WAVETEK

INSTRUCTION MANUAL

MODELS
3003-3006
SIGNAL GENERATOR

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SIGNAL GENERATOR

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WARRANTY

Wavetek warrants that all Products manufactured or procured by Wavetek conform to Wavetek's published specifications and are free from defects in materials and workmanship for a period of one (1) year from the date of delivery to the original Buyer, when used under normal operating conditions and within the service conditions for which they were designed. This warranty is not transferrable and does not apply to used or demonstration products.

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Extended Warranty Programs

Extended warranties and service contracts are available for new and currently owned equipment for an additional cost. Contact the Customer Service Department (800 851-1198) for details pertaining to extended warranties and service contracts.

Return Authorization Procedure

The customer MUST obtain a RETURN AUTHORIZATION NUMBER from the Customer Service Department (800 851-1198) prior to returning any equipment for warranty or non-warranty repair. Wavetek accepts no liability for any instrument or subassembly returned to the factory without this number. Any correspondence regarding returned instruments or subassemblies should be referenced to that number.

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SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

The Wavetek Models 3003 through 3006 are rugged, completely solid-state Signal Generators covering the frequency range of .001 or 1 to 520 MHz. Models 3004 and 3006 cover the range of .001 to 520 MHz while Models 3003 and 3005 cover the 1 to 520 MHz range. Models 3005 and 3006 offer 100 Hz resolution while on Models 3003 and 3004 the resolution is 1 kHz. 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 instrument is set via 6 or 7 front-panel Lever/Indicator switches which yield a resolution of 1 kHz or 100 Hz. In addition, remote programmers are available to facilitate semi-automatic programming of frequency and GPIB 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 instrument to provide high-stability signals to an accuracy of 0.001% over its specified frequency 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 Auxilliary RF output option is also available to drive a counter. Refer to Section 1.3 for a listing of options available for each instrument.

1.1.2 MODULATION

These instruments also feature both internal and external AM and FM capabilities. The internal and external sources can operate independently, or may be used simultaneously to produce complex modulation.

Internal modulation frequencies include 400 Hz, 1000 Hz, and two preset frequencies between 100 Hz and 10 kHz, selected by the user.

Modulation is indicated on a front-panel meter calibrated for full-scale readings of 30% and 100% AM, and 3, 10, 30, and 100 kHz deviation for FM operation.

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. A Programmable Attenuator option is available covering the range of from 0 to 109.9 dB attenuation in .1 dB steps with +13 dBm as the 0 dB reference level.

The calibrated output of the instrument 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	
Model 3006	1 kHz to 520 MHz selectable in 100 Hz steps.
Model 3005	1 MHz to 520 MHz selectable in 100 Hz steps.
Model 3004	1 kHz to 520 MHz selectable in 1 kHz steps.
Model 3003	1 MHz to 520 MHz selectable in 1 kHz steps.
READOUT	
Models 3005, 3006	7 digit Lever/Indicator switches.
Models 3003, 3004	6 digit Lever/Indicator switches.
RESOLUTION	
Models 3005, 3006	100 Hz
Models 3003, 3004	1 kHz
ACCURACY	±0.001% after 15 min. (Typically ±0.0002% after 2 hours within 3 months of calibration.) (±0.001% ±10 kHz when FREQUENCY VERNIER is not in the CAL position.)
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 μVRMS)
LEVEL CONTROL	Continuously adjustable in 10 dB steps 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 (Typically ±0.75 dB) -7 to -77 dBm ±1.95 dB (Typically ±1.25 dB) -77 to -137 dBm ±2.75 dB (Typically ±1.5 dB)
Accuracy Breakdown	Flatness (+13 to -7 dBm) ±0.75 dB (Typ ±0.5 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

RFI 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 dBc 1 kHz to 1 MHz and 10 MHz to 520 MHz
< -26 dBc 1 MHz to 10 MHz

SUB–HARMONICS

None detectable

NON–HARMONICS

Fundamental (MHz)	Non-Harmonic (MHz)	Non-Harmonic Level (dBc)
below 3	below 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

< -65 dBc 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.) <100 Hz in 300 Hz to 3 kHz post-detection bandwidth. (Typically 50 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, 1000 Hz, and two preset frequencies between 100 Hz and 10 kHz (accuracy = ±2%).

EXTERNAL

DC to 20 kHz (3 dB bandwidth). Input level required ~1 VRMS into 600 Ω to provide full-scale adjustment with EXT MOD LEVEL control.

RANGE

0 to 90%

DISTORTION

<3% to 70% AM. (Typically 1.5% to 30% AM)
<5% to 90% AM (At a frequency of 1 kHz)

METER

Scales of 30% AM and 100% AM
Accuracy = ±(2% of full-scale reading +5% of METER reading) at 1 kHz modulation frequency.

1.2.5 FREQUENCY MODULATION

FREQUENCY
INTERNAL

Same sources as AM (see Section 1.2.4)

EXTERNAL

50 Hz to 20 kHz (1 dB bandwidth) with FREQ VERNIER in CAL
DC to 20 kHz (1 dB bandwidth) with FREQ VERNIER not in CAL
Input level required ~1 VRMS into 600 Ω to provide full-scale adjustment with EXT MOD LEVEL control.

RANGE	0 to 100 kHz deviation
DISTORTION	<2% 10 kHz to 100 kHz deviation. <4% 3 kHz to 10 kHz deviation (At a frequency of 1 kHz.)
METER	Scales of 3, 10, 30, and 100 kHz deviation. Accuracy = ±3% of full scale reading at 1 kHz modulation frequency.

1.2.6 GENERAL

OPERATING TEMPERATURE	25 ±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 13¾").
WEIGHT	11.4 kg (25 lb) net 13.6 kg (30 lb) shipping

1.3 OPTIONS

Options 1A, 4, and 7 are factory installed; Options 3, 5, and 6 are either factory or field installed. Options available for each instrument are:

Model 3003
(1A or 3) + 4 + 5 + 6 + 7
Model 3004
(1A or 3 or 4) + (4 or 6) + 5 + 7
Model 3005
(1A or 3 or 4) + (4 or 6) + 5 + 7
Model 3006
(1A or 3 or 4) + (4 or 5) + 7

1.3.1 RF LEVEL PROGRAMMING

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 plus an 11 dB VERNIER. Reverse power protection is also provided by this option.

NOTE

For Option 1A, the instrument is calibrated for +13 dBm at 50 MHz like a standard unit, but due to greater losses in Programmable Attenuators, a calibrated output is guaranteed only to +12 dBm.

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.)

NOTE

DC protection not included on Models 3004, 3006.

1.3.3 AUXILLIARY 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 INTERNAL/EXTERNAL REFERENCE

Option 5A provides a rear-panel BNC input for accepting an external frequency reference (5 or 10 MHz, .5 to 5 VRMS), which is used to improve the instrument accuracy from 10 ppm to that of the external source. Option 5A also includes an internal TCXO (accuracy = ±1 ppm) which can be used in lieu of the external source, and can also be used to drive other devices which require a high stability TTL input.

1.3.6 HIGH STABILITY REFERENCE

Option 5 is required with Option 6.

If Option 6 cannot be installed, use Model 2102 (see Section 1.4).

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
Output Level	TTL
Temp Stability (1 hr warm-up)	
over 10^0 to 40^0C range	0.05 ppm
Aging	0.005 ppm/day
	0.05 ppm/month
	0.3 ppm/year
Typical Overall Accuracy (within	
3 months of calibration)	0.2 ppm

1.3.7 LOW LEAKAGE

Option 7 reduces the instrument RFI leakage by a factor of 10. <0.1 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.

1.4 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.
High-stability frequency source (5 MHz, TTL) useable to drive Option 5, Model 2102.
Module Service Kit, K004

SECTION 2
OPERATION

2.1 INTRODUCTION

This section provides complete installation and operating instructions for the Wavetek Models 3003 through 3006. The instructions include information on 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	1410-00-4650
B (Side)	2 ea	1410-00-5260
C (Screw)	8 ea	2810-17-8108
D (Screw)	4 ea	2810-17-8110

PROCEDURE

Remove the screws from one side panel. Mount items A and B against side panel of the instrument and secure with screws provided. Repeat for other side of unit. If rack mount kit is removed from unit, use screws originally installed in side panels to avoid possible internal damage.

2.3 ELECTRICAL INSTALLATION

The instrument can operate from either 115 VAC or 230 VAC supply mains. The rear-panel AC LINE switch selects which of these operating voltages is being used, and adjusts the Power Supply accordingly. The Power Supply is designed to operate over an AC supply frequency range of 50 to 400 Hz.

Instruments are shipped from the factory set up for 115 V operation unless otherwise specified.

NOTE

Before operating the instrument, check that the rear-panel AC LINE fuse is the correct value for the supply voltage (see Section 2.5).

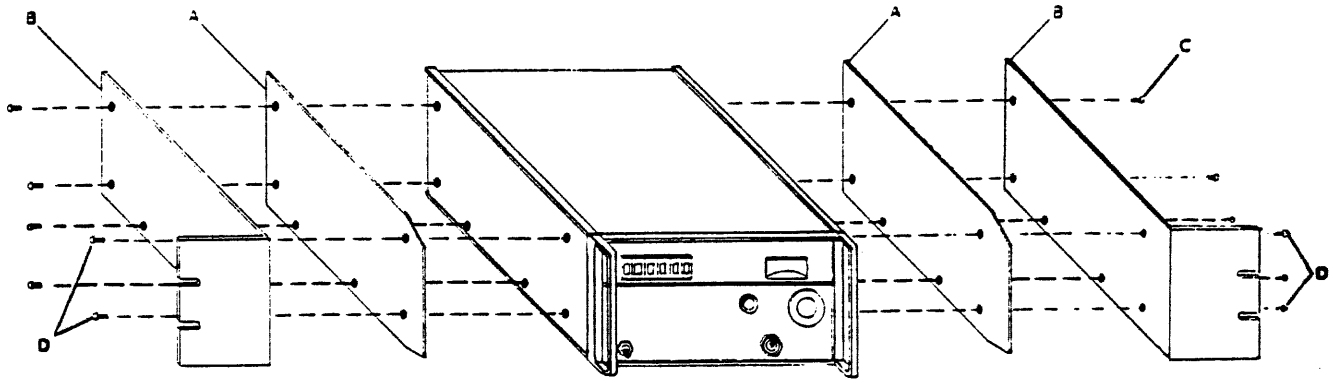


Figure 2-1. K108 Rack Mount

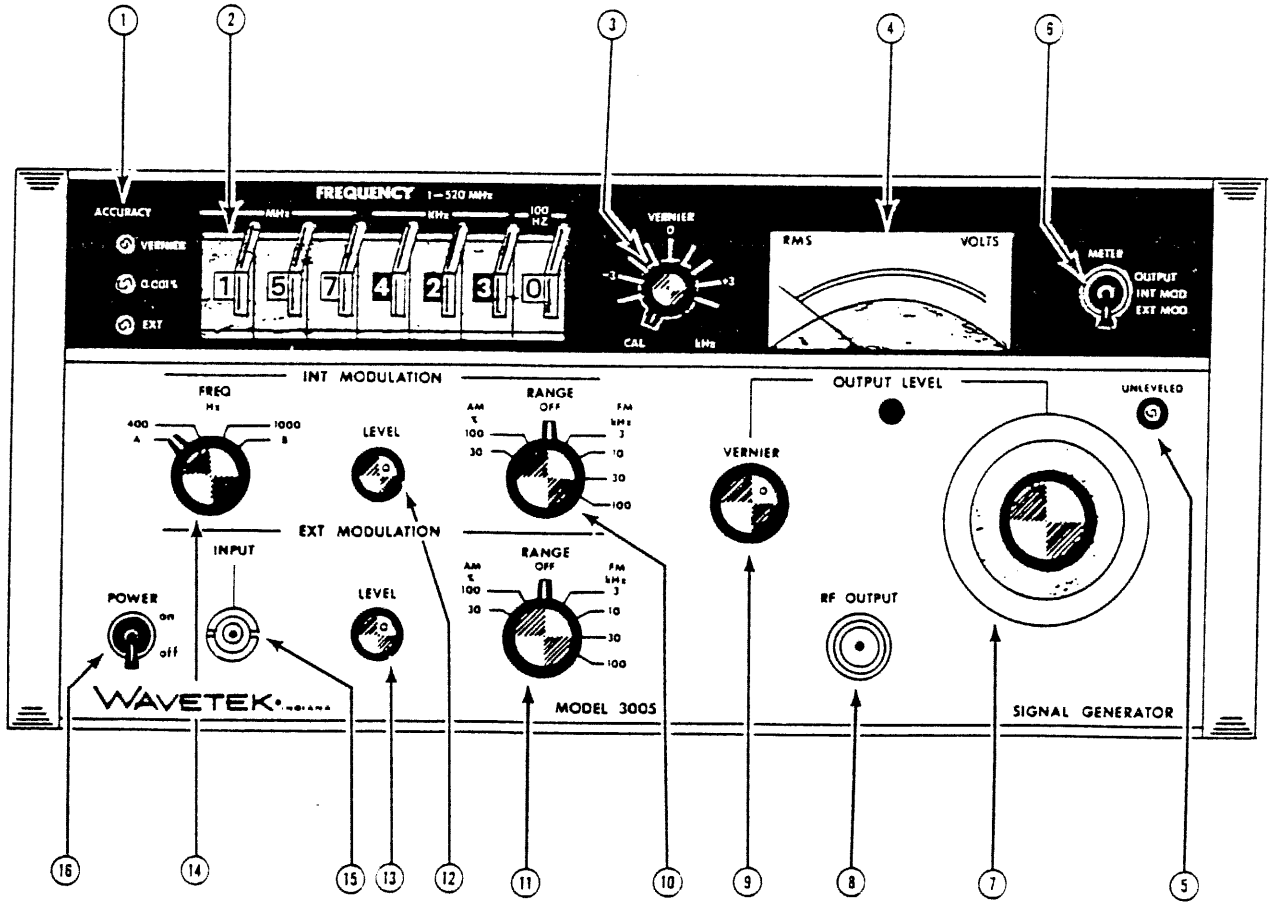


Figure 2-2. Front Panel

2.4 DESCRIPTION OF FRONT PANEL

Refer to Figure 2-2.

(1) ACCURACY lamps indicate the frequency accuracy of the instrument.

"VERNIER" indicates ±0.001% +10 kHz
"0.001%" indicates ±0.001%
"EXT" indicates accuracy of external source

Typically, the lamp will flash for a few seconds after the instrument is turned on. Normally, a steady light indicates that the instrument is phase locked and the frequency accuracy indicated is valid. A continuously flashing light indicates that one or more of the phase-locked loops is open.

(2) Lever/Indicator switches select and indicate output frequency.

(3) FREQ VERNIER shifts output frequency over a 10 kHz range (-5 kHz to +5 kHz).

With the FREQ VERNIER in CAL, the instrument accuracy is ±0.001%. When the FREQ VERNIER is not in CAL, the instrument accuracy is ±0.001% +10 kHz.

(4) OUTPUT METER indicates RF output level over a 10 dB range in VRMS and dBm, %AM, or FM deviation, depending on the METER switch setting.

(5) UNLEVELED lamp lights when the OUTPUT METER reading is not valid.

(6) METER switch selects measurement of RF output, internal modulation, or external modulation.

(7) OUTPUT Step Attenuator controls the RF output level over a 140 dB range from +10 to -130 dBm in 10 dB steps. The Attenuator dial indicates both dBm and VRMS.

(8) RF OUT provides the RF output signal from the instrument (type N connector).

(9) OUTPUT VERNIER controls the RF output level over an 11 dB range.

(10) (11) INT/EXT MOD RANGE switches select amplitude, frequency, or no modulation, and the appropriate METER range.

(12) (13) INT/EXT MOD LEVEL controls provide continuous adjustment of % modulation (AM) and frequency deviation (FM).

(14) INT MOD FREQ switch selects one of four internal modulation frequencies, 400 Hz, 1000 Hz, A, or B, where A and B are user-preset frequencies between 100 Hz and 10 kHz.

(15) EXT MOD INPUT connector (type BNC) accepts external modulating signals (1 VRMS level) as follows:

AM	DC to 20 kHz
FM ((3) in CAL)	50 Hz to 20 kHz
FM ((3) not in CAL)	DC to 20 kHz

(16) POWER switch provides AC power to Power Supply.

2.5 DESCRIPTION OF REAR PANEL

Refer to Figure 2-3.

(1) AC LINE switch enables unit to operate from either 115 VAC or 230 VAC supply mains.

(2) AC LINE Fuse (time-delay); 1.0 amp for 115 VAC operation; 0.5 amp for 230 VAC operation.

(3) AC LINE Cord provides connection to AC mains via 3 prong plug.

(4) PROGRAMMING JACK provides connection for remote programming of frequency.

(5) MOD TP provides convenient connection for monitoring amplitude and/or frequency of internal 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 available line voltage, and that the proper fuse is installed (see Section 2.5). Turn the POWER switch to ON. One of the front-panel ACCURACY lamps will indicate operation. No warmup is needed for the following checks.

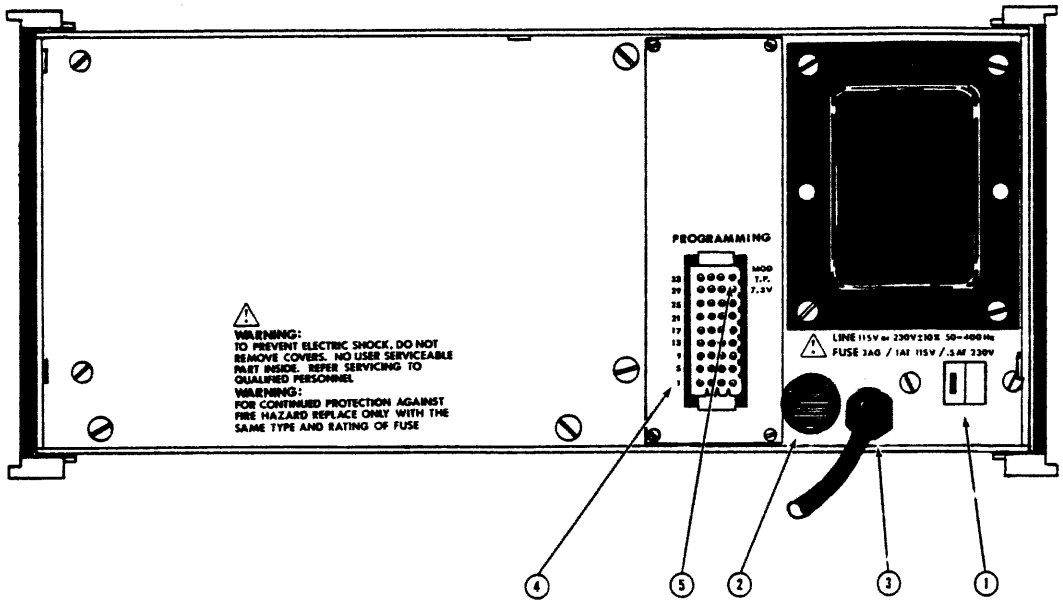


Figure 2-3. Rear Panel

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

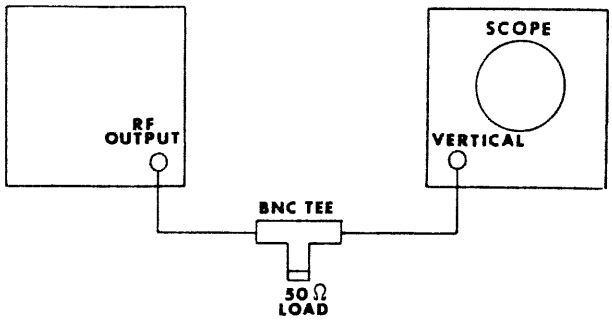


Figure 2-4. Test Setup

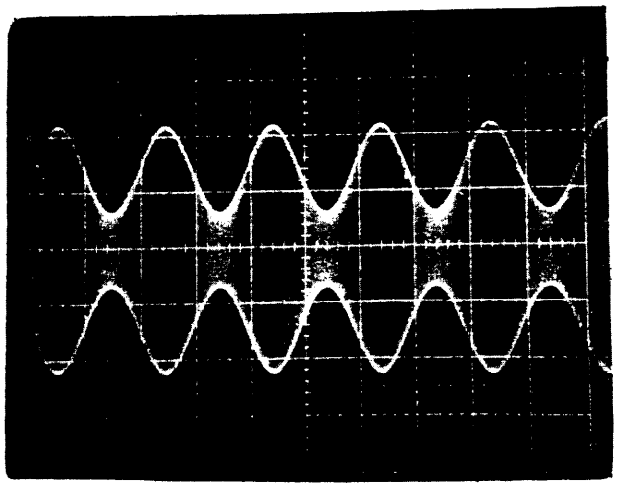


Figure 2-5. Amplitude Modulation

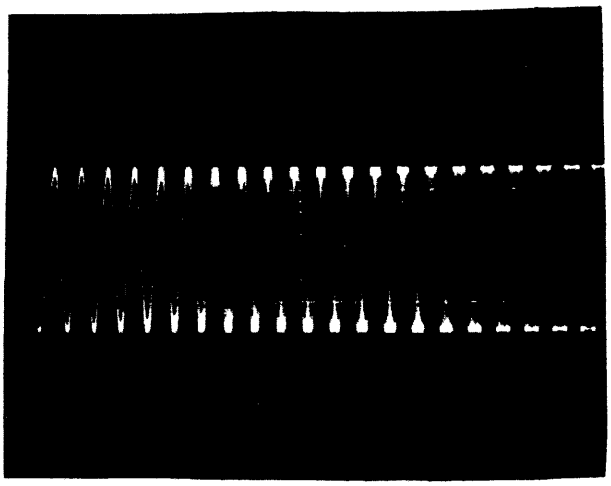


Figure 2-6. Frequency Modulation

2.6.2 INITIAL CONTROL ADJUSTMENT

Set the instrument front-panel controls as follows:

Lever/Indicator switches	010.0000
FREQ VERNIER	CAL
INT MOD RANGE	OFF
EXT MOD RANGE	OFF
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
EXT MOD LEVEL	N/A
METER switch	OUTPUT
OUTPUT Step	0 dBm
OUTPUT VERNIER	full cw

2.6.3 RF OUTPUT CHECK

Connect the equipment as shown in Figure 2-4. The 10 MHz signal should be ~0.9 Vpp. (A high-frequency oscilloscope must be used for these checks.)

2.6.4 AM CHECK

Set the INT MOD RANGE switch to 100% AM, the METER switch to INT MOD, the INT MOD FREQ switch to 1000, and adjust the INT MOD LEVEL control so that the METER reads 50% AM (half scale). Verify that the AM envelope displayed on the oscilloscope has a peak-to-valley voltage of ~0.45 V, and period of 1 msec (see Figure 2-5).

Set the INT MOD FREQ switch to 400. The peak-to-valley voltage should still be ~0.45 V, and the period should now be 2.5 msec.

Turn the INT MOD LEVEL control both ways, verifying that the % AM shown on the METER and the AM envelope on the scope display rise and fall accordingly. Set the METER switch to OUTPUT and verify that turning the INT MOD LEVEL control causes a change in RF output level.

NOTE

The UNLEVELED lamp may come on during this test.

Return the METER switch to the INT MOD position.

2.6.5 FM CHECK

Set the INT MOD RANGE switch to 3 kHz FM. Turn the INT MOD LEVEL control both ways, verifying that an FM display appears on the oscilloscope (see Figure 2.6).

Repeat for INT MOD RANGE settings of 10, 30, and 100 kHz FM.

2.6.6 ATTENUATION CHECK

Set the METER switch to OUTPUT and the INT MOD RANGE switch to OFF. Verify that both the OUTPUT Step and VERNIER controls vary the amplitude of the signal displayed on the oscilloscope, and that the OUTPUT VERNIER varies the METER reading of RF output level.

2.6.7 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.

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 instrument will perform as stated in the specifications, the instrument should have a two-hour warmup before using.

2.7.1 TURN ON

Turn the POWER switch to ON. One of the front-panel ACCURACY lamps will light, indicating an operating condition. 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 OUT connector, otherwise damage may occur to the output circuitry of the instrument.

2.7.2 CW OPERATION

With the METER switch set to OUTPUT and the INT and EXT MOD RANGE switches set to OFF, adjust the output frequency and level to the desired settings. The FREQ VERNIER should be in its CAL position.

NOTE

With the FREQ VERNIER in the CAL position, output frequencies having an accuracy of ±0.001% may be selected by the Lever/Indicator switches. When the FREQ VERNIER is out of the CAL position, the selected output frequency can be shifted ±5 kHz with the FREQ VERNIER

control. The output frequency at the "0 kHz" position of the FREQ VERNIER corresponds closely to the output frequency in CAL.

Connect the RF output to the device under test.

2.7.3 INT AM/FM OPERATION

Starting with the basic set-up of Section 2.7.2, set the METER switch to INT MOD, the INT MOD RANGE switch for the desired modulation function and METER range, and the INT MOD FREQ switch for the desired modulation frequency (400 Hz, 1000 Hz, or pre-set frequencies A or B, see Section 5.4.8). Adjust the INT MOD LEVEL control for the desired % AM or frequency deviation (read on the METER scale).

2.7.4 EXT AM/FM OPERATION

Starting with the basic set-up of Section 2.7.2, set the METER switch to EXT MOD, the EXT MOD RANGE switch for the desired modulation function and METER range, and connect the modulating signal (level should be ~1 VRMS for best resolution of the EXT MOD LEVEL control) to the EXT MOD INPUT connector. Adjust the EXT MOD LEVEL control for the desired % AM or frequency deviation (read on METER scale).

NOTE

At modulating frequencies less that 50 Hz, the METER may start to "wobble". In this case, the "peak" Meter reading is the valid measurement of % AM or frequency deviation.

CAUTION

Input voltage greater than ±5 VDC or 3.5 VRMS should not be applied to the EXT MOD INPUT connector, or damage to the instrument may occur.

NOTE

When amplitude modulating, care must be taken to not exceed the +13 dBm maximum level, or excessive distortion and an unleveled condition can exist. In some cases, a high % AM may cause the UNLEVELED light to come on when the 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 UNLEVELED light should then go out.

2.7.5 SIMULTANEOUS INT/EXT MODULATION

Internal and external modulation can be performed simultaneously by following the procedure given in Sections 2.7.3 and 2.7.4 with both INT and EXT MOD RANGE switches active. In this way, FM/FM, FM/AM, or AM/AM can be accomplished.

NOTE

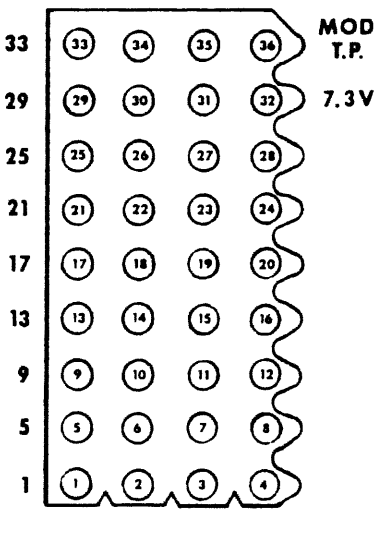
The METER switch provides for reading the internal and external modulations separately. The METER will not show the complex modulation.

2.7.6 PROGRAMMING

Frequency is programmable via a rear-panel input connector using standard 8-4-2-1 BCD contact closure or TTL signals. (Logic "0"= open =⩾2.2 V. Logic "1" = closed = ⩽0.4 V.) The rear-panel PROGRAMMING jack pins are in parallel with the front-panel Lever/Indicator switches; thus, if rear-panel programming is to be implemented, the front-panel switches must indicate all zeroes.

Example - To program 132.4508 MHz (refer to Figure 2-7):

FREQ DIGIT	1	3	2.	4	5	0	8
GND PINS	4	7,8	11	14	18,20	–	26



PIN	FUNCTION
1	NC
2	400 MHz
3	200 MHz
4	100 MHz
5	80 MHz
6	40 MHz
7	20 MHz
8	10 MHz
9	8 MHz
10	4 MHz
11	2 MHz
12	1 MHz
13	800 kHz
14	400 kHz
15	200 kHz
16	100 kHz
17	80 kHz
18	40 kHz
19	20 kHz
20	10 kHz
21	8 kHz
22	4 kHz
23	2 kHz
24	1 kHz
25	GND
26	800 Hz
27	400 Hz
28	200 Hz
29	100 Hz
30	NC
31	NC
32	7.3 V
33	NC
34	NC
35	NC
36	MOD TP

Figure 2-7. PROGRAMMING Jack Pins

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 - 3.17 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 signal generator is essentially a voltage controlled oscillator to which phase-locked loops and a crystal reference have been added for improved accuracy and 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 osciallators 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 Lever/Indicator 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 attenuator. The monitor detects the peak output of the Output Amplifier. 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 Amplifier 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 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 Amplifier can provide a carrier at the highest possible power.

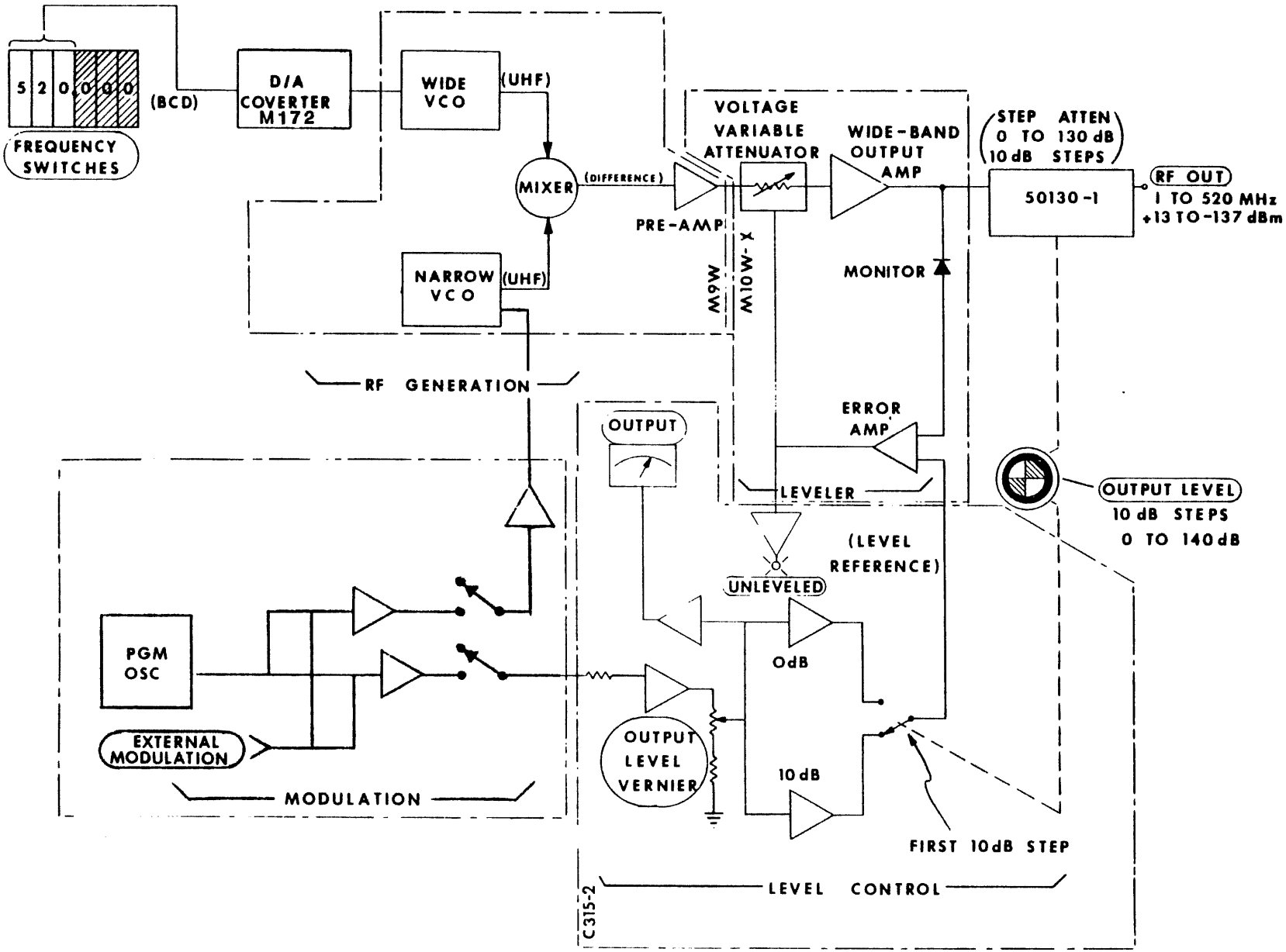


Figure 3-1. Basic Block Diagram

Since the RF level can be voltage controlled, AM can be accomplished by applying the modulating signal to the OUTPUT 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 either an internal oscillator or 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 frequency accuracy is only 3 MHz with 1 MHz resolution. To achieve the desired resolution and accuracy, the instrument includes five phase-locked loops.

A down-conversion system (Models 3004 and 3006) enables the instrument to output frequencies less than 1 MHz. Its operation will be covered in Section 3.17.

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 Lever/Indicator switch setting to reference frequencies for PLL 4.

PLL 3 and 5 provide stabilization to the Narrow VCO 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 5 is also used to program 100 Hz offset steps into the Narrow VCO for 100 Hz resolution (Models 3005 and 3006).

Figure 3-2 illustrates the relationship between the five numbered loops and the "basic signal generator".

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 3-3 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 001 to 039 MHz. These CW steps are then repeated every 40 MHz throughout the entire 1 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 in the same way 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 001.000 to 520.000.

The Wide Oscillator frequency is offset by Mixers 1 and 2 and compared to the 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 Oscillator range is heterodyned in Mixer 1 with 1448 MHz, the difference frequency produced ranges from

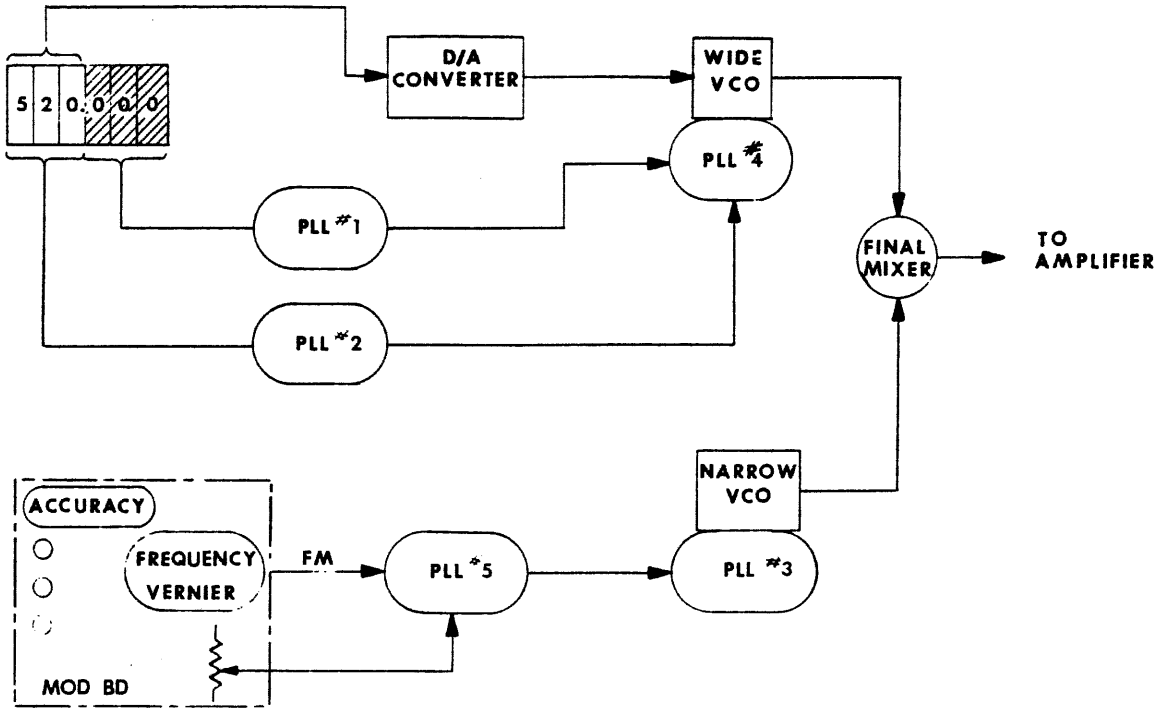


Figure 3-2. PLL Relationships

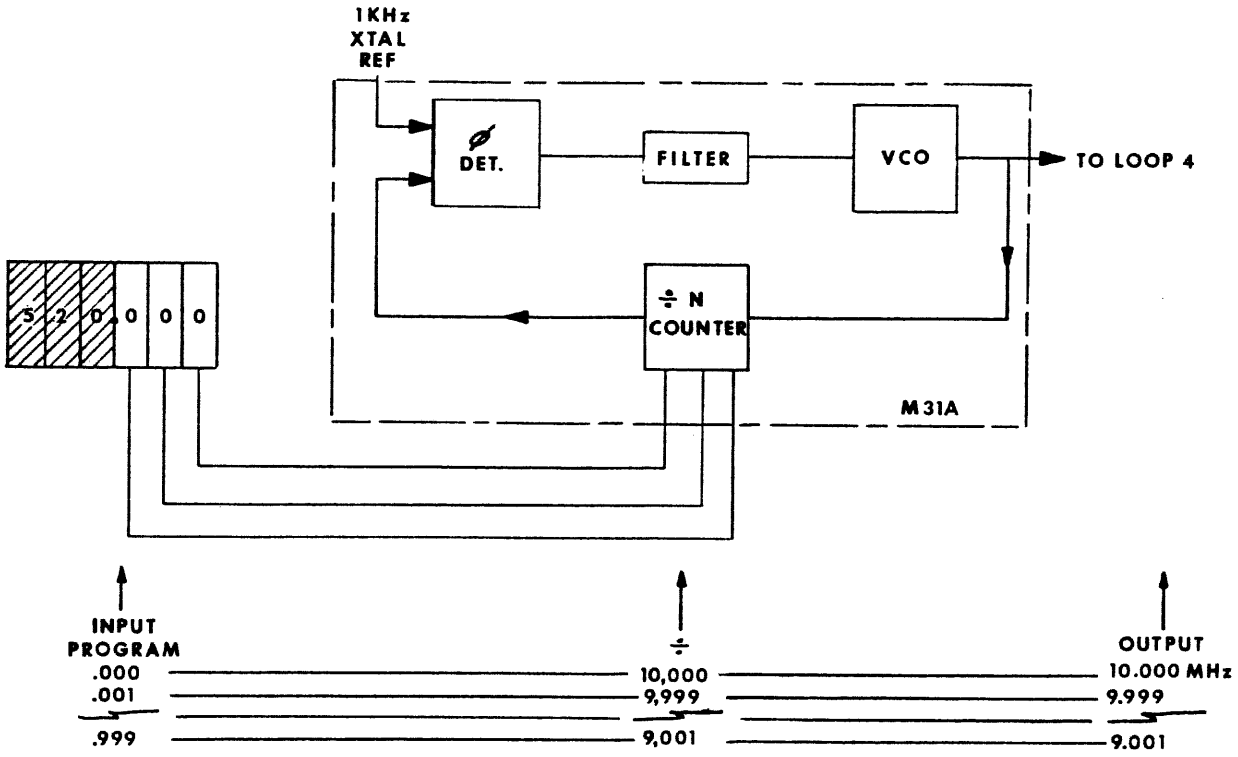


Figure 3-3. PLL 1

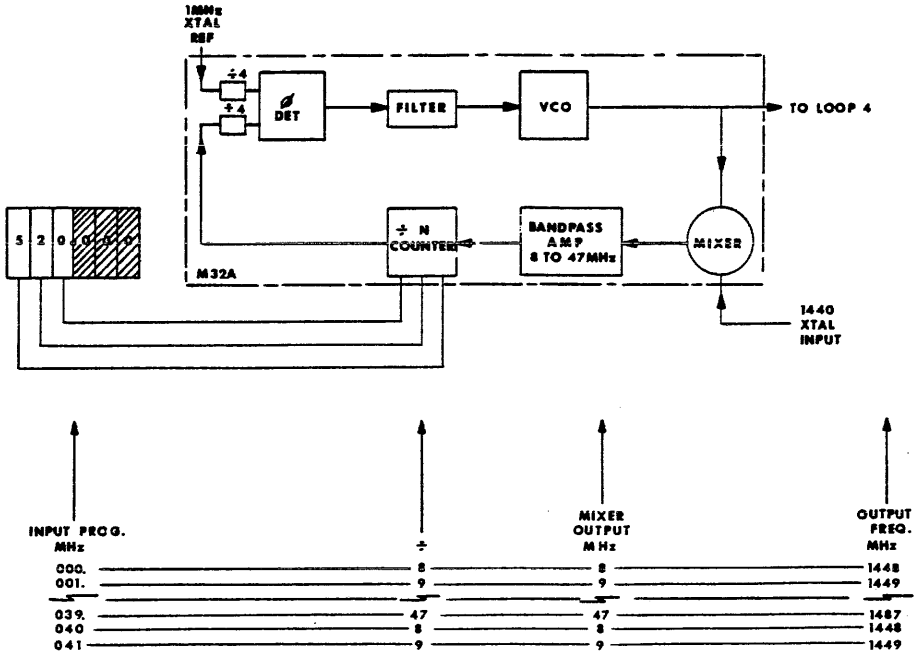


Figure 3-4. PLL 2

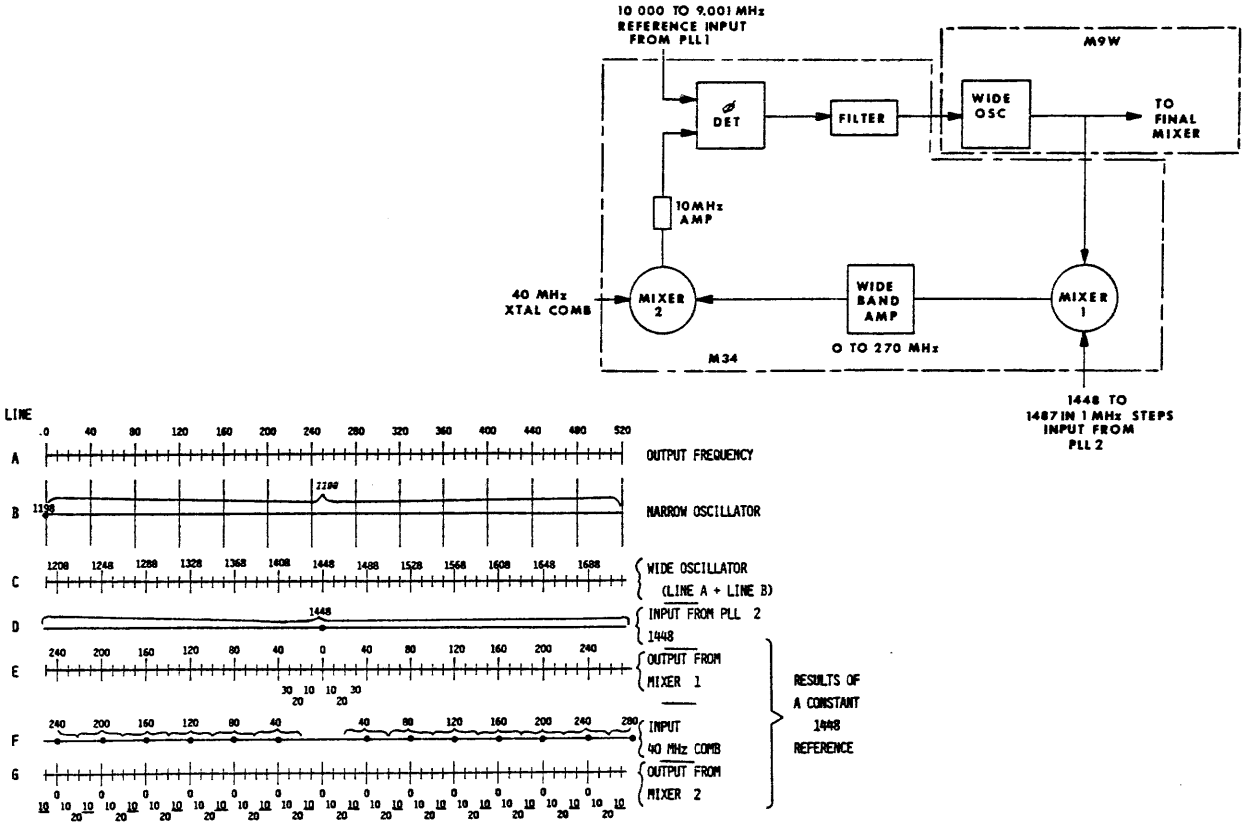


Figure 3-5. PLL 4

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 lines 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 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.

On Models 3005 and 3006, the "2 kHz reference" (refer to Figure 3-7) is replaced by a reference from the 100 Hz Steps circuit. This reference is produced by taking a 40 MHz reference signal from the Crystal Reference and dividing it by a number (20000-19991) determined by the 100 Hz Lever/Indicator switch. This divided signal (2.0000-2.0009 kHz) then becomes the reference for PLL 5; thus the PLL 5 output signal to PLL 3 can be offset from 0 to 900 Hz in 100 Hz steps, and 100 Hz resolution is accomplished.

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 two printed circuit board assemblies, a power supply, and 12 (Model 3003), 13 (Models 3004, 3005), or 14 (Model 3006) module assemblies. These can be identified in Figure 5-6. Sections 3.3 thru 3.17 describe the operation of each subassembly. The name of the subassembly describes, to an extent, the primary fuction it performs.

3.3 C315-2 - METER BOARD

The primary functions of this assambly are to provide the program voltage to the Output Amplifier leveler circuit and indicate the RF output amplitude and modulation (see Figure 3-8).

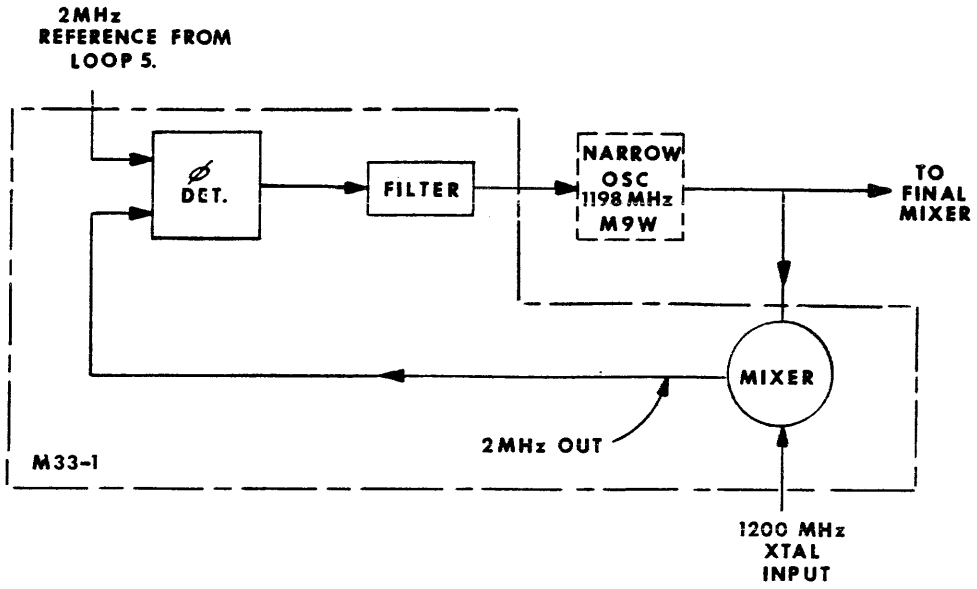


Figure 3-6. PLL 3

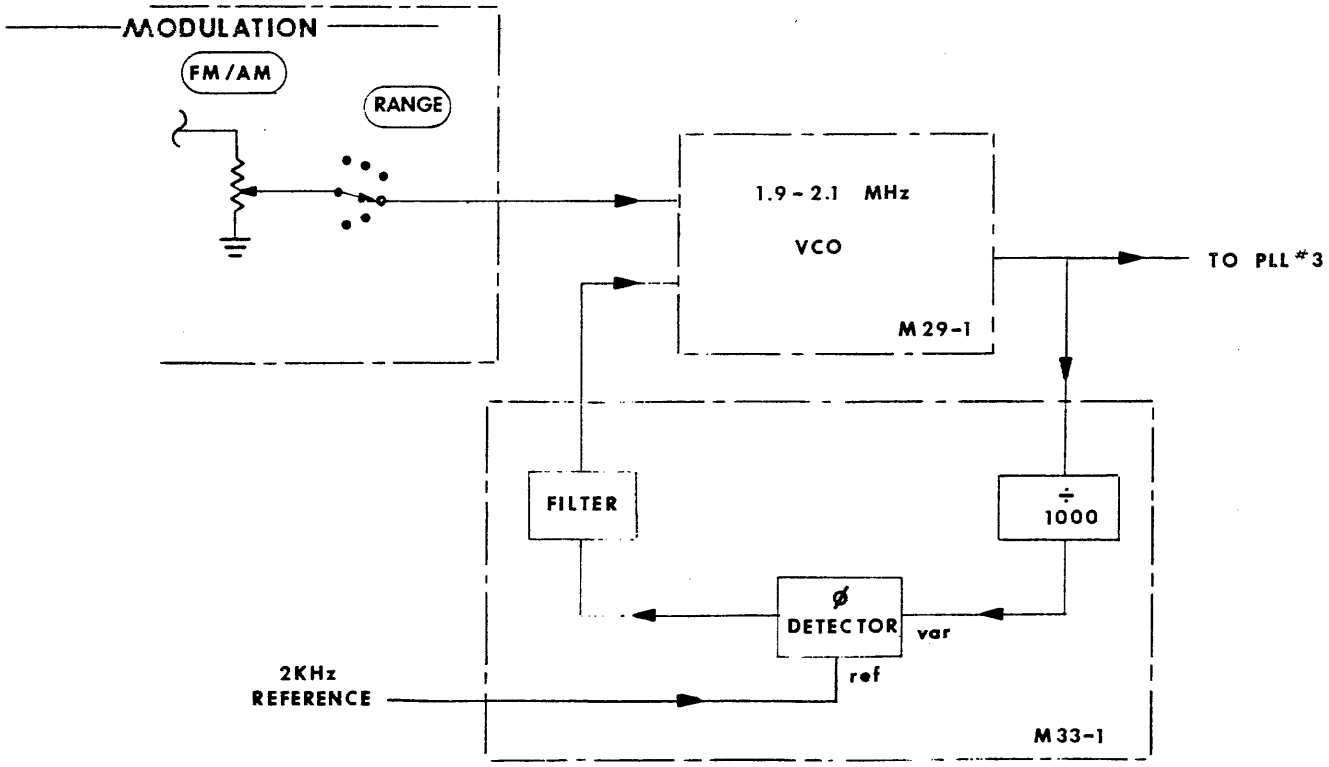


Figure 3-7. PLL 5

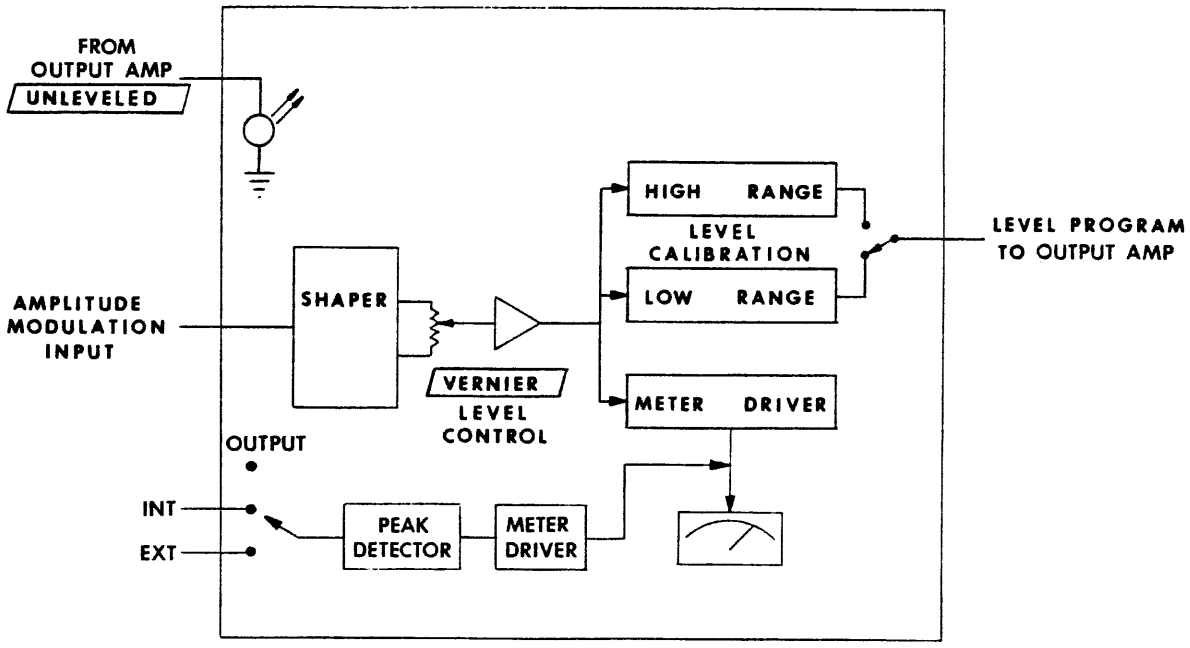


Figure 3-8. C315-2 Meter Board

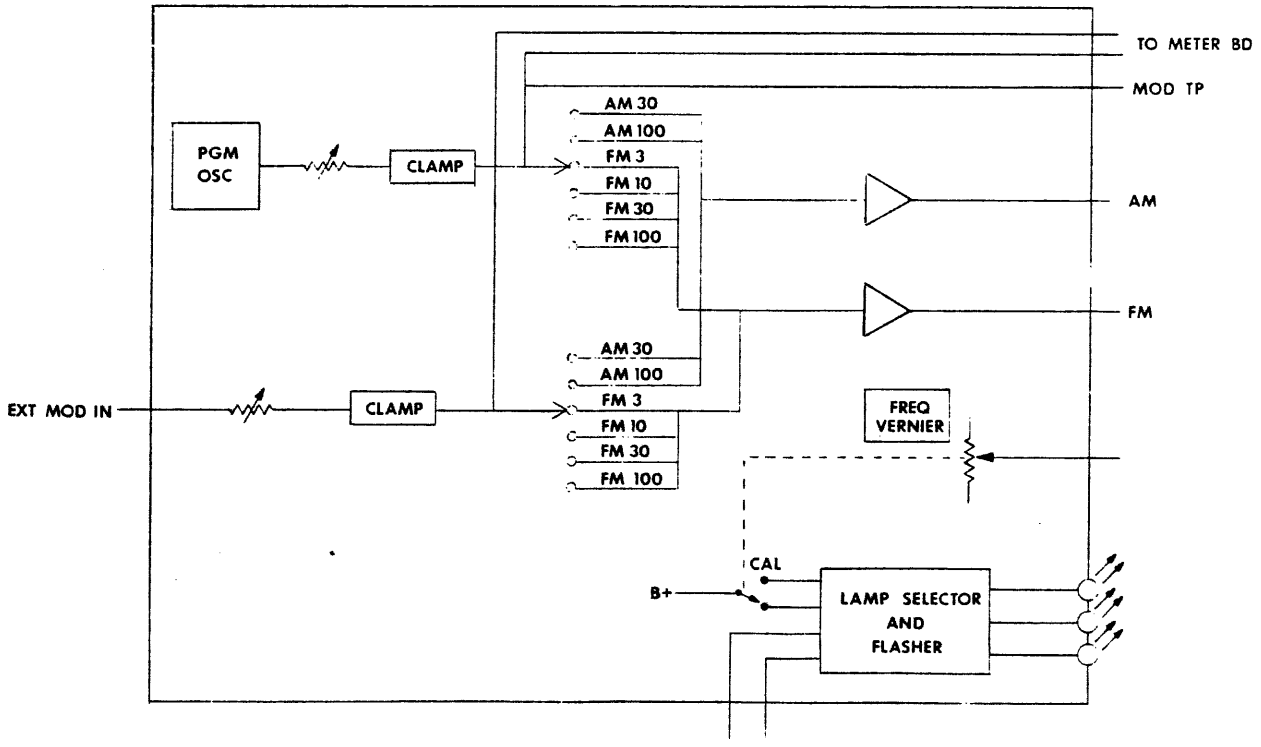


Figure 3-9. Modulation Board

3.3.1 LEVEL PROGRAM

During CW operation of the instrument, the level program is controlled by the OUTPUT VERNIER on the front panel. The output of this control goes to two range calibration circuits which convert the voltage from the OUTPUT VERNIER to a voltage level appropriate to drive the leveler circuit in the Output Amplifier module.

