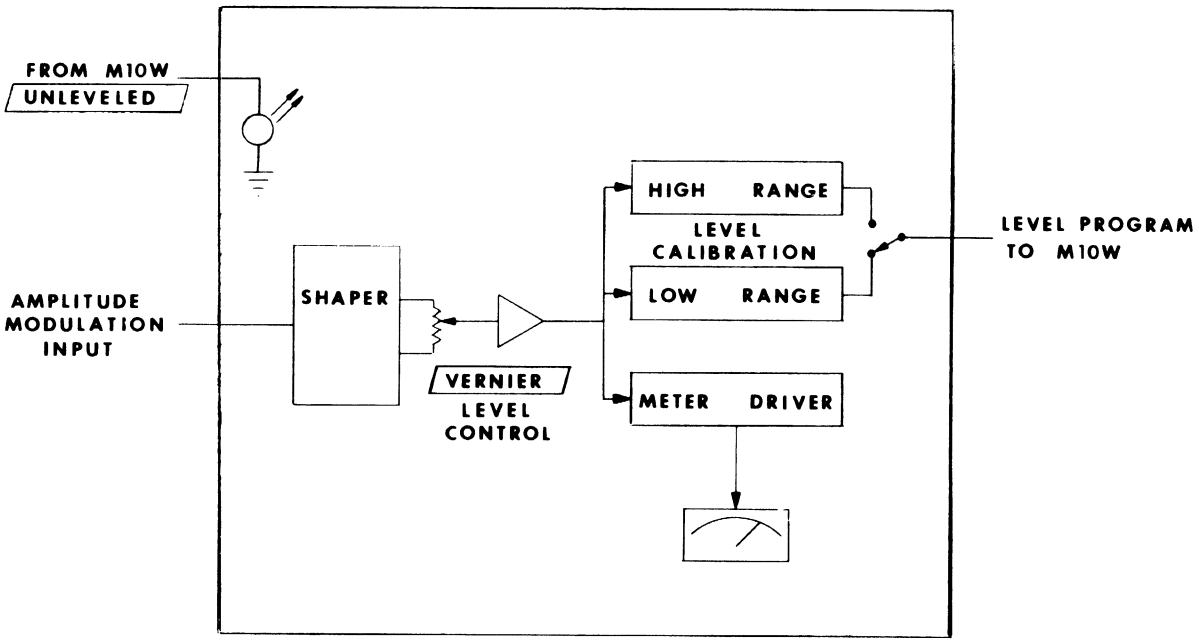


Figure 3-8. C315 - Meter Board

VERNIER. The meter and its driver circuit are designed to display a reading which corresponds to the actual RF level from the M10W.

3.3.4 "UNLEVELED" LIGHT

A light emitting diode is mounted on this assembly and appears on the front panel of the instrument. Refer to the M10W description for an explanation of the circuit driving this light.

3.4 C316-2 - MODULATION BOARD

This assembly provides the modulating signals used in the AM and FM modes. The front-panel Accuracy lights and associated circuitry are also on this assembly. See Figure 3-9.

3.4.1 MODULATING SIGNALS

The AM or FM modes are achieved by simply routing essentially the same signal to the appropriate circuitry by means of the front-panel MODE switch.

The front-panel MODULATION FREQ switch selects one of four sources of modulating frequency, one external and three internal. The internal signal can be selected from one of two CW oscillators or a manually variable DC control.

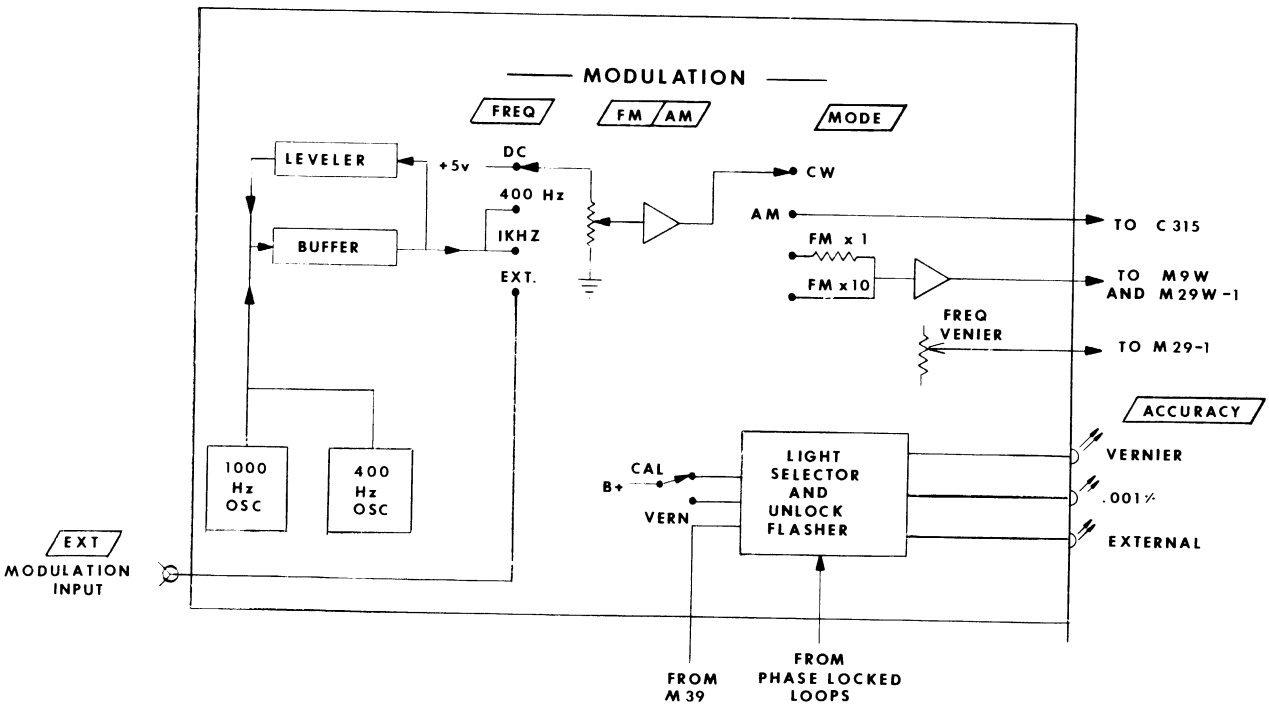


Figure 3-9. C316-2 - Modulation Board

The two internal oscillators are amplified/leveled by the same circuit for simplicity but separately energized by the FREQ switch. The oscillators are twin T oscillators, one is at 400 Hz the other is at 1 kHz.

3.4.2 ACCURACY LIGHTS

Which LED is lit is determined by the CAL switch on the frequency VERNIER or an input from an M39. If any of the phase-locked loops unlock, the energized LED is made to flash by an IC timer which is activated by a DC level from any of the five phase locked loops in the instrument.

3.5 DPS-2 - POWER SUPPLY

The DPS-2 provides DC power for the rest of the instrument. See Figure 3-10.

3.5.1 TRANSFORMER & FILTERS

The transformer steps down the line voltage to appropriate levels for the three circuits. Full wave rectifiers and filter capacitors convert this voltage to DC.

3.5.2 +18 V SUPPLY

The +18 V circuit has a zener diode pre-regulator. This feeds a high accuracy, highly stable, IC voltage regulator. The +18 V supply includes current limiting.

3.5.3 -18 V SUPPLY

This circuit compares the +18 and -18 volt outputs and holds the difference in their magnitudes to zero. A circuit is also included to limit the current output of the -18 V supply.

3.5.4 +7.3 V SUPPLY

This circuit is another comparator circuit referenced to the +18 V supply. It is a pre-regulator which supplies other voltage regulators throughout the instrument.

3.6 M2M - SWEEP DRIVE

Figure 3-11 shows the block diagram of the M2M circuit.

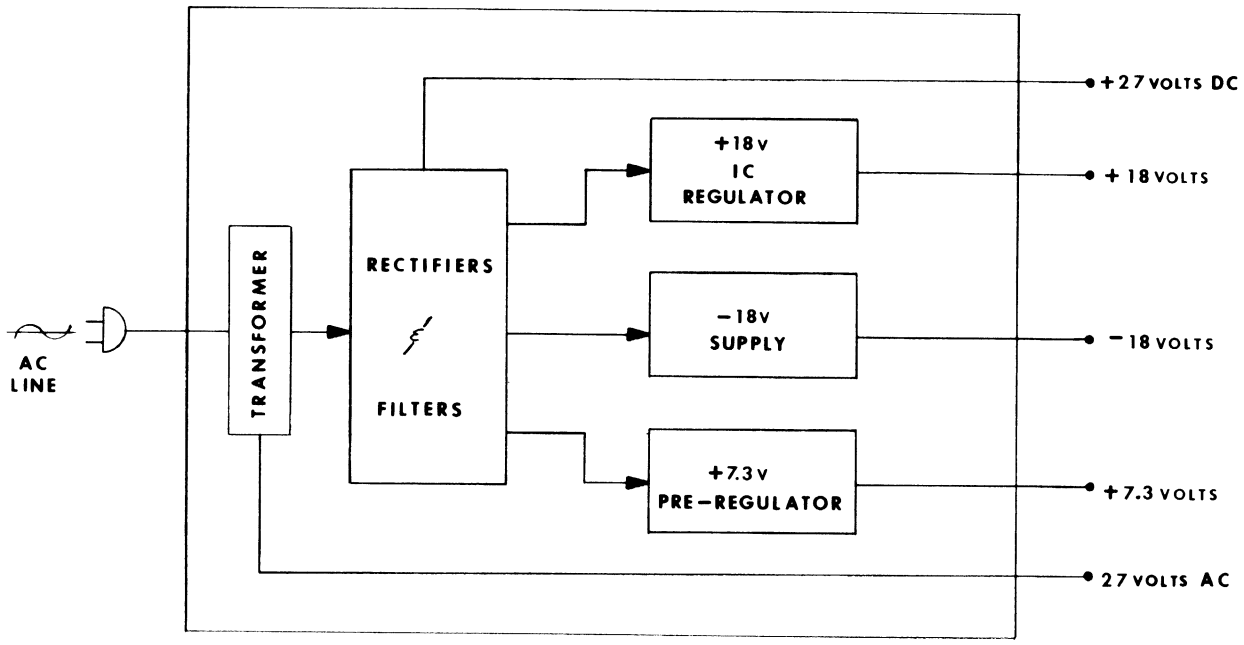


Figure 3-10. DPS-2 - Power Supply

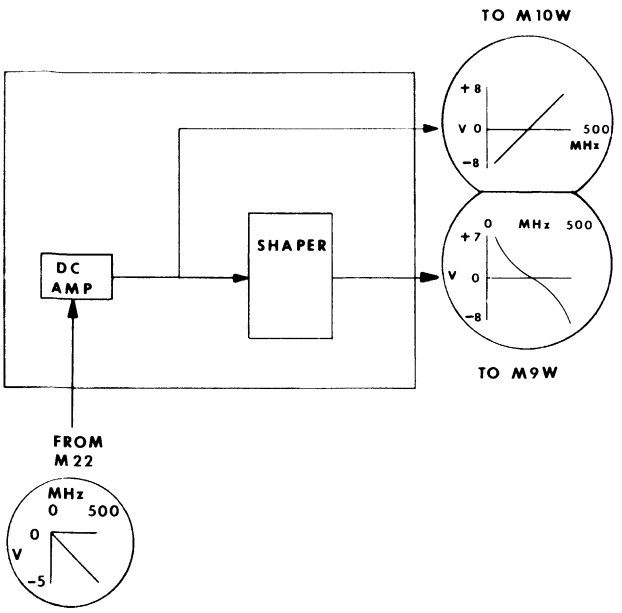


Figure 3-11. M2M - Sweep Drive

The analog tuning signal from the M22 is "shaped" before driving the M9W wide oscillator. This module also provides the varactor drive voltage to the M10W tracking filter. See section 3.8.1

3.6.1 DC AMP

This circuit inverts and slightly amplifies the input voltage for use by the M10W and the M2M shaper circuit. The graphs on the block diagram show the voltages at the input and outputs of the M2M over the range of instrument output frequencies.

3.6.2 SHAPER CIRCUIT

This is an inverting DC amplifier which amplifies the input by a smaller factor for smaller magnitude inputs.

Shaping this analog voltage compensates for the nonlinear change in capacitance of the varactor diodes in the M9W oscillator circuit.

3.7 M9W - SWEEP OSCILLATOR

The M9W is the origin of the instrument's RF output frequency. This frequency is generated by heterodyning the signals from two higher frequency voltage controlled oscillators. See Figure 3-12.

3.7.1 MIXER

The narrow oscillator applies a signal of 1198 MHz to the mixer. The wide oscillator provides between 1199 and 1718 MHz. The difference (1-520 MHz) is applied to a wide band pre-amp and then sent to the M10W.

3.7.2 WIDE OSCILLATOR

The wide range of oscillation is achieved by applying to varactor diodes in the tank circuit an analog signal which is dependent upon the setting of the frequency switches on the instrument's front panel. An additional signal is applied to this VCO from the phase detector in the M34. This is the fine tuning signal which locks the wide oscillator on the proper frequency.

3.7.3 NARROW OSCILLATOR

This oscillator also uses a varactor diode so that the frequency can be voltage controlled for phase locking and for FM operation.

The coarse modulating signal (FM) is applied to the varactor from the modulation board (C316-2). The frequency of this oscillator is further controlled by a "fine tuning" bias voltage from the M33-1 phase detector. The deviation can be controlled up to 100 kHz.

3.7.4 LEVELERS

This module contains three RF leveling circuits as shown in the diagram. These maintain a constant amplitude RF over the frequency range and with temperature variation. The output of a peak detector is compared to a constant DC level. Any error is amplified and applied to a PIN diode attenuator in series with the RF signal.

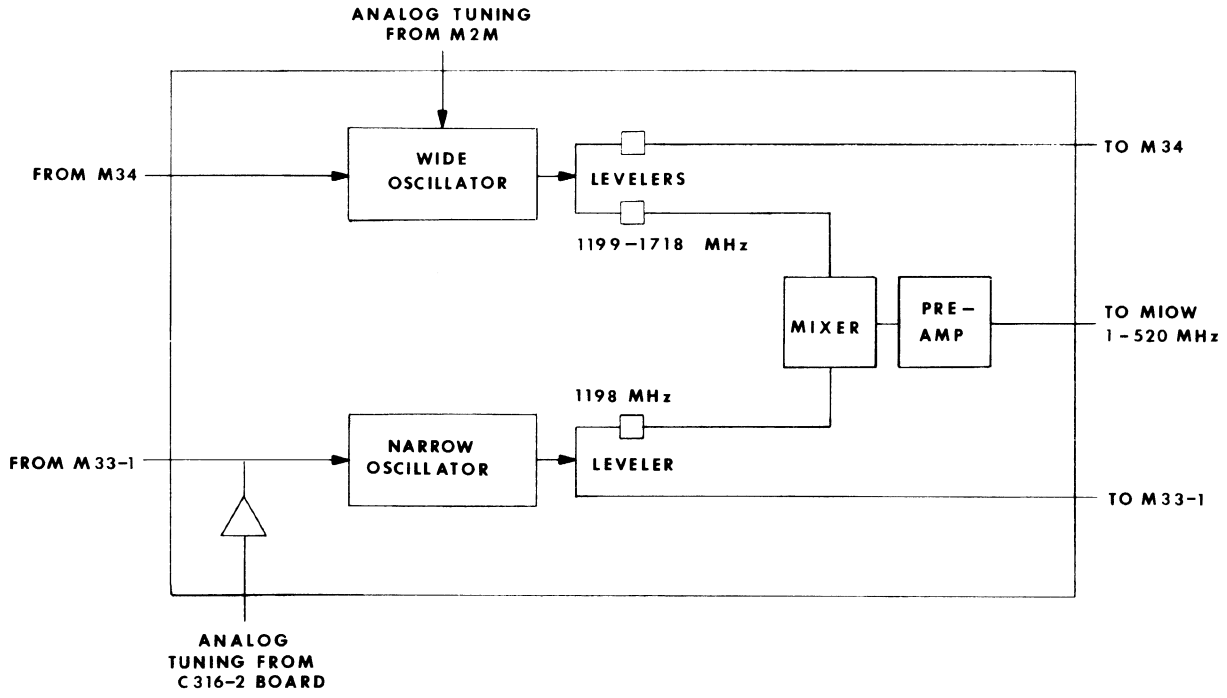


Figure 3-12. M9W Sweep Oscillator

3.8 M10W - OUTPUT AMPLIFIER

The main function of the M10W module is to amplify the RF signal from the M9W to a level programmable between -7 and +13 dBm. A leveler circuit maintains a constant amplitude output signal over the wide frequency range. The Unleveled light driver causes the front-panel light to glow when the leveler circuit exceeds its proper operating range. See Figure 3-13.

3.8.1 AMPLIFIER

This section is a six transistor, wide band amplifier which can increase the RF by about 23 dB. The analog signal from the M2M is applied to the tracking filter varactor diodes in the output of the amplifier section. This filter attenuates spurious and harmonic signals higher than the fundamental but as close to it as possible as the frequency is programmed from 1 to 520 MHz.

3.8.2 LEVELER

The leveler uses a peak detector, differential amplifier and a PIN diode attenuator. The peak detector is fed from the RF output. The resulting level is compared to a DC (or AM) reference by the differential amp which supplies the control current to the PIN diode attenuator. If the detected RF output deviates from the reference level, the signal to the PIN diode causes the input to be decreased or increased.

In addition to providing a flat frequency response, the leveler allows for electronic control of the RF output amplitude by varying the DC reference. The reference comes from the meter board (C315).

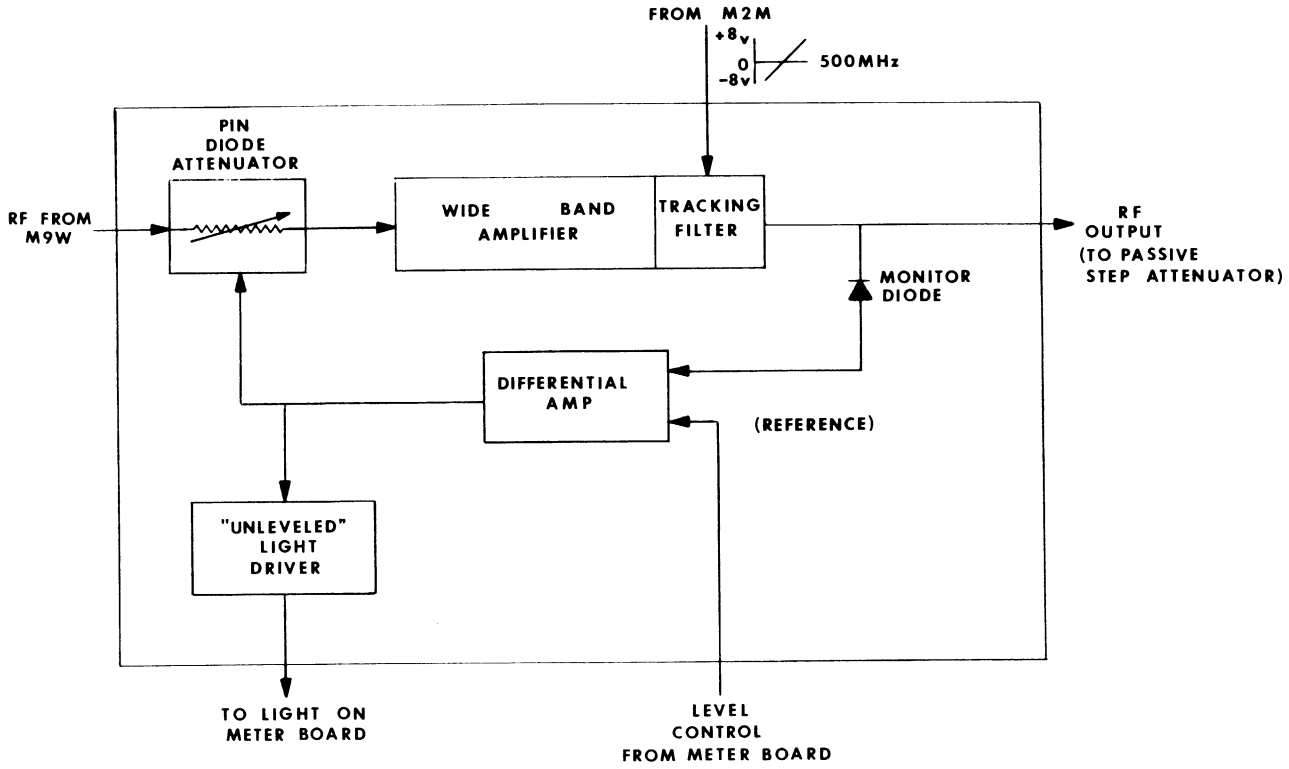


Figure 3-13. M10W - Output Amplifier

3.8.3 "UNLEVELED" LIGHT DRIVER

When the differential amp in the leveler circuit is putting out a voltage which would cause the PIN diode attenuator to be at its high or low resistance limit, the leveling circuit can no longer be effective. The above voltage levels, which are applied to the unlevel light driver, are adequate to turn on a source of current for the indicator which appears through the front panel.

3.9 M22 - DIGITAL TO ANALOG CONVERTER

This module provides two analog outputs which correspond to the frequencies selected by the "MHz" switches (left of decimal point) on the instrument's front panel. One output has a linear voltage versus frequency curve. The other output is linear from 0 to 39 MHz but repeats the analog voltages every 40 MHz. See Figure 3-14.

3.9.1 LINEAR D/A

The front-panel "MHz" switches have BCD output which indicates the desired frequency to the M22. For every logic "1" that is present a current is applied to the summing amp. The more significant the activated input, the more current results. For example, the 4's line (when activated) supplies twice the current of the activated 2's line. The eleven current sources are connected to the summing amp which produces the analog voltage which represents the sum of its "weighted" inputs.

3.9.2 REPEATING D/A

A summing amp with weighted inputs performs like the one above. The summing amp converts the weighted currents into a corresponding voltage output. The repetition of the output is achieved by using the five least significant BCD

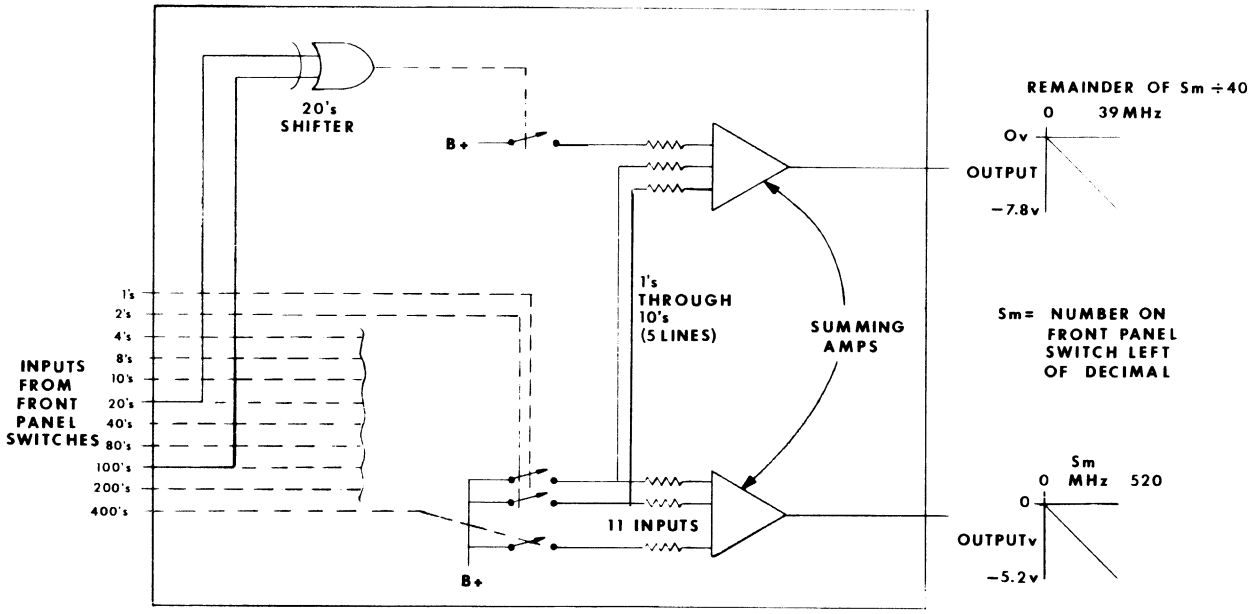


Figure 3-14. M22 - Digital to Analog Converter

lines and an artificial 20's line. These six inputs repeat themselves every 40 MHz as the front-panel switches are changed in 1 MHz steps from 1-520 MHz. A 20's line is necessary in order to represent inputs from 20 to 39, but the original 20's line doesn't repeat its sequence with every 40 MHz change in programmed frequency. See Table 3-1. The proper program for the summing amp is provided by inverting the 20's line whenever the 100's line is activated.

TABLE 3-1. 20's CONVERSION

"MHz" Switch Setting	Original 20's Line	Artificial 20's Line
0	0	0
20	1	1
40	0	0
60	1	1
80	0	0
100	0	1
120	1	0
140	0	1
160	1	0
180	0	1
200	0	0
. . .		

3.10 M29-1 - FM REFERENCE

The M29-1 is a voltage to frequency converter, the output of which is used as a phase lock reference in the M33-1. The module includes a voltage variable current source which feeds (determines the frequency of) a square wave oscillator. (See Figure 3-15.) Zero volts in yields 2 MHz out.

The M29-1 is the VCO for phase-locked loop five. The input to the M29-1 from the phase detector is essentially added to the modulation input. The Frequency VERNIER voltage is also added here. (VERNIER input becomes zero volts when VCO is locked).

3.10.1 CURRENT SOURCES

This circuit provides both a positive and a negative source of current. The

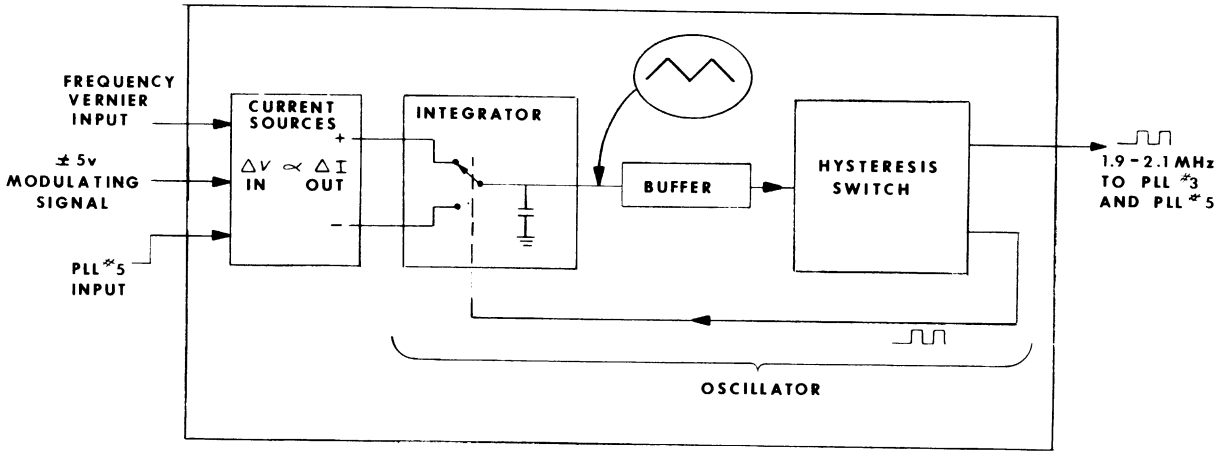


Figure 3-15. M29-1 - FM Reference

positive source is referenced to the negative source so that the instantaneous currents in both sources are equal.

The change in output current is directly proportional to the change in input voltage to the circuit. The input voltage may vary between -5 and +5 volts. The circuit is designed for a very linear graph of current-out vs. voltage in.

3.10.2 OSCILLATOR

The square wave output is produced by the combination of an integrator and a hysteresis switch. The integrator converts a square wave to a triangle wave. The triangle wave causes the hysteresis switch to produce the square wave which is fed back to the integrator.

The integrator is made up of a current switch and a capacitor. The square wave applied to the current switch causes a square current signal to be applied to the capacitor.

Positive constant current produces an increasing voltage ramp on the capacitor and negative constant current produces a decreasing voltage ramp. For a square wave input, therefore, the output is a triangle wave.

Changing the magnitude of the "currents", by changing the input voltage to the module, changes the rate at which the capacitor charges and discharges to the hysteresis points thus the frequency of oscillation changes.

3.11 M30-1 - CRYSTAL REFERENCE

This module supplies reference frequencies at 1 kHz, 2 kHz, 1 MHz, 10 MHz, 40 MHz and its harmonics, 1200 MHz (from 120 comb) and 1440 MHz to the phase locked loops in the instrument. These signals are produced by a 40 MHz crystal oscillator and a series of dividers and multipliers. See Figure 3-16.

3.11.1 40 MHz OSCILLATOR

This crystal oscillator is the heart of the accuracy of the frequency determining circuits in the instrument. It is temperature compensated for frequency stability. A varactor diode is included to enable this oscillator to be phase locked to a high stability reference. A leveler circuit causes the oscillator output level to be the same in all M30 modules.

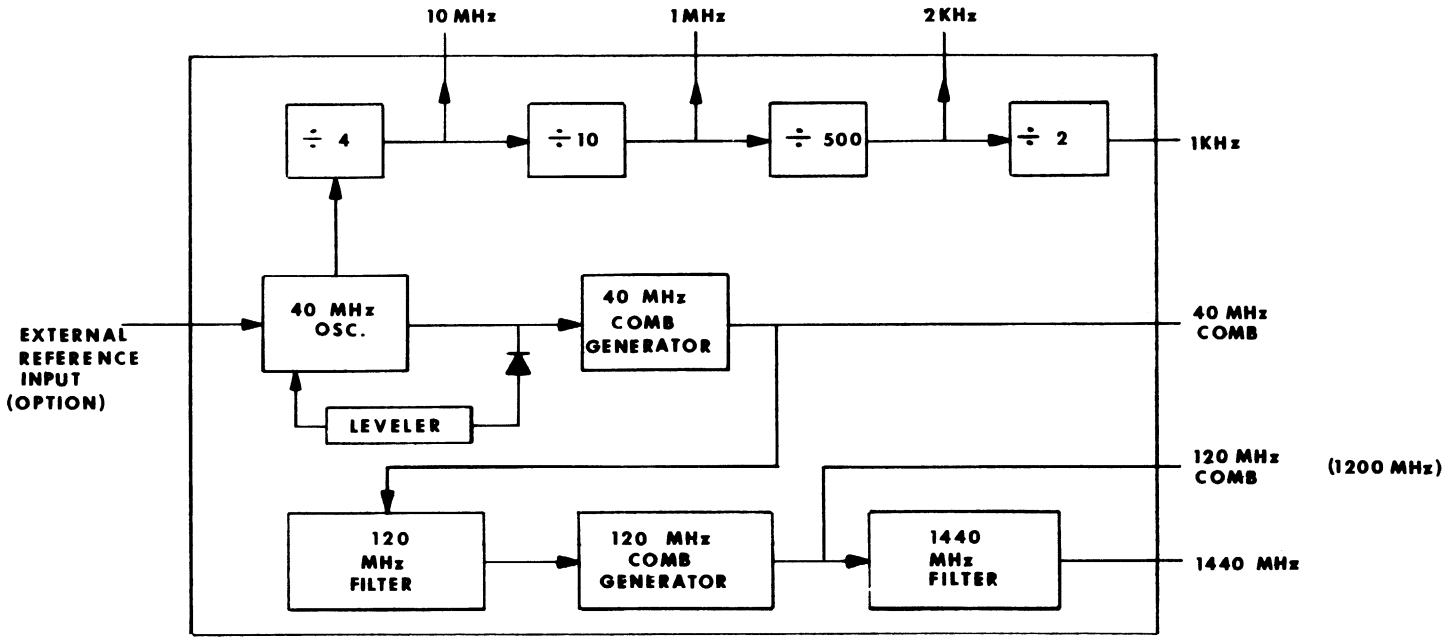


Figure 3-16. M30-1 - Crystal Reference

3.11.2 DIVIDERS

The frequencies below 40 MHz are produced by a series of TTL counters. A "divide by 4" produces the 10 MHz output for the phase-locked loop in the optional high stability reference. This frequency is further divided as shown in Figure 3-16 to provide the 1 MHz, 2 kHz and 1 kHz outputs.

3.11.3 MULTIPLIERS

The 40 MHz CW is fed to a harmonic generator which produces the "comb" output.

From the 40 MHz comb, 120 MHz is selected and applied to another harmonic generator. A sample of the 120 MHz comb output is also fed to a filter which provides the 1440 MHz output.

3.12 M31A - kHz STEPS

The input to this module is the BCD data from the front-panel "kHz" switches (to the right of the decimal point). The output frequency is (10 MHz - S_k kHz), where S_k is the number indicated by the kHz switches. If the FREQUENCY is set to 333.333 MHz, for example, the M31 output is 9.667 MHz. The block diagram of the M31 is shown in Figure 3-17.

3.12.1 VCO

The output frequency is generated by a Voltage Controlled Oscillator which is tuneable from 9.001 to 10.000 MHz.

3.12.2 PHASE LOCKED LOOP

Including the VCO in a phase-locked loop permits accurate programmability. The VCO tuning voltage comes from the Phase/Frequency Detector circuit. A 1 kHz signal from the Crystal Reference is applied to one input of the phase detector (IC9). A sample of the VCO input is divided by the Programmable Divider, and the result is applied to the other input of the phase detector. Any difference in

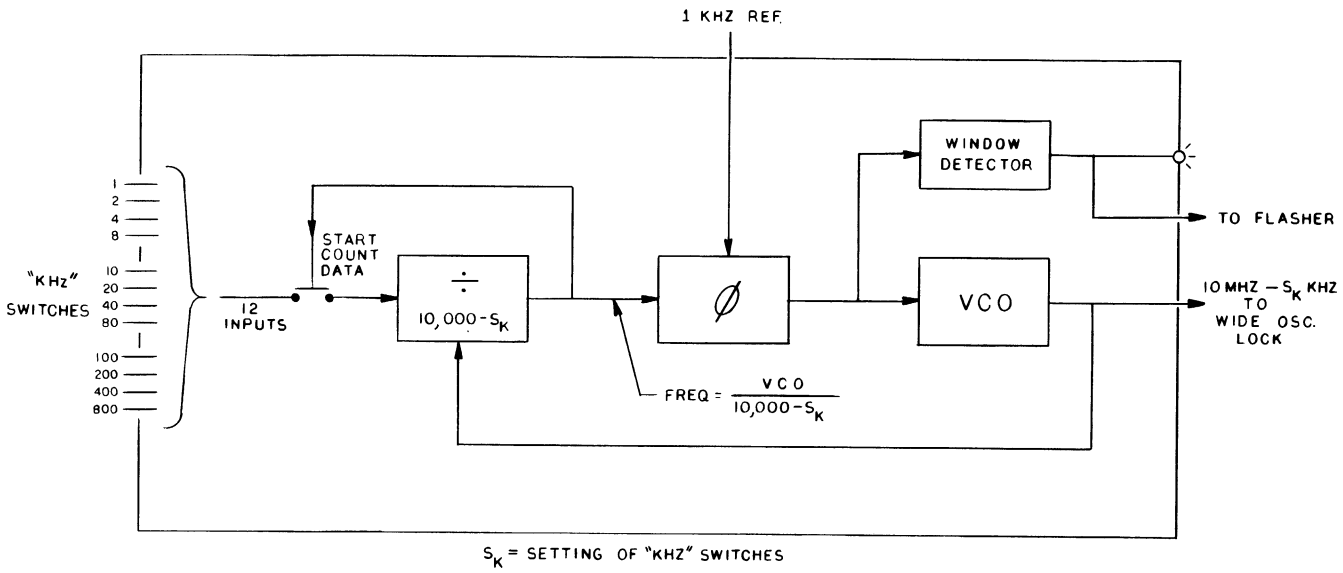


Figure 3-17. M31A - kHz Steps

phase or frequency in the signals applied to the phase detector inputs produces an error voltage at the phase detector output, which controls the VCO. The system is stable only when the phase and frequency error is zero, so that the output frequency is phase locked to the 1 kHz reference signal.

3.12.3 PROGRAMMABLE DIVIDER

In order for the M31A to perform properly, the divider is designed to divide the VCO frequency by (10,000-S_k) where S_k is the number set on the "kHz" switches. The divider counts the number of cycles at its input and puts out a pulse when the count reaches 10,000. The starting count is the number shown on the "kHz" switches. For example, if the instrument is set for 222.500 MHz, this circuit would divide by 9,500 (count from 500 to 10,000). Therefore, the variable input to the phase detector would be correct (1 kHz) only if the VCO output were 9,500 MHz.

3.12.4 UNLOCK INDICATOR

When the phase-locked loop is unlocked, the LED on top of the module will light and the front-panel ACCURACY lights will flash.

A window detector monitors the voltage level which is being fed from the phase detector to the VCO. If the voltage exceeds the normal operating range, power is applied to the module light and the flasher circuit on the Modulation Board.

3.13 M32A - MHz STEPS

The M32A provides, for the M34, a reference frequency which corresponds to the setting on the "MHz" switches. (See block diagram, Figure 3-18.) The M32A output range is 1448 to 1487 MHz, which repeats itself with every 40 MHz change of the frequency switches. Any specific M32A output relates to the "MHz" switch setting (S_m) by the equation (Output = (1448 + R) MHz), where R is the Remainder of dividing S_m by 40. If the front-panel is set, for example, for 333.000, R would be 13 (333.000 + 40 = 8 with a Remainder of 13). The output of the M32A would then be 1448 + 13 = 1461 MHz.

3.13.1 VCO

The output of the M32A is produced by a Voltage Controlled Oscillator. This VCO is coarsely tuned by the repeating analog output of the M22. Fine tuning is the result of including the VCO in a phase-locked loop. In addition to the VCO, the phase-locked loop includes a phase detector and Programmable Divider.

3.13.2 PROGRAMMABLE DIVIDER

A sample of the VCO output is mixed with the 1440 MHz signal from the crystal Reference producing a difference frequency of from 8 to 47 MHz, which is then shaped into TTL pulses and applied to the Programmable Divider.

The Divider counts the falling edges of the 8-47 MHz input pulses, resetting each time a count of 47 is reached. The reset pulse is applied to one input of the phase detector. By controlling the starting count of the Programmable Divider, the effective divisor can be controlled.

The starting count of the Programmable Divider is selected by a Read Only Memory, which is programmed to provide the correct "R" information for each "S_m" setting. This "R" is then applied to the Programmable Divider as the starting count. Thus, as the starting count varies from 0 to 39, the effective divisor varies from 47 to 8.

When the VCO is running at the correct frequency, the Programmable Divider reset pulse rate will be 1 MHz.

3.13.3 PHASE DETECTOR

One input to the phase detector is the reset pulse from the Programmable Divider. The other input is a 1 MHz fixed reference signal from the Crystal Reference. The phase detector output is a voltage determined by the difference in phase at the phase detector inputs, and is used to correct any error in the VCO frequency or phase.

If the VCO output frequency is too high, for example, the phase detector output becomes more negative, thus increasing the VCO varactor diode tuning capacitance and lowering the VCO frequency. If the VCO frequency is too low, the reverse occurs. Thus, the loop will tend to maintain zero phase or frequency error. A voltage-controlled attenuator between the phase detector circuit and the VCO keeps the open-loop gain of the phase-locked loop relatively constant over the programmed frequency range, allowing the loop noise to be minimized.

3.13.4 UNLOCKED INDICATOR

When the phase-locked loop is unlocked, the LED on top of the module will light and the front-panel ACCURACY lights will flash.

A window detector monitors the voltage level which is being fed from the phase detector to the VCO. If the voltage exceeds the normal operating range, power is applied to the module light and the flasher circuit on the Modulation Board.

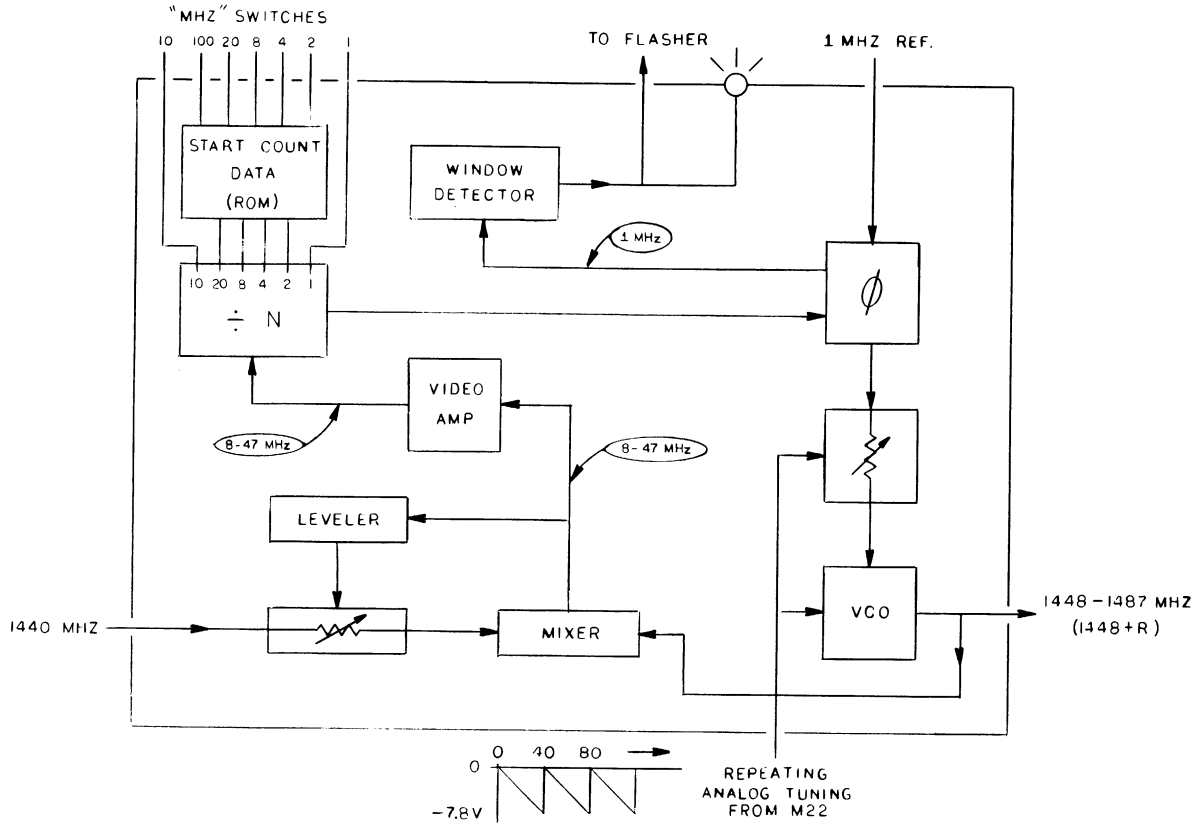


Figure 3-18. M32A - MHz Steps

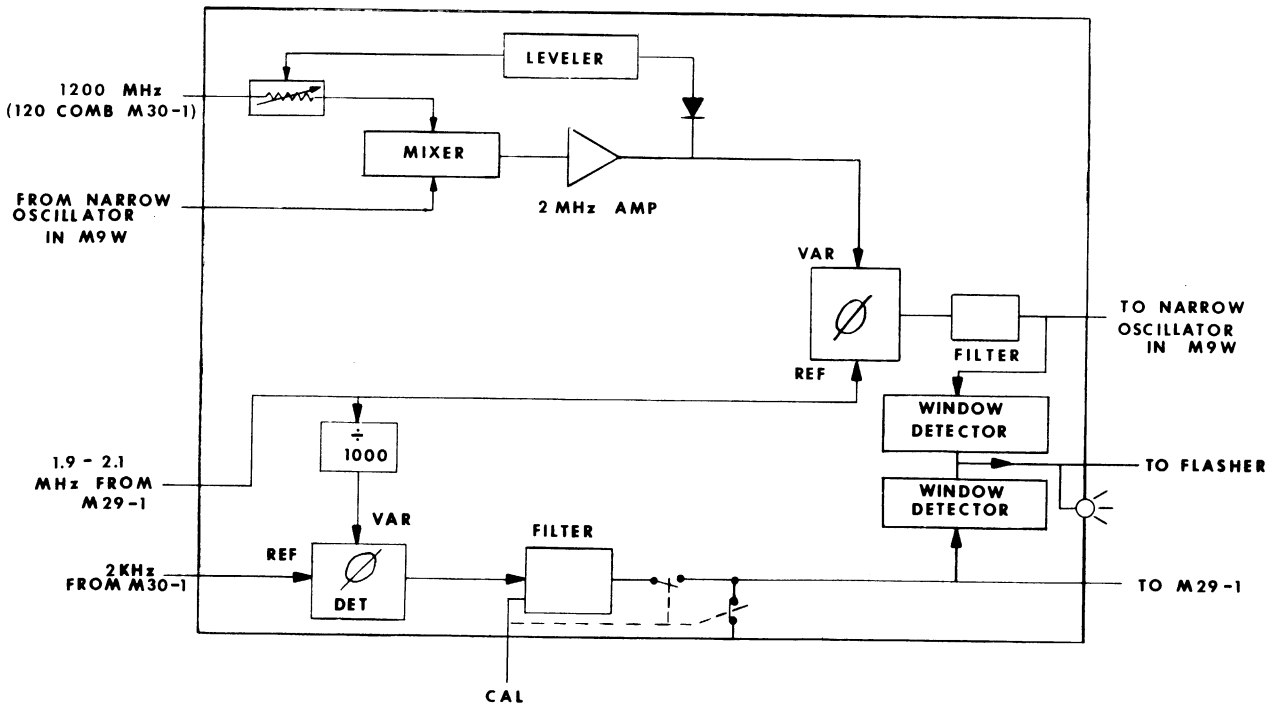


Figure 3-19. M33-1 - Narrow Oscillator Lock

3.14 M33-1 - NARROW OSCILLATOR LOCK

The M33-1 contains the circuits to phase lock the narrow oscillator in the M9W (loop 3) and the M29-1, FM reference, (loop 5). As explained in section 3.2.2 loop 5 provides the reference frequency for loop 3.