The "low" circuit provides the program for all ranges of the dented 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 Output Amplifier to be used when the output is not amplitude modulated.

During amplitude modulation, the modulating signal from the Modulation Board is applied to the OUTPUT VERNIER, which ultimately causes the RF level to change. The leveler in the Output Amplifier does not cause the RF level to respond linearly to changes in the level program voltage. To compensate for this, a stage is included to shape the modulation signal before it is applied to the OUTPUT VERNIER.

3.3.2 METER

The front-panel METER is controlled by the level program when the METER switch is set to OUTPUT. The METER and its driver circuits are calibrated to display a reading corresponding to the actual RF level from the Output Amplifier module.

When the METER switch is set to either INT MOD or EXT MOD, the METER displays the modulation present (%AM or FM deviation) on the selected circuit. The METER scale being read is selected by the front-panel INT MODULATION RANGE and EXT MODULATION RANGE switches.

3.3.3 UNLEVELED LIGHT

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

3.4 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 RANGE switches.

The front-panel INT MODULATION FREQ switch selects one of four internal modulating frequencies derived from a programmable oscillator. The INT MODULATION RANGE switch selects the type of modulation (AM or FM), and the proper resistor network corresponding to the selected METER scale. The INT MODULATION LEVEL control adjusts the ammount of modulating signal fed into the resistor networks, and so the ammount of modulation (%AM or FM deviation) produced.

An EXT MODULATION INPUT connector is provided for modulating from an external source. The EXT MODULATION RANGE and LEVEL controls perform the same functions as their INT counterparts.

IC4A sums together the INT and EXT AM signals, while IC4B sums together the INT and EXT FM signals, enabling complex (AM/FM, FM/AM, FM/FM, AM/AM) modulation to be accomplished.

3.4.2 ACCURACY LAMPS

The CAL switch on the FREQUENCY VERNIER (or an input from Option 5 or 5A) determines which lamp is lit. If any of the phase-locked loops unlock, the energized LED is made to flash by an IC timer activated by a DC level from any of the five phase-locked loops in the instrument.

3.5 DPS2A - POWER SUPPLY

The DPS2A 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. Both the +18 V and −18 V supplies use protected pass transistors with integral current limiting and thermal protection.

3.5.2 +18 V SUPPLY

The +18 V circuit has a temperature-compensated precision voltage reference. This reference is compared to the output voltage by an error amplifier which corrects any error in the output voltage.

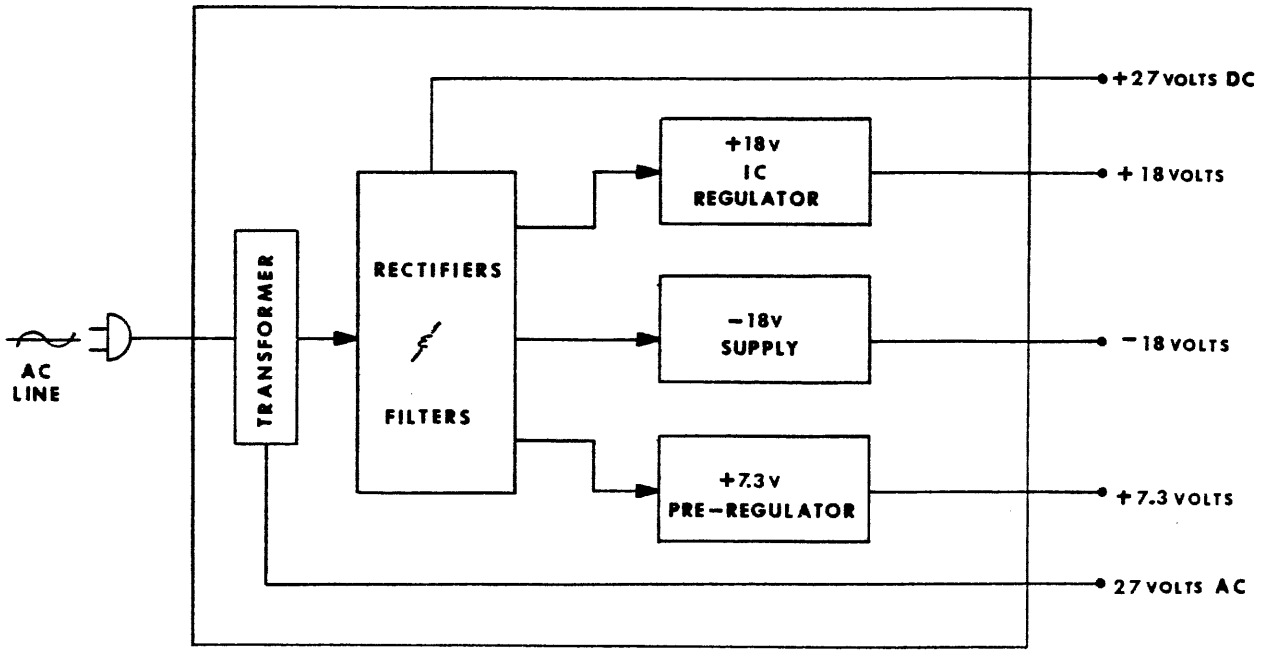


Figure 3-10. DPS2A Power Supply

Figure 3-11 is deleted

3.5.3 −18 V SUPPLY

The −18 V circuit compares the +18 V and −18V outputs and holds the difference in their magnitudes to zero.

3.5.4 +7.3 V SUPPLY

The +7.3 V circuit uses a three-terminal adjustable voltage regulator IC to provide a pre-regulated +7.3 V output. This voltage supplies other voltage regulators throughout the instrument.

3.6 DELETED

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).

3.7.2 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 Output Amplifier.

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 the VCO from the phase detector in PLL 4. 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. The frequency of this oscillator is further controlled by a "fine tuning" bias voltage from the phase detector. The deviation can be controlled up to 100 kHz.

In CW mode on Models 3005 and 3006, the 100 Hz steps are programmed through PLL 3, and thus into the Narrow Oscillator (see Section 3.14).

3.7.4 LEVELERS

This module contains three RF leveling circuits as shown in Figure 3-12. 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.

3.8 M10W-6/M10W-8 - OUTPUT AMPLIFIER

Models 3003 and 3005 use an M10W-6 Output Amplifier module, while Models 3004 and 3006 use an M10W-8.

The main function of the M10W-6 and M10W-8 Output Amplifier modules 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 cirucit exceeds its proper operating range (see Figure 3-13).

The M10W-8 also contains a switch which routes the RF output to either the Step Attenuator or the M115 for down-conversion (Models 3004 and 3006).

3.8.1 SWITCH (M10W-8)

The switch is normally set to route the output signal to the Step Attenuator; however, when the front-panel "MHz" selector switches are set to "000.", the logic signal from the M115 into pin 5 of the M10W-8 triggers the switch (relay K1) and routes the RF signal to the M115.

3.8.2 AMPLIFIER

This section is a four-transistor, wide band amplifier which can increase the RF by about 23 dB.

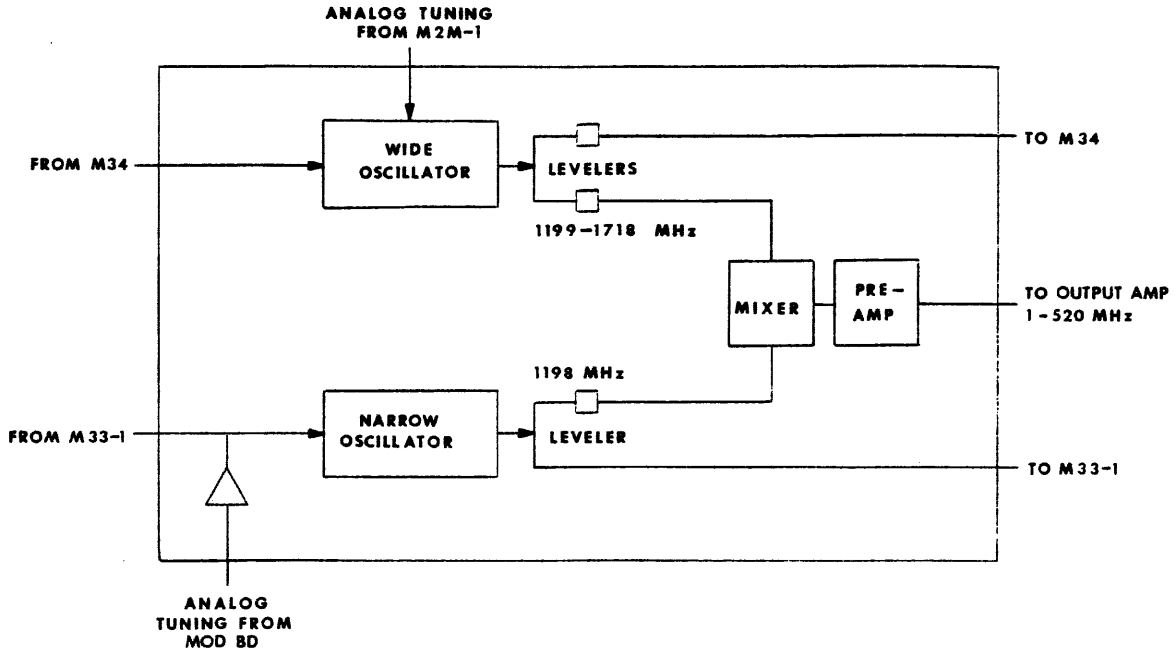


Figure 3-12. M9W Sweep Oscillator

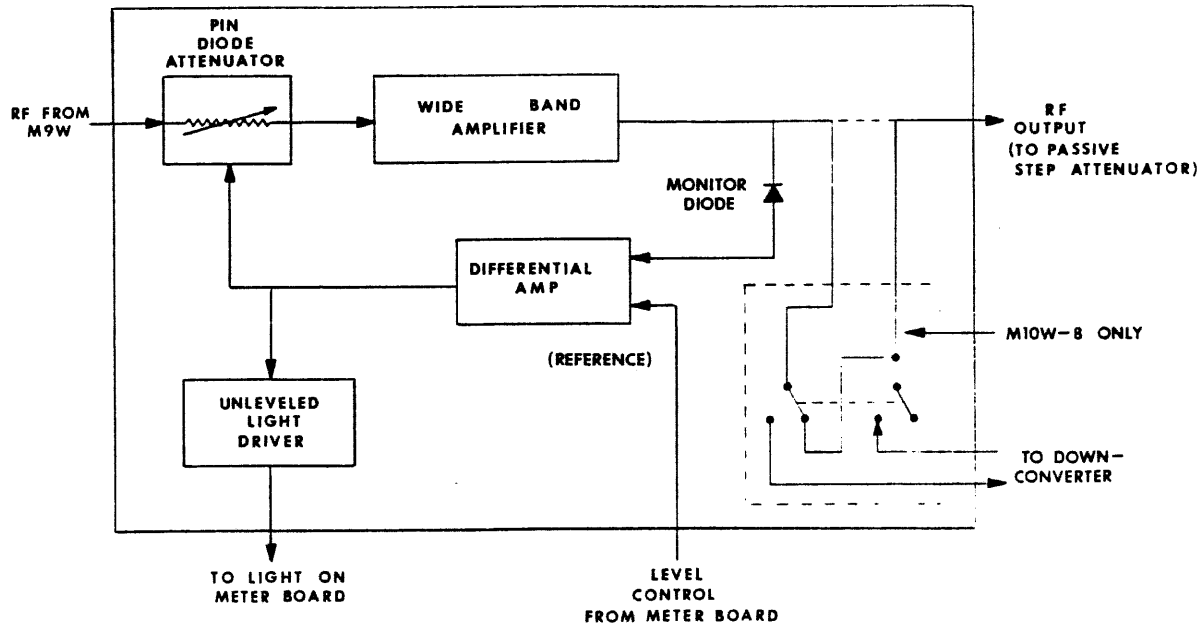


Figure 3-13. M10W-6/8 Output Amplifier

3.8.3 LEVELER

The leveler uses a peak detector, differential amplifier and 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.

3.8.4 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. These extreme voltage levels, which are applied to the UNLEVELED light driver, are adequate to turn on a source of current for the indicator which appears through the front panel.

3.9 M172 – SWEEP DRIVE/DAC

This module provides two output voltages. One is linear from 0 V to -5 V as the frequency goes from 0 to 39 MHz, repeating every 40 MHz; the other varies from +7 V to -8 V as the frequency goes from 0 to 520 MHz. The second voltage is shaped to linearize the VCO in the M9W Sweep Oscillator.

Two digital-to-analog converter ICs, programmed by the front-panel Lever/Indicator switches, provide the 0 to 520 MHz voltage. This is shaped in the next section of the module. A third DAC provides the repeating 0 - 40 MHz voltage. Since the state of the 20's line depends on the 100's line, the 20's line is inverted when the 100's line is high.

The analog tuning signal from the M172 is "shaped" before driving the M9W wide oscillator. The shaper is an inverting DC amplifier which amplifies the input by a smaller factor for smaller magnitude inputs. Shaping this analog voltage compensates for the non-linear change in capacitance of the varactor diodes in the oscillator circuit.

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 PLL 5. 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 the VCO is locked).

3.10.1 CURRENT SOURCES

This circuit provides both a positive and a negative source of current. The 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 relationship 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/M30-4 - CRYSTAL REFERENCE

Models 3003 and 3004 use an M30-1 Crystal Reference module, while Models 3005 and 3006 use an M30-4.

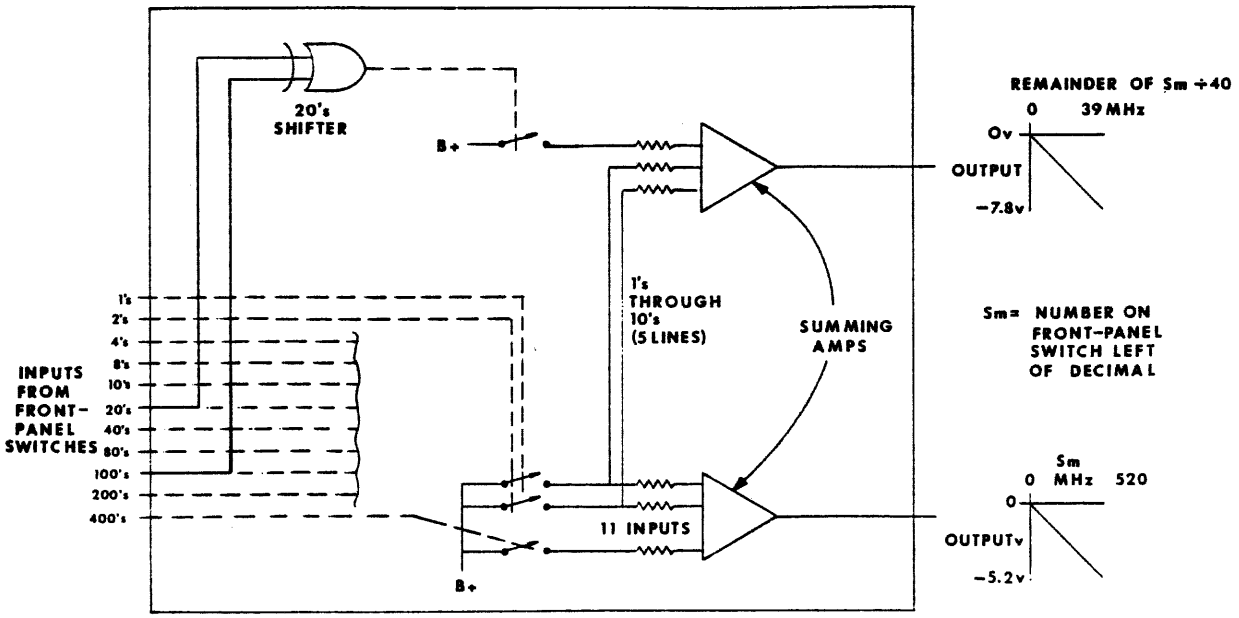


Figure 3-14. M22 DAC

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
. . .		

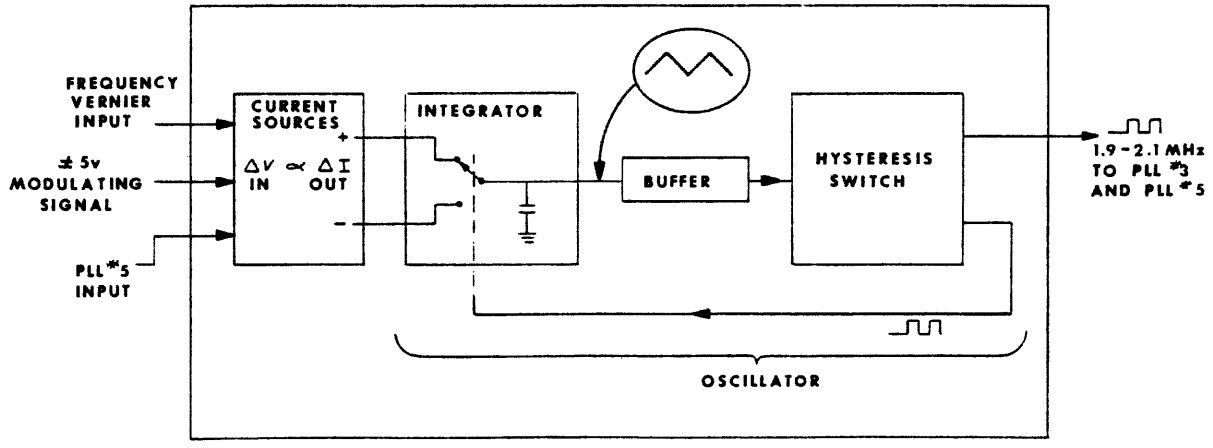


Figure 3-15. M29-2 FM Reference

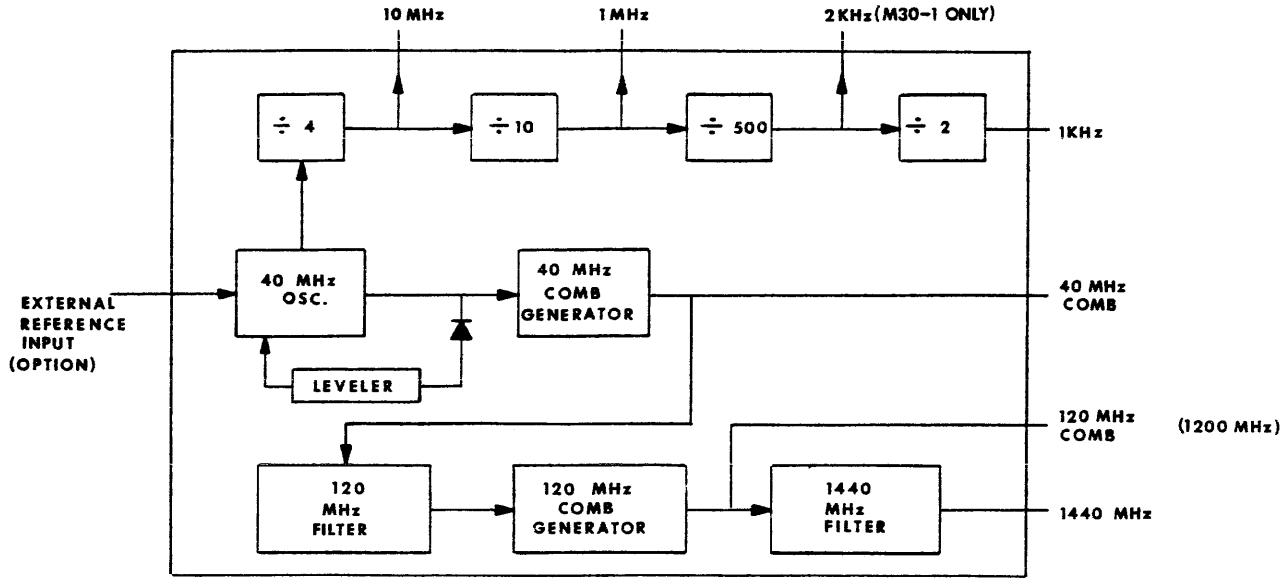


Figure 3-16. M30-1/4 Crystal Reference

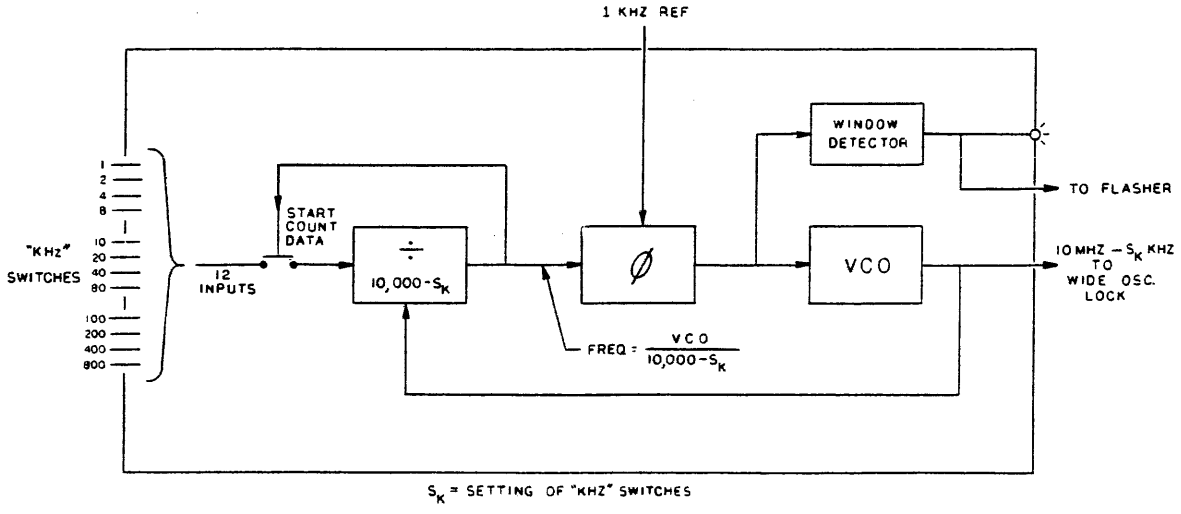


Figure 3-17. M31A kHz Steps

This module supplies reference frequencies at 1 kHz, 2 kHz (M30-1only), 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 M30-1/4 modules.

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 reference outputs.

3.11.3 MULTIPLIERS

The 40 MHz CW is fed to a harmonic generator which procudes 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 three front-panel "kHz" switches (to the right of the decimal point). The output frequency is (10 MHz– Sk kHz), where Sk is the number indicated by the kHz switches. If the frequency is set to 333.333 MHz, for example, the M31A output is 9.667 MHz. The block diagram of the M31A 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 is 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 output is divided by the programmable divider, and the result is applied to the other input of the phase detector. Any difference in 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–Sk) where Sk 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 lamps 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 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 (Sm) by the equation (Output = (1448 + R) MHz), where R is the Remainder of dividing Sm 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

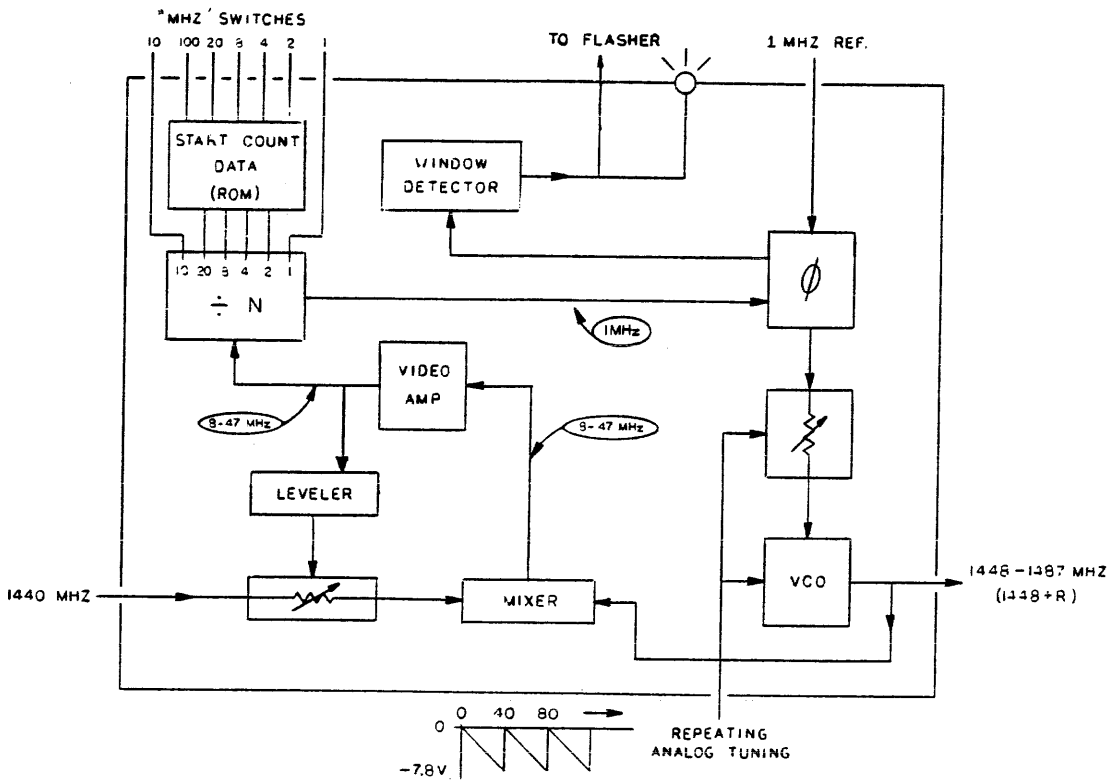


Figure 3-18. M32A MHz Steps

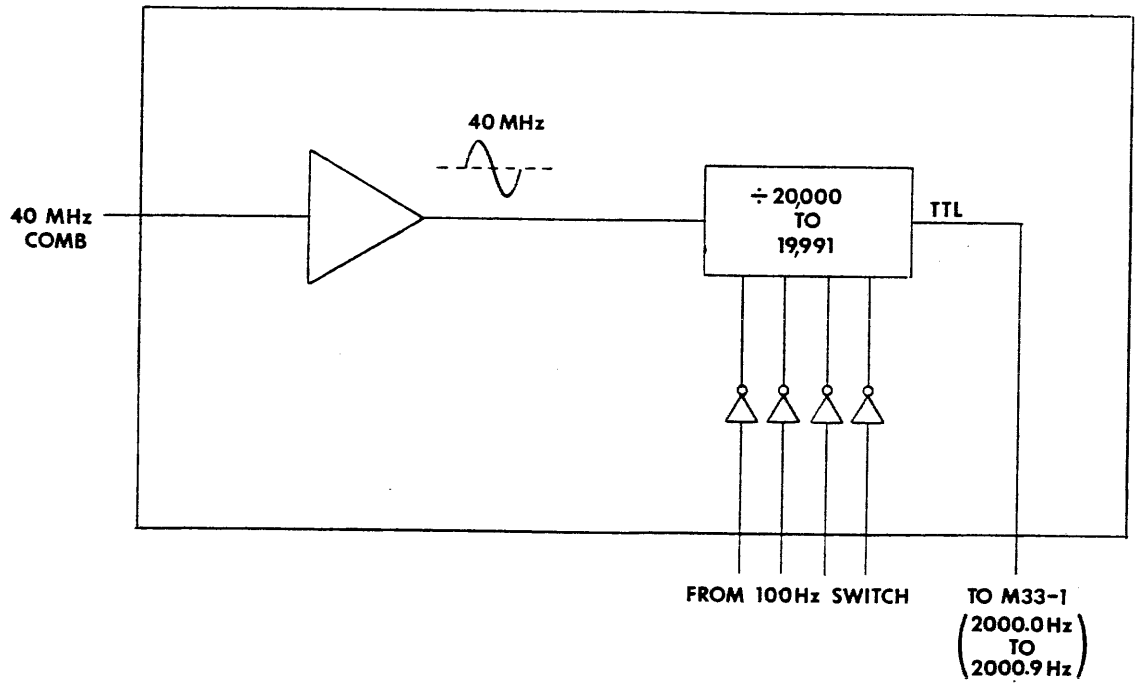


Figure 3-19. M149 100 Hz Steps

repeating analog output of the M172. 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 "Sm" 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 will flash.

A window detector monitors the voltage level 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.

3.14 M149 - 100 Hz STEPS

The M149 100 Hz Steps module enables 100 Hz resolution on Models 3005 and 3006.. The module is essentially a programmable ÷N counter which produces a reference signal for PLL 5 from a reference input from the M30-4 Crystal Reference.

The 40 MHz comb signal from the M30-4 is amplified and fed into the programmable counter which divides the signal by (20000–H) where H is the 100 Hz Lever/Indicator switch setting. For example, if the front-panel switch setting were 214.6127, the counter would divide by 19993 (20000-7). Dividing 40 MHz by 19993 yields a counter output of 2.0007 kHz. The counter output is then used as the reference for PLL 5, and thus ultimately the PLL 3 reference and Narrow Oscillator are offset (shifted) by 700 Hz.

NOTE

Due to the manner in which the 100 Hz steps offset to the Narrow Oscillator is obtained, the exact offsets for each 100 Hz Lever/Indicator switch setting are as follows:

100 Hz SWITCH SETTING	OFFSET (Hz)	ERROR (Hz)
0	000.0000	0.0000
1	100.0050	0.0050
2	200.0200	0.0200
3	300.0450	0.0450
4	400.0800	0.0800
5	500.1250	0.1250
6	600.1801	0.1801
7	700.2451	0.2451
8	800.3201	0.3201
9	900.4052	0.4052

Note that the maximum error is less than 0.5 Hz.

On Model 3006, at frequencies below 40.5 kHz, the fixed error introduced by the 100 Hz digit may cause the output frequency accuracy to not meet its .001% specification; however, the actual output frequency may be determined within .001% by adding the error from the above list to the selected output frequency.

When the FREQUENCY VERNIER is not in its CAL position, PLL 5 is disabled, and the M149 has effectively

no function (100 Hz resolution is not obtainable with the FREQUENCY VERNIER not in CAL).

3.15 M33-1 - NARROW OSCILLATOR LOCK

The M33-1 contains the circuits to phase lock the Narrow Oscillator in the M9W (PLL 3) and the M29-1 FM Reference (PLL 5). As explained in Section 3.2.2, PLL 5 provides the reference frequency for PLL 3.

3.15.1 PHASE DETECTOR FOR PLL 3

This circuit compares the reference frequency to the variable frequency which represents the M9W Narrow Oscillator output. If the frequency 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 Narrow Oscillator to lower the frequency.

3.15.2 MIXER

The phase detector cannot operate at UHF frequencies, so the Narrow Oscillator signal 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.

3.15.3 PHASE DETECTOR FOR PLL 5

This circuit compares the 2 kHz reference from the M30-1 Crystal Reference (or the M149 100 Hz Steps module) 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 intregrator filter, and the error voltage is fed to the M29-1.

3.15.4 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.

3.16 M34 - WIDE OSCILLATOR LOCK

This module provides the fine tuning program for the Wide Oscillator in the M9W. Figure 3-21 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 3-22 and 3-23. The M34 phase locks the Wide Oscillator to 1198 MHz plus the frequency indicated on all six front-panel switches (discounting the 100 Hz switch on Models 3005 and 3006 which affects the Narrow Oscillator). 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 off-set circuit and the phase detector, several auxillary circuits are included.

3.16.1 PHASE DETECTOR

The phase detector compares the "offset" Wide Oscillator frequency to the reference frequency from the M31A. (Refer to the description of the M31A 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.

3.16.2 FREQUENCY OFFSET CIRCUIT

The Wide Oscillator 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 3-21, 3-22 and 3-23 for descriptions of signals.

Mixer 1 heterodynes the Wide Oscillator frequency with the "MHz steps" reference frequency (1448 + R MHz). The difference frequency, | 1448 + R – WO |, 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 3-22 shows the comb frequency which will yield the desired output (below 20 MHz) of mixer 2. If PLL 4 is locked, mixer 2 will produce a 10 MHz difference as shown in Figure 3-22 (assuming the "kHz" switches are set for 000). Figure 3-23 shows signals A thru F for a case when the kHz switches are not 000.

The filter after mixer 2 blocks all the outputs of the mixer except the lower frequency signal containing the Wide Oscillator 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 PLL 4 is locked, the filter decreases to 10 MHz to further eliminate phase-locked-loop-related spurious signals.

3.16.3 AUXILLARY 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 Wide Oscillator to be tuned faster

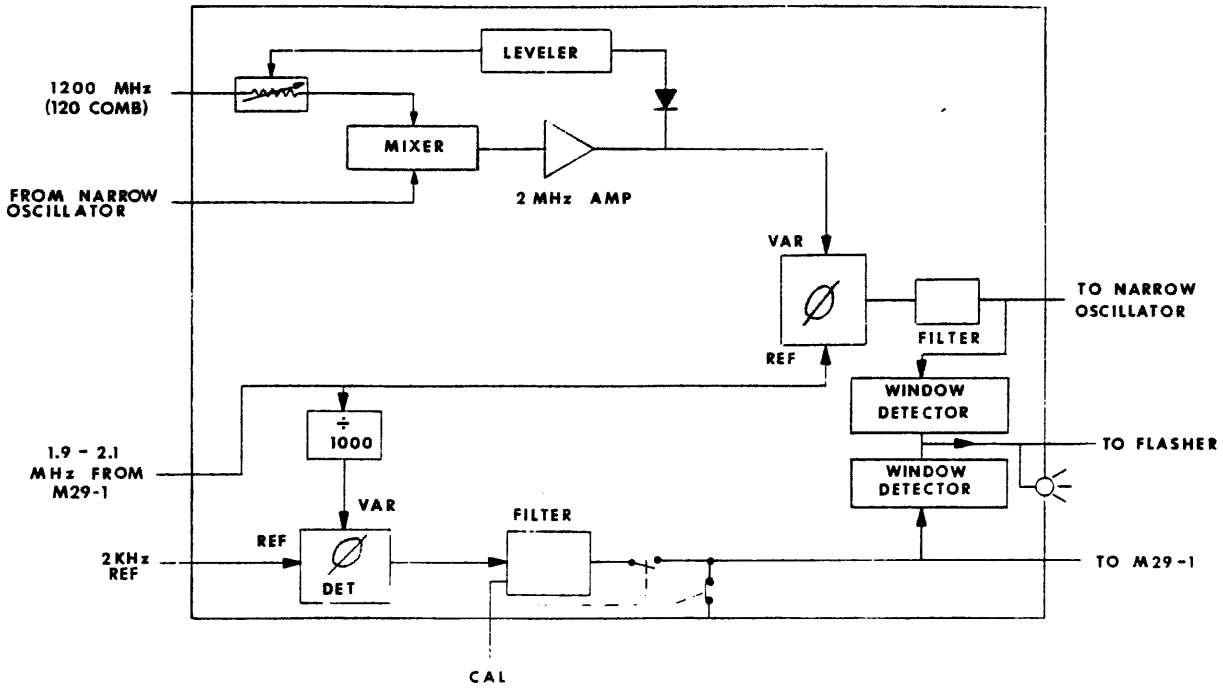


Figure 3-20. M33-1 Narrow Oscillator Lock

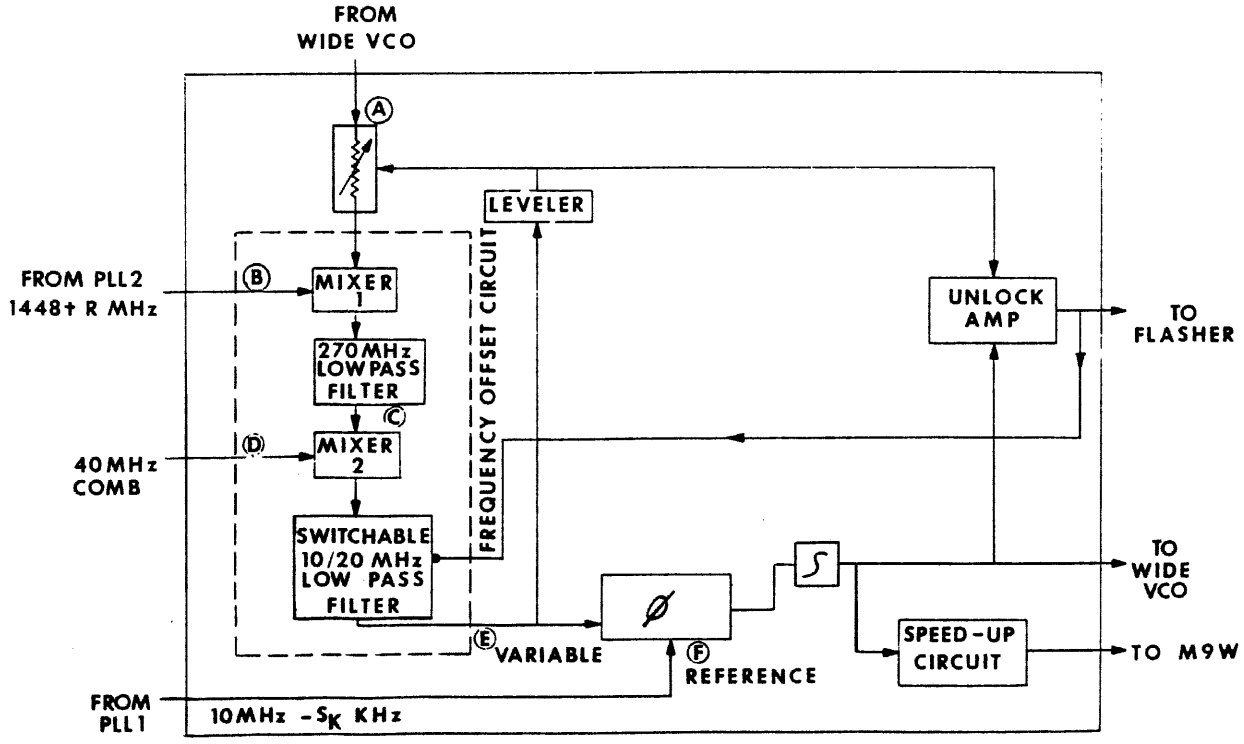


Figure 3-21. M34 Wide Oscillator Lock

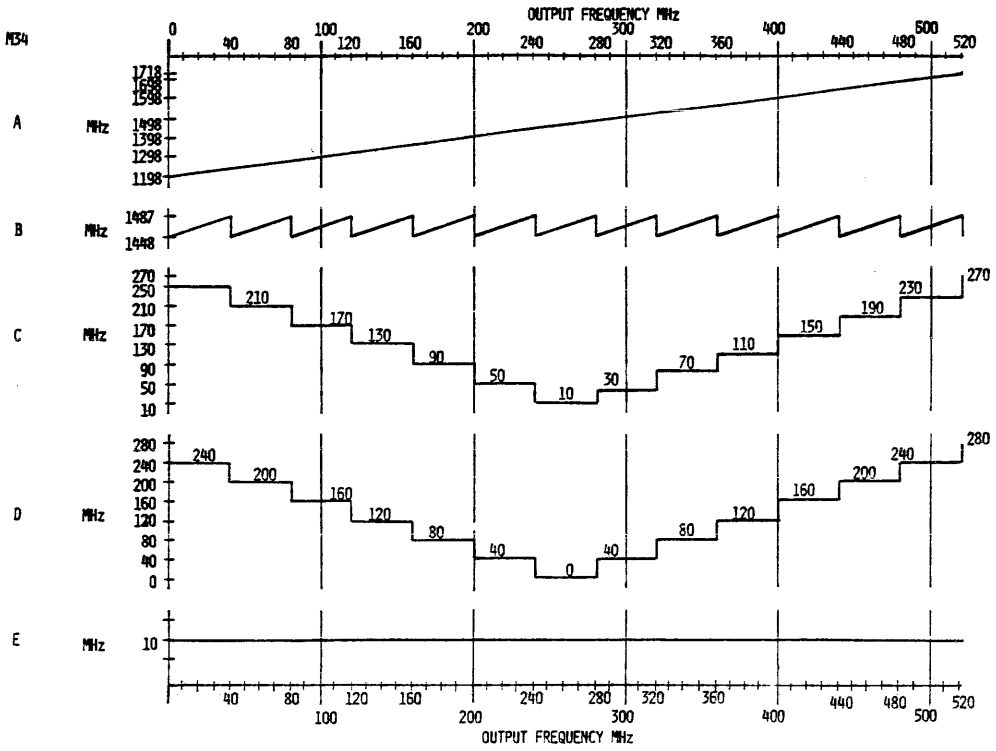


Figure 3-22. M34 Frequencies

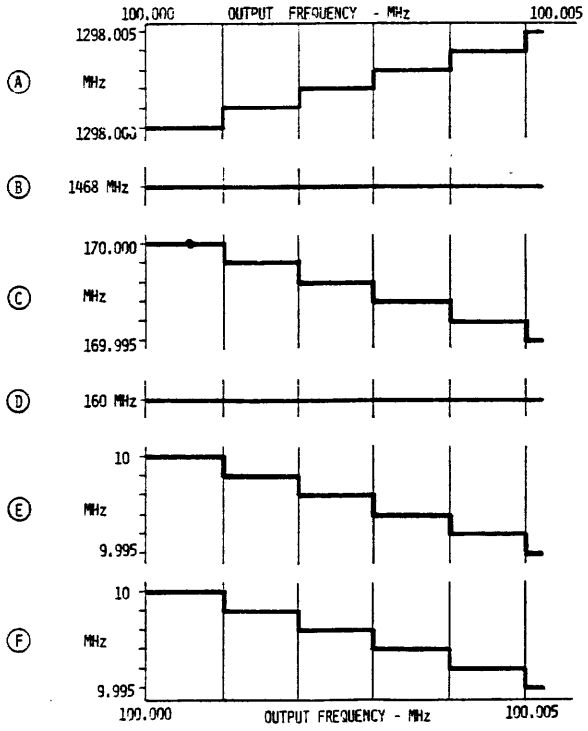


Figure 3-23. M34 Frequencies (Expanded)

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 the 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 cirucit controls a PIN diode attenuator which is between the Wide Oscillator input and mixer 1.

3.17 M115 – DOWN-CONVERTER

The M115 Down-Converter extends the low end of the frequency range of Models 3004 and 3006 to 1 kHz. The module takes the RF output from the M10W-8 (when the front-panel "MHz" selector switches are set to "000.") and converts it to the proper 1 to 999 kHz output frequency.

The BCD signals from the front-panel "MHz" selector switches are fed into a 13-input NAND gate. (Two of the inputs are held high.) This gate determines whether the switches are set for "000.", and, if so, triggers a hex inverter to send out a logic "true" to the M10W-8 and activate the 10 MHz line to the M22 and M32A. This programs the M9W for 10 MHz plus the "kHz" switch setting, and this signal is fed into the M10W-8. At this point, however, the signal is routed to the M115 (see Section 3.8) where it is mixed with the 10 MHz reference signal from the Crystal Reference. The difference frequency from this mixing is simply the "kHz" switch setting, and is output back to the M10W-8 and on to the Step Attenuator.

The M115 also contains a 20 dB attenuation pad for the input from the M10W-8, and an RF amplifier for the 10 MHz reference signal. The effect of these stages is to allow the mixer output to be directly proportional to the output from the M10W-8. The mixer output is then fed into a 3-stage amplifier with complementary push-pull output to restore the output to the proper (−7 to +13 dBm) level. Potentiometer R3 and trimcap C20 fine adjust the gain and frequency response of the module.

If the front-panel "MHz" switches are not set to "000.", the M115 has no function except that the 10 MHz program line from the switches to the M22 and M32A passes through the M115.

NOTE

If the M115 is removed for servicing, the instrument may still be used; however, the frequency range is reduced from .001-520 MHz to 1-520 MHz. In this case, pins 1 and 9 of the M115 module socket must be jumpered together.

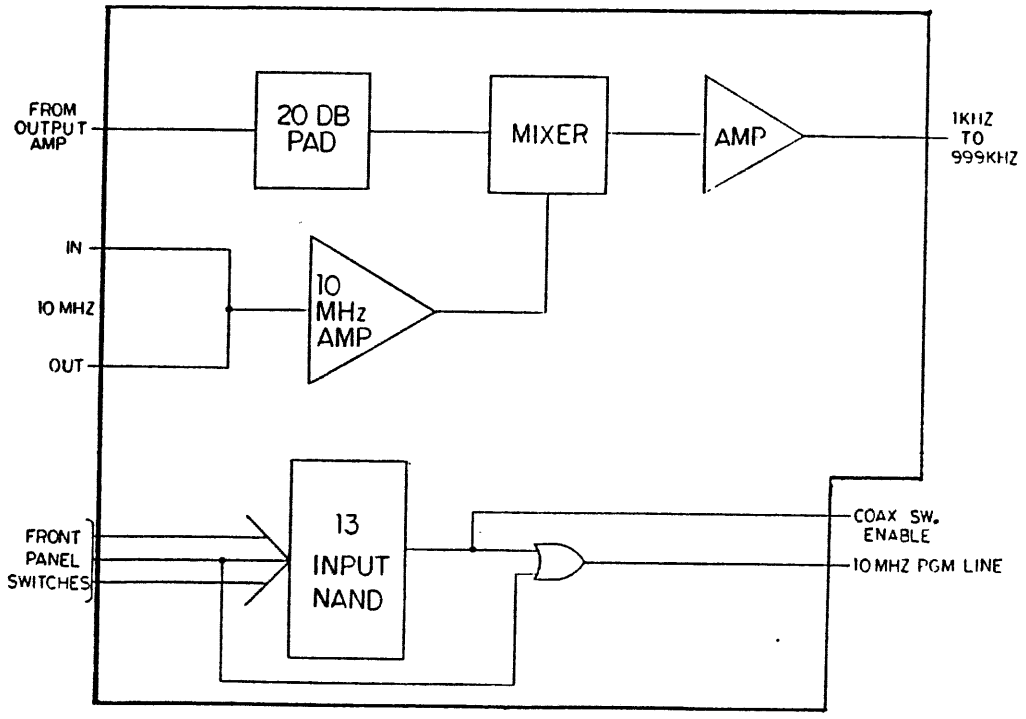


Figure 3-24. M115 Down-Converter

SECTION 4
PERFORMANCE TESTS

4.1 INTRODUCTION

The purpose of the performance tests in the following sections is to verify that the Signal Generator meets its published specifications (Section 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 specifiactions for each item of test equipment are listed in Table 4-1, 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 to 400 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 Signal Generator 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 routing performance testing. The PTR lists the section, test, and specification limits. All tests refer to this record.

TABLE 4-1. RECOMMENDED TEST EQUIPMENT FOR PERFORMANCE TESTS

INSTRUMENT	CRITICAL REQUIREMENT	RECOMMENDED
(1) Digital Multimeter	10 VDC: ±(0.07%R+0.02%FS)	Dana 4200
(2) Distortion Analyzer	Range: 5 Hz to >25 kHz	HP334A
(3) Frequency Counter	Range: to 525 MHz	HP530B/5303B
(4) Function Generator	Level: 10 Vpp sine wave into 600 ohm load Range: >0.2 Hz to >25 kHz Distortion: <1%	Wavetek 130
(5) Power Meter	Range: 10 to >520 MHz Input Level: −7 to +13 dBm Accuracy: ±1% FS	HP435A/8481A
(6) 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
(7) Oscilloscope	Range: DC to 2 MHz Sensitivity: 2 V/cm (AC coupled)	Tektronix D10/ 5A18N/5B10N
(8) Spectrum Analyzer	Range: 1 kHz to 1200 MHz Display: 2 dB log and 10 dB log	HP8558B/182T
(9) Precision Attenuator Pads	10, 20, 30, and 40 dB	Weinschel 50-10 50-20, 50-30 and 50-40
(10) Wideband Amplifier	Range: 1 to 520 MHz Gain: 26 dB Impedance: 50 ohm	HP8447D
(11) Signal Generator	Range: 1 to 520 MHz	Wavetek 3001
(12) VSWR Bridge	5 to 525 MHz, 50 ohm 50 dB directivity	Wiltron 60N50
(13) Coaxial Short	Type N female	HP11511A
(14) Coaxial Termination 50 ohm	Type N male, 1.05 SWR	HP908A
(15) 50 ohm Load	----------	HP11593A
(16) Loop Probe	----------	See Figure 4-5

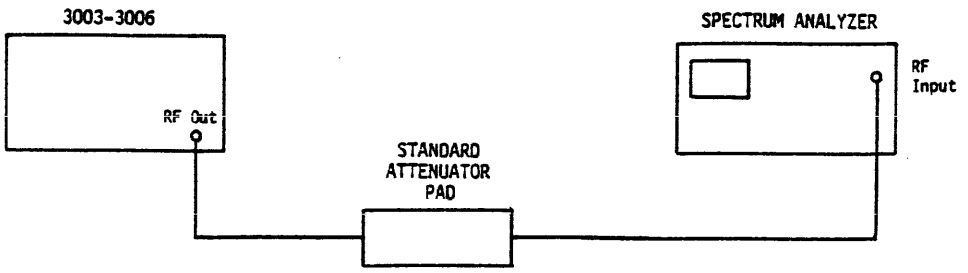


Figure 4-1. Test Set-up

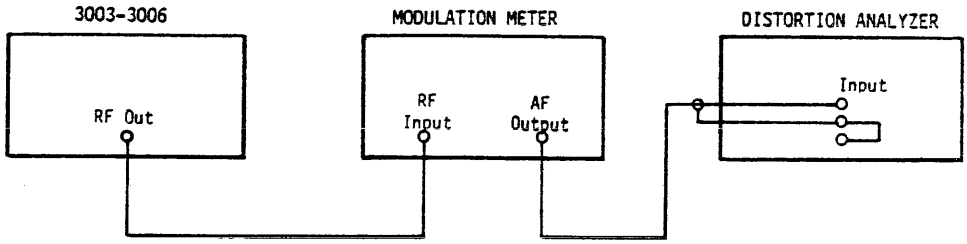


Figure 4-2. Test Set-up

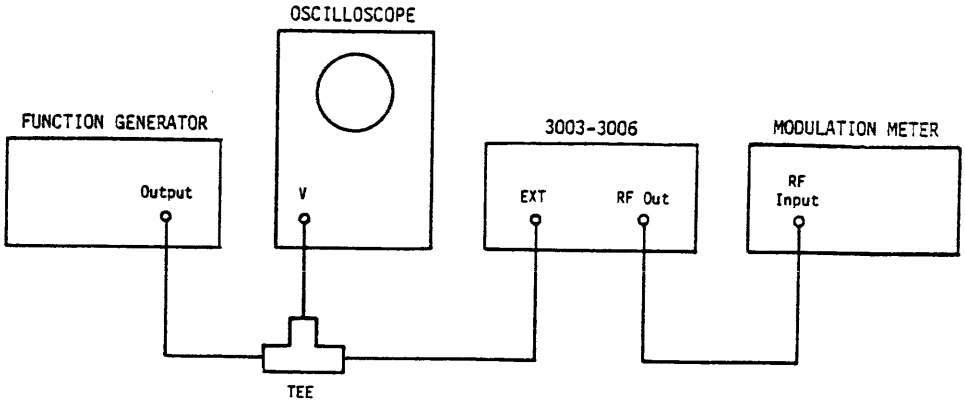


Figure 4-3. Test Set-up

4.2 FREQUENCY RANGE AND RESOLUTION TEST

SPECIFICATION	MIN FREQ	MAX FREQ	RESOLUTION
Model 3006	1 kHz	520 MHz	100 Hz
Model 3005	1 MHz	520 MHz	100 Hz
Model 3004	1 kHz	520 MHz	1 kHz
Model 3003	1 MHz	520 MHz	1 kHz

METHOD

A frequency counter is used to measure frequency range and resolution. Each digit of the Lever/Indicator switches (a total of 56 or 66, depending on the instrument being tested) will be tested.

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	050.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	NA
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full CW

NOTE: The Lever/Indicator switch settings will be given for Models 3005 and 3006. If a Model 3003 or 3004 is being tested, ignore (the last (100 Hz) digit.

2. Connect the front-panel RF OUT connector to the 50 ohm input of the frequency counter. Set the counter resolution to 10 Hz (Models 3005, 3006) or 100 Hz (Models 3003, 3004).

3. Step through each Lever/Indicator switch digit and verify that the actual counter frequency increase per step is equal to the allowable increase per step ±1 count (see following table).

LEVER/INDICATOR SWITCH SETTINGS	COUNTER RESOLUTION	INCREASE/STEP (± 1 COUNT)
050.0000-050.0009	10 Hz	100.0 Hz
050.0000-050.0090	100 Hz	1.00 kHz
050.0000-050.0900	100 Hz	10.000 kHz
050.0000-050.9000	1 kHz	100.0 kHz
050.0000-059.0000	1 kHz	1.000 MHz
100.0000-190.0000	1 kHz	10.000 MHz
020.0000-520.0000	1 kHz	100.000 MHz

4. Verify the instrument frequency range by setting the Lever/Indicator switches to the minimum and maximum specified frequencies and noting the frequency counter readings.

5. If both the resolution (step 3) and range (step 4) are correct, place a check mark in the appropriate space on line 1 of the PTR.

4.3 FREQUENCY ACCURACY TEST

SPECIFICATION

All modes (CW, AM and FM) ±0.001% after 15 minutes. ±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 FREQ VERNIER in CAL position, all carrier frequencies are derived from a single crystal-controlled oscillator. The instrument will be tested at one CW frequency to verify that the crystal-controlled oscillator operates within specified limits.

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

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	040.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

2. Connect the 50 ohm input of the frequency counter to the RF OUT connector.

3. The counter should read between 39,999.60 and 40,000.40 kHz. Record the counter reading to seven places on line 2 of the PTR.

4. Set the FREQ VERNIER control to 0 kHz. The frequency counter should read between 39,989.60 and 40,010.40 kHz. Record the counter reading to 7 places on line 3 of the PTR.

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

6. Subtract the frequency counter reading in Step 4 from the reading in Step 5. The frequency difference should be between 2500 and 3500 Hz. Record the difference on line 4 of the PTR.

7. Set the FREQ VERNIER to –3 kHz and subtract the frequency counter reading from the reading at 0 kHz in Step 4. The difference should be as in Step 6. Record the difference in Hz on line 5 of the PTR.

4.4 FREQUENCY STABILITY TEST

SPECIFICATION

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

METHOD

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

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	N/A
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full CW

2. Connect the 50 ohm input of the frequency counter to RF OUT connector.

3. Allow the instrument 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 6 of the PTR.

4. Set the front-panel FREQ VERNIER TO 0 kHz. 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 7 of the PTR.

4.5 OUTPUT LEVEL ACCURACY TESTS

SPECIFICATION

Power Level: +13 to −137 dBm (1 V to 0.03 uV)

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 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 output level. The resulting instrument 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

(5)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	050.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

2. Calibrate the power meter and power sensor. Set the power meter to the +15 dBm range. Connect the power sensor to the front-panel 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 instrument 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 front-panel 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 8 of the PTR.

4. Set the instrument OUTPUT Step Attenuator to 0 dBm and repeat step 3 above. Record the maximum output METER error on line 9 of the PTR.

4.5.2 FLATNESS TEST

EQUIPMENT

(5)

PROCEDURE

1. Set the instrument controls as in Section 4.5.1.

2. Set the power meter to the +15 dBm range. Connect the power sensor to the front-panel RF OUT connector.

3. Adjust the front-panel OUTPUT VERNIER for a +12 dBm power meter reading.

4. Set the instrument 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 10 of the PTR.

5. Set the Lever/Indicator switches to 050.0000 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 11 of the PTR.

7. Set the Lever/Indicator switches 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 12 of the PTR.

4.5.3 STEP ATTENUATOR ACCURACY TEST

EQUIPMENT

(5) (8) (9) (10)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	full cw

2. Set the power meter to the +5 dBm range. Connect the power sensor to the RF OUT connector.

3. Adjust the OUTPUT VERNIER control for a +2 dBm power meter reading.

4. Disconnect the power sensor from the front-panel 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.

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 to -10 dBm.

8. Disconnect the 10 dB attenuator pad from the setup and reconnect the spectrum analyzer to the RF OUT connector.

9. Adjust the OUTPUT VERNIER control to realign the peak of the trace one division below the log reference line as in step 6.

10. Disconnect the cable from the front-panel RF OUT connector. Connect the power sensor and set the OUTPUT Step Attenuator to 0 dBm.

11. Observe the difference between the actual power meter reading and the +2 dBm reference setting in step 3. The difference or error should be ±0.7 dB maximum. Record the error on line 13 of the PTR.

12. Repeat Steps 3 through 11 using the standard attenuator pads and the instrument OUTPUT Step Attenuator settings indicated in the following table.

Steps 4 and 8 Attenuator pad (dB)	Step 7 OUTPUT Step Attenuator setting (dBm)	Step 11 Record Error on Line of PTR
10	−10	13
20	−20	14
30	−30	15
60	−60	16
90	−90	17

NOTE: To test the OUTPUT Step Attenuator below -20 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 instrument proper.

4.6 HARMONICS TEST

SPECIFICATION

< -30 dBc from 1 kHz to 1 MHz (Models 3004, 3006)
< -26 dBc from 1 to 10 MHz
< -30 dBc from 10 to 520 MHz

METHOD

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

EQUIPMENT

(8)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	001.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

2. Connect the spectrum analyzer to the instrument RF OUT connector.

3. Set the spectrum analyzer to measure harmonic distortion for fundamental frequencies below 10 MHz. Set 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 Lever/Indicator switch setting in 1 MHz steps up to 10 MHz. Record the maximum harmonic level observed (should be < -26 dBc) on line 18 of the PTR.

5. Set the OUTPUT Step Attenuator to 0 dBm and repeat steps 3 and 4. Record the maximum harmonic level observed on line 19 of the PTR.

6. On Models 3004 and 3006, repeat steps 3,4 and 5 for Lever/Indicator switch settings between 000.0010 and 000.9990, incremented in 10 kHz steps. Note the harmonic levels, but do not record them in the PTR as yet.

7. Set the front-panel frequency selector to 10 MHz and the OUTPUT Step Attenuator to +10 dBm.

8. Set the spectrum analyzer to measure the harmonic distortion of the instrument for fundamental frequencies between 10 and 520 MHz.

9. Increase the setting of the front-panel Lever/Indicator switches in 10 MHz steps between 10 and 520 MHz while observing the spectrum analyzer display. The harmonics should be >30 dB below the fundamental. Note the maximum harmonic level observed in the display, and record the greater harmonic level observed in Step 6 and Step 9 for an OUTPUT Step Attenuator setting of +10 dBm on line 20 of the PTR.

10. Set the instrument OUTPUT Step Attenuator to 0 dBm and repeat Steps 8 and 9 at the +3 dBm output level. Note the maximum harmonic level observed, and record the greater harmonic level observed in Step 6 and Step 10 for an OUTPUT Step Attenuator setting of 0 dBm on line 21 of the PTR.

4.7 NON-HARMONICS TEST

SPECIFICATION

Fundamental Range (MHz)	Non-harmonic Range (MHz)	Non-harmonic level (dBc)
below 3	below 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 nonharmonics in the frequency range of the instrument at the maximum specified output level of +13 dBm.

EQUIPMENT

(8)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	001.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD RANGE	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

2. Connect the front-panel RF OUT connector to the RF input of the spectrum analyzer.

3. Set the spectrum analyzer to measure the non-harmonic content of the instrument output between 0 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. On Models 3004 and 3006, set the Lever/Indicator switches to 000.0010 and increase the Lever/Indicator switch setting in 10 kHz steps up to 1 MHz while observing the spectrum analyzer. On all models, increase the setting of the Lever/Indicator switches in 0.1 MHz steps between 1 and 3 MHz. The non-harmonic below 3 MHz should be 60 dB below the fundamental. Record the maximum non-harmonic observed in the display below 3 MHz in dB below the fundemental on line 22 of the PTR.

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

6. Increase the settings of the Lever/Indicator switches 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. Using the table below, record the maximum non-harmonic level observed in each range on the applicable line of the PTR.

FUNDAMENTAL RANGE (MHz)	NON-HARMONIC RANGE (MHz)	NON-HARMONIC LEVEL (dBc)	PTR LINE NUMBER
3-250	3-250	< -65	23
3-350	3-350	< -55	24
3-520	3-1000	< -35	25

4.8 RESIDUAL AM TEST

SPECIFICATION

< -65 dBc in a 50 Hz to 15 kHz post-detection bandwidth.

METHOD

A modulation meter operating in AM mode is used to demodulate the instrument 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

(2) (6)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	500.0000
FREQ VERNIER	CAL
INT MOD FREQ	1 kHz
INT MOD LEVEL	10% METER reading
INT MOD RANGE	30% AM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	–7 dB

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

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 range switch to 10 and the filter bandwidth to 50 Hz–15 kHz.

4. Adjust the front-panel INT MOD LEVEL 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 meter reading. The system is now calibrated at a reference level of -20 dBc. Since the modulating signal and carrier amplitudes are equal at 100% AM, it follows that at 10% AM the modulating signal is -20 dBc.

6. Set the front-panel INT MOD RANGE control to OFF.

7. Without disturbing the instrument or modulation meter controls, set the distortion analyzer to read residual AM. Set the range switch so that the 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 < -65 dBc. Record the residual AM in dBc on line 26 of the PTR.

As many other carrier frequencies may be tested as desired.

4.9 RESIDUAL FM TEST

SPECIFICATION

<100 Hz in a 300 Hz to 3 kHz post-detection bandwidth.
<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 instrument is operated in an FM mode where the residual FM is greater.

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

EQUIPMENT

(6)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	100 kHz deviation
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

2. Connect the front-panel 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 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 <200 Hz. Read the residual FM on the modulation meter with the function switch set to +FM and the –FM positions. Record the greater of the two readings in Hz on line 27 of the PTR.

As many other frequencies may be tested as desired.

4.10 INTERNAL MODULATION FREQUENCY ACCURACY TEST

SPECIFICATION

400 Hz and 1 kHz ±2% (plus two user-preset frequencies)

METHOD

A frequency counter is used to measure modulation frequency at the instrument rear-panel MOD TP. 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. NOTE: Internal frequencies A and B are set by the user; therefore, no performance test is given for their accuracy.

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	N/A
FREQ VERNIER	N/A
INT MOD FREQ	400 Hz
INT MOD LEVEL	mid-range
INT MOD RANGE	30% AM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	N/A
OUTPUT Step Attenuator	N/A
OUTPUT VERNIER	N/A

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

3. The counter should read between 392 and 408 Hz. Record the counter reading on line 28 of the PTR.

4. Set the front-panel INT MOD FREQ control to 1 kHz.

5. The counter should read between 980 and 1020 Hz. Record the counter reading on line 29 of the PTR.

4.11 PERCENT AM ACCURACY TEST

SPECIFICATION

±(2% of full-scale reading +5% of METER reading) at a frequency of 1 kHz. NOTE: 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 in both AM ranges with a modulation meter.

EQUIPMENT

(6)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	1 kHz
INT MOD LEVEL	30% METER reading
INT MOD RANGE	100% AM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	−3 dB

Connect the modulation meter input to the instrument RF OUT connector. Set the modulation meter to read %AM at 520 MHz. Set the range switch to 100%, the RF input attenuation to 10 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +AM and the filter to 200 kHz.

3. With the METER reading exactly 30% AM, 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 26.5 and 33.5%. Record the average %AM to the nearest 0.5% on line 31 of the PTR.

4. Repeat the above procedure for the settings given in the table below. As many other points may be tested as desired.

INT MOD RANGE AND MOD METER RANGE	MOD METER FILTER	INST METER READING	MOD METER READING (MIN)	(MAX)	PTR
100% AM	200 kHz	90%	83.5%	96.5%	32
30% AM	75 kHz	10%	8%	12%	33
30% AM	75 kHz	20%	17.5%	22.5%	34

4.12 AM BANDWIDTH TEST

SPECIFICATION

External, DC to 20 kHz (±3 dB bandwidth), input level required ~1 VRMS into 600 ohms to provide full-scale adjustment with EXT MOD LEVEL 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 instrument. 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

(4) (6)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	050.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	full ccw

EXT MOD RANGE	100% AM
METER SWITCH	EXT MOD
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	+3 dB

2. Connect the equipment as shown in Figure 4-3.

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 range switch to 100% and the filter bandwidth to 200 kHz.

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

5. Adjust the front-panel EXT MOD LEVEL control for a modulation meter reading −6 dB (approximately 50% AM).

6. Maintain the 1 VRMS 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 setting as in Step 6.

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

4.13 AM DISTORTION TEST

SPECIFICATION

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

(2) (6)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	1 kHz
INT MOD LEVEL	full ccw
INT MOD RANGE	100% AM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	−7 dB

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

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 range switch to 100% and the filter bandwidth to 50 Hz to 15 kHz.

4. Adjust the front-panel INT MOD LEVEL control for a modulation meter reading of 70%. Set the modulation meter function switch to –AM, and observe the modulation meter reading. Readjust the INT MOD LEVEL control until the average of the modulation meter readings in the +AM and –AM positions of the 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 front-panel INT MOD LEVEL control as in Step 4 until the average of the modulation meter readings in the +AM and –AM positions of the 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 — +3% of full-scale reading at 1 kHz modulation frequency.

METHOD — The FM deviation is measured in all FM ranges with a modulation meter.

EQUIPMENT — (6)

1. Set the instrument controls as follows:

Lever/Indicator switches	050.0000
FREQ VERNIER	0 kHz
INT MOD FREQ	1 kHz
INT MOD LEVEL	full ccw
INT MOD RANGE	3 kHz FM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

2. Connect the input of the modulation meter to the instrument RF OUT connector.

3. Set the modulation meter to read FM deviation at 50 MHz. Set the 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 to 3 KHz.

4. Adjust the INT MOD LEVEL control for a METER reading of exactly 1 kHz deviation. The modulation meter should read an actual deviation of between 910 and 1090 Hz. Record the modulation meter reading on line 38 of the PTR.

5. Repeat Steps 3 and 4 for all settings in the table below. As many other points may be tested as desired.

INT MOD RANGE AND MOD METER RANGE	MOD METER FILTER	INST METER READING	MOD METER READING (Hz) (MIN)	(MAX)	PTR LINE
3 kHz	3 kHz	2 kHz	1910	2090	39
10 kHz	15 kHz	3 kHz	2700	3300	40
10 kHz	15 kHz	9 kHz	8700	9300	41
30 kHz	15 kHz	10 kHz	9100	10,900	42
30 kHz	15 kHz	20 kHz	19,100	20,900	43
100 kHz	75 kHz	30 kHz	27,000	33,000	44
100 kHz	75 kHz	90 kHz	87,000	93,000	45

4.15 FM BANDWIDTH TEST

SPECIFICATION

External, 50 Hz to 25 Hz (1 dB bandwidth), input level required ≅ 1 VRMS into 600 ohms to provide full-scale adjustment with EXT MOD LEVEL control. (DC to 25 kHz when the FREQ 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 output signal. 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

(4) (6) (7)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	full ccw
EXT MOD RANGE	100 kHz FM
METER switch	EXT MOD
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	−7 dBm

2. Connect the equipment as shown in Figure 4-3.

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 kHz, and the filter bandwidth to 200 kHz.

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

5. Adjust the front-panel EXT MOD LEVEL control for a modulation meter reading of −1 dB (approximately 90 kHz deviation).

6. Maintain the 1 VRMS 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 45 of the PTR.

4.16 FM DISTORTION TEST

SPECIFICATION

2% (10 kHz to 100 kHz deviation) at a frequency of 1 kHz
4% (3 to 10 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 is <60 dB relative to 2×10^{-4} ubar.

EQUIPMENT

(2) (6)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	1 kHz
INT MOD LEVEL	3 kHz METER reading
INT MOD RANGE	10 kHz FM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

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

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 10 kHz 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%.

5. Repeat Steps 3 and 4 for FM deviations up to 10 kHz. The distortion at all points should be less than 4%. Record the worst-case distortion on line 47 of the PTR.

6. Repeat steps 3, 4, and 5 for FM deviations of between 10 and 100 kHz. The distortion at all points should be less than 2%. Record the worst-case distortion on line 48 of the PTR.

4.17 IMPEDANCE TEST

SPECIFICATION

50 ohms, VSWR 1.2 at RF output levels below 0.1 VRMS.

METHOD

The measurement is made with a VSWR bridge and the return loss is displayed on a spectrum analyzer. An RF signal from a 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 instrument. The signal generator is tuned from 1 to 520 MHz and the return loss versus frequency is displayed.

EQUIPMENT

(8) (11) (12) (13)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	−10 dBm
OUTPUT VERNIER	+3 dB

2. Connect the equipment as shown in Figure 4-4. Connect the 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 signal generator output level to −10 dBm, the mode to CW and the 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.

5. Disconnect the coaxial short and connect the device-under-test port of the VSWR bridge to the front-panel RF OUT connector. Use the signal generator frequency selector 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 49 of the PTR.

4.18 RFI TEST

SPECIFICATION

<1.0 uV 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 uV level using the instrument. 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 instrument with the RF OUT connector terminated in 50 ohms. A screen room may be required for this measurement.

EQUIPMENT

(8) (10) (14) (15) (16)

PROCEDURE

1. Set the instrument controls as follows:

Lever/Indicator switches	500.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF

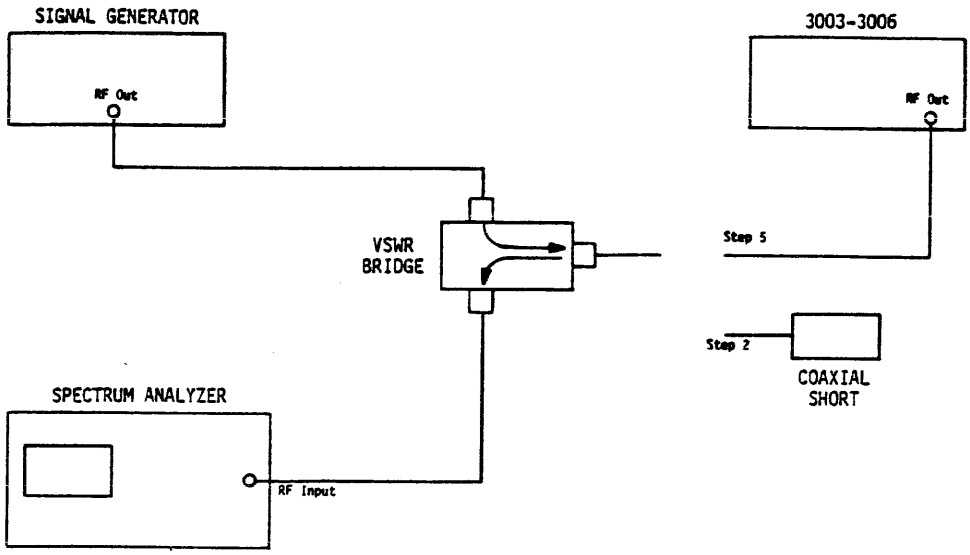
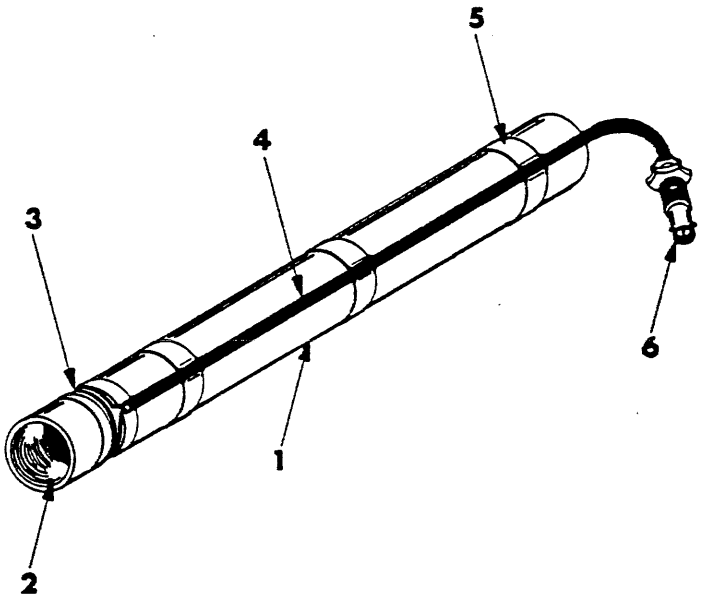


Figure 4-4. Test Set-up



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 ½ in length. Strip insulation from center conductor ½ 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 4-5. Loop Probe

METER switch	OUTPUT
OUTPUT Step Attenuator	−110 dBm
OUTPUT VERNIER	+ 3 dB

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

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 instrument and connect the 50 ohm coaxial termination to the instrument RF OUT connector. Tighten the termination to minimize RF leakage.

5. Set the instrument OUTPUT Step Attenuator to −10 dBm.

6. Connect the loop probe to the input of the RF amplifier. Move the loop probe over the surfaces of the instrument with the two-turn loop at a one-inch distance. The signal plus noise should be less than the −107 dBm reference. Record the maximum reading in dBm on line 50 of the PTR.

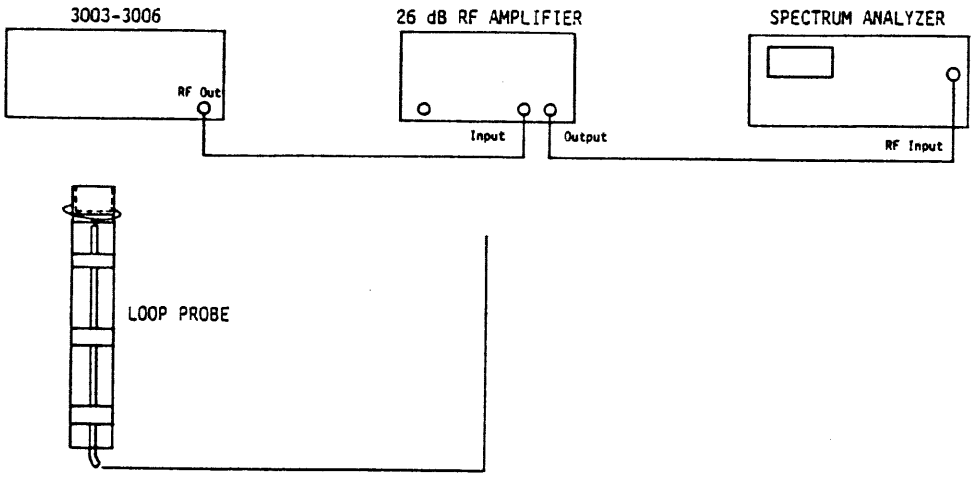


Figure 4-6. Test Set-up

PERFORMANCE TEST RECORD
MODELS 3003 THROUGH 3006

S/N _____

DATE _____

SEC	TEST	MINIMUM SPECIFICATION	MEASUREMENT	MAXIMUM SPECIFICATION	LINE
4.2	FREQ RANGE/RES	----------	( ) CHECK	----------	1
4.3	FREQ ACCURACY	39,999.60 kHz	kHz	40,000.40 kHz	2
		39,989.60 kHz	kHz	40,010.40 kHz	3
		2500 Hz	Hz	3500 Hz	4
			Hz		5
4.4	FREQ STABILITY	----------	Hz	104 Hz	6
			Hz	500 Hz	7
4.5.1	METER ACCURACY	-0.5 dB	dB	+0.5 dB	8
			dB		9
4.5.2	FLATNESS	-0.75 dB	dB	+0.75 dB	10
			dB		11
			dB		12
4.5.3	STEP ATT ACCURACY	-0.7 dB	dB	+0.7 dB	13
			dB		14
			dB		15
			dB		16
		-1.5 dB	dB	+1.5 dB	17
4.6	HARMONICS	-26 dBc	dBc	----------	18
			dBc		19
		-30 dBc	dBc	----------	20
			dBc		21
4.7	NON-HARMONICS	-60 dBc	dBc	----------	22
		-65 dBc	dBc		23
		-55 dBc	dBc		24
		-35 dBc	dBc		25
4.8	RESIDUAL AM	-65 dBc	dBc	----------	26
4.9	RESIDUAL FM	----------	Hz	200 Hz	27
4.10	INT MOD FREQ ACC	392 Hz	Hz	408 Hz	28
		980 Hz	Hz	1020 Hz	29
4.11	% AM ACCURACY	26.5%	%	33.5%	31
		83.5%	%	96.5%	32
		8%	%	12%	33
		17.5%	%	22.5%	34
4.12	AM BANDWIDTH	----------	dB	3 dB	35
4.13	AM DISTORTION	----------	%	3%	36
			%	5%	37
4.14	FM DEV ACCURACY	910 Hz	Hz	1090 Hz	38
		1910 Hz	Hz	2090 Hz	39
		2700 Hz	Hz	3300 Hz	40
		8700 Hz	Hz	9300 Hz	41
		9100 Hz	Hz	10,900 Hz	42
		19,100 Hz	Hz	20,900 Hz	43
		27,000 Hz	Hz	33,000 Hz	44
		87,000 Hz	Hz	93,000 Hz	45
4.15	FM BANDWIDTH	----------	dB	1 dB	46
4.16	FM DISTORTION	----------	%	4%	47
		----------	%	2%	48
4.17	IMPEDANCE	-21 dB	dBc	----------	49
4.18	RFI		dB	-107 dBm	50

SECTION 5
MAINTENANCE

5.1 INTRODUCTION

This section provides information for disassembly, calibration, and troubleshooting the Wavetek Model 3003 through 3006 Signal Generators.

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

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 the two rear feet (A) and lift the cover off with a slight rear movement. Reinstall the cover by reversing the removal procedure.

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

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

5.2.2 MODULE SERVICING

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

REINSTALLING MODULE - Before installing the module, check that all module pins are straight and properly aligned; then, carefully seat the module pins into the chassis socket. Replace the module hold-down screw (C) to insure a good ground connection between the module and chassis, and replace any cables attached to the top of the 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 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 backwards and also provides a method for locating pin 1.

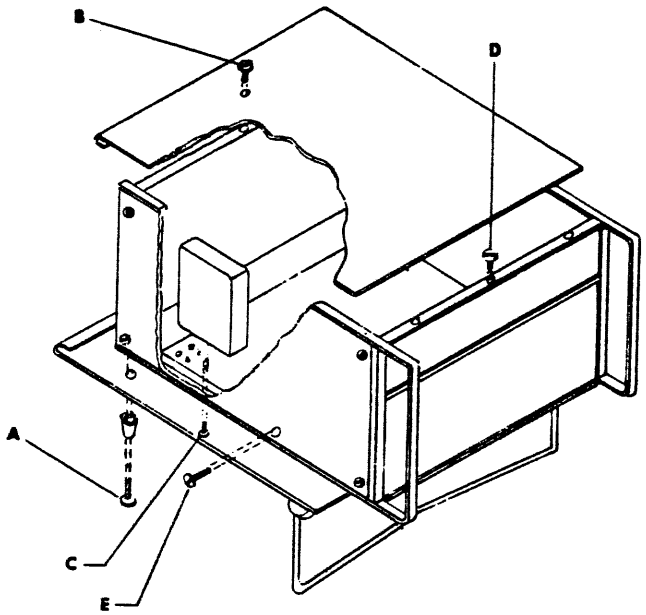


Figure 5-1. Dissassembly

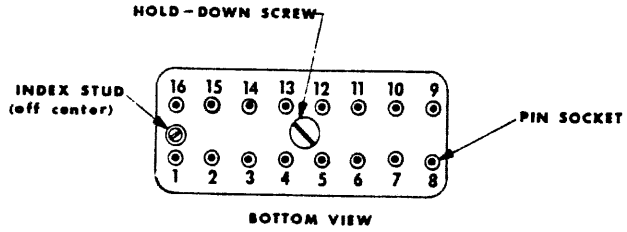


Figure 5-2. Module Pin Numbering System

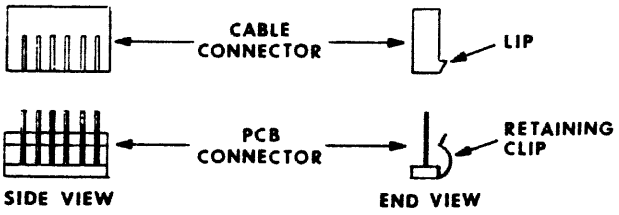


Figure 5-3. Connector Alignment

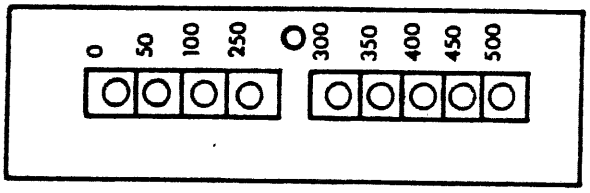


Figure 5-4. M172 Controls

NOTE

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

5.2.3 PRINTED CIRCUIT BOARD SERVICING

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

METER BOARD REMOVAL - Removal of the Meter Board assembly requires that the OUTPUT Step Attenuator knob, the OUTPUT VERNIER knob and retaining nut, and the instrument top rail be removed. Remove the three screws which secure the Meter Board to the front panel. Disengage the six-pin harness connector from the Meter Board, the two-pin harness connector from the Modulation Board, and the three slip-on connectors from the Step Attenuator switch. The Meter Board assembly can now be moved rearward until the OUTPUT VERNIER shaft, UNLEVELED LED, and METER case clear the front panel and the assembly can be lifted from the instrument.

The Meter Board is reinstalled by reversing the removal procedure, being careful to avoid damaging the UNLEVELED LED.

MODULATION BOARD REMOVAL - To remove the Modulation Board assembly from the instrument, disengage the slip-on connectors from the Lever/Indicator switches. Disconnect the 12-pin and two-pin harness connectors from the board and unsolder the wire from the EXT MODULATION INPUT connector. Remove the knobs from the front-panel INT and EXT MODULATION controls and FREQ VERNIER. Remove the instrument top rail, the center screw from the bottom rail, the screw at the upper-outer corner of the Modulation Board, and the screw at the top-center corner of the Meter Board. The assembly can then be angled until the switch levers clear the front panel and the assembly can be lifted from the instrument.

The assembly is reinstalled by reversing the removal procedure.

NOTE

When replacing the connectors on the Lever/Indicator switches, be sure each connector is on the correct switch. The switch cables break out of the main harness in same order that the switches appear.

POWER SUPPLY BOARD REMOVAL- The Power Supply board and heatsink can be removed by removing the four screws which secure the printed circuit board to the instrument rear panel. After removal of the connecting harness, the board can be carefully lifted from the instrument.

CAUTION

The Power Supply board may be raised far enough to allow checking of many components with the harnesses still connected; however, power must NOT be applied to the instrument unless the negative (ground) side of C10 is connected to the instrument chassis ground and to the positive (ground) side of C9 (jumper wires are sufficient).

The Power Supply board is reinstalled by reversing the removal procedure.

5.2.4 RECOMMENDED TEST EQUIPMENT

The test equipment numbered (1) through (8) in Table 4-1 is recommended for servicing, troubleshooting and calibrating the Wavetek Models 3003 through 3006.

5.3 CALIBRATION PROCEDURE

Remove the instrument top and bottom covers and the M172 module cover. 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 the orange +18 volt line on pin 3 of module M30-1/4. Set the +18 V Adj on the Power Supply to produce +18.00 V. (See Figures 5-5 and 5-6.)

5.3.2 –18 VOLT CHECK

Connect digital voltmeter to the yellow -18 volt line on pin 4 of module M30-1/4. Set the -18 V Adj on the Power Supply to produce -18.00 V.

5.3.3 +7.3 VOLT CHECK

Connect digital voltmeter to the green +7.3 volt line on pin 2 of module M30-1/4. The reading must be +7.3 V ±150 mV.

5.3.4 CRYSTAL FREQUENCY ADJUSTMENT M30-1/4

Connect a frequency counter with a 50 ohm input to the instrument RF connector. Set the signal generator Lever/Indicator switches to a high frequency which is within the counter's range, such as 500 MHz. Set the front-panel control as follows:

Lever/Indicator switches	500,0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

Adjust M30-1/4 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 Lever/Indicator switches. Disconnect counter from RF OUT connector. A final frequency check will be covered in Section 5.3.12.

5.3.5 PHASE-LOCKED LOOP 1 ADJUSTMENT M31A

No adjustment of module M31A is necessary.

5.3.6 PHASE-LOCKED LOOP 2 ADJUSTMENT M32A

See Figure 5-5 for location of M32A test points and Figure 5-6 for adjustment controls. Set the Lever/Indicator switches to 200.0000 MHz and all other front-panel controls as in Section 5.3.4. Connect a digital voltmeter to M32A pin 14, and carefully adjust both Crystal Reference trimmers (A and B) to produce a minimum reading on voltmeter. This voltage should be between +0.5 and +3.0 VDC. Set the Lever/Indicator switches to 239.0000 MHz and note that the voltmeter reading is still within the above limits.

Set the Lever/Indicator switches to 200.0000 MHz and connect the scope vertical input (DC, 1 V/cm) to M32A pin 15. Adjust M32A control (A) for a 0 V scope indication. Set the Lever/Indicator switches to 239.0000 MHz and adjust M32A control (B) to again produce a 0 V scope indication.

5.3.7 PHASE-LOCKED LOOP 3 ADJUSTMENT

PLL 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 the Lever/Indicator switches to 250.0000 MHz and all other front-panel controls as in Section 5.3.4. Connect the scope vertical input (DC, 1 V/cm) to M33-1 pin 5. Adjust M9W control (D) for a 0 V scope indication.

Set the INT MOD FREQ control to 1 kHz, the INT MOD RANGE control to 100 kHz FM, the METER switch to INT MOD, and the INT MOD LEVEL control for exactly 100 kHz deviation, read on the METER. Set the 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 PLL 4 involves three modules: M172, M9W, and M34. Test points are located on modules M172 and M34 (see Figure 5-5), while adjustment controls are located on modules M172 and M9W (see Figures 5-4 and 5-6).

Set the Lever/Indicator switches to 250.000 MHz and all other front-panel controls as in Section 5.3.4. Connect a digital voltmeter to M172 pin 1; then, adjust M172 250 MHz Adj for a 0.00 V reading on the voltmeter. The voltmeter may now be disconnected.

Connect a frequency counter to the RF OUT connector and connect the scope vertical input (DC, 1 V/division) to M34 pin 8. Adjust M9W control (A) for 0 ±1 V on the 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.

Set the output frequency to 300 MHz and adjust M172 300 MHz Adj for 0 ±3 V on the scope with a counter reading of 300 MHz. Repeat this step, using the applicable M172 Adj for frequencies of 350, 400, and 450 MHz.

Set the Lever/Indicator switches to 500.000 MHz. Adjust M172 500 MHz Adj for a scope reading near 0 V. Increase the Lever/Indicator switch setting to 520.000 MHz and note the scope indication; then, adjust M172 500 MHz Adj to give scope indications at 500.000 and 520.000 MHz that are symmetrical about 0 V.

Set the Lever/Indicator switches to 100.000 MHz and adjust M172 100 MHz Adj for 0 ±3 V on the scope and a counter reading of 100 MHz. Repeat using the appropriate M172 Adj for frequencies of 50 and 0 MHz. (Set Lever/Indicator switches to 001.000 MHz for 0 MHz adjustment.)

Connect the digital voltmeter to M34 pin 14 (Leveler TP).

Step through the frequency range from 1 to 520 MHz in 10 MHz steps to find the 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

Connect an AC digital voltmeter to the rear-panel MOD TP and set the front-panel controls as follows:

Lever/Indicator switches	002.0000
FREQ VERNIER	0 kHz
INT MOD FREQ	1 kHz
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

Connect a frequency counter to the RF OUT connector. Adjust M29-1 control (B) to produce an output frequency of 2.000 MHz ±100 Hz. Set the INT MOD RANGE control to 100 kHz FM and set the Lever/Indicator switches for 100.0000 MHz. Allow a few minutes for the oscillator to stabilize. Set the INT MOD LEVEL control for 3.535 VRMS at the MOD TP. (If 3.535 VRMS cannot be obtained, set Modulation Board control (Q) as in Section 5.3.11.)

Connect the modulation meter to the RF OUT connector and adjust M29-1 control (A) for a 100 kHz FM average modulation meter reading.

5.3.10 METER BOARD CALIBRATION - C315-2

Refer to Figures 5-5 and 5-6.

In order to adjust the front-panel METER, the instrument must be resting on its bottom surface (normal operating position). Turn off AC power to the instrument and mechanically zero the METER with the front-panel screw-driver adjustment located just below the METER face. Restore power to the instrument and allow it to stabilize.

Turn the OUTPUT VERNIER fully cw and adjust Meter Board control (A) for a +3 dB METER reading.

Set the instrument front-panel controls as follows:

Lever/Indicator switches	050.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

Calibrate a power meter and its sensor. Set the power meter to its +15 dBm range and connect it to the instrument RF OUT connector.

Adjust Meter Board control (F) for a +13 dBm power meter reading. Set the OUTPUT VERNIER for a -7 dB reading on the METER. Set the power meter to its +5 dBm range and adjust Meter Board control (E) for a +3 dBm power meter reading.

Since Meter Board controls (E) and (F) interact, repeat the above procedure until the proper power meter readings are obtained without further adjustment of the controls.

Set the OUTPUT Step Attenuator to 0 dBm and the power meter to the +5 dBm range. Turn the OUTPUT VERNIER fully cw. Adjust Meter Board control (C) for a +3 dBm power meter reading. Set the OUTPUT VERNIER for a -6 dB reading on the METER and set the power meter to its -5 dBm range. Adjust Meter Board control (D) for a -6 dBm power meter reading.

Since Meter Board controls (C) and (D) interact, repeat the above procedure until the proper power meter readings are obtained without further adjustment of the controls.

Set the instrument front-panel controls as follows:

Lever/Indicator switches	100.0000
FREQ VERNIER	CAL
INT MOD FREQ	1 kHz
INT MOD LEVEL	full cw
INT MOD RANGE	100 kHz FM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	+10 dBm
OUTPUT VERNIER	full cw

Adjust the INT MOD LEVEL control for a DVM reading of 3.535 VRMS at the rear-panel MOD TP. Adjust Meter Board control (H) such that the METER reads exactly 100 kHz FM (full scale).

Connect the modulation meter to the RF OUT connector. Set the Lever/Indicator switches to 520.0000 MHz and the INT MOD LEVEL control for a reading of 3.18 VRMS at the MOD TP. Set the OUTPUT VERNIER for a +3 dBm reading on the METER and adjust Meter Board control (G) for an average reading of 90% AM on the modulation meter. Set the OUTPUT VERNIER for a -7 dBm reading on the METER and adjust Meter Board control (B) for an average reading of 90% AM on the modulation meter.

Since Meter Board controls (B) and (G) interact, repeat the above procedure until the proper modulation meter readings are obtained without further adjustment of the controls.

5.3.11 MODULATION BOARD CALIBRATION

Apply a 1 VRMS 1 kHz signal to the EXT MODULATION INPUT connector. Connect an AC digital voltmeter to the gray lead at the top of the METER switch. Adjust Modulation Board control (M) for exactly 3.535 VRMS.

Connect a frequency counter to the rear-panel MOD TP. Set the EXT MOD RANGE control to OFF and the INT MOD RANGE control to 100% AM. Set the INT MOD LEVEL control fully cw. Adjust Modulation Board controls (A), (B), (C), and (D) as follows:

INT MOD FREQ	MOD BD CTL	FREQ CTR READING
B	A	As desired
1000	B	1000 ± 20 Hz
400	C	400 ± 8 Hz
A	D	As desired

NOTE

If it is desired to set A or B to a frequency less than 1 kHz, a jumper must be added across the terminals of switch S1 as indicated on the schematic.

Set the instrument front-panel controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	1 kHz
INT MOD LEVEL	full cw
INT MOD RANGE	100% AM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	full cw

Monitor the rear-panel MOD TP with a DVM. Adjust Modulation Board control (Q) for a 3.535 VRMS reading on the DVM.

Calibrate the distortion analyzer and connect it between the rear-panel MOD TP and ground.

NOTE

A 1 μF blocking capacitor should be inserted in series between the MOD TP and the distortion analyzer input.

Carefully adjust controls (P) and (N) for the lowest distortion analyzer reading (typically less than 1%). (Controls (P) and (N) interact considerably, so they will have to be adjusted alternately.)

Recheck the 3.535 VRMS MOD TP reading and readjust it accordingly; then recheck and readjust the settings of controls (P) and (N), if necessary, until the MOD TP voltage is correct and the distortion is at a minimum.

Disconnect the distortion analyzer and connect the modulation meter to the RF OUT connector. Set the METER switch to INT MOD and adjust the INT MOD LEVEL control for a 30% AM METER reading. Adjust Modulation Board control (K) for a 30% AM average modulation meter reading.

Set the INT MOD RANGE control to OFF and the EXT MOD RANGE control to 100% AM. Connect a function generator, set for 1 kHz at 1.00 VRMS, to the EXT MODULATION INPUT connector. Set the METER switch to EXT MOD and the EXT MOD LEVEL control for a 30% AM METER reading. Adjust Modulation Board control (J) for a 30% AM average modulation meter reading.

Set the instrument front-panel controls as follows:

Lever/Indicator switches	520.0000
FREQ VERNIER	CAL
INT MOD FREQ	1 kHz
INT MOD LEVEL	full cw
INT MOD RANGE	100 kHz FM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	full cw

Adjust M29-1 control (A) for a 100 kHz average modulation meter deviation reading.

Set the INT MOD RANGE control to 30 kHz FM and adjust Modulation Board control (G) for a 30 kHz average modulation meter deviation reading.

Set the INT MOD RANGE control to 3 kHz FM and adjust Modulation Board control (H) for a 3 kHz average modulation meter deviation reading.

Set the INT MOD RANGE control to OFF, the EXT MOD RANGE control to 30 kHz FM, and the METER switch to EXT MOD. With the function generator set for 1 kHz at 1 VRMS connected to the EXT MODULATION INPUT connector, adjust Modulation Board control (E) for a 30 kHz average modulation meter deviation reading.

Set the EXT MOD RANGE control to 3 kHz FM and adjust Modulation Board control (F) for a 3 kHz average modulation meter deviation reading.

5.3.12 DOWN–CONVERSTION ADJUSTMENT – M115

Set the instrument front-panel controls as follows:

Lever/Indicator switches	001.0000
FREQ VERNIER	CAL
INT MOD FREQ	N/A
INT MOD LEVEL	N/A
INT MOD RANGE	OFF
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	OUTPUT
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	full cw

Connect a power meter, spectrum analyzer, RF detector, AC voltmeter, or oscilloscope - accurate in the vicinity of 1 MHz - to the instrument RF OUT connector. Note the output level reading. Set the Lever/Indicator switches to 000.9990 MHz, and adjust the M115 Gain control such that the output level exactly matches the level noted at 001.0000 MHz.

5.3.13 FINAL FREQUENCY CHECK - M30-1/4

Connect a frequency counter to the instrument RF OUT connector and set front-panel controls as specified in Section 5.3.4. Note the frequency reading on counter. If it does not agree with the selected frequency within accuracy specifications, very carefully adjust the M30-1/4 Frequency Adjust trimmer (see Figure 5-5) until the desired frequency is obtained.

5.4 TROUBLESHOOTING

Effective troubleshooting requires a thorough understanding of the block diagrams and circuit descriptions 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 the front-panel controls are set in proper operating position. Refer to the operating instructions in Section 2 of this manual for a complete explanation of each control's function along with typical operating instructions.

After verifying that the trouble is not improper setting of the controls or test setup, make a thorough visual inspection of the 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 instrument 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 Wavetek signal generator, 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 which loops are unlocked, not which module is at fault.

A problem in the Power Supply may cause many symptoms pointing to other areas. The Power Supply 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 DPS2A 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, switch S1 mounted on the Step Attenuator is defective, is not being actuated by the 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, Output Amplifier, or Sweep Oscillator module.

Check the voltage on pin 15 of Output Amplifier module. With the OUTPUT VERNIER fully clockwise, the voltage should be approximately −2.5 VDC on +10 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 the Output Amplifier output. If it is correct, the trouble lies in the Step Attenuator or its RF cables. If the Output Amplifier output is low, measure the Sweep Oscillator RF output. This should be approximately −10 to −11 dBm. If this level is correct, the Output Amplifier is defective; while if the level is low, Sweep Oscillator M9W is defective.

OUTPUT METER DOES NOT MOVE – If the METER is pegged at either end of scale, the trouble is probably a defective component on the Meter Board; while if METER remains at mechanical zero, the 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 Output Amplifier module, defective Attenuator or connecting RF cables.

Connect a power meter directly to the Output Amplifier output. Set the OUTPUT Step and VERNIER controls for a +13 dBm reading on the power meter at 50.0000 MHz. Step through the frequency range from 10 to 520 MHz in 10 MHz steps. A power meter reading of +13 dBm ±0.5 dB with the UNLEVELED lamp off indicates proper operation of the Output Amplifier module. If the output is correct, but the UNLEVELED lamp is on, the trouble is probably a defective lamp driver circuit in the Output Amplifier module. With proper operation of the Output Amplifier module, connect the power meter directly to the Step Attenuator output and repeat the above procedure. If the Attenuator output is correct, the trouble is due to a defective RF cable or possibly a poor ground connection at the 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 the 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 M31A will cause PLL 1 to unlock; thus, module M31A may not supply a proper signal to module M34, causing PLL 4 to unlock. Failure of the 40 MHz crystal oscillator in module M30-1/4 will cause all loops to unlock, since all 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.

Phase-Locked Loop 1 - Unlocking of this loop may be caused by a defective module M31A, module M30–1/4, or RF cable connecting M30–1/4 to M31A.

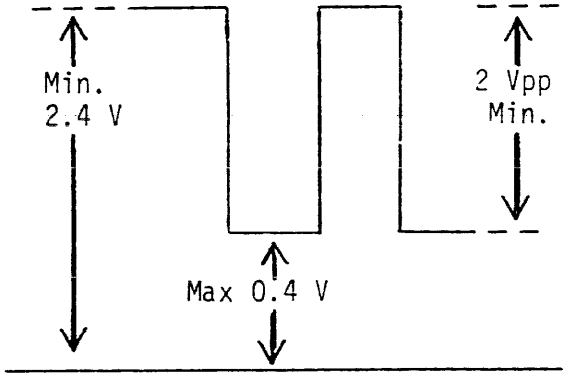
If the M31A unlock indicator is on, check the 1 kHz signal as listed in Table 5–2. If the signal is correct, module M30–1/4 is operating properly. Check the RF cable between M30–1/4 and M31A. If the 1 kHz signal is being applied to M31A, check for 7.3 V on pin 6, +18 V on pin 7, and −18 V on pin 8 of M31A. If the input signal and DC voltages are correct, module M31A is defective.

Phase-Locked Loop 2 – Unlocking of PLL 2 can be caused by defective modules M172, M30–1/4, M32A, or RF cables connecting M30–1/4 to M32A.

Connect a digital voltmeter to M32A pin 11 and observe the voltmeter reading while stepping through the frequency

Table 5-1. PHASE-LOCKED LOOP RF-SIGNAL LEVELS

P.L.L.	MODULE	INPUT-SIGNAL FREQUENCY	INPUT-SIGNAL LEVEL dBm (mV)	MEASURED AT
1	M31A	1 kHz	TTL	M30-1/4 (W13)
2	M32A	1 MHz	TTL	M30-1/4 (W12)
		1440 MHz	-12 to -15 dBm (20 mV)	M30-1/4 (W9)
3 & 5	M33-2	1198 MHz	-10 dBm ±3 dB (150 m V)	M9W (W5)
		1200 MHz (120 comb)	-15 dBm ±5 dB (75 mV)	M30-1/4 (W10)
		2 kHz	TTL	M30-1/4 (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)	M32A (W8)
		40 to 280 MHz (40 comb)	-10 dBm ±3 dB (1 V)	M30-1/4 (W6)
		10 to 9.001 MHz	TTL	M31A (W14)



TTL LOGIC LEVEL

Table 5-2. 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.

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 at 239 MHz. These voltages indicate proper operation of module M172.

Module M30-1/4 can be checked by measuring the 1 MHz and 1440 MHz signals directly at the M30–1/4. The levels specified in Table 5-2 indicate proper operation of module M30–1/4. Check connectors and RF cables connecting module M30–1/4 to module M32A. Check for +18 V on pin 7, –18 V on pin 8, and 7.3 V on pin 9 of M32A. If all input signals and DC voltages to module M32A are normal, but the M32A LED is on, module M32A is defective.

Phase-Locked Loops 3 and 5 – The LED indicator on module M33–1 serves both PLL 3 and PLL 5. If the M33–1 LED is on, determine which loop is defective by switching the FREQUENCY VERNIER out of its CAL position. If the M33–1 LED goes off, the trouble is in PLL 5. If the LED stays on, the trouble is in PLL 3.

PLL 3 consists of modules M33-1 and M9W. It is possible that PLL 3 can be restored to operation simply by recalibtating per Section 5.3.7, and this should be attempted. If adjusting M9W control (D) has no effect on M33-1 pin 5 voltage, the problem is in module M33-1; however, if the pin 5 voltage changes, but phase lock cannot be established, or if the pin 5 voltage cannot be set to within 5 volts of 0 V, the trouble is in M9W. Measure M33-1 Leveler TP (pin 14). If it is between +0.5 and 5 VDC, the trouble is probably in module M33-1; however, if it is greater that 5 VDC, the trouble is probably in module M9W or M30-1/4. Check the M30-1/4 reference frequencies and M9W output level as shown in Table 5-2 to determine which module is defective.

PLL 5 consists of modules M29-1 and M33-1. With the FREQUENCY VERNIER in CAL, measure the PLL 5 voltage on M29-1 pin 6. Adjust M29-1 control (B) for 0 V on pin 6. If, while adjusting the 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 the M29-1.

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

Unlocking of PLL 4 can be caused by defective modules M172, M9W, M30–1/4, M31A, M32A, M34, or connecting RF cables.

Connect a digital voltmeter to M2M-1 pin 1. The voltmeter reading should be 0.00 V with the Lever/Indicator switches set to 000 MHz, -2.5 V at 250 MHz, and -5.0 V at 500 MHz. Connect the voltmeter to M172 pin 8. The M172 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 M172 is operating properly.

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

Measure the 40 comb line at module M30-1/4. 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 M30-1/4 module.

Measure the 1448 MHz to 1487 MHz signal at module M32A. The exact frequency is dependent upon the "MHz" switch setting. If the level is as specified in Table 5-2, the M32A is operating properly.

Next, measure the 10.000 to 9.001 MHz output of the M31A module. The output will be 10.000 MHz with the "kHz" 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 M31A is operating properly.

If the output of each of the above modules is correct, check the connectors and RF cables connecting M9W, M31A, M32A, and M30-1/4 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 the M34 module lamp is on, module M34 is probably defective, but the 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±3 V; however, a defective M34 may give a voltage reading of 12 to 16 volts.

LEVER/INDICATOR SWITCHES – Troubles in the BCD switch circuits may be caused by a defective switch, a loose or disengaged switch connector, a broken switch wire, or possibly, a defective M115 (Models 3004, 3006).

All of the switches utilize four wires plus a ground to select decimal digits from 0 through 9 except the 100's MHz switch, which 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 switches, is given in Table 5-3.

Suspected switch problems can be checked by referring to Table 5-3 and the instrument Wiring Diagram to determine which module pins are grounded for a particular frequency. For example, to select a frequency of 200.5000 MHz, M172 pin 3 is grounded by selecting digit 2 on the 100's MHz switch, and M31A pins 2 and 4 are grounded by digit 5 on the 100's kHz switch.

If only the 10 MHz programming is in error, the trouble may be a defective IC3 in module M115 (Models 3004, 3006).

DOWN-CONVERSION TROUBLES (Models 3004, 3006) Problems in the down-conversion circuitry (modules M115 and M10W-8) can cause a variety of problems.

If the instrument operates properly from 1 to 520 MHz, but not from 1 to 999.9 kHz, the problem probably lies in either module M115 or M10W-8. Check for the TTL "turn-on" signal at pin 5 of the M10W-8. If the signal is correct (0 V above 1 MHz, 3 V below 1 MHz), check to see that the RF signal is being switched to the M115 for output frequencies below 1 MHz. If the switch is working, the problem lies in either the M115 or a connecting cable. If the instrument output frequency is 10 MHz higher than the programmed frequency (for example, 10.4200 MHz instead of 420.0 kHz), and the TTL signal at pin 5 of module M10W-8 is correct, the switch is not working, and the problem lies in the M10W-8.

If the instrument operates properly from 1 to 999.9 kHz, but not above 1 MHz, check for the TTL signal at pin 5 of module M10W-8. If it is correct, the problem lies in the M10W-8.

If the RF output level from 1 to 999.9 kHz is too low, and cannot be corrected by recalibration, the problem lies in either the M115 or a connecting cable.

MODULATION TROUBLES - The Modulation Board 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 Output Amplifier module.

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

Lever/Indicator switches	050.0000
FREQ VERNIER	CAL
INT MOD FREQ	400 Hz
INT MOD LEVEL	30% METER reading
INT MOD RANGE	30% AM
EXT MOD LEVEL	N/A
EXT MOD RANGE	OFF
METER switch	INT MOD
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	full cw

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

AM Troubles - Connect the scope vertical input to pin 3 of the Modulation Board and check for a 1 VRMS sine wave. Connect the scope vertical input to pin 4 of the Meter Board and again check for a 1 VRMS sine wave. Presence of the sine wave at this point indicates proper operation of Modulation Board and wiring.

Connect the scope vertical input to pin 2 of the 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 the Meter Board. If the DC voltages are normal, the Meter Board is defective or a wire is disconnected from Attenuator switch S1.

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

FM Troubles - Set the INT MOD RANGE control to 10 KHz FM and check for a 1 VRMS sine wave on pin 6 of the Modulation Board. Connect the scope vertical input to pin 16 of module M29-1 and again check for a 1 VRMS sine wave. A 1 VRMS sine wave at this point indicates proper operation of the Modulation Board and wiring.

Remove RF cable W7 from the top of module M29-1; then, check for a 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 the DC voltages are normal, the FM problems are caused by a defective module M29-1. If the 1.9/2.1 MHz signal is present at the M29-1 connector, the FM problems are probably caused by a defective M33-1 module.

5.4.2 MODULE REPLACEMENT

While in many cases the instrument will work satisfactorily after simply replacing a defective module, to maintain the high accuracy of which the unit is capable, module replace-

ment should be followed by calibration of the affected circuits. Table 5-4 lists each module and the adjustment needed.