3.14.1 PHASE DETECTOR FOR LOOP #3

This circuit compares the reference frequency to the variable frequency which represents the M9W VCO output. If the VCO is too high, for example, the phase detector puts out a more positive voltage which is filtered and inverted by an integrator and applied to the VCO (narrow oscillator) to lower the frequency.

3.14.2 MIXER

The phase detector can not operate at UHF frequencies so the VCO is mixed with 1200 MHz CW. This provides an offset frequency which is the variable input to the phase detector. The deviation of this variable signal from 2 MHz is precisely the same as the deviation of the VCO from 1198 MHz.

3.14.3 PHASE DETECTOR FOR LOOP #5

This circuit compares the 2 kHz reference from the M30-1 to the variable frequency which is the M29-1 output divided by 1000. The variable frequency is divided by 1000 so that even when M29-1 is frequency modulated the variable frequency will remain in the capture range of the phase detector. Any frequency modulation (above 50 Hz) is filtered out by the integrator filter and the error voltage is fed to the M29-1.

3.14.4 UNLOCK INDICATOR

Window detectors are fed by the integrator outputs. If the integrators put out a voltage outside their normal operating range the window detectors apply voltage to the module's unlock indicator and to the flasher circuit on the Modulation board assembly.

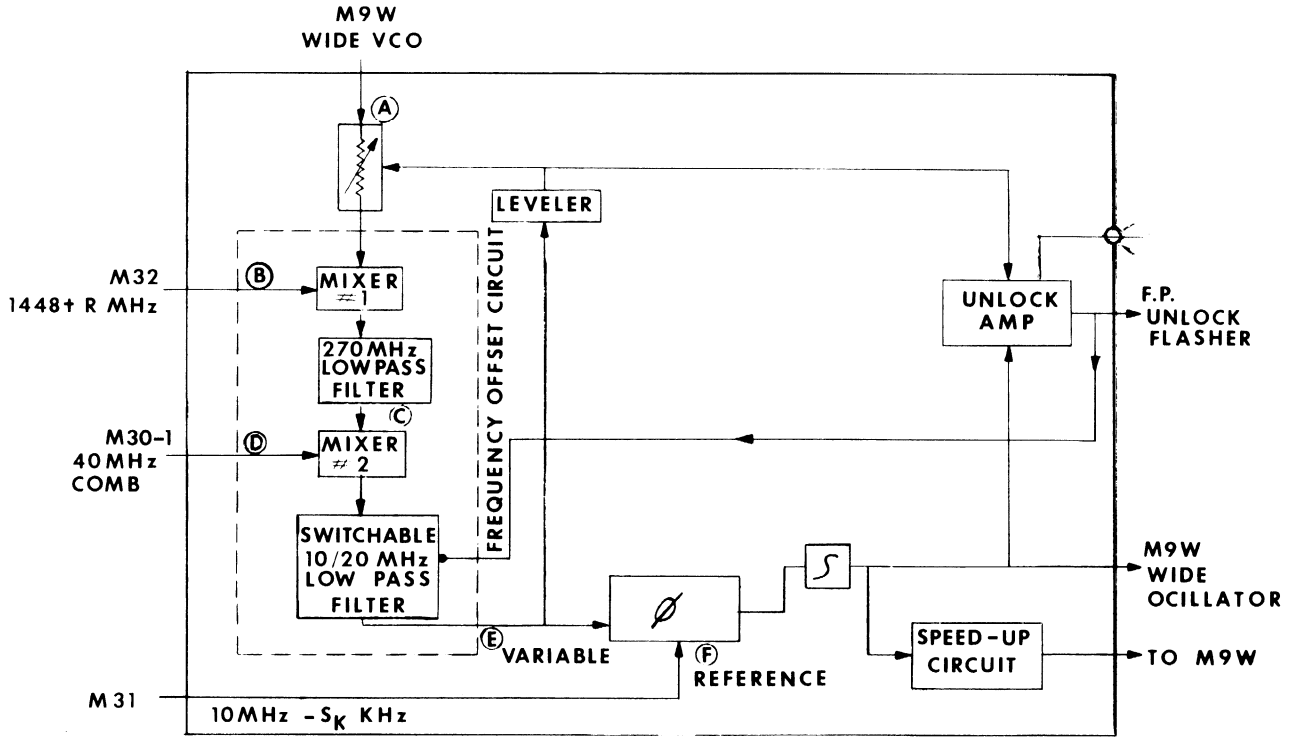


Figure 3-20. M34 - Wide Oscillator Lock

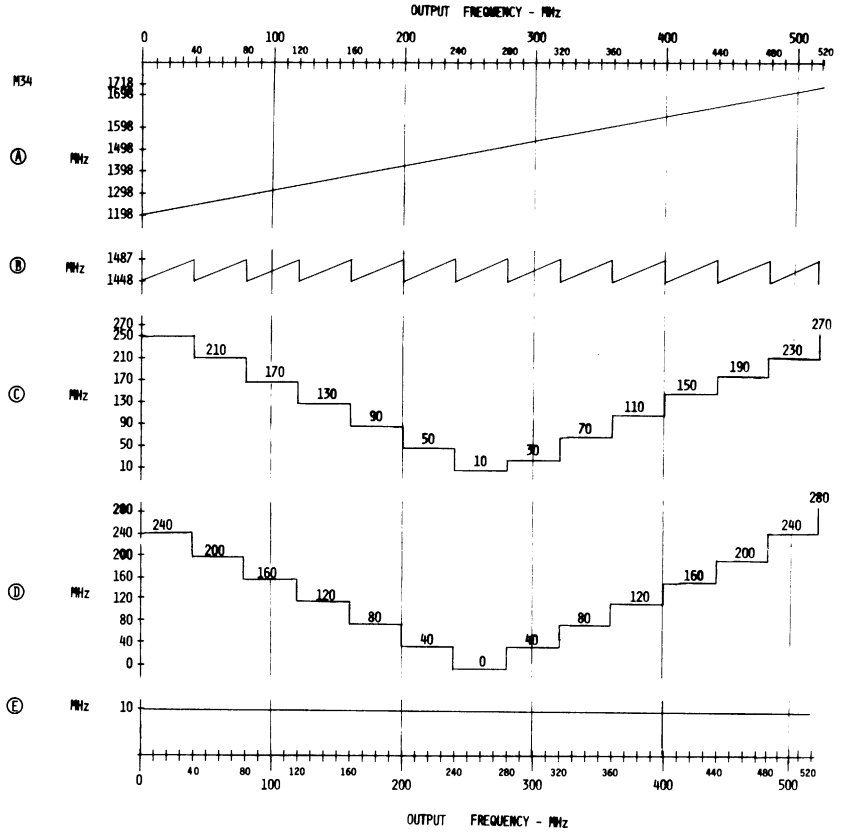


Figure 3-21. M34 Signal Frequencies

3.15 M34 - WIDE OSCILLATOR LOCK

This module provides the fine tuning program for the wide oscillator in the M9W. Figure 3-20 is the block diagram of the M34. The letters A thru F relate the signals at the associated points in the module to the graphs A thru F in Figures 3-18 and 3-19. The M34 phase locks the VCO to 1198 MHz plus the frequency indicated on all six front-panel switches. The frequency offset circuit converts the frequency of the VCO to a lower frequency which retains the frequency error information for use by the phase detector. In addition to the frequency offset circuit and the phase detector, several auxillary circuits are included.

3.15.1 PHASE DETECTOR

The phase detector compares the "offset" VCO frequency to the reference frequency from the M31. (Refer to the description of the M31 for a more detailed description of this 10.000 - 9.001 MHz reference.)

The phase detector output voltage goes positive or negative to ultimately drive the wide oscillator higher or lower in frequency until both inputs to the phase detector are the same frequency. The integrator serves as a low pass filter for the phase detector.

3.15.2 FREQUENCY OFFSET CIRCUIT

The VCO error information must be converted to a frequency useable by the phase detector. This conversion is made by mixer #1, a 270 MHz low pass filter, mixer #2 and a 10 MHz low pass filter. Refer to Figures 3-20, 3-21 and 3-22 for descriptions of signals.

Mixer #1 heterodynes the VCO frequency with the "MHz steps" reference fre-

quency (1448 + R) MHz. The difference frequency, |1448 + R - VCO|, is below 270 MHz. This signal is sent to mixer #2 where it is heterodyned with the 40 MHz comb. For any output frequency graph D in Figure 3-21 shows only the comb frequency which will yield the desired output (below 20 MHz) of mixer #2. If the loop is locked, mixer #2 will produce a 10 MHz difference as shown in Figure 3-21 (assuming the "kHz" switches are set for 000). Figure 3-22 shows signals A thru F for a case when the kHz switches are not 000.

The filter after the mixer #2 blocks all the outputs of the mixer except the lower frequency signal containing the VCO error information. When the unit is unlocked the filter passes up to 20 MHz (to be able to capture over the 20 MHz range allowed for analog tuning). Once the loop is locked, the filter decreases to 10 MHz to further eliminate phase-locked loop related spurious signals.

3.15.3 AUXILIARY CIRCUITS

The "speed-up circuit" is activated when the phase-locked loop becomes unlocked. The output of this circuit is sent to the M9W to cause the VCO to be tuned faster by the analog voltage.

The "unlock" amp monitors both the tuning voltage from the phase detector and the leveler voltage to detect an unlocked condition of the M34. When unlock occurs, it sends a voltage to the flasher circuit.

The leveler circuit maintains a constant input amplitude to the phase detector by controlling the amplitude of the input from M9W wide oscillator. The input to the phase detector (about 10 MHz) is peak detected and compared to a DC reference in the leveler circuit. The leveler circuit controls a PIN diode attenuator which is between the VCO input and mixer #1.

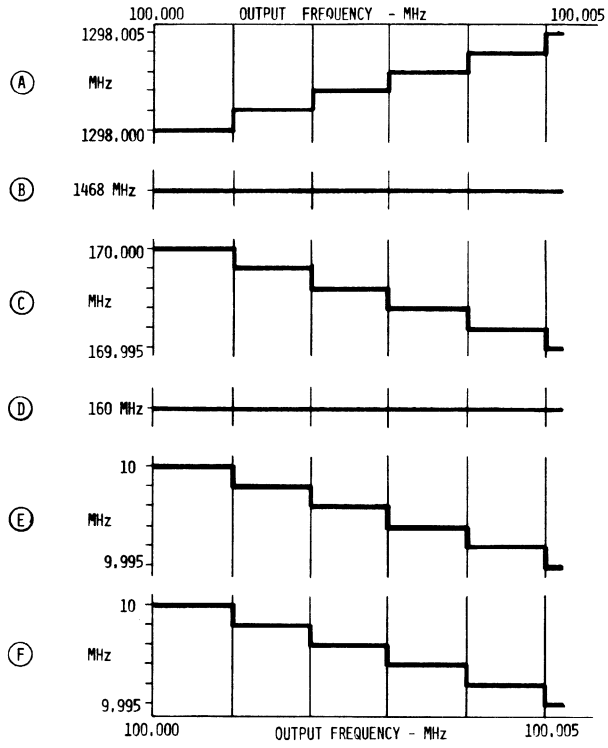


Figure 3-22. M34 - Frequencies (Expanded)

SECTION 4
PERFORMANCE TESTS

4.1 INTRODUCTION

The purpose of the performance tests in the following paragraphs is to verify that the Model 3001 Signal Generator meets its published specifications (paragraph 1.2). Individual performance tests consist of: the specification to be verified, the method of testing, a list of equipment required, and a detailed test procedure including in some cases a simplified setup drawing. If optional features are installed in the instrument refer to Section 8 for possible changes to the performance test procedure.

Critical specifications for each item of test equipment are listed in Table 4-1 of Recommended Test Equipment. Except as detailed settings of test equipment apply to performance test procedures, all other test equipment operating details are omitted.

The Signal Generator should have its top and bottom covers installed for the performance tests. All of the tests can be performed without access to the internal controls. Before applying power to the Signal Generator see Section 2 for details of electrical installation. The line voltage should be maintained at 115 or 230 volts ±10%, 50 or 60 Hz throughout the tests. The performance test procedures are begun after a two-hour minimum warmup of the Signal Generator in a +20 to +30° C ambient temperature range.

A copy of the Performance Test Record (PTR) is provided at the end of this section for convenience in recording the performance of the Model 3001 during performance tests. It can be filled out and used as a permanent record for incoming inspection or it can be used as a guide for routine performance testing. The PTR lists the paragraph, test, basic control settings and limits. All of the tests refer to this test record.

TABLE 4-1. RECOMMENDED TEST EQUIPMENT FOR MODEL 3001 PERFORMANCE TESTS

INSTRUMENT	CRITICAL REQUIREMENT	RECOMMENDED
Digital Multimeter	10 VDC: ±(0.07%R+0.02%FS)	Dana 4300
Distortion Analyzer	Range: 5 Hz to >25 kHz	HP334A
Frequency Counter	Range: to 525 MHz	HP5300B/5303B
Function Generator	Level: 10 Vpp sine wave into 600 ohm load Range: >0.2 Hz to >25 kHz Distortion: <1%	Wavetek 130

TABLE 4-1. (Cont'd)

Power Meter	Range: 10 to >520 MHz Input Level: -7 to +13 dBm Accuracy: ±1% FS	HP435A/8481A
Modulation Meter	Range: 5 to >520 MHz Residual FM: <100 Hz (RMS) (quiet room) Residual AM: <0.1% (RMS) (in CW) AM Accuracy: ±(2%R+1%FS)	AFM2 Radiometer
Oscilloscope	Range: DC to 2 MHz Sensitivity: 2 V/cm (AC coupled)	Tektronix D10/ 5A18N/5B10N
Spectrum Analyzer	Range: 500 kHz to 1200 MHz Display: 2 dB log and 10 dB log	HP8554L/8552B/ 141T
Precision Attenuator Pads	10, 20, 30, and 40 dB	Weinschel 50-10, 50-20, 50-30, and 50-40
Wideband Amplifier	Range: 1 to 520 MHz Gain: 26 dB Impedance: 50 ohm	HP8447D
Sweep/Signal Generator	Range: 1 to 520 MHz	Wavetek 2001
VSWR Bridge	5 to 525 MHz, 50 ohm 50 dB directivity	Wiltron 60N50
Coaxial Short	Type N female	HP11511A
Coaxial Termination, 50 ohm	Type N male, 1.05 SWR	HP908A
Loop Probe	See Figure 4-9.	

4.2 FREQUENCY RANGE AND RESOLUTION TEST

SPECIFICATION RANGE — 1 MHz to 520 MHz selectable in 1 kHz steps.

READOUT — 6 digit Lever/Indicator switches

RESOLUTION — 1 kHz

METHOD — A frequency counter is used to measure the frequency range and the frequency resolution. All frequencies in CW and AM modes between 1 and 520 MHz are selected by front-panel Lever/Indicator switches. Each of the digits of the frequency selector (a total of 56) will be tested. The 0 through 9 kHz digits provide 1 kHz resolution.

EQUIPMENT

Frequency Counter HP5300B/5303B

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	050.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive in CW MODE)
MODULATION FM/AM	(Inactive in CW MODE)
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the Signal Generator RF out connector to the 50 ohm input of the frequency counter. Set the counter to read frequency to seven digits.

3. Observe the frequency counter reading. Increase the setting of the Signal Generator FREQUENCY selector in 1 kHz steps and verify that the frequency counter reading increases by 1.00 kHz ±1 count for each step increase from 1 through 9 kHz. The foregoing procedure verifies the 1 kHz resolution specification.

4. Repeat the procedure in step 3 for all other step increases indicated in the table below beginning with the 10 kHz digits. If the actual counter frequency increase per step is equal to the allowable increase per step ±1 count for each of the steps indicated in the table, place a check mark in the applicable space on line 1 of the PTR.

FREQUENCY Selector		Frequency Counter Reading	
Range (MHz)	Increase per step	No. Digits	Allowable Increase per step ±1 count
050.000-050.009	1 kHz	7	1.00 kHz
050.000-050.090	10 kHz	7	10.00 kHz
050.000-050.900	100 kHz	6	100.0 kHz
050.000-059.000	1 MHz	5	1.000 MHz
001.000-091.000	10 MHz	5	10.000 MHz
020.000-520.000	100 MHz	6	100.00 MHz

4.3 FREQUENCY ACCURACY TEST

SPECIFICATION

ACCURACY All modes (CW, AM and FM) ±0.001%
(±0.001% +10 kHz when frequency VERNIER is not in CAL position. Frequency VERNIER range is ±5 kHz.)

METHOD

A frequency counter is used to measure frequency accuracy. With the frequency VERNIER in CAL position all carrier frequencies between 1 and 520 MHz are derived from a single crystal-controlled oscillator. The Signal Generator will be tested at one CW frequency to verify that the crystal-controlled oscillator operates within specified limits.

When the frequency VERNIER is not in CAL position, all carrier frequencies are derived from a voltage-controlled oscillator in addition to the crystal-controlled oscillator. Frequency accuracy with the frequency VERNIER not in CAL position will be measured by utilizing DC modulation equal to maximum peak sinusoidal modulation in both FM modes. The frequency VERNIER range will be tested in CW mode.

EQUIPMENT

Frequency Counter	HP5300B/5303B

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	040.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive in CW MODE)
MODULATION FM/AM	(Inactive in CW MODE)
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the 50 ohm input of the frequency counter to the Signal Generator RF out connector.

3. The counter should read between 39,999.59 and 40,000.41 kHz. Record the counter reading to seven places on line 2 of the PTR.

4. Set the Signal Generator controls as follows:

Frequency VERNIER	0 kHz
FREQUENCY selector	001.000 MHz
MODULATION MODE	FMx1
MODULATION FREQ	DC
MODULATION FM/AM	10 kHz

5. The frequency counter should read between 999.99 and 1,020.01 kHz. Record the counter reading to 6 places on line 3 of the PTR.

6. Set the Signal Generator MODULATION MODE to FMx10.

7. The frequency counter should read between 1,089.99 and 1,110.01 kHz. Record the counter reading to 6 places on line 4 of the PTR.

8. Set the FREQUENCY selector to 002.000 MHz.

9. Set the frequency VERNIER to +3 kHz, and make a note of the counter reading in Hz.

10. Set the frequency VERNIER to 0 kHz, and subtract the frequency counter reading in Hz from the reading in step 9. The frequency difference should be between 2500 and 3500 Hz. Record the difference on line 5 of the PTR.

11. Set the frequency VERNIER to -3 kHz, and subtract the frequency counter reading in Hz from the reading at 0 kHz in step 10. The frequency difference should be as in step 10. Record the difference in Hz on line 6 of the PTR.

4.4 FREQUENCY STABILITY TEST

STABILITY

All modes (CW, AM and FM) <0.2 ppm/hour
(500 Hz per 10 min when frequency VERNIER is not in CAL position.)

METHOD

The frequency stability is measured with a frequency counter at the indicated time intervals after a 2 hour minimum warmup.

EQUIPMENT

Frequency Counter HP5300B/5303B

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive)
MODULATION FM/AM	(Inactive)
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the 50 ohm input of the frequency counter to the Signal Generator RF out connector.

3. Allow the Signal Generator to warm up for two hours minimum. Record the frequency counter readings to nine-places at 15-minute intervals for a one-hour period. The difference between the maximum and minimum readings in the one-hour period should not exceed 104 Hz. Record the difference between the maximum and minimum readings in Hz on line 7 of the PTR.

4. Set the Signal Generator frequency VERNIER to 0 kHz, the MODULATION MODE to FMx1, and MODULATION FREQ to DC and adjust the MODULATION FM/AM control to 10 kHz.

5. After a one-minute interval record the frequency counter readings to nine-places at five-minute intervals for a ten-minute period. The difference between the maximum and minimum readings in the ten-minute period should not exceed 500 Hz. Record the difference between the maximum and minimum frequency readings in Hz on line 8 of the PTR.

4.5 OUTPUT LEVEL ACCURACY TESTS

SPECIFICATION

Power Level	+13 to -137 dBm (1 V to 0.03 μV)
Attenuator Range	Continuously adjustable in 10 dB steps and an 11 dB VERNIER. Output level is indicated on a front-panel meter calibrated in dBm and volts RMS.
Total Level Accuracy	±1.25 dB (+13 to -7 dBm) ±1.95 dB (-7 to -77 dBm) ±2.75 dB (-77 to -137 dBm)
Accuracy Breakdown	
Flatness	±0.75 dB (+13 to -7 dBm)
Output Meter	±0.5 dB
Step Attenuator	±0.5 dB to 70 dB (±0.2 dB calibration error) ±1.0 dB to 130 dB (±0.5 dB calibration error)

METHOD

The ±1.25 dB level accuracy between +13 and -7 dBm consists of the sum of the output meter error (±0.5 dB) and the flatness (±0.75 dB). Both errors are measured with a power meter.

The output meter error is measured at 50 MHz in two 10 dB output ranges (+13 to +3 dBm and +3 to -7 dBm).

The flatness is measured relative to 50 MHz in 10 MHz steps between 10 and 520 MHz at +12, +3 and -7 dBm output levels.

The level accuracy below -7 dBm depends upon the output step attenuator error in addition to the output meter error and the flatness.

The output step attenuator is a combination of pi-pad sections of 10, 20, 30, 30 and 40 dB. These five pi-pads are programmed by cams to provide 0 to 130 dB of attenuation in 10 dB steps as shown in the table below.

OUTPUT STEP ATTENUATOR POSITION	ACTIVE STEP ATTENUATOR PADS (X)				
dBm	10 dB	20 dB	30 dB	30 dB	40 dB
+ 10					
0					
- 10	x				
- 20		x			
- 30			x		
- 40	x		x		
- 50		x	x		
- 60			x	x	
- 70	x		x	x	
- 80		x	x	x	
- 90		x		x	x
-100			x	x	x
-110	x		x	x	x
-120		x	x	x	x
-130	x	x	x	x	x

Note that no step attenuator pads are active in the +10 dBm and 0 dBm positions. A leveled pin-diode attenuator reduces the output level by 10 dB in all positions of the output step attenuator below +10 dBm. The output level over the entire range of +13 dBm to -137 dBm including an 11 dB VERNIER is controlled by the pin leveler system.

The output step attenuator error is measured by an RF substitution method. Each of the five pads in the output step attenuator is measured at 520 MHz. The second 30 dB pad and the 40 dB pad are measured in combination with other pads. A reference output level is set with a power meter. A reference trace is obtained with a spectrum analyzer and a standard attenuator pad. The standard pad is removed and the output step attenuator position to be measured is substituted. The spectrum analyzer trace is returned to the reference level by resetting the Signal Generator output level. The resulting Signal Generator output level is measured and compared to the original power meter reference level. A 26 dB RF amplifier is required to boost signal levels below the -60 dBm level.

4.5.1 OUTPUT METER ACCURACY TEST

EQUIPMENT

Power Meter and Sensor	HP435A/8481A

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	050.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive in CW MODE)
MODULATION FM/AM	(Inactive in CW MODE)
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Calibrate the power meter and power sensor. Set the power meter to the +15 dBm range. Connect the power sensor to the Signal Generator RF out connector. (When reading the power meter, set the range switch so that the meter indicates between 0 and -5 dBm).

NOTE: The indicated output level of the Signal Generator is equal to the sum of the output meter reading and the step attenuator setting. The difference between the actual power meter reading and the indicated output level is the output meter error. For example, the indicated output level is +13 dBm for an output meter reading of +3 dBm and an OUTPUT step attenuator setting of +10 dBm. If the power meter reading is +13.15 dBm, the output meter error is +0.15 dB.

3. Adjust the Signal Generator OUTPUT VERNIER for a +3 dBm output meter reading. Observe the power meter reading and make a note of the output meter error to the nearest 0.05 dB (¼ division). Continue to adjust the OUTPUT VERNIER for output meter reading increments of 1 dB between +3 and -7 dBm, and note the output meter error at each reading. As the test progresses make a note of the maximum output meter error to the nearest 0.05 dB. The allowable error is ±0.5 dB. Record the maximum output meter error on line 9 of the PTR.

4. Set the Signal Generator OUTPUT step attenuator to 0 dBm and repeat step 3 above. Record the maximum output meter error on line 10 of the PTR.

4.5.2 FLATNESS TEST

EQUIPMENT

Power Meter and Sensor	HP435A/8481A

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	050.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive in CW MODE)
MODULATION FM/AM	(Inactive in CW MODE)
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Set the power meter to the +15 dBm range. Connect the power sensor to the Signal Generator RF out connector.

3. Adjust the Signal Generator OUTPUT VERNIER for a +12 dBm power meter reading.

4. Set the Signal Generator FREQUENCY selector in 10 MHz steps between 10 and 520 MHz and observe the maximum change in the power meter readings from the +12 dBm reading in step 3. The maximum allowable change is ±0.75 dB. Record the maximum change to the nearest 0.05 dB (¼ division) on line 11 of the PTR.

5. Set the Signal Generator FREQUENCY selector to 050.000 MHz and adjust the OUTPUT VERNIER for a +3 dBm power meter reading.

6. Repeat step 4 above except observe the maximum change in the power meter readings from the +3 dBm reading in step 5. Record the maximum change from the +3 dBm reading to the nearest 0.05 dB on line 12 of the PTR.

7. Set the Signal Generator FREQUENCY selector to 050.000 MHz and the OUTPUT step attenuator to 0 dBm. Adjust the OUTPUT VERNIER for a -7 dBm power meter reading.

8. Repeat step 4 above except observe the maximum change in the power meter readings from the -7 dBm reading in step 7. Record the maximum change from the -7 dBm reading to the nearest 0.05 dB on line 13 of the PTR.

4.5.3 STEP ATTENUATOR ACCURACY TEST

EQUIPMENT

Power Meter and Sensor	HP435A/8481A
Spectrum Analyzer	HP8554L/8552B/141T
10 dB Attenuator Pad	Weinschel 50-10
20 dB Attenuator Pad	Weinschel 50-20
30 dB Attenuator Pad	Weinschel 50-30
40 dB Attenuator Pad	Weinschel 50-40
Wideband Amplifier 26 dB Gain	HP8447D

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	AM
MODULATION FREQ	DC
MODULATION FM/AM	0% AM
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	0 dBm

2. Set the power meter to the +10 dBm range. Connect the power sensor to the Signal Generator RF out connector.

3. Adjust the MODULATION FM/AM control of the Signal Generator for a +7 dBm power meter reading.

NOTE: Increasing the MODULATION FM/AM control setting in the preceeding step causes the output meter needle to read off scale. This is normal.

4. Disconnect the power sensor from the Signal Generator RF out connector. Connect a standard 10 dB attenuator pad to the RF out connector. Connect the output of the attenuator pad to the spectrum analyzer as shown in Figure 4-1.

5. Set the spectrum analyzer to 520 MHz, the bandwidth to 10 kHz, the frequency span per division to 2 kHz, and the tuning stabilizer switch on. Set the video filter to 100 Hz and the vertical display to 2 dB per division.

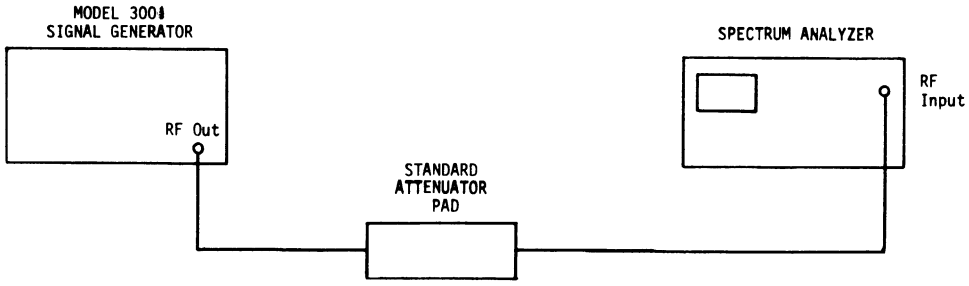


Figure 4-1. Step Attenuator Accuracy Setup

6. Use the log reference controls to obtain a peak trace one division below the log reference line of the spectrum analyzer display. Center the trace in the display with fine tuning.

7. Set the OUTPUT step attenuator of the Signal Generator to -10 dBm.

8. Disconnect the 10 dB attenuator pad from the setup and reconnect the spectrum analyzer to the RF out connector of the Signal Generator.

9. Adjust the MODULATION FM/AM control of the Signal Generator to realign the peak of the trace one division below the log reference line as in step 6.

10. Disconnect the cable to the Signal Generator RF out connector. Connect the power sensor to the Signal Generator RF out connector. Set the OUTPUT step attenuator to 0 dBm.

11. Observe the difference between the actual power meter reading and the +7 dBm reference setting in step 3. The difference or error should be ±0.7 dB maximum. Record the error on line 14 of the PTR.

12. Repeat steps 3 through 11 using the standard attenuator pads and the Signal Generator OUTPUT step attenuator settings indicated in the following table.

Steps 4 and 8 Attenuator pad dB	Step 7 OUTPUT Step Attenuator dBm setting	Step 11 Record Error on Line of PTR
10	-10	14
20	-20	15
30	-30	16
60	-60	17
90	-90	18

NOTE: To test the OUTPUT step attenuator below -60 dBm an RF amplifier (>20 dB gain) is required. Insert the 26 dB wideband amplifier between the standard attenuator pad and the spectrum analyzer (Figure 4-1). The allowable error for the -90 dBm setting (step 11) is ±1.5 dB. The OUTPUT step attenuator can be tested down to the -130 dBm position if a 40 dB RF amplifier is used and if precautions are taken to properly shield the RF output from the Signal Generator.

4.6 HARMONICS TEST

SPECIFICATION

Harmonics Outputs: >30 dB below fundamental from 10 to 520 MHz
>20 dB below fundamental from 1 to 10 MHz

METHOD

A spectrum analyzer is used to measure harmonics in the frequency range of the Signal Generator at +13 and +3 dBm output levels.

EQUIPMENT

Spectrum Analyzer HP8554L/8552B/141T

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	001.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive)
MODULATION FM/AM	(Inactive)
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the Signal Generator RF out connector to the RF input of the spectrum analyzer.

3. Set the spectrum analyzer to measure the harmonic distortion of the Signal Generator for fundamental frequencies between 1 and 10 MHz. Set the bandwidth to 100 kHz, the frequency span per division to 5 MHz, and the display to 10 dB/div. Locate the zero reference at the left edge of the graticule, and adjust the fundamental amplitude to the log reference line (0 dB) in the display.

4. Increase the setting of the Signal Generator FREQUENCY selector in 1 MHz steps between 1 and 10 MHz while observing the spectrum analyzer display. The harmonics should be >20 dB below the fundamental. Record the maximum harmonic observed in the display in dB below the fundamental on line 19 of the PTR.

5. Set the Signal Generator OUTPUT step attenuator to 0 dBm, and repeat steps 3 and 4 at the +3 dBm output level. Record the maximum harmonic observed in dB below the fundamental on line 20 of the PTR.

6. Set the Signal Generator FREQUENCY selector to 10 MHz and the OUTPUT step attenuator to +10 dBm.

7. Set the spectrum analyzer to measure harmonic distortion of the Signal Generator for fundamental frequencies between 10 and 520 MHz. Set the bandwidth to 300 kHz and the frequency span per division to 100 MHz.

8. Increase the setting of the Signal Generator FREQUENCY selector in 10 MHz steps between 10 and 520 MHz while observing the spectrum analyzer display. The harmonics should be >30 dB below the fundamental. Record the maximum harmonic observed in the display in dB below the fundamental on line 21 of the PTR.

9. Set the Signal Generator OUTPUT step attenuator to 0 dBm and repeat steps 7 and 8 at the +3 dBm output level. Record the maximum harmonic observed in dB below the fundamental on line 22 of the PTR.

4.7 NON-HARMONICS TEST

SPECIFICATION

Fundamental Range (MHz)	Non-harmonic Range (MHz)	Non-harmonic level dB below fundamental
1 to 3	1 to 3	>60
3 to 250	3 to 250	>65
3 to 350	3 to 350	>55
3 to 520	3 to 1000	>35

METHOD

A spectrum analyzer is used to measure the level of non-harmonics in the 1 to 520 MHz range at +13 dBm, the maximum specified output level of the Signal Generator.

EQUIPMENT

HP8554L/8552B/141T

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	001.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive)
MODULATION FM/AM	(Inactive)
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the Signal Generator RF out connector to the RF input of the spectrum analyzer.

3. Set the spectrum analyzer to measure the non-harmonic content of the Signal Generator output between 1 and 3 MHz. Set the bandwidth to 30 kHz, the frequency span per division to 1 MHz and the display to 10 dB/div. Locate the zero reference at the left edge of the graticule, and adjust the fundamental to the log reference line (0 dB) in the display.

4. Increase the setting of the Signal Generator FREQUENCY selector in 1 MHz steps between 1 and 3 MHz. The non-harmonics between 1 and 3 MHz should be 60 dB below the fundamental. Record the maximum non-harmonic observed in the display between 1 and 3 MHz in dB below the fundamental on line 23 of the PTR.

5. Set the spectrum analyzer to measure the non-harmonic content of the Signal Generator output between 3 and 250 MHz. Set the bandwidth to 300 kHz and the frequency span per division to 100 MHz.

6. Increase the setting of the Signal Generator FREQUENCY selector in 1 MHz steps between 3 and 10 MHz and in 10 MHz steps between 10 and 520 MHz while observing the spectrum analyzer display. Use the table below to determine the maximum non-harmonic level in each of the frequency ranges shown. Record the maximum non-harmonic level observed in each range indicated in the table on the applicable line of the PTR.

Frequency Range of Fundamental (MHz)	Non-harmonic Frequency Range (MHz)	Non-harmonic Level (dB below fundamental)	Record Max Non-harmonic (Line number in PTR)
3-250	3-250	>65	24
3-350	3-350	>55	25
3-520	3-1000	>35	26

4.8 RESIDUAL AM TEST

SPECIFICATION >55 dB below carrier in a 50 Hz to 15 kHz post-detection bandwidth.

METHOD A modulation meter operating in AM mode is used to demodulate the Signal Generator output at the minimum leveler point where AM noise is maximum. A distortion analyzer (operating in level mode) is used to increase the resolution of the demodulated output of the modulation meter. The system is calibrated at a 10% AM level. The 10% AM is removed and the residual AM is read in dB below the calibrated 10% AM level. 20 dB is added to the reading to relate the residual AM to the carrier.

EQUIPMENT

Modulation Meter Radiometer AFM2

Distortion Analyzer HP334A

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	500.000 MHz
MODULATION MODE	AM
MODULATION FREQ	1 kHz
MODULATION FM/AM	0% AM
OUTPUT VERNIER	-7 dBm reading on output meter
OUTPUT step attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-2.

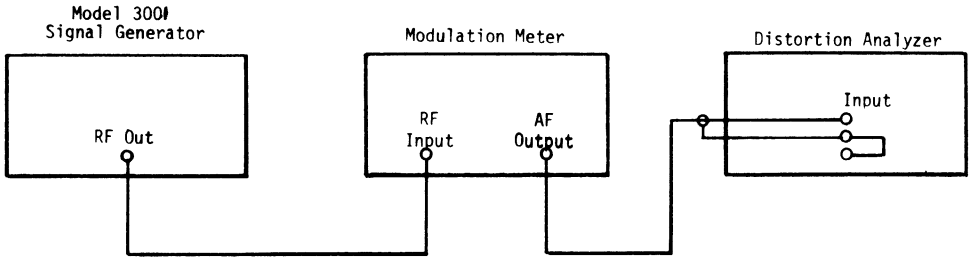


Figure 4-2. Residual AM Setup

3. Set the modulation meter to read %AM at 500 MHz. Set the RF input attenuation to 10 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +AM, the meter range switch to 10 and the filter bandwidth to 50 Hz-15 kHz.

4. Adjust the Signal Generator MODULATION FM/AM control for a modulation meter reading of 10% AM. NOTE: 10% AM is obtained at a full-scale reading of 100 with the modulation meter range switch set to 10.

5. With the distortion analyzer operating in level mode, calibrate it for a 0 dB panel-meter reading. The system is now calibrated at a reference level 20 dB below the carrier. Since the modulating signal and carrier amplitudes are equal at 100% AM, it follows that at 10% AM the modulating signal is 20 dB below the carrier.

6. Set the Signal Generator MODULATION FM/AM control to 0% AM.

7. Without disturbing the Signal Generator and modulation meter controls, set the distortion analyzer to read residual AM. Set the range switch so that the panel meter reads between 0 and -10 dB. First, read the residual AM below the 0 dB reference level in step 5. Then add 20 dB to the above reading to obtain the residual AM below the carrier. (For example, a 38 dB residual AM below the 0 dB reference +20 dB = 58 dB residual AM below the carrier.) The residual AM should be >55 dB below the carrier. Record the residual AM in dB below the carrier on line 27 of the PTR.

As many other carrier frequencies may be tested as desired.

4.9 RESIDUAL FM TEST

SPECIFICATION <200 Hz in a 50 Hz to 15 kHz post-detection bandwidth

METHOD

A modulation meter which is set to read frequency deviation is used to measure residual FM. The test is performed at maximum frequency and output level. The Signal Generator is operated in an FM mode where the residual FM is greatest.

The residual FM is measured in an environment where the noise level <60 dB relative to 2×10^{-4} µbar.

EQUIPMENT

Modulation Meter Radiometer AFM2

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	FMx10
MODULATION FREQ	EXT
MODULATION FM/AM	0 kHz
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the Signal Generator RF out connector to the 50 ohm RF input of the modulation meter.

3. Set the modulation meter to read FM deviation at 520 MHz. Set the meter range switch to 3, the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast and the filter bandwidth to 50 Hz-15 kHz.

4. Measure the average level of the FM deviation on the modulation meter and disregard occasional peaks. The residual FM should be <250 Hz. Read the residual FM on the panel meter with the function switch set to +FM and then -FM positions. Record the greater of the two readings in Hz on line 28 of the PTR.

As many other frequencies may be tested as desired.

4.10 INTERNAL MODULATION FREQUENCY TEST

SPECIFICATION

Amplitude & Frequency Modulation

Internal 400 Hz and 1 kHz ±5%

METHOD

A frequency counter is used to measure modulation frequency at the rear-panel modulation test point of the Signal Generator. Since the internal 400 Hz and 1 kHz oscillators are used for both the AM and FM modes, this test will suffice for both modes.

EQUIPMENT

Frequency Counter	HP5300B/5303B

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	N/A (not applicable to this test)
FREQUENCY selector	N/A
MODULATION MODE	N/A
MODULATION FREQ	400 Hz
MODULATION FM/AM	Mid-range
OUTPUT VERNIER	N/A
OUTPUT step attenuator	N/A

2. Connect the low frequency input of the frequency counter to the modulation test point (pin 36 of rear-panel jack J101) and the cable shield to ground (pin 25 of J101) of the Signal Generator. (See Figure 2-3 and Schematic 1).

3. The counter should read between 380 and 420 Hz. Record the counter reading on line 29 of the PTR.

4. Set the Signal Generator MODULATION FREQ control to 1 kHz.

5. The counter should read between 950 and 1050 Hz. Record the counter reading on line 30 of the PTR.

4.11 PERCENT AM ACCURACY TEST

SPECIFICATION

ACCURACY: ±(5% of reading +5%) at a frequency of 1 kHz

This specification applies for output limits ≤+3 dBm. AM is possible above +3 dBm if the peak of the modulated output does not exceed +13 dBm.

METHOD

The %AM accuracy is measured with a modulation meter after the front-panel MODULATION FM/AM control error, which is ±4%, is subtracted out. The FM/AM control accuracy, which consists of the control linearity and the modulation scale errors, is measured in terms of the DC voltage at the rear-panel modulation test point. The calibration of the voltage across the control at maximum position is checked initially.

The remaining %AM accuracy, which is ±(5% of the reading + 1% of full scale), is measured by the modulation meter with accurately measured voltage applied to the Signal Generator modulation system. The measurement uncertainty is 2% of the reading +1% of full scale.

EQUIPMENT

Modulation Meter Radiometer AFM2

Digital Multimeter Dana 4300

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	CW
MODULATION FREQ	DC
MODULATION FM/AM	0% AM
OUTPUT VERNIER	-3 dBm reading on output meter
OUTPUT step attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-3. Connect the center conductor of the cable between the high terminal of the digital multimeter and the modulation test point (pin 36 of rear-panel jack J101). Connect the cable shield between the low terminal of the digital multimeter and the Signal Generator ground (pin 25 of J101).

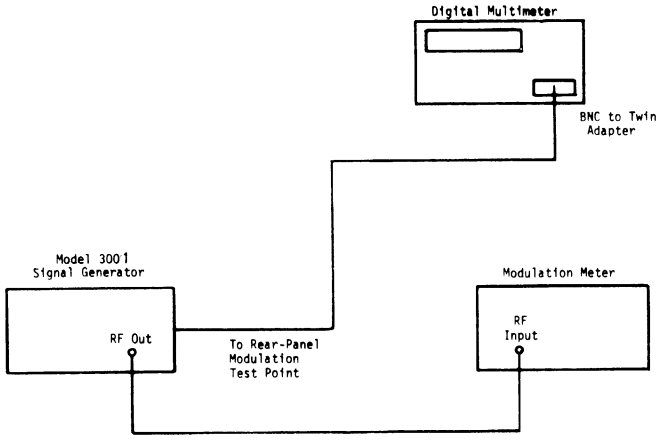


Figure 4-3. Percent AM Accuracy Setup

3. Adjust the Signal Generator MODULATION FM/AM control to its maximum up position.

4. The digital multimeter should read 5.000 ±0.020 volts DC. If the voltage is within limits, continue to step 5. If out of limits, the voltage should be recalibrated (par. 5.3.9).

5. Adjust the Signal Generator MODULATION FM/AM control to 30% AM.

6. The digital multimeter should read between 1.300 and 1.700 volts DC. Record the reading on line 31 of the PTR.

7. Set the Signal Generator MODULATION FM/AM control to 90% AM.

8. The digital multimeter should read between 4.300 and 4.700 volts DC. Record the reading on line 32 of the PTR.

9. Adjust the Signal Generator MODULATION FM/AM control to 0% AM.

NOTE: This concludes the MODULATION FM/AM control accuracy test. As many other points may be tested as desired.

10. Set the modulation meter to read %AM at 520 MHz. Set the meter range switch to 100, the RF input attenuation to 10 dB, the IF bandwidth to ±400 Hz, the meter response to fast, the function switch to +AM and the filter bandwidth to 50 Hz-15 kHz.

11. Adjust the Signal Generator MODULATION FM/AM control for a reading of 1.500 ±0.003 volts DC on the digital multimeter. Set the MODULATION FREQ switch to 1 kHz and the MODULATION MODE switch to AM.

12. Make a note of the modulation meter reading in %AM. Set the modulation meter function switch to -AM, and note the modulation meter %AM reading as before. Compute the average of the two readings. The average %AM should be between 27.5 and 32.5%. Record the average %AM to the nearest 0.5% on line 33 of the PTR.

13. Set the Signal Generator MODULATION MODE switch to CW and the MODULATION FREQ switch to DC.

14. Adjust the Signal Generator MODULATION FM/AM control for a reading of 4.500 ±0.003 volts DC on the digital multimeter. Set the MODULATION FREQ switch to 1 kHz and the MODULATION MODE switch to AM.

15. Make a note of the modulation meter reading in %AM. Set the modulation function switch to +AM and note the modulation meter %AM reading as before. Compute the average of the two readings. The average %AM should be between 84.5 and 95.5% AM. Record the average %AM to the nearest 0.5% on line 34 of the PTR.

NOTE: This concludes the modulation system accuracy test. As many other points may be tested as desired.

4.12 AM BANDWIDTH TEST

SPECIFICATION

Modulation Freq. External	DC to 20 kHz (±3 dB bandwidth), input level required = 10 volts pp into 600 ohms to provide calibrated % modulation control.

METHOD

The measurement is made with a modulation meter operating in AM mode and a function generator. The function generator supplies an external sine wave to amplitude modulate the Signal Generator. The system is calibrated at -6 dB on the modulation meter dB scale (approximately 50% AM). The external modulation frequency is increased from 1 kHz to 20 kHz and the AM bandwidth is measured as the change in dB level from the calibration level.

EQUIPMENT

Modulation Meter	Radiometer AFM2
Function Generator	Wavetek 130
Oscilloscope	Tektronix D10/5A18N/5B10N

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	050.000 MHz
MODULATION MODE	AM
MODULATION FREQ	EXT
MODULATION FM/AM	0% AM
OUTPUT VERNIER	+3 dBm reading on output meter
OUTPUT step attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-4.

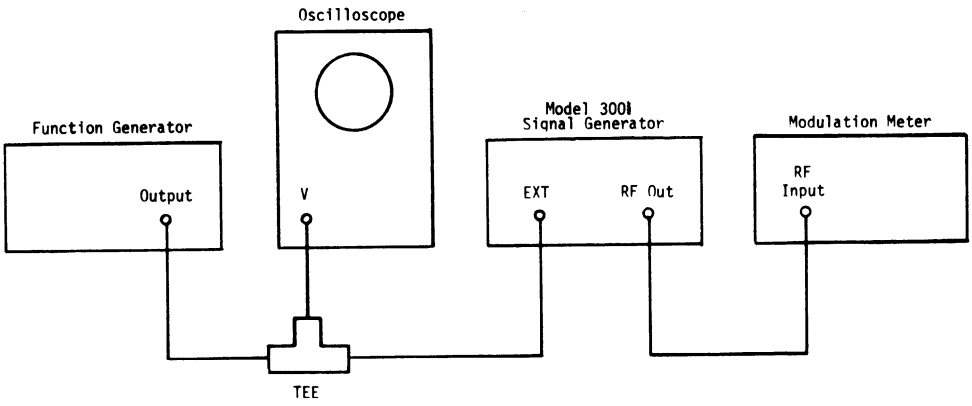


Figure 4-4. AM Bandwidth Setup

3. Set the modulation meter to read %AM at 50 MHz. Set the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +AM, the meter range switch to 100 and the filter bandwidth to 75 kHz.

4. Set the function generator for a 1 kHz sine wave output and the attenuator controls for a 10 volt pp sine wave on the oscilloscope.

5. Adjust the Signal Generator MODULATION FM/AM control for a modulation meter reading of -6 dB (approximately 50% AM).

6. Maintain the 10 volt pp output level and increase the function generator frequency from 1 to 20 kHz. Observe the modulation meter scale. It should read between -3 and -9 dB. Note the change in dB from the -6 dB calibration level.

7. Repeat steps 4 through 6 with the modulation meter function switch set to -AM. Note the change in dB from the -6 dB setting as in step 6.

8. Record the larger of the two dB changes obtained in steps 6 and 7 on line 35 of the PTR.

4.13 AM DISTORTION TEST

SPECIFICATION

Distortion	3% distortion to 70% AM (5% to 90% AM) at a frequency of 1 kHz.
	This specification applies for output limits $\leq$ +3 dBm. AM is possible above +3 dBm if the peak of the modulated output does not exceed +13 dBm.

METHOD

The measurement is made with a modulation meter and a distortion analyzer, which measures the distortion of the demodulated AM from the modulation meter. The measurement is made at the minimum leveler point where the AM distortion is normally worst-case.

EQUIPMENT

Modulation Meter	Radiometer AFM2
Distortion Analyzer	HP334A

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	AM
MODULATION FREQ	1 kHz
MODULATION FM/AM	0% AM
OUTPUT VERNIER	-7 dBm reading on output meter
OUTPUT step attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-5.

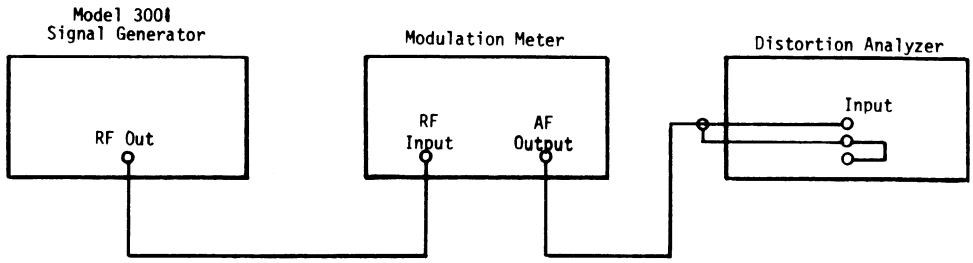


Figure 4-5. AM Distortion Setup

3. Set the modulation meter to read %AM at 520 MHz. Set the RF input attenuation to 10 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +AM, the meter range switch to 100 and the filter bandwidth to 50 Hz to 15 kHz.

4. Adjust the Signal Generator MODULATION FM/AM control for a modulation meter reading of 70% AM. Set the modulation meter function switch to -AM, and observe the modulation meter reading. Readjust the MODULATION FM/AM control until the average of the two modulation meter readings in +AM and -AM positions of the modulation meter function switch is equal to 70% AM.

5. Calibrate the distortion analyzer and measure the distortion. The distortion should be less than 3%. Record the distortion on line 36 of the PTR.

6. Adjust the Signal Generator MODULATION FM/AM control as in step 4 until the average of the modulation meter readings in +AM and -AM positions of the modulation function switch is equal to 90% AM.

7. Calibrate the distortion analyzer and measure the distortion. The distortion should be less than 5%. Record the distortion on line 37 of the PTR.

4.14 FM DEVIATION ACCURACY TEST

SPECIFICATION

Deviation Accuracy	±500 Hz on FMx1 range ±5 kHz on FMx10 range

METHOD

The deviation is measured in both FM modes using an internal DC voltage equal to the peak of the internal sine wave voltages. A frequency counter is used to measure the maximum deviation in both FM modes.

EQUIPMENT

Frequency Counter HP5300B/5303B

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	0 kHz
FREQUENCY selector	050.000 MHz
MODULATION MODE	FMx1
MODULATION FREQ	DC
MODULATION FM/AM	5 kHz on FM scale
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the 50 ohm input of the frequency counter to the Signal Generator RF out connector.

3. Read the frequency counter and record the reading to 8 places on line 38 of the PTR.

4. Adjust the Signal Generator MODULATION FM/AM control to 0 kHz deviation on the FM scale.

5. Read the frequency counter and record the reading to 8 places on line 39 of the PTR.

6. Subtract the reading obtained in step 5 from the reading obtained in step 3. The difference between the two readings should be between 9.500 and 10.500 kHz. Record the difference in kHz on line 40 of the PTR.

7. Set the Signal Generator MODULATION MODE to FMx10 and adjust the MODULATION FM/AM control to 10 kHz deviation on the FM scale.

8. Read the frequency counter and record the reading to 6 places on line 41 of the PTR.

9. Adjust the Signal Generator MODULATION FM/AM control to 0 kHz deviation on the FM scale.

10. Read the frequency counter and record the reading to 6 places on line 42 of the PTR.

11. Subtract the reading obtained in step 10 from the reading obtained in step 8. The difference between the two readings should be between 95.0 and 105.0 kHz. Record the difference in kHz on line 43 of the PTR.

4.15 FM BANDWIDTH TEST

SPECIFICATION

External, 50 Hz to 25 kHz, (1 dB bandwidth), input level required = 10 volts pp into 600 ohms to provide calibrated deviation control.
(DC to 25 kHz when frequency VERNIER is not in CAL position.)

METHOD

The measurement is made with a modulation meter and a function generator. The function generator supplies an external sine wave to frequency modulate the Signal Generator. The system is calibrated with a 1 kHz external sine wave at an indicated deviation 1 dB below the 0 dB reference on the modulation meter dB scale (approximately 90 kHz deviation). The external modulation frequency is varied from 1 kHz to 50 Hz, and from 1 kHz to 25 kHz, and the FM bandwidth is measured as the change in dB level from the calibrated level.

EQUIPMENT

Modulation Meter	Radiometer AFM2
Function Generator	Wavetek 130
Oscilloscope	Tektronix D10/5A18N/5B10N

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	FMx10
MODULATION FREQ	EXT
MODULATION FM/AM	0 kHz
OUTPUT VERNIER	+3 dBm reading on output meter
OUTPUT step attenuator	+10 dBm

2. Connect the equipment as shown in Figure 4-6.

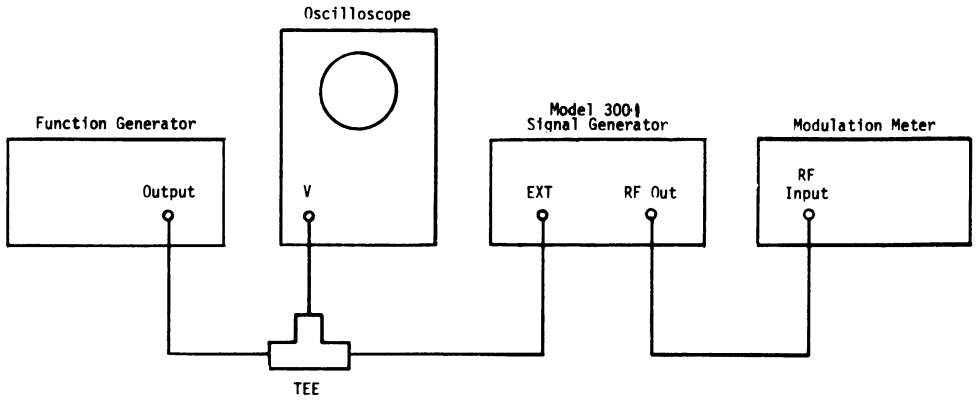


Figure 4-6. FM Bandwidth Setup

3. Set the modulation meter to read FM deviation at 520 MHz. Set the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +FM, the meter range switch to 100 and the filter bandwidth to 75 kHz.

4. Set the function generator for a 1 kHz sine wave output and the attenuator controls for a 10 volt pp sine wave on the oscilloscope.

5. Adjust the Signal Generator MODULATION FM/AM control for a modulation meter reading of -1 dB (approximately 90 kHz deviation).

6. Maintain the 10 volt pp external input level during this step. Slowly decrease the function generator frequency from 1 kHz to 50 Hz, and then slowly increase the frequency to 25 kHz while observing the dB scale on the modulation meter. It should read between 0 and -2 dB. Note the maximum change from the -1 dB reference (step 5) to the nearest 0.25 dB.

7. Repeat steps 4 through 6 with the modulation meter function switch set to -FM. Note the change from -1 dB reference as in step 6. Record the larger of the two changes in dB (in this step and in step 6) on line 44 of the PTR.

4.16 FM DISTORTION TEST

SPECIFICATION

Distortion	4% (3 to 100 kHz deviation) at a frequency of 1 kHz

METHOD

The measurement is made with a modulation meter and a distortion analyzer, which measures the distortion of the demodulated FM from the modulation meter. Distortion below 3 kHz deviation increases because of residual FM noise. The distortion at 3 kHz deviation is measured in an environment where the noise level <60 dB relative to 2×10^{-4} µbar.

EQUIPMENT

Modulation Meter	Radiometer AFM2
Distortion Analyzer	HP334A

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	FMx1
MODULATION FREQ	1 kHz
MODULATION FM/AM	3 kHz
OUTPUT VERNIER	Fully Clockwise
OUTPUT step attenuator	+10 dBm

2. Connect the equipment as shown in Figure 4-7.

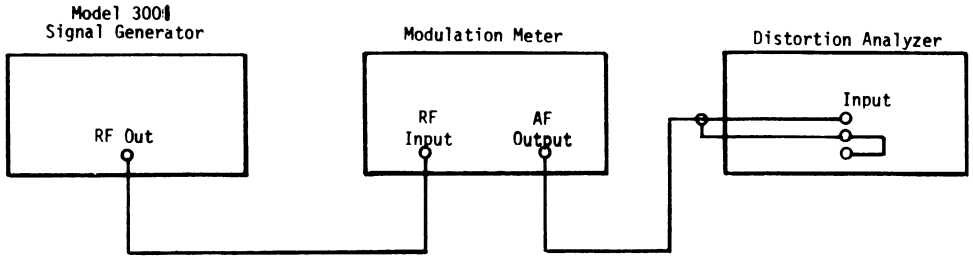


Figure 4-7. FM Distortion Setup

3. Set the modulation meter to read FM deviation at 520 MHz. Set the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +FM, the meter range switch to 3 and the filter bandwidth to 50 Hz-15 kHz. The modulation meter should read approximately 3 kHz.

4. Calibrate the distortion analyzer and measure distortion. The distortion should be less than 4%. Record the distortion on line 45 of the PTR.

5. Set the meter range switch of the modulation meter to 300. Set the Signal Generator MODULATION MODE to FM x10.

6. Adjust the Signal Generator MODULATION FM/AM for a reading of 300 kHz deviation on the modulation meter.

7. Calibrate the distortion analyzer and measure the distortion. The distortion should be less than 4%. Record the distortion on line 46 of the PTR.

4.17 IMPEDANCE TEST

SPECIFICATION

Impedance	50 ohm, VSWR 1.2 at RF output levels below 0.1 V.

METHOD

The measurement is made with a VSWR bridge and the return loss is displayed on a spectrum analyzer. An RF signal from a sweep/signal generator is fed to the input of the bridge. A reference level is established by shorting the bridge output port. The short is replaced by the RF impedance of the Signal Generator. The sweep/signal generator is tuned from 1 to 520 MHz and the return loss versus frequency is displayed.

EQUIPMENT

Spectrum Analyzer	HP8554L/8552B/141T
Sweep/Signal Generator	Wavetek 2001
VSWR Bridge	Wiltron 60N50
Coaxial Short, Type N Male	HP11512A

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	520.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive)
MODULATION FM/AM	(Inactive)
OUTPUT VERNIER	+3 dBm reading on output meter
OUTPUT step attenuator	-10 dBm

2. Use the setup in Figure 4-8. Connect the sweep/signal generator to the input port, the spectrum analyzer to the reflected output port and the coaxial short to the device-under-test port of the VSWR bridge.

3. Set the sweep/signal generator output level to -10 dBm, the mode to CW and the center frequency to 250 MHz.

4. Set the spectrum analyzer to span 0 to 500 MHz and the bandwidth to 300 kHz. Use the log reference level controls to calibrate the 250 MHz signal at the top line (0 dB reference) of the display graticule.

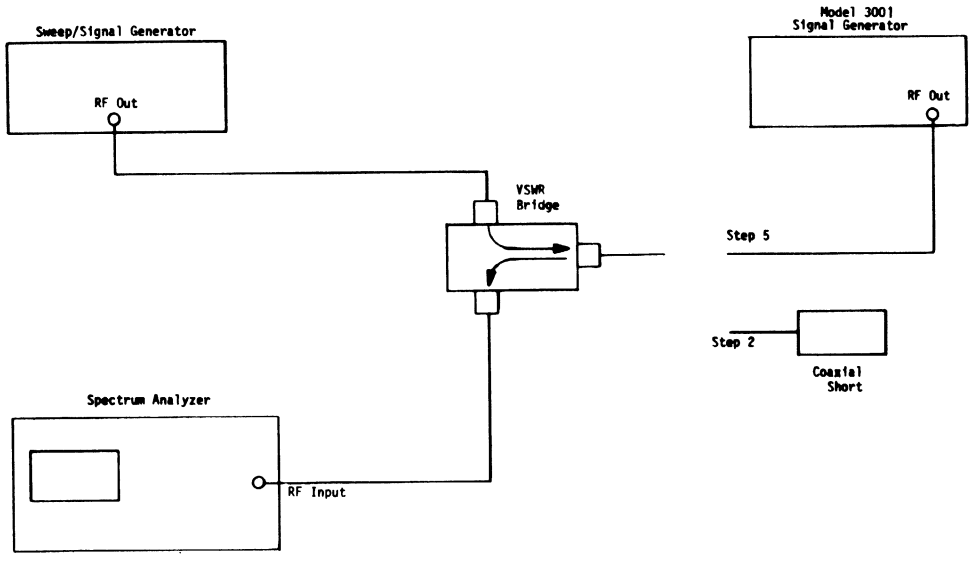


Figure 4-8. Test Setup

5. Disconnect the coaxial short and connect the device-under-test port of the VSWR bridge to the Signal Generator RF out connector. Use the sweep/signal generator center frequency control to tune from 1 to 520 MHz and verify that the signal level in the display is >21 dB below the 0 dB reference. Disregard the signal at 520 MHz. Record the reading in dB below the reference on line 47 of the PTR.

4.18 RFI TEST

SPECIFICATION

<1.0 µV is induced in a two-turn, one-inch diameter loop which is held one inch away from any surface. Loop feeds a 50 ohm receiver.

METHOD

A 50 ohm receiver consisting of a 26 dB amplifier and a spectrum analyzer are calibrated at a 1 µV level using the Signal Generator. A loop probe is then connected to the receiver and the leakage is measured at a one-inch distance from the external surfaces of the Signal Generator with the RF output terminated in 50 ohms. A screen room may be required for this measurement.

EQUIPMENT

Spectrum Analyzer	HP8554L/8552B/141T
Wideband Amplifier	HP3447D
50 ohm Load	HP11593A
Loop Probe	See Figure 4-9
Coaxial Termination (50 ohm)	HP908A

PROCEDURE

1. Set the Signal Generator controls as follows:

Frequency VERNIER	CAL
FREQUENCY selector	500.000 MHz
MODULATION MODE	CW
MODULATION FREQ	(Inactive)
MODULATION FM/AM	(Inactive)
OUTPUT VERNIER	Set to +3 dBm on output meter
OUTPUT step attenuator	-110 dBm

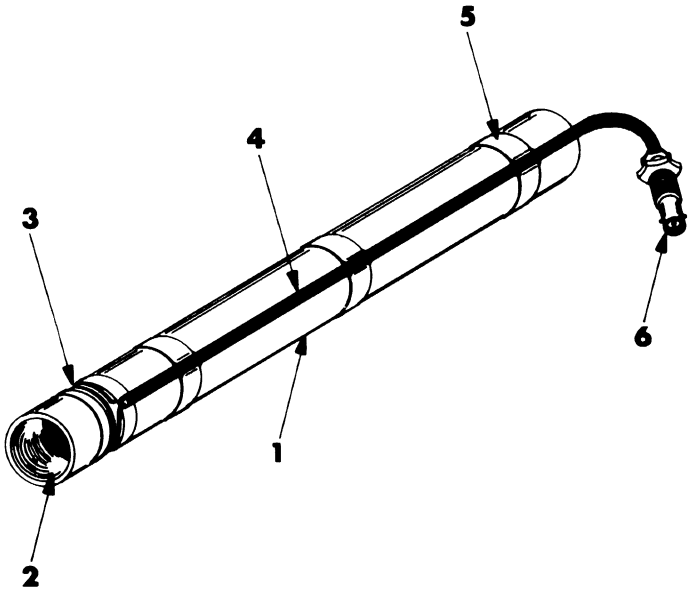
2. Connect the equipment as shown in Figure 4-10.

3. Set the spectrum analyzer bandwidth to 100 kHz, the scan width to 0.5 MHz/div, the video filter to 100 Hz, the input attenuation to 0 dB and the log reference level to -50 dBm with a 10 dB/div vertical scale. Center the signal in the display using the center frequency control. Calibrate the analyzer for the -107 dBm signal at the -31 dBm graticule using the log reference controls.

4. Disconnect the RF amplifier from the Signal Generator, and connect the 50 ohm coaxial termination to the RF out connector of the Signal Generator. Tighten the termination to minimize RF leakage.

5. Set the Signal Generator OUTPUT step attenuator to -10 dBm, and the OUTPUT VERNIER to a +3 dBm reading on the output meter.

6. Connect the loop probe to the input of the RF amplifier. Move the loop probe over the surfaces of the Signal Generator with the two-turn loop at a one-inch distance. The signal plus noise should be less than the -107 dBm reference (step 2). Record the maximum reading in dBm on line 48 of the PTR.



1. Rexolite Rod: 1.25 in. dia. by 11 in.
2. Hole: 1.00 in dia. by 0.80 in. deep.
3. Groove: 0.120 in wide by 0.125 in deep 1.00 in from end of rod.
4. Coaxial Cable: (RG-174/U) 0.110" diameter by 19" long. Strip shield for 7 in, and cut off shield to ¼ in length. Strip insulation from center conductor ¼ in. Wind 2 turns of insulated center conductor in groove of rod. Solder shield to center conductor, and insulate the solder joint.
5. Wind mylar tape around the two-turn loop, and around the rod (three places).
6. BNC male connector.

Figure 4-9. Loop Probe

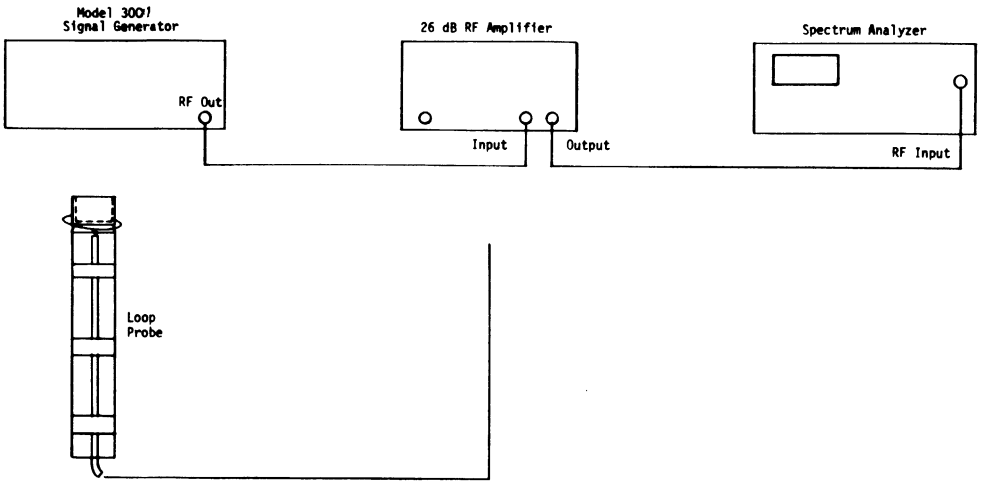


Figure 4-10. RF Leakage Setup

S/N _____

DATE _____

e Only)		TEST RESULTS			LINE
ETER	ATT'N				
Bm	dBm	MINIMUM	MEASUREMENT	MAXIMUM	
+3	+10		( ) Check		1
		39,999.59 kHz	. kHz	40,000.41 kHz	2
		999.99 kHz	- . Hz	1,020.01 kHz	3
3	+10	1,089.99 kHz	- . Hz	1,110.01 kHz	4
		2500 Hz	Hz	3500 Hz	5
			Hz		6
+3	+10		Hz	104 Hz	7
			Hz	500 Hz	8
	+10	-0.5 dB	dB	+0.5 dB	9
o -7	0		dB		10
2	+10	-0.75 dB	dB	+0.75 dB	11
7	+10		dB		12
7	0		dB		13
	-10	-0.7 dB	dB	+0.7 dB	14
	-20		dB		15
ff	-30		dB		16
ale	-60		dB		17
7)	-90	-1.5 dB	dB	+1.5 dB	18
	+10	20 dB down	dB		19
	0		dB		20
3	+10	30 dB down	dB		21
	0		dB		22
		60 dB down	dB		23
		65 dB down	dB		24
3	+10	55 dB down	dB		25
		35 dB down	dB		26
7	0	55 dB down	dB		27
3	+10		Hz	200 Hz	28
	--	380 Hz	Hz	420 Hz	29
		950 Hz	Hz	1050 Hz	30
-	--	1.300 VDC	VDC	1.700 VDC	31
		4.300 VDC	VDC	4.700 VDC	32
3	0	27.5 %	%	32.5 %	33
		84.5 %	%	95.5 %	34
3	0		dB	3 dB	35
			%	3 %	36
7	0		%	5 %	37
			. kHz		38
			. kHz		39
		9.500 kHz	. kHz	10.500 kHz	40
3	+10		. -- kHz		41
			. -- kHz		42
		95.0 kHz	. -- kHz	105.0 kHz	43
3	+10		dB	1 dB	44
			%		45
3	+10		%	4 %	46
0	-10	21 dB down	dB		47
3	0		dB	-107 dBm	48

SECTION 5
MAINTENANCE

5.1 INTRODUCTION

This section provides information for disassembly, calibration, and troubleshooting the Model 3001 Signal Generator.

Measurements and adjustments will be facilitated by placing instrument on its right side, as access is required to top and bottom of unit for adjustments and test points.

5.2 SERVICE INFORMATION

5.2.1 DISASSEMBLY INFORMATION

Refer to Figure 5-1. The side panels form part of the support for the top and bottom covers; therefore, these covers should be removed before removing either side panel. The covers and panels can be removed as indicated below.

NOTE

One side panel must remain on the instrument to secure front - panel assembly to chassis.

REMOVAL OF BOTTOM COVER - Remove two rear feet (A) and lift cover off with a slight rear movement. Reinstall cover by reversing the removal procedure.

REMOVAL OF TOP COVER - Remove the single screw (B) from top and lift off cover with a slight rear movement. Reinstall cover by reversing the removal procedure.

REMOVAL OF FRONT-TOP RAIL - The top rail may be removed to facilitate removal of the meter or modulation board assembly. The rail is removed by removing three screws (D) and lifting rail upward.

REMOVAL OF SIDE PANEL - Either side panel can be removed to provide better access by removing the six screws (E) holding side panel to the instrument.

CAUTION

To prevent possible damage to harness when reinstalling side panels, use only the original screws or equivalent. Longer screws in the bottom two holes can cause damage to wiring.

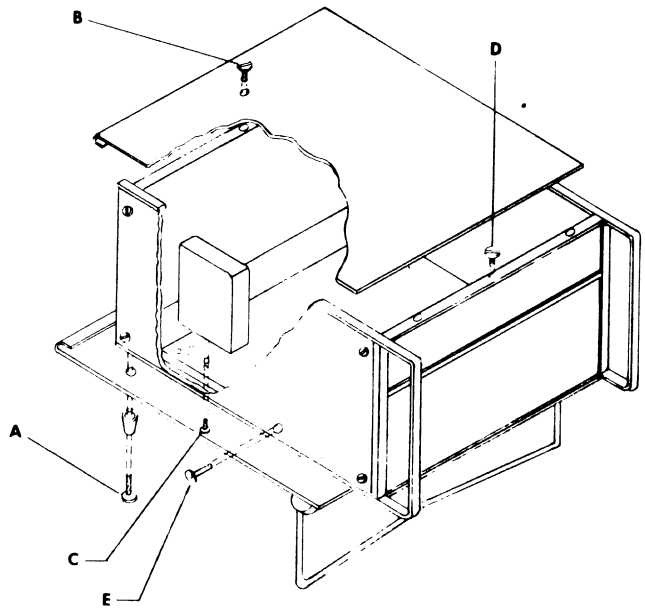


Figure 5-1. Dissassembly

5.2.2 MODULE SERVICING

REMOVAL OF MODULE - Modules may be removed by removing any cables attached to top of the module and removing hold-down screw (C) from bottom. Rock module slightly while lifting upward to free module from chassis socket.

REINSTALLING MODULE - Before installing the module, check that module pins are straight and properly aligned; then, carefully seat module pins into the chassis socket, replace module hold-down screw (C) to insure a good ground connection between module and chassis, and replace any cables attached to top of module. Module - cable connections are shown in Figure 5-6.

NOTE

If a module is replaced with a new module, it will be necessary to calibrate the phase-locked loop or other circuits involved. See Calibration Procedure in this section, Table 5-4.

MODULE-PIN NUMBERING SYSTEM - The module pins are numbered as shown in Figure 5-2. The off-center index stud prevents the module's being plugged in backward and also provides a method for locating pin #1.

NOTE

All 16 pins are not required in each module; only the pins actually used are installed, but the numbering system remains the same.

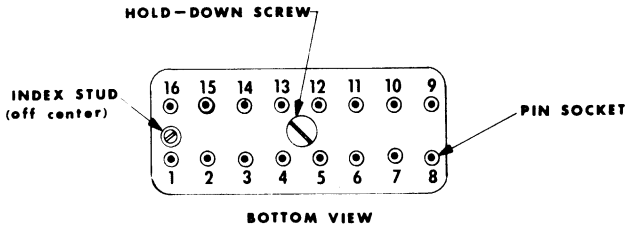


Figure 5-2. Module pin Numbering System

5.2.3 PRINTED-CIRCUIT BOARD SERVICING

PRINTED-CIRCUIT BOARD CONNECTORS - When reinstalling a cable connector on a printed-circuit board, be sure connector is properly aligned with the board connector pins and that connector faces proper direction (See Figure 5-3).

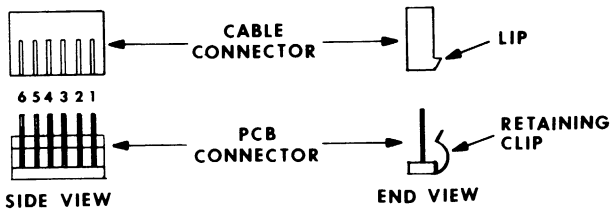


Figure 5-3. Connector Alignment

METER-BOARD (C315) REMOVAL - Removal of the meter-board assembly requires that the attenuator dial, VERNIER knob and potentiometer retaining nut and front top rail be removed. The meter board is secured to front panel by three screws - one through front panel (behind attenuator dial) and one at each top corner of meter board. Remove these three screws and disengage six-pin connector from meter board. Remove three slip-on wire connectors from attenuator switch. The meter-board assembly can then be moved toward rear until the VERNIER potentiometer shaft, UNLEVELED LED and meter case clear the front panel, then the board can be lifted from instrument.

The meter board is reinstalled by reversing the removal procedure. When installing the meter board, use care not to damage the UNLEVELED Lamp.

MODULATION BOARD (C316-2) Removal - The modulation-board assembly can be removed by the following procedure: Disengage slip-on connectors from the six BCD FREQUENCY switches; disengage twelve-pin connector from modulation board; unsolder wire from EXT modulation connector and remove retaining nut from backside of this BNC connector; remove black spring - loaded knobs from MODULATION MODE and FREQ switches; remove knob from FREQUENCY VERNIER pot shaft; remove front-top rail; then remove one screw from top-left corner of modulation board and one screw from top-left corner of C315 meter board. The modulation-board assembly can now be angled until switch levers clear the front panel. The assembly then can be lifted from instrument.

The board assembly is reinstalled by reversing the removal procedure.

NOTE

When placing connectors on FREQUENCY switches, be sure each connector is on correct switch; switch cables break out of main harness in same order that switches appear.

POWER-SUPPLY CARD (C352) REMOVAL - The power-supply card can be removed by removing four screws which secure the printed-circuit card standoffs to rear panel. The card can then be angled to allow it to clear modules, cables and side rail, and thus be lifted from instrument. The printed-circuit card can be raised far enough to permit many components to be checked without removing the three connecting cables. Disengaging the three cable connectors allows the power-supply card to be completely removed from the instrument. The power-supply card is reinstalled by reversing the removal procedure.

CAUTION

When reinstalling C352 card, use care NOT to pinch cables connected to rear-panel-mounted transistors.

5.2.4 RECOMMENDED TEST EQUIPMENT

The following test equipment, shown in Table 5-1, is recommended for servicing, troubleshooting and calibrating the Wavetek Model 3001.

TABLE 5-1. RECOMMENDED TEST EQUIPMENT

INSTRUMENT	CRITICAL REQUIREMENT	RECOMMENDED
Digital Voltmeter	.04% Accuracy	Dana Model 4200
Oscilloscope	DC and AC coupled At least 50 mV/cm sensitivity High frequency - at least 10 MHz	Tektronix 5400
Power Meter	10-520 MHz Frequency Range -10 dBm to +15 dBm Power Range	HP Model 435A with Model 8481A Power Sensor
Frequency Counter		HP Model 5303B
Spectrum Analyzer		HP Model 8558B

5.3 CALIBRATION PROCEDURE

Remove instrument top cover, bottom cover, left-side panel and M2M module cover. The M2M module can be located by reference to Figure 5-6; then remove screw from top of module and slide cover off. *Allow a two-hour warmup period before calibrating.*

In general, calibration should be performed in the sequence given. Refer to Figures 5-4, 5-5 and 5-6 for test point and adjustment locations.

NOTE

All measurements are made with reference to chassis ground.

5.3.1 +18 VOLT ADJUSTMENT

Connect digital voltmeter to orange +18 volt line on pin 3 of module M30-1; set +18 V ADJ. on power supply to produce +18.00 V. (See Figures 5-5 and 5-6).

5.3.2 -18 VOLT CHECK

Connect digital voltmeter to yellow -18 volt line on pin 4 of module M30-1. The reading must be -18 V ±40 mV.

5.3.3 +7.3 VOLT CHECK

Connect digital voltmeter to green +7.3 volt line on pin 2 of module M30-1. The reading must be +7.3 V ±150 mV.

5.3.4 CRYSTAL - FREQUENCY ADJUSTMENT MODULE M30-1

Connect frequency counter having 50-ohm input to the Model 3001 RF OUT connector. Set the signal generator FREQUENCY switches to a high frequency which is within the counter's range, such as 500.000 MHz. Set front-panel controls as follows:

MODE	CW
FREQ	EXT
MODULATION FM/AM	minimum
OUTPUT Dial	+10 dBm
OUTPUT VERNIER	Fully clockwise
FREQ VERNIER	CAL

Adjust M30-1 Frequency Adjust trimmer (Figure 5-5) for minimum-frequency indication on counter; then, carefully turn Frequency Adjust trimmer clockwise until counter indicates the frequency selected by FREQUENCY switches. Disconnect counter from RF OUT connector. A final frequency check will be covered in paragraph 5.3.11.

5.3.5 PHASE-LOCKED LOOP #1 ADJUSTMENT M31A

No adjustment of module M31A is necessary.

5.3.6 PHASE-LOCKED LOOP #2 ADJUSTMENT M32

See Figure 5-5 for location of M32 test points and Figure 5-6 for adjustment controls. Set FREQUENCY to 200.000 MHz and other front-panel controls as in Section 5.3.4. Connect digital voltmeter to M32 pin 14, and carefully adjust both M30-1 trimmers (A and B) to produce a minimum reading on voltmeter. This voltage should be between +0.5 V and +3.0 VDC. Set FREQUENCY to 239.000 MHz and note that voltmeter reading is still within above limits.

Set FREQUENCY to 200.000 MHz and connect scope vertical input (DC, 1 V/cm) to M32 pin 15. Adjust M32 control (A) for a 0 V scope indication. Set FREQUENCY to 239.000 MHz, and adjust M32 control (B) to again produce a 0 V scope indication.

5.3.7 PHASE-LOCKED LOOP #3 ADJUSTMENT

P.L.L. #3 consists of two modules: The M33-1 and the M9W. The test point is

on module M33-1 (Figure 5-5), while the adjustment controls are on module M9W (Figure 5-6). Set FREQUENCY to 250 MHz, and other front-panel controls as in Section 5.3.4. Connect scope vertical input (DC, 1 V/cm) to M33-1 pin 5. Adjust M9W control (D) for a 0 V scope indication.

Set front-panel controls as follows:

MODE	FM x 10
FREQ	1 kHz
MODULATION FM/AM	maximum

Set scope vertical input (on M33-1 pin 5) for AC, 50 mV/cm. Adjust M9W control (C) for minimum (null) indication of 1 kHz sine wave on scope.

5.3.8 PHASE-LOCKED LOOP #4 ADJUSTMENT

Calibration of P.L.L. #4 involves three modules: M2M, M9W and the M34. Test points are located on modules M2M and M34 (Figure 5-5), while adjustment controls are located on modules M2M and M9W (Figures 5-4 and 5-6).

Set FREQUENCY switches for 250.000 MHz and other front-panel controls as in Section 5.3.4. Connect digital voltmeter to M2M pin 8; then, adjust M2M 250 MHz control (Figure 5-4) for a 0.00 V reading on voltmeter. The voltmeter may now be disconnected.

Connect frequency counter to RF OUT connector and connect scope vertical input (DC, 1 V/cm) to M34 pin 8. Adjust M9W control (A) for 0, ±1 V, on scope. The counter should indicate a frequency of 250 MHz.

NOTE

Due to the way the M34 locks on harmonics of 40 MHz, it is possible to adjust M9W control (A) for "0 V" at multiples of 40 MHz offset from 250 MHz. If this happens, it will be necessary to readjust M9W control (A) several turns to break lock and relock at the next multiple of 40 MHz until "0, +1 V", can be obtained with a 250 MHz counter reading.

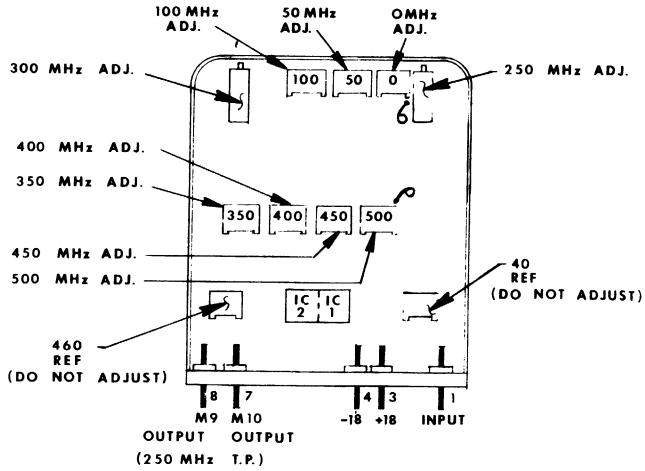


Figure 5-4. M2M Module

Set FREQUENCY switches for 300 MHz and adjust M2M 300 MHz pot. for 0, ±3 V, on scope with a counter reading of 300 MHz. Repeat this step, using applicable M2M pots, for frequencies of 350, 400, and 450 MHz. Refer to Figure 5-4 for M2M pot locations.

Set FREQUENCY switches to 500 MHz. Adjust M2M 500 MHz pot for a scope reading near 0 V. Increase frequency to 520 MHz and note scope indication; then, adjust 500 MHz pot to give scope indications at 500 and 520 MHz that are symmetrical about 0 V.

Set FREQUENCY to 100 MHz and adjust M2M 100 MHz pot for 0, ±3 V, on scope and a counter reading of 100 MHz. Repeat using appropriate M2M pots, for 50 MHz and 0 MHz.

Connect digital voltmeter to M34 pin 14, Leveler TP. Step through frequency range from 1 to 520 MHz in 10 MHz steps to find frequency having highest leveler voltage; then adjust M9W control (B) for +1.0 VDC at this frequency setting.

5.3.9 PHASE-LOCKED LOOP #5 ADJUSTMENT

Adjustment controls for P.L.L. #5 are located on Modulation Board C316-2 and module M29-1 (Figure 5-6), while the MOD TP is located on underneath side of the chassis (Figure 5-5). Connect frequency counter to front-panel RF OUT connector and digital voltmeter to chassis MOD TP ; then, set other front-panel controls as follows:

FREQUENCY	2.000 MHz
Freq VERNIER	"0" kHz
MODE	FM x 10
FREQ	DC
MODULATION FM/AM	Maximum
OUTPUT VERNIER	Fully clockwise
OUTPUT Dial	+10 dBm

NOTE

Modulation Board C316-2 contains a Size Adj. pot (C) and a Balance Adj.. pot (D) which are factory adjustments. DO NOT change setting of these two controls.

Refer to Figure 5-6 for control location, and adjust Modulation Board pot (A) for a +5.00 ±.01 V reading on voltmeter. Set FM/AM slider to minimum; the voltmeter should indicate 0 V ±20 mV. Disconnect voltmeter from MOD TP.

Adjust M29-1 control (B) to produce a frequency counter reading of 2.000 MHz ±100 Hz. Increase FM/AM slider to maximum and adjust M29-1 control (A) for a counter reading of 2.100 MHz ±100 Hz.

Set MODE to FM xl, and adjust Modulation Board control (B) for a counter reading of 2.010 MHz ±100 Hz.

5.3.10 METER BOARD CALIBRATION - C315

To adjust output meter, the unit must rest on its bottom surface (normal operating position). Momentarily turn OFF power to instrument and mechanically zero output meter with front-panel zero adjust screw. The meter needle should bisect dot at left end of meter scale. Restore power to instrument and allow it to stabilize.

Set the OUTPUT VERNIER fully ccw; then, adjust Meter Board pot (B) until meter needle again bisects dot at left end of meter scale. See Figure 5-6 for location of Meter Board pots. Set VERNIER completely cw and adjust Meter Board pot (A) for a +3 dBm output meter reading.

Set front-panel controls as follows:

FREQUENCY	50.000 MHz
MODE	CW
MODULATION FM/AM	minimum
OUTPUT Dial	+10 dBm
OUTPUT VERNIER	Fully clockwise
FREQ VERNIER	CAL

Calibrate power meter and its thermistor or power sensor. Set power meter to the +15 dBm range; then connect thermistor or sensor to RF OUT connector of Model 3001.

Adjust Meter Board pot (F) for a +13 dBm power meter reading. Set the OUTPUT VERNIER for -7 dBm reading on output meter and set power meter to the +5 dBm range. Adjust Meter Board pot (E) for +3 dBm power meter reading. Again set power meter to the +15 dBm range and turn front-panel VERNIER fully cw. Repeat this paragraph until +13 dBm and +3 dBm power meter readings are obtained without further adjustment of Meter Board pots (E) and (F).

Set OUTPUT dial to 0 dBm and power meter to the +5 dBm range. With VERNIER completely cw, adjust Meter Board pot (C) for a +3 dBm power meter reading. Turn VERNIER for -6 dBm reading on OUTPUT meter and set power meter to the -5 dBm range. Adjust Meter Board pot (D) for -6 dBm power meter reading. Repeat this paragraph until +3 dBm and -6 dBm power meter readings are obtained without further adjustment of Meter Board pots (C) and (D).

Set Model 3001 front-panel controls as follows:

FREQUENCY	100.000 MHz
MODE	AM
FREQ	DC
MODULATION FM/AM	Minimum
OUTPUT Dial	0 dBm

Set power meter to its 0 dBm range and adjust OUTPUT VERNIER for a -3 dBm reading on power meter. Set power meter to the +5 dBm range and place AM/FM slider to 100% AM. Adjust Meter Board pot (G) for +3 dBm reading on power meter. This 6 dB increase corresponds to 100% amplitude modulation.

5.3.11 FINAL FREQUENCY CHECK - M30-1

Connect frequency counter to signal generator RF OUT connector, and set front panel controls as specified in Section 5.3.4. Note frequency reading on counter; if it does not agree with the selected frequency within accuracy specifications, very carefully adjust M30-1 Frequency Adjust trimmer (See Figure 5-5) until desired frequency is obtained.

5.4 TROUBLESHOOTING

Effective troubleshooting requires a thorough understanding of block diagrams and circuit description located in Section 3 of this manual; then the Performance Tests in Section 4 and Calibration Procedures in Section 5 will aid in localizing the trouble symptom to a particular module or PC board. Once this has been accomplished the module or board can be replaced; or, repaired with aid of the proper schematic and parts layout diagram. In general, it is preferable to replace a defective module or PC board assembly.

Equipment troubles are frequently due simply to improper control settings; therefore, before engaging in a troubleshooting procedure, be sure front-panel controls are set in proper operating position. Refer to the operating instructions in Section 2 of this manual for complete explanation of each control's function along with typical operating instructions.

After verifying that trouble is not improper setting of the controls or test setup, make a thorough visual inspection of instrument for such obvious defects as loose or missing screws, broken wires, defective module-pin sockets, loose RF cables, and burned or broken components.

After localizing the problem, voltage and resistance checks will help find the defective component.

For troubleshooting purposes, it is permissible to operate the Model 3001 with any of the plug-in modules or RF cables removed; however, the instrument should be turned off when removing or installing modules. If substitute modules are available, possibly from another Model 3001, this provides an easy method of verifying if a suspected module is defective.

RF cables can be disconnected from the module output connectors; then a power meter or spectrum analyzer can be connected directly to the module connector for power level or frequency measurements. Fabrication of a short coax adapter cable, terminated in a mating connector for the modules on one end and a BNC connector on the other, will facilitate connection of test equipment.

The front-panel Accuracy lamps together with the four internal module "unlock indicator" lamps aid in troubleshooting phase-locked loop problems. One module in each loop contains an indicator lamp which lights to indicate when that loop is unlocked. The lamps indicate only which loops are unlocked, but not which module is at fault.

A problem in a power supply may cause many symptoms pointing to other areas and should be checked when the symptom

does not clearly indicate a specific problem. Loss of the -18 V supply, for example, will cause the Accuracy lamp to flash; while loss of the +18 V supply will extinguish all lamps. The +18, -18 and +7.3 V supplies comprise the DPS-2 power supply which forms the rear panel of the instrument. Performance of these supplies is indicated in the CALIBRATION PROCEDURE.

5.4.1 TROUBLESHOOTING HINTS

Following is a list of several typical symptoms, accompanied by the possible cause(s) or a troubleshooting procedure. It is assumed the instrument has been properly calibrated previously, and that a warmup period will precede troubleshooting.

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

LOW RF OUTPUT (+10 dBm RANGE) - If power is 10 dB low on this range but is correct on the 0 dBm range, micro-switch S1 mounted on attenuator is defective, is not being actuated by attenuator shaft, or a switch wire is disconnected.

LOW OR NO RF OUTPUT (ANY RANGE) - Defective attenuator or RF cables connecting to input or output of attenuator, defective meter board, defective module M10W or M9W.

Check voltage on pin 15 of module M10W. With OUTPUT VERNIER fully clockwise, the voltage should be approximately as follows: -2.5 VDC on +10 dBm range; -0.7 VDC on 0 dBm range. These voltages indicate proper operation of the meter board; while other values, particularly positive voltages, indicate a defective IC or other problem on the meter board.

Next, check RF power directly at M10W output. If it is correct, the trouble lies in the attenuator or its RF cables. If module M10W output is low, measure module M9W RF output - this should be approximately -10 to -11 dBm. If this level is correct, module M10W is defective; while if the level is low, Sweep Oscillator M9W is defective.

OUTPUT METER DOES NOT MOVE - If meter is pegged at either end of scale, the trouble is probably a defective component on meter board C315; while if meter remains at mechanical zero, meter movement may be open or a meter board component may be defective.

UNLEVELED LAMP ON - RF OUT connector not terminated in 50-ohm load, AM percentage set so that peak of modulated output exceeds +13 dBm, defective module M10W, defective attenuator or connecting RF cables.