TABLE 5-4. MODULE REPLACEMENT CALIBRATION

MODULE REPLACED	ADJUSTMENT REQUIRED (See indicated sections in Calibration Procedure)
M9W Sweep Oscillator	Reset Phase-Locked Loops 3 and 4 (5.3.7 and 5.3.8)
M10W-6/8 Output Amplifier	Recalibrate C315-2 Meter Board (5.3.10)
M172 SWEEP DRIVE/DAC	Reset Phase-Locked Loop 4 (5.3.8)
M29-1 FM Reference	Reset Phase-Locked Loop 5 (5.3.9)
M30-1/4 Crystal Reference	Adjust Crystal Frequency (5.3.4 and 5.3.11)
M31A kHz Steps	None required
M32A MHz Steps	Adjust Phase-Locked Loop 2 (5.3.6)
M33-1 Narrow Osc. Lock	Adjust Phase-Locked Loop 3 (5.3.7)
M34 Wide Osc. Lock	Set M34 pin 14 for +1.0 VDC (5.3.8)
M115 Down Converter	Adjust Gain Calibration (5.3.11)
M149 100 Hz Steps	None required
C315-2 Meter Board	Adjust Meter Board Calibration (5.3.10)
Modulation Board	Adjust Phase-Locked Loop 5 (5.3.9)
DPS2A Power Supply	Adjust ±18 V and check 7.3 V (5.3.1-5.3.3)

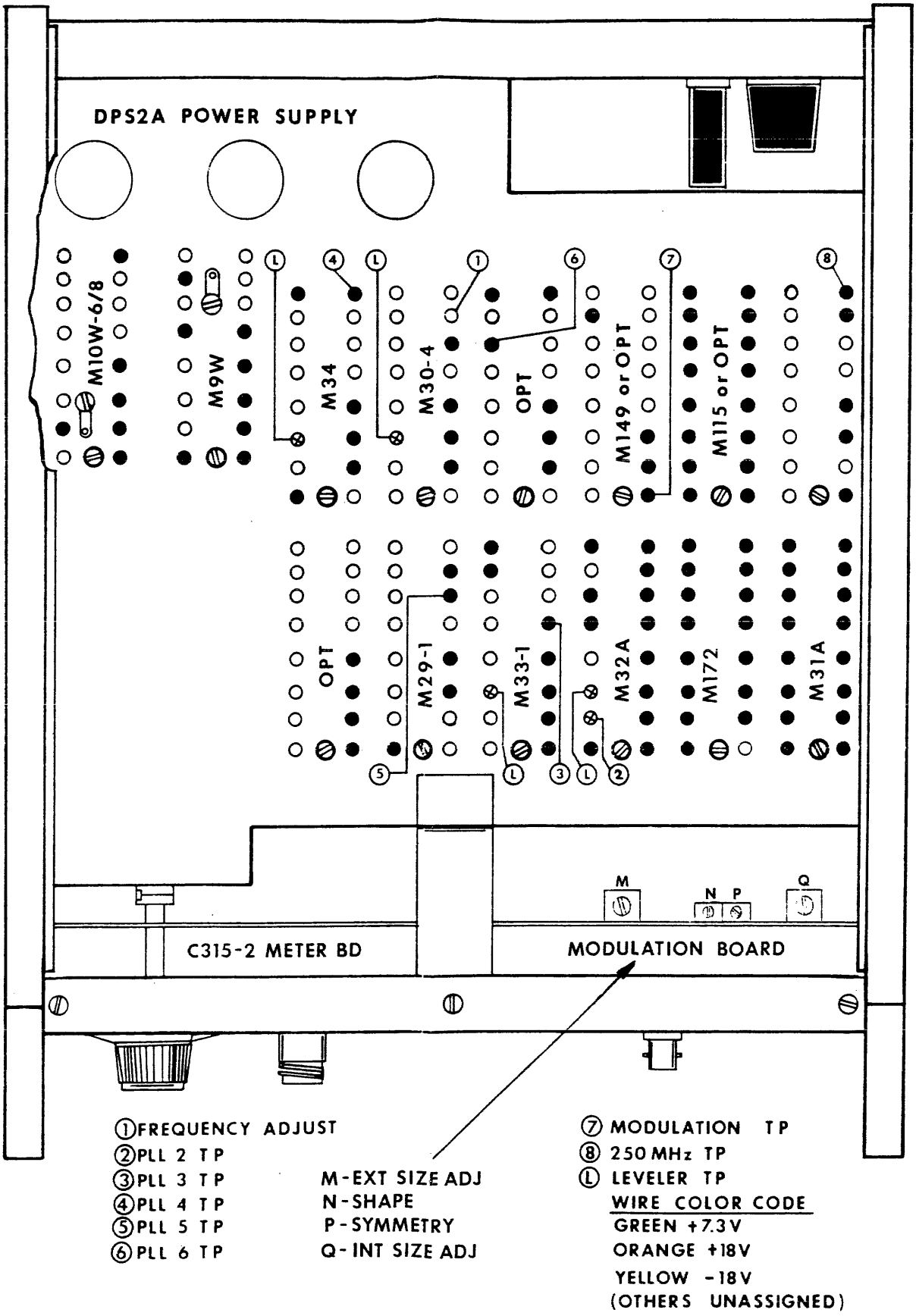


Figure 5-5. Test Points, Chassis Bottom View

(1) DPS2A POWER SUPPLY
A– +18 V ADJ
B– - 18 V ADJ
C– FUSE 2 AT

(2) NOT USED

(3) M37 AUX RF OUT (OPT 4)

(4) M40 HIGH STAB REF (OPT 6)

(5) M39 EXT REF (OPT 5)
OR
M153 INT/EXT REF (OPT 5A)

(6) M30-1 XTAL REF
A– 1440 MHZ ADJ
B– 1440 MHZ ADJ
C– 10 MHZ TP

(7) M34 WIDE OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(8) M9W SWEEP OSC
A– WIDE OSC CENT ADJ
B– WIDE OSC LEV ADJ
C– NARROW OSC SW ADJ
D– NARROW OSC LEV ADJ

(9) M10W-6 OUTPUT AMP

(10) M31A KHZ STEPS
A– UNLOCK INDICATOR

(11) M172 SWEEP DRIVE/DAC

(12) M32A MHZ STEPS
A– 000 MHZ ADJ
B– 039 MHZ ADJ
C– UNLOCK INDICATOR

(13) M33-1 NARROW OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(14) M29-1 FM REF
A– 2.1 MHZ ADJ
B– 2 MHZ ADJ

(15) M35-1 RF CKT BKR (OPT 3)

(16) 50130-01 STEP ATTEN

(17) MODULATION BOARD
A– 400 HZ ADJ
B– 1000 HZ ADJ
C– RANGE B ADJ
D– RANGE A ADJ
E– EXT 30 KHZ FM ADJ
F– EXT 3 KHZ FM ADJ
G– INT 30 KHZ FM ADJ
H– INT 3 KHZ FM ADJ
J– EXT 30% AM ADJ
K– INT 30% AM ADJ

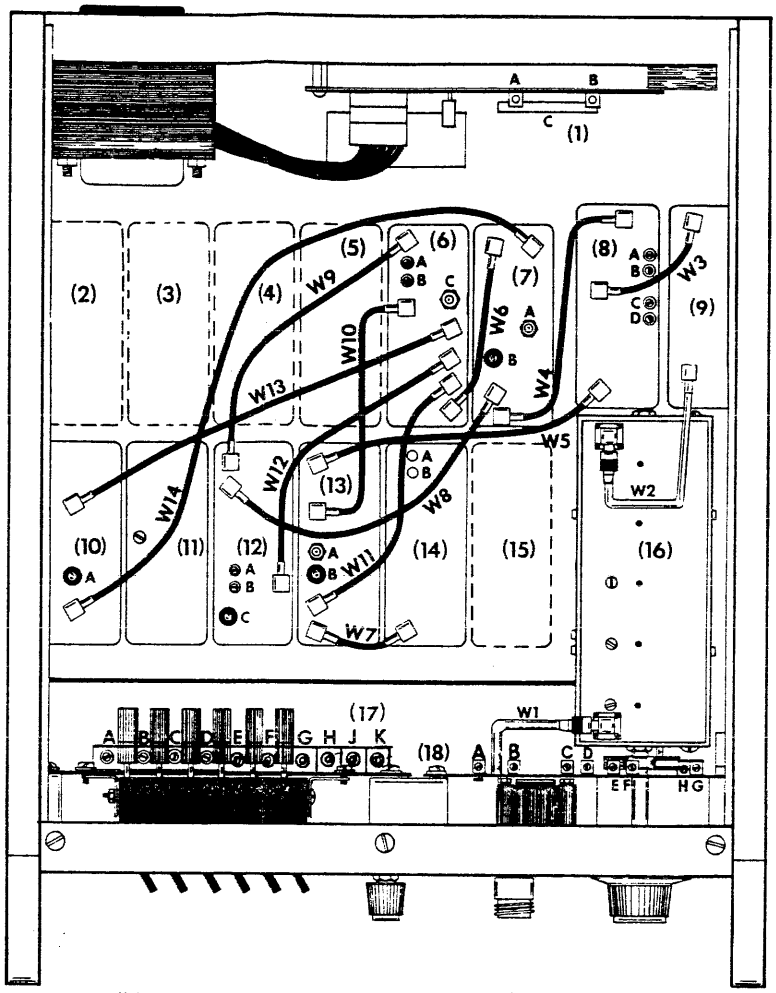


Figure 5-6a. Model 3003 Top View

(18) C315-2 METER BD
A–METER CAL ADJ
B–%AM -7 DBM ADJ
C–LEVEL 0 DBM RANGE +3 ADJ
D–LEVEL 0 DBM RANGE -7 ADJ
E–LEVEL +10 DBM RANGE +3 ADJ
F–LEVEL +10 DBM RANGE +13 ADJ
G–%AM +3 DBM ADJ
H–METER DEV ADJ

(1) DPS2A POWER SUPPLY
A– +18 V ADJ
B– - 18 V ADJ
C– FUSE 2 AT

(2) NOT USED

(3) M115 DOWN CONV
A– 10 MHZ TP
B– GAIN ADJ

(4) M40 HIGH STAB REF (OPT 6)
OR
M37 AUX RF OUT (OPT 4)

(5) M39 EXT REF (OPT 5)
OR
M153 INT/EXT REF (OPT 5A)

(6) M30-1 XTAL REF
A– 1440 MHZ ADJ
B– 1440 MHZ ADJ
C– 10 MHZ TP

(7) M34 WIDE OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(8) M9W SWEEP OSC
A– WIDE OSC CENT ADJ
B– WIDE OSC LEV ADJ
C– NARROW OSC SW ADJ
D– NARROW OSC LEV ADJ

(9) M10W-8 OUTPUT AMP

(10) M31A KHZ STEPS
A– UNLOCK INDICATOR

(11) M172 SWEEP DRIVE/DAC

(12) M32A MHZ STEPS
A– 000 MHZ ADJ
B– 039 MHZ ADJ
C– UNLOCK INDICATOR

(13) M33-1 NARROW OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(14) M29-1 FM REF
A– 2.1 MHZ ADJ
B– 2 MHZ ADJ

(15) M35-2 RF CKT BKR (OPT 3)
OR
M37 AUX RF OUT (OPT 4)

(16) 50130-01 STEP ATTEN

(17) MODULATION BOARD
A– 400 HZ ADJ
B– 1000 HZ ADJ
C– RANGE B ADJ
D– RANGE A ADJ
E– EXT 30 KHZ FM ADJ
F– EXT 3 KHZ FM ADJ
G– INT 30 KHZ FM ADJ
H– INT 3 KHZ FM ADJ
J– EXT 30% AM ADJ
K– INT 30% AM ADJ

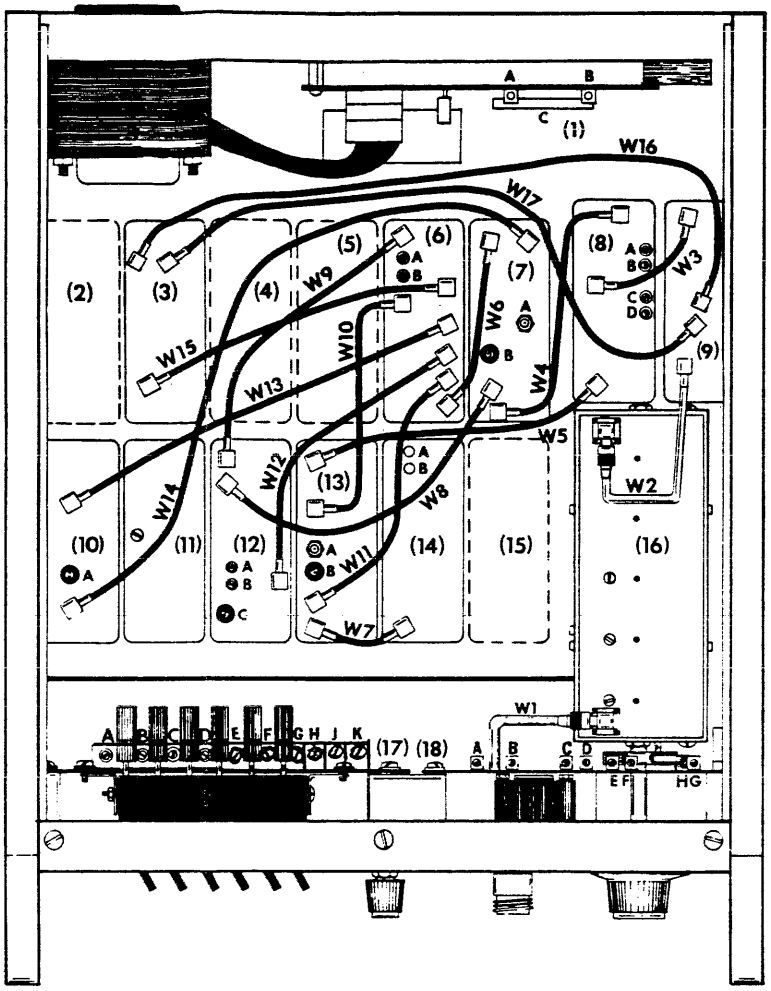


Figure 5-6b. Model 3004 Top View

(18) C315-2 METER BD
A–METER CAL ADJ
B–%AM -7 DBM ADJ
C–LEVEL 0 DBM RANGE +3 ADJ
D–LEVEL 0 DBM RANGE -7 ADJ
E–LEVEL +10 DBM RANGE +3 ADJ
F–LEVEL +10 DBM RANGE +13 ADJ
G–%AM +3 DBM ADJ
H–METER DEV ADJ

(1) DPS2A POWER SUPPLY
A– +18 V ADJ
B– - 18 V ADJ
C– FUSE 2 AT

(2) NOT USED

(3) M37 AUX RF OUT (OPT 4)
OR
M40 HIGH STAB REF (OPT 6)

(4) M149 100 HZ STEPS

(5) M39 EXT REF (OPT 5)
OR
M153 INT/EXT REF (OPT 5A)

(6) M30-4 XTAL REF
A– 1440 MHZ ADJ
B– 1440 MHZ ADJ
C– 10 MHZ TP

(7) M34 WIDE OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(8) M9W SWEEP OSC
A– WIDE OSC CENT ADJ
B– WIDE OSC LEV ADJ
C– NARROW OSC SW ADJ
D– NARROW OSC LEV ADJ

(9) M10W-6 OUTPUT AMP

(10) M31A KHZ STEPS
A– UNLOCK INDICATOR

(11) M172 SWEEP DRIVE/DAC

(12) M32A MHZ STEPS
A– 000 MHZ ADJ
B– 039 MHZ ADJ
C– UNLOCK INDICATOR

(13) M33-1 NARROW OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(14) M29-1 FM REF
A – 2.1 MHZ ADJ
B– 2 MHZ ADJ

(15) M35-1 RF CKT BKR (OPT 3)
OR
M37 AUX RF OUT (OPT 4)

(16) 50130-01 STEP ATTEN

(17) MODULATION BOARD
A– 400 HZ ADJ
B– 1000 HZ ADJ
C– RANGE B ADJ
D– RANGE A ADJ
E– EXT 30 KHZ FM ADJ
F– EXT 3 KHZ FM ADJ
G– INT 30 KHZ FM ADJ
H– INT 3 KHZ FM ADJ
J– EXT 30% AM ADJ
K– INT 30% AM ADJ

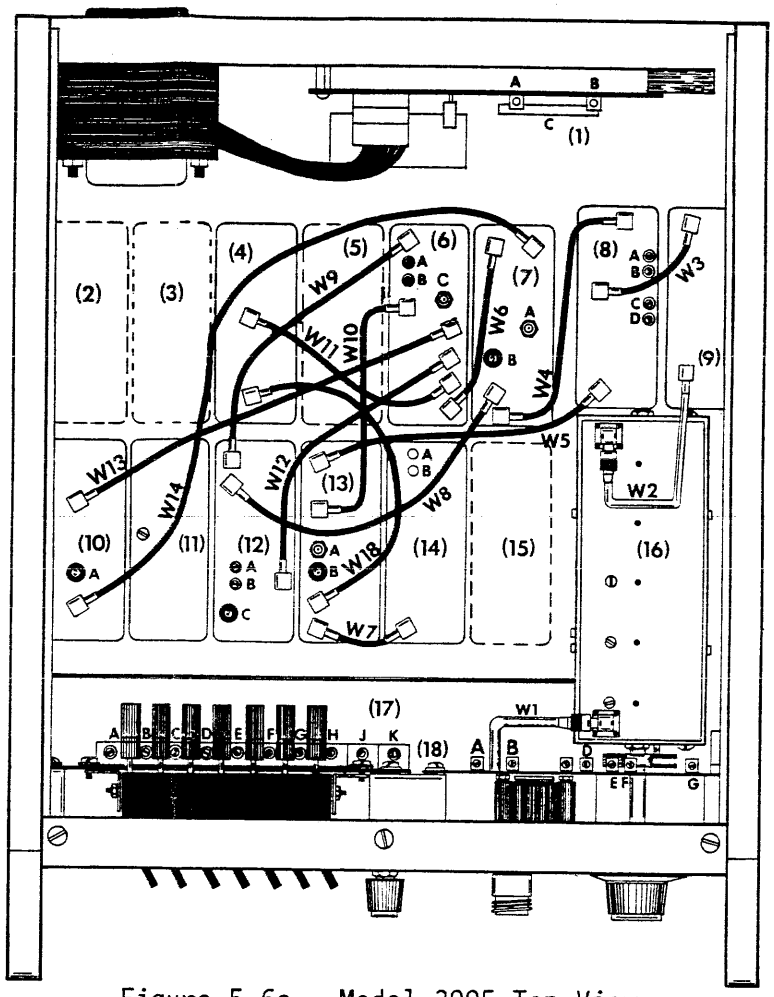


Figure 5-6c. Model 3005 Top View

(18) C315-2 METER BD
A–METER CAL ADJ
B–%AM -7 DBM ADJ
C–LEVEL 0 DBM RANGE +3 ADJ
D–LEVEL 0 DBM RANGE -7 ADJ
E–LEVEL +10 DBM RANGE +3 ADJ
F–LEVEL +10 DBM RANGE +13 ADJ
G–%AM +3 DBM ADJ
H–METER DEV ADJ

(1) DPS2A POWER SUPPLY
A– +18 V ADJ
B– - 18 V ADJ
C– FUSE 2 AT

(2) NOT USED

(3) M115 DOWN CONV
A– 10 MHZ TP
B– GAIN ADJ

(4) M149 100 HZ STEPS

(5) M37 AUX RF OUT (OPT 4)
OR
M39 EXT REF (OPT 5)
OR
M153 INT/EXT REF (OPT 5A)

(6) M30-4 XTAL REF
A– 1440 MHZ ADJ
B– 1440 MHZ ADJ
C– 10 MHZ TP

(7) M34 WIDE OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(8) M9W SWEEP OSC
A– WIDE OSC CENT ADJ
B– WIDE OSC LEV ADJ
C– NARROW OSC SW ADJ
D– NARROW OSC LEV ADJ

(9) M10W-8 OUTPUT AMP

(10) M31A KHZ STEPS
A– UNLOCK INDICATOR

(11) M172 SWEEP DRIVE/DAC

(12) M32A MHZ STEPS
A– 000 MHZ ADJ
B– 039 MHZ ADJ
C– UNLOCK INDICATOR

(13) M33-1 NARROW OSC LOCK
A– RF TP
B– UNLOCK INDICATOR

(14) M29-1 FM REF
A – 2.1 MHZ ADJ
B– 2 MHZ ADJ

(15) M35-2 RF CKT BKR (OPT 3)
OR
M37 AUX RF OUT (OPT 4)

(16) 50130-01 STEP ATTEN

(17) MODULATION BOARD
A– 400 HZ ADJ
B– 1000 HZ ADJ
C– RANGE B ADJ
D– RANGE A ADJ
E– EXT 30 KHZ FM ADJ
F– EXT 3 KHZ FM ADJ
G– INT 30 KHZ FM ADJ
H– INT 3 KHZ FM ADJ
J– EXT 30% AM ADJ
K– INT 30% AM ADJ

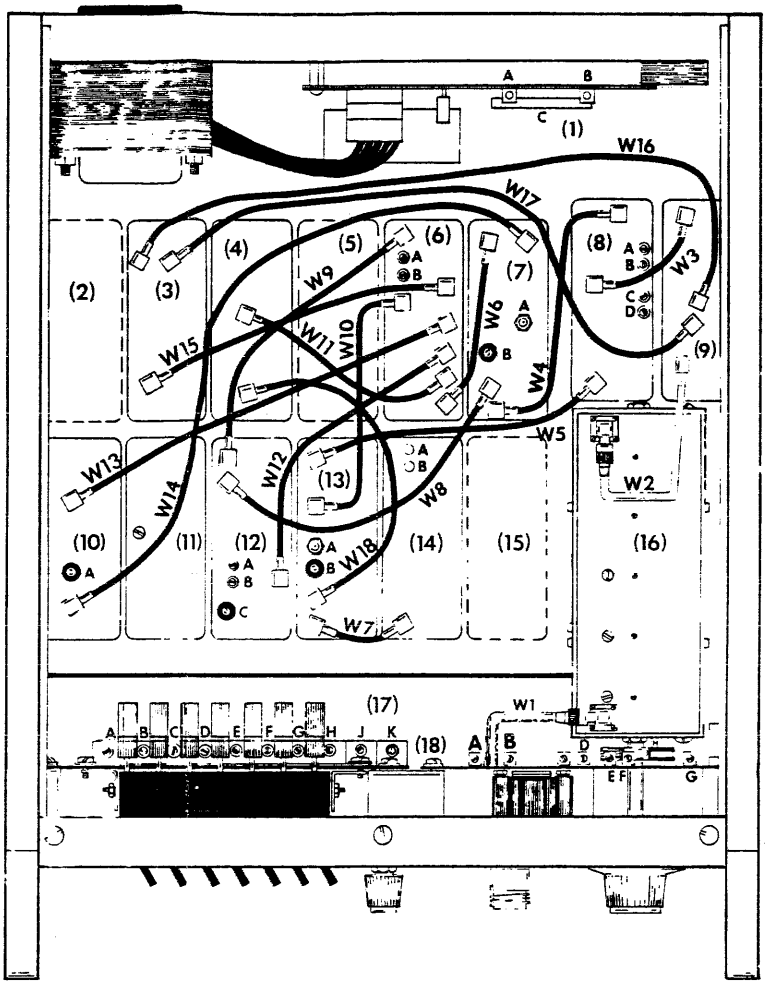


Figure 5-6d. Model 3006 Top View

(18) C315-2 METER BD
A–METER CAL ADJ
B–%AM -7 DBM ADJ
C–LEVEL 0 DBM RANGE +3 ADJ
D–LEVEL 0 DBM RANGE -7 ADJ
E–LEVEL +10 DBM RANGE +3 ADJ
F–LEVEL +10 DBM RANGE +13 ADJ
G–%AM +3 DBM ADJ
H–METER DEV ADJ

SECTION 6
REPLACEABLE PARTS

6.1 INTRODUCTION

This section contains lists of all replaceable parts for the instrument. For an assembly containing one of more subassemblies, the assembly list appears first, and is followed by the subassembly lists. The lists appear in the following order.

PARTS LIST	ASSEMBLY
1010-00-0133	3003
1010-00-0138	3004
1010-00-0043	3005
1010-00-0044	3006
1111-00-0089	CHASSIS ASSY
1212-00-0006	PWR SW ASSY
1219-00-0145	HARNESS - 3003 - 3006
1219-00-0126	HARNESS - 3003 - 3006
1219-00-0163	HARNESS - 3005 - 3006
1110-00-0981	MOD BD
1110-00-0292	C315-2
1115-00-0011	DPS2A
1218-00-0250	PC ASSY - DPS2A
1219-00-0144	LINE CORD - DPS2A
1114-00-0020	M9W
1219-00-0055	MIXER - M9W
1219-00-0054	PREAMP - M9W
1114-00-0360	M10W-9
1114-00-0361	M10W-10
1218-00-0600	AMPLIFIER - M10W-9/10
1218-00-0610	LEVELER - M10W-9/10
1114-00-0016	M29-2
1114-00-0024	M30-1/4
1114-00-0143	M31A
1114-00-0215	M32A
1218-00-0022	DIG DGM - M32A
1218-00-0021	OSC CTL - M32A
1219-00-0117	MIXER - M32A
1219-00-0118	VIDEO AMP - M32A
1114-00-0023	M33-2
1114-00-0008	M34
1219-00-0129	W. B. MIXER/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
1114-00-0185	M115
1218-00-1460	PC - M115
1218-00-1450	PC - M115
1114-00-0302	M149
1114-00-0320	M172

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
ACEIN	ACE INDUSTRIAL HDWR.	CAMDEN	NJ
ACI	ADVANCE COMPONENTS, INC.	CENTERBROOK	CT
AEG-T	AEG-TELEFUREN CORP.	SOMERVILLE	NJ
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
AMD	ADVANCED MICRO DEVICES INC.	SUNNYVALE	CA
AMELC	AMERICAN ELECTRIC CORDSETS	BENSENVILLE	IL
AMP	AMP, INC.	HARRISBURG	PA
ANZAC	ADAMS-RUSSELL, ANZAC DIV	BURLINGTON	MA
APL	AMPHENOL CONNECTOR SYSTEMS	BROADVIEW	IL
APP	A-P PRODUCTS	PAINESVILLE	OH
APX	AMPEREX ELECTRONIC CORP.	SLATERSVILLE	RI
ARC	ARCO ELECTRIC PRODUCTS	SHELBYVILLE	IN
ARN	ARNOLD ENGINEERING CO.	MARENGO	IL
ARW-M	ARROW-M CORP.	CARSON	CA
ASC	ASSOCIATED SPRING	BRISTOL	CT
ASE	AIRCO SPEER ELECTRONICS	ST. MARYS	PA
ASTID	ASTRO INDUSTRIES	DAYTON	OH
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
AULT	AULT INC.	MINNEAPOLIS	MN
AUTCP	AUTOMATION CORP.	PECKVILLE	PA
AVDEL	AVDEL FASTENER SYS.	PARSIPPANY	NJ
AVT	AVANTEK, INC.	SANTA CLARA	CA
AWC	ALPHA WIRE	ELIZABETH	NJ
B-T	BEK-TEK, INC.	READING	PA
BEARI	BEARINGS, INC.	CLEVELAND	OH
BEK	BECKMAN INSTRUMENTS, INC.	FULLERTON	CA
BEL	BELDEN CORP.	GENEVA	IL
BER	BERG ELECTRONICS	NEW CUMBERLAND	PA
BGH	BEECH GROVE HARDWARE	BEECH GROVE	IN
BORDN	BORDEN INC.	COLUMBUS	OH
BOU	BOURNS, INC.	RIVERSIDE	CA
BREZ	BREEZE CORPORATIONS, INC.	UNION	NJ
BSCAN	B-SCAN, INC.	PHILADELPHIA	PA
BUCK	BUCKEYE STAMPING CO.	COLUMBUS	OH
BUD	BUD RADIO, INC.	WILLOUGHBY	OH
BURND	BURNDY CORP.	NORWALK	CT
BUS	BUSSMAN MFG.	ST. LOUIS	MO
BWC	BARON WIRE AND CABLE CORP.	NILES	IL
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 M	C-M		
C-W	C-W INDUSTRIES	WARMINSTER	PA
CAI	CUSTOM ACCESSORIES, INC.	SKOKIE	IL
CAM	CAMBION	CAMBRIDGE	MA
CAR	CARLING ELECTRIC, INC.	WEST HARTFORD	CT
CCM	CORCOM, INC.	CHICAGO	IL
CDC	COMPONENT DEVELOPMENT CORP.	CARSON	CA
CECO	CENTRAL COIL CO.	BRAZIL	IN
CFI	CIRCUIT FUNCTIONS INC.	NEWBURY PK	CA
CGW	CORNING GLASS WORKS	CORNING	NY
CHE	CHERRY ELECTRICAL PRODUCTS	WAUKEGAN	IL
CHEMP	CHEMPLAST, INC.	WAYNE	NJ
CHLAR	CHARLES LARSON CO.	STERLING	IL
CHOM	CHOMERICS INC.	WOBURN	MA
CHRY	CHRYSLER CORP.	DETROIT	MI
CIMCO	CIMCO WIRE AND CABLE INC.	ALLENDALE	NJ

ABBRV	NAME.....	CITY.....	ST
CKI	CTS KNIGHTS, INC.	SANDWICH	IL
CLA	CLAIREX CORP.	MT. VERNON	NY
CLAR	CLAROSTAT MFG. CO	DOVER	NH
CLFRM	COILFORM	GENEVA	IL
CLFX	COLE-FLEX CORP.	BABYLON	NY
CNCRD	CONCORD ELEX	NEW YORK	NY
CPKG	CREATIVE PACKAGING DIV.	INDIANAPOLIS	IN
CPLRD	COMPLETE READING		
CRTR	CORE-TRONICS	ORANGE	NJ
CTS	CHICAGO TELEPHONE SYSTEMS	CHICAGO	IL
CTS-E	CTS OF ELKHART	ELKHART	IN
CTS-F	C.T.S. OF FAIRBERRY	FAIRBERRY	IL
CTS-K	CTS OF KEENE	PASO ROBLES	CA
CTSBR	CTS OF BERNE	BERNE	IN
CTSBV	CTS OF BROWNSVILLE	BROWNSVILLE	TX
CW/AL	C.W./ALPHA	SOUTHAMPTON	PA
DAL	DALE TECHNOLOGY CORP.	HARTSDALE	NY
DATEL	DATEL SYSTEMS, INC.	MANSFIELD	MA
DAV	HARRY DAVIES MOLDING CO.	CHICAGO	IL
DAYTN	DAYTON ELECTRIC CO.	CHICAGO	IL
DEL	DELEVAN DIV.	EAST AURORA	NY
DEN	DENNISON MFG. CO.	FRAMINGHAM	MA
DEW	DEWIRE FABRICATING CORP.	LOWELL	MA
DILEC	DILECTRON	MONROVIA	CA
DIO	DIODES, INC.	CHATSWORTH	CA
DK-WR	DAKO-WARE	CHICAGO	IL
DLGHT	DIALIGHT	BROOKLYN	NY
DNTCH	DONTECH, INC.		
DRA	DRAKE MANUFACTURING CO.	HARWOOD HEIGHTS	IL
DRMYR	DORMEYER	ROCKVILLE	IN
DYNR	DYNEER CORP.	CHATSWORTH	CA
E-C	ELECTRONIC CRYSTALS	KANSAS CITY	MO
E-I	ELECTRICAL INDUSTRIES, INC.	MURRAY HILL	NJ
E-M	ELECTRA/MIDLAND CORP.	MINERAL WELLS	TX
EBY	EBY COMPANY	PHILADELPHIA	PA
ECKDT	ECKARDT LABORATORIES	ORANGE	CA
ECMC	ELECTRI-CORD MFG. CO. INC.	WESTFIELD	PA
ELC-I	ELECTRA	CUMBERLAND	IN
ELCO	ELCO INDUSTRIES	ROCKFORD	IL
ELEXP	ELECT EXPEDITERS	MILWAUKEE	WI
ELFX	ELECTRO-FLEX HEAT INC.	BLOOMFIELD	CT
ELHDW	ELECTRONIC HARD	FARMINGDALE	NY
ELNA	ELNA	CARSON	CA
EMRON			S
EPITK	EPITEK ELECTRONICS	KANATA, ONT., CAN.	**
EPOXT	EPOXY TECHNOLOGY, INC.	BILLERICA	MA
ETC	ELECTRONIC TRANSISTOR CORP.	FLUSHING	NY
ETP	ERIE TECHNOLOGICAL PRODUCTS	ERIE	PA
EVRDY	EVEREADY	NEW YORK	NY
EXAR	EXAR INTEGRATED SYSTEMS	SUNNYVALE	CA
EZLOK	E-Z LOK	GARDENIA	CA
F-K	THERMWELL PRODUCTS, INC.	FRAMINGHAM	MA
F-S	FEDERAL SCREW	CHICAGO	IL
FAN	FANCOURT & CO.	GREENSBORO	NC
FASTX	FASTEX DIV., ILL. TOOL WORKS	DES PLAINES	IL
FCD	FAIRCHILD	MOUNTAIN VIEW	CA
FNWL	FENWAL	FRAMINGHAM	MA
FRK	FRAKO	FRANKFORT, GER.	**
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
G-T	GRAND TRANSFORMERS	GRAND HAVEN	MI
GAL	GALILEO ELECTRO-OPTICS	CARMEL	IN
GATES	GATES ENERGY PROD.	DENVER	CO
GBN	GILBERT ENGINEERING CO. INC.	PHOENIX	AZ
GCE	GC ELECTRONICS	ROCKFORD	IL
GHZ	GHZ DEVICES, INC.	CHELMSFORD	MA
GLOBE	GLOBE	MILWAUKEE	WI
GNATR	GENERAL ATRONICS CORP.	PHILADELPHIA	PA
GOU	GOULD, INC.	ST. PAUL	MN
GRIES	GRIES REPRODUCER	NEW ROCHELLE	NY
GRIP	GRIPMASTER CO.	MARLBORO	NJ
GRVCO	GROVE COMPANY	DAYTON	OH
GUDL	GUDEBROD BROS. SILK CO.	CHICAGO	IL

ABBRV	NAME.....	CITY.....	ST
H-P	HEWLETT-PACKARD	INDIANAPOLIS	IN
HARTW	HARTWELL CORP.	PLACENTIA	CA
HEL	HELIPOT	ANAHEIM	CA
HEY	HEYMAN MFG. CO.	WAUKESHA	WI
HHS	HERMAN H. SMITH, INC.	BROOKLYN	NY
HI-G	HI-G INC.	WINDSOR LOCKS	CT
HI-G	HI-G INC	WINDSOR LOCKS	CT
HIT	HITACHI AMERICA, LTD.	SAN FRANCISCO	CA
HMLN	HAMLIN	LAKE MILLS	WI
HOLGW	HOLLINGSWORTH SLDRLS TERM.	POTTSTOWN	PA
HOLUB	HOLUB DISTRIBUTING CO.	NEWPORT	KY
HSD	HARRIS CORP. SEMICDR. DIV.	MELBOURNE	FL
HUD	HUDSON TOOL & DIE CO.	NEWARK	NJ
HY/PL	HYDRO PLASTICS INC.	GEORGETOWN	KY
HYSYS	HYBRID SYSTEMS	BEDFORD	MA
HYT	HYTRONICS	PINELLAS PARK	FL
ICI	ILLINOIS CAPACITOR INC.	MORTON GROVE	IL
ICO-R	ICO-RALLY	PALO ALTO	CA
IERC	INT'L ELEC. RESEARCH CORP.	BURBANK	CA
INDCP	INDUCTIVE COMPONENTS	HAUPPAUGE	NY
INDEC	INDUSTRIAL ELECTRONIC HDWR.	NEW YORK	NY
INLOK	INTERLOK/WM J PURDY CO.	BURLINGAME	CA
INT	INTERSIL, INC.	CUPERTINO	CA
INWEB	INTERNATIONAL WEBBING	WHITEHALL	PA
IRC	INTERNATIONAL RESISTANCE CO.	PHILADELPHIA	PA
IREC	INT'L RECTIFIER CORP.	LOS ANGELES	CA
ITRON	ISE ELECTRONICS	ISE, JAPAN	**
ITT	INT'L TELEPHONE & TELEGRAPH	W. PALM BEACH	FL
JAMES	JAMES ELECTRONICS	CHICAGO	IL
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
JFD	JFD ELECTRONICS	BROOKLYN	NY
JFW	JFW INDUSTRIES	BEECH GROVE	IN
JHSN	JOHANSON MFG. CORP.	BOONTON	NJ
JON	E.F. JOHNSON CO.	WASECA	MN
JUDD	JUDD WIRE DIV. ECC	TURNERS FALLS	MA
K-L	KERRIGAN LEWIS MFG.	CHICAGO	IL
K-S	K & S ENGINEERING CO.	CHICAGO	IL
KDI-P	KDI-PYROFILM CORP.	WHIPPANY	NJ
KEENE	KEENE CORP.	NEWARK	DE
KEM	KEMTRON ELECTRON PRODUCTS	NEWBURYPORT	MA
KEY	KEYSTONE ELECTRONIC CORP.	NEW YORK	NY
KID	KIDCO, INC.	MEDFORD	NJ
KIN	KINGS ELECTRONICS	TUCKAHOE	NY
KMYO	KAMAYA OHM	JAPAN	**
KRYST	KRYSTINEL	PATERSON	NJ
KSTR	KESTER SOLDER DIV.	CHICAGO	IL
KSW	KSW ELECTRONICS	BURLINGTON	MA
KSW	KSW ELECTRONICS	BURLINGTON	MA
KUL	KULKA ELECTRIC CORP.	MT. VERNON	NY
LAURN	LAUREN MFG CO.	NEW PHILADELPHIA	OH
LEYSE	LEYSE ALUMINUM CO.	KEWANEE	WI
LIT	LITTELFUSE, INC.	DES PLAINES	IL
LNMST	LINEMASTER SWITCH CORP.	WOODSTOCK	CT
LOCTT	LOCTITE CORP.	NEWINGTON	CT
LRC	LRC ELECTRONICS, INC.	HORNELL	NY
LTRNX	LITRONIX	CUPERTINO	CA
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
M-P	MICRO PLASTICS INC.	CHATSWORTH	CA
MAL	MALLORY CONTROLS CO.	FRANKFORT	IN
MAND	MANDEX	CHICAGO	IL
MARQ	J. & J. MARQUARDT	TUTTLINGEN, GER.	**
MCREL	MICRO ELEX LTD	HONG KONG	**
MD-AM	MID AMERICA	CHICAGO	IL
MDC	MAIDA DEVELOPMENT CO.	HAMPTON	VA
MDLRS	MIDLAND ROSS	CINCINNATI	OH
MDTC	MODUTEC	NORWALK	CT
MILN	MILLEN MFG. CO.	NEW YORK	NY
MILSP	MILITARY SPECIFICATION	WASHINGTON	DC
MIN-C	MINI-CIRCUITS	BROOKLYN	NY
MINIS	MINI SYSTEMS	NORTH ATTLEBORO	MA

ABBRV	NAME.....	CITY.....	ST
MINOR	MINOR RUBBER CO.	BLOOMFIELD	NJ
MITEK	MITEK	LEXINGTON	MA
MLRJW	J.W. MILLER	COMPTON	CA
MMM	3M COMPANY	ST. PAUL	MN
MNO	MONSANTO COMM. PROD. DIV.	PALO ALTO	CA
MOL	MOLEX PRODUCTS	LISLE	IL
MORAD	MORGAN ADHESIVES	STOW	OH
MOSTK	MOSTK CORP.	CARROLLTON	TX
MOT	MOTOROLA SEMI. PROD. DIV.	INDIANAPOLIS	IN
MRM	M. ROSS MASON	INDIANAPOLIS	IN
MRO	MICRO SWITCH DIV.	FREEPORT	IL
MRRUB	MARION RUBBER PROD.	INDIANAPOLIS	IN
MSN	MICROSONICS DIV.	WEYMOUTH	MA
MSP	MICRO SEMICONDUCTOR CORP.	SANTA ANA	CA
MULSO	MULTICORE SOLDERS LTD.	WESTBURY	NY
MURA	MURA		
MURA	MURA	WESTBURY	NY
MURGA	MURATA-GEORGIA	MARIETTA	GA
MWS	MAGNET WIRE SUPPLY CO.	CHATSWORTH	CA
MYERS	MYERS SPRING CO.	LOGANSPORT	IN
N-T	NATIONAL TEL-TRONICS	LAREDO	TX
NAT	NATIONAL SEMICONDUCTOR CORP.	SANTA CLARA	CA
NCC	NATIONAL CERAMIC CO	TRENTON	NJ
NCSVC	NATL COM SERV.	WILLOW GROVE	PA
NEC	NIPPON ELECTRIC CO.	TOKYO, JAPAN	**
NEL	NATIONAL ENGINEERING LABS	INDIANAPOLIS	IN
NEW	NEWARK ELECTRONICS	INDIANAPOLIS	IN
NHWC	NEW HAVEN WIRE & CABLE	NEW HAVEN	IN
NICHN	NICHICON (AMERICA) CORP.	SCHAUMBURG	IL
NMB	NMB CORP.	ARLINGTON HEIGHTS	IL
NMC	MAGNUM MICROWAVE CORP.	SUNNYVALE	CA
NPC	NUCLEONIC PRODUCTS CO.	CANOGA PARK	CA
NYLO	NYLOMATIC	MORRISVILLE	PA
O-G	OPTI-GAGE INC.	DAYTON	OH
O-S	OMNI SPECTRA INC.	FARMINGTON	MI
OAK	OAK INDUSTRIES INC.	CRYSTAL LAKE	IL
OHM	OHMITE MFG. CO.	SKOKIE	IL
OMEGA	OMEGA WIRE & CABLE	HARLEYSVILLE	PA
OPTRN	OPTRON INC.	CARROLLTON	TX
P-B	POTTER AND BRUMFIELD	PRINCETON	IN
P-C	POWER COMPONENTS	WOODLAND HILLS	CA
P-K	PARKER KALON CORP.	CLIFTON	NJ
P-T	PENN TUBE PLASTICS CO.	CLIFTON HEIGHTS	PA
P-U	PROJECTS UNLIMITED INC.	DAYTON	OH
POLPH	POLYPHASE INSTR. CO.	BRIDGEPORT	PA
PACTC	PACTEC DIV.	PHILADELPHIA	PA
PAM	PAMOTOR DIV.	BURLINGAME	CA
PAND	PANDUIT CORP.	TINLEY PARK	IL
PARA	PARAMETRIC INDUSTRIES	NORTHFIELD	IL
PCC	PANEL COMPONENTS CORP.	BERKELEY	CA
PEC	PACIFIC ELECTRICORD CO.	GARDENA	CA
PEM	PENN ENGRG & MANUF CO.	DANBORO	PA
PFZR	PFIZER, INC.		
PHC	PHILADELPHIA HANDLE CO.	CAMDEN	NJ
PHILP	PHILPOTT RUBBER CO.	CLEVELAND	OH
PIC	PIHER INTERNATIONAL CORP.	ARLINGTON HEIGHTS	IL
PLI	PRECISION LAMP, INC.	MT. VIEW	CA
PLSSY	PLESSEY ENG.	SCHILLER PARK	IL
PLSTI	PLASTIC TECHNIQUES, INC	NEW BOSTON	NH
PLYCL	POLYCLAD LAMINATES	SOUTHFIELD	MI
PMCL	PERMACEL DIV.	NEW BRUNSWICK	NJ
PMI	PRECISION MONOLITHICS INC.	SANTA CLARA	CA
PNSNC	PANASONIC		
POM	POMONA ELECTRONICS CO., INC.	POMONA	CA
PREH	PREH VERT, MBH	GERMANY	**
PRMD	PYRAMID INDUSTRIES, INC.	PHOENIX	AZ
PRSLK	PRESTO-LOCK	GARFIELD	NJ
PRSN	PRECISION TUBE CO., INC	NORTH WALES	PA
PTN	PENN TRAN CORP.	BELLEFONT	PA
PWRMT	POWER-MATE CORP.	HACKENSACK	NJ
PYRO	PYROFILM CORP.	WHIPPANY	NY
PYTT	PYTTRONICS INDUSTRIES, INC.	MONTGOMERYVILLE	PA
Q-C	QUALITY COMPONENTS	ST. MARYS	PA
R-N	ROBINSON-NUGENT	NEW ALBANY	IN
R-OHM	R-OHM	IRVINE	CA
RAWST	RAW STOCK	*****	**

ABBRV	NAME.....	CITY.....	ST
RAY	RAYTHEON	INDIANAPOLIS	IN
RCA	RCA	CAMDEN	NJ
REL	RELIANCE MICA CO.	BROOKLYN	NY
RGNCY	REGENCY ELECTRONICS, INC.	INDPLS.	IN
RGR	ROGERS CORP.	CHANDLER	AZ
RICH	RICHCO PLASTIC CO.	CHICAGO	IL
RICHM	RICHARDS METAL PRODUCTS	WOLCOTT	CT
RMC	RADIO MATERIALS CORP.	CHICAGO	IL
RMF	RMF PRODUCTS INC.	BATAVIA	IL
ROCKW	ROCKWELL INTL.	ANAHEIM	CA
ROGAN	ROGAN CORP.	NORTHBROOK	IL
ROTRN	ROTRON INC.	WOODSTOCK	NY
RPBLC	REPUBLIC ELECTRONICS CORP	PATTERSON	NJ
RSSLL	RUSSELL	OCEANSIDE	NY
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
SAGE	SAGE LABORATORIES, INC.	NATIC	MA
SAYRO	SAYROSA ENGINEERS LTD.	ALTON, HANTS, U.K.	**
SCBE	SCANBE DIVISION	EL MONTE	CA
SCC	STACKPOLE CARBON CO.	ST. MARYS	PA
SCX	SILICONIX INC.	SANTA CLARA	CA
SEAST	SEASTROM MFG. CO.	GLENDALE	CA
SECR	SECOR INC.	WESTWOOD	NJ
SEL	SEALECTRO CORP.	MAMARONECK	NY
SEM	SEMTECH	NEWBURY PARK	CA
SEMTX	SEMTEX	DAYTON	OH
SGM	SIGMA INSTRUMENTS	BRAINTREE	MA
SGS-A	SGS-ATES COMP ELET SPA	AGRATE BRIANZE, ITALY	**
SHAM	SHAMROCK PLASTICS & RUBBER CO.	INDIANAPOLIS	IN
SHDW	I.E.E. SCHADOW	EDEN PRAIRIE	MN
SHKMN	SHACKMAN INSTRUMENTS	CHESHAM, ENGLAND	**
SIEM	SIEMENS	ISELIN	NJ
SIG	SIGNETICS CORPORATION	SUNNYVALE	CA
SIGPT	SIGMA PLASTRONICS	DEARBORN	MI
SINCR	SINCLAIR & RUSH, INC.	ST. LOUIS	MO
SKDRV	STOCK DRIVE PROD. DIV.	NEW HYDE PARK	NY
SLT	SOLITRON/MICROWAVE DIV.	PORT SALERNO	FL
SMTC	SAMTEC INC.	NEW ALBANY	IN
SOUTH	SOUTHCO FASTENERS	LESTER	PA
SPE	SPECTROL	DAYTON	OH
SPEC	SPECTRUM CONTROL, INC.	FAIRVIEW	PA
SPR	SPRAGUE ELECTRIC CO.	INDIANAPOLIS	IN
SPRTX	SUPERTEX INC.	CUPERTINO	CA
SPST	SPECTRA-STRIP	GARDEN GROVE	CA
SSS	SOLID STATE SCIENTIFIC	MONTGOMERYVILLE	PA
STDPS	STANDARD PRESSED STEEL	JENKINTOWN	PA
STKFS	STAKE FASTENERS	SOUTH EL MONTE	CA
STR	STETTNER TRUSH CO.	CAZENOVIA	NY
STSA	STEEL SALES	INDIANAPOLIS	IN
SYL	GTE SYLVANIA	WALTHAM	MA
SYNTC	SYNTAC CORP.	CLEVELAND	OH
SYNTX	SYNERTEK	**	*
SYS	SYSCON INTERNATIONAL, INC.	SOUTH BEND	IN
T-I	TEXAS INSTRUMENTS	DALLAS	TX
TCPL	TACONIC PLASTIC	PETERSBURG	NY
TEK	TEKTRONIX	INDIANAPOLIS	IN
TEKA	TEKA PRODUCTS INC.	COLLEGE POINT	NY
TEKNT	TECKNIT	CRANFORD	NJ
TELE	TELETYPE CORP.	ELK GROVE VILLAGE	IL
TELRY	TELEDYNE RELAYS	HAWTHORNE	CA
TFI	T&F INDUSTRIES DIV.	ROLLING MEADOWS	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
TOKO	TOKO AMERICA	SKOKIE	IL
TOKO	TOKO AMERICA	SKOKIE	IL
TORCO	TOR CORP.	VAN NUYS	CA
TR-UT	TRIAD-UTRAD DIV.	HUNTINGTON	IN
TRIYX	TRIONYX INDUSTRIES	INDIANAPOLIS	IN
TRU	WALDES TRUARC	LONG ISLAND CITY	NY

ABBRV	NAME.....	CITY.....	ST
TRW	TRW CAPACITOR DIV.	OGALLALA	NB
TSHBA	TOSHIBA	**	*
TVL	TEL-VISION LABS	WAUCONDA	IL
TWAY	TWAY COMPANY	INDIANAPOLIS	IN
TYTON	TYTON CORP.	MILWAUKEE	WI
U-C	UNIVERSAL COMPONENTS	LOS ANGELES	CA
ULSP	UNDERWRITERS LAB. SPEC.	CHICAGO	IL
UNCAR	UNION CARBIDE COMPONENTS	GREENVILLE	SC
UNIC	UNICORP	ORANGE	NJ
UNIT	UNITRODE CORP.	WATERTOWN	MA
USECO	USECO DIV.	VAN NUYS	CA
UTK	UNITRACK DIV.	UPPER DARBY	PA
VAC	VACTEC INC.	MARYLAND HEIGHTS	MO
VACO	VACO PRODUCTS CO.	NORTHBROOK	IL
VAR	VARADYNE CAPACITOR DIV.	SANTA MONICA	CA
VARIL	VARI-L CO.	DENVER	CO
VELCR	VELCRO USA INC	NEW YORK	NY
VISCM	VISUAL COMM		
VLIER	VLIER ENGINEERING CORP.	BURBANK	CA
VONGT	VONNEGUT HARDWARE	INDIANAPOLIS	IN
VRN	VERNITRON CORP.	GREAT NECK	NY
VTRMN	VITRAMON, INC.	BRIDGEPORT	CT
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
WHTMN	WHITMAN	CINCINNATI	OH
WKFLD	WAKEFIELD ENGINEERING	WAKEFIELD	MA
WLDM	WALDOM	CHICAGO	IL
WMBG	W.M. BERG	ROCKAWAY	NY
WNSL	WEINSCHEL ENGINEERING	GAITHERSBURG	MD
WNZLR	WINZLER MFG	CHICAGO	IL
WSD	WAVETEK	SAN DIEGO	CA
WSTN	WESTON COMPONENTS	ARCHBALD	PA
ZEN	ZENITH RADIO CORP.	CHICAGO	IL
ZERO	ZERO MANUFACTURING CO.	BURBANK	CA
ZIE	ZIERICK MFG. CORP.	MOUNT KISCO	NY
ZPT	ZIPPERTUBING, CO.	LOS ANGELES	CA

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
ZA01	METER BD, C315-2	C315-2	W-I	1110-00-0292	1
ZA02	MOD BD, 3003	1110-00-0980	W-I	1110-00-0980	1
ZA03	SWP OSC, M9W	M9W	W-I	1114-00-0020	1
ZA04	OUTPUT AMP, M10W-9	M10W-9	W-I	1114-00-0360	1
ZA05	FM REF, M29-2	M29-2	W-I	1114-00-0016	1
ZA06	XTAL REF, M30-1	M30-1	W-I	1114-00-0024	1
ZA07	KHZ STEPS, M31A	M31A	W-I	1114-00-0143	1
ZA08	MHZ STEPS, M32A	M32A	W-I	1114-00-0215	1
ZA09	NAR OSC LK, M33-2	M33-2	W-I	1114-00-0023	1
ZA10	WIDE OSC LK, M34	M34	W-I	1114-00-0008	1
ZA14	DAC/SWP DRIVE, M172	M172	W-I	1114-00-0320	1
ZA14	POWER SUPPLY, DPS2A	DPS2A	W-I	1115-00-0011	1
ZA15	ATTEN, 50130-01	50130-01	W-I	1113-30-0041	1
ZA16	CHASSIS, 3003	1111-00-0070	W-I	1111-00-0070	1
HH1	HARNESS, WY3004	WY3004	W-I	1219-00-0145	1
HH2	HARNESS, 3003FP	WY3003FP	W-I	1219-00-0126	1
W01	CABLE ASSY, 7 IN	WX3001-W1	W-I	1217-90-0005	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
W02	CABLE ASSY, 5 IN	WX3000-200-W3	W-I	1217-90-0003	1
W03	CABLE ASSY, 2-1/4 IN	WX3000-200-W10	W-I	1217-90-0004	1
W04 W11	CABLE ASSY, 4 IN	WX3001-W4	W-I	1217-00-0040	2
W05 W08 W09 W12	CABLE ASSY, 5 IN	WX3000-200-W18	W-I	1217-00-0050	4
W06 W10	CABLE ASSY, 3-1/4 IN	WX3001-W10	W-I	1217-00-0032	2
W07	CABLE ASSY, 2-1/4 IN	WX2000-A1	W-I	1217-00-0022	1
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
1	PLUG, 36-PIN MC000-055	03-06-2362	MOL	2113-04-0005	1
2	TERMINAL, MALE MC000-019	1854	MOL	2113-05-0002	36

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
ZA01	METER BD, C315-2	C315-2	W-I	1110-00-0292	1
ZA02	MOD BD, 3003	1110-00-0980	W-I	1110-00-0980	1
ZA03	SWP OSC, M9W	M9W	W-I	1114-00-0020	1
ZA04	OUTPUT AMP, M10W-10	M10W-10	W-I	1114-00-0361	1
ZA05	FM REF, M29-2	M29-2	W-I	1114-00-0016	1
ZA06	XTAL REF, M30-1	M30-1	W-I	1114-00-0024	1
ZA07	KHZ STEPS, M31A	M31A	W-I	1114-00-0143	1
ZA08	MHZ STEPS, M32A	M32A	W-I	1114-00-0215	1
ZA09	NAR OSC LK, M33-2	M33-2	W-I	1114-00-0023	1
ZA10	WIDE OSC LK, M34	M34	W-I	1114-00-0008	1
ZA11	DOWN CONV, M115	M115	W-I	1114-00-0185	1
ZA13	DAC/SWP DRIVE, M172	M172	W-I	1114-00-0320	1
ZA14	POWER SUPPLY, DPS2A	DPS2A	W-I	1115-00-0011	1
ZA15	ATTEN, 50130-01	50130-01	W-I	1113-30-0041	1
ZA16	CHASSIS 3004	1111-00-0085	W-I	1111-00-0085	1
HH1	HARNESS, WY3004	WY3004	W-I	1219-00-0145	1
HH2	HARNESS, 3003FP	WY3003FP	W-I	1219-00-0126	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
W01	CABLE ASSY, 7 IN	WX3001-W1	W-I	1217-90-0005	1
W02	CABLE ASSY, 5 IN	WX3000-200-W3	W-I	1217-90-0003	1
W03	CABLE ASSY, 2-1/4 IN	WX3000-200-W10	W-I	1217-90-0004	1
W04 W11	CABLE ASSY, 4 IN	WX3001-W4	W-I	1217-00-0040	2
W05 W08 W09 W12 W15	CABLE ASSY, 5 IN	WX3000-200-W18	W-I	1217-00-0050	5
W06 W10	CABLE ASSY, 3-1/4 IN	WX3001-W10	W-I	1217-00-0032	2
W07	CABLE ASSY, 2-1/4 IN	WX2000-A1	W-I	1217-00-0022	1
W13 W16	CABLE ASSY, 8-1/2 IN	WX3000-200-W9	W-I	1217-00-0084	2
W14 W17	CABLE ASSY, 10-1/4 IN	WX3000-200-W21	W-I	1217-00-0102	2
1	PLUG, 36-PIN MC000-055	03-06-2362	MOL	2113-04-0005	1
2	TERMINAL, MALE MC000-019	1854	MOL	2113-05-0002	36