Connect power meter directly to M10W output. Set OUTPUT dial and VERNIER for a +13 dBm reading on power meter at 50.000 MHz. Step through frequency range from 10 to 520 MHz in 10 MHz steps. A power meter reading of +13 dBm $\pm$0.5 dB with unleveled lamp OFF indicates proper operation of module M10W. If output is correct at M10W but the unleveled lamp is ON, the trouble is probably a defective lamp-driver circuit in module M10W. With proper operation of module M10W, connect power meter directly to attenuator output and repeat above steps. If attenuator output is correct, trouble is due to a defective RF cable or possibly a poor ground connection at RF OUT connector.

ACCURACY LAMP FLASHES CONTINUOUSLY - A steady light in CW mode but flashing in FM modes indicates a defective M29-1 or M33-1 module. If Accuracy lamp flashes in all modes, one or more of the phase-locked loops is open; see PHASE-LOCKED LOOP TROUBLES below.

NOTE

Above the normal frequency range of the instrument (in the vicinity of 560 MHz), it is normal for phase-locked loop #4 to unlock causing the Accuracy lamp to flash.

PHASE-LOCKED LOOP TROUBLES - An open or unlocked loop, indicated by a lighted module lamp, can be caused by a number of factors, including: low AC - input voltage, low DC-supply voltages, improper phase-locked loop DC voltages, an open or shorted RF cable or a defective module.

A defective RF cable or module can have a "chain-reaction" effect that causes two or more loops to unlock. For example, loss of the 1 kHz signal to module M31 will cause PLL #1 to unlock; thus, module M31 may not supply a proper signal to module M34, causing PLL #4 to unlock. Failure of the 40 MHz crystal oscillator in module M30-1 will cause all loops to unlock, since all six reference frequencies will be lost.

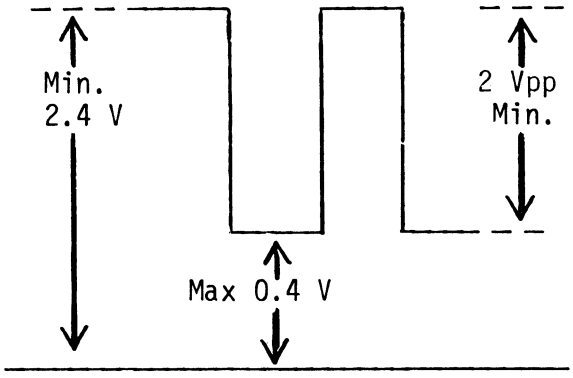
Table 5-2 lists typical RF signal-input levels for each of the phase-locked loops. Those signals having a TTL level or 1 V level may be measured with a high-frequency oscilloscope; the other signals are best measured with a spectrum analyzer (dBm), or a 50-ohm detector and calibrated scope (mV).

NOTE

The TTL waveform shown in Table 5-2 is for illustration of voltage values only, and does not necessarily represent the observed waveshape.

TABLE 5-2. PHASE-LOCKED LOOP RF-SIGNAL LEVELS

P.L.L. #	MODULE	INPUT-SIGNAL FREQUENCY	INPUT-SIGNAL LEVEL dBm (mV)	MEASURED AT
1	M31	1 kHz	TTL	M30-1 (W13)
2	M32	1 MHz	TTL	M30-1 (W12)
		1440 MHz	-12 to -15 dBm (20 mV)	M30-1 (W9)
3 & 5	M33-1	1198 MHz	-10 dBm ±3 dB (150 mV)	M9W (W5)
		1200 MHz (120 comb)	-15 dBm ±5dB (75 mV)	M30-1 (W10)
		2 kHz	TTL	M30-1 (W11)
		1.9 to 2.1 MHz	1 volt pp	M29-1 (W7)
4	M34	1198 to 1718 MHz	-10 dBm ±5 dB (25 mV)	M9W (W4)
		1448 to 1487 MHz	-2 dBm ±3 dB (200 mV)	M32 (W8)
		40 to 280 MHz (40 comb)	-10 dBm ±3 dB (1 V)	M30-1 (W6)
		10 to 9.001 MHz	TTL	M31 (W14)



TTL LOGIC LEVEL

Phase-Locked Loop #1 - Unlocking of this loop may be caused by a defective module M31, module M30-1 or RF cable connecting M30-1 to M31A.

If the unlock indicator on module M31A is on, check 1 kHz signal as listed in Table 5-2. If 1 kHz signal is correct, module M30-1 is operating properly; then, check RF cable between M30-1 and M31. If proper 1 kHz signal is being applied to M31A, check for 7.3 V on pin 6, +18 V on pin 7, and -18 V on pin 8 of M31A. If input signal and DC voltages are correct, module M31A is defective.

Phase-Locked Loop #2 - Unlocking of loop #2 can be caused by defective modules M22, M30-1, M32 or RF cables connecting M30-1 to M32.

Connect digital voltmeter to M32 pin 11 and observe voltmeter reading while stepping through frequency range from 200 to 239 MHz in 1 MHz steps. The voltmeter reading should change -0.2 V per MHz from 0 V at 200 MHz to -7.8 V at 239 MHz. These voltages indicate proper operation of module M22.

Module M30-1 can be checked by measuring the 1 MHz and 1440 MHz signals directly at the M30-1 - the levels specified in Table 5-2 indicate proper operation of module M30-1. Check connectors and RF cables connecting M30-1 to module M32. Check for +18 V on pin 7, -18 V on pin 8, and 7.3 V on pin 9 of M32. If all input signals and DC voltages to module M32 are normal, but the M32 LED is ON, module M32 is defective.

Phase-Locked Loops #3 and #5 - The LED indicator on module M33-1 serves both P.L.L. #3 and P.L.L. #5. If M33-1 LED is ON, determine which loop is defective by switching FREQUENCY VERNIER out of CAL position. If M33-1 LED goes OFF, trouble is in P.L.L. #5; if LED stays ON, trouble is in P.L.L. #3.

P.L.L. #3 consists of modules M33-1 and M9W. It is possible that P.L.L. #3 can be restored to operation simply by recalibrating per paragraph 5.3.7, and this should be attempted. If adjusting M9W control (D) has no effect on M33-1 pin 5 voltage, problem is in module M33-1; however, if pin 5 voltage changes but phase lock cannot be established, or if pin 5 voltage cannot be set to within 5 volts of 0 V, trouble is in M9W. Measure M33-1 Leveler TP (pin 14): If +0.5 to 5 VDC, trouble is probably in module M33-1; however, if greater than 5 VDC, trouble is probably in module M9W or M30-1. Check M30-1 reference frequencies and M9W output level as shown in Table 5-2 to determine which module is defective.

P.L.L. #5 consists of modules M29-1 and M33-1. With Freq VERNIER in CAL position, measure P.L.L. #5 voltage on M29-1 pin 6. Adjust M29-1 control (B) for 0 V on pin 6. If, while adjusting M29-1 from 1.9 to 2.1 MHz this voltage does not move, the problem is in module M33-1. If the voltage adjusts, but will not stay locked, the trouble is in module M29-1.

Phase-Locked Loop #4 - Unlocking of loop #4 may, under certain conditions, be caused by problems originating in the other loops. Therefore, loops #1, 2, and 3 should be operating properly before troubleshooting loop #4.

Unlocking of loop #4 can be caused by defective modules M2M, M22, M9W, M30-1, M31, M32, M34 or connecting RF cables.

Connect digital voltmeter to M2M pin 1. The voltmeter reading should be 0.00 V with FREQUENCY switches set at 000 MHz, -2.5 V at 250 MHz and -5.0 V at 500 MHz. These voltages indicate proper operation of module M22. Connect voltmeter to M2M pin 8. The voltmeter reading should be +5 to +8 V at 000 MHz, 0 V at 250 MHz and -6 to -10 V at 500 MHz. If these voltages are obtained, module M2M is operating properly.

Measure the Wide Oscillator signal at module M9W. The frequency will be between 1198 MHz and 1718 MHz, depending upon the setting of the FREQUENCY switches. If the signal level is as specified in Table 5-2, module M9W is probably operating correctly.

Measure the 40 comb line at module M30-1. The 40 MHz harmonics from 40 MHz to 280 MHz should be fairly equal in amplitude and the level should be as specified in Table 5-2. This level indicates proper operation of the M30-1 module.

Measure the 1448 MHz to 1487 MHz signal at module M32. The exact frequency is dependent upon the setting of the MHz FREQUENCY switches. If the level is as specified in Table 5-2, the M32 is operating properly.

Next, measure the 10 MHz to 9.001 MHz output of the M31 module. The output will be 10.000 MHz with the kHz FREQUENCY switches set to 000 kHz, and the frequency will decrease to 9.001 MHz with the kHz switches set to 999 kHz. If the signal level is as specified in Table 5-2, module M31 is operating properly.

If output of each of the above modules is correct, check connectors and RF cables connecting M9W, M31, M32 and M30-1 to module M34. Check for +7.3 V on pin 2, +18 V on pin 3, and -18 V on pin 4 of M34. If all input signals and DC voltages to module M34 are correct, but M34 module lamp is ON, module M34 is probably defective, but trouble could be caused by M9W.

A further check of the M34 can be made by monitoring M34 pin 8 with a digital voltmeter while stepping through the frequency range from 10 MHz to 520 MHz in 10 MHz steps. The voltmeter reading should be 0 $\pm$3 V; however, a defective M34 may give a voltage reading of 12 to 16 volts.

BCD FREQUENCY SWITCHES - Troubles in the BCD switch circuits may be caused by a defective switch, loose or disengaged switch connector or a broken switch wire.

Five of the switches utilize four wires plus a ground to select decimal digits from 0 through 9. The 100's MHz switch uses three wires plus ground, since it only needs to select digits between 0 and 5. A "BCD Truth Table", applicable to each of the six switches, is given in Table 5-3.

Suspected switch problems can be checked by referring to Table 5-3 and the Model 3001 Wiring Diagram to determine which module pins are grounded for a particular frequency. For example, to select a frequency of 200.500 MHz, M22 pin 3 is grounded by selecting digit 2 on the 100's MHz switch, and M31 pins 2 and 4 are grounded by digit 5 on the 100's kHz switch.

TABLE 5-3. BCD FREQUENCY SWITCHES

Decimal Digit	BCD Wires 8 4 2 1
0	- - - -
1	- - - 0
2	- - 0 -
3	- - 0 0
4	- 0 - -
5	- 0 - 0
6	- 0 0 -
7	- 0 0 0
8	0 - - -
9	0 - - 0

NOTE: 0 = Wire Grounded by Switch.
- = Wire NOT Grounded.

MODULATION TROUBLES - The Modulation Board (C316-2) is the most common cause of modulation problems, particularly when the modulating signal is lost. Non-linear amplitude modulation, at

higher-audio frequencies from an external source, may be caused by the M10W output amplifier.

Set front-panel controls as follows to determine presence of modulating signal:

MODE	AM
FREQ	400 Hz
MODULATION FM/AM	Maximum
OUTPUT Dial	0 dBm
OUTPUT VERNIER	Fully clockwise
FREQ VERNIER	CAL

Connect oscilloscope vertical input to MOD TP. The scope should display a 10 V peak-to-peak sine wave at a frequency of 400 Hz (2.5 ms period). Set FREQ switch to 1 kHz - scope display should be a 10 Vpp sine wave with a period of 1 ms. If the 10 V signals are not obtained, check for +7.3 V on pin 8, +18 V on pin 1, and -18 V on pin 2 of C316-2 Modulation Board. If DC voltages are normal, the Modulation Board is defective.

AM Troubles - Connect scope vertical input to pin 3 of C316-2 Mod. Board and check for a 10 Vpp sine wave; then, connect scope vertical input to pin 4 of Meter Board C315 and again check for a 10 V sine wave. Presence of the sine wave at this point indicates proper operation of Modulation Board and wiring.

Connect scope vertical input to pin 2 of C315 Meter Board and check for a sine wave having an approximate amplitude of 1.75 Vpp. If the 1.75 V signal is not present, check for +18 V on pin 6 and -18 V on pin 5 of Meter Board. If DC voltages are normal, Meter Board C315 is defective, or a wire is disconnected from Attenuator switch S1.

Check for 1.75 Vpp sine wave on pin 15 of module M10W. If sine wave is normal at this point, but amplitude-modulation is abnormal, amplifier M10W is defective.

FM Troubles - Set MODE to FM x 10, and check for 10 Vpp sine wave on pin 6 of Modulation Board C316-2; then, connect scope vertical input to pin 16 of module M29-1 and again check for a 10 V sine wave. A 400 Hz or 1 kHz 10 V sine wave at this point indicates proper operation of Modulation Board and wiring.

Remove RF cable W7 from top of module M29-1; then check for 1 volt peak-to-peak 1.9/2.1 MHz signal at this connector. If this signal is not present, check for +18 V on pin 3 and -18 V on pin 4 of M29-1. If DC voltages are normal, FM problems are caused by a defective module M29-1. If the 1.9/2.1 MHz signal is present at M29-1 connector, FM problems are probably caused by a defective M33-1 module.

5.4.2 PC-BOARD PARTS LOCATION DIAGRAMS

To aid in servicing or troubleshooting the Model 3001, the following printed-circuit board parts location diagrams are provided in Section 7 immediately in front of the associated schematic.

Module or Board	Schematic No.
C315	13
C316-2	4
C352 (DPS-2 PCB)	2
M2M	9
M22	8

5.4.3 MODULE REPLACEMENT

While in many cases the Model 3001 will work satisfactorily after simply replacing a defective module, to maintain the high accuracy of which the unit is capable, module replacement should be followed by calibration of the affected circuits. Table 5-4 lists each module and the adjustment needed.

TABLE 5-4. REPLACEMENT MODULE CALIBRATION

MODULE REPLACED	ADJUSTMENT REQUIRED (See indicated paragraphs in Calibration Procedure)
M2M Sweep Drive	Reset Phase-Locked Loop #4 (Section 5.3.8)
M9W Sweep Oscillator	Reset Phase-Locked Loops #3 and #4 (Sections 5.3.7 and 5.3.8)
M10W Output Amplifier	Recalibrate C315 Meter Board (Section 5.3.10)
M22 DAC	None required
M29-1 FM Reference	Reset Phase-Locked Loop #5 (Section 5.3.9)
M30-1 Crystal Reference	Adjust Crystal Frequency (Section 5.3.4 and 5.3.11)
M31 kHz Steps	Set Phase-Locked Loop #1 (Section 5.3.5)
M32 MHz Steps	Adjust Phase-Locked Loop #2 (Section 5.3.6)
M33-1 Narrow Osc. Lock	Adjust Phase-Locked Loop #3 (Section 5.3.7)
M34 Wide Osc. Lock	Set M34 pin 14 for +1.0 VDC (last para. Section 5.3.8)
C315 Meter Board	Adjust Meter Board Calibration (Section 5.3.10)
C316-2 Modulation Board	Adjust Phase-Locked Loop #5 (Section 5.3.9)
DPS-2 Power Supply	Adjust +18 V; check -18 V and 7.3 V (Sections 5.3.1 through 5.3.3).

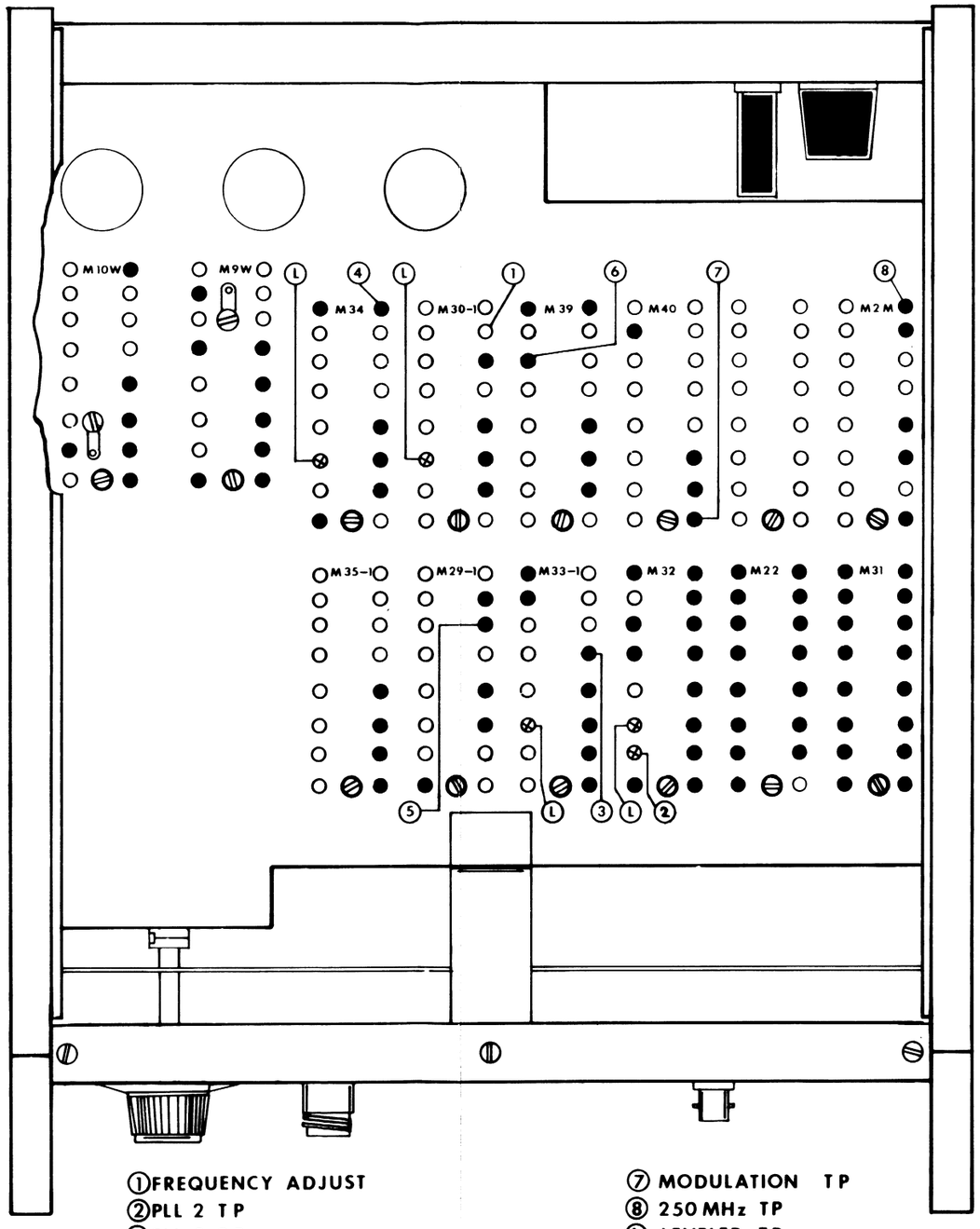


Figure 5-5. Test Points, Chassis Bottom View

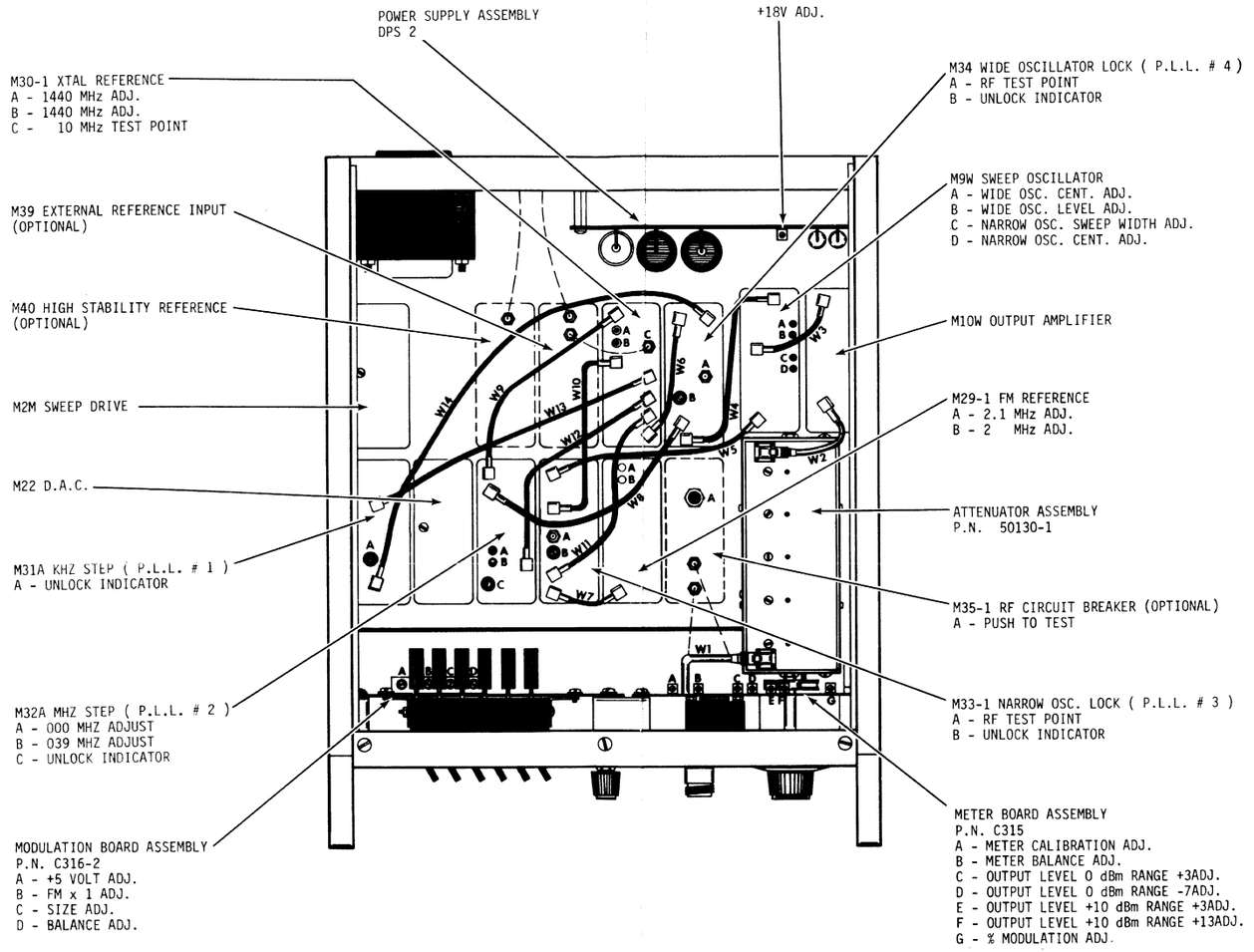


Figure 5-6. Adjustment Controls and Cable Connections

SECTION 6
REPLACEABLE PARTS

6.1 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
1010-00-0014	3001
1219-00-0006	HARNESS - 3001
1110-00-0294	C315
1110-00-0682	C316-2
1115-00-0002	DPS2
1218-00-0564	PC - DPS2
1114-00-0013	M2M
1114-00-0020	M9W
1219-00-0055	MIXER - M9W
1219-00-0054	PREAMP - M9W
1114-00-0018	M10W
1114-00-0017	M22
1114-00-0024	M30-1
1218-00-0191	PC - M30-1
1114-00-0143	M31A
1114-00-0215	M32A
1218-00-0022	DIG PGM - M32A
1218-00-0021	OSC CTL - M32A
1219-00-0117	MIXER - M32A
1219-00-0118	VIDEO AMP - M32A
1114-00-0022	M33-1
1114-00-0008	M34
1219-00-0017	MIXER - M34
1219-00-0018	W.B. AMP - M34
1219-00-0019	VIDEO AMP - M34
1218-00-0314	LEVELER - M34
1218-00-0334	PHASE LOCK - M34
1219-00-0020	VIDEO MIXER - M34

6.2 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 STATION	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
R-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	PENN TRAN 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	METER BOARD ASSY C315	A500-315	W-I	1110-00-0294	1
2	MOD BD ASSY C316-2	A500-316-2	W-I	1110-00-0682	1
3	POWER SUPPLY, DPS2	DPS2	W-I	1115-00-0002	1
4	SWP DRIVE,M2M	M2M	W-I	1114-00-0013	1
5	SWP OSC,M9W	M9W	W-I	1114-00-0020	1
6	OUTPUT AMP,M10W	M10W	W-I	1114-00-0018	1
7	DAC,M22	M22	W-I	1114-00-0017	1
8	FM REF,M29-1	M29-1	W-I	1114-00-0015	1
9	XTAL REF,M30-1	M30-1	W-I	1114-00-0024	1
10	KHZ STEPS,M31A	M31A	W-I	1114-00-0143	1
11	MHZ STEPS,M32A	M32A	W-I	1114-00-0215	1
12	NAR OSC LK,M33-1	M33-1	W-I	1114-00-0022	1
13	WIDE OSC LK,M34	M34	W-I	1114-00-0008	1
14	ATTEN, 50130-01	50130-01	W-I	1115-30-0041	1
25	HARNESS ASSY	WY3001	W-I	1219-00-0006	1
W1	CABLE ASSY,7 IN	WX3001-W1	W-I	1217-90-0005	1

WAVETEK PARTS LIST	TITLE SGL GEN,3001	ASSEMBLY NO. 1010-00-0014 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
W2	CABLE ASSY,4-5/8 IN	WX3000-200-W3	W-I	1217-90-0003	1
W3	CABLE ASSY,2-1/4 IN	WX3000-200-W10	W-I	1217-90-0004	1
W11 W4	CABLE ASSY,4 IN	WX3001-W4	W-I	1217-00-0040	2
W12 W5 W8 W9	CABLE ASSY,5 IN	WX3000-200-W18	W-I	1217-00-0050	4
W6	CABLE ASSY,2-1/4 IN	WX2000-A1	W-I	1217-00-0022	1
W10 W7	CABLE ASSY,3-1/4 IN	WX3001-W7	W-I	1217-00-0032	2
W13	CABLE ASSY,8-1/2 IN	WX3000-200-W9	W-I	1217-00-0084	1
W14	CABLE ASSY,10-1/4 IN	WX3000-200-W21	W-I	1217-00-0102	1

WAVETEK PARTS LIST	TITLE SGL GEN,3001	ASSEMBLY NO. 1010-00-0014 PAGE: 2	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
3	RECEP,36-PIN MC000-054	03-06-1361	MOL	2113-03-0004	1
2	TERMINAL,FEMALE MC000-018	1855	MOL	2113-05-0001	26
4	PLUG,36-PIN MC000-055	03-06-2362	MOL	2113-04-0005	1
1	TERMINAL,MALE MC000-019	1854	MOL	2113-05-0002	26
5	SOCKET MC000-065	583369-1	AMP	2113-15-0001	6
8	CONTACT MC000-069	583259-2	AMP	2113-16-0001	29
10	CONN,12-CIRCUIT MC000-107	09-50-3121	MOL	2113-06-0005	1
6	JACK,FEMALE,9-CKT MC000-067	09-50-3091	MOL	2113-06-0001	2
9	CONN,6-PIN,KONEKTON MC000-076	09-50-3061	MOL	2113-06-0002	2
7	CONTACT MC000-068	08-50-0107	MOL	2113-07-0001	33
12	CONTACT,MC000-131	08-50-0106	MOL	2113-07-0002	5

WAVETEK PARTS LIST	TITLE HARNESS ASSY	ASSEMBLY NO. 1219-00-0006 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1	CAP,TANT,.47MF,50V CE113-447	935	TRW	1510-21-9470	1
14	LED DL000-001	NSL5046	NAT	4810-02-0001	1
CR2 CR3	DIODE DR000-001	1N4004	P-C	4806-01-4004	2
IC1 IC2 IC3	IC,IC000-005	RC4558DN	RAY	7000-14-5800	3
M1	METER, 3 SCALE MI000-004	MI000-004	W-I	2410-06-0001	1
P1	PLUG,6-PIN KONEKTON MC000-075	09-65-1061	MOL	2112-05-0002	1
R01 R22	POT,2K,RP130-220	89PR2K	BEK	4610-00-2202	2
R02	RES,C,1/4W,5%,8.2K RC103-282	CF1/4-8.2K	ASE	4700-15-8201	1
R03	RES,MF,1/8W,1%,36.5K RF213-365	MF55K-36.5K	ASE	4701-03-3652	1
R04 R28	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	2
R05 R06	RES,MF,1/8W,1%,10K RF213-100	MF55K10K	ASE	4701-03-1002	2
R07 R23	RES,C,1/4W,5%,20K RC103-320	CF1/4-20K	ASE	4700-15-2002	2
R08	RES,MF,1/8W,1%,2.74K RF212-274	MF55K-2.74K	ASE	4701-03-2741	1

WAVETEK PARTS LIST	TITLE METER BOARD ASSY C315	ASSEMBLY NO. 1110-00-0294 PAGE: 1	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R09	RES,MF,1/8W,1%,11.3K RF213-113	MF55K-11.3K	ASE	4701-03-1132	1
R10	RES,MF,1/8W,1%,3.92K RF212-392	MF55K-3.92K	ASE	4701-03-3921	1
R11	POT,MOD,10K,10% RP140-310	70A1N048P103U	A-B	4610-11-3103	1
R12 R15 R17 R18 R26	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	5
R13	RES,C,1/4W,5%,5.6K RC103-256	CF1/4-5.6K	ASE	4700-15-5601	1
R14	RES,C,1/4W,5%,220K RC103-422	CF1/4220K	ASE	4700-15-2203	1
R16 R20	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R19	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R21	RES,MF,1/8W,1%,15.8K RF213-158	MF55K-15.8K	ASE	4701-03-1582	1
R24	RES,C,1/4W,5%,68K RC103-368	CF1/4-68K	ASE	4700-15-6802	1
R25	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R27	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1

WAVETEK PARTS LIST	TITLE METER BOARD ASSY C315	ASSEMBLY NO. 1110-00-0294 PAGE: 2	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C06 C12 C13	CAP,TANT,.47MF,50V CE113-447	935	TRW	1510-21-9470	4
C02 C03 C07 C08	CAP,MICA,470PF,500V CM101-147	DM15-471J	ARC	1510-50-0471	4
C04 C09 C10	CAP,MICA,1000PF,500V CM101-210	DM15-102J	ARC	1510-50-0102	3
C05	CAP,CER,330PF,1KV CC104-133	10TCU-T33	SPR	1510-10-3331	1
C11	CAP,CER,.001MFD,1KV CC102-210	5GA010	SPR	1510-10-1102	1
C14	CAP,CER,.05MF,100V CC103-350	TG-S50	SPR	1510-10-2503	1
C15	CAP,CER,.01MF,100V CC103-310	68U103M	MOC	1510-10-2103	1
C16 C17 C18	CAP,TANT,10MF,25V CE120-010	162D106X0025002	SPR	1510-21-7100	3
CR1 CR2 CR3 CR4 CR7	DIODE DR000-001	1N4004	P-C	4806-01-4004	5
CR5 CR6 CR8	LED DL000-001	NSL5046	NAT	4810-02-0001	3
IC1 IC2 IC3	IC,IC000-003	RC4558DN	RAY	7000-14-5800	3
IC4	IC IC000-006	MC1455P1	MOT	7000-14-5500	1
OC1	LED,AXIAL VACTROL MP000-002	VTL5C3	VAC	3710-00-0001	1

WAVETEK PARTS LIST	TITLE MOD BD ASSY C316-2	ASSEMBLY NO. 1110-00-0682 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
P1	PLUG,LOCKING MC000-106	09-65-1121	MOL	2112-05-0004	1
Q1 Q2	TRANS QA054-580	2N5458	MOT	4901-05-4580	2
Q3 Q4	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
Q5	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
R01 R17 R30	RES,C,1/4W,5%,270K RC103-427	CF1/4-270K	ASE	4700-15-2703	3
R02 R05 R16 R37	RES,C,1/4W,5%,10M RC103-610	CB1065	A-B	4700-15-1005	4
R03 R12 R26 R54	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	4
R04 R18	RES,C,1/4W,10%,5.6M RC104-556	CB5651	A-B	4700-16-5604	2
R06 R21	RES,C,1/4W,5%,4.7M RC103-547	CB4755	A-B	4700-15-4704	2
R07 R34 R35	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	3
R08 R60	RES,MF,1/8W,1%,178K RF214-178	MF55K-178K	ASE	4701-03-1783	2
R09 R10	RES,MF,1/8W,1%,340K RF214-340	MF55K-340K	ASE	4701-03-3403	2

WAVETEK PARTS LIST	TITLE MOD BD ASSY C316-2	ASSEMBLY NO. 1110-00-0682 PAGE: 2	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R11 R13 R25 R27 R57 R58 R59	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	7
R14	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R15	RES,C,1/4W,5%,390K RC103-439	CF1/4-390K	ASE	4700-15-3903	1
R19 R20 R53	RES,C,1/4W,10%,22M RC104-622	CB2261	A-B	4700-16-2205	3
R22	RES,MF,1/8W,1%,464K RF214-464	MF55K-464K	ASE	4701-03-4643	1
R23 R24	RES,MF,1/8W,1%,845K RF214-845	MF55K-845K	ASE	4701-03-8453	2
R28	RES,C,1/4W,5%,560K RC103-456	CF1/4-560K	ASE	4700-15-5603	1
R29	RES,C,1/4W,5%,7.5K RC103-275	CF1/4-7.5K	ASE	4700-15-7501	1
R31	RES,MF,1/8W,1%,4.87K RF212-487	MF55K-4.87K	ASE	4701-03-4871	1
R32 R42 R47	POT,1K,RP129-210	360S102B	CTS	4610-00-1102	3
R33	RES,MF,1/8W,1%,12.1K RF213-121	MF55K-12.1K	ASE	4701-03-1212	1
R36	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R38	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R39	RES,C,1/4W,5%,18K RC103-318	CF1/4-18K	ASE	4700-15-1802	1
R40	RES,C,1/4W,5%,620K RC103-462	CB6245	A-B	4700-15-6203	1
R41	RES,MF,1/8W,1%,2.74K RF212-274	MF55K-2.74K	ASE	4701-03-2741	1
R43	RES,MF,1/8W,1%,5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	1
R44	RES,SLIDETROL,10K PER B/P	RP137-310	A-I	4610-12-9103	1
R46	RES,MF,1/8W,1%,16.5K RF213-165	MF55K-16.5K	ASE	4701-03-1652	1
R48	RES,MF,1/8W,1%,1.50K RF212-150	MF55K-1.50K	ASE	4701-03-1501	1
R49	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R50	RES,C,1/4W,5%,200 RC103-120	CF1/4-200	ASE	4700-15-2000	1
R51	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R52	RES,C,1/4W,5%,330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R55	RES,C,1/4W,5%,47M RC103-647	CB4765	A-B	4700-15-4705	1
R56	RES,C,1/4W,5%,620 RC103-162	CF1/4-620	ASE	4700-15-6200	1
R61	RES,MF,1/8W,1%,44.2K RF213-442	MF55K-44.2K	ASE	4701-03-4422	1
R62	POT/SWITCH 10K 10% RP150-310	70K1G040R103U(1001)	A-B	4610-30-8103	1
S01 S02	LEVER SWITCH FROM:5101-00-0007	SL000-003	W-I	5101-00-0003	2
S03	SWITCH,P/O POT ASSY	SWITCH	W-I	5199-00-9999	1
S22	LEVER SWITCH SL000-002	L20-35AD	CHE	5101-00-0002	1
S23 S24	LEVER SWITCH SL001-002	L20-36AD	CHE	5101-00-0004	2
S25	LEVER SWITCH SL002-002	L20-37AD	CHE	5101-00-0005	1
S26 S27	LEVER SWITCH SL003-002	L20-02A	CHE	5101-00-0006	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
7	FUSE,S.B.,1 AMP MF000-010	MDL-1	BUS	2410-05-0005	1
Q1 Q2	TRANS QA060-990	2N6099	RCA	4901-06-0990	2
Q3	TRANS QA052-940	2N5294	RCA	4901-05-2940	1
8	SWITCH,DPDT,LOCKING SS000-003	46256LFE	S-I	5105-00-0003	1
9	SWITCH,TOG,ST000-007	ST000-007	W-I	5106-00-0005	1
2	XFMR,PWR,TT000-025	TT000-025	W-I	5610-00-0009	1
30	POWER SUPPLY BOARD	A500-352	W-I	1218-00-0564	1

WAVETEK PARTS LIST	TITLE POWER SUPPLY, DPS2	ASSEMBLY NO. 1115-00-0002 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C10	CAP,ELECT,1500MF,50V CE102-215	D76374	SPR	1510-20-1152	2
C02 C05 C07 C09	CAP,ELECT,100MF,25V CE105-110	TE1211	SPR	1510-20-4101	4
C03	CAP,CER,.005MF,1KV CD103-250	TG-050	SPR	1510-10-2502	1
C04 C12	CAP,CER,100PF,1KV CD102-110	600101M	MOC	1510-10-1101	2
C06 C11	CAP,TANT,10MF,25V CE120-010	1620106X0025DD2	SPR	1510-21-7100	2
C09	CAP,10000MF,16V CE122-310	D76381	SPR	1510-21-4103	1
CR01 CR02 CR03 CR04 CR05 CR06	DIODE DR000-008	1N5059	G-E	4806-01-5059	6
CR07	DIODE DB000-010	1N4732	ITT	4801-01-4732	1
CR08 CR10 CR11 CR12 CR13 CR15 CR16 CR17 CR18 CR19	DIODE DR000-001	1N4004	P-C	4806-01-4004	10
CR09	DIODE DB000-003	HA128	MSP	4801-02-0003	1
CR14	DIODE DG000-009	5082-2835	H-P	4809-02-0002	1
F1	FUSE,3.B.,2AMP MF000-002	313-002	LIT	2410-05-0001	1

WAVETEK PARTS LIST	TITLE POWER SUPPLY BOARD	ASSEMBLY NO. 1218-00-0564 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
IC1	IC,IC000-001	LM723CH	NAT	7000-17-2300	1
IC2	IC,IC000-005	RC4558DN	RAY	7000-14-5800	1
P1	PLUG,6-PIN KONEKTON MC000-075	09-65-1061	MOL	2112-05-0002	1
P2 P3	CINN,MALE,9-PIN MC000-071	09-65-1091	MOL	2112-05-0001	2
Q1 Q4 Q5 Q8 Q9	TRANS QA038-541	2N3854A	G-E	4901-03-8541	5
Q2 Q6	TRANS QA036-440	2N3644	FCD	4901-03-6440	2
Q3	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
Q7	TRANS QA040-300	2N4030	NAT	4901-04-0300	1
R01 R02	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	2
R03	RES,MF,1/8W,1%,499 RF211-499	MF55K-499	ASE	4701-03-4990	1
R04*	RES,MF,1/8W,1%,21.5K RF213-215	MF55K-21.5K	ASE	4701-03-2152	1
R05	RES,MF,1/8W,1%,3.92K RF212-392	MF55K-3.92K	ASE	4701-03-3921	1
R06	POT,2K,RP130-220	89PR2K	BEK	4610-00-2202	1
R07 R26	RES,MF,1/8W,1%,5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	2

WAVETEK PARTS LIST	TITLE POWER SUPPLY BOARD	ASSEMBLY NO. 1218-00-0564 PAGE: 2	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R09	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R10	RES,MF,1/8W,1%,2.49K RF212-249	MF55K-2.49K	ASE	4701-03-2491	1
R11	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1
R12	RES,C,1/4W,10%,3.3K RC104-233AB	CB3321	A-B	4705-16-3301	1
R13	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	1
R14	RES,MF,1/8W,1%,10K RF213-100	MF55K10K	ASE	4701-03-1002	1
R15 R28	RES,MF,1/8W,1%,1K RF212-100	MF55K-1K	ASE	4701-03-1001	2
R16 R17 R18 R33 R34 R35	RES,1/2W,1%,5 RD01K-050	R20-5	KID	4701-23-0050	6
R19	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	1
R20 R21	RES,SET,2-10K,1/8W QTY:2:4701-03-1002	RX000-003	W-I	4789-00-0004	1
R22 R27 R30	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	3

WAVETEK PARTS LIST	TITLE POWER SUPPLY BOARD	ASSEMBLY NO. 1218-00-0564 PAGE: 3	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R23	RES,MF,1/8W,1%,11.3K RF213-113	MF55K-11.3K	ASE	4701-03-1132	1
R24	RES,MF,1/8W,1%,8.06K RF212-806	MF55K-8.06K	ASE	4701-03-8061	1
R25	RES,WW,RX000-009	RX000-009	W-I	4789-00-0005	1
R29	RES,MF,1/8W,1%,16.5K RF213-165	MF55K-16.5K	ASE	4701-03-1652	1
R31	RES,C,1/2W,5%,2.7K RC105-227	CF1/2-2.7K	ASE	4700-25-2701	1
R32	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1

WAVETEK PARTS LIST	TITLE POWER SUPPLY BOARD	ASSEMBLY NO. 1218-00-0564 PAGE: 4	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1 C2 C3	CAP,F.T.,120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	3
C4 C5	CAP,CER,.05MF,100V CD103-350	TG-850	SPR	1510-10-2503	2
C6 C7	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	2
CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8	DIODE DR000-001	1N4004	P-C	4806-01-4004	8
IC1 IC2	IC,IC000-005	RC4558DN	RAY	7000-14-5800	2
Q1	TRANS-QA042-500	2N4250	FCD	4901-04-2500	1
Q2	TRANS QA050-880	2N5088	MOT	4901-05-0880	1
R01 R39	RES,MF,1/8W,1%,56.2K RF213-562	MF55K-56.2K	ASE	4701-03-5622	2
R02 R38	POT,20K,RP131-320	360T203B	CTS	4610-00-3203	2
R03 R15 R26 R32	RES,MF,1/8W,1%,100K RF214-100	MF55K-100K	ASE	4701-03-1003	4
R04 R40	RES,MF,1/8W,1%,4.02K RF212-402	MF55K-4.02K	ASE	4701-03-4021	2
R05	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R06 R11 R12 R25	RES,C,1/4W,5%,330K RC103-433	CF1/4-330K	ASE	4700-15-3303	4

WAVETEK PARTS LIST	TITLE SWP DRIVE,M2M	ASSEMBLY NO. 1114-00-0013 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R07 R10 R13 R24 R30 R34 R37	POT,CONT,100K RP131-410	360T104B	CTS	4610-00-3104	7
R08 R18 R23 R31 R33	RES,MF,1/8W,1%,1K RF212-100	MF55K-1K	ASE	4701-03-1001	5
R09	RES,MF,1/8W,1%,3.01K RF212-301	MF55K-3.01K	ASE	4701-03-3011	1
R14	RES,MF,1/8W,1%,5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	1
R16	RES,C,1/4W,5%,910K RC103-491	CF1/4-910K	ASE	4700-15-9103	1
R17	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R19	RES,MF,1/8W,1%,16.5K RF213-165	MF55K-16.5K	ASE	4701-03-1652	1
R20	RES,MF,1/8W,1%,40.2K RF213-402	MF55K-40.2K	ASE	4701-03-4022	1
R21	RES,C,1/4W,5%,270K RC103-427	CF1/4-270K	ASE	4700-15-2703	1
R22 R28	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	2
R27	RES,C,1/4W,5%,75K RC103-375	CF1/4-75K	ASE	4700-15-7502	1

WAVETEK PARTS LIST	TITLE SWP DRIVE,M2M	ASSEMBLY NO. 1114-00-0013 PAGE: 2	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R29 R35	RES,C,1/4W,5%,220K RC103-422	CF1/4220K	ASE	4700-15-2203	2
R36	RES,C,1/4W,5%,120K RC103-412	CF1/4-120K	ASE	4700-15-1203	1

WAVETEK PARTS LIST	TITLE SWP DRIVE,M2M	ASSEMBLY NO. 1114-00-0013 PAGE: 3	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C04 C22 C23	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	4
C02	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	1
C03	CAP,F.T.,120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	1
C05	CAP,Q-C,2.0PF,10% CG101-220	QC-2.0PF	Q-C	1510-40-0020	1
C06 C07 C08 C09 C24 C38 C40 C41 C42	CAP,TANT,.47MF,50V CE113-447	935	TRW	1510-21-9470	9
C10 C11 C12 C13 C20 C21 C26 C28 C36 C43	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	10
C14 C15 C16 C17 C32 C33 C34	CAP,Q-C,10PF,10%, CG101-310	QC-10PF	Q-C	1510-40-0100	7
C18 C35	CAP,CER,120PF,1KV CD102-112	60U121M	MUC	1510-10-1121	2
C19	CAP,CER,.02UF,50V	TG-S20	SPR	1510-10-2203	1
C25	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
C27	CAP,Q.C.,1PF CG101-210	QC-1PF	Q-C	1510-40-0010	1
C29	CAP,Q.C.,.75PF CG101-175	QC-.75PF	Q-C	1510-40-0758	1

WAVETEK PARTS LIST	TITLE SWP OSC,M9W	ASSEMBLY NO. 1114-00-0020 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C30	CAP,CHIP,1PF,100V CC101-R10	3BN100S1R0C(S)	VAR	1510-00-0010	1
C31	CAP,Q.C.,3PF CG101-230	QC-3PF	Q-C	1510-40-0030	1
C37 C39	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	2
C44	CAP,CER,100PF,1KV CD102-110	60U101M	MUC	1510-10-1101	1
CR01 CR02 CR03 CR04 CR09	DIODE DC000-008	BB205	APX	4803-02-0004	5
CR05 CR07 CR10	DIODE DP000-040	MA47980	M-A	4805-02-0001	3
CR06 CR08 CR11	DIODE DG100-821	1N82AG	G-I	4807-01-0082	3
IC1 IC2 IC3 IC4	IC,IC000-004	N5741T	SIG	7000-57-4101	4
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01 L02 L21 L22	FERRITE CHOKE LA009-010	T1255-2	HYI	1810-05-0002	4
L03 L04 L07 L08 L11 L12 L14 L15 L16 L17 L20	RF CHOKE	CHOKE	W-I	1819-99-9999	11
L05 L09 L10 L13 L18 L19	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	6

WAVETEK PARTS LIST	TITLE SWP OSC,M9W	ASSEMBLY NO. 1114-00-0020 PAGE: 2	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L06	CHOKE,.22MH,10% LA008-R02	506-000022V1	SYS	1810-04-0228	1
L23	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	1
Q1	TRANS QB000-013	A430	APX	4902-00-4300	1
Q2	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
Q3 Q4 Q6 Q7	TRANS QA050-530	2N5053	APX	4901-05-0530	4
Q5	TRANS QA051-090	2N5109	SSS	4901-05-1090	1
NONE	RES,C,1/4W,10%,4.7K RC104-247AB	CB4721	A-B	4705-16-4701	1
R01 R14	RES,C,1/4W,5%,12K RC103-312	CF1/4-12K	ASE	4700-15-1202	2
R02 R38	POT,5K,RP130-250	89PR5K	BEK	4610-00-2502	2
R03	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
R04 R27 R29 R42 R60	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	5
R05	RES,C,1/4W,5%,330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R06	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R07	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	1
R08	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1
R09	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	1
R10	RES,C,1/4W,5%,680 RC103-168	CF1/4-680	ASE	4700-15-6800	1
R11 R15	RES,C,1/4W,5%,8.2K RC103-282	CF1/4-8.2K	ASE	4700-15-8201	2
R12 R13	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	2
R16 R22 R28 R32 R33 R34 R50 R54 R59 R61	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	10
R17 R20 R23 R37 R39 R48 R51 R55	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	8
R18 R24 R52 R56	RES,C,1/4W,5%,560 RC103-156	CF1/4-560	ASE	4700-15-5600	4
R19 R21 R49 R53	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	4
R25 R46	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	2
R26 R51	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R30 R57	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	2
R35 R62	RES,C,1/2W,5%,47 RC105-047	EB4705	A-B	4705-25-4709	2
R36 R63	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	2
R40	RES,C,1/4W,5%,51K RC103-351	CF1/4-51K	ASE	4700-15-5102	1
R41 R58	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	2
R43	RES,C,1/4W,5%,5.6K RC103-256	CF1/4-5.6K	ASE	4700-15-5601	1
R44	RES,C,1/2W,5%,150 RC105-115	CF1/2-150	ASE	4700-25-1500	1
R45	RES,C,1/4W,5%,3.9K RC103-239	CF1/43.9K	ASE	4700-15-3901	1
R47	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
R64	RES,C,1/4W,5%,270 RC103-127	CF1/4-270	ASE	4700-15-2700	1
R65	RES,C,1/4W,10%,1.2K	CB1221	A-B	4705-16-1201	1
R66	RES.1/4,5%,6.2K A-B RC103-262AB	CB6225	A-B	4705-15-6201	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
31	RF MIXER ASSY	A500-319	W-I	1219-00-0055	1
30	RF PRE AMP ASSY	A500-318	W-I	1219-00-0054	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101	CAP,Q-C,2.4PF,10% CG101-224	QC-2.4PF	Q-C	1510-40-0249	1
CR101 CR102 CR103 CR104	DIODE DG000-009	5082-2835	H-P	4809-02-0002	4
T101	RF XFMR FROM:1813-00-0007	TR001-003	W-I	1210-40-0003	1
T102	RF XFMR FROM:1813-00-0008	TR002-001	W-I	1210-41-0001	1

WAVETEK PARTS LIST	TITLE RF MIXER ASSY	ASSEMBLY NO. 1219-00-0055 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201 C205	CAP,TANT,.47MF,50V CE113-447	935	TRW	1510-21-9470	2
C202	CAP,ELECT,1MF,25V CE120-001	162D105X90258C2	SPR	1510-21-7010	1
C203 C204	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	2
C206	CAP,N-C,2.0PF,10% CG101-220	QC-2.0PF	Q-C	1510-40-0020	1
CR201	DIODE DB000-001	HW6.8B	MSP	4801-02-0001	1
J201	CONN JF000-005	37JR116-1	S-C	2110-03-0002	1
L201 L203	RF CHOKE	CHOKE	W-I	1819-99-9999	2
L202	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	1
L204	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
Q201 Q202	TRANS QA050-530	2N5053	APX	4901-05-0530	2
Q203	TRANS QA051-790	2N5179	RCA	4901-05-1790	1
R201	RES,C,1/4W,5%,100 RC105-110	CF1/4-100	ASE	4700-15-1000	1
R202	RES,C,1/4W,5%,470 RC105-147	CF1/4-470	ASE	4700-15-4700	1

WAVETEK PARTS LIST	TITLE RF PRE AMP ASSY	ASSEMBLY NO. 1219-00-0054 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R203	RES,C,1/4W,5%,330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R204	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	1
R205 R206	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	2
R207	RES,C,1/4W,5%,270 RC103-127	CF1/4-270	ASE	4700-15-2700	1

WAVETEK PARTS LIST	TITLE RF PRE AMP ASSY	ASSEMBLY NO. 1219-00-0054 PAGE: 2	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	1
C02* C08	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	2
C03 C04 C06	CAP,CER,200PF,1KV CD102-120	5GA-T20	SPR	1510-10-1201	3
C05 C13 C14 C29	CAP,TANT,.47MF,50V CE113-447	935	TRW	1510-21-9470	4
C07	CAP,CER,47PF,1KV CD104-047	60U2J470J	MDC	1510-10-3470	1
C09	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	1
C10 C11 C30	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	3
C12 C17 C19 C21	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	4
C15 C24 C25 C32	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	4
C16	CAP,CER,15PF,1KV CD101-015	101CC-Q15	SPR	1510-10-0150	1
C18 C20 C27 C31	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	4

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10W	ASSEMBLY NO. 1114-00-0018 PAGE: 1	REV L

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C22	CAP,CER,4.7PF,1KV CD101-R47	101CC-V47	SPR	1510-10-0479	1
C23	CAP,CER,10PF,1KV CD101-010	101CC-010	SPR	1510-10-0100	1
C28	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	1
C33	CAP,CER,470PF,1KV CD102-147	60U471M	MDC	1510-10-1471	1
C34	CAP,V.C.,.1PF CG101-110	VC-.1PF	V-C	1510-40-0019	1
CR01 CR03 CR04	DIODE DP000-050	5082-3080	H-P	4805-02-0002	3
CR02 CR12 CR13	DIODE DG000-007	5082-2800	H-P	4809-02-0001	3
CR05 CR06 CR07	DIODE DR000-001	1N4004	P-C	4806-01-4004	3
CR08 CR09	DIODE DC000-008	BB205	APX	4803-02-0004	2
CR10 CR11	DIODE DC000-005	BB141A	ITT	4889-00-0001	2
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01 L02 L06	RF CHOKE	CHOKE	W-I	1819-99-9999	3
L03 L04 L08 L09 L10 L11	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	6
L05 L07 L12 L13 L15	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	5

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10W	ASSEMBLY NO. 1114-00-0018 PAGE: 2	REV L

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L14	CHOKE,10MILH,10% LA004-310	15S103K	ASE	1810-02-1001	1
Q01	TRANS QB000-010	TD101	SPR	4902-00-1010	1
Q02 Q03	TRANS QA050-530	2N5053	APX	4901-05-0530	2
Q04 Q05	TRANS QB000-009	MPS3702	MOT	4902-03-7020	2
Q06 Q10 Q11	TRANS QB000-018	SD1006	SSS	4902-01-0060	3
Q07	TRANS QB000-013	A430	APX	4902-00-4300	1
Q08 Q09	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
NONE	RES,C,1/4W,10%,100 RC104-110AB	CB1001	A-B	4705-16-1000	2
R01 R08 R45 R51	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	4
R02 R06 R12 R47	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	4
R03 R20 R37	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	3
R04 R19	RES,C,1/4W,5%,560K RC103-456	CF1/4-560K	ASE	4700-15-5603	2
R05 R10 R38 R40	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	4

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10W	ASSEMBLY NO. 1114-00-0018 PAGE: 3	REV L

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R07	RES,C,1/4W,5%,330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R09	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
R11 R21	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	2
R13	RES,C,1/4W,5%,150 RC103-115	CF1/4-150	ASE	4700-15-1500	1
R14 R26 R31 R36 R41	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	5
R15 R53	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	2
R16	RES,C,1/4W,5%,820 RC103-182	CF1/4-820	ASE	4700-15-8200	1
R17	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	1
R18 R24 R25	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	3
R22	RES,C,1/4W,5%,560 RC103-156	CF1/4-560	ASE	4700-15-5600	1
R23 R33	RES,C,1/4,5%,27 RC103-027	CF1/4-27	ASE	4700-15-2709	2

WAVETEK PARTS LIST	TITLE OUTPUT AMP,M10W	ASSEMBLY NO. 1114-00-0018 PAGE: 4	REV L

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R27	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R28 R32 R35	RES,C,1/4W,5%,82 RC103-082	CF1/4-82	ASE	4700-15-8209	3
R29	RES,C,1/2W,5%,360 W-I/RC105-136AB	EB3615	A-B	4705-25-3600	1
R30	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R34	RES,C,1/4W,5%,22 RC103-022	CF1/4-22	ASE	4700-15-2209	1
R39	RES,C,1/4W,5%,7.5K RC103-275	CF1/4-7.5K	ASE	4700-15-7501	1
R42	RES,C,1W,5%,150 RC107-115	GB1515	A-B	4700-35-1500	1
R43* R50	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	2
R44*	RES,C,1/4W,5%,39K RC103-339	CF1/4-39K	ASE	4700-15-3902	1
R46	RES,C,1W,5%,100 RC107-110	GB1015	A-B	4700-35-1000	1
R48	RES,C,1/4W,5%,620 RC103-162	CF1/4-620	ASE	4700-15-6200	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R52	RES,C,1/4W,5%,82 W-I/RC103-08243	CB9205	A-B	4705-15-8209	1
R54	RES,C,1/4W,10%,15K W-I/RC104-31548	CB1531	A-B	4705-16-1502	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C04 C05 C06 C07 C08 C09 C10 C11 C12 C13	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	13
C14 C15	CAP,F.T.,6.8PF CF102-R68	FASC-6892	A-B	1510-30-1689	2
IC1	IC,IC000-005	RC4558DN	RAY	7000-14-5800	1
Q01	TRANS QA053-060	2N5306	G-E	4901-05-3060	1
Q02 Q03 Q04 Q05 Q06 Q07 Q08 Q09 Q10 Q11 Q12 Q24 Q25	TRANS QA038-541	2N3854A	G-E	4901-03-8541	13
Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q26	TRANS QB000-009	MPS3702	MOT	4902-03-7020	12
R01	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R02 R40	RES,C,1/4W,5%,3.3K RC103-233	CF1/4-3.3K	ASE	4700-15-3301	2
R03	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	1
R04 R08 R12	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	3
R05 R06 R07 R09 R10 R11 R13 R14 R15	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	9

WAVETEK PARTS LIST	TITLE DAC,M22	ASSEMBLY NO. 1114-00-0017 PAGE: 1	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	11
R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	11
R38 R39	RES,C,1/4W,5%,270K RC103-427	CF1/4-270K	ASE	4700-15-2703	2
R41	RES,C,1/4W,5%,20K RC103-320	CF1/4-20K	ASE	4700-15-2002	1
R42	RES,MF,1/8W,1%,17.8K RF213-178	MF55K-17.8K	ASE	4701-03-1782	1
R43	RES,MF,1/8W,1%,4.02K RF212-402	MF55K-4.02K	ASE	4701-03-4021	1
R44	RES,MF,1/8W,1%,2.74K RF212-274	MF55K-2.74K	ASE	4701-03-2741	1
R45	RES,MF,1/8W,1%,8.06K RF212-806	MF55K-8.06K	ASE	4701-03-8061	1
R46	RES,MF,1/8W,1%,16.9K RF213-169	MF55K-16.9K	ASE	4701-03-1692	1
R47	RES,MF,1/8W,1%,34.0K RF213-340	MF55K-34.0K	ASE	4701-03-3402	1
R48	RES,MF,1/8W,1%,42.2K RF213-422	MF55K-42.2K	ASE	4701-03-4222	1

WAVETEK PARTS LIST	TITLE DAC,M22	ASSEMBLY NO. 1114-00-0017 PAGE: 2	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R49	RES,MF,1/8W,1%,86.6K RF213-866	MF55K-86.6K	ASE	4701-03-8662	1
R50 R51	POT,2K,RP130-220	89PR2K	BEK	4610-00-2202	2
R52 R53 R54	POT,5K,RP130-250	89PR5K	BEK	4610-00-2502	3
R55 R62	RES,MF,1/8W,1%,178K RF214-178	MF55K-178K	ASE	4701-03-1783	2
R56 R61	RES,MF,1/8W,1%,357K RF214-357	MF55K-357K	ASE	4701-03-3573	2
R57	RES,MF,1/8W,1%,442K RF214-442	MF55K-442K	ASE	4701-03-4423	1
R58	RES,MF,1/8W,1%,887K RF214-887	MF55K-887K	ASE	4701-03-8873	1
R59	RES,MF,1/8W,1%,1.78M RF215-178	MF55K-1.78K	ASE	4701-03-1784	1
R60	RES,MF,1/8W,1%,3.57M RF215-357	MF55K-3.57M	ASE	4701-03-3574	1
R63	RES,MF,1/8W,1%,88.7K RF213-887	MF55K-88.7K	ASE	4701-03-8872	1
R64	RES,MF,1/8W,1%,44.2K RF213-442	MF55K-44.2K	ASE	4701-03-4422	1
R65	RES,MF,1/8W,1%,35.7K RF213-357	MF55K-35.7K	ASE	4701-03-3572	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R66	POT,100K,RP130-410	89PR100K	BEK	4610-00-2104	1
R67	RES,MF,1/8W,1%,2.43M RF215-243	MF55K-2.43M	ASE	4701-03-2434	1
R68 R69	RES,MF,1/8W,1%,2.43K RF212-243	MF55K-2.43K	ASE	4701-03-2431	2
R70	RES,MF,1/8W,1%,8.25K RF212-825	MF55K-8.25K	ASE	4701-03-8251	1
R71	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	1
R72	RES,C,1/4W,5%,330K RC103-433	CF1/4-330K	ASE	4700-15-3303	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C29 C30	CAP,F.T.,6.8PF CF102-R68	FASC-6892	A-B	1510-30-1689	3
C02	CAP,CER,75PF,1KV CD104-075	10TCU-Q75	SPR	1510-10-3750	1
C03 C05 C08 C09 C19 C24 C25 C26 C27	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	9
C04 C10	CAP,CER,150PF,1KV CD102-115	60U151M	MDC	1510-10-1151	2
C06	CAP,CER,3000PF,1KV CD102-230	5GA-D30	SPR	1510-10-1302	1
C07	CAP,CER,68PF,1KV CD104-068	68U2J680J	MDC	1510-10-3680	1
C11	CAP,VARI,7.35PF,250V CV101-035	7STRIK0-02	STR	1510-70-0350	1
C12	CAP,MICA,50PF,500V CM101-050	DM15-500J	ARC	1510-50-0500	1
C13	CAP,MICA,470PF,500V CM101-147	DM15-471J	ARC	1510-50-0471	1
C15 C18	CAP,TANT,10MF,25V CE120-010	162D106X0025D02	SPR	1510-21-7100	2
C16 C17	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	2

WAVETEK PARTS LIST	TITLE FM REF,M29-1	ASSEMBLY NO. 1114-00-0015 PAGE: 1	REV E

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,MICA,100PF,500V CM101-110	DM15-101J	ARC	1510-50-0101	1
C23 C28	CAP,CER,20PF,1KV CD101-020	60C0G200J	MDC	1510-10-0200	2
CR01 CR10 CR11	DIODE DR000-001	1N4004	P-C	4806-01-4004	3
CR02 CR07 CR08 CR09	DIODE DG000-011	FD-6666	FCD	4807-02-0003	4
CR03 CR04 CR05 CR06	DIODE DG000-010	FD777	FCD	4807-02-0002	4
IC1 IC2	IC,8 PIN,IC000-008	LM301-AN	NAT	7000-03-0100	2
IC3	IC,IC000-010	CA3049T	RCA	7000-30-4900	1
J1	CONN JF000-005	57JR116-1	S-C	2110-03-0002	1
L1 L2	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	2
Q01	TRANS QB000-011	TD401	SPR	4902-00-4010	1
Q02	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
Q03	TRANS QB000-010	TD101	SPR	4902-00-1010	1
Q04	TRANS QA058-541	2N3854A	G-E	4901-03-8541	1
Q05 Q07 Q10	TRANS QA051-590	2N5139	NAT	4901-05-1390	3

WAVETEK PARTS LIST	TITLE FM REF,M29-1	ASSEMBLY NO. 1114-00-0015 PAGE: 2	REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q06	TRANS QB000-026	AD3958	A-D	4902-03-9580	1
Q08 Q09	TRANS QA036-400	3640-18	NAT	4901-03-6400	2
R01	POT,2K,RP130-220	89PR2K	BEK	4610-00-2202	1
R02 R17 R29 R56 R57	RES,MF,1/8W,1%,5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	5
R03 R05 R10 R16 R19 R22 R25	RES,MF,1/8W,1%,1K RF212-100	MF55K-1K	ASE	4701-03-1001	7
R04 R07 R38 R40	RES,MF,1/8W,1%,2K RF212-200	MF55K-2K	ASE	4701-03-2001	4
R06 R12 R15	RES,MF,1/8W,1%,110K RF214-110	MF55K-110K	ASE	4701-03-1103	3
R08 R21	RES,MF,1/8W,1%,249 RF211-249	MF55K-249	ASE	4701-03-2490	2
R09 R14 R30 R32 R33 R44	RES,MF,1/8W,1%,499 RF211-499	MF55K-499	ASE	4701-03-4990	6
R13	RES,C,1/4W,5%,150K RC103-415	CF1/4-150K	ASE	4700-15-1503	1
R18	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	1
R20 R23 R58	RES,MF,1/8W,1%,4.02K RF212-402	MF55K-4.02K	ASE	4701-03-4021	3
R26	RES,C,1/8W,1%,33.2 RF21R-332	MF55K-33.2	ASE	4701-03-3329	1

WAVETEK PARTS LIST	TITLE FM REF,M29-1	ASSEMBLY NO. 1114-00-0015 PAGE: 3	REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R28 R39 R41 R42 R46	RES,MF,1/8W,1%,100 RF211-100	MF55K100	ASE	4701-03-1000	5
R34	RES,MF,1/8W,1%,845 RF211-845	MF55K-845	ASE	4701-03-8450	1
R35 R50	RES,MF,1/8W,1%,1.1K RF212-110	MF55K-1.1K	ASE	4701-03-1101	2
R36 R37 R51	RES,MF,1/8W,1%,1.50K RF212-150	MF55K-1.50K	ASE	4701-03-1501	3
R43 R54	RES,MF,1/8W,1%,15K RF213-150	MF55K-15K	ASE	4701-03-1502	2
R45	RES,MF,1/8W,1%,174 RF211-174	MF55K-174	ASE	4701-03-1740	1
R47 R49	RES,MF,1/8W,1%,357 RF211-357	MF55K-357	ASE	4701-03-3570	2
R48	RES,MF,1/8W,1%,2.10K RF212-210	MF55K-2.10K	ASE	4701-03-2101	1
R55	RES,MF,1/8W,1%,2.49K RF212-249	MF55K-2.49K	ASE	4701-03-2491	1
R59	RES,MF,1/8W,1%,1M RF215-100	RN55D	ASE	4701-03-1004	1
R60	RES,MF,1/8W,1%,48.7K RF213-487	MF55K-48.7K	ASE	4701-03-4872	1

WAVETEK PARTS LIST	TITLE FM REF,M29-1	ASSEMBLY NO. 1114-00-0015 PAGE: 4	REV E

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C18 C57 C58	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	6
C04 C05 C06 C07 C08	CAP,ELECT,1MF,25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	5
C09	CAP,ELECT,100MF,12V CE119-110	500D107G012CC7	SPR	1510-21-2101	1
C10	CAP,ELECT,100MF,6V CE118-110	500D107G006CC7	SPR	1510-21-1101	1
C13	CAP,CER,47PF,1KV CD101-047	10TCC-Q47	SPR	1510-10-0470	1
C14	CAP,VALUE DETERMINED IN CALIBRATION	CAP,TRIM	W-I	1519-99-9999	1
C15	CAP,CER,470PF,1KV CD102-147	60U471M	MDC	1510-10-1471	1
C16	CAP,CER,25PF,1KV CD101-025	60C0G250J	MDC	1510-10-0250	1
C17	CAP,VAR,1.4/9.2PF CV107-001	189-0563-001	JOH	1510-70-6929	1
C19 C50	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	2
C20	CAP,MICA,180PF,500V CM101-118	DM15-181J	ARC	1510-50-0181	1

WAVETEK PARTS LIST	TITLE XTAL REF,M30-1	ASSEMBLY NO. 1114-00-0024 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C21 C41 C46	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	3
C22	CAP,CER,20PF,1KV CD101-020	60C0G200J	MDC	1510-10-0200	1
C23 C48	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	2
C24 C25 C28 C40 C45	CAP,CER,FT,2200PF, GMV,CF115-222	4420-2200PF	AER	1510-31-1222	5
C26 C34 C36 C39 C42 C47 C60	CAP,VAR,3.5-13PF250V CV101-013	7S-TRIK0-02-3.5-13PF	STR	1510-70-0130	7
C27	CAP,CER,4.7PF,1KV CD101-R47	10TCC-V47	SPR	1510-10-0479	1
C29	CAP,CER,200PF,1KV CD102-120	5GA-120	SPR	1510-10-1201	1
C30	CAP,CER,15PF,1KV CD101-015	10TCC-Q15	SPR	1510-10-0150	1
C31	CAP,G-C,2.0PF,10% CG101-220	GC-2.0PF	G-C	1510-40-0020	1
C32	CAP,M-C,4.7PF,10% CG102-247	GC-4.7PF	G-C	1510-40-1479	1
C33 C38	CAP,MC,1.1PF,10% CG102-211	MC1.1PF	G-C	1510-40-1119	2

WAVETEK PARTS LIST	TITLE XTAL REF,M30-1	ASSEMBLY NO. 1114-00-0024 PAGE: 2	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C35 C37	CAP,M.C.,.47PF CG102-147	MC-.47PF	Q-C	1510-40-1478	2
C43	CAP,CER,F.T.,27PF CF114-027	4420-N1500	AVX	1510-31-0270	1
C44 C49 C51 C52	CAP,CER,10PF,1KV CD101-010	10TCC-Q10	SPR	1510-10-0100	4
C53 C55	CAP,VARI,.5/3PF CV102-R30	R-TRIKO-107-02-M	STR	1510-70-1030	2
C54	CAP,Q.C.,.1PF CG101-110	QC-.1PF	Q-C	1510-40-0019	1
C56	CAP,M.C.,.75PF CG102-175	MC-.75PF	Q-C	1510-40-1758	1
C59	CAP,Q-C,10PF,10%, CG101-310	QC-10PF	Q-C	1510-40-0100	1
CR1 CR2 CR4	DIODE DR000-001	1N4004	P-C	4806-01-4004	3
CR3	DIODE DP000-040	MA47980	M-A	4805-02-0001	1
CR5	DIODE DG100-341	1N34A	HIT	4807-01-0034	1
CR6 CR7	DIODE DG000-012	5082-0180	H-P	4811-02-0001	2
CR8	DIODE DC000-005	BB141A	ITT	4889-00-0001	1
IC1	IC,IC000-011	78M05UC	FCD	7000-78-0500	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
IC2	IC,IC000-002	N5741CV	SIG	7000-57-4100	1
J1 J2 J3 J4 J5 J6 J7	CONN JF000-005	37JR116-1	S-C	2110-03-0002	7
L01 L02 L03 L27	FERRITE CHOKE LA009-010	T1255-2	HYI	1810-05-0002	4
L07	CHOKE .47MH 10% LA005-R04	08NR47K	ASE	1810-03-0478	1
L08 L09 L16 L17	FERRITE CHOKE LA009-004	T1255-1	HYI	1810-05-0001	4
L10 L11 L21 L23 L24 L25	RF CHOKE	CHOKE	W-I	1819-99-9999	6
L12 L13 L14 L15 L19	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	5
L18	CHOKE .10MH 10% LA005-R01	08NR10K	ASE	1810-03-0019	1
L20	CHOKE, 1MH, 10% LA005-R10	08N1R0K	ASE	1810-03-0010	1
L26	GROUND LUG,#6,INT HG102-600	58-111	F-S	2112-03-0003	1
Q01 Q02 Q06 Q07 Q08 Q09 Q10	TRANS QA050-530	2N5053	APX	4901-05-0530	7
Q03	TRANS QA051-790	2N5179	RCA	4901-05-1790	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q04 Q05	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
R04	RES,MF,1/8W,1%,5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	1
R05 R50	RES,MF,1/8W,1%,10K RF213-100	MF55K10K	ASE	4701-03-1002	2
R06 R18 R19	RES,MF,1/8W,1%,2K RF212-200	MF55K-2K	ASE	4701-03-2001	3
R07 R14 R23 R41	RES,C,1/4W,10%,100 RC104-110AB	CB1001	A-B	4705-16-1000	4
R08 R29	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	2
R09 R11 R22	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	3
R10	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R12	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	1
R13	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R15	RES,MF,1/8W,1%,40.2K RF213-402	MF55K-40.2K	ASE	4701-03-4022	1
R16	RES,MF,1/8W,1%,15K RF213-150	MF55K-15K	ASE	4701-03-1502	1

WAVETEK PARTS LIST	TITLE XTAL REF,M30-1	ASSEMBLY NO. 1114-00-0024 PAGE: 5	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R17	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R20	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1
R21	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	1
R24	RES,C,1/8W,5%,10 RC101-010	CF1/8-10	ASE	4700-05-1009	1
R25 R26	RES,C,1/8W,5%,100 RC101-110	CF1/8-100	ASE	4700-05-1000	2
R27	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R28	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	1
R30 R36 R43	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	3
R31 R35 R42	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	3
R32 R34 R44 R45	RES,C,1/8W,5%,47 RC101-047	CF1/8-47	ASE	4700-05-4709	4
R33 R39 R49	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	3

WAVETEK PARTS LIST	TITLE XTAL REF,M30-1	ASSEMBLY NO. 1114-00-0024 PAGE: 6	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R34 R37	RES,C,1/8W,5%,22 RC101-022	CF1/8-22	ASE	4700-05-2209	2
R40	RES,C,1/4W,5%,82 RC103-082	CF1/4-82	ASE	4700-15-8209	1
R46 R47	RES,C,1/8W,5%,270 RC101-127	CF1/8-270	ASE	4700-05-2700	2
R48	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	1
R51	RES,MF,1/8W,1%,34.0K RF213-340	MF55K-34.0K	ASE	4701-03-3402	1
R52	RES,MF,1/8W,1%,13.0K RF213-130	MF55K-13.0K	ASE	4701-03-1302	1
T1	RF XFMR FROM:1810-03-0010	TR004-001	W-I	1210-43-0001	1
X1	CRYSTAL X40W XX000-401	X-40W-00.00000	W-I	2310-00-0401	1
34	PC ASSY	M30-1-SUB	W-I	1218-00-0191	1

WAVETEK PARTS LIST	TITLE XTAL REF,M30-1	ASSEMBLY NO. 1114-00-0024 PAGE: 7	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101 C103 C104 C105 C106 C107	CAP,ELECT,1MF,25V CE120-001	1620105X9025BC2	SPR	1510-21-7010	6
C102	CAP,CER,.01MF,100V CD103-510	680103M	MDC	1510-10-2103	1
IC101	IC,IC000-015	74S74N	T-I	8000-82-7401	1
IC102	IC,IC000-016	N8290A	SIG	8000-82-9000	1
IC103 IC104 IC105	IC,IC000-005	N8292A	SIG	8000-82-9201	3
L101 L103 L104 L105 L106 L107	FERRITE CHOKE LA009-010	T1255-2	HYI	1810-05-0002	6
L102	FERRITE CHOKE LA009-004	T1255-1	HYI	1810-05-0001	1
R101	RES,C,1/4W,5%,390 RC103-159	CF1/4-390	ASE	4700-15-3900	1
R102	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
R103	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1

WAVETEK PARTS LIST	TITLE PC ASSY	ASSEMBLY NO. 1218-00-0191 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C04 C05 C06 C07 C08 C09 C10 C11 C12 C13 C14 C15 C16	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	16
C17	CAP,ELECT,100MF,12V CE119-110	500D107G012CC7	SPR	1510-21-2101	1
C18	CAP,ELECT,100MF,6V CE118-110	500D107G006CC7	SPR	1510-21-1101	1
C19 C20 C25 C28 C32 C37	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	6
C21 C22 C27 C29	CAP.FILM,.12MF,250V 5%	60E124J250	PLSSY	1510-60-8124	4
C23 C24 C25	CAP,MON,1MF,50V	3420-050-E105M	AER	1510-11-3105	3
C30	CAP,MICA,1000PF,500V CM101-210	DM15-102J	ARC	1510-50-0102	1
C31	CAP,CER,10PF,1KV CD101-010	10TCC-Q10	SPR	1510-10-0100	1
C33 C34	CAP,MICA,180PF,500V CM101-118	DM15-181J	ARC	1510-50-0181	2
C35	CAP,CER,.001MFD,1KV CD102-210	5GA010	SPR	1510-10-1102	1
C36	CAP,CER,.01MF,100V CD103-310	680103M	MDC	1510-10-2103	1

WAVETEK PARTS LIST	TITLE KHZ STEPS,M31A	ASSEMBLY NO. 1114-00-0143 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
CR01	MOT MV2301 TUNER DIODE	MV2301	MOT	4803-02-0008	1
CR02 CR03 CR05	DIODE DG109-140	1N4148	FCD	4807-01-0914	3
CR04	LED DL000-001	NSL5046	NAT	4810-02-0001	1
IC01 IC02 IC12	IC,IC000-012	SN7404N	T-I	8000-74-0400	3
IC03 IC05 IC06	IC,IC000-016	N8290A	SIG	8000-82-9000	3
IC04	IC,IC000-017	N82S90A	SIG	8000-82-9001	1
IC07	IC,IC000-019	SN74H102N	T-I	8007-41-0200	1
IC08	IC,IC000-018	N74H11A	SIG	8000-74-1100	1
IC09	IC,IC000-029	11C44DC	FCD	8000-11-4400	1
IC10	IC,IC000-005	RC4558DN	RAY	7000-14-5800	1
IC11	IC,IC000-002	N5741CV	SIG	7000-57-4100	1
IC13	IC,IC000-011	78M05UC	FCD	7000-78-0500	1
J01 J02	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01 L02 L03 L04 L05 L06 L07 L08 L09 L10 L11 L12 L13 L14 L15 L16	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	16
L17	CHOKE,2.2MH,10% LA005-R22	08N2R2K	ASE	1810-03-0229	1

WAVETEK PARTS LIST	TITLE KHZ STEPS,M31A	ASSEMBLY NO. 1114-00-0143 PAGE: 2	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L18	CHOKE .47MH 10% LA005-R04	08NR47K	ASE	1810-03-0478	1
L19	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	1
Q01	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
Q02	TRANS QA053-060	2N5306	G-E	4901-05-3060	1
Q03 Q04	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
R01 R02	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	2
R03 R04 R06 R07 R26	RES,C,1/4W,5%,30K RC103-330	CF1/4-30K	ASE	4700-15-3002	5
R05	POT,2K,RP144-220	91WR2K	BEK	4610-00-4202	1
R08 R27	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2
R09	RES,C,1/4W,5%,68K RC103-368	CF1/4-68K	ASE	4700-15-6802	1
R10 R11 R14	RES,C,1/4W,5%,6.8K RC103-268	CF1/4-6.8K	ASE	4700-15-6801	3
R12	RES,C,1/4W,5%,3.3K RC103-233	CF1/4-3.3K	ASE	4700-15-3301	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R13 R22 R25	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	3
R15	RES,MF,1/8W,1%,30.1K RF213-301	MF55K-30.1K	ASE	4701-03-3012	1
R16	RES,MF,1/8W,1%,4.32K RF212-432	MF55K-4.32K	ASE	4701-03-4321	1
R17 R18	RES,MF,1/8W,1%,19.6K RF213-196	MF55K-19.6K	ASE	4701-03-1962	2
R19	RES,MF,1/8W,1%,2.10K RF212-210	MF55K-2.10K	ASE	4701-03-2101	1
R20 R30	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	2
R21	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R23	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R24	RES,C,1/4W,5%,2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1
R28	RES,C,1/4W,5%,160K RC103-416	CF1/4-160K	ASE	4700-15-1603	1
R29	RES,C,1/4W,5%,20K RC103-320	CF1/4-20K	ASE	4700-15-2002	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
C02	CAP,ELECT,100MF,6V CE118-110	500D107G006CC7	SPR	1510-21-1101	1
C03 C04 C05 C06 C07 C08 C09 C10 C11 C12	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	10
C13	CAP,Q.C.,3.9PF CG101-239	QC-3.9PF	Q-C	1510-40-0399	1
C14	CAP,M.C.,.62PF CG102-162	MC-.62PF	Q-C	1510-40-1628	1
C16 C17 C19	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	3
C18	CAP,M.C.,3.9PF CG102-239	MC-3.9PF	Q-C	1510-40-1399	1
C20	CAP,MC,1.1PF,10% CG102-211	MC1.1PF	Q-C	1510-40-1119	1
C21	CAP,VAR, .3/1.2PF	7263	JHSN	1510-70-9129	1
C22 C23	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	2
C24	CAP,MON,1MF,50V,20%	3420-050-E105M	AER	1510-11-3105	1
C26 C27 C28 C29	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	4

WAVETEK PARTS LIST	TITLE MHZ STEPS,M32A	ASSEMBLY NO. 1114-00-0215 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C30 C31	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	2
CR1	DIODE DC000-008	BB205	APX	4803-02-0004	1
CR2	DIODE DG000-007	5082-2800	H-P	4809-02-0001	1
CR3	LED DL000-001	NSL5046	NAT	4810-02-0001	1
IC1	IC,IC000-011	78M05UC	FCD	7000-78-0500	1
J1 J2 J3 J301	CONN JF000-005	37JR116-1	S-C	2110-03-0002	4
L01 L02 L03 L04 L05 L06 L07 L08 L09 L10 L16 L17 L18 L19	FERRITE CHOKE LA009-010	T1255-2	MYT	1810-05-0002	14
L15	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	1
Q1	TRANS QA050-530	2N5053	APX	4901-05-0530	1
Q2	TRANS QB000-013	A430	APX	4902-00-4300	1
Q3	TRANS QB000-035	BFR90	MOT	4902-00-0900	1
R01	RES,C,1/8W,5%,6M RC101-068	CF1/8-68	ASE	4700-05-6809	1
R02	RES,C,1/8W,5%,2K RC101-220	CF1/8-2K	ASE	4700-05-2001	1
R03	RES,C,1/4W,5%,430 RC103-143	CF1/4-430	ASE	4700-15-4300	1

WAVETEK PARTS LIST	TITLE MHZ STEPS,M32A	ASSEMBLY NO. 1114-00-0215 PAGE: 2	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R04 R08 R11	RES,C,1/8W,5%,4.7K RC101-247	CF1/8-4.7K	ASE	4700-05-4701	3
R05 R10	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	2
R06	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1
R07	RES,C,1/4W,5%,2.7 RC103-R27	CF1/4-2.7	ASE	4700-15-2708	1
R09	RES,MF,1/8W,1%,499 RF211-499	MF55K-499	ASE	4701-03-4990	1
R12	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R13	RES,C,1/8W,5%,820 RC101-182	CF1/8-820	ASE	4700-05-8200	1
2	DIG PGM BD ASSY	M32A-S2	W-I	1218-00-0022	1
1	OSC CTL BD ASSY	M32A-S1	W-I	1218-00-0021	1
3	MIXER ASSY	M32A-S3	W-I	1219-00-0117	1
4	VIDEO AMP ASSY	M32A-S4	W-I	1219-00-0118	1
30	HARNESS ASSY,M32A	WYM32A	W-I	1219-00-0119	1

WAVETEK PARTS LIST	TITLE MHZ STEPS,M32A	ASSEMBLY NO. 1114-00-0215 PAGE: 3	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
C102 C104	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	2
C103	CAP.,CHIP,360PF,10%	100B361KP200X	ATC	1510-00-2361	1
C105	CAP,CER,DISC,.001MF 50V,CD112-210	8101-050-102M	ETP	1510-10-7102	1
CR101 CR102 CR103	DIODE DG000-007	5082-2800	H-P	4809-02-0001	3
CR104	DIODE DG000-009	5082-2835	H-P	4809-02-0002	1
IC101	PROM,PER M32A PROM:8007-42-8800	8410-00-0001	W-I	8410-00-0001	1
IC102 IC103	IC,IC000-017	NB2S90A	SIG	8000-82-9001	2
IC104	DUAL J-K FLIP-FLIP	SN74S112N	T-I	8007-41-1200	1
IC105	IC,IC000-029	11C440C	FCD	8000-11-4400	1
J101	SOCKET,S.I.L.,6-PIN	1-583773-3	AMP	2112-00-0017	1
J102	TERM.,MINISERT	75060-008	BER	2112-23-0001	1
L101 L102 L103 L104	FERRITE CHOKE LA009-010	T1255-2	MYI	1810-05-0002	4
P101A P101B P101C P101D P101E P101F P101G P101H P101I P101J	EDGE-CLIP CONNECTOR	75382-001	BER	2112-22-0001	10

WAVETEK PARTS LIST	TITLE DIG PGM BD ASSY	ASSEMBLY NO. 1218-00-0022 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q101	TRANS QA050-530	2N5053	APX	4901-05-0530	1
R101	RES,NETWORK,7-4.7K, 8-PIN,5%	807-472J	EPITK	4770-00-0006	1
R102	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	1
R103	RES,C,1/4W,5%,33 RC103-033	CF1/4-33	ASE	4700-15-3309	1
R104	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
R105	RES,MF,1/8W,1%,2.10K RF212-210	MF55K-2.10K	ASE	4701-03-2101	1
R106	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R107	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R108	RES,MF,1/8W,1%,499 RF211-499	MF55K-499	ASE	4701-03-4990	1
R109	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R110 R111	RES,C,1/8W,5%,4.7K RC101-247	CF1/8-4.7K	ASE	4700-05-4701	2

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	DIG PGM BD ASSY	1218-00-0022	
		PAGE: 2	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201	CAP,CER,.005MF,1KV CD103-250	TG-050	SPR	1510-10-2502	1
C202	CAP,CER,.001MFD,1KV CD102-210	5GA010	SPR	1510-10-1102	1
C203 C210 C211	CAP,MON,1MF,50V	3420-050-E105M	AER	1510-11-3105	3
C204 C205	CAP,CER,150PF,1KV CD102-115	6001S1M	MDC	1510-10-1151	2
C206 C207	CAP,FILM,.047MF,250V 5%	B32547-.047-5%-250V	SIEM	1510-60-9473	2
C208 C209	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
CR201 CR202 CR203 CR204	DIODE DG109-140	1N4148	FCD	4807-01-0914	4
IC201 IC202 IC203	DUAL OP AMP,RAYTHEON IC000-027	RC4558DN	RAY	7000-45-5801	3
OC201 OC202	LED,AXIAL VACTROL MP000-002	VTL5C3	VAC	5710-00-0001	2
P201	HEADER,6-PIN,STRGHT REF:2112-24-0000	2112-24-0001	M-I	2112-24-0001	1
P202A P202B P202C P202D P202E P202F P202G P202H P202I P202J P202K P202L	EDGE-CLIP CONNECTOR	75382-001	BER	2112-22-0001	12

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	OSC CTL BD ASSY	1218-00-0021	B
		PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R201 R221 R222	RES,C,1/4W,5%,6.8K RC103-268	CF1/4-6.8K	ASE	4700-15-6801	3
R202 R203 R211	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	3
R204	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R205 R206	POT,CERMET,20K-OHM	A4C203	A-B	4610-13-5203	2
R207 R210	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	2
R208	RES,MF,1/8W,1%,2K RF212-200	MF55K-2K	ASE	4701-03-2001	1
R209 R225 R226	RES,C,1/4W,5%,220K RC103-422	CF1/4220K	ASE	4700-15-2203	3
R212	RES,C,1/8W,5%,1K RC101-210	CF1/8-1K	ASE	4700-05-1001	1
R213	POT,CERMET,5K	A28502	A-B	4610-13-4502	1
R214	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R215	POT,CERMET,20K-OHM	A28203	A-B	4610-13-4203	1
R216 R217 R219 R220	RES.,1/8W,5%,30K	CF1/8-30K	ASE	4700-05-3002	4
R223 R224	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R227	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
R228	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C301 C305	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	2
C302 C303 C304	CAP,CER,DISC,.001MF 50V,CD112-210	8101-050-102M	ETP	1510-10-7102	3
C306	CAP,MC,1.1PF,10% CG102-211	MC1.1PF	Q-C	1510-40-1119	1
CR301 CR302	DIODE DP000-060	MA47047	M-A	4805-02-0003	2
CR303 CR304	DIODE DG000-009	5082-2835	H-P	4809-02-0002	2
L301	FERRITE CHOKE,1 TURN FROM:1813-00-0007	LA007-001	W-I	1210-30-0004	1
L302	RF CHOKE	CHOKE	W-I	1819-99-9999	1
R301 R302	RES,C,1/8W,5%,47K RC101-347	CF1/8-47K	ASE	4700-05-4702	2
R303	RES,C,1/8W,5%,390 RC101-139	CF1/8-390	ASE	4700-05-3900	1
T301	RF XFMR FROM:1813-00-0007	TR001-001	W-I	1210-40-0001	1

WAVETEK PARTS LIST	TITLE MIXER ASSY	ASSEMBLY NO. 1219-00-0117 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C401	CAP,CER,120PF,1KV CD102-112	600121M	MOC	1510-10-1121	1
C402	CAP,CER,.005MF,1KV CD103-250	TG-050	SPR	1510-10-2502	1
C403	CAP,CER,F.T.,39PF CF114-039	4420-N1500-39PF	AVX	1510-31-0390	1
J401	TERM.,MINISERT	75060-008	BER	2112-23-0001	1
L401	CHOKE .10MH 10% LA005-R01	08NR10K	ASE	1810-03-0019	1
Q401 Q402	TRANS QA050-530	2N5053	APX	4901-05-0530	2
R401 R407 R408	RES,C,1/4W,5%,820 RC103-182	CF1/4-820	ASE	4700-15-8200	3
R402 R409	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	2
R403 R406	RES,C,1/4W,5%,2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	2
R404	RES,C,1/4W,5%,3.3K RC103-233	CF1/4-3.3K	ASE	4700-15-3301	1
R405	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1

WAVETEK PARTS LIST	TITLE VIDEO AMP ASSY	ASSEMBLY NO. 1219-00-0118 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C20 C21	CAP,F.T.,6.8PF CF102-R68	FASC-6892	A-B	1510-30-1689	3
C02	CAP,Q-C,10PF,10%, CG101-310	QC-10PF	Q-C	1510-40-0100	1
C03 C07 C13 C24 C31	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	5
C04 C10	CAP,CER,F.T.,150PF CF116-115	4420-Z5P	AVX	1510-31-2151	2
C05 C06 C08 C09 C11 C15 C26 C27 C30 C32	CAP,ELECT,1MF,25V CE120-001	162D105X90258C2	SPR	1510-21-7010	10
C12	CAP,CER,470PF,1KV CD102-147	600471M	MOC	1510-10-1471	1
C14 C18 C19 C37	CAP,CER,.001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	4
C16 C42	CAP,CER,.05MF,100V CD103-350	TG-S50	SPR	1510-10-2503	2
C17 C35 C36	CAP,CER,.002MF,1KV CD102-220	5GAD20	SPR	1510-10-1202	3
C22	CAP,ELECT,100MF,12V CE119-110	500D107G012CC7	SPR	1510-21-2101	1
C23 C28 C29 C34	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	4

WAVETEK PARTS LIST	TITLE NAR OSC LK,M33-1	ASSEMBLY NO. 1114-00-0022 PAGE: 1	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C25	CAP,ELECT,100MF,6V CE116-110	500D107G006CC7	SPR	1510-21-1101	1
C38 C39	CAP,MON,1MF,50V, 80-20% CD114-510	3430-050-E105Z	AVX	1510-10-9105	2
C40	CAP,CER,.1MF,50V CD103-410	TGP-10	SPR	1510-10-2104	1
C41	CAP,F.T.,120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	1
CR01 CR02	DIODE DP000-040	MA47980	M-A	4805-02-0001	2
CR03	DIODE DG000-009	5082-2835	H-P	4809-02-0002	1
CR05 CR06 CR07 CR08 CR11 CR12 CR13 CR14 CR15	DIODE DR000-001	1N4004	P-C	4806-01-4004	9
CR09	LED DL000-001	NSL5046	NAT	4810-02-0001	1
CR10	DIODE DR000-010	1N4732	ITT	4801-01-4732	1
IC1	IC,IC000-002	NE5741CV	SIG	7000-57-4100	1
IC2 IC3 IC9	IC,IC000-005	RC4558DN	RAY	7000-14-5800	3
IC4	IC,IC000-011	78M05UC	FCD	7000-78-0500	1
IC5	IC,IC001-001	MC14553BCL	MOT	8001-45-5300	1
IC6	IC,IC000-023	SN7405N	T-I	8000-74-0500	1