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
ZA01	METER BD, C315-2	C315-2	W-I	1110-00-0292	1
ZA02	MOD BD 3005, 3006	1110-00-0981	W-I	1110-00-0981	1
ZA03	SWP OSC, M9W	M9W	W-I	1114-00-0020	1
ZA04	OUTPUT AMP, M10W-9	M10W-9	W-I	1114-00-0360	1
ZA05	FM REF, M29-2	M29-2	W-I	1114-00-0016	1
ZA06	XTAL REF M30-4	M30-4	W-I	1114-00-0307	1
ZA07	KHZ STEPS, M31A	M31A	W-I	1114-00-0143	1
ZA08	MHZ STEPS, M32A	M32A	W-I	1114-00-0215	1
ZA09	NAR OSC LK, M33-2	M33-2	W-I	1114-00-0023	1
ZA10	WIDE OSC LK, M34	M34	W-I	1114-00-0008	1
ZA11	100 HZ STEPS, M149	M149	W-I	1114-00-0302	1
ZA12	DAC/SWP DRIVE, M172	M172	W-I	1114-00-0320	1
ZA14	POWER SUPPLY, DPS2A	DPS2A	W-I	1115-00-0011	1
ZA15	ATTEN, 50130-01	50130-01	W-I	1113-30-0041	1
ZA16	CHASSIS 3005	1111-00-0088	W-I	1111-00-0088	1
HH1	HARNESS, WY3004	WY3004	W-I	1219-00-0145	1
HH2	HARNESS, 3003FP	WY3003FP	W-I	1219-00-0126	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
HH3	HARNESS 3005	WY3005	W-I	1219-00-0163	1
W01	CABLE ASSY, 7 IN	WX3001-W1	W-I	1217-90-0005	1
W02	CABLE ASSY, 5 IN	WX3000-200-W3	W-I	1217-90-0003	1
W03	CABLE ASSY, 2-1/4 IN	WX3000-200-W10	W-I	1217-90-0004	1
W04 W11 W15	CABLE ASSY, 4 IN	WX3001-W4	W-I	1217-00-0040	3
W05 W08 W09 W12	CABLE ASSY, 5 IN	WX3000-200-W18	W-I	1217-00-0050	4
W06 W10	CABLE ASSY, 3-1/4 IN	WX3001-W10	W-I	1217-00-0032	2
W07	CABLE ASSY, 2-1/4 IN	WX2000-A1	W-I	1217-00-0022	1
W13	CABLE ASSY, 8-1/2 IN	WX3000-200-W9	W-I	1217-00-0084	1
W14 W18	CABLE ASSY, 10-1/4 IN	WX3000-200-W21	W-I	1217-00-0102	2
1	PLUG, 36-PIN MC000-055	03-06-2362	MOL	2113-04-0005	1
2	TERMINAL, MALE MC000-019	1854	MOL	2113-05-0002	36

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
ZA01	METER BD, C315-2	C315-2	W-I	1110-00-0292	1
ZA02	MOD BD 3005, 3006	1110-00-0981	W-I	1110-00-0981	1
ZA03	SWP OSC, M9W	M9W	W-I	1114-00-0020	1
ZA04	OUTPUT AMP, M10W-10	M10W-10	W-I	1114-00-0361	1
ZA05	FM REF, M29-2	M29-2	W-I	1114-00-0016	1
ZA06	XTAL REF M30-4	M30-4	W-I	1114-00-0307	1
ZA07	KHZ STEPS, M31A	M31A	W-I	1114-00-0143	1
ZA08	MHZ STEPS, M32A	M32A	W-I	1114-00-0215	1
ZA09	NAR OSC LK, M33-2	M33-2	W-I	1114-00-0023	1
ZA10	WIDE OSC LK, M34	M34	W-I	1114-00-0008	1
ZA11	DOWN CONV, M115	M115	W-I	1114-00-0185	1
ZA12	100 HZ STEPS, M149	M149	W-I	1114-00-0302	1
ZA13	DAC/SWP DRIVE, M172	M172	W-I	1114-00-0320	1
ZA15	POWER SUPPLY, DPS2A	DPS2A	W-I	1115-00-0011	1
ZA16	ATTEN, 50130-01	50130-01	W-I	1113-30-0041	1
ZA17	CHASSIS, 3006	1111-00-0089	W-I	1111-00-0089	1
HH1	HARNESS, WY3004	WY3004	W-I	1219-00-0145	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
HH2	HARNESS, 3003FP	WY3003FP	W-I	1219-00-0126	1
HH3	HARNESS 3005	WY3005	W-I	1219-00-0163	1
W01	CABLE ASSY, 7 IN	WX3001-W1	W-I	1217-90-0005	1
W02	CABLE ASSY, 5 IN	WX3000-200-W3	W-I	1217-90-0003	1
W03	CABLE ASSY, 2-1/4 IN	WX3000-200-W10	W-I	1217-90-0004	1
W04 W11 W18	CABLE ASSY, 4 IN	WX3001-W4	W-I	1217-00-0040	3
W05 W08 W09 W12 W15	CABLE ASSY, 5 IN	WX3000-200-W18	W-I	1217-00-0050	5
W06 W10	CABLE ASSY, 3-1/4 IN	WX3001-W10	W-I	1217-00-0032	2
W07	CABLE ASSY, 2-1/4 IN	WX2000-A1	W-I	1217-00-0022	1
W13 W16	CABLE ASSY, 8-1/2 IN	WX3000-200-W9	W-I	1217-00-0084	2
W14 W17	CABLE ASSY, 10-1/4 IN	WX3000-200-W21	W-I	1217-00-0102	2
1	PLUG, 36-PIN MC000-055	03-06-2362	MOL	2113-04-0005	1
2	TERMINAL, MALE MC000-019	1854	MOL	2113-05-0002	36

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
CR101 (SEE C315-2)	LED DL000-001	NSL5046	NAT	4810-02-0001	1
S102 (SEE C315-2)	SWITCH, TOGGLE ST004-006	7211P3NYZQ	C-K	5106-00-0013	1
NONE	PWR SW ASSY	1212-00-0006	W-I	1212-00-0006	1
J112	CONN, UG1094A/U	31-2221	APL	2110-01-1014	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	CHASSIS ASSY	1111-00-0089 (ALSO -0088, -0085,-0070) PAGE: 1	D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
NONE	TERMINAL,MALE	02-09-2118	MOL	2113-09-0004	4
P201	PLUG	19-09-2042	MOL	2113-26-0001	1
S201	SWITCH,TOGGLE DPDT	9201P3HZQ	C-K	5106-00-0016	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	POWER SWITCH, IG-1/2 IN	1212-00-0006 PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
J101	RECEP, 36-PIN MC000-054	03-06-1361	MOL	2113-03-0004	1
3	TERMINAL, FEMALE MC000-018	02-06-1131	MOL	2113-05-0001	30
J102	JACK, FEMALE, 9-CKT MC000-067	09-50-3091	MOL	2113-06-0001	1
J109	CONN, 6-PIN, KONEKTON MC000-076	09-50-3061	MOL	2113-06-0002	1
J110	CONN, 12-CIRCUIT MC000-107	09-50-3121	MOL	2113-06-0005	1
8	CONTACT MC000-068	08-50-0107	MOL	2113-07-0001	22
9	CONTACT, MC000-131	08-50-0106	MOL	2113-07-0002	2
J103 J104 J105 J106 J107 J108	SOCKET MC000-065	583369-1	AMP	2113-15-0001	6
11	CONTACT MC000-069	583259-2	AMP	2113-16-0001	29

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	HARNESS, WY3004	1219-00-0145 PAGE: 1	A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
J2 (SEE C315-2)	HSG, MINI-LATCH, 7-PIN MC000-113	65039-030	BER	2113-10-0003	1
J4 (SEE C315-2)	HSG, MINI-LATCH, 2-PIN	65039-035	BER	2113-10-0015	1
4	TERM, MINI-PV MC000-092	47439	BER	2113-20-0001	8
3	PLUG, POLARIZING MC000-117	65307-001	BER	2113-23-0001	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	HARNESS, 3003FP	1219-00-0126 PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
J1-1-1	SOCKET MC000-065	583369-1	AMP	2113-15-0001	1
NONE	CONTACT MC000-069	583259-2	AMP	2113-16-0001	5

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	HARNESS 3005	1219-00-0163 PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C07 C08 C09	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	4
C02 C11	CAP, CER, .05MF, 100V CD103-350	TG-S50	SPR	1510-10-2503	2
C03	CAP., FILM, .015MF400V	60B153K400	PLSSY	1510-61-0153	1
C04	CAP, FILM, .15MF, 100V	60C154K100	PLSSY	1510-60-7154	1
C05	CAP, ELECT, 1MF, 25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	1
C10 C12 C13	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	3
CR03 CR04 CR05 CR06 CR07	DIODE DG109-140	1N4148	T-I	4807-01-0914	5
CR08 CR09 CR10	LED DL000-001	NSL5046	NAT	4810-02-0001	3
HH1	HARNESS, 3003M8	WY3003M8	W-I	1219-00-0127	1
IC01	MNLTHC FUNCT. GEN.	XR2206CP	EXAR	8000-22-0600	1
IC02	IC, IC000-002	N5741CV	SIG	7000-57-4100	1
IC03 IC04	IC, IC000-005	RC4559N8	RAY	7000-14-5800	2
IC05	IC IC000-006	MC1455P1	MOT	7000-14-5500	1
P1	PLUG, LOCKING	09-65-1121	MOL	2112-05-0004	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
P2	HEADER, STRT, 2 PIN REF: 2112-07-0000	2112-07-0007	W-I	2112-07-0007	1
Q03 Q05 Q07 Q09	TRANS	2N3904	NAT	4901-03-9040	4
Q04 Q06 Q08	TRANS	MPS3702	NAT	4902-03-7020	3
R02 R03 R17 R20 R21 R28 R52 R54 R57 R58 R59	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K}RD025-5%	ASE}K	4700-15-1002	11
R04	POT, 20K, RP130-320	89PR20K	BEK	4610-00-2203	1
R05	RES, C, 1/4W, 5%, 22K RC103-322	CF1/422K}RD025-5%	ASE}K	4700-15-2202	1
R06 R09	RES, C, 1/4W, 5%, 33K RC103-333	CF1/4-33K}RD025-5%	ASE}K	4700-15-3302	2
R07 R22 R24 R30 R32	RES, C, 1/4W, 5%, 12K RC103-312	CF1/4-12K}RD025-5%	ASE}K	4700-15-1202	5
R08 R61	RES, C, 1/4W, 5%, 4.7K RC103-247	CF1/4-4.7K}RD025-5%	ASE}K	4700-15-4701	2
R10 R13	POT, 100K, RP129-410	360S104B	CTS	4610-00-1104	2
R11	POT, 5 K	363S105B	CTS	4610-00-1502	1
R12	POT, 2K, RP129-220	360S202B	CTS	4610-00-1202	1
R16	POT, 1K, RP130-210	89PR1K	BEK	4610-00-2102	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R18	POT, 20K, RP129-320	360S203B	CTS	4610-00-1203	1
R19 R27	POT., 10K, 30%, U TERM. D, .125 X 1-7/8 SHAFT	SER.200	CTS	4610-13-6103	2
R23 R25 R31 R33	RES, C, 1/4W, 5%, 3.9K RC103-239	CF1/43.9K}RD025-5%	ASE}K	4700-15-3901	4
R26	RES, C, 1/4W, 5%, 680 RC103-168	CF1/4-680}RD025-5%	ASE}K	4700-15-6800	1
R29 R37 R46	POT, 50K, RP129-350	360S503B	CTS	4610-00-1503	3
R34 R43	POT, 1K, RP129-210	360S102B	CTS	4610-00-1102	2
R35 R44	RES, C, 1/4W, 5%, 3K RC103-230	CF1/4-3K}RD025-5%	ASE}K	4700-15-3001	2
R36 R45 R53 R55	RES, MF, 1/8W, 1%, 1K RF212-100	MF55K-1K	ASE	4701-03-1001	4
R38 R47	RES, C, 1/4W, 5%, 150K RC103-415	CF1/4-150K}RD025-5%	ASE}K	4700-15-1503	2
R39 R48	RES, 1/8W, 1%, 49.9K	MF55K-49.9K	ASE	4701-03-4992	2
R40 R50	RES, MF, 1/8W, 1%, 15K RF213-150	MF55K-15K	ASE	4701-03-1502	2
R41 R49	POT, 10K, RP129-310	360S103B	CTS	4610-00-1103	2
R42 R51	RES, MF, 1/8W, 1%, 4.99K RF212-499	MF55K-4.99K	ASE	4701-03-4991	2

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	MODULATION BOARD	1110-00-0981	D
		PAGE: 3	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R56	POT/SWITCH 10K 10% RP150-310	70K1G040R103U(1001)	A-B	4610-30-8103	1
R60	RES, C, 1/4W, 5%, 200 RC103-120	CF1/4-200}RD025-5%	ASE}K	4700-15-2000	1
R62	RES, C, 1/4W, 5%, 330 RC103-133	CF1/4-330}RD025-5%	ASE}K	4700-15-3300	1
R63	RES, C, 1/4W, 10%, 22M RC104-622	CB2261	A-B	4700-16-2205	1
R64	RES, C, 1/4W, 5%, 100K RC103-410	CF1/4-100K}RD025-5%	ASE}K	4700-15-1003	1
R65	RES, C, 1/4W, 10%, 47M RC104-647	CB4761	A-B	4700-16-4705	1
R66 R67	RES, C, 1/4W, 5%, 82K RC103-382	CF1/4-82K}RD025-5%	ASE}K	4700-15-8202	2
R70	RES, C, 1/4W, 5%, 20K RC103-320	CF1/4-20K}RD025-5%	ASE}K	4700-15-2002	1
S1	SWITCH, ROTARY	5104-00-0023	W-I	5104-00-0023	1
S2 S3	SWITCH, ROTARY	5104-00-0022	W-I	5104-00-0022	2
S101	LEVER SWITCH	L20-35AD	CHE	5101-00-0002	1
S104	LEVER SWITCH	L20-37AD	CHE	5101-00-0005	1
S102 S103 S107(A)	LEVER SWITCH	L20-36AD	CHE	5101-00-0004	3
S105 S106	LEVER SWITCH	L20-02A	CHE	5101-00-0006	2

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	MODULATION BOARD	1110-00-0981	D
	(A) S107 NOT USED ON 1110-00-0980	PAGE: 4	

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
C2	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	1
C3	CAP, MYLAR, .15MF, 100V CP103-415	WMF1P15	C-D	1510-60-2154	1
C4	CAP, ELECT, 2000MF, 3V CE123-220	500D208G003FH7	SPR	1510-21-8202	1
CR2 CR3	DIODE DR000-001	1N4004	P-C	4806-01-4004	2
CR4	DIODE DG109-140	1N4148	T-I	4807-01-0914	1
CR5	DIODE DG000-007	5082-2800	H-P	4809-02-0001	1
IC1 IC2 IC3	IC, IC000-005	RC4558N8	RAY	7000-14-5800	3
IC4	IC, IC000-030	LM318N	NAT	7000-03-1800	1
J3	HSG, MINI-LATCH, 7-PIN MC000-113	65039-030	BER	2113-10-0003	1
M1	0-1 MA METER WITH 3 METER SCALE PER B/P	2410-06-0004	W-I	2410-06-0004	1
P1	PLUG, 6-PIN KONEKTON MC000-075	09-65-1061	MOL	2112-05-0002	1
P2	HEADER, 7-PIN, R.A. REF: 2112-08-0000	MC000-099	W-I	2112-08-0002	1

WAVETEK PARTS LIST	TITLE METER BD, C315-2	ASSEMBLY NO. 1110-00-0292 PAGE: 1	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
P3	HEADER, RA, 5-PIN REF: 2112-08-0000	2112-08-0020	W-I	2112-08-0020	1
Q1	TRANS QA054-580	2N5458	INT	4901-05-4580	1
R01	POT, 5K, RP130-250	89PR5K	BEK	4610-00-2502	1
R02	RES, C, 1/4W, 5%, 7.5K RC103-275	CF1/4-7.5K}RD025-5%	ASE}K	4700-15-7501	1
R03	RES, MF, 1/8W, 1%, 36.5K RF213-365	MF55K-36.5K	ASE	4701-03-3652	1
R04 R21	RES, C, 1/4W, 5%, 33K RC103-333	CF1/4-33K}RD025-5%	ASE}K	4700-15-3302	2
R05 R06	RES, MF, 1/8W, 1%, 10K RF213-100	MF55K10K	ASE	4701-03-1002	2
R22 R7	RES, C, 1/4W, 5%, 20K RC103-320	CF1/4-20K}RD025-5%	ASE}K	4700-15-2002	2
R08	RES, MF, 1/8W, 1%, 2.74K RF212-274	MF55K-2.74K	ASE	4701-03-2741	1
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	70AIN048P103U	A-B	4610-11-3103	1

WAVETEK PARTS LIST	TITLE METER BD, C315-2	ASSEMBLY NO. 1110-00-0292 PAGE: 2	REV G

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R12 R15 R17 R18 R25	POT, 20K, RP130-320	89PR20K	BEK	4610-00-2203	5
R13	RES, C, 1/4W, 5%, 5.6K RC103-256	CF1/4-5.6K}RD025-5%	ASE}K	4700-15-5601	1
R14	RES, C, 1/4W, 5%, 220K RC103-422	CF1/4220K}RD025-5%	ASE}K	4700-15-2203	1
R16 R20	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K}RD025-5%	ASE}K	4700-15-1002	2
R19	RES, C, 1/4W, 5%, 1M RC103-510	CF1/4-1M}RD025-5%	ASE}K	4700-15-1004	1
R23	RES, C, 1/4W, 5%, 68K RC103-368	CF1/4-68K}RD025-5%	ASE}K	4700-15-6802	1
R24	RES, C, 1/4W, 5%, 100K RC103-410	CF1/4-100K}RD025-5%	ASE}K	4700-15-1003	1
R26	RES, C, 1/4W, 5%, 15K RC103-315	CF1/4-15K}RD025-5%	ASE}K	4700-15-1502	1
R27	RES, C, 1/4W, 5%, 22K RC103-322	CF1/422K}RD025-5%	ASE}K	4700-15-2202	1
R28	RES, C, 1/4W, 10%, 100M RC104-710	CB1071	A-B	4700-16-1006	1
R29	RES, C, 1/4W, 5%, 2.2K RC103-222	CF1/4-2.2K}RD025-5%	ASE}K	4700-15-2201	1
R30	RES, C, 1/4W, 5%, 47K RC103-347	CF1/4-47K}RD025-5%	ASE}K	4700-15-4702	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R31	RES, MF, 1/8W, 1%, 4.02K RF212-402	MF55K-4.02K	ASE	4701-03-4021	1
R32	POT, 2K, RP130-220	89PR2K	BEK	4610-00-2202	1
R33	RES, C, 1/4W, 5%, 1.2K RC103-212	CF1/4-1.2K}RD025-5%	ASE}K	4700-15-1201	1
R34	RES, VAR. CERMET, 100	89PR100	BEK	4610-00-2101	1
HH1	HARNESS, C315-2	WYC315-2	W-I	1219-00-0328	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
F101	FUSE, SLO BLO, 1 AMP, 250V	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	4021.0512	MARQ	5105-00-0011	1
T101	XFMR, PWR	8720	A-M	5610-00-0027	1
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

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
C01 C08	CAP, ELECT, 1500MF, 50V CE102-215	D76374	SPR	1510-20-1152	2
C02 C06	CAP, CER, .005MF, 100V	TC-D50	SPR	1510-10-2502	2
C03 C05 C07	CAP, ELECT, 1MF, 25V CE120-001	162D105X9025BC2	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	162D106X0025DD2	SPR	1510-21-7100	1
CR01	DIODE BRIDGE	MDA101	MOT	4806-02-0003	1
CR02 CR04	DIODE DG109-140	1N4148	T-I	4807-01-0914	2
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	ASSEMBLY NO.	REV
	PC ASSEMBLY, DPS2A	1218-00-0250 PAGE: 1	C

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
Q01	JFET, N-CHANNEL	E232	SCX	4902-00-2320	1
Q02	TRANS QA039-060	2N3906	T-I	4901-03-9060	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	89PR500	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
R10	RES., VAR. CERMET 200-OHM	89PR200	BEK	4610-00-2201	1

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

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

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

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	17237SVT	BEL	6011-80-0001	1

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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C04 C22 C23	CAP, F.T., 6.8PF CF102-R68	54-794-010-6892	SPEC	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 C20 C21 C26 C28 C36 C43 C46	CAP, FT, CER, 100PF, 20% CF104-110	4420-100PF	AER	1510-30-3101	10
C13	CAP., CHIP, .1 MF	51C1209-B104Z	CFI	1510-00-3104	1
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	MDC	1510-10-1121	2
C19	CAP, CER, .02UF, 50V	TG-520	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

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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C29	CAP, Q.C., .75PF CG101-175	QC-.75PF	Q-C	1510-40-0758	1
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	MDC	1510-10-1101	1
CR01 CR02 CR03 CR04 CR09	DIODE DC000-008	BB205B	APX	4803-02-0004	5
CR05 CR07 CR10	DIODE DP000-040	MA47980	M-A	4805-02-0001	3
CR06 CR08 CR11	DIODE, 1N82 MITEK ONLY	1N82	MTK	4807-03-0003	3
IC1 IC2 IC3 IC4	IC, IC000-004	N5741T	SIG	7000-57-4101	4
J1 J2 J201	CONN JF000-005	37JR116-1	S-C	2110-03-0002	3
L01 L21 L22	TORRID, 10 TURN	LA009-010-1	HYT	1810-05-0004	3
L02	TORRID, 10 TURN	LA009-010-2	HYT	1810-05-0005	1
L03 L04 L07 L08 L11 L12 L14 L15 L16 L17 L20	RF CHOKE	CHOKE	W-I	1819-99-9999	11

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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L05 L09 L10 L13 L18 L19	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	6
L06	CHOKE. .22MH, 10% LA008-R02	506-000022V1	SYS	1810-04-0228	1
L23	TORRID. 4 TURN	LA009-004-1	HYT	1810-05-0003	1
Q05	TRANS GB000-018	SD1006	SSS	4902-01-0060	1
Q1	TRANS GB000-013	A430	APX	4902-00-4300	1
Q2	TRANS GA054-580	2N5458	INT	4901-05-4580	1
Q3 Q4 Q6 Q7	TRANS GA050-530	2N5053	APX	4901-05-0530	4
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 R40	RES, C, 1/4W, 5%, 47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2

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 R31	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	3609203B	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
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
R68	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
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% CQ101-224	QC-2.4PF	Q-C	1510-40-0249	1
MX101	DIODE, QUAD, BAL MIXER	5082-2830	H-P	4899-02-0001	1
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

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	162D105X9025BC2	SPR	1510-21-7010	1
C203 C204	CAP, FT, 500PF, 20%250V CF104-150	4420-500PF	AER	1510-30-3501	2
C206	CAP, G-C, 2.0PF, 10% CG101-220	GC-2.0PF	G-C	1510-40-0020	1
CR201	DIODE DB000-001	HW6.8B	MSP	4801-02-0001	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	LA009-010-3	HYT	1810-05-0006	1
Q201 Q202 Q203	TRANS QA050-530	2N5053	APX	4901-05-0530	3
R201	RES, C, 1/4W, 5%, 100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
R202	RES, C, 1/4W, 5%, 470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
R203	RES, C, 1/4W, 5%, 330 RC103-133	CF1/4-330	ASE	4700-15-3300	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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%, 150 RC103-115	CF1/4-150	ASE	4700-15-1500	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP, CER, 200PF, 1KV CD102-120	50A-T20	SPR	1510-10-1201	1
C02	CAP, G-C, 2.4PF, 10% CG101-224	GC-2.4PF	G-C	1510-40-0249	1
C03 C20 C22	CAP., CHIP, .1 MF	51C1209-B104Z	CFI	1510-00-3104	3
C07	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
C08 C09 C14 C15	CAP, FT, CER, 100PF, 20% CF104-110	4420-100PF	AER	1510-30-3101	4
C11 C12 C16 C24	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	4
C17	CAP, F.T., 6.8PF CF102-R68	54-794-010-6892	SPEC	1510-30-1689	1
C21	CAP, FT, 500PF, 20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
CR02 CR03	DIODE DP000-050	5082-3080	H-P	4805-02-0002	2
CR05	DIODE SELECTED FROM: 4809-02-0001	4889-00-0002	W-I	4889-00-0002	1
J01 J03	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01	CHOKE, 47MH, 10% LA005-047	08N470K	ASE	1810-03-0470	1

WAVETEK PARTS LIST	TITLE OUTPUT AMP, M10W-9	ASSEMBLY NO. 1114-00-0360 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L03 L06 L07 L08 L10	TOROID	LA009-010-1	HYT	1810-05-0004	5
L11	CHOKE, 33MH, 10% LA005-033	08N330	ASE	1810-03-0330	1
L22	RF CHOKE	CHOKE	W-I	1819-99-9999	1
Q01	TRANS QB000-034	BFR94	APX	4902-00-0940	1
R01*	RES, C, 1/4W, 5%, 120 RC103-112	CF1/4-120	ASE	4700-15-1200	1
R02	RES, C, 1/4W, 5%, 330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R05	RES, C, 1/2W, 5%, 470 RC105-147	CF1/2-470	ASE	4700-25-4700	1
R06	RES, C, 1/8W, 5%, 1K RC101-210	CF1/8-1K	ASE	4700-05-1001	1
R07 R08 R09	RES, C, 1/4W, 5%, 56 RC103-056	CF1/4-56	ASE	4700-15-5609	3
R10	RES, C, 1/4W, 5%, 160OHM	CF1/4-160	ASE	4700-15-1600	1
R14	RES, C, 1/4W, 5%, 47 RC103-047	CF1/4-47	ASE	4700-15-4709	1
R16	RES, C, 1/8W, 5%, 100 RC101-110	CF1/8-100	ASE	4700-05-1000	1
R17	RES, C, 1/4W, 5%, 2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1

WAVETEK PARTS LIST	TITLE OUTPUT AMP, M10W-9	ASSEMBLY NO. 1114-00-0360 PAGE: 2	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
22	AMP BD	1218-00-0600	W-I	1218-00-0600	1
23	LEV BD	1218-00-0610	W-I	1218-00-0610	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	OUTPUT AMP, M10W-9	1114-00-0360	
		PAGE: 3	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP, CER, 200PF, 1KV CD102-120	5GA-T20	SPR	1510-10-1201	1
C02	CAP, G-C, 2.4PF, 10% CG101-224	QC-2.4PF	G-C	1510-40-0249	1
C03 C20 C22	CAP., CHIP, .1 MF	51C1209-B104Z	CFI	1510-00-3104	3
C07	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
C08 C09 C14 C15 C25	CAP, FT, CER, 100PF, 20% CF104-110	4420-100PF	AER	1510-30-3101	5
C11 C12 C16 C24 C26	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	5
C17	CAP, F.T., 6.8PF CF102-R68	54-794-010-6892	SPEC	1510-30-1689	1
C21	CAP, FT, 500PF, 20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
CR02 CR03	DIODE DP000-050	5082-3080	H-P	4805-02-0002	2
CR05	DIODE SELECTED FROM: 4809-02-0001	4889-00-0002	W-I	4889-00-0002	1
CR06 CR07	DIODE DG109-140	1N4148	T-I	4807-01-0914	2
J01 J03 J04 J05	CONN JF000-005	37JR116-1	S-C	2110-03-0002	4
K01	RF RELAY 2PDT MR000-003	3SCS5007K1	G-E	4510-00-0003	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	OUTPUT AMP, M10W-10	1114-00-0361	
		PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L01	CHOKE, 47MH, 10% LA005-047	08N470K	ASE	1810-03-0470	1
L11	CHOKE, 33MH, 10% LA005-033	08N330	ASE	1810-03-0330	1
L22	RF CHOKE	CHOKE	W-I	1819-99-9999	1
Q01	TRANS QB000-034	BFR94	APX	4902-00-0940	1
Q02	TRANS QA039-040	2N3904	NAT	4901-03-9040	1
R01*	RES, C, 1/4W, 5%, 120 RC103-112	CF1/4-120	ASE	4700-15-1200	1
R02	RES, C, 1/4W, 5%, 330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R05	RES, C, 1/2W, 5%, 470 RC105-147	CF1/2-470	ASE	4700-25-4700	1
R06	RES, C, 1/8W, 5%, 1K RC101-210	CF1/8-1K	ASE	4700-05-1001	1
R07 R08 R09	RES, C, 1/4W, 5%, 56 RC103-056	CF1/4-56	ASE	4700-15-5609	3
R10	RES, C, 1/4W, 5%, 160OHM	CF1/4-160	ASE	4700-15-1600	1
R14	RES, C, 1/4W, 5%, 47 RC103-047	CF1/4-47	ASE	4700-15-4709	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R16	RES, C, 1/8W, 5%, 100 RC101-110	CF1/8-100	ASE	4700-05-1000	1
R17	RES, C, 1/4W, 5%, 2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1
22	AMP BD	1218-00-0600	W-I	1218-00-0600	1
23	LEV BD	1218-00-0610	W-I	1218-00-0610	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101 C105 C109	CAP, CHIP, 1PF, 100V CC101-R10	3BN100S1R0C(S)	VAR	1510-00-0010	3
C102 C103 C106 C107 C110 C111 C115 C116 C117	CAP., CHIP, .1 MF	51C1209-B104Z	CFI	1510-00-3104	9
C104	CAP, CER, 1200PF, 1KV CD102-212	5GA-D12	SPR	1510-10-1122	1
C108 C113 C114	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	3
L101 L102 L103	CHOKE, 33MH, 10% LA005-033	08N330	ASE	1810-03-0330	3
L104	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	1
Q101 Q102	TRANS MCRWV	NE02135	NEC	4902-02-1350	2
Q103	TRANS, 200MW, 2GHZ	NE41635D	NEC	4902-41-6354	1
R101 R108 R115	RES, C, 1/8W, 5%, 1K RC101-210	CF1/8-1K	ASE	4700-05-1001	3
R102 R106 R109* R113* R116 R120	RES, C, 1/8W, 5%, 120 RC101-112	CF1/8-120	ASE	4700-05-1200	6
R103 R104 R110 R111 R117 R118	RES. C, 1/8W, 5%, 24-OHM	CF1/8-24	ASE	4700-05-2409	6
R105 R112 R119	RES, C, 1/8W, 5%, 6.8K-OHM	CF1/8-6.8K	ASE	4700-05-6801	3

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	AMP BD	1218-00-0600	
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R107 R114	RES, C, 1/4W, 5%, 470 RC103-147	CF1/4-470	ASE	4700-15-4700	2
R121 R122	RES, C, 1/4W, 5%, 390 RC103-139	CF1/4-390	ASE	4700-15-3900	2
R123*	RES, C, 1/4W, 5%, 47 RC103-047	CF1/4-47	ASE	4700-15-4709	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	AMP BD	1218-00-0600	
		PAGE: 2	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201	CAP, CER, .001MFD, 1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C203	CAP, CER, 470PF, 1KV CD102-147	60U471M	MDC	1510-10-1471	1
C204	CAP, CER, 100PF, 1KV CD102-110	60U101M	MDC	1510-10-1101	1
C205 C206	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
C207	CAP, MON, 1MF, 50V, 20%	3420-050-E105M	AER	1510-11-3105	1
C208	CAP, CER, .05MF, 100V CD103-350	TG-S50	SPR	1510-10-2503	1
CR201	DIODE DG000-007	5082-2800	H-P	4809-02-0001	1
CR202 CR203 CR204	DIODE DG109-140	1N4148	T-I	4807-01-0914	3
IC201	OP AMP, DUAL, 10 MHZ	NE5533AN	SIG	7000-55-3300	1
Q201	TRANS QA039-060	2N3906	T-I	4901-03-9060	1
R201	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R202 R203	RES, C, 1/4W, 5%, 560K RC103-456	CF1/4-560K	ASE	4700-15-5603	2
R204	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R204 R207 R208 R214	RES, C, 1/4W, 5%, 22K RC103-322	CF1/422K	ASE	4700-15-2202	4
R204	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1
R204 R207 R208 R214	RES, C, 1/4W, 5%, 22K RC103-322	CF1/422K	ASE	4700-15-2202	4
R206	RES, C, 1/4W, 5%, 18K RC103-318	CF1/4-18K	ASE	4700-15-1802	1
R209	RES, C, 1/4W, 5%, 2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	1
R210	RES, C, 1/4W, 5%, 15K RC103-315	CF1/4-15K	ASE	4700-15-1502	1
R211	RES, C, 1W, 5%, 20 OHM	GB2005	AB	4700-35-2009	1
R212	RES, C, 1/4W, 5%, 12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1 C29 C30 C31	CAP, F.T., 6.8PF CF102-R68	54-794-010-6892	SPEC	1510-30-1689	4
C10 C4	CAP, CER, 150PF, 1KV CD102-115	60U151M	MDC	1510-10-1151	2
C11	CAP, VARI, 7.35PF, 250V CV101-035	7STRIKO-02	STR	1510-70-0350	1
C12*	CAP, MICA, 27PF	CM05ED270J03	ARC	1510-50-0270	1
C13	CAP, MICA, 470PF, 500V CM101-147	DM15-471J	ARC	1510-50-0471	1
C15 C18	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
C16 C17	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	2
C19 C24 C25 C26 C27 C3 C5 C8 C9	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	9
C2	CAP, CER, 75PF, 1KV CD104-075	10TCU-G75	SPR	1510-10-3750	1
C20	CAP, CER, .001MFD, 1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C21	CAP, MICA, 100PF, 500V CM101-110	DM15-101J	C-D	1510-50-0101	1
C23 C28	CAP, CER, 20PF, 1KV CD101-020	60C0G200J	MDC	1510-10-0200	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C6	CAP, CER, 3000PF, 1KV CD102-230	5GA-D30	SPR	1510-10-1302	1
C7	CAP, CER, 68PF, 1KV CD104-068	68U2J680J	MDC	1510-10-3680	1
CR1 CR10 CR11	DIODE DR000-001	1N4004	P-C	4806-01-4004	3
CR2 CR7 CR8 CR9	DIODE DG000-011	FD-6666	FCD	4807-02-0003	4
CR3 CR4 CR5 CR6	DIODE DG000-010	FD777	FCD	4807-02-0002	4
IC03	DUAL DIFF AMP	CA3102AE	RCA	7000-31-0200	1
IC1 IC2	IC, 8 PIN, IC000-008	LM301-AN	NAT	7000-03-0100	2
J1	CONN JF000-005	37JR116-1	S-C	2110-03-0002	1
L01 L02	TOROID	LA009-010-1	HYT	1810-05-0004	2
Q1	TRANS QB000-011	TD401	SPR	4902-00-4010	1
Q10 Q7	TRANS QA051-390	2N5139	NAT	4901-05-1390	2
Q2	TRANS QB000-009	MPS3702	NAT	4902-03-7020	1
3	DECAL, CAN M29-2	CDB-92	W-I	2410-04-0084	1
Q3	TRANS QB000-010	TD101	SPR	4902-00-1010	1
Q4	TRANS QA039-040	2N3904	NAT	4901-03-9040	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q5	TRANS QA039-060	2N3906	T-I	4901-03-9060	1
Q6	TRANS QB000-026	AD3958	A-D	4902-03-9580	1
Q8 Q9	TRANS QA036-400	3640-18	NAT	4901-03-6400	2
R02	RES, MF, 1/8W, 1%, 4.87K RF212-487	MF55K-4.87K	ASE	4701-03-4871	1
R1	POT, 2K, RP130-220	89PR2K	BEK	4610-00-2202	1
R10 R16 R19 R22 R25 R3 R5	RES, MF, 1/8W, 1%, 1K RF212-100	MF55K-1K	ASE	4701-03-1001	7
R12 R15 R6	RES, MF, 1/8W, 1%, 110K RF214-110	MF55K-110K	ASE	4701-03-1103	3
R13	RES, C, 1/4W, 5%, 150K RC103-415	CF1/4-150K	ASE	4700-15-1503	1
R14 R30 R32 R33 R44 R9	RES, MF, 1/8W, 1%, 499 RF211-499	MF55K-499	ASE	4701-03-4990	6
R17 R29 R56 R57	RES, MF, 1/8W, 1%, 5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	4
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
R21 R8	RES, MF, 1/8W, 1%, 249 RF211-249	MF55K-249	ASE	4701-03-2490	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R26	RES, C, 1/8W, 1%, 33.2 RF21R-332	MF55K-33.2	ASE	4701-03-3329	1
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
R38 R4 R40 R7	RES, MF, 1/8W, 1%, 2K RF212-200	MF55K-2K	ASE	4701-03-2001	4
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	4701-03-2101	1
R55	RES, MF, 1/8W, 1%, 2.49K RF212-249	MF55K-2.49K	ASE	4701-03-2491	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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
R61	RES, MF, 1/8W, 1%, 10K RF213-100	MF55K10K	ASE	4701-03-1002	1

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	500D107G012CC5	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, CER, FACTORY ADJ. 0-15, NPO	1510-99-9997	W-I	1510-99-9997	1
C15	CAP, CER, 470PF, 1KV CD102-147	60U471M	MDC	1510-10-1471	1
C16	CEA, CER, FACTORY ADJ. 20-27, N1500/25, NPO	1510-99-9998	W-I	1510-99-9998	1
C17	CAP, VAR, 1.4/9.2PF CV107-001	189-0563-001	JON	1510-70-6929	1
C19 C50	CAP, CER, .005MF, 100V	TG-D50	SPR	1510-10-2502	2
C20	CAP, MICA, 180PF, 500V CM101-118	DM15-181J	ARC	1510-50-0181	1
C21 C41 C46	CAP, FT, 500PF, 20%250V CF104-150	4420-500PF	AER	1510-30-3501	3

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	XTAL REF, M30-1	1114-00-0024	H
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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-TRIKO-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-T20	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
C35 C37	CAP, M.C., .47PF CG102-147	MC-.47PF	G-C	1510-40-1478	2

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C43	CAP, CER, F.T., 27PF CF114-027	4420-27PF	AER	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, G.C., .1PF CG101-110	GC-.1PF	G-C	1510-40-0019	1
C56	CAP, M.C., .75PF CG102-175	MC-.75PF	G-C	1510-40-1758	1
C59	CAP, G-C, 10PF, 10%, CG101-310	GC-10PF	G-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	BB121A	ITT	4889-00-0001	1
IC1	IC, IC000-011	78M05U1C	FCD	7000-78-0500	1
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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L01 L02 L03 L27	TOROID	LA009-010-1	HYT	1810-05-0004	4
L07	CHOKE .47MH 10% LA005-R04	08NR47K	ASE	1810-03-0478	1
L08 L09 L17	TOROID, 4 TURN	LA009-004-1	HYT	1810-05-0003	3
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
L16	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	1
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	38-111	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
Q4 Q5	TRANS QA039-040	2N3904	NAT	4901-03-9040	2
R04	RES, MF, 1/8W, 1%, 5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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
R17	RES, C, 1/4W, 5%, 1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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 R38 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
R34 R37	RES, C, 1/8W, 5%, 22 RC101-022	CF1/8-22	ASE	4700-05-2209	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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
FOR M30-4 (1114-00-0307), R53	ADD: RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101 C103 C104 C105 C106 C107	CAP, ELECT, 1MF, 25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	6
C102	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	1
IC101	IC, IC000-015	74S74N	T-I	8000-82-7401	1
IC102	DECADE COUNTER	SN74196N	T-I	8007-41-9600	1
IC103 IC104 IC105	DECADE CTR PRESET LS	SN74LS196N	T-I	8007-41-9610	3
L101 L104 L105 L106 L107	TORRID, 10 TURN	LA009-010-1	HYT	1810-05-0004	5
L102	TORRID, 4 TURN	LA009-004-1	HYT	1810-05-0003	1
L103	TORRID, 10 TURN	LA009-010-2	HYT	1810-05-0005	1
R101	RES, C, 1/4W, 5%, 390 RC103-139	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	ASSEMBLY NO.	REV
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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, .13MF, 100V 5%	160C124J100C	PLSSY	1510-60-8124	4
C23 C24 C26	CAP, MON, 1MF, 50V, 20%	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	5GAD10	SPR	1510-10-1102	1
C36	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	1

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	T-I	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 IC04 IC05 IC06	DECADE CTR PRESET LS	SN74LS196N	T-I	8007-41-9610	4
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	RC4558NB	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

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	INT	4901-05-4580	1
Q02	TRANS QA053-060	2N5306	Q-E	4901-05-3060	1
Q03 Q04	TRANS QA038-541	2N3854A	SPR	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 FROM: 4610-00-7202	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

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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
CR04 CR05 CR06	DIODE DR000-001	1N4004	P-C	4806-01-4004	3
CR1	DIODE DC000-008	BB205B	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 L13 L19	TORRID, 10 TURN	LA009-010-1	HYT	1810-05-0004	12
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	APX	4902-00-0900	1
R01	RES, C, 1/8W, 5%, 68 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

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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R03	RES, C, 1/4W, 5%, 430 RC103-143	CF1/4-430	ASE	4700-15-4300	1
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

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
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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 FROM: 8007-42-8800	8410-00-0001	W-I	8410-00-0001	1
IC102 IC103	DECADE COUNTER	SN74S196N	T-I	8007-41-9601	2
IC104	DUAL J-K FLIP-FLIP	SN74S112N	T-I	8007-41-1200	1
IC105	IC, IC000-029	11C44DC	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	TOROID, 10 TURN, 1/16" INSULATION	LA-009-010-3	HYT	1810-05-0006	4
P101A P101B P101C P101D P101E P101F	EDGE-CLIP CONNECTOR	75382-001	BER	2112-22-0001	10

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
P1010 P101H P101I P101J					
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	D
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201	CAP, CER, .005MF, 100V	TG-D50	SPR	1510-10-2502	1
C202	CAP, CER, .001MFD, 1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C203 C210 C211	CAP, MON, 1MF, 50V, 20%	3420-050-E105M	AER	1510-11-3105	3
C204 C205	CAP, CER, 150PF, 1KV CD102-115	60U151M	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	T-I	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	3710-00-0001	2
P201	HEADER, 6-PIN, STRGHT REF: 2112-24-0000	2112-24-0001	W-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
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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	A2B502	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	A2B203	A-B	4610-13-4203	1
R216 R217 R219 R220	RES, , 1/8W, 5%, 30K	CF1/8-30K	ASE	4700-05-3002	4
R218	POT, CERMET, 2K-OHM	A2B202	A-B	4610-13-4202	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R223 R224	RES, C, 1/4W, 5%, 100K RC103-410	CF1/4-100K	ASE	4700-15-1003	2
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	G-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	ASSEMBLY NO.	REV
	MIXER ASSY	1219-00-0117 PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C401	CAP, CER, 120PF, 1KV CD102-112	60U121M	MDC	1510-10-1121	1
C402	CAP, CER, .005MF, 100V	TG-D50	SPR	1510-10-2502	1
C403	CAP, CER, F.T., 39PF CF114-039	4420-39PF	AER	1510-31-0390	1
L401	CHOKE .10MH 10% LA005-R01	09NR10K	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	ASSEMBLY NO.	REV
	VIDEO AMP ASSY	1219-00-0118 PAGE: 1	A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1 C20 C21	CAP, F.T., 6.8PF CF102-R68	54-794-010-6892	SPEC	1510-30-1689	3
C2	CAP, G-C, 10PF, 10%, CG101-310	GC-10PF	G-C	1510-40-0100	1
C24 C3 C31 C7	CAP, CER, .005MF, 100V	TG-D50	SPR	1510-10-2502	4
C10 C4	CAP, CER, F.T., 150PF CF116-115	4420-150PF	AER	1510-31-2151	2
C11 C15 C26 C27 C30 C32 C5 C6 C8 C9	CAP, ELECT, 1MF, 25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	10
C12	CAP, CER, 470PF, 1KV CD102-147	60U471M	MDC	1510-10-1471	1
C13	CAP, CER, 33PF, 1KV CD104-033	10TU-G33	SPR	1510-10-3330	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 C33 C34	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	5

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C25	CAP, ELECT, 100MF, 6V CE118-110	500D107G006CC7	SPR	1510-21-1101	1
C38 C39	CAPACITOR, MON, 4.7, 50V, 20%	C350C475M5U1CA	KEM	1510-11-3475	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
CR1 CR2	DIODE DP000-040	MA47980	M-A	4805-02-0001	2
CR3	DIODE DG000-009	5082-2835	H-P	4809-02-0002	1
CR4	DIODE DG000-007	5082-2800	H-P	4809-02-0001	1
CR9	LED DL000-001	NSL5046	NAT	4810-02-0001	1
CR11 CR12 CR13 CR14 CR15 CR16 CR17 CR18 CR5 CR6 CR7 CR8	DIODE DR000-001	1N4004	P-C	4806-01-4004	12
CR10	DIODE DB000-010	1N4732	ITT	4801-01-4732	1
IC01	OP AMP LO NOISE	NE5534AN	SIG	7000-55-3401	1
IC02 IC03 IC09	DUAL OP AMP, RAYTHEON IC000-027	RC4558DN	RAY	7000-45-5801	3
IC4	IC, IC000-011	78M05U1C	FCD	7000-78-0500	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
IC5	IC, ID001-001 STATIC SENSITIVE	MC14553BCL	MOT	8001-45-5300	1
IC6	IC, IC000-023	SN7405N	T-I	8000-74-0500	1
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
L1 L2 L5 L6	CHOKE, 3.3MH, 10% LA005-R33	08N3R3K	ASE	1810-03-0339	4
L03 L04 L08 L09 L10 L11 L12 L13	TORRID, 10 TURN	LA009-010-1	HYT	1810-05-0004	8
L07	TORRID, 4 TURN	LA009-004-1	HYT	1810-05-0003	1
L14	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
Q1 Q2	TRANS QA038-541	2N3854A	SPR	4901-03-8541	2
Q3	TRANS QA050-530	2N5053	APX	4901-05-0530	1
Q4	TRANS QA054-610	2N5461	T-I	4901-05-4610	1
Q5	TRANS QA054-580	2N5458	INT	4901-05-4580	1
R1 R2 R5	RES, C, 1/4W, 5%, 56 RC103-056	CF1/4-56	ASE	4700-15-5609	3
R3 R41 R43 R44 R45 R46	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	6

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R10 R13 R25 R4 R55	RES, C, 1/4W, 5%, 2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	5
R7 R8	RES, C, 1/4W, 5%, 470 RC103-147	CF1/4-470	ASE	4700-15-4700	2
R14 R9	RES, C, 1/4W, 5%, 22K RC103-322	CF1/422K	ASE	4700-15-2202	2
R15	RES, C, 1/4W, 5%, 47 RC103-047	CF1/4-47	ASE	4700-15-4709	1
R16*	RES, C, 1/4W, 5%, 330 RC103-133	CF1/4-330	ASE	4700-15-3300	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 R50	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K	ASE	4700-15-1002	4

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R23	POT, 100K, RP144-410 FROM: 4610-00-7104	91WR100K	BEK	4610-00-4104	1
R24	RES, C, 1/4W, 10%, 2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1
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
R37	RES, C, 1/4W, 5%, 39K RC103-339	CF1/4-39K	ASE	4700-15-3902	1
R39 R42 R51 R52 R53 R54 R67	RES, C, 1/4W, 5%, 27K RC103-327	CF1/4-27K	ASE	4700-15-2702	7
R40	RES, C, 1/4W, 5%, 270 RC103-127	CF1/4-270	ASE	4700-15-2700	1
R47	RES, C, 1/4W, 5%, 33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1
R48	RES, C, 1/4W, 5%, 7.5K RC103-275	CF1/4-7.5K	ASE	4700-15-7501	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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
R68 R69	RES, C, 1/4W, 5%, 150K RC103-415	CF1/4-150K	ASE	4700-15-1503	2
R70	POT, 20K	43P203T601	SPE	4610-00-5203	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	54-794-010-6892	SPEC	1510-30-1689	5
C18 C19	CAP, F.T., 120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	2
C21	CAP, CER, 200PF, 1KV CD102-120	5GA-T20	SPR	1510-10-1201	1
C602	CAP, CER, F.T., 39PF CF114-039	4420-39PF	AER	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

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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
IC1	IC, IC000-011	78M05U1C	FCD	7000-78-0500	1
IC2	IC, IC000-029	11C44DC	FCD	8000-11-4400	1
J1 J2 J3 J4 J5	CONN JF000-005	37JR116-1	S-C	2110-03-0002	5
L01	FERRITE CHOKE, 1 TURN FROM: 1813-00-0007	LA007-001	W-I	1210-30-0004	1
L02 L03 L04 L05 L07 L08 L09 L11 L12	TOROID	LA009-010-1	HYT	1810-05-0004	9
L10	TOROID, 10 TURN	LA009-010-2	HYT	1810-05-0005	1
L301 L601	CHOKE, 4.7MH, 10% LA005-R47	08N4R7K	ASE	1810-03-0479	2
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
R06	RES, C, 1/4W, 5%, 1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1

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

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
NONE	W.B. MIXER/AMP ASSY	M34-S2/3	W-I	1219-00-0129	1
NONE	LEV ASSY	M34S-5	W-I	1218-00-0314	1
NONE	PH LK ASSY	M34S-6	W-I	1218-00-0334	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	WIDE OSC LK, M34	1114-00-0008	Q
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101 C104 C203	CAP, FT, 500PF, 20%250V CF104-150	4420-500PF	AER	1510-30-3501	3
C102 C103	CAP, CER, DISC, .001MF 50V, CD112-210	8101-050-102M	ETP	1510-10-7102	2
C105*	CAP, G.C., 1.5PF CG101-215	GC-1.5PF	G-C	1510-40-0159	1
C201 C204	CAP, CER, .005MF, 100V	TG-D50	SPR	1510-10-2502	2
C202* C207 C210	CAP, CER, 6.8PF, 1KV CD101-R68	60C0H6R8D	MDC	1510-10-0689	3
C205*	CAP, G.C., 2.7PF CG101-227	GC-2.7PF	G-C	1510-40-0279	1
C206	CAP, M-C, 4.7PF, 10% CG102-247	GC-4.7PF	G-C	1510-40-1479	1
C208 C209	CAP, CER, 15PF, 1KV CD101-015	10TCC-Q15	SPR	1510-10-0150	2
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, 1TURN FROM: 1813-00-0007	LA007-001	W-I	1210-30-0004	1
L102	TORRID, 10 TURN	LA009-010-1	HYT	1810-05-0004	1
L201 L202 L203 L204	RF CHOKE	CHOKE	W-I	1819-99-9999	4

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	W.B. MIXER/AMP ASSY	1219-00-0129	B
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q201 Q202	TRANS GA050-530	2N5053	APX	4901-05-0530	2
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
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 RC103-047	CF1/4-47	ASE	4700-15-4709	1
R205	RES, C, 1/4W, 5%, 100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
T101	RF XFMR FROM: 1813-00-0007	TR001-001	W-I	1210-40-0001	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	W.B. MIXER/AMP ASSY	1219-00-0129 PAGE: 2	B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C301	CAP, CER, F.T., 39PF CF114-039	4420-39PF	AER	1510-31-0390	1
C302	CAP, CER, F.T., 27PF CF114-027	4420-27PF	AER	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 C316*	CAP, CER, F.T., 120PF CF116-112	4420-120PF	AER	1510-31-2121	3
C314	CAP, CER, F.T., 150PF CF116-115	4420-150PF	AER	1510-31-2151	1
C317	CAP, CER, F.T., 360PF CF116-136	4420-360PF	AER	1510-31-2361	1
C318*	CAP, CER, F.T., 18PF CF113-018	4420-18PF	AER	1510-30-9180	1
C319	CAP, CER, 100PF, 1KV CD104-110	10TCU-T10	SPR	1510-10-3101	1
CR301 CR302 CR303	DIODE, SIL, HOT CAR DG000-013	5082-3188	H-P	4812-02-0002	3

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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L06 L308	TOROID	LA009-010-1	HYT	1810-05-0004	2
L302	CHOKE, 4.7MH, 10% LA005-R47	08N4R7K	ASE	1810-03-0479	1
L303	TOROID, 4 TURN	LA009-004-1	HYT	1810-05-0003	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 GA050-530	2N5053	APX	4901-05-0530	4
R05	RES, C, 1/4W, 5%, 470 RC103-147	CF1/4-470	ASE	4700-15-4700	1
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

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
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
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, 100V	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	RC4558NB	RAY	7000-14-5800	1
Q401 Q402 Q403 Q405	TRANS QA039-040	2N3904	NAT	4901-03-9040	4
Q404	TRANS QB000-009	MPS3702	NAT	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

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

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, 100V	TG-D50	SPR	1510-10-2502	1
C509	CAP, CER, .001MFD, 1KV CD102-210	5GAD10	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

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

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	ASSEMBLY NO.	REV
	PH LK ASSY	1218-00-0334 PAGE: 3	H

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C601	CAP, CER, F.T., 18PF CF113-018	4420-18PF	AER	1510-30-9180	1
CR601 CR602	DIODE DG000-009	5082-2835	H-P	4809-02-0002	2
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	ASSEMBLY NO.	REV
	VID MIXER ASSY	1219-00-0020 PAGE: 1	H

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, F.T., 470PF CF101-147	FA5C-4712	A-B	1510-30-0471	16
C17 C18	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C34	CAP, CER, .15MF, 100V CD113-415	CY20A154M	C-L	1510-11-1154	16
IC01	IC, IC000-011	78M05U1C	FCD	7000-78-0500	1
J01 J02 J03 J04	CONN JF000-005	37JR116-1	S-C	2110-03-0002	4
L001	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
ZA1	PC ASSY, F, M115	1218-00-1450	W-I	1218-00-1450	1
ZA2	PC ASSY, R, M115	1218-00-1460	W-I	1218-00-1460	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	DOWN CONV, M115	1114-00-0185	I
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101	CAP, CER, 330PF, 1KV CD104-133	10TCU-T33	SPR	1510-10-3331	1
C102	CAP, CER, 150PF, 1KV CD102-115	60U151M	MDC	1510-10-1151	1
C103	CAP, MICA, 1500PF, 500V CM101-215	DM19-152J	ARC	1510-50-0152	1
C104	CAP, CER, 270PF, 1KV CD102-127	60U271M	MDC	1510-10-1271	1
C105 C112	CAP, VARI, 7.35PF, 250V CV101-035	7STRIK0-02	STR	1510-70-0350	2
C106	CAP, CER, 100PF, 1KV CD102-110	60U101M	MDC	1510-10-1101	1
C107 C108 C109	CAP, CER, .001MFD, 1KV CD102-210	5GAD10	SPR	1510-10-1102	3
C110 C111	CAP, CER, 20PF, 1KV CD101-020	60C0G200J	MDC	1510-10-0200	2
C113 C114	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
CR101 CR102 CR103 CR104	DIODE DG000-007	5082-2800	H-P	4809-02-0001	4
IC101	13-INPUT NAND	74S133	FCD	8007-41-3300	1
IC102	IC, IC000-023	SN7405N	T-I	8000-74-0500	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	PC ASSY, R, M115	1218-00-1460	
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L101	CHOKE, .39MH, 10%	08NR39K	ASE	1810-03-0398	1
L102	CHOKE, 1MH, 10% LA005-R10	08N1R0K	ASE	1810-03-0010	1
L103	CHOKE, 3.9MH, 10%	08N3R9K	ASE	1810-03-0399	1
L104 L108	CHOKE, 10.0MH, 10% LA005-010	08N100K	ASE	1810-03-0100	2
L105	CHOKE, .68MH, 10%	08NR68K	ASE	1810-03-0688	1
L106 L109	CHOKE, 4.7MH, 10% LA005-R47	08N4R7K	ASE	1810-03-0479	2
L107	CHOKE, 2.2MH, 10% LA005-R22	08N2R2K	ASE	1810-03-0229	1
L110	CHOKE, 6.8MH, 10% LA005-R68	08N6R8K	ASE	1810-03-0689	1
Q101	XSTOR, POWER, NPN	2N6715	NAT	4902-09-2011	1
R101	RES, L-A, 1/4W, 1%, 61.1 RF406-110	SPS-N-347-61.1	IRC	4741-61-1007	1
R102	RES, L-A, 1/4W1%, 247.5 RF412-475	SPS-N-347-247.5	IRC	4741-24-7508	1
R103	RES, VAR. CERMET, 100 10%	89PR100	BEK	4610-00-2101	1
R104	RES, C, 1/2W, 5%, 330 RC105-133	CF1/2-330	ASE	4700-25-3300	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R105	RES, C, 1/4W, 5%, 3.3K RC103-233	CF1/4-3.3K	ASE	4700-15-3301	1
R106	RES, C, 1/4W, 5%, 330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R107	RES, C, 1/4W, 5%, 100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
R108 R109 R110 R113	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	4
R111	RES, C, 1/4W, 5%, 4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	1
R112	RES, C, 1/4W, 5%, 47 RC103-047	CF1/4-47	ASE	4700-15-4709	1
T101 T102	RF XFMR FROM: 1813-00-0007	1210-40-0017	W-I	1210-40-0017	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201 C202 C207 C208 C218	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	5
C203 C206 C213 C214	CAP, ELECT, 100MF, 25V CE105-110	TE1211	SPR	1510-20-4101	4
C204 C211	CAP, VARI, 7.35PF, 250V CV101-035	7STRIKO-02	STR	1510-70-0350	2
C205 C212	CAP, CER, 25PF, 1KV CD101-025	60C0G250J	MDC	1510-10-0250	2
C209 C210	CAP, ELECT, 1MF, 25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	2
C215	CAP, CER, 360PF, 1KV CD102-136	60U361M	MDC	1510-10-1361	1
C216	CAP, CER, .001MFD, 1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C217	CAP, CER, 20PF, 1KV CD101-020	60C0G200J	MDC	1510-10-0200	1
CR201 CR202	DIODE DB000-003	HW12B	MSP	4801-02-0003	2
IC201	OP AMP LO NOISE	NE5534AN	SIG	7000-55-3401	1
L203	CHOKE, 2.2MH, 10% LA005-R22	08N2R2K	ASE	1810-03-0229	1
L205	CHOKE, 4.7MH, 10% LA005-R47	08N4R7K	ASE	1810-03-0479	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	PC ASSY, F, M115	1218-00-1450	
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q201	TRANS GA038-541	2N3854A	SPR	4901-03-8541	1
Q202	XSTOR, POWER, NPN	2N6715	NAT	4902-09-2011	1
Q203	TRANS GA051-090	2N5109	SSS	4901-05-1090	1
Q204	XSTOR, POWER, PNP	MM4018	MOT	4902-04-0180	1
R201	RES, C, 1/4W, 5%, 750 RC103-175	CF1/4-750	ASE	4700-15-7500	1
R202	RES, C, 1/4W, 5%, 1.8K RC103-218	CF1/4-1.8K	ASE	4700-15-1801	1
R203	RES, C, 1/4W, 5%, 33 RC103-033	CF1/4-33	ASE	4700-15-3309	1
R204	RES, C, 1/4W, 5%, 150 RC103-115	CF1/4-150	ASE	4700-15-1500	1
R205 R212 R213	RES, C, 1/4W, 5%, 100 RC103-110	CF1/4-100	ASE	4700-15-1000	3
R206 R209	RES., 1W, 5, 75-OHM	GB7505	A-B	4700-35-7509	2
R207	RES, C, 1/2W, 5%, 330 RC105-133	CF1/2-330	ASE	4700-25-3300	1
R208	RES., 1W, 5, 1K-OHM	GB1025	A-B	4700-35-1001	1
R210 R214	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	2

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	PC ASSY, F, M115	1218-00-1450	
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R211 R215	RES, C, 1/2W, 5%, 27 RC105-027	EB2705	A-B	4700-25-2709	2
R216	RES, C, 1/4W, 5%, 1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R217	RES, L-A, 1/4W, 1%, 49.9 RF404-990	SPS-N-347-49.9	IRC	4741-49-9007	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	PC ASSY, F, M115	1218-00-1450	
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01	CAP, CER, 20PF, 1KV CD101-020	60C0G200J	MDC	1510-10-0200	1
C02 C04	CAP, CHIP, 1000PF, 50V CC101-210	5BN050S102KS	VAR	1510-00-1102	2
C03 C20 C21 C22 C23	CAP., CHIP, .1 MF	51C1209-B104Z	CFI	1510-00-3104	5
C05	CAP, CER, FT, 2200PF, GMV, CF115-222	4420-2200PF	AER	1510-31-1222	1
C06 C07 C08 C09 C10	CAP, MON, 1MF, 50V, 20%	3420-050-E105M	AER	1510-11-3105	5
C11 C12 C13 C14	CAP, F.T., 6.8PF CF102-R68	54-794-010-6892	SPEC	1510-30-1689	4
C15 C17 C19	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	3
C16 C18	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	2
IC01	PGM DIVIDER	SP8690B	PLSSY	8000-86-9010	1
IC02	SYNC 4-BIT UP/DN CTR	SN74LS169N	T-I	8007-41-6910	1
IC03 IC04 IC05 IC06	SYNC, UP-DOWN, CTR.	SN74LS168N	T-I	8007-41-6810	4
IC07	PO VOLTAGE REG.	UA7805UC	FCD	7000-78-0523	1
IC08	QUAD POS NAND	SN74LS00N	T-I	8000-74-0010	1
IC09	HEX INVERTER	SN74LS04N	T-I	8000-74-0410	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
J01 J02	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	1
L02	CHOKE .47MH 10% LA005-R04	08NR47K	ASE	1810-03-0478	1
Q01	TRANS QA050-530	2N5053	APX	4901-05-0530	1
R01	RES, C, 1/4W, 5%, 68K RC103-368	CF1/4-68K	ASE	4700-15-6802	1
R02	RES, C, 1/4W, 5%, 180 RC103-118	CF1/4-180	ASE	4700-15-1800	1
R03	RES, C, 1/4W, 5%, 10 RC103-010	CF1/4-10	ASE	4700-15-1009	1
R04	RES, C, 1/8W, 5%, 1.8K- OHM	CF1/8-1.8K	ASE	4700-05-1801	1
R05 R06 R07 R08	RES, C, 1/4W, 5%, 4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	4
R09	RES, C, 1/4W, 5%, 3K RC103-230	CF1/4-3K	ASE	4700-15-3001	1
R10	RES, C, 1/4W, 5%, 1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R11	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03	CAP, CER, .01MF, 50V CD113-310	CY15C103M	C-L	1510-10-8103	3
C04 C05	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
C06 C07 C08 C09 C10 C11 C12 C13 C14 C15 C16 C17 C18	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	13
C19	CAP, F.T., 6.8PF CF102-R68	54-794-010-6892	SPEC	1510-30-1689	1
C20 C21	CAP, F.T., 120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	2
IC01 IC02 IC07	DUAL OP AMP, RAYTHEON IC000-027	RC4558DN	RAY	7000-45-5801	3
IC03	VOLTAGE REF	REF-01CJ	PMI	7000-00-0100	1
IC04 IC05 IC06	DAC, 2-DIGIT, BCD	DAC-20CQ	PMI	8000-00-0200	3
L01 L02	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	2
Q01	TRANS-QA042-500	2N4250	FCD	4901-04-2500	1
Q02	TRANS QA050-880	2N5088	MOT	4901-05-0880	1
Q3 Q4	TRANS QA039-040	2N3904	NAT	4901-03-9040	2
CR01 CR02 CR03 CR04 CR05 CR06 CR07 CR08	DIODE DG109-140	1N4148	T-I	4807-01-0914	8

WAVETEK PARTS LIST	TITLE DAC/SWP DRIVE, M172	ASSEMBLY NO. 1114-00-0320 PAGE: 1	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R01 R39	RES, MF, 1/8W, 1%, 5.62K RF212-562	MF55K-5.62K	ASE	4701-03-5621	2
R02 R08 R18 R23 R31 R33	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	6
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
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, 100K, RP130-410	89PR100K	BEK	4610-00-2104	7
R09	RES, MF, 1/8W, 1%, 3.01K RF212-301	MF55K-3.01K	ASE	4701-03-3011	1
R14 R49 R50 R51 R54 R56 R57 R58 R59 R60	RES, MF, 1/8W, 1%, 5.11K RF212-511	MF55K-5.11K	ASE	4701-03-5111	10
R15 R17 R26 R43 R44 R45 R46	RES, C, 1/4W, 5%, 100K RC103-410	CF1/4-100K	ASE	4700-15-1003	7
R16	RES, C, 1/4W, 5%, 910K RC103-491	CF1/4-910K	ASE	4700-15-9103	1
R19	RES, MF, 1/8W, 1%, 16.5K RF213-165	MF55K-16.5K	ASE	4701-03-1652	1

WAVETEK PARTS LIST	TITLE DAC/SWP DRIVE, M172	ASSEMBLY NO. 1114-00-0320 PAGE: 2	REV B

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R20	RES, MF, 1/8W, 1%, 40.2K RF213-402	MF55K-40.2K	ASE	4701-03-4022	1
R21 R47 R48	RES, C, 1/4W, 5%, 270K RC103-427	CF1/4-270K	ASE	4700-15-2703	3
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
R52 R53	RES, C, 1/4W, 5%, 2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	2
R55	RES, MF, 1/8W, 1%, 48.7K RF213-487	MF55K-48.7K	ASE	4701-03-4872	1

SECTION 7
SCHEMATICS

7.1 INTRODUCTION

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

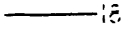
Components	Units
Resistor	ohms
Capacitor	picofarads
Inductor	microhenries

Denotes DC voltage reading in volts unless otherwise specified.

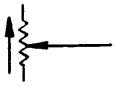
Denotes high impedance crystal detector reading in volts unless otherwise specified.

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

Signal or voltage source.

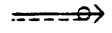


Connects to indicated signal or voltage source.

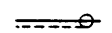


Arrow indicates clockwise rotation of wiper.

Coaxial jack

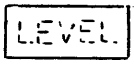


Coaxial plug



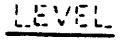
Coaxial cable

Factory adjusted part.

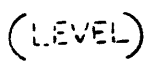


Denotes a front panel device.

Denotes a rear panel device.



Denotes a PC board adjustment or accessible module adjustment.



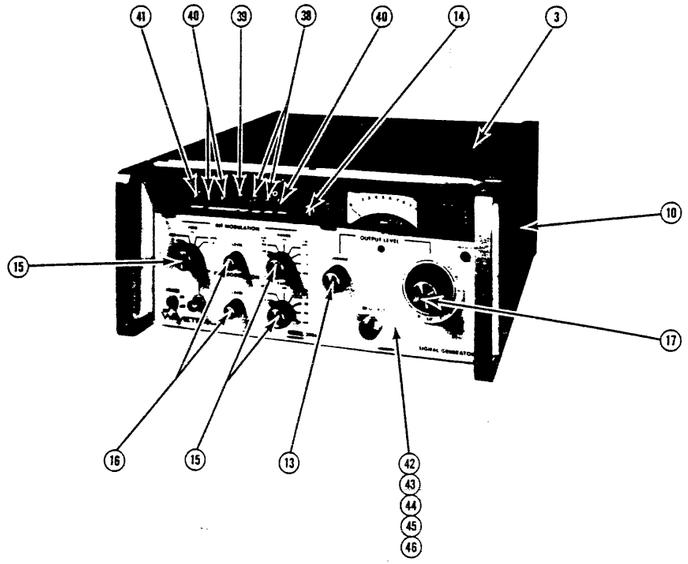
Denotes an internal module adjustment not accessible without removing module cover.

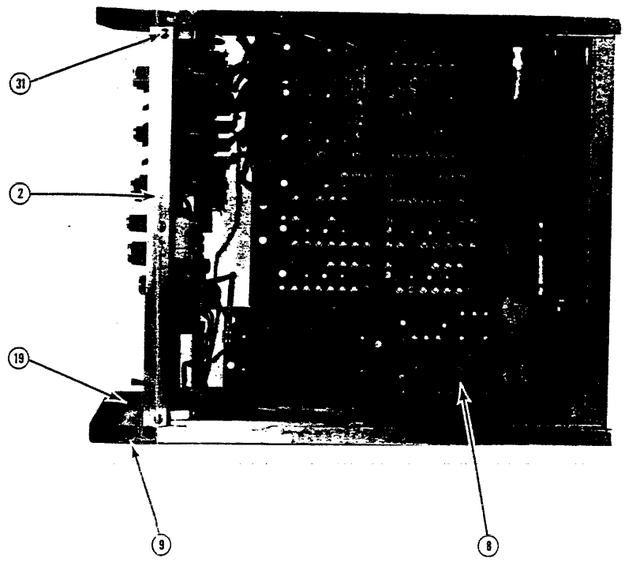
7.3 ABBREVIATION CODE

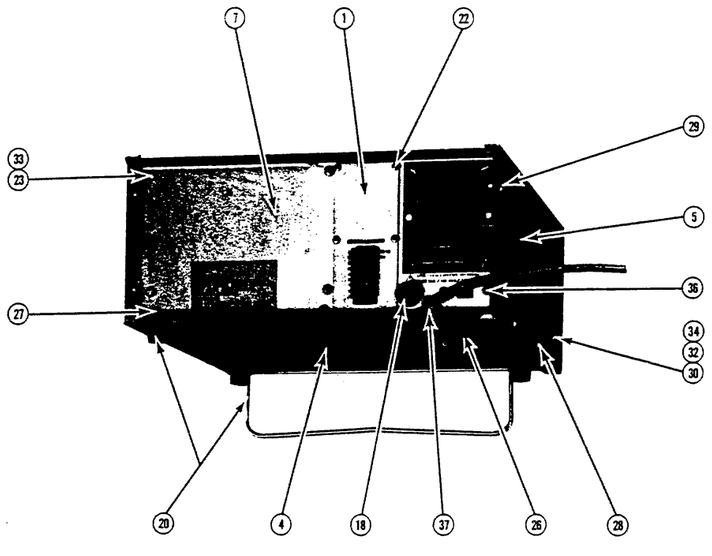
A	Assembly	IF	intermediate frequency	Ω	ohm
A	ampere	J	jack	OC	opto coupler
AC	alternating current	K	relay	P	plug
C	capacitor	kHz	kilohertz	pp	peak-to-peak
CR	diode	kΩ	kilohm	pF	picofarad
CW	continuous wave	kV	kilovolt	Q	transistor
cw	clockwise	kW	kilowatt	R	resistor
dB	decibel	L	inductor	RF	radio frequency
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	T.P.	test point
F.P.	front panel	M	meter	V	volt
H	henry	mA	milliampere	VA	voltampere
Har	harmonic	mH	millihenry	W	watt
Hz	hertz	mV	millivolt	X	crystal
IC	integrated circuit	mW	milliwatt		

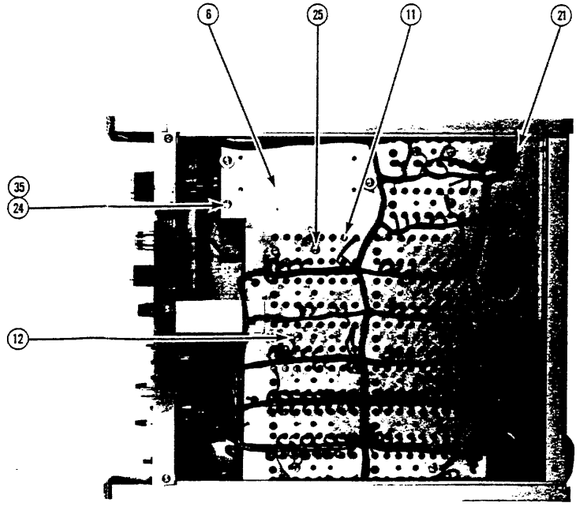
7.4 SCHEMATIC INDEX

ASSY	NAME
3003	Wiring Diagram
3004	Wiring Diagram
3005	Wiring Diagram
3006	Wiring Diagram
DPS2A	Power Supply
M30-1/4	Crystal Reference
MOD BD	Modulation Board
M29-2	FM Reference
M31A	kHz Steps
M33-2	Narrow Osc. Lock
M172	Sweep Drive/DAC
M32A	MHz Steps
M34	Wide Osc. Lock
M9W	Sweep Oscillator
C315-2	Meter Board
M10W-9	Output Amplifier
M10W-10	Output Amplifier
M115	Down-Converter
M149	100 Hz Steps









ITEM	DESCRIPTION	PART NUMBER	QTY.
46	FRONT PANEL, 3010	1410-60-1740	1
45	FRONT PANEL, 3006	1410-00-9110	1
44	FRONT PANEL, 3005	1410-00-9100	1
43	FRONT PANEL, 3004	1410-00-2110	1
42	FRONT PANEL, 3003	1410-00-8110	1
41	SWITCH	5101-00-0006	1
40	SWITCH	5101-00-0005	3
39	SWITCH	5101-00-0004	1
38	SWITCH	5101-00-0002	2
37	STRAIN RELIEF	2810-37-0001	1
36	RIVET, 1/8 X 5/16	2810-30-0007	2
35	FLATWASHER,#8 1/2 O.D.	2810-26-0010	3
34	WASHER DULITE BK	2810-26-0008	12
33	LOCKWASHER, EXT 6	2810-25-6000	4
32	LOCKWASHER, 8 INT	2810-24-8000	14
31	SCREW,TH,6/32X3/8OH	2810-21-6106	6
30	SCREW,TH,8/32 X 1/2	2810-20-8108	4
29	SCREW,TH,8/32 X 5/16	2810-20-8105	4
28	SCREW,TH,8/32 X 1/4	2810-20-8104	5
27	SCREW, 8/32 X 3/16	2810-17-8103	2
26	SCREW, 6/32 X 1/2	2810-17-6108	2
25	SCREW, 6/32 x 5/16, BH	2810-17-6105	18
24	SCREW, 6/32 X 3/16	2810-17-6103	3
23	SCREW, 6/32 X 1/8, BH	2810-17-6102	7
22	SCREW, 4/40 X 3/16	2810-17-4103	6
21	GROMMET, CAT	2810-10-0004	1
20	BAIL, 10", WITH FEET	2810-08-0006	1
19	HANDLE TRIM 4-7/16	2810-07-0005	2
18	FUSEHOLDER	2410-05-0005	1
17	KNOB, SCRN Z250	2410-01-1006	1
16	KNOB, BK	2410-01-0024	2
15	KNOB, 23/32 DIA, BK	2410-01-0018	3
14	KNOB	2410-01-0012	1
13	KNOB	2410-01-0005	1
12	GROUND LUG, #6 INT	2112-03-0003	7
11	PIN SOCKET	2112-00-0002	103
10	PANEL, RIGHT SIDE	1410-60-0480	1
9	HANDLE	1410-30-0710	2
8	GASKET, RFI	1410-01-0440	2
7	CHASSIS, P.S.	1410-00-8340	1
6	UNIT CHASSIS	1410-00-7140	2
5	PANEL, LEFT SIDE	1410-00-6680	1
4	BOTTOM COVER	1410-00-5300	1
3	TOP COVER	1410-00-5290	1
2	TOP SUPPORT RAIL	1410-00-4610	2
1	REAR PANEL	1410-00-3580	1

NO	DESCRIPTION	BY
REVISION		

MATERIAL:

FINISH

ARTWORK :

WAVETEK INDIANA

3003-3006 & 3010
— MECHANICAL —

DRAWN BY: D. J. WATSON | SCALE | DATE: 11-6-81

RELEASED BY | DATE

DRAWING NO: DD-60

MODEL 3003 WIRING DIAGRAM

REV. F

PROGRAM PLUG R.P.
J101
1 MHz
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 T.P 36 — TO MOD BD, PIN 5

S101 100's MHz
S102 10's MHz
S103 1's MHz
FREQUENCY
S104 100's KHz
S105 10's KHz
S106 1's KHz
8 4 2 1 C
J103 J104 J105 J106 J107 J108
FREQUENCY PROGRAM

M172 Sweep Drive/DAC
+18 -18

M32A MHz STEPS
1 MHz
1440 MHz
+7.3 +18 -18 T.P.

M31A KHz STEPS
1 KHz
+7.3 +18 -18

W8
W14
T.P.
M34 WIDE OSCILLATOR LOCK
40 COMB
+7.3 +18 -18 T.P.

W4
M9W SWEEP OSCILLATOR
+18 -18

W3
M10W-9 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
W1
J113
RF OUT

EXT. REF. INPUT
5 MHz REF OUTPUT

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

10 MHz
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.

W5
T.P.
M29-1 FM REFERENCE
+18 -18

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

W7

J109
C315-2 METER BOARD

J110
MODULATION BOARD

+7.3
TO J101-36

EXT.
J112

POWER
OFF ON
S201
P201 J201
DP52A POWER SUPPLY
1 +27V
2 +18V
3 +18V
4 -18V
5 -18V
6 -27V
7 +7.3V
8
9
J102

MODEL 3004
WIRING DIAGRAM
REV. E

PROGRAM PLUG R.P.
J101 MHz
400
200
100
80
40
20
10
8
4
2
1
.8
.4
.2
.1
.08
.04
.02
.01
.008
.004
.002
.001
+7.3
MOD T.P. 34 — TO MOD BOARD, PIN 5

S101 100's MHz
S102 10's MHz
S103 1's MHz
FREQUENCY
S104 100's KHz
S105 10's KHz
S106 1's KHz
8 4 2 1 C
J103 J104 J105 J106 J107 J108
FREQUENCY PROGRAM

W16
W17
M115 DOWN CONVERTER
10 MHz IN (W15)
10 MHz OUT
-18 +18 +7.3

OPTION 3 M35-2
RF CIRCUIT BREAKER
FROM STEP ATTN OUTPUT
TO FRONT-PANEL RF OUTPUT
T.P. -18 +18 +7.3

RF OUT

M172 SWEEP DRIVE/DAC
+18 -18

1MHz
M32A MHz STEPS
1440 MHz
+7.3 +18 -18 T.P.

1KHz
M31A KHz STEPS
+7.3 +18 -18

W8
W14
M34 WIDE OSCILLATOR LOCK
40 COMB
+7.3 +18 -18 T.P.

W4
T.P.
M9W SWEEP OSCILLATOR
+18 -18

W3
M10W-10 OUTPUT AMPLIFIER
+18 -18

W2
STEP ATTENUATOR 50130-1
J113
W1

EXT. REF INPUT
5 MHz REF OUTPUT
OPTION 6
M40 HIGH STABILITY REFERENCE 5 MHz
+27 +18 +7.3

10 MHz IN
OPTION 5
M39 EXT. REFERENCE
+7.3 -18 +18

M30-1 CRYSTAL REFERENCE
1KHz (W13)
1MHz (W12)
2KHz (W11)
10MHz (W15)
1440 MHz (W9)
40 COMB (W6)
120 COMB (W10)
+7.3 +18 -18 T.P.

W5
J109
C315-2 METER BOARD
J110
MODULATION BOARD
TO J101-36
+7.3

W7
M29-2 FM REFERENCE
+18 -18

120 COMB
2KHz
M33-2 NARROW OSCILLATOR LOCK
+7.3 +18 -18 T.P.

EXT.
J112

POWER
OFF
ON
S201
DPS2A POWER SUPPLY
+27V
+18V
+18V
-18V
-18V
-27V
+7.3V
P201 J201
P2 J102

MODEL 3005 WIRING DIAGRAM REV. D

PROGRAM PLUG R.P.
J101
1 MHz
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 GND
26 800 Hz
27 400 Hz
28 200 Hz
29 100 Hz
30
31
32 +7.3
33
34
35
MOD. T.P. 36 TO MOD BD, PIN 5

S101 100's MHz
S102 10's MHz
S103 1's MHz
FREQUENCY
S104 100's KHz
S105 10's KHz
S106 1's KHz
S107 100's Hz
8 4 2 1 C
J103 J104 J105 J106 J107 J108 J109
FREQUENCY PROGRAM

M144 100Hz STEPS
6 7 8 9
2 4
7.3 -18
40 COMB (W11)
W15

OPTION 3
M35-1 RF CIRCUIT BREAKER
FROM STEP ATTEN OUTPUT
TO FRONT-PANEL RF OUTPUT
1
12 4 3 2
T.P. -18 +18 +7.3

W8
W4

M172 SWEEP DRIVE/DAC
2 4 15 13 11 9
3 16 14 12 10
5 7 8 1
+18 -18

1 MHz
M32A MHz STEPS
16 1 3 5
2 4 6
11 15 12
1440 MHz
9 7 8 14
+7.3 +18 -18 T.P.

1 KHz
M31A KHz STEPS
1 3 16 14 12 10
2 4 15 13 11 9
6 7 8 5
+7.3 +18 -18

40 COMB (W6)
W14
M34 WIDE OSCILLATOR LOCK
T.P.
8 16 12 2 1 9
2 3 4 14
+7.3 +18 -18 T.P.

M9W SWEEP OSCILLATOR
10 16 12 2 1 5
3 4
+18 -18

W3
M10W-6 OUTPUT AMPLIFIER
3 4 1 15
+18 -18

W2
STEP ATTENUATOR 50130-1
J113
W1
RF OUT

EXT. REF. INPUT
5 MHz REF OUTPUT

OPTION 6
M40 HIGH STABILITY REFERENCE 5 MHz
10 3 2
+27 +18 +7.3

10 MHz
OPTION 5
M39 EXT. REFERENCE
11 9 8
2 4 3
+7.3 -18 +18

M30-4 CRYSTAL REFERENCE
6
(W13) 1 KHz
(W12) 1 MHz
(W11) 40 COMB
10 MHz
(W9) 1440 MHz
(W8) 40 COMB
(W10) 120 COMB
2 3 4 14
+7.3 +18 -18 T.P.

OFF ON POWER S201
4 3 2 1
P201 J201

DP52A POWER SUPPLY
1 +27V
2 +18V
3 +18V
4 -18V
5 -18V
6 -27V
7 +7.3V
8
9
J102

W5
M29-2 FM REFERENCE
16 7 6
3 4
+18 -18

120 COMB
T.P.
M33-2 NARROW OSCILLATOR LOCK
5 6 9 1 10
2 3 4 14
+7.3 +18 -18 T.P.
W7

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

J110
+18 1 -18 2 3 4 5 6 7 +7.3 8 9 10 11 12
MODULATION BOARD
TO J101-36

EXT.
J112

MODEL 3006 WIRING DIAGRAM

Rev. E

PROGRAM PLUG R.P.

J101 MHz
400
200
100
80
40
20
10
8
4
2
1
.8
.4
.2
.1
.08
.04
.02
.01
.008
.004
.002
.001
GND
800 Hz
400 Hz
200 Hz
100 Hz
+7.3
MOD. T.P. — TO MOD BOARD, PIN 5

S101 100's MHz
S102 10's MHz
S103 1's MHz
FREQUENCY
S104 100's KHz
S105 10's KHz
S106 1's KHz
S107 100's Hz
8 4 2 1 C
J103 J104 J105 J106 J107 J108
FREQUENCY PROGRAM

M149 100 Hz STEPS
9 8 7 6 2 4 +7.3 -18
40 COMB (W11)
W18

W16 W17
M115 DOWN CONVERTER
10 MHz IN (W15)
10 MHz OUT
-18 +18 +7.3

OPTION 3 M35-2 RF CIRCUIT BREAKER
FROM STEP ATTN OUTPUT
TO FRONT-PANEL RF OUTPUT
T.P. -18 +18 +7.3

M172 SWEEP DRIVE/DAC
+18 -18

M32A MHz STEPS
1 MHz
1440 MHz
+7.3 +18 -18 T.P.

M31A KHz STEPS
1 KHz
+7.3 +18 -18

W8 W14

M34 WIDE OSCILLATOR LOCK
40 COMB (W6)
+7.3 +18 -18 T.P.

W4

M9W SWEEP OSCILLATOR
+18 -18

W3

M10W-10 OUTPUT AMPLIFIER
+18 -18

W2

STEP ATTENUATOR 50130-1

J113 W1 RF OUT

W5

EXT. REF. INPUT
5 MHz REF. OUTPUT

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

OPTION 5 M39 EXT. REFERENCE
10 MHz IN
+7.3 -18 +18

POWER OFF ON S201

DPS2A POWER SUPPLY
+27V
+18V
+18V
-18V
-18V
-27V
+7.3V
P2 J102

M30-4 CRYSTAL REFERENCE
1 KHz (W13)
1 MHz (W12)
40 COMB (W11)
10 MHz (W15)
1440 MHz (W9)
40 COMB (W6)
120 COMB (W10)
+7.3 +18 -18 T.P.

M29-2 FM REFERENCE
+18 -18

W7

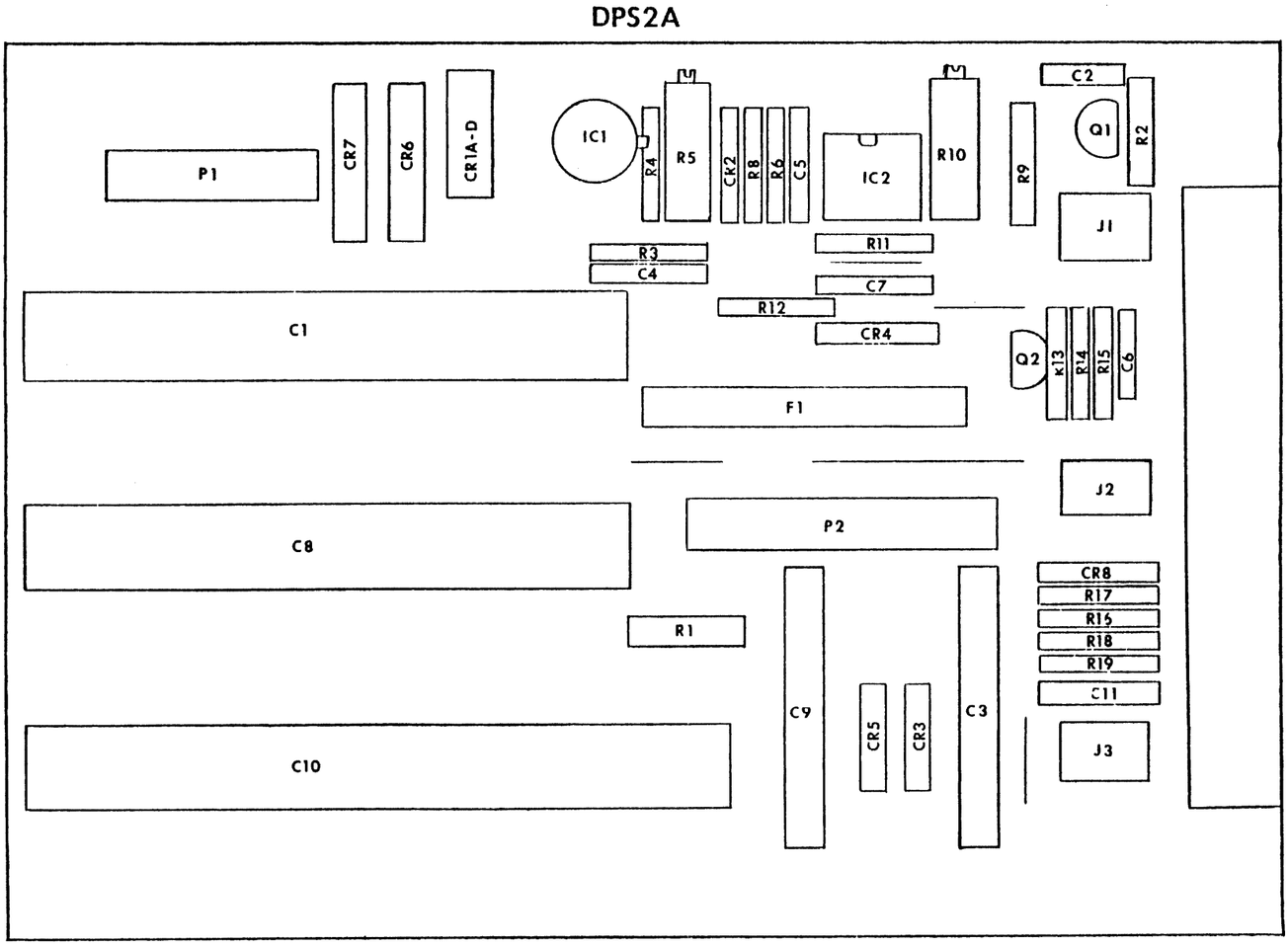
M33-2 NARROW OSCILLATOR LOCK
120 COMB
+7.3 +18 -18 T.P.

J109
C315-2 METER BOARD

J110
TO J101-36
+7.3
MODULATION BOARD

EXT. J112

DPS2A


P1
CR7
CR6
CR1A-D
IC1
R4
R5
CR2
R8
R6
C5
IC2
R10
R9
C2
Q1
R2
J1
R3
C4
R11
C7
R12
CR4
C1
Q2
K13
R14
R15
C6
F1
J2
P2
C8
CR8
R17
R16
R18
R19
C11
R1
C9
CR5
CR3
C3
J3
C10

DPS2A
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

3

5

CR1A-D

F1

2A. AT.

R1

4.7 K

C1

1500μF

+18

2

IC 1

REF02

7

4

R3

39K

C4

1μF

Q1

E232

C2

.005μF

R2

1K

+18

J1

3

C

Q101

LM395

E

J1

2

8

J1-1

C3

100μF

CR3

IC2A

TL082

CR2

R6

3.9K

R8

13.0K

C5

1μF

R4

4.87K

R5

500

(+18 ADJ.)

R9

10.0K

R10

200

(-18 ADJ.)

TL082

IC2B

CR4

R12

4.7K

-18

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

C8

1500μF

C9

100μF

2

CR6

4

CR7

C10

10,000μF

J3

3

IC 101

LM317

J3

2

J3

-1

C11

10μF

R16

150

R17

*

R18

768

R19

*

CR8

P2

8 AC

1 +27

2 +18

3 +18

4 -18

5 -18

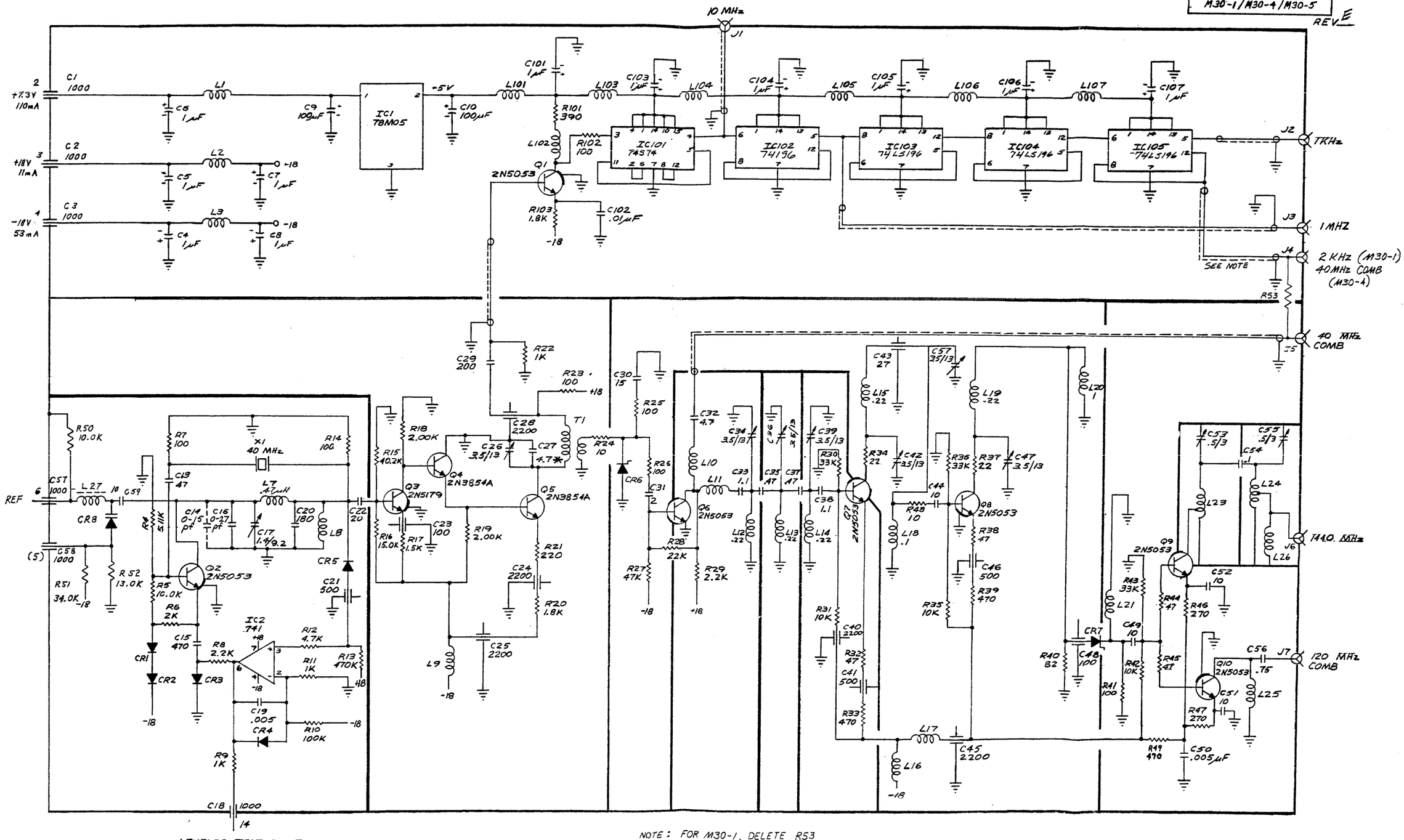
6 -27

7 +7.3

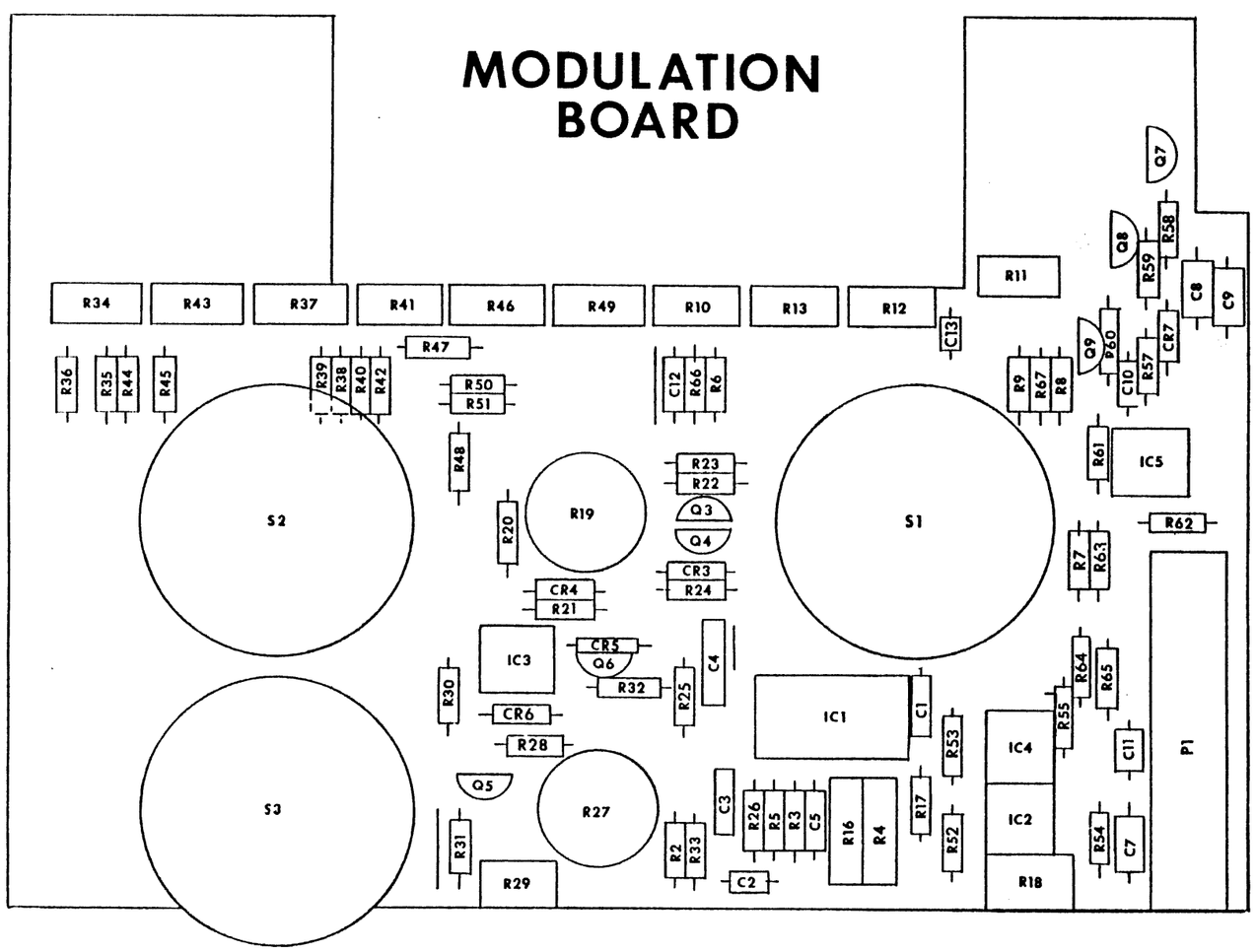
9 GND

CRYSTAL REFERENCE M30-1/M30-4/M30-5

REV E



NOTE: FOR M30-1, DELETE R53
FOR M30-4, DELETE COAX TO J4, R53 = 390
FOR M30-5, DELETE COAX TO J4, R53 = 47


MODULATION
BOARD
R34
R43
R37
R41
R46
R49
R10
R13
R12
R11
C13
Q7
Q8
R58
R59
C8
C9
R60
Q9
C12
R66
R6
R9
R67
R8
C10
R57
CR7
R36
R35
R44
R45
R39
R38
R40
R42
R47
R50
R51
R48
R61
IC5
R23
R22
R19
R20
Q3
Q4
S2
S1
R62
R7
R63
CR3
R24
CR4
R21
CR5
Q6
IC3
C4
R64
R65
R30
R32
R25
CR6
IC1
C1
R53
IC4
R55
C11
P1
R28
Q5
R27
C3
R26
R5
R3
C5
R16
R4
R17
IC2
R54
C7
S3
R31
R2
R33
R52
R29
C2
R18

MODEL 3003 - 3006
MODULATION BOARD

REV D

IC1
XR2206

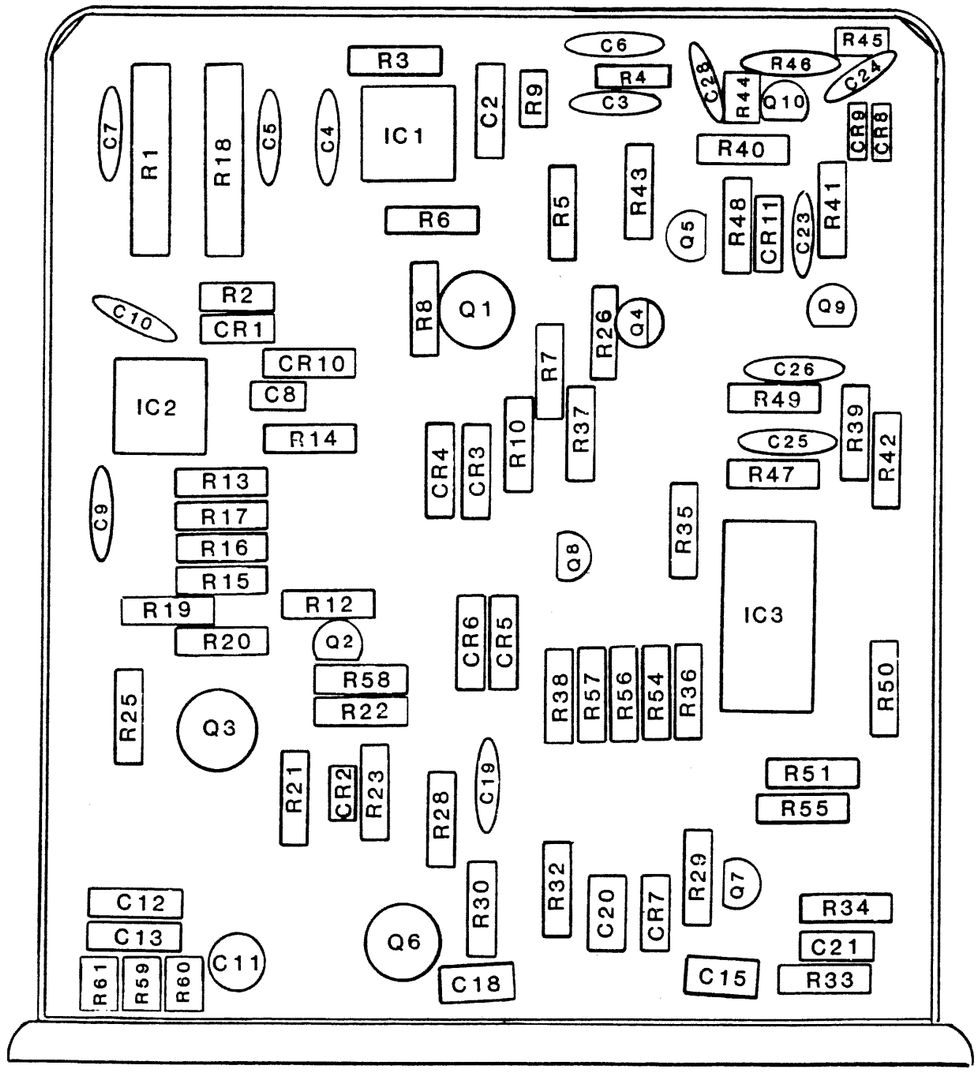
SHAPING
SYMMETRY
SIZE
INT. MOD LEVEL
MOD FREQ.
EXT MOD INPUT
EXT MOD LEVEL
INT MOD RANGE
EXT MOD RANGE
FREQ VERNIER
ACCURACY
VERNIER
EXTERNAL
.001%

P2
1 TO METER BD J4
2

P1
5 MOD T.P.
3 AM
1 +18V
6 FM
9 TO M29-1 PIN 7
4 TO M33-1 PIN 1
8 +7.3V
2 -18V
10 TO M39 PIN 8
7 UNLOCK
11
12

S1
S2
S3
S4
A
B
AM30
AM100
OFF
FM3
FM10
FM30
FM100
+18
-18
+7.3
1458
741
IC1
IC2
IC3A
IC3B
IC4A
IC4B
IC5 MC1455
Q3 2N3854A
Q4 MPS3702
Q5 2N3854A
Q6 MPS3702
Q7 2N3854A
Q8 MPS3702
Q9 2N3964A
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
J1
R1 400
R2 10K
R3 10K
R4 20K
R5 22K
R6 82K
R7 12K
R8 4.7K
R9 33K
R10 100K
R11 5K
R12 2K
R13 100K
R16 1K
R17 10K
R18 20K
R19 10K
R20 10K
R21 10K
R22 12K
R23 3.9K
R24 12K
R25 3.9K
R26 680
R27 10K
R28 10K
R29 50K
R30 12K
R31 3.9K
R32 12K
R33 3.9K
R34 1K
R35 3K
R36 1.00K
R37 50K
R38 150K
R39 49.9K
R40 15.0K
R41 10K
R42 4.99K
R43 1K
R44 3K
R45 1.00K
R46 50K
R47 150K
R48 49.9K
R49 10K
R50 15.0K
R51 4.99K
R52 10K
R53 1.00K
R54 10K
R55 1.00K
R56 10K
R57 10K
R58 10K
R59 10K
R60 200
R61 4.7K
R62 330
R63 22M
R64 100K
R65 47M
C1 10µF
C2 .05µF
C3 .015µF
C4 .15µF
C5 1µF
C6 .01µF
C7 10µF
C8 10µF
C9 10µF
C10 .01µF
C11 .05µF
C12 .01µF
C13 .01µF

M29-2


R3
C6
R4
C3
R45
R46
C24
C28
R44
Q10
CR9
CR8
R40
C7
R1
R18
C5
C4
IC1
C2
R9
R43
R5
R6
Q5
R48
CR11
C23
R41
Q9
R2
CR1
C10
R8
Q1
R26
Q4
CR10
C8
IC2
R7
C26
R49
R14
CR4
CR3
R10
R37
C25
R39
R42
R47
R13
R17
R16
R15
C9
Q8
R35
IC3
R19
R12
R20
Q2
CR6
CR5
R38
R57
R56
R54
R36
R50
R58
R22
R25
Q3
R21
CR2
R23
R28
C19
R51
R55
R32
C20
CR7
R29
Q7
R34
C12
C13
C11
Q6
R30
C18
C21
R33
C15
R61
R59
R60

M29-2/3
FM REFERENCE

REV. D

MODULATION INPUT ±5V FROM MODULATION BOARD

FREQ VERNIER INPUT

VOLTS	KHz
+18	10
0	0

PLL #5 NARROW OSC. LOCK

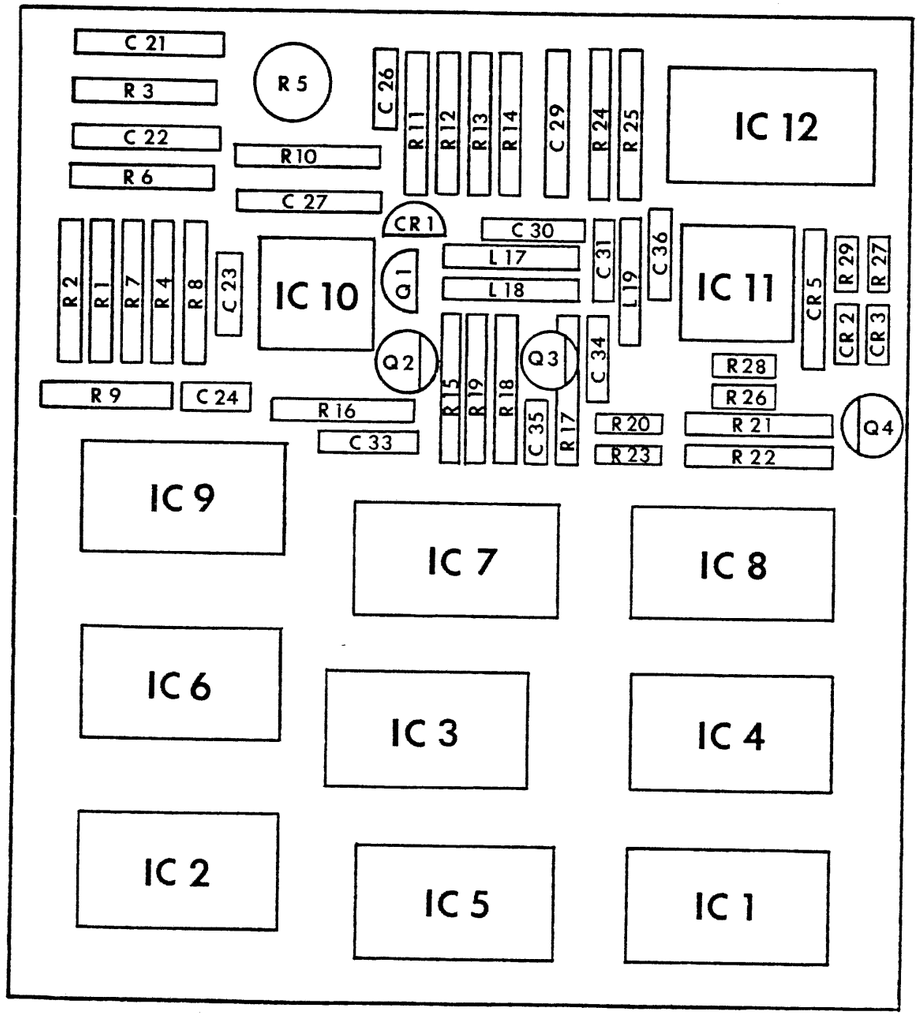
VOLTS	KHz
+10	+45
0	0
-10	-45

2.1 MHz ADJ.

2 MHz ADJ.

OUTPUT TO NARROW OSC LOCK

M31A


C 21
R 3
C 22
R 6
R 5
R 10
C 27
C 26
R 11
R 12
R 13
R 14
C 29
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 21
R 22
Q 4
R 9
C 24
R 16
C 33
R 15
R 19
R 18
C 35
R 17
R 20
R 23
IC 9
IC 7
IC 8
IC 6
IC 3
IC 4
IC 2
IC 5
IC 1

M31A
KHz STEPS

REV A

FROM CRYSTAL REF.
1KHz REFERENCE
INPUT
J1

BCD KHz FREQ PROGRAM

800 KHz
400 KHz
200 KHz
100 KHz
80 KHz
40 KHz
20 KHz
10 KHz
8 KHz
4 KHz
2 KHz
1 KHz

C1 1000 L1
C2 1000 L2
C3 1000 L3
C4 1000 L4
C5 1000 L5
C6 1000 L6
C7 1000 L7
C8 1000 L8
C9 1000 L9
C10 1000 L10
C11 1000 L11
C12 1000 L12

IC1 7404
IC2 7404
IC3 74LS196
IC4 74LS196
IC5 74LS196
IC6 74LS196
IC7 74H102
IC8 74H11
IC9 11C44
IC10A 4558
IC10B 4558
IC11 741
IC12 7404
IC13 78MOS

+5

R1 4.7K
R2 4.7K
R3 30K
R4 30K
R5 2K
R6 30K
R7 30K
R8 47K
R9 68K
C21 .12μF
C22 .12μF
C23 1μF
C24 1μF
C25 10μF

R10 6.8K
R11 6.8K
R12 3.3K
R13 10K
R14 6.8K
C26 1μF
C27 .12μF
C28 10μF
C29 .12μF
C30 1000

L17 2.2
L18 .47
L19 .22
C31 10
C32 10μF
C33 180
C34 180
Q1 2N5458
Q2 2N5306
Q3 2N3854A
CR1 MV2301
R15 30.1K
R16 4.32K
R17 19.6K
R18 19.6K
R19 2.10K
+18
-18

R21 1K
R22 10K
R23 15K
R20 1.8K
C35 .001μF
Q4 2N3854A

C36 .01μF
R24 2.7K
R25 10K

R26 30K
R27 47K
R28 160K
R29 20K
C37 10μF
CR2
CR3
CR5
L16
R30 1.8K

TO WIDE
OSC. LOCK
J2

10.000
TO
9.001
MHz
OUTPUT

UNLOCK
INDICATOR
CR4

C17 100μF
C18 100μF
L13
L14
L15
C13 1000
C14 1000
C15 1000
C16 1000
C19 10μF
C20 10μF

PIN 6
+7.3v

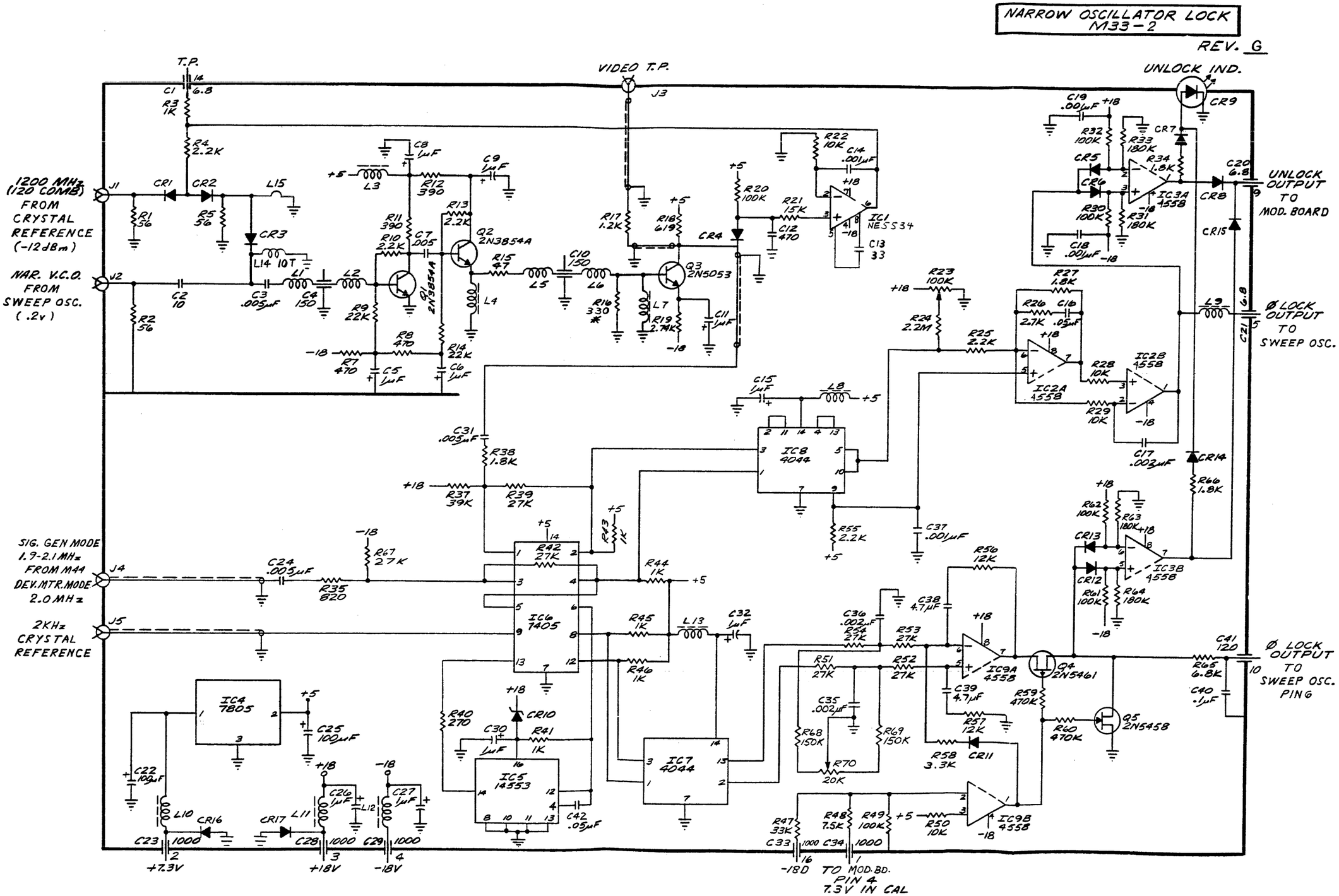
PIN 7
+18v

PIN 8
-18v

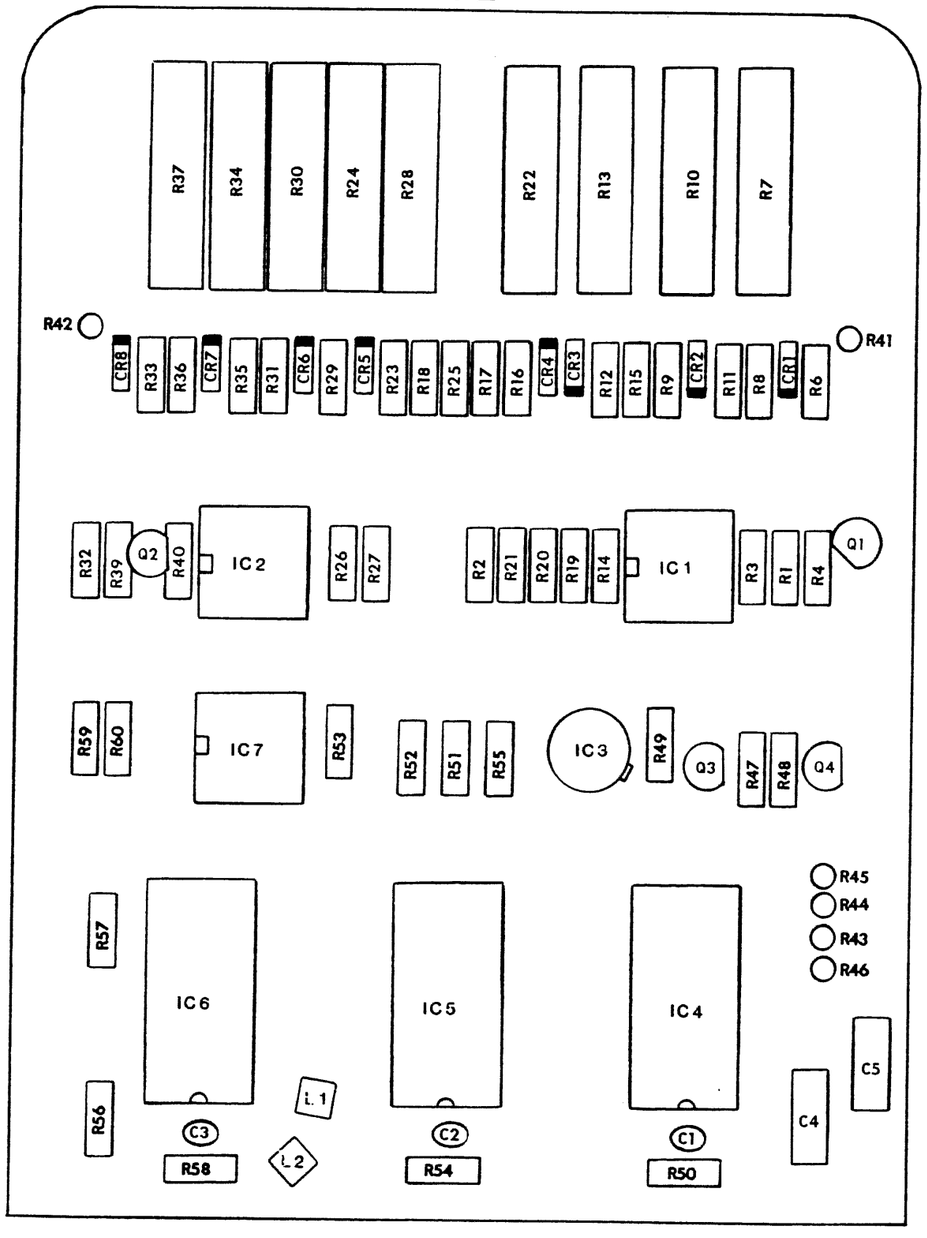
PIN 5
UNLOCK OUTPUT

NARROW OSCILLATOR LOCK M33-2

REV. G



M172


R37
R34
R30
R24
R28
R22
R13
R10
R7
R42
R41
CR8
R33
R36
CR7
R35
R31
CR6
R29
CR5
R23
R18
R25
R17
R16
CR4
CR3
R12
R15
R9
CR2
R11
R8
CR1
R6
R32
R39
Q2
R40
IC 2
R26
R27
R2
R21
R20
R19
R14
IC 1
R3
R1
R4
Q1
R59
R60
IC 7
R53
R52
R51
R55
IC 3
R49
Q3
R47
R48
Q4
R45
R44
R43
R46
R57
IC 6
IC 5
IC 4
C5
C4
L 1
R56
C3
C2
C1
L 2
R58
R54
R50

M172
SWEEP DRIVE / DAC

REV A

TO SWEEP OSC.