WAVETEK PARTS LIST	TITLE NAR OSC LK,M33-1	ASSEMBLY NO. 1114-00-0022 PAGE: 2	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
IC7 IC8	IC,IC000-013	MC4044P	MOT	8000-40-4400	2
J1 J2 J3 J4 J5	CONN JF000-005	37JR116-1	S-C	2110-03-0002	5
L01 L02 L05 L06	CHOKE, 3.3MH, 10% LA005-R33	08N3R3K	ASE	1810-03-0339	4
L03 L04 L08 L09 L10 L11 L12 L13	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	8
Q1 Q2	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
Q3	TRANS QA050-530	2N5053	APX	4901-05-0530	1
Q4	TRANS QA054-610	2N5461	MOT	4901-05-4610	1
Q5	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
R01 R02 R05	RES,C,1/4W,5%,56 RC103-056	CF1/4-56	ASE	4700-15-5609	3
R03 R41 R43 R44 R45 R46	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	6
R04 R10 R13 R25 R55	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	5
R06	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1
R07 R08	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	2

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	NAR OSC LK,M33-1	1114-00-0022	C
		PAGE: 3	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R09 R14	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	2
R11 R12	RES,C,1/4W,5%,390 RC103-139	CF1/4-390	ASE	4700-15-3900	2
R15	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	1
R16	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
R17	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
R18	RES,MF,1/8W,1%,619 RF211-619	MF55K-619	ASE	4701-03-6190	1
R19	RES,MF,1/8W,1%,2.74K RF212-274	MF55K-2.74K	ASE	4701-03-2741	1
R20 R30 R32 R49 R61 R62	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	6
R21	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R22 R28 R29 R48 R50	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	5
R23	POT,100K,RP144-410	91WR100K	BEK	4610-00-4104	1
R24	RES,C,1/4W,10%,2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	NAR OSC LK,M33-1	1114-00-0022	C
		PAGE: 4	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R26	RES,C,1/4W,5%,2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1
R27 R34 R38 R66	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	4
R31 R33 R63 R64	RES,C,1/4W,5%,180K RC103-418	CF1/4-180K	ASE	4700-15-1803	4
R35	RES,C,1/4W,5%,820 RC103-182	CF1/4-820	ASE	4700-15-8200	1
R39 R42 R51 R52 R53 R54	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	6
R40	RES,C,1/4W,5%,270 RC103-127	CF1/4-270	ASE	4700-15-2700	1
R56 R57	RES,C,1/4W,5%,12K RC103-312	CF1/4-12K	ASE	4700-15-1202	2
R58	RES,C,1/4W,5%,3.3K RC103-233	CF1/4-3.3K	ASE	4700-15-3301	1
R59 R60	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	2
R65	RES,C,1/4W,5%,6.8K RC103-268	CF1/4-6.8K	ASE	4700-15-6801	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP,ELECT,100MF,12V CE119-110	500D107G012CC7	SPR	1510-21-2101	1
C02 C06 C09	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	3
C03	CAP,ELECT,100MF,6V CE118-110	500D107G006CC7	SPR	1510-21-1101	1
C04 C05 C07 C08	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	4
C10 C11 C12	CAP,ELECT,1MF,25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	3
C13	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
C14 C15 C16 C17 C20	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	5
C18 C19	CAP,F.T.,120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	2
C602	CAP,CER,F.T.,39PF CF114-039	4420-N1500-39PF	AVX	1510-31-0390	1
CR1	DIODE DG000-009	5082-2835	H-P	4809-02-0002	1
CR2	LED DL000-001	NSL5046	NAT	4810-02-0001	1
IC1	IC,IC000-011	78M05UC	FCD	7000-78-0500	1

WAVETEK PARTS LIST	TITLE WIDE OSC LK,M34	ASSEMBLY NO. 1114-00-0008 PAGE: 1	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
IC2	IC,IC000-029	11C440C	FCD	8000-11-4400	1
J1 J2 J3 J4 J5	CONN JF000-005	37JR116-1	S-C	2110-03-0002	5
L02 L03 L04 L05 L07 L08 L09 L10 L11 L12	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	10
R01	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	1
R02 R07	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	2
R03 R08	RES,C,1/4W,5%,47 RC103-047	CF1/4-47	ASE	4700-15-4709	2
R04	RES,C,1/8W,5%,47 RC101-047	CF1/8-47	ASE	4700-05-4709	1
R05	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R06	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
NONE	LEV ASSY	M34S-5	W-I	1218-00-0314	1
NONE	PH LK ASSY	M34S-6	W-I	1218-00-0334	1
NONE	MIXER ASSY	M34S-2	W-I	1219-00-0017	1
NONE	W.B.AMP ASSY	M34S-3	W-I	1219-00-0018	1

WAVETEK PARTS LIST	TITLE WIDE OSC LK,M34	ASSEMBLY NO. 1114-00-0008 PAGE: 2	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
NONE	VID AMP ASSY	M34S-4	W-I	1219-00-0019	1
NONE	VID MIXER ASSY	M34S-7	W-I	1219-00-0020	1

WAVETEK PARTS LIST	TITLE WIDE OSC LK,M34	ASSEMBLY NO. 1114-00-0008 PAGE: 3	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101 C104	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	2
C102 C103	CAP,CER,DISC,.001MF 50V,CD112-210	8101-050-102M	ETP	1510-10-7102	2
C105*	CAP,V.C.,1.5PF CG101-215	VC-1.5PF	V-C	1510-40-0159	1
CR101 CR102	DIODE DP000-040	MA47980	M-A	4805-02-0001	2
CR103 CR104	DIODE DG000-009	5082-2835	H-P	4809-02-0002	2
L101	FERRITE CHOKE,6TURN FROM: 1813-00-0007	LA006-006	W-I	1210-30-0001	1
L102	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
R101 R102	RES,C,1/8W,5%,47K RC101-347	CF1/8-47K	ASE	4700-05-4702	2
R103	RES,C,1/4,5%,27 RC103-027	CF1/4-27	ASE	4700-15-2709	1

WAVETEK PARTS LIST	TITLE MIXER ASSY	ASSEMBLY NO. 1219-00-0017 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201 C204	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	2
C202* C207 C210	CAP,CER,6.8PF,1KV CD101-R68	60C0H6R8D	MDC	1510-10-0689	3
C203	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
C205*	CAP,Q.C.,2.7PF CG101-227	QC-2.7PF	Q-C	1510-40-0279	1
C206	CAP,M-C,4.7PF,10% CG102-247	QC-4.7PF	Q-C	1510-40-1479	1
C208 C209	CAP,CER,15PF,1KV CD101-015	10TCC-Q15	SPR	1510-10-0150	2
L201 L202 L203 L204	RF CHOKE	CHOKE	W-I	1819-99-9999	4
Q201 Q202	TRANS QA050-530	2N5053	APX	4901-05-0530	2
R201	RES,C,1/4W,5%,820 RC103-182	CF1/4-820	ASE	4700-15-8200	1
R202	RES,C,1/4W,5%,560 RC103-156	CF1/4-560	ASE	4700-15-5600	1
R203	RES,C,1/4W,5%,68 RC103-068	CF1/4-68	ASE	4700-15-6809	1
R204	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	1
R205	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1

WAVETEK PARTS LIST	TITLE W.B.AMP ASSY	ASSEMBLY NO. 1219-00-0018 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C301	CAP,CER,F.T.,39PF CF114-039	4420-N1500-39PF	AVX	1510-31-0390	1
C302	CAP,CER,F.T.,27PF CF114-027	4420-N1500	AVX	1510-31-0270	1
C303 C306 C308 C320	CAP,CER,.01MF,50V CD113-310	CY15C103M	C-L	1510-10-8103	4
C304 C305 C307 C309 C310 C312	CAP,CER,FT,2200PF, GMV,CF115-222	4420-2200PF	AER	1510-31-1222	6
C311 C321 C322	CAP,ELECT,1MF,25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	3
C313 C315	CAP,CER,F.T.,120PF CF116-112	4420-Z5F	AVX	1510-31-2121	2
C314	CAP,CER,F.T.,150PF CF116-115	4420-Z5P	AVX	1510-31-2151	1
C316 C317 C318	CAP,CER,F.T.,360PF CF116-136	4200-Z5F-360PF	AVX	1510-31-2361	3
C319	CAP,CER,100PF,1KV CD104-110	101C0-110	SPR	1510-10-3101	1
CR301 CR302 CR303	DIODE,SIL,HOT CAR DG000-013	5082-3188	H-P	4812-02-0002	3
L06 L308	FERRITE CHOKE LA009-010	T1255-2	MYT	1810-05-0002	2

WAVETEK PARTS LIST	TITLE VID AMP ASSY	ASSEMBLY NO. 1219-00-0019 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L301 L302	CHOKE,4.7MH,10% LA005-R47	08N4R7K	ASE	1810-03-0479	2
L303	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	1
L304	CHOKE .47MH 10% LA005-R04	08NR47K	ASE	1810-03-0478	1
L305 L306 L307	CHOKE, 1MH, 10% LA005-R10	08N1R0K	ASE	1810-03-0010	3
Q301 Q302 Q303 Q304	TRANS QA050-530	2N5053	APX	4901-05-0530	4
R301 R308 R310	RES,C,1/8W,5%,22K RC101-322	CF1/8-22K	ASE	4700-05-2202	3
R302 R307 R309 R313	RES,C,1/8W,5%,47 RC101-047	CF1/8-47	ASE	4700-05-4709	4
R303 R305 R311	RES,C,1/8W,5%,2.2K RC101-222	CF1/8-2.2K	ASE	4700-05-2201	3
R304 R306 R312	RES,C,1/8W,5%,390 RC101-139	CF1/8-390	ASE	4700-05-3900	3
R314 R315 R316	RES,C,1/8W,5%,2K RC101-220	CF1/8-2K	ASE	4700-05-2001	3
R317	RES,MF,1/8W,1%,15K RF213-150	MF55K-15K	ASE	4701-03-1502	1
R318	RES,MF,1/8W,1%,1K RF212-100	MF55K-1K	ASE	4701-03-1001	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R319	RES,MF,1/8W,1%,499 RF211-499	MF55K-499	ASE	4701-03-4990	1
R320	RES,MF,1/8W,1%,2.43K RF212-243	MF55K-2.43K	ASE	4701-03-2431	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C401 C404	CAP,ELECT,1MF,25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	2
C402	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	1
C403	CAP,CER,.001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	1
CR401 CR402 CR403 CR404 CR405 CR406 CR407 CR408	DIODE DR000-001	1N4004	P-C	4806-01-4004	8
IC401	IC,IC000-005	RC4558DN	RAY	7000-14-5800	1
Q401 Q402 Q403 Q405	TRANS QA038-541	2N3854A	G-E	4901-03-8541	4
Q404	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
R401 R403	RES,C,1/4W,5%,15K RC103-315	CF1/4-15K	ASE	4700-15-1502	2
R402 R410 R417	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	3
R404 R405	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R406	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R407	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1

WAVETEK PARTS LIST	TITLE LEV ASSY	ASSEMBLY NO. 1218-00-0314 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R408 R409	RES,C,1/4W,5%,7.5K RC103-275	CF1/4-7.5K	ASE	4700-15-7501	2
R411	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R412	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R413	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	1
R414	RES,C,1/4W,5%,330K RC103-433	CF1/4-330K	ASE	4700-15-3303	1
R415	RES,C,1/4W,5%,2.2M RC103-522	CF1/4-2.2M	ASE	4700-15-2204	1
R416	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R418	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	1
R419	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1

WAVETEK PARTS LIST	TITLE LEV ASSY	ASSEMBLY NO. 1218-00-0314 PAGE: 2	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C501	CAP,CER,25PF,1KV CD101-025	60C0G250J	MDC	1510-10-0250	1
C502	CAP,MYLAR,.022MF200V CP101-322	WMF2S22	C-D	1510-60-0223	1
C503	CAP,ELECT,1MF,25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	1
C504 C507	CAP,CER,.05MF,100V CD103-350	TG-S50	SPR	1510-10-2503	2
C505	CAP,CER,150PF,1KV CD102-115	60U151M	MDC	1510-10-1151	1
C506	CAP,CER,470PF,1KV CD102-147	60U471M	MDC	1510-10-1471	1
C508	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	1
C509	CAP,CER,.001MFD,1KV CD102-210	5GA010	SPR	1510-10-1102	1
CR501 CR502 CR503 CR504 CR505 CR506	DIODE DR000-001	1N4004	P-C	4806-01-4004	6
IC501 IC502	DUAL OP AMP,RAYTHEON IC000-027	RC4558DN	RAY	7000-45-5801	2
Q501	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
Q502	TRANS QA054-610	2N5461	MOT	4901-05-4610	1

WAVETEK PARTS LIST	TITLE PH LK ASSY	ASSEMBLY NO. 1218-00-0334 PAGE: 1	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R501	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R502	RES,C,1/4W,5%,82K RC103-382	CF1/4-82K	ASE	4700-15-8202	1
R503	RES,C,1/4W,10%,1.2K	CB1221	A-B	4705-16-1201	1
R504 R510	RES,C,1/4W,10%,3.3K RC104-233AB	CB3321	A-B	4705-16-3301	2
R505	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	1
R506	RES,C,1/4W,5%,12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1
R507 R508	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	2
R509	RES,C,1/4W,10%,2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1
R511	RES,C,1/4W,10%,4.7K RC104-247AB	CB4721	A-B	4705-16-4701	1
R512 R514	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	2
R513 R515	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	2
R516 R519 R521	RES,C,1/4W,5%,33K RC103-333	CF1/4-33K	ASE	4700-15-3302	3

WAVETEK PARTS LIST	TITLE PH LK ASSY	ASSEMBLY NO. 1218-00-0334 PAGE: 2	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R517 R518	RES,C,1/4W,5%,680K RC103-468	CF1/4-680K	ASE	4700-15-6803	2
R520 R522	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	2

WAVETEK PARTS LIST	TITLE PH LK ASSY	ASSEMBLY NO. 1218-00-0334 PAGE: 5	REV F

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C601	CAP,CER,F.T.,18PF CF113-018	4420-N470	AVX	1510-30-9180	1
CR601 CR602	DIODE DG000-009	5082-2835	H-P	4809-02-0002	2
L601	CHOKE,4.7MH,10% LA005-R47	08N4R7K	ASE	1810-03-0479	1
R601	RES,C,1/8W,5%,47 RC101-047	CF1/8-47	ASE	4700-05-4709	1
R602	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
T601	RF XFMR FROM:1813-00-0007	TR001-002	W-I	1210-40-0002	1

WAVETEK PARTS LIST	TITLE VID MIXER ASSY	ASSEMBLY NO. 1219-00-0020 PAGE: 1	REV G

SECTION 7
SCHEMATICS

7.1 INTRODUCTION

This section contains all schematics for the instrument. A schematic index is given in paragraph 7.4.

7.2 SCHEMATIC NOTES

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

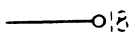
All values are shown in the following units unless otherwise specified.

Components	Units
Resistor	ohms
Capacitor	picofarads
Inductor	microhenries

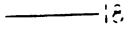
Denotes DC voltage reading in volts unless otherwise specified.

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

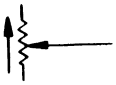
Denotes 50 ohm crystal detector reading in volts unless otherwise specified.



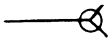
Signal or voltage source.



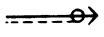
Connects to indicated signal or voltage source.



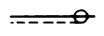
Arrow indicates clockwise rotation of wiper.



Coaxial jack

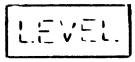


Coaxial plug



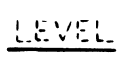
Coaxial cable

Factory adjusted part.

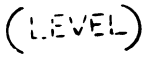


Denotes a front-panel device.

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.

7.3 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	pp	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
dBm	decibel referred to 1 mW	MHz	megahertz	RMS	root-mean-square
dBmV	decibel referred to 1 mV	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	TP	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		

7.4 SCHEMATIC INDEX

ASSEMBLY	NAME	SCHEMATIC NO.
C315	Meter Board	13
C316-2	Modulation Board	4
DPS-2	Power Supply	2
M2M	Sweep Drive	9
M9W	Sweep Oscillator	12
M10W	Output Amplifier	14
M22	DAC	8
M29-1	FM Reference	5
M30-1	Crystal Reference	3
M31	kHz Steps	6
M32	MHz Steps	10
M33-1	Narrow Oscillator Lock	7
M34	Wide Oscillator Lock	11
Model 3001	Wiring Diagram	1

SCHEMATIC 1
MODEL 3001
WIRING DIAGRAM

REV. __

PROGRAM PLUG R.P. J101

	MHz
1	
2	400
3	200
4	100
5	80
6	40
7	20
8	10
9	8
10	4
11	2
12	1
13	.8
14	.4
15	.2
16	.1
17	.08
18	.04
19	.02
20	.01
21	.008
22	.004
23	.002
24	.001
25	
26	
27	
28	
29	
30	
31	
32	+7.3
33	
34	
35	
MOD TP 36	TO C316-2, PIN 5

FREQUENCY

S1 100's MHz — S2 10's MHz — S3 1's MHz — S4 100's KHz — S5 10's KHz — S6 1's KHz

8 4 2 1 C

J103 J104 J105 J106 J107 J108

FREQUENCY PROGRAM

W8 W4

M22 D.A.C. — +18 -18

M32A MHz STEPS — 1 MHz, 1440 MHz, 11 STEPS, 15 T.P. — +7.3 +18 -18 T.P.

M31A KHz STEPS — 1 KHz — +7.3 +18 -18

M34 WIDE OSCILLATOR LOCK — T.P., 40 COMB, W14 — +7.3 +18 -18 T.P.

M9W SWEEP OSCILLATOR — +18 -18

W3

M10W OUTPUT AMPLIFIER — +18 -18

OPTION 3 — M35-1 RF CIRCUIT BREAKER — FROM STEP ATTEN OUTPUT — TO FRONT PANEL RF OUTPUT — T.P. -18 +18 +7.3

W2

STEP ATTENUATOR 50130-1

J113 W1 RF OUT

EXT. REF. INPUT

5 MHz REF OUTPUT

10 MHz

OPTION 6 — M40 HIGH STABILITY REFERENCE 5 MHz — +27 +18 +7.3

OPTION 5 — M39 EXT. REFERENCE — +7.3 -18 +18

M30-1 CRYSTAL REFERENCE — (W13) 1 KHz, (W12) 1 MHz, (W11) 2 KHz, 10 MHz, (W9) 1440 MHz, (W6) 40 COMB, (W10) 120 COMB — +7.3 +18 -18 T.P.

M2M SWEEP DRIVE — +18 -18

W5

M29-1 FM REFERENCE — +18 -18

M33-1 NARROW OSCILLATOR LOCK — T.P., 120 COMB, 2 KHz, W7 — +7.3 +18 -18 T.P.

TO J101-36

J109 — C315 METER BOARD — 1 2 3 4 -18 5 +18 6

J110 — C316-2 MODULATION BOARD — +18 1, -18 2, 3, 4, 5, 6, 7, +7.3 8, 9, 10, 11, 12

EXT. J112

AC LINE PLUG R.P.

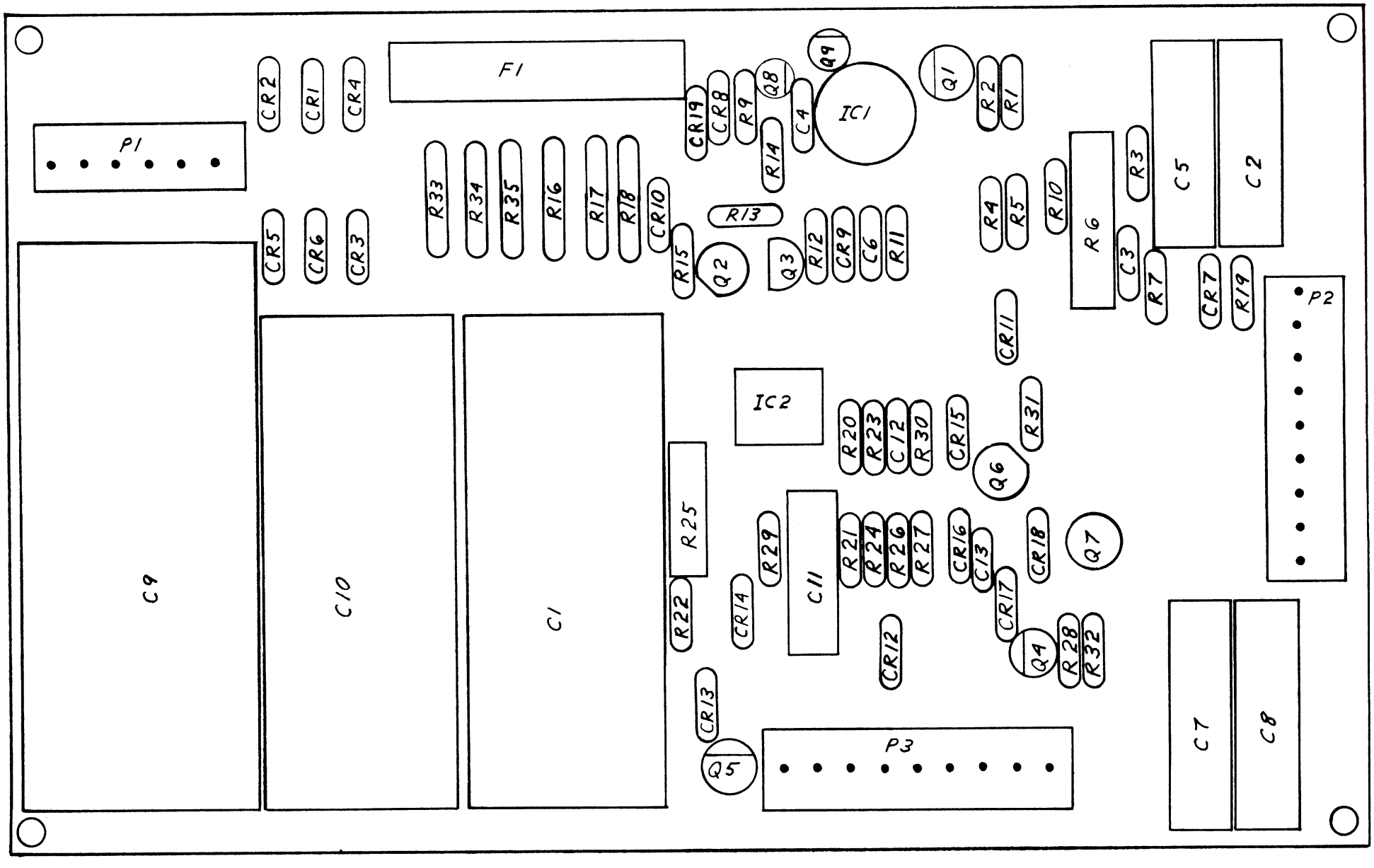
POWER

DPS-2 POWER SUPPLY

1	+27V
2	+18V
3	+18V
4	-18V
5	-18V
6	-27V
7	+7.3V
8	
9	

J102

C352



COMPONENT SIDE OF BOARD

SCHEMATIC 2
POWER SUPPLY
DPS2 / DPS2-1
REV. H

TO CHASSIS WIRING
6 9 1 8 2 3 4 5 7
-27 +27 +18 -18 +7.3
NOTE 1 : C14, R8 ON DPS2-1 ONLY
P2
P.C. CARD
P3

S101 POWER
S102 VOLTAGE SELECT R.P.
T101
BLACK
115
VIOLET
BROWN
230
WHITE
RED
GREEN
R/Y
GREEN
YELLOW
J101 P1
TO CHASSIS WIRING 6 5 4 3 2 1

CR1 CR2 CR3 CR4 CR5 CR6
C1 1500μF
F1 2A
R8 4.7K NOTE 1

R1 2.2K
R2 2.2K
CR7 4.7V
+18
C2 100μF
Q1 2N3854A
Q8 2N3854A
Q9 2N3851A
CR19
R15 1K
R16 5
R17 5
R18 5
CR10
J102
3 GRAY
Q101 2N6099
1 BLUE
2 ORANGE
Q2 2N3644
R14 10K
R13 27K
+27
Q3 MP53702
R9 100K
R12 3.3K
CR9 12V
R11 10K
CR8
C6 10μF
+18V
R19 220
CR11
C7 100μF
CR12
C8 100μF
-18V
6 YELLOW

+18
R7 5.11K
C3 .005μF
R3 499
R6 2K
+18V ADJ.
C4 100
IC1 723C
R4 * 21.5K
R5 3.92K
R10 2.49K
C5 100μF

P1 6 5 4 3 2 1
P2 1 2 3 4 5 6 7 8 9
PIN NUMBERING (COMPONENT SIDE)
P3 987654321

F101 1A SLOW R.P.
GREEN
BLACK
WHITE
P101 AC LINE PLUG R.P.

C12 100
R26 5.11K
R30 1K
CR15
Q6 2N3644
CR16
CR17
C13 120
CR18
Q7 40537
-18
R20 10K
R21 10K
IC2A 1458
C11 10μF
R27 1K
R29 16.5K
R31 2.7K
Q4 2N3854A
R28 1K
R32 470
R33 5
R34 5
R35 5
Q102 2N6099
5 VIOLET
4 WHITE
MATCHED TO .1%

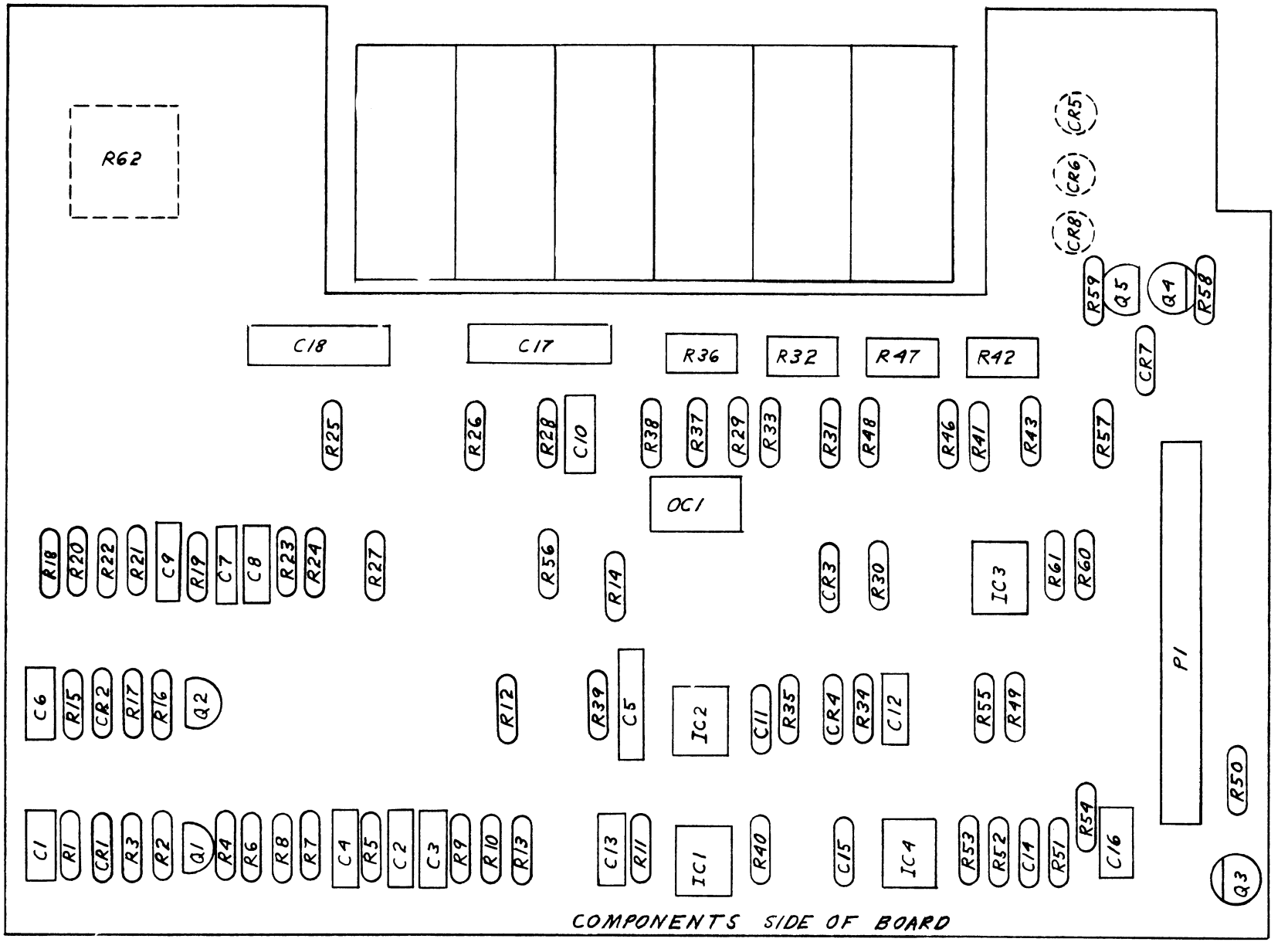
C10 1500μF
Q5 2N3854A
9 BROWN
Q103 2N5294
8 RED
7 GREEN
R22 1K
CR13
C9 10000μF
IC2B 1458
CR14
R25 .13
R23 11.3K
R24 8.06K
C14 100μF
+7.3V
NOTE 1

SCHEMATIC 3
CRYSTAL REFERENCE
M30—1

REV. A

+73V 110mA
+18V 11mA
-18V 53mA
C1 1000
C2 1000
C3 1000
C4 1µF
C5 1µF
C6 1µF
C7 1µF
C8 1µF
L1
L2
L3
C9 100µF
IC1 78M05
C10 100µF
+5V
10 MHz
J1
C101 1µF
L101
L102
L103
L104
L105
L106
L107
C103 1µF
C104 1µF
C105 1µF
C106 1µF
C107 1µF
R101 390
R102 100
Q1 2N5053
R103 1.8K
C102 .01µF
IC101 7474
IC102 8290
IC103 8292
IC104 8292
IC105 8292
J2 TO M31 1KHz
J3 TO M32 1 MHz
J4 TO M33-1 2 KHz
J5 TO M34 40 MHz COMB
C29 200
R22 1K
R23 100
C30 15
R25 100
C28 2200
T1
C26 3.5/13
C27 4.7
R24 10
CR6
R26 100
C31
R27 47K
R28 22K
R29 2.2K
C32 4.7
C34 3.5/13
C36 3.5/13
C39 3.5/13
C43 27
C60 35/13
L15 .22
L19 .22
L20 1
L10
L11
L12 .22
L13 .22
L14 .22
C33 1.1
C35 47
C37 47
C38 1.1
Q6 2N5053
Q7 2N5053
R30 33K
R34 22
C42 3.5/13
C44 10
R36 33K
R37 22
C47 3.5/13
R48 10
L18 .1
Q8 2N5053
R38 47
C46 500
R39 470
R35 10K
R31 10K
C40 2200
R32 47
C41 500
R33 470
L17
L16
C45 2200
C53 .5/3
C55 .5/3
C54 1
L23
L24
L26
J6 TO M32 1440 MHz
Q9 2N5053
C52 10
R43 33K
L21
R44 47
R46 270
C49 10
CR7
C48 100
R40 82
R41 100
R42 10K
R45 47
C56 .75
J7 TO M33-1 120 MHz COMB
Q10 2N5053
C51 10
L25
R47 270
R49 470
C50 .005µF
L22
R18 2.00K
R15 10.2K
Q4 2N3854A
Q3 2N5179
C23 100
R16 15.0K
R17 1.5K
R19 2.00K
Q5 2N3854A
R21 220
C24 2200
R20 1.8K
C25 2200
L9
M39
C57 1000
L27 10
C59
CR8
C58 1000
(5)
R51 34.0K
R52 13.0K
R4 5.11K
R7 100
X1 40 MHz
R14 100
C13 47
L7 .47µH
C14
C16
C17 1.4/9.2
C20 180
LB
C22 20
Q2 2N5053
R5 10.0K
R6 2K
C15 470
CR1
CR2
CR3
R8 2.2K
IC2 741
R12 4.7K
R11 1K
R13 470K
C19 .005
CR4
R10 100K
R9 1K
C18 1000
14
CR5
C21 500
R50 10.0K
LEVELER TEST POINT

C316-2



R44 ✳
AM/FM
MODULATION
VERNIER

S1 ✳
MODULATION
FREQUENCY
SWITCH

S2 ✳
MODULATION
MODE
SWITCH

✳ MOUNTED ON
FRONT-SIDE OF
PC BOARD

SCHEMATIC 4
MODULATION BOARD
C316-2

REV. B

MODULATION FREQUENCY

S1 — DC — 400 Hz — 1000 Hz — EXT.

CR1

R1 * 270K

R2 10M

Q1 2N5458

C1 .47µF

R3 100K

R4 * 5.6M

R5 10M

R6 * 4.7M

TP2

C2 470

C3 470

R7 * 1M

R8 178K

C4 1000

R10 340K

R9 340K

-18

R11 10K

R13 10K

R12 100K

IC1A RC4558

C5 330

R14 470K

1000 Hz OSC.

+18

R43 5.11K

R42 1K 5 VOLT ADJ.

R41 2.74K

AM & FM MODULATION SLIDER

R44 10K

IC3A MC1458

-18

MODULATION MODE

S2

CW

AM

FM x 1

FM x 10

R46 16.5K

FMX1

R48 1.5K

R47 1K

R60 178K

R61 44.2K

+18

IC3B MC1458

R49 1K

P1

3 AM MOD TO METER BOARD

6 FM MOD TO M29-1 PIN 16 & M9W - PIN 1

5 TO J101-36 MOD T.P. REAR PANEL

FREQ VERNIER

+18

R62 10K

9 TO M29-1 - PIN 7

+7.3

S3

4 TO M33-1 - PIN 1

R40 * 620K

EXT. MOD INPUT

R56 620

ACCURACY

VERNIER

CR5

.001 %

CR6

CR7

+18

R57 10K

8 TO +7.3V 30 mA

+7.3

C16 10µF

Q4 2N3859A

R58 10K

R59 10K

Q5 MPS3702

EXTERNAL

CR8

1 TO +18V 17 mA

+18

C17 10µF

C13 .47µF

+18

R39 18K

R38 47K

R37 10M

-18

BALANCE

+18

R36 20K

TP1

CR2

R18 * 5.6M

R15 * 390K

R16 10M

Q2 2N5458

C6 .47µF

R17 270K

R19 22M

R20 * 22M

TP3

C7 470

C8 470

R21 * 4.7M

R22 464K

C9 1000

R24 845K

R23 845K

+18

-18

R25 10K

R27 10K

R26 100K

IC2A RC4558

C10 1000

R28 560K

400 Hz OSC.

+18

R29 7.5K

OC-1

TP4

C11 .001µF

IC2B RC4558

R35 1M

CR4

R34 1M

C12 .47µF

CR3

-18

R30 270K

R31 4.87K

SIZE

R32 1K

R33 12.1K

+18

+7.3

R50 200

R52 330

Q3 2N3859A

R51 4.7K

IC4 MC1455

R54 100K

R53 22M

R55 47M

C15 .01µF

-18

2 TO -18V 15mA

-18

C18 10µF

10 TO M39 - PIN 8

C14 .05µF

7 UNLOCK INPUT 0 V LOCK +18V UNLOCK

11 N.C.

12

UNLOCK FLASHER

SCHEMATIC 5
M29-1
FM REFERENCE

REV.___

MODULATION INPUT ±5V FROM C316-2

C1 6.8

R1 2K 2.5 MHz ADJ.

R2 5.11K

C7 68

CR1

R12 110K

IC1 LM301

R3 1K

C3 .01μF

C4 150

C5 .01μF

R4 2K

C6 .003μF

R5 1K

R7 2K

R8 249

Q1 TD401

R10 1K

R6 110K

R9 499

+18

-18

FREQ VERNIER INPUT

VOLTS	KHz
+18	10
0	0

R59 1M

C29 6.8

PLL #5 FROM M33-1

VOLTS	KHz
+10	+45
0	0
-10	-45

R60 48.7K

C30 6.8

IC2 LM301

C8 .01μF

C9 .01μF

C10 150

R16 1K

R15 110K

R13 150K

R17 5.11K

CR10

R18 20K 2MHz ADJ.

R19 1K

R58 4.02K

R14 499

Q2 MPS3702

R20 4.02K

R21 249

Q3 TD101

CR2

R22 1K

R23 4.02K

R25 1K

CR3

CR4

CR5

CR6

C11 7/35

C12 68

C13 470

R26 33.2

Q4 2N3854A

Q5 2N5139

R28 100

C19 .01μF

R29 5.11K

Q6 AD3958

R30 499

Q7 2N5139

R32 499

C27 .01μF

C20 .001μF

CR7

R34 845

R33 499

C21 100

R43 15K

C28 20

R44 499

J1 OUTPUT TO M33-1

R45 174

Q10 2N5139

R46 100

C24 .01μF

C23 20

R37 1.5K

Q8 2N3640

Q9 2N3640

R38 2K

R40 2K

CR8

CR9

R41 100

R39 100

R42 100

IC3 CA3049

R35 1.1K

R36 1.5K

R50 1.1K

R51 1.5K

R54 15K

R55 2.49K

R47 357

C25 .01μF

R56 5.11K

R48 2.1K

CR11

R57 5.11K

R49 357

C26 .01μF

L1

C15 10μF

C16 1000

+18V 52mA

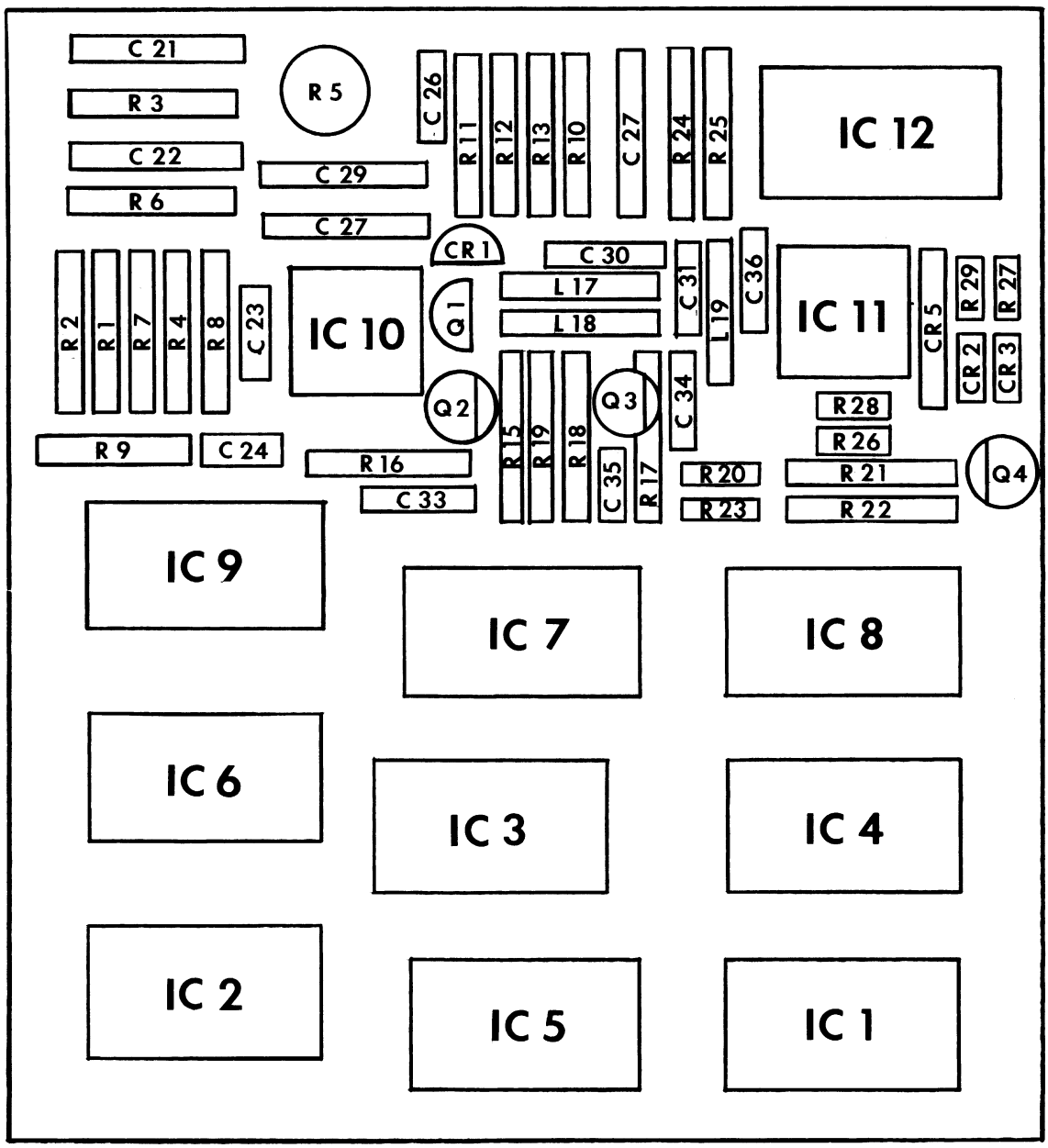
L2

C17 1000

C18 10μF

-18V 52mA

M31A


C 21
R 3
C 22
R 6
R 5
C 29
C 27
C 26
R 11
R 12
R 13
R 10
C 27
R 24
R 25
IC 12
CR 1
C 30
L 17
L 18
C 31
L 19
C 36
IC 11
CR 5
R 29
R 27
CR 2
CR 3
R 2
R 1
R 7
R 4
R 8
C 23
IC 10
Q 1
Q 2
Q 3
C 34
R 28
R 26
R 9
C 24
R 16
C 33
R 15
R 19
R 18
C 35
R 17
R 20
R 23
R 21
R 22
Q 4
IC 9
IC 7
IC 8
IC 6
IC 3
IC 4
IC 2
IC 5
IC 1

SCHEMATIC 6
KHz STEPS
M31A

FROM CRYSTAL REF.
1KHz REFERENCE
INPUT
J1

BCD KHz FREQ PROGRAM

800KHz C1 1000 L1
400KHz C2 1000 L2
200KHz C3 1000 L3
100KHz C4 1000 L4
80KHz C5 1000 L5
40KHz C6 1000 L6
20KHz C7 1000 L7
10KHz C8 1000 L8
8KHz C9 1000 L9
4KHz C10 1000 L10
2KHz C11 1000 L11
1KHz C12 1000 L12

IC1 7404
IC2 7404
IC3 8290
IC4 8290
IC5 8290
IC6 8290
IC7 74H102
IC8 74H11
IC9 11C44
IC10A 4558
IC10B 4558
IC11 741
IC12 7404
IC13 78M05

R1 4.7K
R2 4.7K
R3 30K
R4 30K
R5 2K
R6 30K
R7 30K
R8 47K
R9 68K
R10 6.8K
R11 6.8K
R12 3.3K
R13 10K
R14 6.8K
R15 30.1K
R16 4.32K
R17 19.6K
R18 19.6K
R19 2.10K
R20 1.8K
R21 1K
R22 10K
R23 15K
R24 2.7K
R25 10K
R26 30K
R27 47K
R28 160K
R29 20K
R30 1.8K

C21 .12µF
C22 .12µF
C23 1µF
C24 1µF
C25 10µF
C26 1µF
C27 .12µF
C28 10µF
C29 .12µF
C30 1000
C31 10
C32 10µF
C33 180
C34 180
C35 .001µF
C36 .001µF
C37 10µF
C17 100µF
C18 100µF
C19 10µF
C20 10µF
C13 1000
C14 1000
C15 1000
C16 1000

L17 2.2
L18 .47
L19 .22
L13
L14
L15
L16

Q1 2N5458
Q2 2N5306
Q3 2N3854A
Q4 2N3854A
CR1 MV2301
CR2
CR3
CR4
CR5

TO WIDE
OSC. LOCK
J2

10.000
TO
9.001
MHz
OUTPUT

UNLOCK
INDICATOR

PIN 6
+7.3v

PIN 7
+18v

PIN 8
-18v

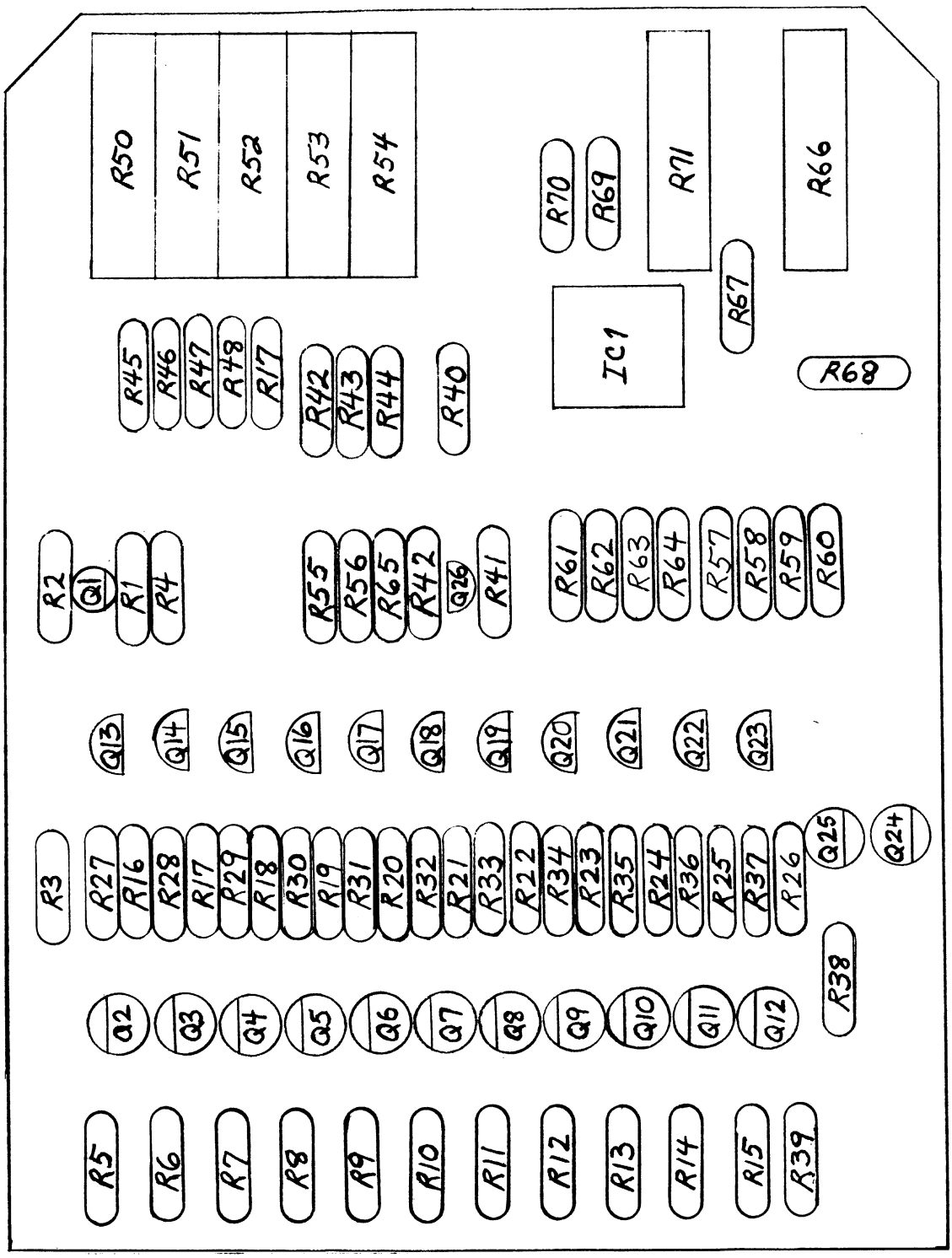
PIN 5
UNLOCK OUTPUT

SCHEMATIC 7
NARROW OSCILLATOR LOCK
M33-1

REV. A

T.P.
VIDEO T.P.
UNLOCK IND.
1200 MHz (120 COMB) FROM M30-1 (-12 dBm)
NAR. V.C.O. FROM M9W (.2V)
19-2.1 MHz FROM M29-1
2 KHz FROM M 30-1
UNLOCK OUTPUT TO C316-2
Ø LOCK OUTPUT TO M9W
Ø LOCK OUTPUT TO M29-1 PIN 6
TO C316-2 PIN 4 7.3V IN CAL
+7.3V (62 mA)
+18V (25 mA)
-18V (20 mA)

M22



COMPONENT SIDE OF PC BOARD

SCHEMATIC 8
D.A.C.
M22

REV C

MHz FREQUENCY PROGRAM, BCD NEGATIVE LOGIC FROM F.P. SWITCHES

400 200 100 80 40 20 10 8 4 2 1

2 3 4 16 15 14 13 12 11 10 9

C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 1000 (11)

+18 +18

R1 15K R4 470

Q1 2N5306

R2 3.3K R3 220

R5 1K R6 1K R7 1K R8 470 R9 1K R10 1K R11 1K R12 470 R13 1K R14 1K R15 1K

Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 2N3854A (11)

R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 4.7K (11)

R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37 22K (11)

+18

Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 MPS3702 (11)

R65 35.7K

R64 44.2K

R63 88.7K

R62 178K

R61 357K

R45 8.06K R46 16.9K R47 34.0K R48 42.2K R49 86.6K

R50 2K R51 2K R52 5K R53 5K R54 5K

R55 178K R56 357K R57 442K R58 887K R59 1.78M R60 3.57M

R67 2.43M

R66 100K

+18 -18

C12 1000 7 +18V 31mA

C13 1000 8 -18V 10mA

+18

R40 3.3K

Q26 MPS3702

R41 20K

R42 17.8K

R38 270K Q24 2N3854A

R39 270K Q25 2N3854A

MHz 0 20 39

V 0 -4.0 -7.8

R72 330K

R43 4.02K

+18 -18

IC1A 1458

C14 6.8

5 ANALOG PROGRAM TO M32

R44 2.74K

R70 8.25K R71 20K

R69 2.43K

+18 -18

IC1B 1458

R68 2.43K

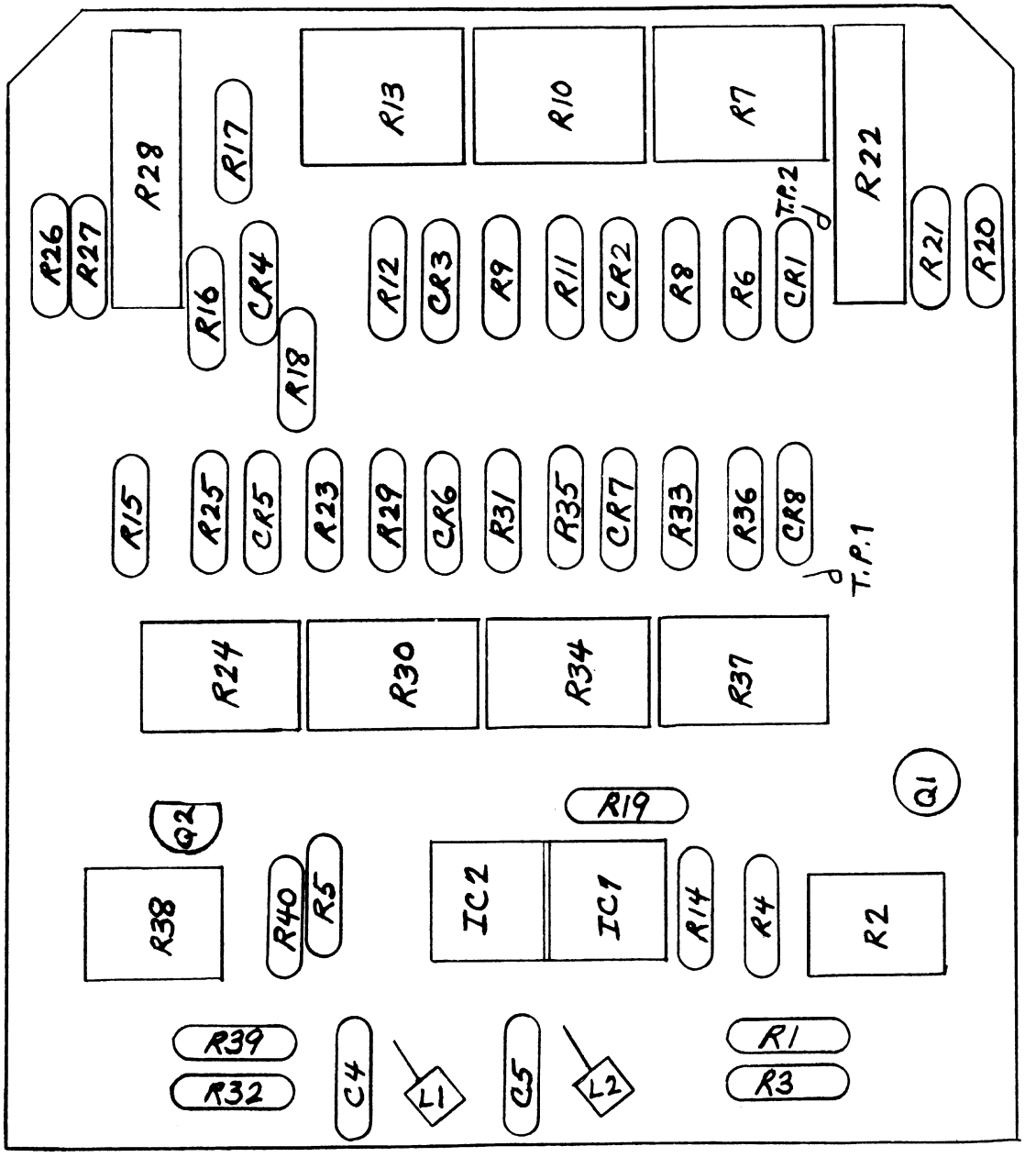
C15 6.8

6 ANALOG PROGRAM TO M2M

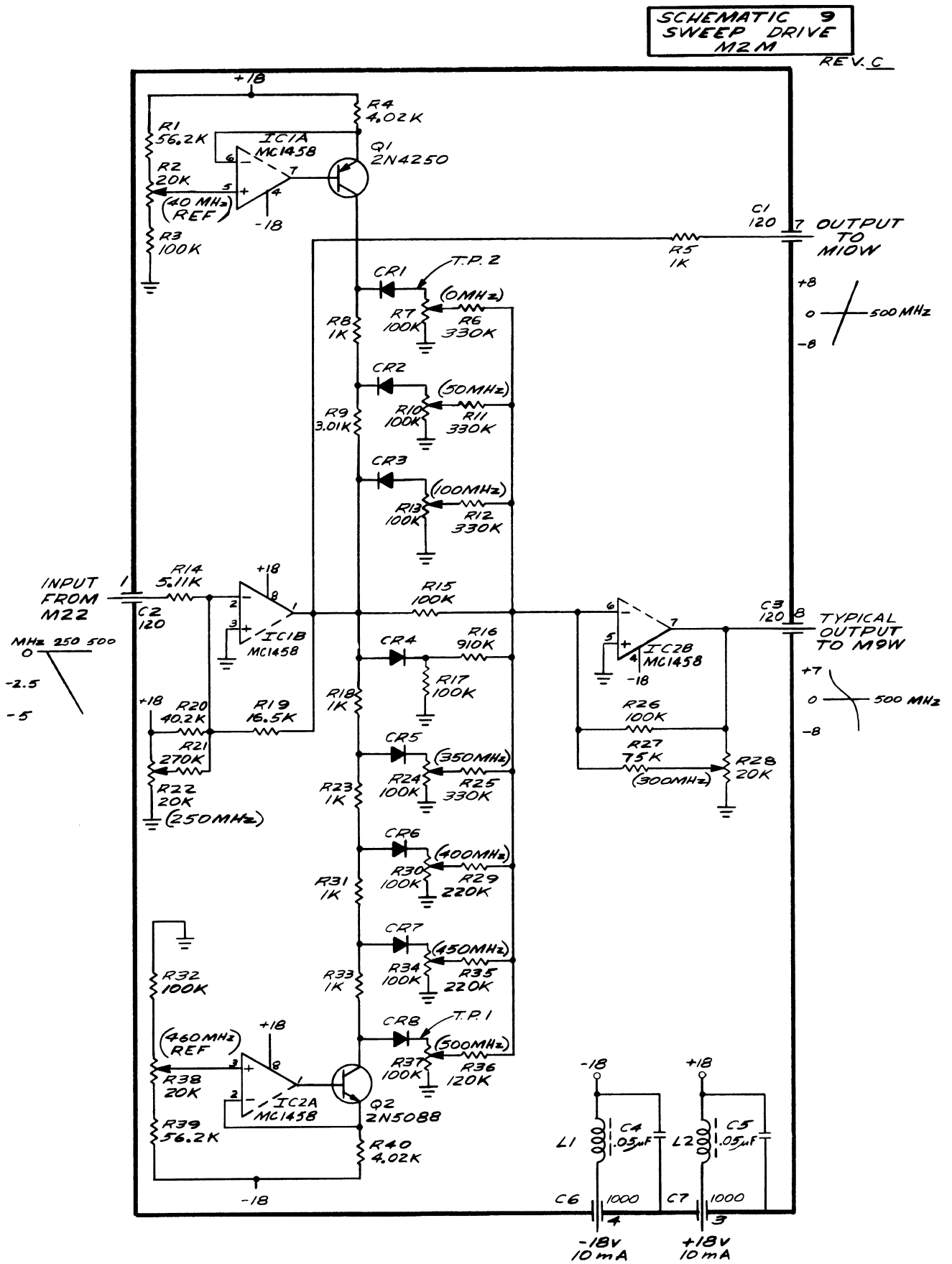
MHz 0 250 500

V 0 -2.5 -5.0

M2M



COMPONENT SIDE OF PC BOARD


SCHEMATIC 9
SWEEP DRIVE
M2M
REV. C
+18
R4
4.02K
R1
56.2K
IC1A
MC1458
Q1
2N4250
R2
20K
(40 MHz)
REF
R3
100K
-18
C1
120
OUTPUT
TO
M10W
R5
1K
+8
0
-8
500 MHz
CR1
T.P. 2
(0MHz)
R8
1K
R7
100K
R6
330K
CR2
(50MHz)
R9
3.01K
R10
100K
R11
330K
CR3
(100MHz)
R13
100K
R12
330K
INPUT
FROM
M22
C2
120
R14
5.11K
IC1B
MC1458
R15
100K
CR4
R16
910K
R17
100K
R18
1K
R20
40.2K
R19
16.5K
R21
270K
R22
20K
(250MHz)
CR5
(350MHz)
R24
100K
R25
330K
R23
1K
CR6
(400MHz)
R30
100K
R29
220K
R31
1K
CR7
(450MHz)
R34
100K
R35
220K
R33
1K
R32
100K
CR8
T.P. 1
(500MHz)
R37
100K
R36
120K
(460MHz)
REF
R38
20K
IC2A
MC1458
Q2
2N5088
R39
56.2K
R40
4.02K
-18
MHz 250 500
0
-2.5
-5
IC2B
MC1458
C3
120
TYPICAL
OUTPUT
TO M9W
+7
0
-8
500 MHz
R26
100K
R27
75K
(300MHz)
R28
20K
L1
C4
.05μF
L2
C5
.05μF
C6
1000
C7
1000
-18V
10 mA
+18V
10 mA

SCHEMATIC 10
M32A
1 MHz STEPS

UNLOCK INDICATOR
CR3

1448 - 1487 OUTPUT TO WIDE OSC LOCK
0dBm
J3

1440 MHz FROM CRYSTAL REF.
J2
R1 68

MIXER
CR301 CR302
C301 500
R301 47K
CR303
C302 .001μF
C303 .001μF
CR304
L301
T301
J301
L302
UHF T.P.
C304 .001μF
R302 47K
R303 390
C306 1.1
C305 500
-18
R2 2K

C25 500
+18
C13 3.9

R3 430
R4 4.7K
C19 .62μF
L11
Q1 2N5053
R5 1K
C16 500
L13 10T
C17 500
R10 1K
C18 3.9
L20
R11 4.7K
R12 470
Q3 BFR90
C20 1.1
L14
C15
L12
R7 2.7
C21 .3/1.2
R4 10K
R8 4.7K
Q2 A430
L15 .22
R9 499
C19 500
-18
C22
CR1 100
R13 820
C23 100
CR2
C24 1μF

OSCILLATOR CONTROL BOARD
J5 P202
R201 6.8K
IC201A RC4558
R206 SWEEPWIDTH 20K
R202 10K
R204 47K
R205 CENTERING 20K
R203 10K
R207 15K

OC201
+5
R208 2.0K
C210 1μF
R209 220K
IC202 RC4558
R214 470K
OC202
R215 (MAX. GAIN ADJ.) 20K
R213 (MIN. GAIN ADJ.) 5K
C211 1μF
R227 1.2K
R228 1.8K
CR204
CR203

VIDEO AMPLIFIER
R404 3.3K
R403 2.7K
R405 1K
R408 820
C402 .005μF
L401 .10μH
C401 120
R406 2.7K
Q401 2N5053
Q402 2N5053
J104
C403 39
J4
R401 820
R402 10
R407 820
R409 10

L103 10T
L104 10T
+5
R108 499
C104 .1μF
R109 100K
R107 1K
P101
Q101 2N5053
J101
CR104
C105 .001μF
R106 15K
C103 360
R105 2.1K
L102 10T
C102 .1μF
P201
R210 15K
C201 .005μF
IC203B RC4558
C202 .001μF
R211 10K
R212 1K
C
-18

1MHz FROM CRYSTAL REF.
J1

DIGITAL DIVIDER BOARD
BCD MHz
(10) (100) (20) (8) (4) (2) (1)
L2 - L8 10T (TYP.)
C4 C5 C6 C7 C8 C9 C10
J4
P101
R101A-G 4.7K (TYP.)
IC101 74S288
IC102 82S90
IC103 82S90
IC104 74S112
CR101 CR102 CR103
R102 4.7K
1000 (TYP.)
C101 10μF
J102
L101 10T
F
C203 1μF
+5
R103 33
R104 1.2K
E
VIDEO T.P.
IC105 11C44
R110 4.7K
B
C204 150
R111 4.7K
A
C205 150
P101
J4
B

R219 30K
R222 6.8K
C207 .047μF
R216 30K
R218 (BALANCE) 2K
R221 6.8K
IC201B RC4558
C206 .047μF
R217 30K
R220 30K
C208 10μF
P202
J5
+18
C209 10μF
-18

CR201
CR202
R223 100K
R225 220K
IC203A RC4558
R224 100K
R226 220K

IC 1 78M05
C2 100μF
L1 10T
C1 10μF
C3 1000
+7.3
C30 .1μF
L9 10T
C11 1000
+18
C31 .1μF
L10 10T
C12 1000
-18

L16 10T
C26 470
14
LEVELER T.P.
C27 470
11
C28 470
15
C29 470
12
0/-7.8 ANALOG PROGRAM
PLL T.P.
UNLOCK OUTPUT

SCHEMATIC II
WIDE OSCILLATOR LOCK
M34

REV. F

VIDEO T.P.

LEVELER T.P.

FROM SWEEP OSC.

1448
1487
FROM MHz STEPS

40 MHz COMB FROM CRYSTAL REFERENCE

10-9 MHz FROM KHz STEPS

PHASE DETECTOR OUTPUT TO SWEEP OSC.

UNLOCK OUTPUT TO MOD. BOARD

TO SPEED-UP CKT. SWEEP OSC.

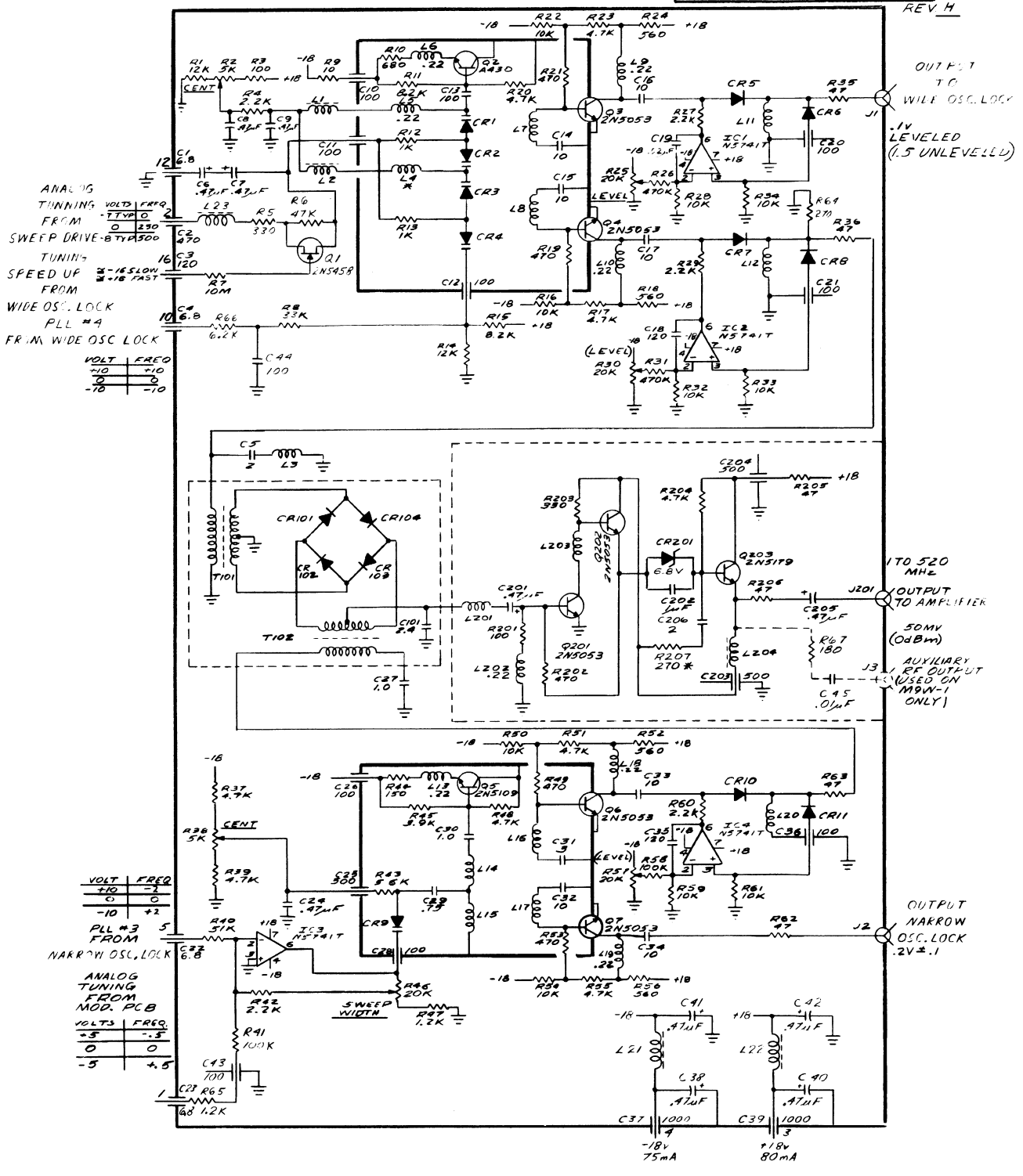
+7.3V 61 mA

-18V 23 mA

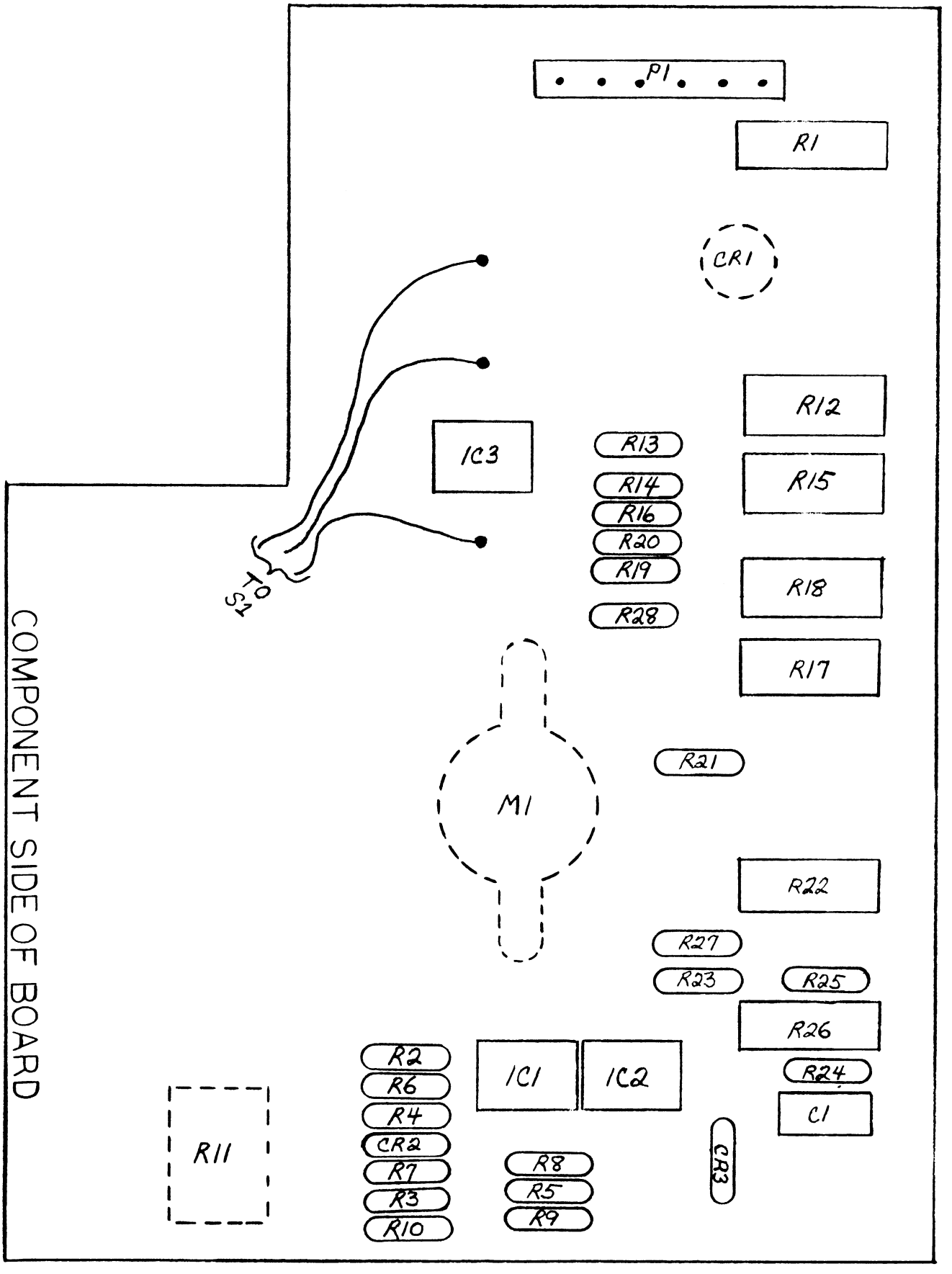
+18V 36 mA

SCHEMATIC 12
WIDE SWEEP OSCILLATOR
1198 TO 1718 MHz
M9W/M9W-1

REV H



C315


P1
R1
CR1
R12
IC3
R13
R15
R14
R16
R20
R19
R18
R28
R17
TO S1
M1
R21
R22
R27
R23
R25
R26
R24
C1
R2
R6
R4
CR2
R7
R3
R10
IC1
IC2
R11
R8
R5
R9
CR3
COMPONENT SIDE OF BOARD

SCHEMATIC 13
METER BOARD
C315

REV. E

P1
+18V (17ma) 6 → +18
-18V (17ma) 5 → -18
MODULATION INPUT (FROM MODULATION BOARD PIN 3) 4
UNLEVEL CKT. (FROM M10W, PIN1) 3
LEVEL PROG. (TO M10W, PIN5) 2
1

UNLEVELED CR1

% MOD R1 2K

R2 8.2K

R3 36.5K

R4 CR2 33K

R5 10K

R7 20K

R8 2.74K

R6 10K

R9 11.3K

R10 3.92K

IC1A IC1B

-4.9

VERNIER R11 10K

-1.3

IC2A

LEVEL SET-UP

IC3A

R11 C≅-2.5 C≅-0.7

R13 5.6K

R14 220K

R16 10K

R12 20K +13

R15 20K +3

+10 dBm RANGE

S1 1V N.O.

.3 TO 1μV

MICRO SWITCH MOUNTED ON ATTENUATOR, AND OPERATED BY ARM FASTENED TO ATTENUATOR SHAFT.

IC3B

R11 C≅-0.7 C≅-0.15

R28 33K

R19 1M

R20 10K

R17 20K +3

R18 20K -6

0 dBm RANGE

IC1, IC2, & IC3 = MC1458PI

CAL

R24 6.8K

R25 100K

R26 20K

C1 .47μF

CR3

R23 20K

IC2B

R21 15.8K

BAL R22 2K

R27 15K

M1 METER

METER CKT

SCHEMATIC 14
OUTPUT AMPLIFIER
M10W

REV K

RF INPUT ≅ -10dBm FROM M9W

J1

CR1

CR4

C5 47pF

Q2 2N3053

R14 10

+18

R15 100

R24 220

C12 .01µF

C10 500

C11 500

R16 820

Q3 2N5053

R23 27

C13 .47µF

R22 560

L4

C14 .47µF

R17 56

L3

R13 150

L2

KB 47

CR3

R7 330

C4 200

R6 1K

C3 200

R1 47

L1

R54 15K

Q6 SD1006

R29 360

L6

Q7 A430

R30 1.5K

L5

R31 10

R32 82

R33 27

C22 4.7

C23 10

R27 470

R28 82

C15 10µF

R34 22

C16 15

L7

C24 10µF

R35 82

R26 10

R36 10

C17 .01µF

L8

Q10 SD1006

R45 47

Q11 SD1006

C34 .10

C29 .47µF

R51 47

RF OUTPUT >+13dBm TO STEP ATTENUATOR

J2

CR8

CR9

L13

L12

R44 39K *

R43 33K *

-18

R42 150

R40 100

C28 100

CR10

R50 33K

CR11

CR12

L15

CR13

R52 82 *

C30 500

R49 18K *

+18

R53 100

R41 10

L11

C25 10µF

L14 10 mH

R18 220

+18

C32 10µF

C9 .005

C6 200

R11 4.7K

R12 1K

C2 120 *

R9 1.2K

Q4 MPS3702

C7 47

C8 120

CR5

Q1 TD101

Q5 MPS3702

LEVEL CONTROL INPUT FROM METER BOARD

J5

R2 1K

CR2

R5 10K

C1 6.8

R3 47K

R4 560K

+18

R10 10K

R19 560K

+18

-18

R20 47K

R21 4.7K

R25 220

C33 470

R37 47K

Q9 2N3854A

R38 10K

Q8 2N3854A

CR7

R39 7.5K

CR6

R40 10K

-18

R48 620

C31 1000

TO UNLEVEL LIGHT ON METER BOARD

L9

-18

C19 .01µF

C18 1000

4

-18V 190mA

L10

+18

C21 .01µF

C20 1000

3

+18V 35mA

R47 1K

C27 1000

8

0 MHz 500 +8 VOLTS -8

FROM M2M

SECTION 8
MANUAL CHANGES & OPTIONS

8.1 INTRODUCTION

This section contains descriptions of engineering updates as well as corrections to any errors in the manual. Also in this section is the necessary information to document the options which have been ordered with this instrument.

8.2 MANUAL CHANGES

WAVETEK's product improvement program incorporates the latest electronic developments into these instruments as rapidly as development and testing permit. Due to the time required to document and print these instruction manuals, it is not always possible to include the change information in the current printing. The following changes should be made to this manual:

MODEL 3001 CHANGES

M31A has replaced M31. M32A has replaced M32. M2M-1 has replaced M2M. All references to M31, M32, M2M should be updated (see also attached addendum.

PAGE	CORRECTION
5-12	Section 5.4.2 - Add "M31A.....6" to list of PC diagrams.
6-1	The M29-1 Parts List (1114-00-0015) was omitted from the index. It should be inserted between lists M22 (1114-00-0017) and M30-1 (1114-00-0024). The actual list appears in its proper position within the section.
3-20	Figure 3-18 - The arrow from the "1 MHz" balloon should point to the "÷N" output instead of the "Window Detector" input.
M9W SCH	J201 - Output level should read "50 mV (-10 dBm)".
M10W SCH/PL	R45 is now specified "A-B only". C34 is now .27 pF instead of .1 pF. Wavetek P/N is 1510-40-1278.
M30-1 SCH/PL	C14 and C16 are now both factory selected values determined in calibration.

M32A SCH

C16 and C25 are actually the same capacitor, thus the junction of C16 and R5 should be connected to the junction of C25 and C301, with C25 then being deleted. Also, pin 3 of IC105 should be connected directly to pin 2 of IC102, and not to CR103.

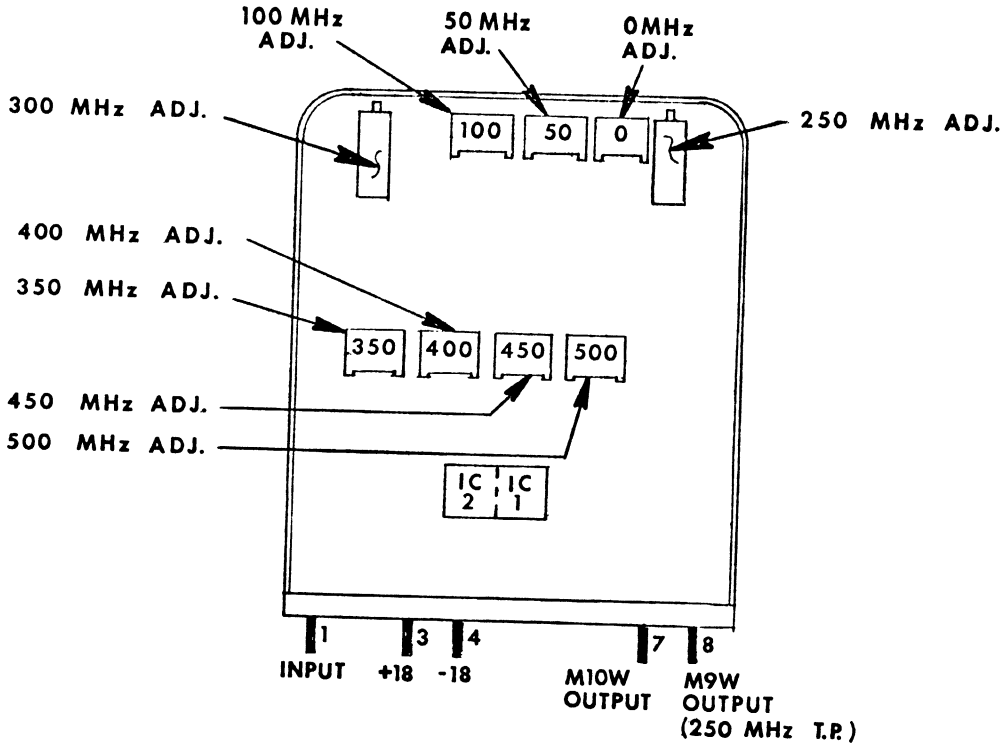
8.3 OPTIONS

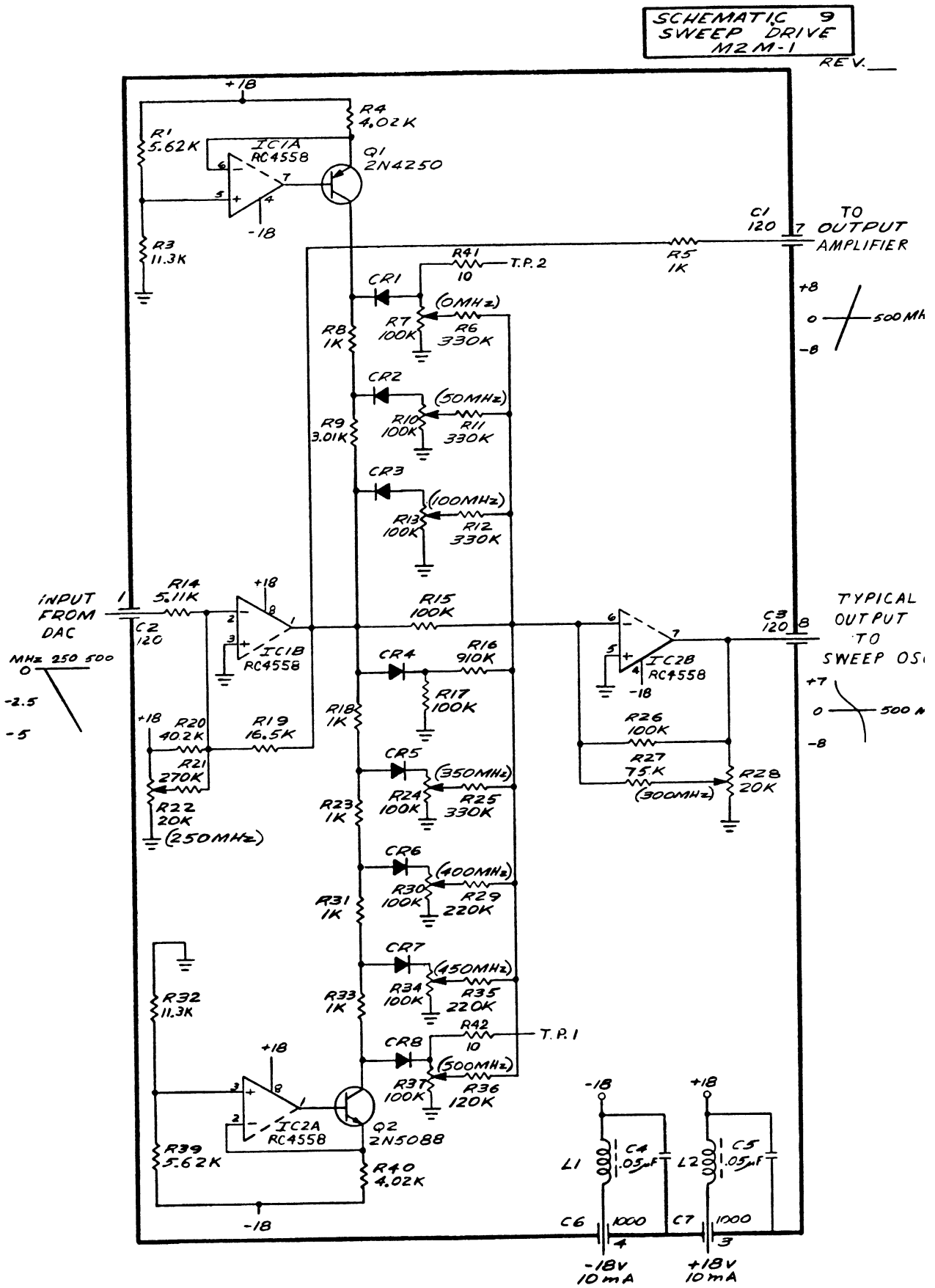
Refer to Section 1.3 for a list of the options available with this instrument. The option documentation includes the operation, theory of operation, maintenance, list of replaceable parts, and schematics.

M2M-1 SUBSTITUTION

This instrument is equipped with an M2M-1 Sweep Drive module instead of an M2M module. The M2M-1 is a refinement of the M2M. It performs the same function, operates according to the same basic theory of operation, and is pin-for-pin compatible with the M2M.

The major difference for the operator is that the Linearity controls are now accessible from the top of the instrument, thus eliminating the need to remove a side cover (Section 5.1) for calibration.




SCHEMATIC 9
SWEEP DRIVE
M2M-1
REV.
+18
R4
4.02K
R1
5.62K
IC1A
RC4558
Q1
2N4250
-18
R3
11.3K
C1
120
TO
OUTPUT
AMPLIFIER
R5
1K
R41
10
T.P. 2
CR1
(0MHz)
R7
100K
R6
330K
R8
1K
CR2
(50MHz)
R10
100K
R11
330K
R9
3.01K
CR3
(100MHz)
R13
100K
R12
330K
INPUT
FROM
DAC
MHz 250 500
0
-2.5
-5
R14
5.11K
C2
120
IC1B
RC4558
R15
100K
R16
910K
CR4
R17
100K
R18
1K
R20
40.2K
R19
16.5K
R21
270K
R22
20K
(250MHz)
CR5
(350MHz)
R24
100K
R25
330K
R23
1K
CR6
(400MHz)
R30
100K
R29
220K
R31
1K
CR7
(450MHz)
R34
100K
R35
220K
R33
1K
R32
11.3K
R42
10
T.P. 1
CR8
(500MHz)
R37
100K
R36
120K
IC2A
RC4558
Q2
2N5088
R39
5.62K
R40
4.02K
IC2B
RC4558
C3
120
TYPICAL
OUTPUT
TO
SWEEP OS
R26
100K
R27
75K
(300MHz)
R28
20K
+8
0
-8
500 MH
+7
0
-8
500 K
L1
C4
.05μF
L2
C5
.05μF
C6
1000
C7
1000
-18V
10mA
+18V
10mA

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1 C2 C3	CAP,F.T.,.120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	3
C4 C5	CAP,CER,.05MF,100V CD103-350	TG-850	SPR	1510-10-2503	2
C6 C7	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	2
CR1 CR2 CR3 CR4 CR5 CR6 CR7 CR8	DIODE DR000-001	1N4004	P-C	4806-01-4004	8
IC1 IC2	IC,IC000-005	RC4558DN	RAY	7000-14-5800	2
L1 L2	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	2
Q1	TRANS-QA042-500	2N4250	FCD	4901-04-2500	1
Q2	TRANS QA050-880	2N5088	MOT	4901-05-0880	1
R01 R39	RES,MF,1/8W,1%,5.62K RF212-562	MF55K-5.62K	ASE	4701-03-5621	2
R03 R32	RES,MF,1/8W,1%,11.3K RF213-113	MF55K-11.3K	ASE	4701-03-1132	2
R04 R40	RES,MF,1/8W,1%,4.02K RF212-402	MF55K-4.02K	ASE	4701-03-4021	2
R05	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1

WAVETEK PARTS LIST	TITLE SWEEP DRIVE,M2M-1	ASSEMBLY NO. 1114-00-0226 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R06 R11 R12 R25	RES,C,1/4W,5%,330K RC103-433	CF1/4-330K	ASE	4700-15-3303	4
R07 R10 R13 R24 R30 R34 R37	POT,CONT,100K RP131-410	360T104B	CTS	4610-00-3104	7
R08 R18 R23 R31 R33	RES,MF,1/8W,1%,1K RF212-100	MF55K-1K	ASE	4701-03-1001	5
R09	RES,MF,1/8W,1%,3.01K RF212-301	MF55K-3.01K	ASE	4701-03-3011	1
R14	RES,MF,1/8W,1%,5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	1
R15 R26	RES,MF,1/8W,1%,100K RF214-100	MF55K-100K	ASE	4701-03-1003	2
R16	RES,C,1/4W,5%,910K RC103-491	CF1/4-910K	ASE	4700-15-9103	1
R17	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R19	RES,MF,1/8W,1%,16.5K RF213-165	MF55K-16.5K	ASE	4701-03-1652	1
R20	RES,MF,1/8W,1%,40.2K RF213-402	MF55K-40.2K	ASE	4701-03-4022	1
R21	RES,C,1/4W,5%,270K RC103-427	CF1/4-270K	ASE	4700-15-2703	1

WAVETEK PARTS LIST	TITLE SWEEP DRIVE,M2M-1	ASSEMBLY NO. 1114-00-0226 PAGE: 2	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R22 R28	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	2
R27	RES,C,1/4W,5%,75K RC103-375	CF1/4-75K	ASE	4700-15-7502	1
R29 R35	RES,C,1/4W,5%,220K RC103-422	CF1/4220K	ASE	4700-15-2203	2
R36	RES,C,1/4W,5%,120K RC103-412	CF1/4-120K	ASE	4700-15-1203	1
R41 R42	RES,C,1/4W,5%,10 RC103-010	CF1/4-10	ASE	4700-15-1009	2

WAVETEK PARTS LIST	TITLE SWEEP DRIVE,M2M-1	ASSEMBLY NO. 1114-00-0226 PAGE: 3	REV

DPS2A SUBSTITUTION

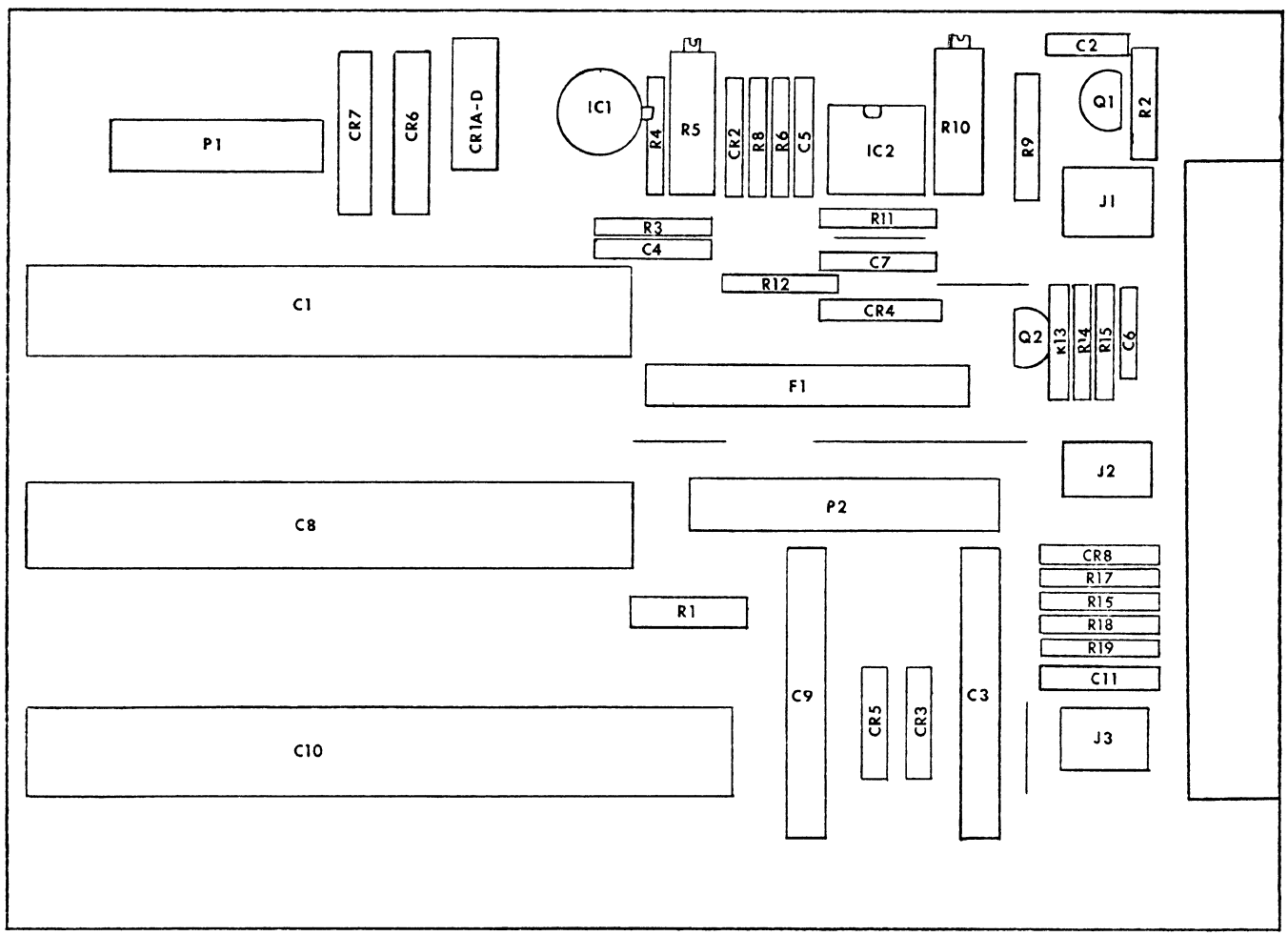
This instrument is equipped with Power Supply DPS2A instead of DPS2. The DPS2A is an improvement on the DPS2 offering improved noise performance and stability. The DPS2A calibration procedure follows.