C20 120

TO OUTPUT AMP

C21 120

+18V

-18V

R1 3.62K

R2 1K

R3 11.3K

R4 402K

IC1A RC4558

Q1 2N4250

R41 10

T.P.2

CR1

R7 100K (10MHz)

R8 1K

R6 330K

CR2

R10 100K (50MHz)

R9 3.01K

R11 330K

CR3

R13 100K (100MHz)

R12 330K

R14 5.11K

R15 100K

IC1B RC4558

CR4

R16 910K

R17 100K

R18 1K

R20 402K

R19 16.5K

R21 270K

R22 20K (250MHz)

CR5

R24 100K (350MHz)

R25 330K

R23 1K

CR6

R30 100K (400MHz)

R29 220K

R31 1K

CR7

R34 100K (450MHz)

R35 220K

R32 11.3K

R33 1K

R42 10

T.P.1

CR8

R37 100K (500MHz)

R36 120K

Q2 2N5088

IC2A RC4558

R39 3.62K

R40 4.02K

IC2B RC4558

R26 100K

R27 75K

R28 20K (300MHz)

400 200 100

C18 C17 C16

80 40 20 10

C15 C14 C13 C12

8 4 2 1

C11 C10 C9 C8

1000 (TYP)

R43 100K

R44 100K

R45 100K

R46 100K

REF-01 IC3

DAC-20CQ IC4

DAC-20CQ

DAC-20CQ

C1 .01μF

C2 .01μF

C3 .01μF

R50 5.11K

R54 5.11K

R56 5.11K

R57 5.11K

R58 5.11K

R55 487K

R47 270K

Q3 2N3904

R48 270K

Q4 2N3904

R51 5.11K

R52 2.7K

R53 2.7K

IC7A/4 RC4558

T.P. 3

R59 5.11K

R60 5.11K

IC7B/8 RC4558

L1

L2

C4 10μF

C5 10μF

C6 1000

C7 1000

C19 16.8

TO MHZ STEPS

M32A
1 MHz STEPS
REV G

1448 - 1487 OUTPUT TO WIDE OSC. LOCK
0dBm

UNLOCK INDICATOR

1440 MHz FROM CRYSTAL REF.

1 MHz FROM CRYSTAL REF.

MIXER

VIDEO AMPLIFIER

DIGITAL DIVIDER BOARD

OSCILLATOR CONTROL BOARD

BCD MHz

LEVELER T.P.

0/-7.8 ANALOG PROGRAM

PLL T.P.

UNLOCK OUTPUT

VIDEO T.P.

M34
WIDE OSC. LOCK
REV. G

WIDE VCO

1448 1487 FROM MHz STEPS

40 MHz COMB FROM CRYSTAL REFERENCE

10-9 MHz FROM KHz STEPS

VIDEO T.P.

LEVELER T.P.

PHASE DETECTOR OUTPUT TO SWEEP OSC.

UNLOCK OUTPUT

TO SPEED-UP CKT. SWEEP OSC.

+7.3v 61 mA

-18v 23 mA

+18v 36 mA

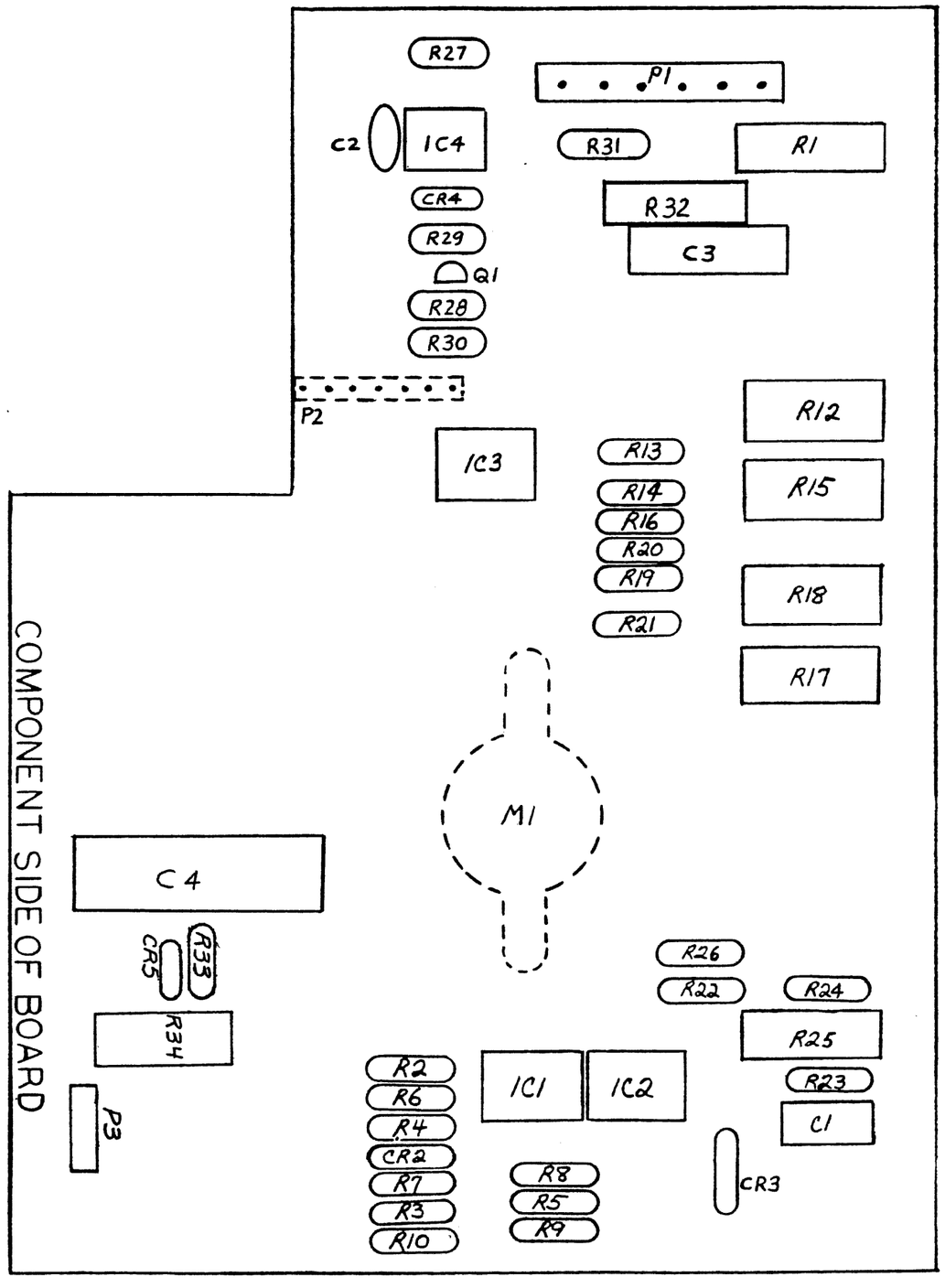
M9W/M9W-1 SWEEP OSCILLATOR

REV. N

NOTE 1 - FERRITE BEAD MAY BE ADDED AT THIS POINT

▽ NOTE: C45, R67 AND J3 USED ON M9W-1 ONLY

C315-2


R27
P1
C2
IC4
R31
R1
CR4
R32
R29
C3
Q1
R28
R30
P2
R12
IC3
R13
R15
R14
R16
R20
R19
R18
R21
R17
M1
C4
R26
R22
R24
CR5
R33
R25
R34
R23
R2
IC1
IC2
C1
R6
R4
CR2
CR3
R7
R8
R3
R5
R10
R9
P3
COMPONENT SIDE OF BOARD

METER BOARD
C315-2

REV E

J1 P1
+18 — 6 ← o +18
-18 — 5 ← o -18
MODULATION INPUT (FROM MOD. BOARD) — 4
UNLEVEL DRIVE (FROM OUTPUT AMP) — 3
TO OUTPUT AMP — 2
1

+18
R3 36.5K
R7 20K
R4 33K
CR2
R8 2.74K
R5 10.0K
% MOD
R1 5K
R2 7.5K
IC1B 1458
R6 10.0K
R9 11.3K
-4.9
VERNIER
IC1A 1458
-1.3
R10 3.92K
P2
J2
UNLEVELED
CR101
U2
P2
-18
R33 1.2K
R34 100
CR5
P3
J3 3 5 2 1 4

IC2A 1458
-18
+18 1458
IC3A
R13 5.6K
R14 220K
R16 10K
R12 20K
R15 20K
-18 +18
+13 +3
+10 dBm RANGE
N.O.
1v
S101
.3 TO 1μv
MICRO SWITCH OPERATED BY ARM FASTENED TO ATTENUATOR SHAFT.
MC1458PI
IC3B
-18
R21 33K
R19 1M
R20 10K
R17 20K
R18 20K
-18 +18
+3 -6
0 dBm RANGE
≅ -2.5
≅ -0.7
≅ -0.7
≅ -0.15

R23 68K
R25 20K CAL.
R24 100K
C1 .47μF
CR3
+18
R22 20K
IC2B 1458
R26 15K P2
U2
M1
J2 4 P2
C4 2000μF

TO MOD BD P2
J4
1
2
OUTPUT
INT. MOD
EXT. MOD
J2
P2
R27 22K
LM318
IC4
CR4
C2 .01μF
+18 -18
R28 100M
-18
C3 .15μF
+18
R29 2.2K
Q1 2N5458
R30 47K
-18V
R31 4.02K
R32 2K P2
U2
S102

M10W-9
OUTPUT AMP REV. B

RF IN J1
L1 47
R1 120 *
CR2
CR3
L3 10T
L22 3T
C2 2.4
R2 330
C1 200
R123* 47
L104 .22
C113 .01μF
R101 1K
L101 33
C115 .1μF
C102 .1μF
R105 6.8K
R106 120
Q101 NEC2135
C101 L0
R102 120
R104 24
R103 24
R107 470
C103 .1μF
R7 56
B+
C104 1200
R108 1K
R109* 120
L102 33
C116 .1μF
C106 .1μF
R112 6.8K
Q102 NEC2135
R113* 120
C105 1.0
R110 24
R111 24
R114 470
C107 .1μF
R8 56
B+
C108 .01μF
R115 1K
L103 33
C114 .01μF
C117 .1μF
C110 .1μF
R119 6.8K
Q103 NE41635
R116 120
R117 24
R118 24
R120 120
C109 1.0
R121 390
R122 390
C111 .1μF
R9 56
B+
R14 47
J3 RF OUT
C22 .1μF
R10 160
C3 .1μF
Q1 BFR94
L10 10T
CR5
R16 100
C21 500
L11 33
R17 2.7K
C20 .1μF

LEVEL CIRCUIT
C204 100
IC201A NE5533AN
+16
+18
R202 560K
R203 560K
R201 1K
C201 1000
R204 10K
CR201
R210 15K
R213 22K
C203 470
R206 18K
R207 22K
-18
CR202
CR203
IC201B NE5533AN
CR204
R214 22K
R208 22K
C205 10/25V
C207 1μF
C206 10/25V
R211 20
R209 2.2K
C208 .05μF
R212 12K
Q201 2N3906

B+
C7 10μF
-18
L6 10T
+18
C8 100
C9 100
C14 100
C15 100
L7 10T
L8 10T
R5 47Ω
R6 1K
C11 1000
C12 1000
C16 1000
C24 1000
NC
C17 6.8
4
3
1
6
15
-18
+18
UNLEVELED
UNLEVELED
LEVELER INPUT

M10W-10
OUTPUT AMP Rev. B

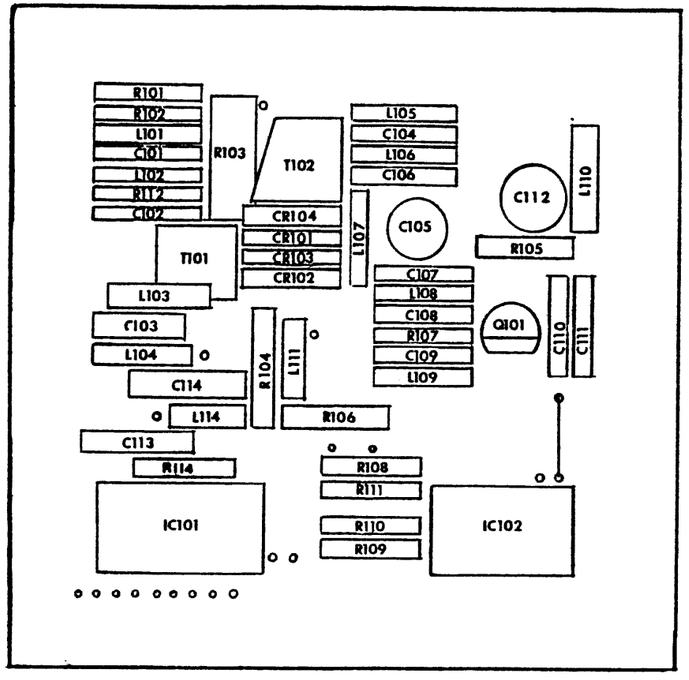
RF IN J1
L1 47
R1 120 *
CR2
CR3
C2 2.4
L3 10T
L22 3T
R2 330
C1 200
R123* 47
L104 .22
C113 .01µF
R101 1K
Q101 NEC2135
L101 33
C102 .1µF
C101 L0
R105 6.8K
R106 120
C115 .1µF
R102 120
R104 24
R103 24
R107 470
C103 .1µF
R7 56
B+
C104 1200
R108 1K
R109* 120
Q102 NEC2135
L102 33
C106 .1µF
R112 6.8K
C116 .1µF
C105 1.0
R110 24
R111 24
R113* 120
R114 470
C107 .1µF
R8 56
B+
C108 .01µF
R115 1K
R116 120
Q103 NE41635
C114 .01µF
L103 33
C110 .1µF
R119 6.8K
C117 .1µF
C109 1.0
R117 24
R118 24
R120 120
R121 390
C111 .1µF
R122 390
R9 56
B+
R14 47
C22 .1µF
R10 160
C3 .1µF
Q1 BFR94
L10 10T
CR5
R16 100
C21 500
R17 2.7K
L11 33
C20 .1µF

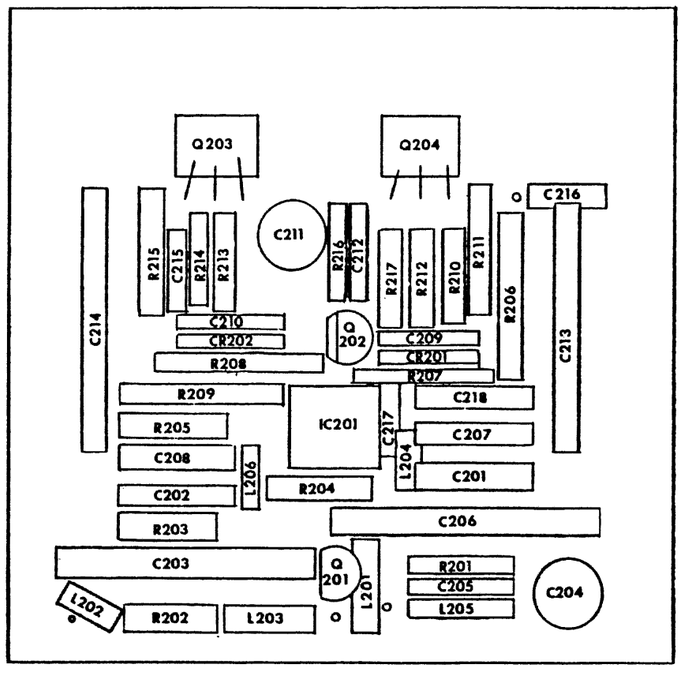
LEVEL CIRCUIT
C204 100
IC2C1A NE5533AN
+16
+16
R202 560K
R203 560K
R201 1K
C201 1000
R204 10K
CR201
R213 22K
R205 15K
+15
C203 47C
R206 18K
CR202
R207 22K
-16
IC2C1B NE5533AN
CR203
CR204
R214 22K
R208 22K
C205 10µF
-16
C207 1µF
+16
C206 10µF
R211 20
R209 2.2K
C208 .05µF
R212 12K
Q201 2N3906

K1
J3 FROM M115
J4 RF OUT
J5 TO M115
B+
CR6
Q2 3904
CR7

B+
C7 10µF
L6 10T
+18
-18
C8 100
L7 10T
C11 1000
4
-18
C9 100
L8 10T
C12 1000
3
+18
C14 100
R5 47C
C16 1000
1
UNLEVELED
NC
C24 1000
6
UNLEVELED
C15 100
R6 1K
C17 6.8
15
LEVELER INPUT
C25 100
C26 1000
5
DOWN-CONVERTER ENABLE

M115

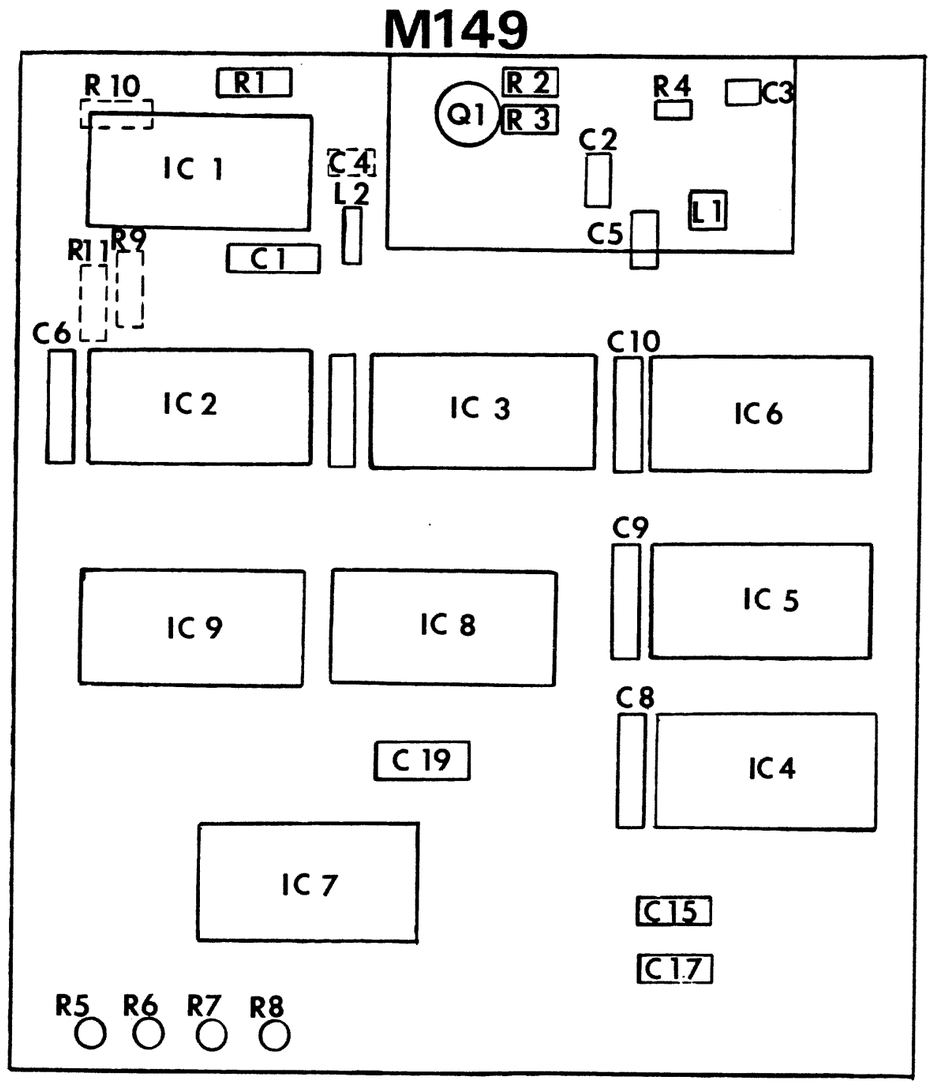

R101
R102
L101
C101
L102
R112
C102
R103
T102
L105
C104
L106
C106
C112
L110
CR104
CR101
CR103
CR102
L107
C105
R105
T101
L103
C107
L108
C108
R107
C109
L109
Q101
C110
C111
C103
L104
C114
R104
L111
L114
R106
C113
R114
R108
R111
R110
R109
IC101
IC102


Q203
Q204
C216
C214
R215
C215
R214
R213
C211
R216
C212
R217
R212
R210
R211
R206
C213
C210
CR202
202
C209
CR201
R208
R207
R209
IC201
C218
R205
C217
C207
C208
L206
L204
C201
C202
R204
R203
C206
C203
201
L201
R201
C205
C204
L202
R202
L203
L205

M115
DOWN CONVERTER

REV. D

10-10.999 MHZ FROM COAX SWITCH
J1
R102 247.5
L101 .39
L102 1
R103 100
R101 61.1
C101 330
C102 150
R112 47
T101
CR101
CR103
CR102
CR104
T102
L103 3.9
L104 10
C103 1500
C110 20
L110 68
C111 20
IN J2
10MHz FROM CRYSTAL REF
OUT J3
CR105
R113 1K
MHz FREQ. PGM. FROM F.P. SWITCHES
470 (TYP)
400 15 C1
200 14 C2
100 13 C3
80 12 C4
40 11 C5
20 10 C6
10 9 C7
8 8 C8
4 7 C9
2 6 C10
1 5 C11
C19-C29 .15μF (TYP)
+18
R104 330
C108 .001μF
L108 10
C107 .001μF
L107 2.2
L106 4.7
R105 3.3K
Q101 92PU01A
C106 100
C105 7/35
C104 270
L109 4.7K
R106 330
R107 100
C109 .001μF
-18
+5
R114 1K
IC101 74S133
IC102
L105 .66
L201 10T B
C201 10μF
L204 10T
C207 10μF
R206 75
R201 750
R207 330
C218 10μF
R210 1K
R211 27
C213 100μF
2N3554A Q201
C206 100μF
P204 150
IC201 NE5534
L205 4.7
L203 2.2
C203 100μF
C204 7/35
C205 25
C217 20
R205 100
R208 1K
R212 100
Q204 MM4018
CR201
C209 1μF
CR202
C210 1μF
R213 100
Q203 2N5109
R214 1K
R215 27
C215 360
R217 49.9
J4
0-1 MHZ OUTPUT
C216 .001μF
R202 1.8K
R203 33
L206 10T
R209 75
C202 10μF
L202 10T A
C208 10μF
C211 7/35
R216 5K
C212 25
R108 1K
R109 1K
R110 1K
R111 4.7K
.15μF
C34
C16 16
470
COAX SWITCH
C15 1
470
10MHz PGM. TO DAC
C33 .15μF
C113 10μF
L111 10T
C114 10μF
L114 10T
C17 10μF
L1 10T
IC1 78M05
C18 10μF
+5
C30 .15μF
C12 470 A
-.8V
C31 .15μF
C13 470 B
+18V
C32 .15μF
C14 470
+7.3

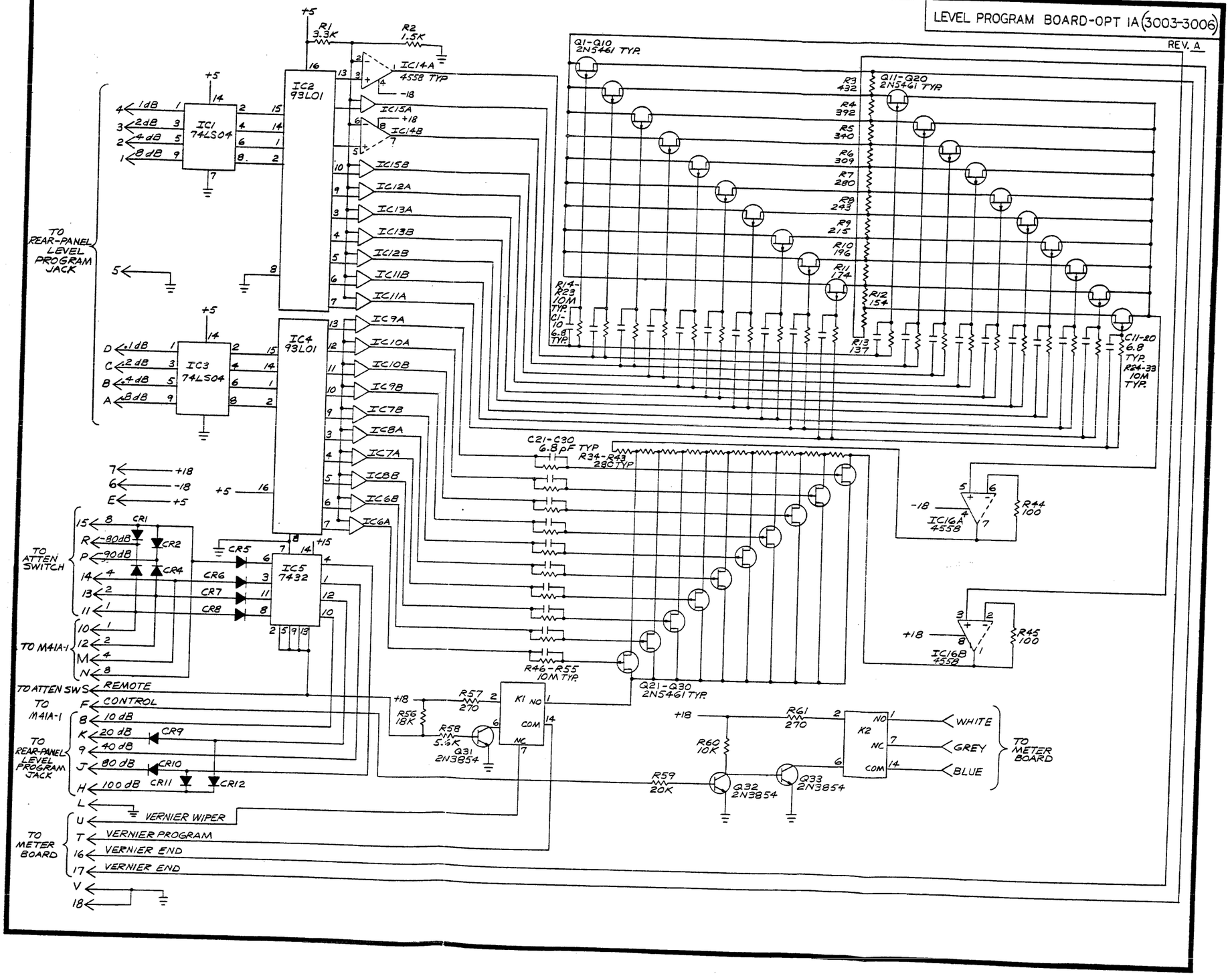

M149
R 10
R1
R 2
R 3
Q1
R4
C3
C2
IC 1
C 4
L 2
L1
C5
R11
R9
C1
C6
C10
IC 2
IC 3
IC6
C9
IC 9
IC 8
IC 5
C8
C 19
IC 4
IC 7
C 15
C 17
R5
R6
R7
R8

M149
100 HZ STEPS
REV. A

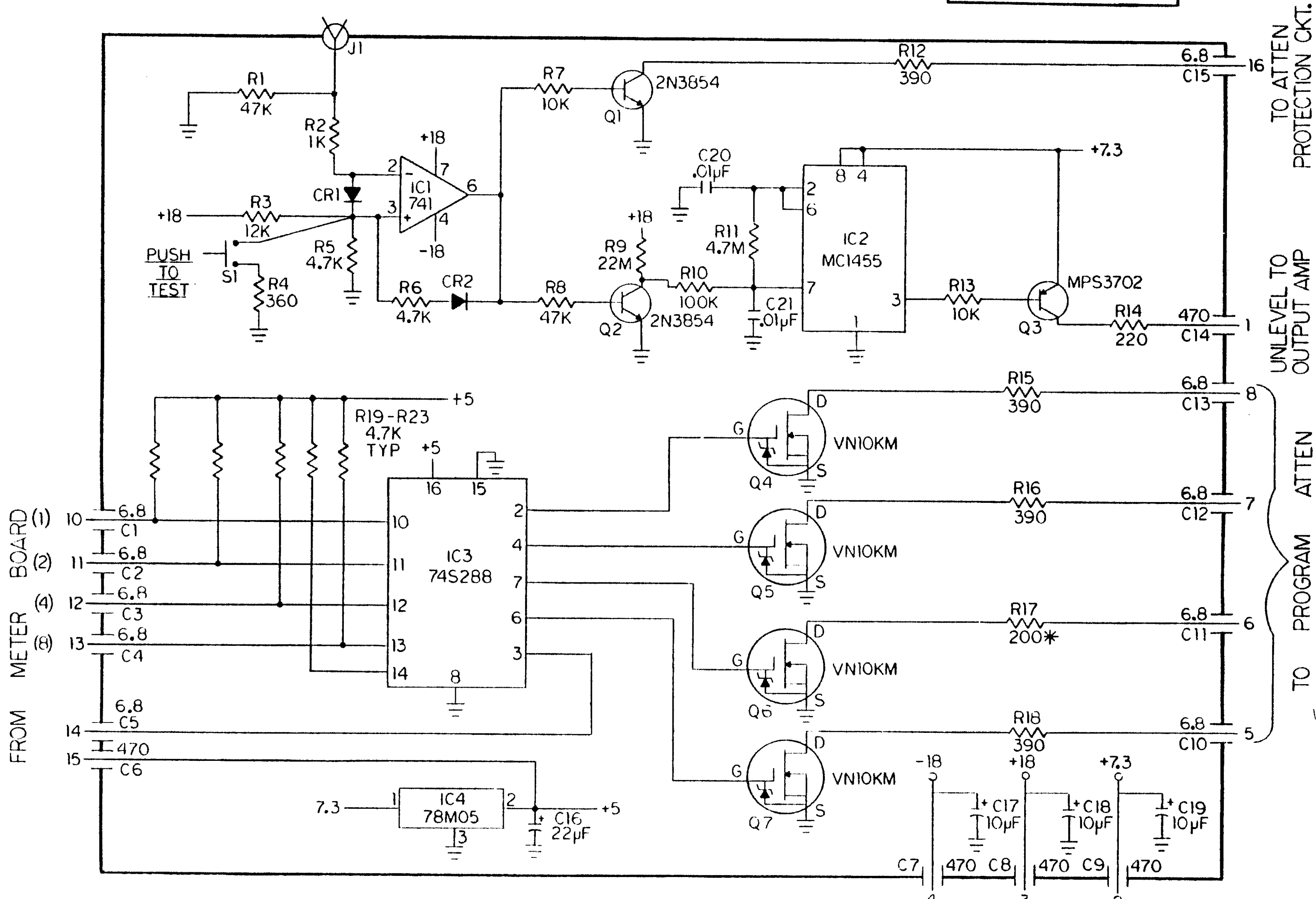
40MHZ COMB LINE FROM XTAL REF
J1
R9 3K
R10 1.5K
+5
IC1 SP8690B
R1 68K
+5V
C1 20
R11 1K
+5
IC9E 74LS04
R3 10
Q1 2N5053
R2 180
C2 1000
R4 1.8K
C3 .1µF
L1 10T
C4 100Ω
L2 .47
C5 2200
-18V
NARROW OSC LOCK
IC8A 74LS00
IC8B
IC8C
IC8D
IC2 74LS169
IC3 74LS168
IC4 74LS168
IC5 74LS168
IC6 74LS168
C6 1µF
C7 1µF
C8 1µF
C9 1µF
C10 1µF
LSD
MSD
IC9A-D 74LS04
+5V R5-8 4.7K TYP.
C20 .1µF
C21 .1µF
C22 .1µF
C23 .1µF
C11 6.8
C12 6.8
C13 6.8
C14 6.8
100HZ DIGITS
C15 10µF
C16 1000
C17 10µF
C18 1000
-18V
+7.3V
IC7 7805
C19 10µF
+5V

LEVEL PROGRAM BOARD-OPT 1A (3003-3006)

REV. A



M41A/M41A-1 ATTENUATOR DRIVER



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 the instrument.

8.2 MANUAL CHANGES

Wavetek's product improvement program incorporates the latest electronic developments into these instruments as rapidly as developement and testing permit. Due to the time required to document and print these instruction manuals, it is not always possible to include the changes in the original printing. Change information, if any, appears at the end of this section.

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, replaceable parts list and schematics.

OPTION 1A

RF LEVEL PROGRAMMING

INTRODUCTION

This factory-installed option requires a number of changes to the standard signal generator, and provides remote programming of the RF level, front-panel RF level control, and reverse-power protection.

Remote programming is accomplished via the rear-panel connector using 8-4-2-1 BCD contact closures or TTL signals to cover the range from 0 to 109.9 dB in 0.1 dB steps with +13 dBm as the 0 dB reference point.

Front-panel level control is continuously adjustable from +13 dBm to -97 dBm (110 dB range) in 10 dB steps plus 10 dB vernier.

Reverse-power protection is provided by this option to prevent damage to the instrument if DC (100 volts max) or RF (50 W max) voltages are inadvertently applied to the signal generator RF OUT connector.

NOTE

DC protection is not included on Models 3004 and 3006.

Option 1A removes the standard Step Attenuator from the signal generator, and adds a Programmable Step Attenuator, a Level Program Board, and an M41A Attenuator Driver module.

Due to the slight "insertion loss" and change in flatness caused by addition of the Programmable Attenuator to the signal generator, it will not be possible to obtain +13 dBm output on all frequencies; therefore, the maximum calibrated output is +12 dBm when Option 1A is installed.

SPECIFICATIONS

PROTECTION CIRCUIT

FREQUENCY RANGE	1 to 520 MHz (.001 to 520 MHz on 3004, 3006)
INSERTION LOSS	<0.2 dB
TRIP TIME	<2 msec
RF TRIP VOLTAGE	4.5 to 5.5 volts (0.5 W)
MAX. RF	50 W
DC BLOCKING VOLTAGE	100 volts maximum (N/A on 3004, 3006)

RF LEVEL PROGRAMMING

POWER LEVEL	The maximum calibrated output is +12 dBm (.891 VRMS) when Option 1A is installed
RANGE, FRONT-PANEL	Continuously adjustable from +13 dBm to -97 dBm (110 dB range).
RANGE, REMOTE PROGRAMMING	Adjustable in 0.1 dB steps from +13 dBm to -96.9 dBm (109.9 dB range; 0 dB reference = +13 dBm).
ACCURACY (EACH 10 dB STEP)	±0.1 dB
SWITCHING SPEED	10 dB step: <6 msec (Typ. <3 msec)
IMPEDANCE	50 ohm (SWR <1.3)
FLATNESS	±.75 dB

OPERATING INSTRUCTIONS

FRONT-PANEL OPERATION

Front-panel operation remains basically the same as for standard instrument, except the standard +13 dBm to -137 dBm range is changed to +13 dBm to -97 dBm.

NOTE

When front-panel operation is employed, any remote programming connected to the rear-panel LEVEL PROGRAM plug is automatically disabled.

REMOTE PROGRAMMING

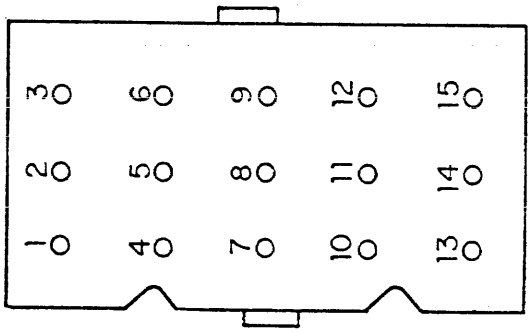
Set the front-panel Step Attenuator to the REMOTE position; then, connect remote-programming BCD switches or TTL signals to the signal generator rear-panel LEVEL PROGRAM plug as shown in Table 8/1A-1. A mating plug is furnished with each instrument.

For example, to program an attenuation of 106.5 dB, pins 14, 7, 8, 10, and 12 of the LEVEL PROGRAM plug must be grounded; then, to reduce the attenuation by 6 dB (i.e. 100.5 dB), ground is removed from pins 7 and 8. (Note that the 0 dB reference point is +13 dBm.)

Table 8/1A-1

DB ATTEN	R.P. PINS GROUNDED	DB ATTEN	R.P. PINS GROUNDED	DB ATTEN	R.P. PINS GROUNDED
0	None				
10	2	1	6	0.1	10
20	3	2	7	0.2	11
30	2 & 3	3	6 & 7	0.3	10 & 11
40	4	4	8	0.4	12
50	2 & 4	5	6 & 8	0.5	10 & 12
60	3 & 4	6	7 & 8	0.6	11 & 12
70	2,3, & 4	7	6, 7, & 8	0.7	10, 11, & 12
80	5	8	9	0.8	13
90	2 & 5	9	6 & 9	0.9	10 & 13
100	14				

PIN #	CONNECTION
1	Ground
2	1 10 dB
3	2 10 dB
4	4 10 dB
5	8 10 dB
6	1 1 dB
7	2 1 dB
8	4 1 dB
9	8 1 dB
10	1 0.1 dB
11	2 0.1 dB
12	4 0.1 dB
13	8 0.1 dB
14	1 100 dB
15	- -



Level Program Plug

REVERSE POWER PROTECTION CIRCUIT

If an external RF voltage of approximately 6 VRMS or more is accidentally applied to the instrument's RF OUT connector, an internal switch in the Programmable Attenuator 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 by a flashing of the UNLEVELED lamp on the front panel. Once the switch is tripped, it will latch in the open position and remain open until reset. A combination of a bad mismatch, high output level (0.1 V), and changing frequency can also cause the protection circuit to trip.

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

NOTE

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

CIRCUIT DESCRIPTION

Refer to the schematics at the end of this section.

REVERSE POWER PROTECTION CIRCUIT

The reverse power protection circuitry is located in the Programmable Attenuator and in Attenuator Drive module M41A. With the instrument's POWER switch turned off, the protection circuit internal relay, in series with the RF output, is in its normally open position. This prevents damage to the Attenuator or Output Amplifier if reverse power is inadvertently applied to the RF OUT connector while the instrument is not in use. As soon as AC power is applied to the instrument, the comparator, IC1, will compare the RF monitor voltage to a fixed reference voltage of approximately 5 volts. As long as the monitor voltage is less than the 5 volt reference, the comparator output will be approximately +17 volts. This positive output turns on relay driver Q1, which energizes the protection circuit relay, thus completing the RF output circuit.

The positive output from IC1 also turns on Q2; thus effectively grounding pin 7 of timer IC5, which operates as an astable oscillator. With pin 7 grounded, the timer is inoperative, and its output at pin 3 is "high". The "high" output from IC5 turns off Q3 and thus prevents the current flow to the front-panel UNLEVELED lamp.

If an external RF signal exceeding 6 VRMS is applied to the instrument's RF OUT connector, the RF monitor voltage will go above 5 volts. This will produce a negative output from IC1, and the feedback provided by the negative latch diode and resistor will latch IC1 in this state. The negative output from IC1 will turn off relay driver Q1 and cause the protection circuit relay to return to its normally open position, thereby removing the external RF signal from the Attenuator circuitry.

The negative output from comparator IC1 also turns off Q2, thus removing the ground from pin 7 of timer IC5, which allows the timer to oscillate. The output at pin 3 of IC5 then varies between 0 and +7 volts. As the output swings down toward 0, Q3 turns on and supplies current to the front-panel UNLEVELED lamp; then, as the output rises toward +7 volts, Q3 turns off and prevents current flow. This on/off cycle of Q3 causes the UNLEVELED lamp to flash.

The comparator can be unlatched by momentarily removing AC power to the instrument after the external RF signal is removed.

FRONT-PANEL RF LEVEL CONTROL

When Option 1A is installed, the RF output level is adjustable over a range of 110 dB (+13 dBm to -97 dBm) as follows: The output can be reduced 10 dB by level program relay K2 on the Level Program Board. The Programmable Attenuator provides another 90 dB of attenuation in 10 dB steps, and the OUTPUT VERNIER provides continuous adjustment of the output level over a 10 dB range. These combine to provide a total attenuation of 110 dB. With the front-panel BCD switch (Attenuator dial) in any position except REMOTE, Level Program Board relay K1 will be energized; thus the OUTPUT VERNIER will be connected to thre +10 dBm/0 dBm level circuitry.

Assume the front-panel Attenuator dial is set for an output of -70 dBm (80 dB total attenuation). The BCD switch grounds the "80" wire, which applies ground to pin 13 of ROM IC3 in the M41A-1. The "10", "20", and "40" inputs to the ROM remain "high". This turns on the appropriate FET switches to activate the 10 dB, 20 dB, and 40 dB pads in the Programmable Attenuator. A "high" on ROM pin 3 de-energizes Level Program Board relay K2, thus selecting 0 dBm program voltage for the Output Amplifier. Therefore, 0 dBm output from the Output Amplifier attenuated 70 dB by the Programmable Attenuator results in an output of -70 dBm, as selected by the front-panel Attenuator dial.

NOTE

+10 dBm output is equivalent to the "0" BCD switch position, 0 dBm corresponds to the "10" BCD position, and -10 dBm is the "20" BCD position, etc. The BCD number indicates the total attenuation in the unit, including the +10 dB/0 dB position of relay K2 and the Programmable Attenuator active pads.

REMOTE RF LEVEL PROGRAMMING

With the front-panel BCD switch (Attenuator dial) set to the REMOTE position, IC4 is energized and the Attenuator Drive module input is switched from the front-panel BCD switch to the 80-40-20-10 BCD input from the rear-panel LEVEL PROGRAM plug. In the Attenuator dial REMOTE position, Level Program Board relay K1 is de-energized, thereby disabling the OUTPUT VERNIER and replacing it with the level program output voltage from the Level Program Board.

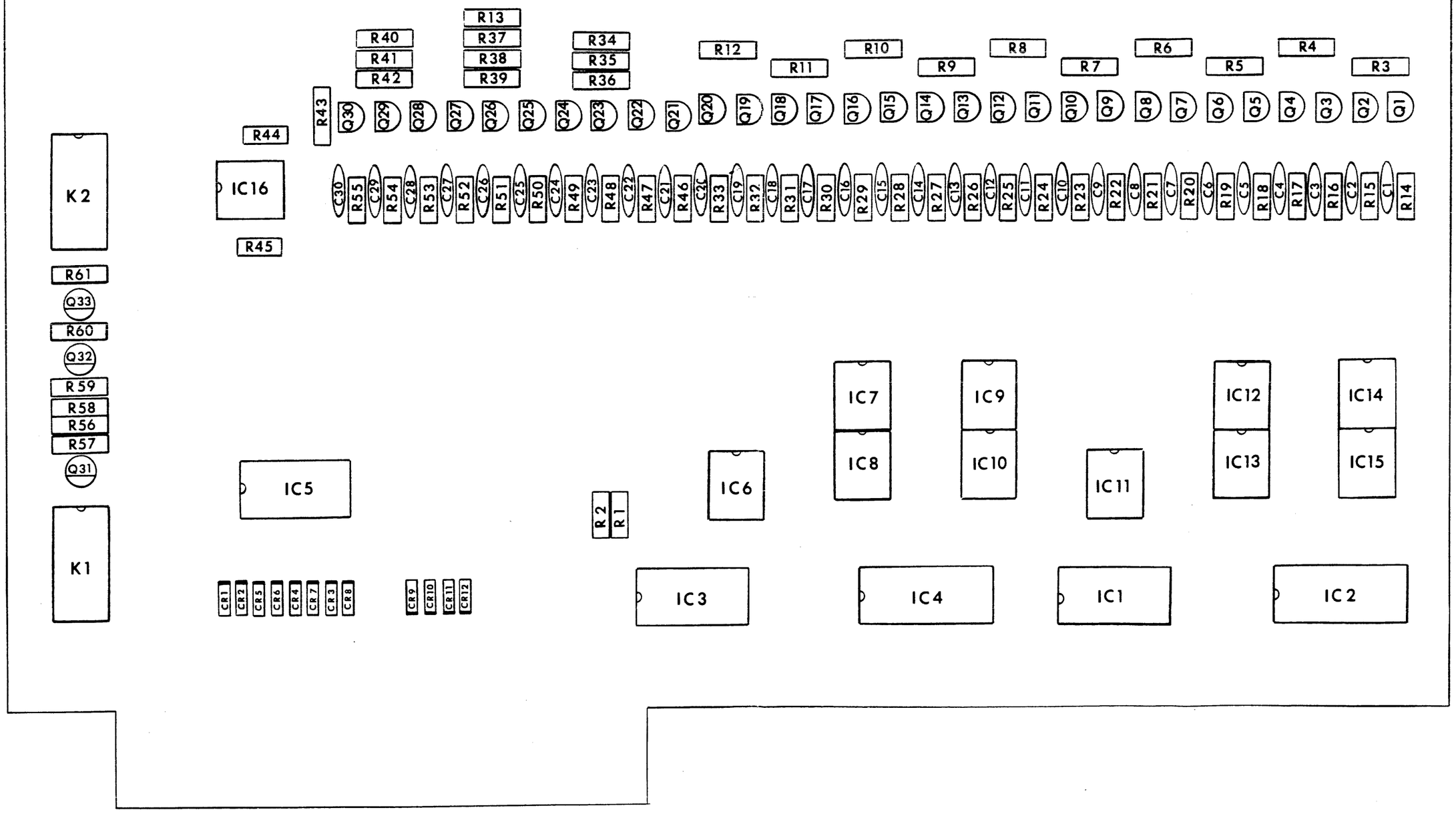
Basically, the rear-panel 80-40-20-10 BCD input determines whether Level Program Board relay K2 selects +10 dBm or 0 dBm program voltage, and also which Programmable Attenuator pads (if any) are activated.

The negative voltage applied across the OUTPUT VERNIER control is also applied to a voltage divider network on the 1 dB program select circuit. The 8-4-2-1 BCD input from the rear-panel plug activates FET switches to select voltage points on the divider network corresponding to the 1 dB steps. These voltage points are, in turn, connected across another voltage divider in the 0.1 dB program select circuit. Then, the rear-panel .8-.4-.2-.1. BCD input activates more FET switches to select voltage points on this divider which correspond to 0.1 dB steps. The output of the FET switches is connected through relay K1 to the +10 dBm/0 dBm level circuitry.

MAINTENANCE

No calibration or maintenance should be required for this option, other than that described in previous sections of this manual for calibration of the Meter Board; however, if a malfunction of some kind should make it necessary to repair the boards, they can be safely probed with a high impedance probe such as a scope or DVM. A logical trouble-shooting procedure of isolating the fault should be followed. The integrated circuits, which are most vulnerable to accidental shorts, are in sockets for easy replacement.