Allow a two-minute warm-up.

Connect a DVM to pin 3 of the Crystal Reference (M30-_) module. Set the +18 V Adj. control (R5) for a reading of +18.00 V. Connect the DVM to pin 4 of the Crystal Reference module. Set the -18 V Adj. control (R10) for a reading of -18.00 V.

NOTE: The -18 V supply tracks the +18 V supply; therefore, the +18 V supply must be adjusted first.

DPS2A



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
23	PC ASSEMBLY, DPS2A	1218-00-0250	W-I	1218-00-0250	1
24	LINE CORD ASSEMBLY	1219-00-0144	W-I	1219-00-0144	1
F101	FUSE,S.B.,1 AMP MF000-010	MDL-1	BUS	2410-05-0005	1
IC101	POS, VOLTAGE REG.	LM317T	NAT	7000-03-1700	1
J101	CONN,6-PIN,KONEKTON MC000-076	09-50-3061	MOL	2113-06-0002	1
18	CONTACT,MC000-131	08-50-0106	MOL	2113-07-0002	5
J201	RECEPTACLE	19-09-1042	MOL	2113-26-0002	1
Q101 Q102	PROT PWR DARLINGTON	LM395T	NAT	4902-00-3950	2
S101	SWITCH,SLIDE,DPDT	EPSI-SLI	S-I	5105-00-0011	1
T101	XFMR,PWR	8720	A-M	5610-00-0027	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	POWER SUPPLY,DPS2A	1115-00-0011 PAGE: 1	C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
6	TERM,FEMALE MC000-136	02-09-1118	MOL	2113-09-0003	4
P202	CORD SET,18/3SVT,6FT GRY,MLD.CAP,UL-APPRV	17257SVT	BEL	6011-30-0001	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	LINE CORD ASSEMBLY	1219-00-0144 PAGE: 1	A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C08	CAP,ELECT,1500MF,50V CE102-215	D76374	SPR	1510-20-1152	2
C02 C06	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	2
C03 C05 C07	CAP,ELECT,1MF,25V CE120-001	1620105X9025BC2	SPR	1510-21-7010	3
C04 C09	CAP,ELECT,100MF,25V CE105-110	TE1211	SPR	1510-20-4101	2
C10	CAP,10000MF,16V CE122-310	D76381	SPR	1510-21-4103	1
C11	CAP,TANT,10MF,25V CE120-010	1620106X0025DD2	SPR	1510-21-7100	1
CR01	DIODE BRIDGE	MDA101	MOT	4806-02-0003	1
CR03 CR05 CR08	DIODE DR000-001	1N4004	P-C	4806-01-4004	3
CR06 CR07	DIODE DR000-009	1N5624	G-E	4806-01-5624	2
F01	FUSE,S.B.,2AMP MF000-002	313-002	LIT	2410-05-0001	1
IC01	VOLTAGE REFERENCE	REF-02CJ	PMI	7000-00-0200	1
IC02	DUAL OP AMP	TL082CP	T-I	7000-00-8200	1
J01 J02 J03	CONN.,RECEPT.,3-PIN	6-86105-3	AMP	2112-25-0001	3

WAVETEK PARTS LIST	TITLE PC ASSEMBLY, DPS2A	ASSEMBLY NO. 1218-00-0250 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
P01	PLUG,6-PIN KONEKTON MC000-075	09-65-1061	MOL	2112-05-0002	1
P02	CONN,MALE,9-PIN MC000-071	09-65-1091	MOL	2112-05-0001	1
Q01	JFET,N-CHANNEL	E232	SCX	4902-00-2320	1
Q02	TRANS QA039-060	2N3906	T-I	4901-03-3060	1
R01 R12 R14	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	3
R02	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R03	RES,C,1/4W,5%,39K RC103-339	CF1/4-39K	ASE	4700-15-3902	1
R04	RES,MF,1/8W,1%,4.87K RF212-487	MF55K-4.87K	ASE	4701-03-4871	1
R05	RES,VAR,CERMET,500	83PR500	BEK	4610-00-2501	1
R06	RES,C,1/4W,5%,3.9K RC103-239	CF1/43.9K	ASE	4700-15-3901	1
R08	RES,MF,1/8W,1%,13.0K RF213-130	MF55K-13.0K	ASE	4701-03-1302	1
R09 R11	RES,MF,1/8W,1%,10K RF213-100	MF55K10K	ASE	4701-03-1002	2

WAVETEK PARTS LIST	TITLE PC ASSEMBLY, DPS2A	ASSEMBLY NO. 1218-00-0250 PAGE: 2	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R13	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1
R15	RES,C,1/4W,5%,1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
R16	RES.,M.F.,1/8W,1%, 150-OHM	MF55K-150	ASE	4701-03-1500	1
R18	RES.,M.F.,1/8W,1%, 768-OHM	MF55K-768	ASE	4701-03-7680	1
NONE	CONN,6-PIN,KONEKTON MC000-076	09-50-3061	MOL	2113-06-0002	1

WAVETEK PARTS LIST	TITLE PC ASSEMBLY, DPS2A	ASSEMBLY NO. 1218-00-0250 PAGE: 3	REV A

DPS-2A
POWER SUPPLY

REV A

AC LINE FUSE R.P.

F101

115V-1A AT
230V-.5A AT

AC LINE 115/230 R.P.

115

VIOLET

S102

BROWN

230

TO POWER SWITCH

J201

3

4

1

2

BN

BU

GN/YL

P202

AC LINE PLUG R.P.

T101

J101 P1

BLACK

RD

GN

RD/YL

GN

WHITE

YL

GRAY

1

3

5

2

4

CR1A-D

F1

2A. AT.

R1

4.7 K

C1

1500μF

+18

2

IC 1

REF02

7

4

R3

39K

C4

1μF

C2

.005μF

Q1

E232

R2

1K

J1

3

C

Q101

LM395

E

J1

2

8

J1-1

+18

3

2

IC2A

8

1

TL082

CR2

R6

3.9K

C3

100μF

CR3

R8

13.0K

R9

10.0K

C5

1μF

R4

4.87K

R5

500

(+18 ADJ)

R10

200

(-18 ADJ.)

P2

TL082

6

7

IC2B

5

4

-18

CR4

R12

4.7K

2N3906

Q2

R13

10K

R14

4.7K

C6

.005μF

C7

1μF

R11

10.0K

CR5

R15

1.2K

J2

-1

8

J2

2

E

Q102

LM395

C

J2

3

C9

100μF

C8

1500μF

CR6

CR7

J3

3

IC 101

LM317

J3

2

J3

-1

C10

10,000μF

C11

10μF

R16

150

R17

*

R18

768

R19

*

CR8

AC

+27

+18

+18

-18

-18

-27

+7.3

GND

1

2

3

4

5

6

7

8

9

INTRODUCTION

Option 3 is a circuit breaker in the RF output system of the instrument. This prevents damage to the RF output system in the event that large RF signals are fed into the signal generator while testing a transceiver. In addition to the RF protection, the option contains a DC block which will prevent damage to the Attenuator if the RF output is connected to a circuit operating at a DC potential.

SPECIFICATIONS

Frequency Range	1 to 520 MHz
Insertion Loss*	<.2 dB
VSWR**	< 1.15
Trip Time	< 2 msec
RF Trip Level	≈ .7 W
Max RF	50 W
DC Blocking Voltage	100 Volts

* This loss is calibrated out when module is installed in the signal generator.

** The VSWR of the generator is increased to <1.25 when this module is installed.

OPERATING INSTRUCTIONS

If an external RF voltage of approximately 6 VRMS or more is accidentally applied to the instrument's RF output connector, an internal switch in series with the RF output will open. This prevents damage to the instrument's Attenuator or Output Amplifier. This open switch will be indicated on the front panel by the flashing of the UNLEVELED light. Once the switch is tripped, it will latch in the open position and remain open until reset. Also, a combination of a high mismatch, high output level (over .1 V) and changing frequency can cause the circuit breaker to trip.

After removing the RF signal causing the overload, the switch can be reset by momentarily turning the front-panel AC POWER switch off.

NOTE: Normal operation of the UNLEVELED light is a steady glow if the instrument is unleveled. If the circuit breaker is tripped while the instrument is unleveled, the UNLEVELED light will vary in intensity instead of flashing on and off.

THEORY OF OPERATION

Figure 8/3-1 is a block diagram of the RF circuit breaker. This block diagram, along with the M35-1 Schematic, should be used to follow the information contained in this section.

With the instrument's POWER switch set to the OFF position, relay K1 is in it's normally open position. This prevents any damage to the instrument while it is not in use. As soon as AC power is applied to the instrument, IC1 will compare the voltage from RF monitor CR1 to a fixed reference voltage of approximately 5 V. As long as the output of the monitor is less than the 5 V reference voltage, the output of IC1 will be approximately +17 V. This positive output from IC1 turns on the relay driver, Q1. This engerizes relay K1, thus completing the RF output circuit.

The positive output from IC1 also turns on Q2. This effectively grounds pin 7 of timer IC2, which is being operated as as astable oscillator. With pin 7 grounded, the timer is inoperative, and its output, pin 3, is high. The high output from IC2 turns off Q3. This prevents any current flow to the front-panel UNLEVELED light.

If an external RF signal exceeding 6 VRMS is applied to the instrument's RF output connector, the output from monitor diode CR1 will go above 5 V. This will produce a negative output from IC1. The positive feedback provided by R7 will latch IC1 in this state. The negative output from IC1 will turn off relay driver Q1. This causes relay K1 to return to its normally open position, re-

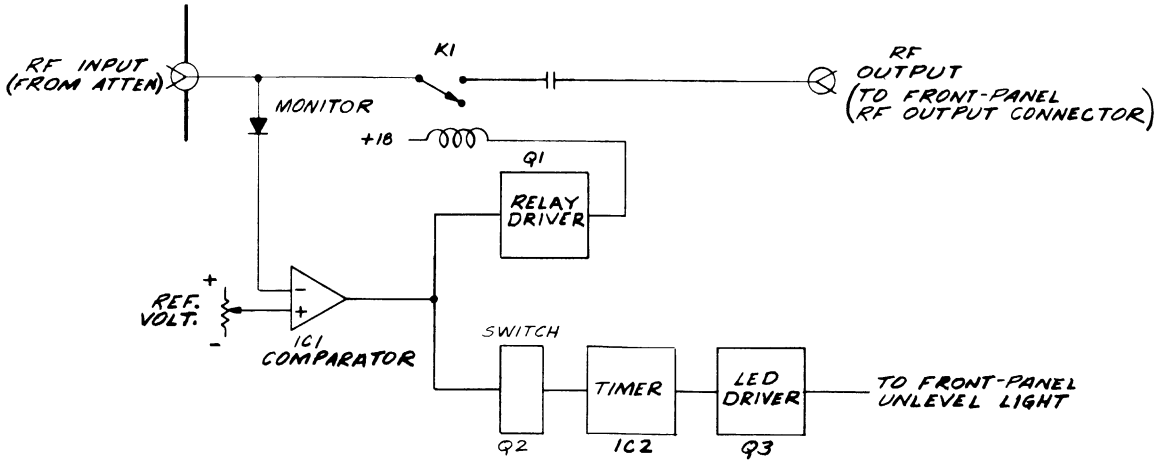


Figure 8/3-1. Block Diagram

moving the external RF signal from the instrument.

The negative output from IC1 also turns off Q2, thus removing the short on pin 7 of timer IC2. This allows the timer to operate as an astable oscillator. The output, pin 3 of IC2, then varies between 0 and 7 volts. This causes Q3, the LED driver, to supply current intermittently to the front-panel UNLEVELED light, causing it to flash.

After the RF overload is removed, IC1 can be unlatched by momentarily removing AC power to the instrument.

OPERATION CHECK

The following procedure is recommended to insure proper operation of the protection device. The top cover must be removed from the instrument.

With the instrument operating normally in the CW mode, set the output level to +5 dBm. Connect a 50 ohm detector to the output of the signal generator. The DC output of the detector should be monitored on a suitable oscilloscope. Set the output frequency to 100 MHz.

The circuitry in the M35-1 is checked by pushing the momentary switch located on top of the module. This switch lowers the trip level of the module. While holding down the switch slowly increase the output of the unit using the VERNIER until the M35-1 trips. This causes the circuit breaker to open and latch, the UNLEVELED light to flash, and the detected output displayed on the oscilloscope to go to zero. The circuit breaker can then be reset by momentarily turning the AC POWER switch off. The M35-1 should have tripped at +7.5 dBm $\pm$1 dB. Perform the same test at 500 MHz. It should then trip at an output level of +10.5 dBm $\pm$2 dB.

The above procedure, while not a complete performance check, is considered adequate for most applications. Additional tests can be performed as desired. For example, insertion loss and VSWR can be checked in the same manner as any passive device. Also, if available, a high power RF signal source, set for an output of slightly over .7 W can be used to verify circuit breaker operation.

MAINTENANCE

The only maintenance for the RF circuit breaker is periodic testing to insure its operation. If a malfunction occurs, a trouble can be localized and repaired with the aid of the theory of operation and the schematic. If the problem is a defective monitor diode, care should be observed to keep lead length and position the same as the original diode.

Option 3 can be factory or field installed. The following procedure should be followed for field installation.

OPTION 3 FIELD INSTALLATION KIT

QTY	DESCRIPTION	PART #
1	RF Circuit Breaker Module	M35-1
1	RF Cable	W1A
1	RF Cable	W1B
1	6/32 x 5/8 Screw	HS101-610

Install the M35-1 module in the location shown in Figure 8/3-2 and secure with the 6-32 hold-down screw. Remove the front-panel RF output cable, W1, and replace with W1A and W1B which will route the RF output signal thru the M35-1 module.

Before use, the module should be tested by the procedure shown in Operation Check.

Note: The above information applies to all 3000 Series instruments except Models 3002 and 3004. For these instruments the M35-1 is replaced by M35-2, which permits operation from .001 to 520 MHz, but does not inlcude DC blocking. All other specifications, operating instructions, and descriptions apply.

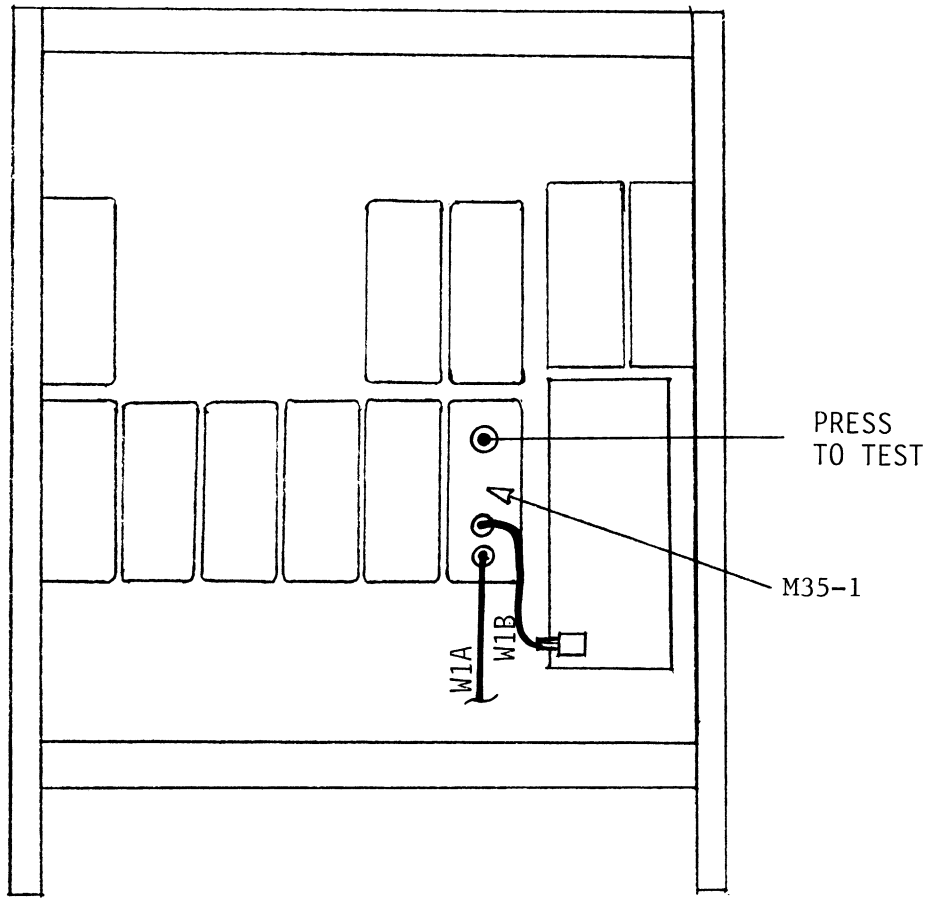
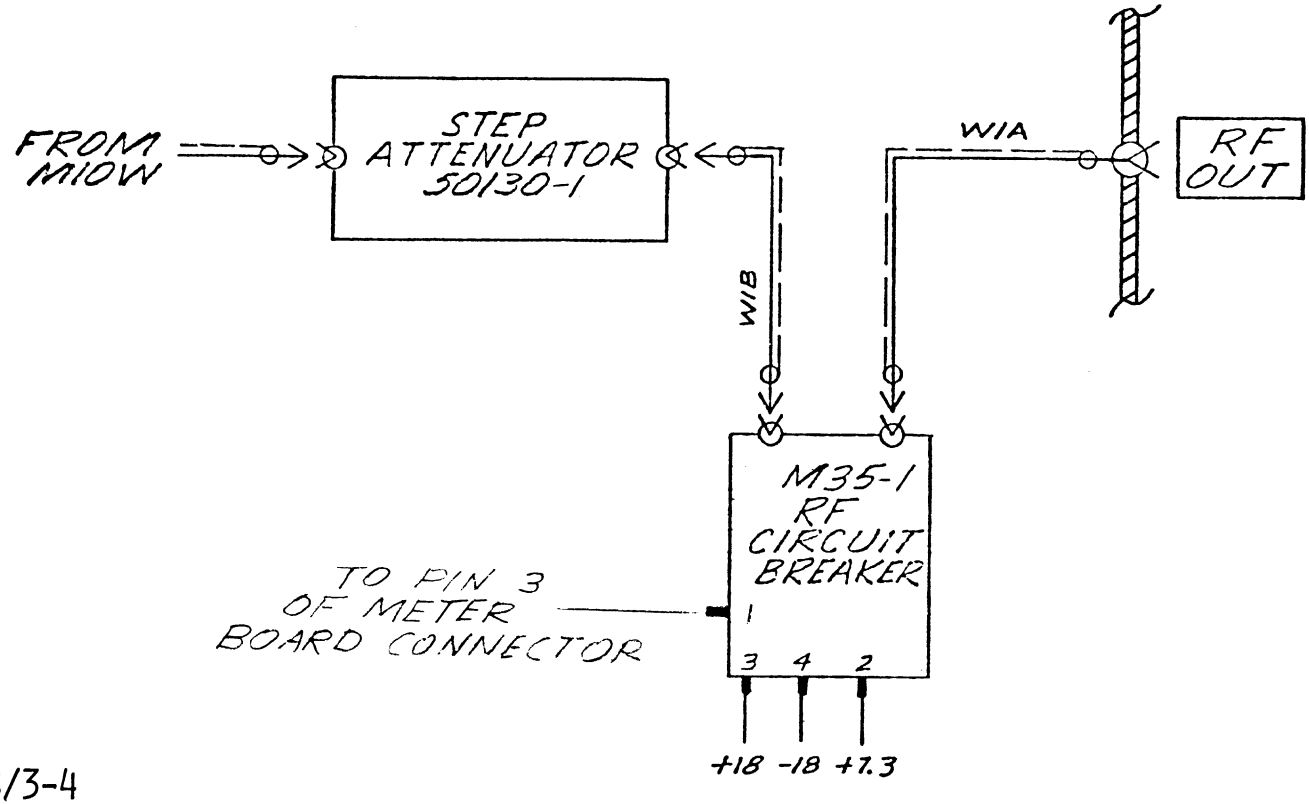


Figure 8/3-2. Top View, RF Circuit Breaker Location



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1	CAP,F.T.,.09MF,1KV CF111-390	CL003DA903P	A-B	1510-30-7903	1
C10 C11 C2 C8 C9	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	5
C3 C4	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	2
C5 C6 C7	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	3
C12 C13 C14 C15	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	4
CR1 CR4	DIODE DG100-341	1N34A	HIT	4807-01-0034	2
CR2 CR3	DIODE DR000-001	1N4004	P-C	4806-01-4004	2
IC1	IC,IC000-002	N5741CV	SIG	7000-57-4100	1
IC2	IC IC000-006	MC1455P1	MOT	7000-14-5500	1
J1 J2	CONN,JACK,JE000-007	050-643-0000-31	SEL	2110-02-1003	2
K1	RF RELAY 2PDT MR000-003	3SCS5007K1	G-E	4510-00-0003	1
L1 L2	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	2
Q1 Q2	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2

WAVETEK PARTS LIST	TITLE RF CKT BKR,M35-1	ASSEMBLY NO. 1114-00-0010 PAGE: 1	REV B

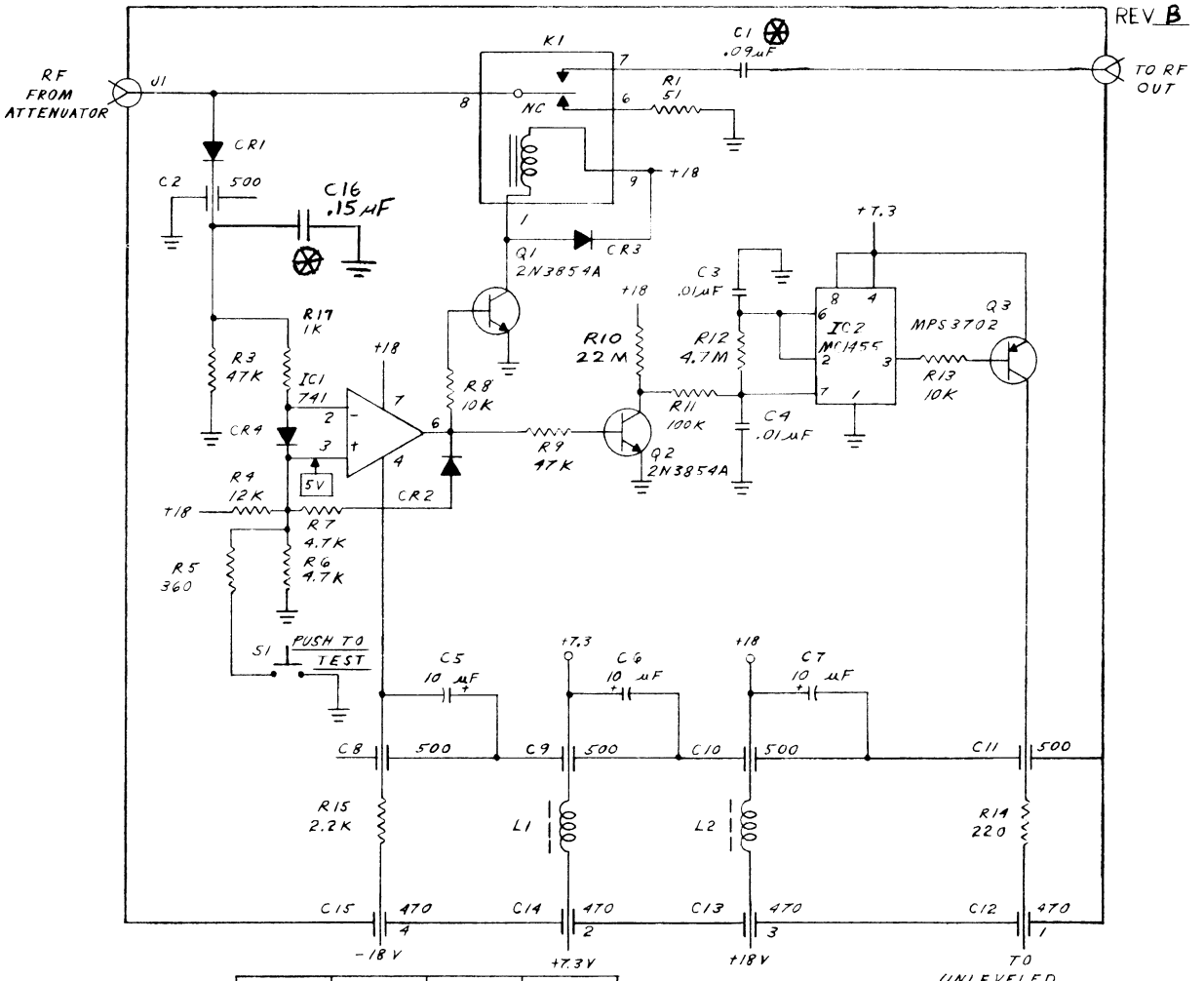
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q3	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
R1	RES,C,1/4W,5%,51 RC103-051	CF1/451	ASE	4700-15-5109	1
R3 R9	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2
R4	RES,C,1/4W,5%,12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1
R5	RES,C,1/4W,5%,360 RC103-136	CF1/4-360	ASE	4700-15-3600	1
R6	RES,C,1/4W,5%,4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	1
R7	RES,C,1/4W,10%,4.7K RC104-247AB	CB4721	A-B	4705-16-4701	1
R13 R8	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	2
R10	RES,C,1/4W,10%,22M RC104-622	CB2261	A-B	4700-16-2205	1
R11	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R12	RES,C,1/4W,10%,4.7M RC104-547	CB4751	A-B	4700-16-4704	1
R14	RES,C,1/4W,5%,220 RC103-122	CF1/4-220	ASE	4700-15-2200	1

WAVETEK PARTS LIST	TITLE RF CKT BKR,M35-1	ASSEMBLY NO. 1114-00-0010 PAGE: 2	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R15	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	1
R17	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
S1	SWITCH,SM000-007	30-1	G-H	5111-00-0002	1
FOR M35-2 DELETE C1 AND ADD:					
C16	CAP,CER,.15MF,100V	CY20A154M	C-L	1510-11-1154	1

WAVETEK PARTS LIST	TITLE RF CKT BKR,M35-1	ASSEMBLY NO. 1114-00-0010 PAGE: 3	REV B

SCHEMATIC
RF CIRCUIT BREAKER
M35-1/M35-2



CURRENT INPUTS	-18V	+7.3V	+18V
NORMAL OPERATION	1ma	4ma	12ma
TRIPPED	3ma	8ma (AV)	3ma

⊛ C1 ON -1 ONLY

C16 ON -2 ONLY

OPTION 5
EXTERNAL REFERENCE

GENERAL INFORMATION

Option 5 includes the circuitry necessary to enable the instrument to be driven by an external reference frequency, thus improving the accuracy of the signal generator. The reference input requirements are as follows:

FREQUENCY - 1, 2, 2.5, 5 or 10 MHz

ACCURACY - within 1 ppm of above frequencies.

LEVEL RANGE - 50 mV to 5 V (RMS)

IMPEDANCE - 1 kilohm

INSTALLATION

To add this option to the instrument, first remove top and bottom covers as explained in Section 5.2 of this manual. The module plugs into the open socket adjacent to the M30-1 (refer to Figures 5-5 and 5-6). The additional RF cables connect the M39 to the M30-1 and the instrument rear panel.

OPERATION

When an external signal is connected to the rear-panel BNC connector, the instrument is ready to use with increased accuracy. The front-panel ACCURACY lights should indicate "EXTERNAL" unless the FREQUENCY VERNIER is out of the CAL position.

THEORY OF OPERATION

The purpose of this circuit is to phase lock the Crystal Reference in the instrument to a higher accuracy reference. The circuit functions include: "phase detection" to compare the variable frequency to the reference and supply a reference voltage, "harmonic generation" to allow the external reference to be any of several frequencies, "unlock indication" to tell the operator when this loop is unlocked, and "reference monitoring" to disengage this loop from the instrument when the reference input is disconnected.

Refer to Figure 8/5-1 for a block diagram of the circuit.

PHASE DETECTION

The reference (10 MHz) input to the phase detector is supplied from an external source via the harmonic generator. The signal is fed thru a pair of inverters to make the signal level more compatible with the phase detector. The variable (10 MHz) signal from the voltage controlled oscillator is fed thru inverters for the same reason. The phase detector output is filtered by an integrator circuit and applied to a varactor diode in the oscillator in the M30-1 module. The 40 MHz oscillator frequency is divided by four and fed to the phase detector. A certain voltage to the VCO will tune the variable input to the phase detector to the exact frequency of the reference input. If the variable input frequency shifts high or low, the phase detector output voltage changes and tunes the varactor oscillator in the opposite direction, thus keeping the variable input locked to the reference input.

UNLOCK INDICATION

The integrator output (phase detection circuit) is fed to a window detector. When this tuning voltage goes outside the normal operating range (too positive or negative), a DC voltage is applied to both an LED on top of the module and to the flasher circuitry in the Modulation Board assembly to cause the front-panel ACCURACY light to flash.

HARMONIC GENERATION

The external reference is fed into a circuit which generates harmonics. The output is fed to a 10 MHz filter to eliminate undesired harmonics. This signal is then fed to an Amplifier with Automatic Gain Control.

The AGC circuit includes a detector and a comparator. The detector produces a DC level proportional to the RF signal level. This is then "compared" to a DC reference. The comparator output is applied to the AGC input of the Amplifier to complete the AGC loop. If the Amp output level starts to change (increase for example), the detector output changes (goes more positive) and the comparator output changes the voltage (more negative) on the AGC input to the Amp. The gain of the Amp is thus changed (decreased), and the output returns (decreases) to its original level.

REFERENCE MONITOR

The circuit monitors the amplitude o the 10 MHz reference by looking at th detector output in the AGC circuit o the 10 MHz amplifier stage. This leve is compared to a fixed DC level. Whe the reference falls below a leve necessary to drive the phase detector the comparator switches thre transistors which eliminate the tunin output to the VCO and also prevent th unlock indicator from being activated.

SCHEMATICS AND PARTS LISTS

Included in this section is a schematic diagram of the M39 module and corresponding parts list. The instrument Wiring Diagram (Schematic 1 in Section 6) shows the incorporation of this option into the instrument.

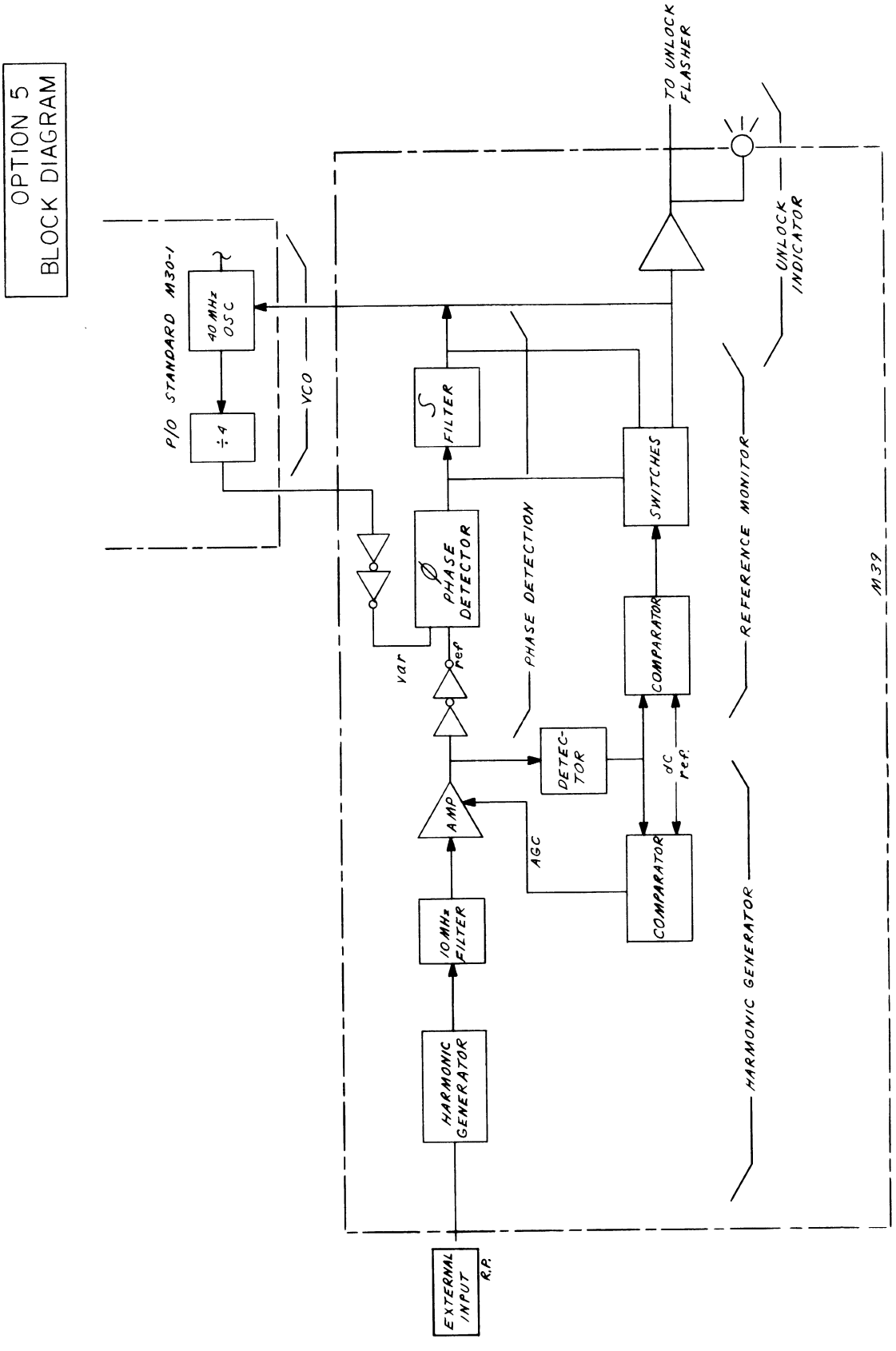


Figure 8/5-1. Option 5 Block Diagram

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1 C13 C15 C18 C2 C29	CAP,CER,.005MF,1KV CD103-250	TG-D50	SPR	1510-10-2502	6
C3	CAP,CER,200PF,1KV CD102-120	5GA-T20	SPR	1510-10-1201	1
C4 C6 C8	CAP,VAR,3.5-13PF250V CV101-013	78-TRIKO-02-3.5-13PF	STR	1510-70-0130	3
C5 C7	CAP,M.C.,.75PF CG102-175	MC-.75PF	Q-C	1510-40-1758	2
C10 C11 C9	CAP,CER,270PF,1KV CD102-127	60U271M	MDC	1510-10-1271	3
C12	CAP,VAR,10-60PF,250V CV104-060	10S-TRIKO-24-10-60PF	STR	1510-70-3600	1
C14 C16 C33	CAP,CER,.001MFD,1KV CD102-210	5GAD10	SPR	1510-10-1102	3
C17 C36 C37	CAP,F.T.,6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	3
C19 C22 C25	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	3
C20 C21 C31 C32 C34 C35	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	6
C23 C26	CAP,F.T.,470PF CF101-147	FA5C-4712	A-B	1510-30-0471	2

WAVETEK PARTS LIST	TITLE EXT REF,M39	ASSEMBLY NO. 1114-00-0053 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C24 C27 C30	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	3
C38	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	1
CR1 CR2 CR3 CR6	DIODE DG100-821	1N82AG	G-I	4807-01-0082	4
CR4	DIODE DG000-012	5082-0180	H-P	4811-02-0001	1
CR5 CR7 CR8	DIODE DR000-001	1N4004	P-C	4806-01-4004	3
CR10 CR9	DIODE DG109-140	1N4148	FCD	4807-01-0914	2
CR11	LED DL000-001	NSL5046	NAT	4810-02-0001	1
IC1	IC,IC000-023	SN7405N	T-I	8000-74-0500	1
IC2 IC4	IC,IC000-005	RC4558DN	RAY	7000-14-5800	2
IC3	IC,IC000-011	78M05UC	FCD	7000-78-0500	1
IC5	IC,IC000-013	MC4044P	MOT	8000-40-4400	1
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L1 L12 L13 L5	CHOKE, 1MH, 10% LA005-R10	08N1R0K	ASE	1810-03-0010	4
L2 L3 L4	CHOKE,33MH,10% LA005-033	08N330	ASE	1810-03-0330	3
L6	CHOKE, 10.0MH,10% LA005-010	08N100K	ASE	1810-03-0100	1

WAVETEK PARTS LIST	TITLE EXT REF,M39	ASSEMBLY NO. 1114-00-0053 PAGE: 2	REV B

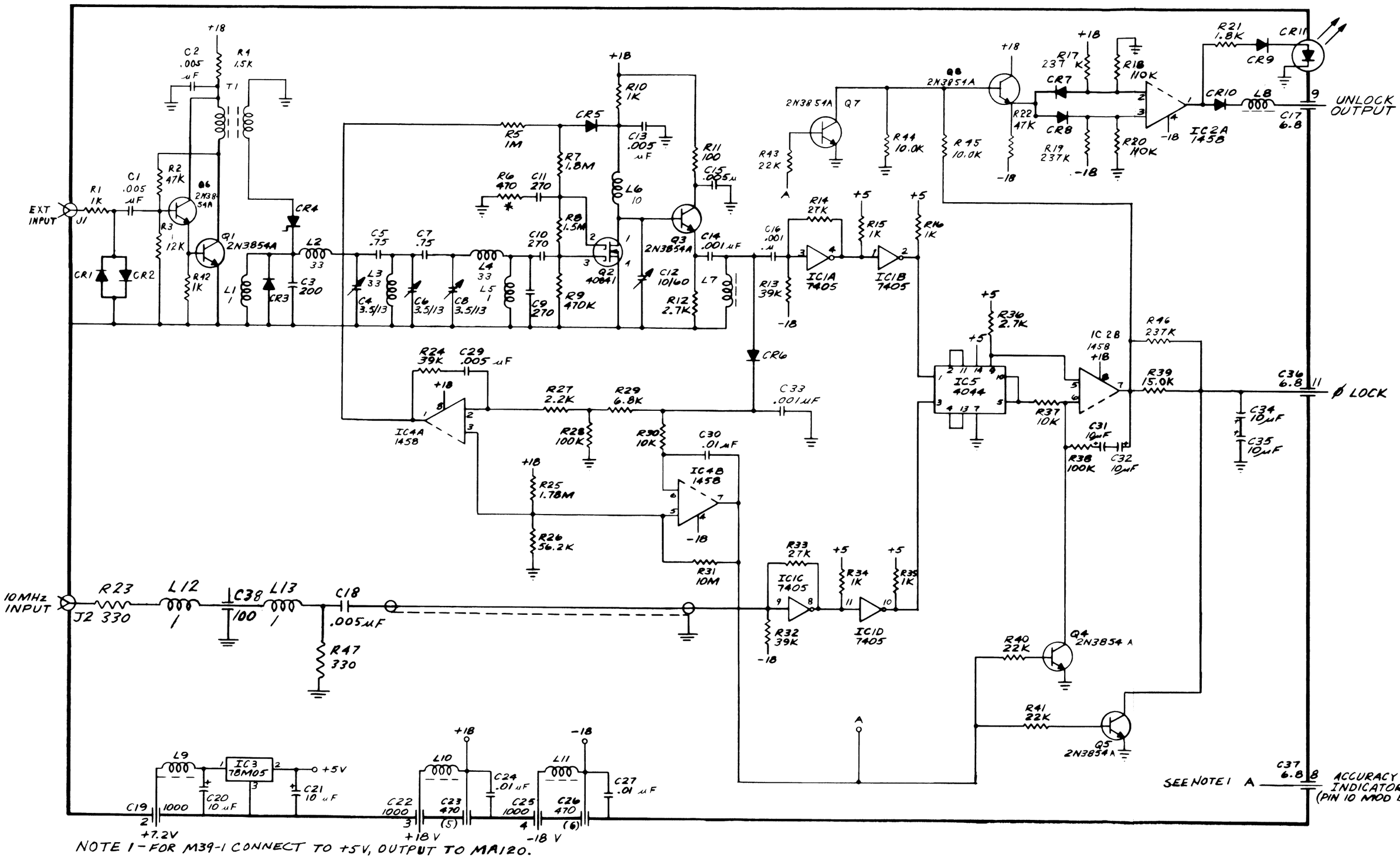
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L10 L11 L7 L8 L9	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	5
Q1 Q3 Q4 Q5 Q6 Q7 Q8	TRANS QA038-541	2N3854A	G-E	4901-03-8541	7
Q2	TRANS QB000-020	40841	RCA	4902-40-8410	1
R1 R10 R15 R16 R34 R35 R42	RES,C,1/4W,5%,1K RC103-210	CF1/4-1K	ASE	4700-15-1001	7
R2 R22	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2
R3	RES,C,1/4W,5%,12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1
R4	RES,C,1/4W,5%,1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R5	RES,C,1/4W,5%,1M RC103-510	CF1/4-1M	ASE	4700-15-1004	1
R6	RES,C,1/4W,5%,470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R7	RES,C,1/4W,5%,1.8M RC103-518	CF1/4-1.8M	ASE	4700-15-1804	1
R8	RES,C,1/4W,5%,1.5M RC103-515	CF1/4-1.5M	ASE	4700-15-1504	1
R9	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R11	RES,C,1/4W,5%,100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
R12 R36	RES,C,1/4W,5%,2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	2
R13 R24 R32	RES,C,1/4W,5%,39K RC103-339	CF1/4-39K	ASE	4700-15-3902	3
R14 R33	RES,C,1/4W,5%,27K RC103-327	CF1/4-27K	ASE	4700-15-2702	2
R17 R19 R46	RES,MF,1/8W,1%,237K RF214-237	MF55K-237K	ASE	4701-03-2373	3
R18 R20	RES,MF,1/8W,1%,110K RF214-110	MF55K-110K	ASE	4701-03-1103	2
R21	RES,C,1/4W,5%,1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1
R23 R47	RES,C,1/4W,5%,330 RC103-133	CF1/4-330	ASE	4700-15-3300	2
R25	RES,MF,1/8W,1%,1.78M RF215-178	MF55K-1.78K	ASE	4701-03-1784	1
R26	RES,MF,1/8W,1%,56.2K RF213-562	MF55K-56.2K	ASE	4701-03-5622	1
R27	RES,C,1/4W,5%,2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R28 R38	RES,C,1/4W,5%,100K RC103-410	CF1/4-100K	ASE	4700-15-1003	2
R29	RES,C,1/4W,5%,6.8K RC103-268	CF1/4-6.8K	ASE	4700-15-6801	1
R30 R37	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R31	RES,C,1/4W,5%,10M RC103-610	CB1065	A-B	4700-15-1005	1
R39	RES,MF,1/8W,1%,15K RF213-150	MF55K-15K	ASE	4701-03-1502	1
R40 R41 R43	RES,C,1/4W,5%,22K RC103-322	CF1/422K	ASE	4700-15-2202	3
R44 R45	RES,MF,1/8W,1%,10K RF213-100	MF55K10K	ASE	4701-03-1002	2
T1	RF XFMR FROM:1813-00-0007	TR001-009	W-I	1210-40-0004	1

WAVETEK PARTS LIST	TITLE EXT REF,M39	ASSEMBLY NO. 1114-00-0053 PAGE: 5	REV B

OPTION 5
EXTERNAL REFERENCE MODULE
M39/M39-1
REV. B



NOTE 1 - FOR M39-1 CONNECT TO +5V, OUTPUT TO MA120.

OPTION 7

LOW LEAKAGE

PRELIMINARY INFORMATION

Option -7 provides for a reduction in RF leakage such that less than 0.1 μV is induced in a two-turn, one inch diameter loop (feeding a 50 Ω receiver) held one inch away from any surface, when the instrument is developing 30 mVRMS or less into a 50 Ω termination.

An alternate method of detection is to place a paging receiver with .2 μV sensitivity (such as Motorola A04FNC in a TEK-69 fixture connected to the instrument RF OUT connector) 6 inches in front of the instrument with the instrument OUTPUT STEP ATTENUATOR set at minimum and the instrument frequency set to that of the paging receiver.

The paging receiver IF test point is monitored with an AC voltmeter, and should change less than 0.5 dB.