OPTION 1A — LEVEL PROGRAM BOARD



3003 — 3006 OPTION 1A REV. B

LEVEL PROGRAMMING BOARD

D C B A 4 3 2 1 8 K 9 J H 5

1 2 4 8 1 2 4 8 1 2 4 8 100dB GND

.1dB 1.0dB 10 dB

VIOLET GREEN BLUE RED BLACK WHITE BROWN GREY WHITE GREY VIOLET GREEN BLUE BLACK

10 11 12 13 6 7 8 9 2 3 4 5 14 1

REAR-PANEL LEVEL PROGRAM JACK

11 13 14 15 R P S L

GREEN RED BROWN ORANGE VIOLET BLUE YELLOW BLACK

1 2 4 8 -80dB -90dB REMOTE GND

ATTENUATOR SWITCH

U 16 17 T (SPADE TERMINALS) 18 V

VERNIER WIPER VERNIER END VERNIER END VERNIER PROGRAM GREY WHITE BLUE GND GND

VIOLET GREEN BLUE RED

J3 P3

3 2 4 1

METER BOARD

E 10 12 M N F 7 6

+5 VIOLET 1 GREEN 2 WHITE 4 BLUE 8 RED CONTROL BROWN ORANGE YELLOW -18 +18

15 10 11 12 13 14

M41A-1

1 TO OUTPUT AMP PIN 1 (UNLEVELED)
2 +7.3
3 +18
4 -18

16 5 6 7 8

+27

J2 P2

6 5 4 3 2

RED VIOLET GREY 20dB BROWN 20dB GREEN 20dB BLUE 10dB

RF IN — PROGRAMMABLE ATTENUATOR — RF OUT

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C04 C05 C10 C11 C12 C13 C16	CAP, F.T., 6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	10
C06	CAP, TANT, 22MF, 10V	T322C226K010AS	KEM	1510-22-2220	1
C07 C08 C09 C14 C15	CAP, F.T., 470PF CF101-147	FA5C-4712	A-B	1510-30-0471	5
C17 C18 C19	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	3
C20 C21	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	2
CR01 CR02	DIODE DG109-140	1N4148	FCD	4807-01-0914	2
IC01	IC, IC000-002	N5741CV	SIG	7000-57-4100	1
IC02	IC IC000-006	MC1455P1	MOT	7000-14-5500	1
IC03	PROM, PER M41A-1 FROM: 8007-42-8800	8410-00-0008	W-I	8410-00-0008	1
IC04	IC, IC000-011	78M05UC	FCD	7000-78-0500	1
Q01 Q02	TRANS QA038-541	2N3854A	G-E	4901-03-8541	2
Q03	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
Q04 Q05 Q06 Q07	POWER FET	VN10KM	SCX	4902-00-0100	4
R01 R08	RES, C, 1/4W, 5%, 47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	ATTEN DRVR,M41A-1	1114-00-0323	
		PAGE 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R02	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R03	RES, C, 1/4W, 5%, 12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1
R04	RES, C, 1/4W, 5%, 360 RC103-136	CF1/4-360	ASE	4700-15-3600	1
R05 R06 R19 R20 R21 R22 R23	RES, C, 1/4W, 5%, 4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	7
R07 R13	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K	ASE	4700-15-1002	2
R09	RES, C, 1/4W, 10%, 22M RC104-622	CB2261	A-B	4700-16-2205	1
R10	RES, C, 1/4W, 5%, 100K RC103-410	CF1/4-100K	ASE	4700-15-1003	1
R11	RES, C, 1/4W, 5%, 4.7M RC103-547	CB4755	A-B	4700-15-4704	1
R12 R15 R16 R18	RES, C, 1/4W, 5%, 390 RC103-139	CF1/4-390	ASE	4700-15-3900	4
R14	RES, C, 1/4W, 5%, 220 RC103-122	CF1/4-220	ASE	4700-15-2200	1
R17	RES, C, 1/4W, 5%, 200 RC103-120	CF1/4-200	ASE	4700-15-2000	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	ATTEN DRVR,M41A-1	1114-00-0323	
		PAGE 2	

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 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30	CAP, CER, 6.8PF, 1KV CD101-R68	60C0H6R8D	MDC	1510-10-0689	30
CR01 CR02 CR03 CR04 CR05 CR06 CR07 CR08 CR09 CR10 CR11 CR12	DIODE DG109-140	1N4148	FCD	4807-01-0914	12
IC01 IC03	HEX INVERTER	SN74LS04N	T-I	8000-74-0410	2
IC02 IC04	IC, IC000-028	93L01PC	FCD	7000-93-0110	2
IC05	IC, ID004-001	SM7432A	T-I	8000-74-3200	1
IC06 IC07 IC08 IC09 IC10 IC11 IC12 IC13 IC14 IC15 IC16	IC, IC000-005	RC4558DN	RAY	7000-14-5800	11
K01 K02	RELAY, SPDT MR000-002	191TE1C1-12G	SGM	4510-00-0002	2
Q01 Q02 Q03 Q04 Q05 Q06 Q07 Q08 Q09 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30	TRANS QA054-610	2N5461	MOT	4901-05-4610	30
Q31 Q32 Q33	TRANS QA038-541	2N3854A	G-E	4901-03-8541	3
R01	RES, C, 1/4W, 5%, 3.3K RC103-233	CF1/4-3.3K	ASE	4700-15-3301	1

WAVETEK PARTS LIST	TITLE LEVEL PGM BD	ASSEMBLY NO. 1110-00-0732 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R02	RES, C, 1/4W, 5%, 1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	1
R03	RES, MF, 1/8W, 1%, 432 RF211-432	MF55K-432	ASE	4701-03-4320	1
R04	RES, MF, 1/8W, 1%, 392 RF211-392	MF55K-392	ASE	4701-03-3920	1
R05	RES, MF, 1/8W, 1%, 340 RF211-340	MF55K-340	ASE	4701-03-3400	1
R06	RES, MF, 1/8W, 1%, 309 RF211-309	MF55K-309	ASE	4701-03-3090	1
R07 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43	RES, MF, 1/8W, 1%, 280 RF211-280	MF55K-280	ASE	4701-03-2800	11
R08	RES, MF, 1/8W, 1%, 243 RF211-243	MF55K-243	ASE	4701-03-2430	1
R09	RES, MF, 1/8W, 1%, 215 RF211-215	MF55K-215	ASE	4701-03-2150	1
R10	RES, MF, 1/8W, 1%, 196 RF211-196	MF55K-196	ASE	4701-03-1960	1
R11	RES, MF, 1/8W, 1%, 174 RF211-174	MF55K-174	ASE	4701-03-1740	1
R12	RES, MF, 1/8W, 1%, 154 RF211-154	MF55K-154	ASE	4701-03-1540	1

WAVETEK PARTS LIST	TITLE LEVEL PGM BD	ASSEMBLY NO. 1110-00-0732 PAGE: 2	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R13	RES, MF, 1/8W, 1%, 137 RF211-137	MF55K-137	ASE	4701-03-1370	1
R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32 R33 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55	RES, C, 1/4W, 5%, 10M RC103-610	CB1065	A-B	4700-15-1005	30
R44 R45	RES, C, 1/4W, 5%, 100 RC103-110	CF1/4-100	ASE	4700-15-1000	2
R56	RES, C, 1/4W, 5%, 18K RC103-318	CF1/4-18K	ASE	4700-15-1802	1
R57 R61	RES, C, 1/4W, 5%, 270 RC103-127	CF1/4-270	ASE	4700-15-2700	2
R58	RES, C, 1/4W, 5%, 5.6K RC103-256	CF1/4-5.6K	ASE	4700-15-5601	1
R59	RES, C, 1/4W, 5%, 20K RC103-320	CF1/4-20K	ASE	4700-15-2002	1
R60	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1

NOTE: PROGRAMMABLE ATTENUATOR IS
A-I 50DA90-CP; W-I P/N 3010-50-0003.

OPTION 3

REVERSE POWER PROTECTION

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 trasnceiver. 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.

NOTE

This information applies to all 3000 Series instruments except Models 3002, 3004, and 3006. For these instruments the M35-1 is replaced by M35-2, which permits operation from .001 to 520 MHz, but does not include DC blocking. All other specifications, operating instructions, and descriptions apply.

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 the option is installed in the signal generator.

** The VSWR of the generator is increased to <1.25 when this option 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 its 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 energizes 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 an 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, removing 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 from the insturment.

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 OUTPUT 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 ±1 dB. Perform the same test at 500 MHz. It should then trip at an output level of +10.5 dBm ±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. 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 detailed in Operation Check.

OPTION 3 FIELD INSTALLATION KIT

QTY	DESCRIPTION	PART NO
1	RF Circuit Breaker Module	M35-1
1	RF Cable	W1A
1	RF Cable	W1B
1	6/32 x 5/16 Screw	2810-17-6105

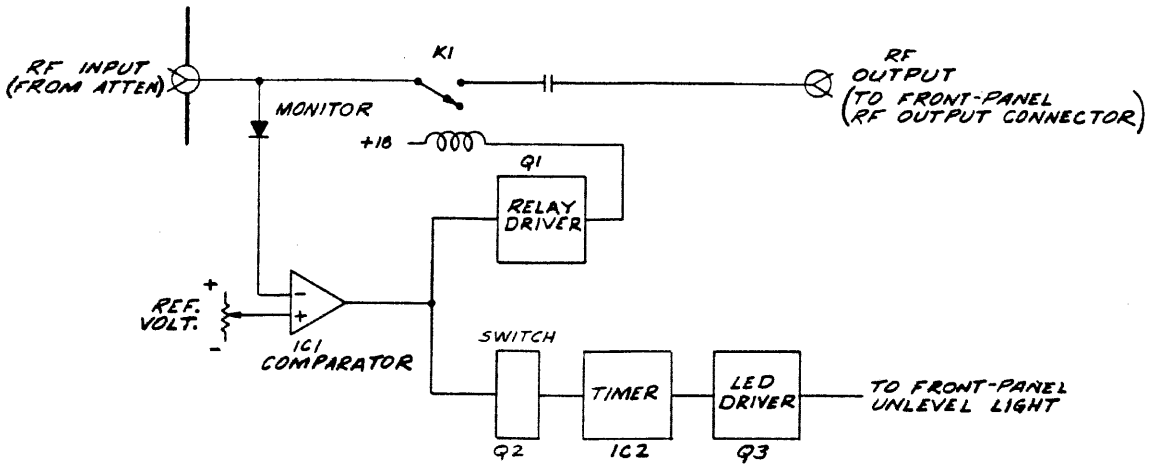


Figure 8/3-1. Block Diagram

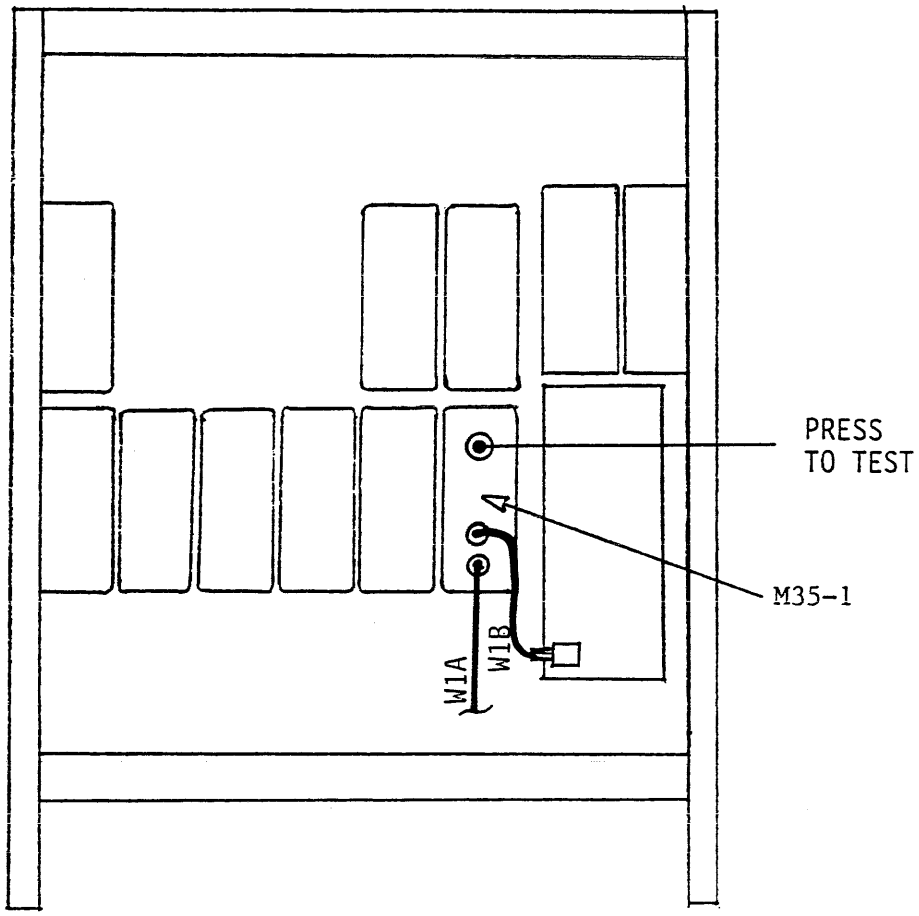
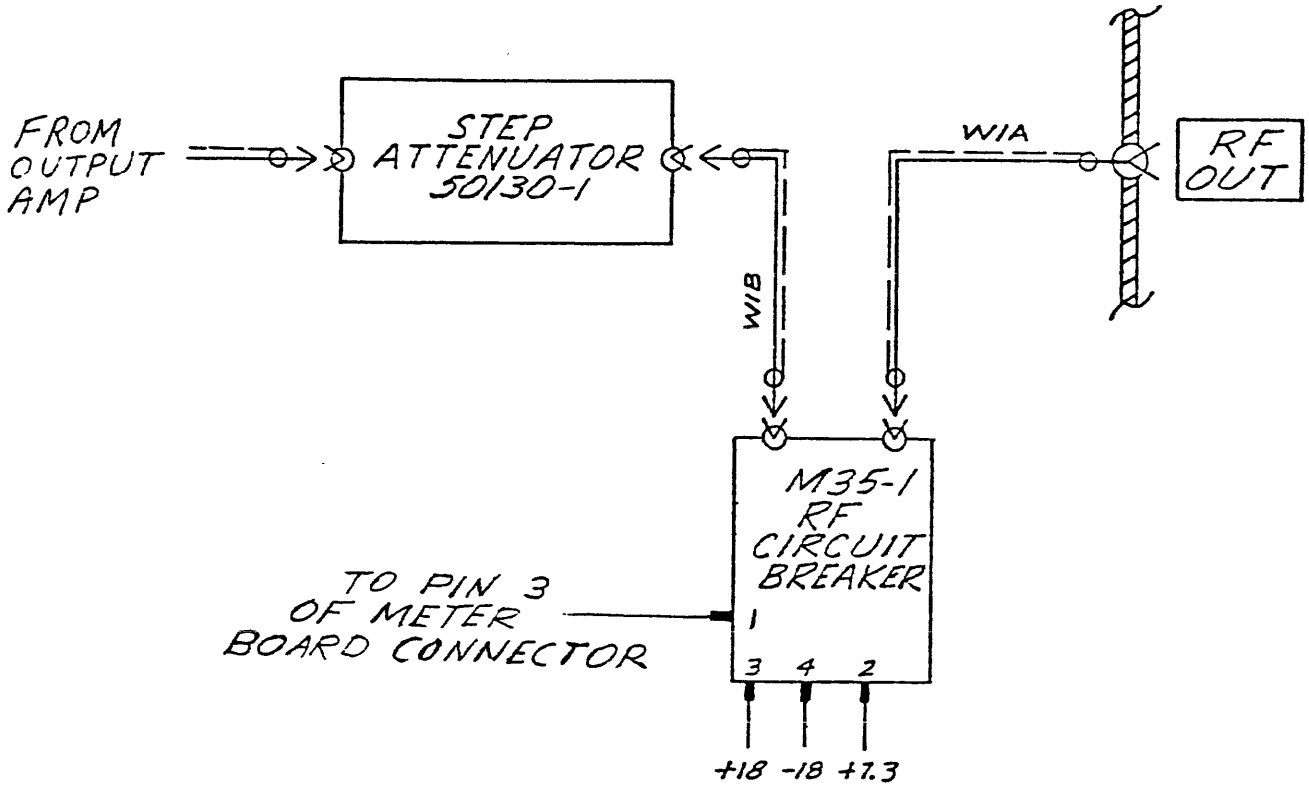


Figure 8/3-2. Top View, RF Circuit Breaker Location



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1	CAP,F.T.,.09MF,1KV CF111-390	CL003DA903P	A-H	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	162D106X0025D02	SPR	1510-21-7100	3
C12 C13 C14 C15	CAP,F.T.,.470PF CF101-147	FA5C-4712	A-H	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	NE741CV	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	3SC35007K1	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	4901-03-9541	2

WAVETEK PARTS LIST	TITLE RF CKT BKR,M35-1	ASSEMBLY NO. 1114-00-0010 PAGE: 1	REV B

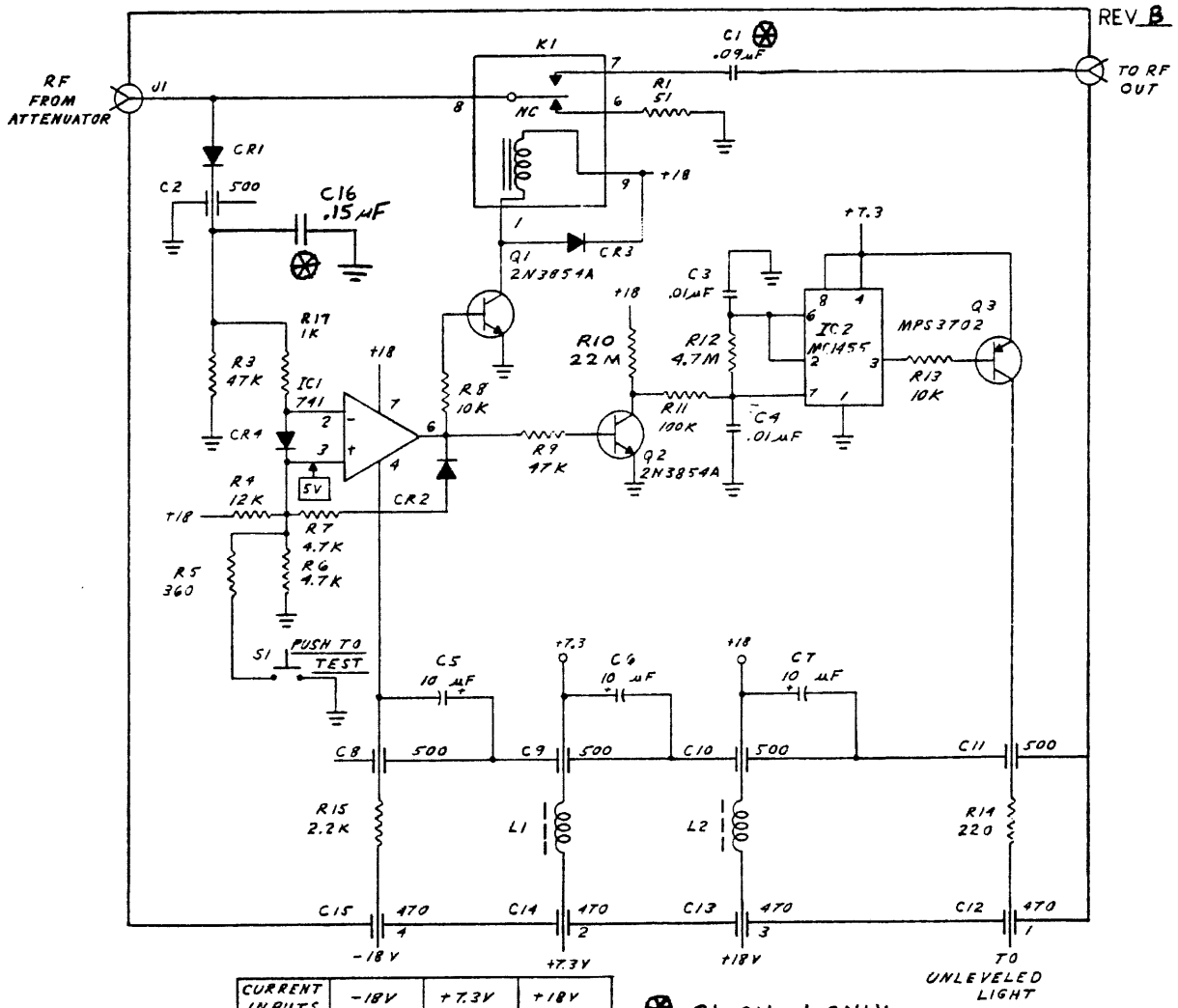
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q3	TRANS QB000-009	MPS3702	MOT	4902-03-7020	1
R1	RES,C,1/4W,5%,51 RC103-051	CF1/451	ASE	4700-15-5109	1
R3 R9	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2
R4	RES,C,1/4W,5%,12K RC103-312	CF1/4-12K	ASE	4700-15-1202	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 ASSY,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 4

AUXILIARY RF OUTPUT

INTRODUCTION

This option provides a constant amplitude Auxiliary RF Output signal at the rear panel of the signal generator. The amplitude (-10 dBm) of this signal is sufficient to drive most frequency counters. This auxiliary signal does not contain amplitude modulation; however, it does contain frequency modulation.

This factory-installed option entails changing the M9W Oscillator to an M9W-1, the addition of an M37 Amplifier module, harnessing, and additional cabling to the rear panel. The addition and operation of this option has no effect on the operation or specifications of the signal generator.

SPECIFICATIONS

Frequency Range	1 to 520 MHz
Level	-10 dBm ±.5 dB (70 mV)
Harmonic output	25 dBc from 1 to 520 MHz.

OPERATING INSTRUCTIONS

To use the Auxiiiary RF Output, disconnect the 50 Ω termination on the rear panel and connect a frequency counter or other monitoring device with a 50 Ω coaxial cable. The Auxiliary RF Output cable should be kept as short as possible. The output is controlled by a rear-panel on/off switch.

IMPORTANT

When not is use, terminate the Auxiliary RF Output with the 50 Ω terminator supplied.

NOTE

Although the reverse isolation of the Auxiliary RF Output is approximately 30 dB, a signal that is coupled into the Auxiliary RF Output could be coupled to the main RF output on the instrument's front panel. For example, sub-harmonic signals at a counter's input can be coupled through the instrument and applied to the device under test.

NOTE

If Option 4 is used on Model 3002, 3004, or 3006, it will function normally from 1 to 520 MHz. However, at frequency settings of 1 to 999 kHz, the Auxiliary RF Output frequencies will range from 10.001 to 10.999 MHz.

CIRCUIT DESCRIPTION

The M37 module contains a wide band amplifier, monitor diode, error amplifier, and voltage variable attenuator.

The input signal to the M37 module is fed thru the VVA to amplifier IC1. The approximate gain of the amplifier is 13 dB from 1 to 520 MHz. The monitor diode, CR2, detects the output from the wide band amplifier. This detected level is compared to a DC reference by the error amp, IC2. The output of the error amp is fed to the PIN diode (VVA) attenuator which changes the input level to the wide band amplifier until the monitored signal produces a DC level equal to the reference level. This reference level is adjusted by R5, the Output Level control.

The output impedance is provided by the resistor, R2, connected between the monitor and the RF output connector.

MAINTENANCE

The only maintenance for the Auxiliary RF Output is a periodic check of the output level. If a malfunction occurs, a trouble can be localized and repaired with the aid of the theory of operation and the schematics. The M37 Schematic is included in this section. The M9W/M9W-1 Schematic is located in Section 7 of this manual.

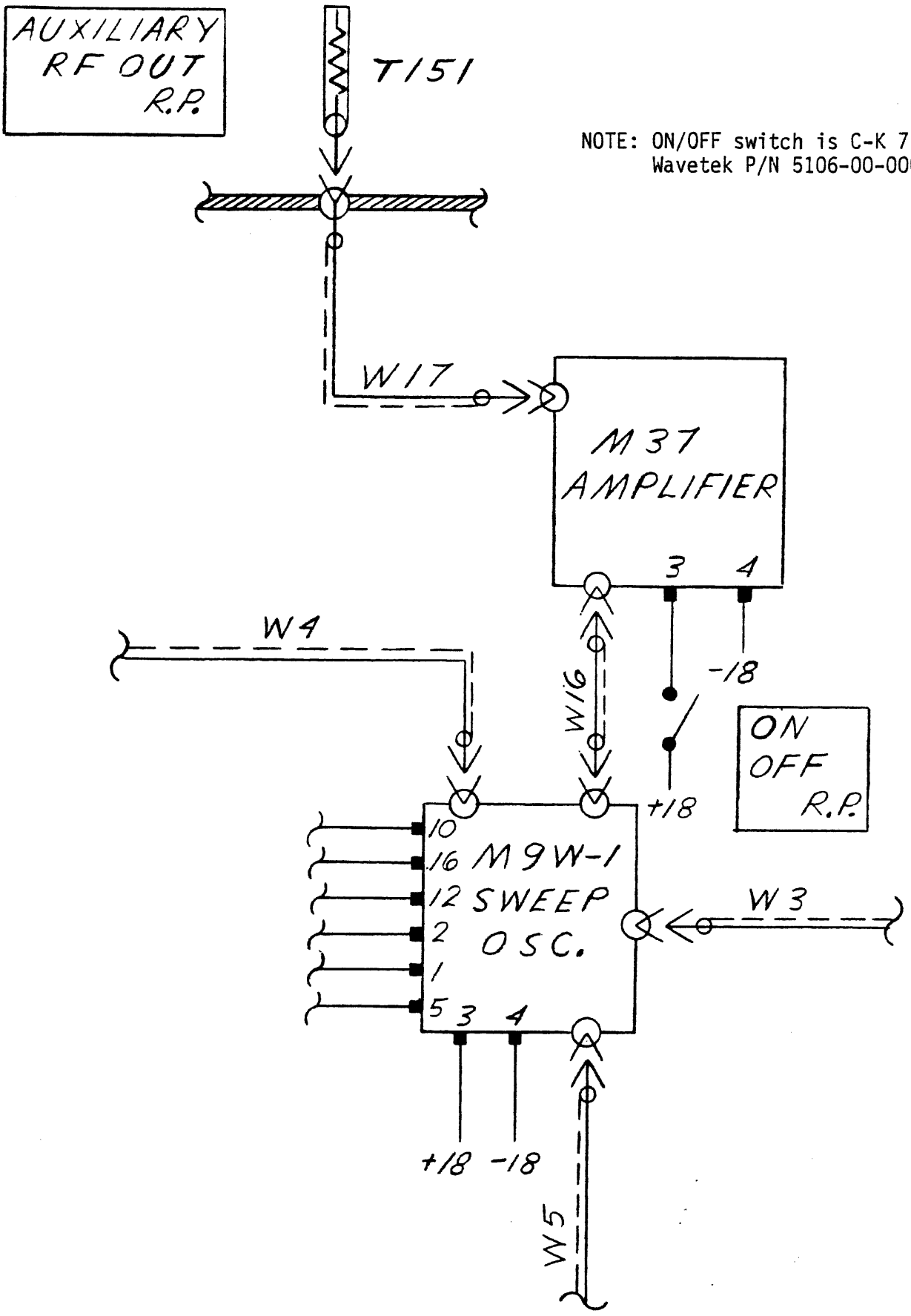


Figure 8/4-1. Additional Wiring

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1	CAP,Q.C.,3PF CG101-230	QC-3PF	Q-C	1510-40-0030	1
C2 C3	CAP,FT,500PF,20%250V CF104-150	4420-500PF	AER	1510-30-3501	2
C4	CAP,CER,120PF,1KV CD102-112	60U121M	MDC	1510-10-1121	1
C5	CAP,ELECT,1MF,25V CE120-001	162D105X9025BC2	SPR	1510-21-7010	1
C6	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	1
C7 C8	CAP,F.T.,470PF CF101-147	FASC-4712	A-B	1510-30-0471	2
CR1	DIODE DP000-050	5082-3080	H-P	4805-02-0002	1
CR2	DIODE DG100-821	1N82AG	G-I	4807-01-0092	1
IC1	IC,IL001-001	GPD-402	AVT	7000-04-0200	1
IC2	IC,IC000-002	NS741CV	SIG	7000-57-4100	1
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L1 L2 L3 L4	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	4
R1	RES,C,1/4W,5%,150 RC103-115	CF1/4-150	ASE	4700-15-1500	1

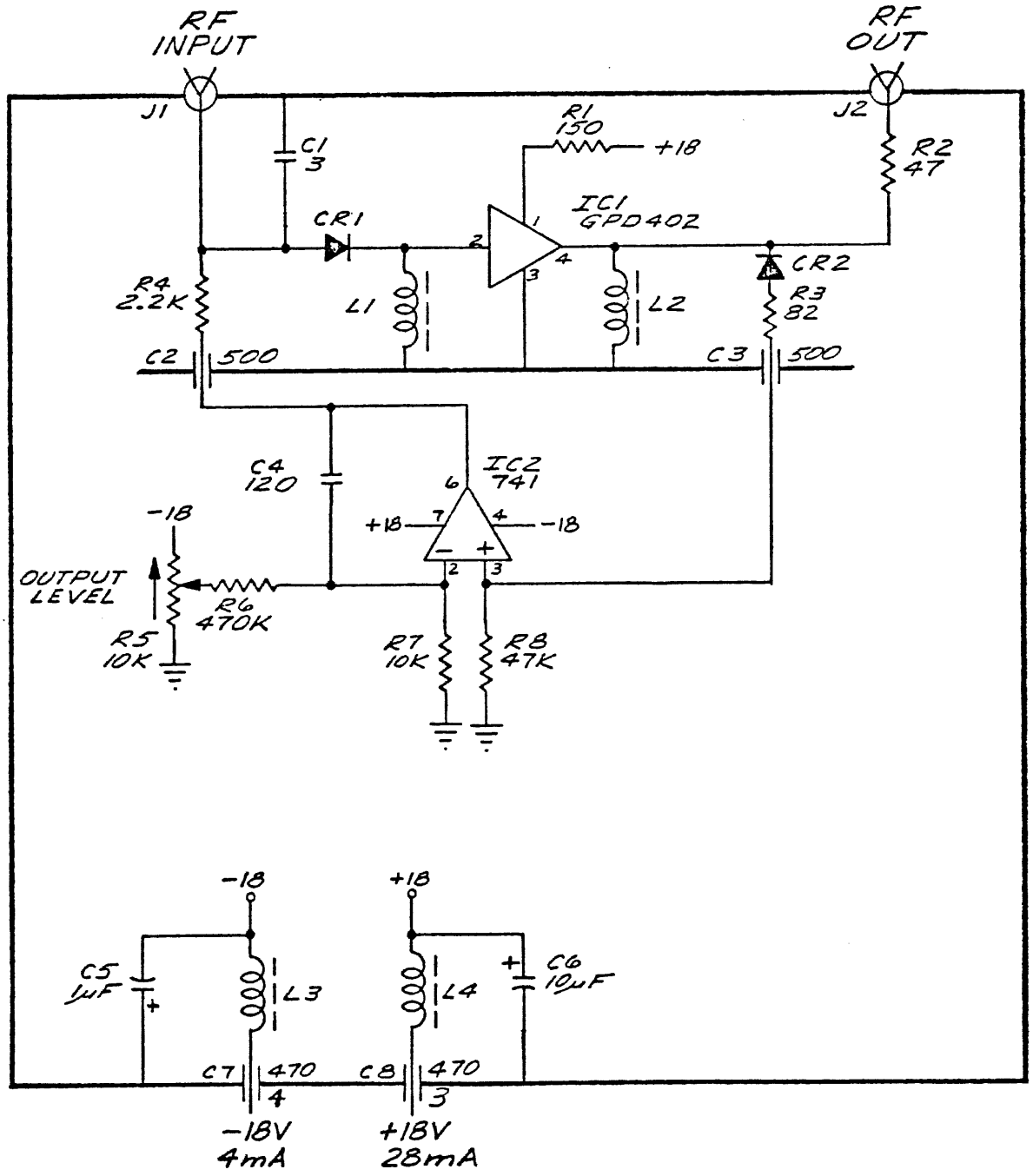
WAVETEK PARTS LIST	TITLE AUX RF OUT,M37	ASSEMBLY NO. 1114-00-0055 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R2	RES,C,1/2W,5%,47 RC105-047	CF1/2-47	ASE	4700-25-4709	1
R3	RES,C,1/4W,5%,82 RC103-082	CF1/4-82	ASE	4700-15-8209	1
R4	RES,C,1/2W,5%,2.2K RC105-222	CF1/2-2.2K	ASE	4700-25-2201	1
R5	POT,10K,RP129-310	360S103B	CTS	4610-00-1103	1
R6	RES,C,1/4W,5%,470K RC103-447	CF1/4-470K	ASE	4700-15-4703	1
R7	RES,C,1/4W,5%,10K RC103-310	CF1/4-10K	ASE	4700-15-1002	1
R8	RES,C,1/4W,5%,47K RC103-347	CF1/4-47K	ASE	4700-15-4702	1

WAVETEK PARTS LIST	TITLE AUX RF OUT,M37	ASSEMBLY NO. 1114-00-0055 PAGE: 2	REV A

AUXILIARY
RF OUTPUT
M37

REV.___



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 M30-1/4 (refer to Figures 5-5 and 5-6). The additional RF cables connect the M39 to the M30-1/4 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 this instrument when the refernce 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 through 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 through 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 Crystal Reference 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 amplifier 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 amplifier. The gain of the amplifier is thus changed (decreased), and the output returns (decreases) to its original level.

REFERENCE MONITOR

This circuit monitors the amplitude of the 10 MHz reference by looking at the detector output in the AGC circuit of the 10 MHz amplifier stage. This level is compared to a fixed DC level. When the reference falls below a level necessary to drive the phase detector, the comparator switches three transistors which eliminate the tuning output to the VCO and also prevent the 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 7) shows the incorporation of this option into the instrument.

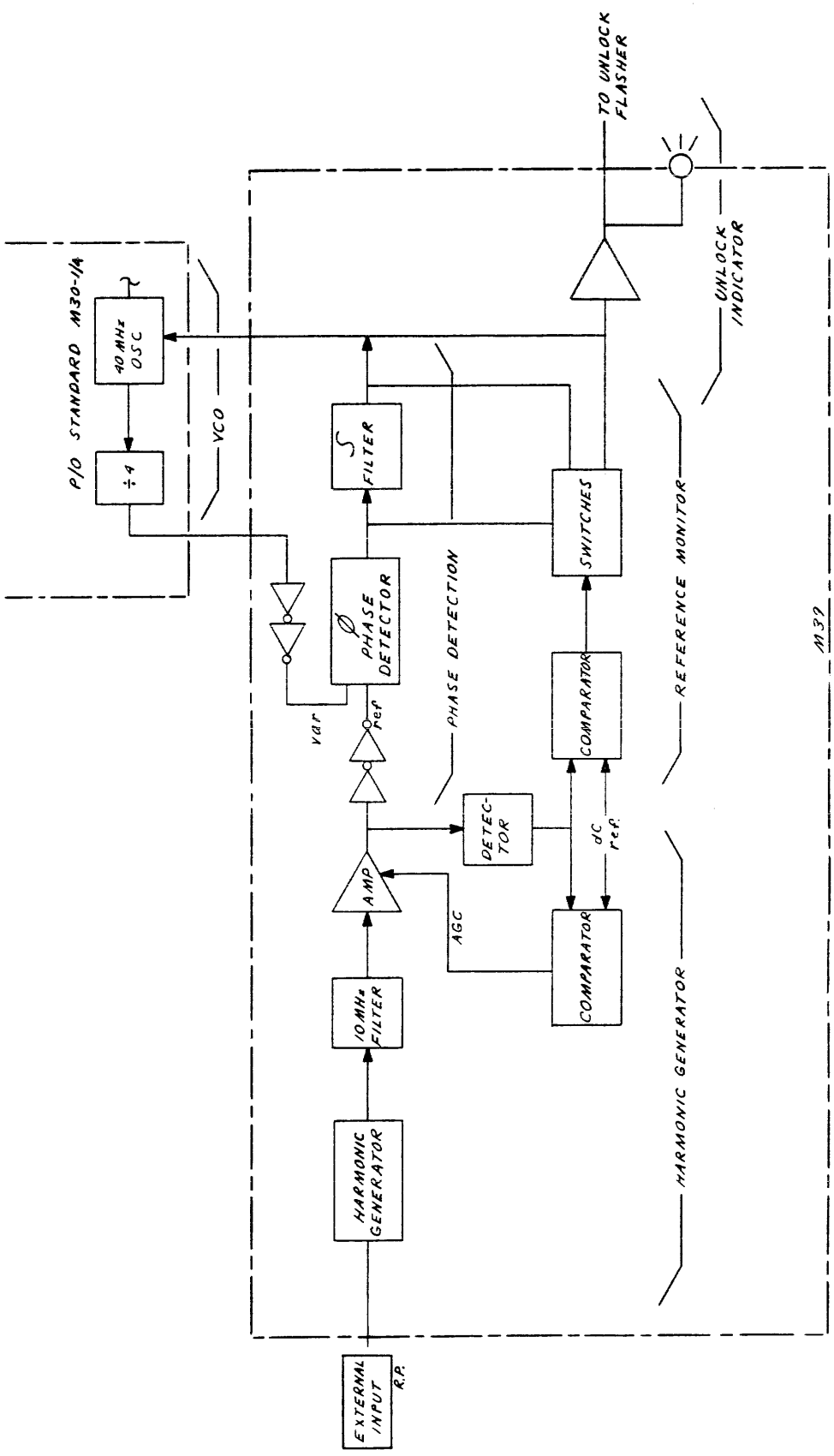


Figure 8/5-1. Block Diagram

EXTERNAL REFERENCE
M39

REV. D

EXT INPUT J1
R1 1K
C1 .005 µF
R2 47K
R3 12K
Q1 2N3904
R42 1K
CR1
CR2
C2 .005 µF
R4 1.5K
T1
+18
CR3
C3 200
L1 1
L2 33
CR4
R5 1M
CR5
R6 470
C11 270
R7 1.8M
R8 1.5M
L6 1
C10 270
C9 270
R9 470K
Q2 40841
C12 10/160
Q3 2N3904
R10 1K
C13 .005 µF
R11 100
C15 .005µ
C14 .001 µF
L7
R12 2.7K
C5 .75
C7 .75
L3 33
L4 33
L5 1
C4 3.5/13
C6 3.5/13
C8 3.5/13
CR6
C33 .001µF
R24 39K
C29 .005 µF
IC4A 1458
R27 2.2K
R29 6.8K
R28 100K
R30 10K
C30 .01µF
IC4B 1458
R25 1.78M
R26 56.2K
R31 10M
-18
Q7 2N3904
R43 22K
R44 10.0K
R45 10.0K
Q8 2N3904
R22 47K
R17 237K
CR7
CR8
R19 237K
R18 110K
R20 110K
IC2A 1458
R21 1.8K
CR9
CR11
CR10
L8
C17 6.8
9
UNLOCK OUTPUT
C16 .001 µF
R14 27K
R13 39K
IC1A 7405
R15 1K
R16 1K
IC1B 7405
IC5 4044
R36 2.7K
IC 2B 1458
R46 237K
R39 15.0K
R37 10K
C39 .001µF
C31 10µF
R38 100K
C32 10µF
C34 10µF
C35 10µF
C36 6.8
11
Ø LOCK
10 MHZ INPUT J2
R23 330
L12 1
C38 100
L13 1
C18 .005
R47 330
R33 27K
IC1C 7405
R34 1K
R35 1K
IC1D 7405
R32 39K
R40 22K
Q4 2N3904
R41 22K
Q5 2N3904
A
B
C37 6.8
8
ACCURACY INDICATOR
L9
IC3 78M05
+5V
C20 10 µF
C21 10 µF
C19 1000
+7.2V
L10
C24 .01 µF
C22 1000
C23 470
(5)
+18 V
L11
C27 .01 µF
C25 1000
C26 470
(6)
-18 V

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C13 C15 C18 C29 C39	CAP,CER,.005MF,100V	TG-D50	SPR	1510-10-2502	7
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	54-794-010-6892	SPEC	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
C24 C27 C30	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	3
C3	CAP,CER,200PF,1KV CD102-120	5GA-T20	SPR	1510-10-1201	1
C38	CAP,FT,CER,100PF,20% CF104-110	4420-100PF	AER	1510-30-3101	1

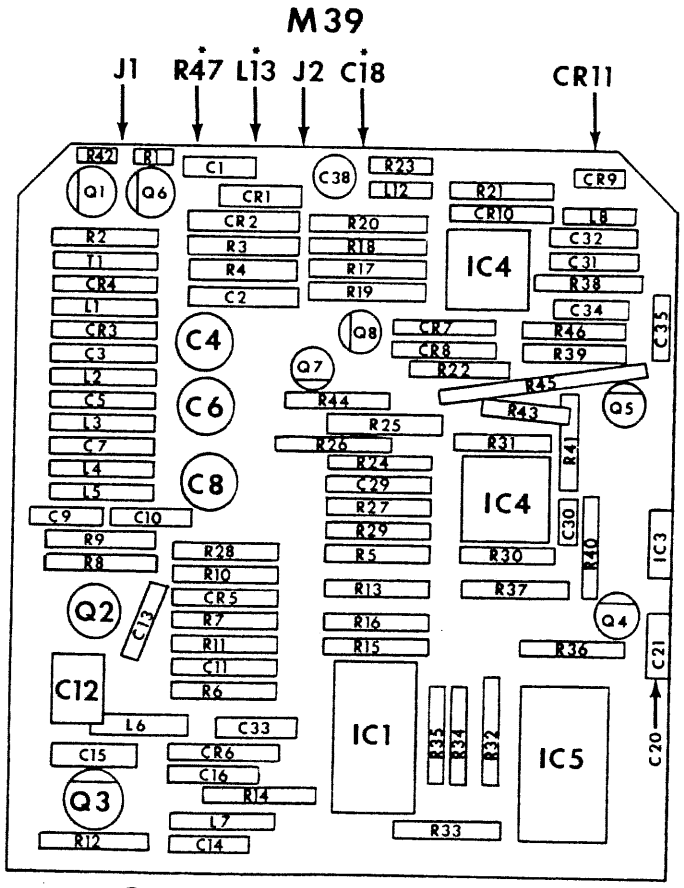
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C4 C6 C8	CAP,VAR,3.5-13PF250V CV101-013	7S-TRIKO-02-3.5-13PF	STR	1510-70-0130	3
C5 C7	CAP,M.C.,.75PF CG102-175	MC-.75PF	G-C	1510-40-1758	2
CR1 CR2 CR3 CR6	DIODE DG100-821	1N82AG	G-I	4807-01-0082	4
CR10 CR9	DIODE DG109-140	1N4148	T-I	4807-01-0914	2
CR11	LED DL000-001	NSL5046	NAT	4810-02-0001	1
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
IC1	IC,IC000-023	SN7405N	T-I	8000-74-0500	1
IC2 IC4	IC,IC000-005	RC4558NB	RAY	7000-14-5800	2
IC3	IC,IC000-011	78M05U1C	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
L09	TOROID, 10 TURN	LA009-010-2	HYT	1810-05-0005	1
L1 L12 L13 L5	CHOKE, 1MH, 10% LA005-R10	08N1R0K	ASE	1810-03-0010	4
L10 L11	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	2

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
R39	RES, MF, 1/8W, 1%, 15K RF213-150	MF55K-15K	ASE	4701-03-1502	1
R4	RES, C, 1/4W, 5%, 1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	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
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
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 H



*ON BACK OF PC BOARD

OPTION 5A

INTERNAL/EXTERNAL REFERENCE

INTRODUCTION

Option 5A includes the circuitry necessary to enable the instrument to be driven by an external reference frequency, and also provides an internal reference from a temperature-compensated crystal oscillator (TCXO). The accuracy of the instrument may be improved by using either the internal or external reference. In addition, the internal TCXO may be used as a reference for other instruments.

SPECIFICATIONS

INTERNAL	
Frequency Accuracy	±1 ppm
Temperature Range	25° ±5° C
Aging	1 ppm/year
Stability	<0.2 ppm/hour after 3 hour warm-up (Typically after 2 hour warm-up)
Reference Output	10 MHz TTL
EXTERNAL	
Frequency Accuracy	Equal to external source
External Input	
Frequency	5 or 10 MHz
Accuracy	±1 ppm
Input Level	TTL or .5 to 5 VRMS into 2 kohm (sine or square wave)
INPUT/OUTPUT CONNECTOR	Rear-panel BNC

INSTALLATION

The circuitry for Option 5A includes the M153 Internal/External Reference module and two RF cable assemblies. To install Option 5A, remove the instrument top and bottom covers (refer to instruction manual Section 5.2) and plug module M153 into the open module socket next to the M30-1/4 Crystal Reference module. Install the module hold-down screw underneath the instrument chassis. Connect the RF cable assemblies as shown in Figure 8/5A-1.

OPERATION

When the Int/Ext switch on top of module M153 is in the "Int" position, the instrument is phase locked to the TCXO in the M153 and the instrument accuracy is ±1 ppm (.0001%). The TCXO signal is also output at the rear-panel connector for use in driving other devices.

When the M153 switch is in the "Ext" position, the instrument is phase locked to the external source. If no external source is present, Option 5A is non-functional, and the instrument accuracy is returned to the standard (±10 ppm (.001%)).

The front-panel EXT ACCURACY lamp will light when the instrument is phase locked to either the external source or the internal TCXO.

WARM-UP TIME

When the instrument is turned on from a cold start, the front-panel ACCURACY indicator may flash, indicating an unlocked condition. As soon as the ACCURACY indicator stops flashing, the instrument is warmed up and has an accuracy of ±1 ppm. The warm-up time is typically less than 5 minutes at 25° C ambient temperature.

NOTE

If the front-panel FREQ VERNIER is not in its CAL position, Option 5A is non-functional.

THEORY OF OPERATION

Refer to Figure 8/5A-2.

The purpose of Option 5A is to phase lock the M30-1/4 Crystal Reference to a higher accuracy reference. The option circuitry is contained in the M153 Internal/External Reference module, and includes a tuned amplifier, a phase detector, a filter, a comparator, a reference monitor, and a TCXO.

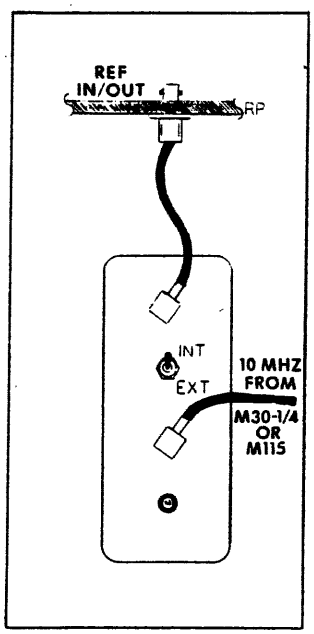


Figure 8/5A-1. Top View

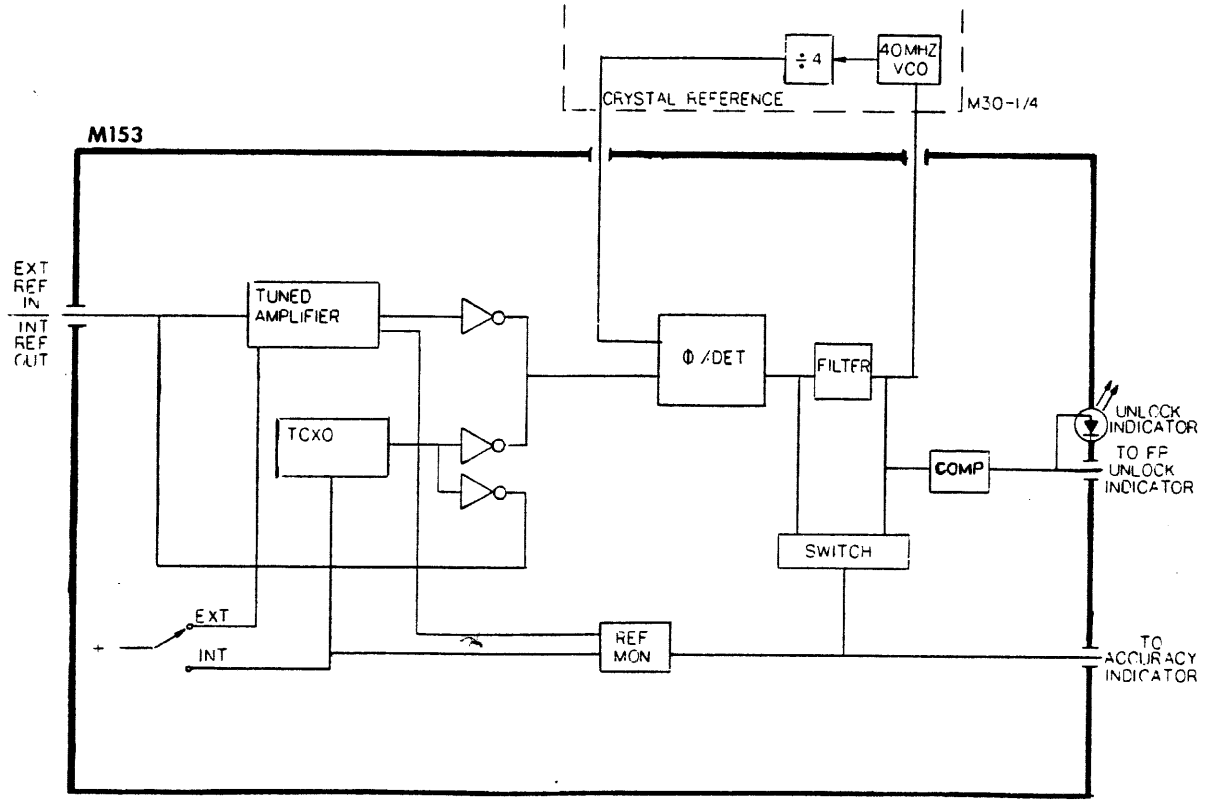


Figure 8/5A-2. Block Diagram

When the M153 switch is set to "Int", the TCXO is energized. The TCXO output is input to a phase detector, the other input of which is derived from the M30-1/4 Crystal Reference, which serves as the VCO in the phase-locked loop. Any difference in frequency or phase produces an error voltage which corrects the M30-1/4 Crystal Reference frequency to keep it phase locked to the TCXO.

When the M153 switch is set to "Ext", the tuned amplifier is energized and the TCXO is turned off. The tuned amplifier accepts the external reference signal, amplifies it (if the external reference is 5 MHz, the tuned amplifier converts it to 10 MHz), and inputs it to the phase detector. The phase-locked loop then operates in the same manner as it did for the TCXO, and the M30-1/4 Crystal Reference is phase locked to the external reference source.

If the external reference is not within accuracy specifications, the phase-locked loop will not be able to lock onto the external signal. When this occurs, the comparator senses the excessive error voltage from the phase detector and activates the module and instrument unlock indicators.

If the M153 switch is set to "Ext" but no (or insufficient) external signal is available, the reference monitor senses the condition and disables the phase-locked loop.

CALIBRATION

Tank circuit L4/C12 is broad-tuned at the factory, and should require no adjustment.

An adjustment trimmer is provided on the TCXO to adjust the 10 MHz reference frequency. This adjustment should be performed at 3 to 6 month intervals to compensate for aging of the TCXO.

To adjust the TCXO frequency, first ensure the instrument has been turned off for at least 3 hours and has stabilized in a ~ 25° C ambient temperature. Remove the instrument's top cover and the M153 module cover. Set the Int/Ext switch to "Int" and connect a frequency counter to the rear-panel REF IN/OUT connector. (Ensure that the counter is properly warmed up and has at least 0.1 ppm accuracy with 1 Hz resolution at 10 MHz.) Turn the instrument on and adjust the TCXO Frequency Adjustment to 10.000000 MHz ± the offset indicated on the calibration tag adjacent to the Frequency Adjustment. (Example— If the tag reads "Freq Set at 25° -3.0 Hz", adjust the frequency to 9.999997 MHz). This adjustment should be performed within 5 minutes after turn-on. Replace the module and instrument covers.

TROUBLESHOOTING

If the M153 unlock indicator is lit, the fault may be in the M153, but may also be in the M30-1/4 Crystal Reference module or in the external source. If either the M30-1/4 or the external source is not within its prescribed specification limits, the M153 may not be able to accomplish phase lock, and the unlock indicator will light. If the unlock occurs only when the M153 switch is set to "Ext", suspect the external source or the tuned amplifier in the M153. If the unlock occurs only when the M153 switch is set to "Int", recalibrate the TCXO. If the unlock occurs in both switch positions (with external source present), the problem is probably a defective M153 or an out-of-specification M30-1/4.

Calibrate the M30-1/4 as follows: Check the DC voltage present on pin 11 of module M153. This is the PLL correction voltage. The unlock indicator will light when this voltage exceeds ~ ±4 V. If the instrument is unlocked after a 5 minute warm-up period, immediately set the PLL correction voltage to -3.5 V using the M30-1/4 Frequency Adjust. If the instrument becomes unlocked after 15 minutes, allow the instrument to warm up until it has been on for at least 2 hours and set the PLL correction voltage to +3.5 V.

NOTE

It may be necessary to repeat the above procedure several times in order to phase lock the M30-1/4 at all temperatures. Do not adjust the M30-1/4 Frequency Adjust for 0 V, since this could produce an unlocked condition at extreme temperatures.

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C04 C14 C15 C16 C17 C28 C31	CAP, TANT, 10MF, 25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	10
C05 C07 C09	CAP, CER, .01MF, 100V CD103-310	68U103M	MDC	1510-10-2103	3
C06	CAP, CER, .001MFD, 1KV CD102-210	5GAD10	SPR	1510-10-1102	1
C08 C10 C13 C30	CAP, CER, .005MF, 100V	TG-D50	SPR	1510-10-2502	4
C11	CAP, CER, 200PF, 1KV CD102-120	5GA-T20	SPR	1510-10-1201	1
C12	CAP, VAR, 3.5-13PF250V CV101-013	7S-TRIKO-02-3.5-13PF	STR	1510-70-0130	1
C18 C20 C21 C22 C23 C24 C25 C27	CAP, F.T., 470PF CF101-147	FA5C-4712	A-B	1510-30-0471	8
C29	CAP, CER, 6.8PF, 1KV CD101-R68	60C0H6R8D	MDC	1510-10-0689	1
CR01	LED DL000-001	NSL5046	NAT	4810-02-0001	1
CR02 CR03 CR04 CR05 CR06 CR07 CR08 CR12 CR13	DIODE DG109-140	1N4148	FCD	4807-01-0914	9
CR09	DIODE DG000-007	5082-2800	H-P	4809-02-0001	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	INT/EXT REF,M153	1114-00-0314	C
		PAGE: 1	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
CR10 CR11 CR14	DIODE DG100-821	1N82AG	G-I	4807-01-0082	3
Q01	TCXO, 10 MHZ	K1087A-1T13	MSN	2310-00-0002	1
IC01	IC, IC000-023	SN7405N	T-I	8000-74-0500	1
IC02	IC, IC000-013	MC4044P	MOT	8000-40-4400	1
IC03 IC04	IC, IC000-005	RC4558DN	RAY	7000-14-5800	2
IC05	IC, IC000-011	78M05UC	FCD	7000-78-0500	1
J01 J02	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L01 L05 L07 L08	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	4
L03	CHOKE, 1MH, 10% LA005-R10	08N1R0K	ASE	1810-03-0010	1
L04	CHOKE, 10.0MH, 10% LA005-010	08N100K	ASE	1810-03-0100	1
L09	CHOKE, 2.2MH, 10% LA005-R22	08N2R2K	ASE	1810-03-0229	1
Q01 Q02 Q03 Q04 Q05 Q06 Q07 Q08 Q10	TRANS QA038-541	2N3854A	G-E	4901-03-8541	9
Q09	XSTOR, POWER, NPN	92PU01A	NAT	4902-09-2011	1
R01 R31 R35	RES, C, 1/8W, 5%, 1K RC101-210	CF1/8-1K	ASE	4700-05-1001	3

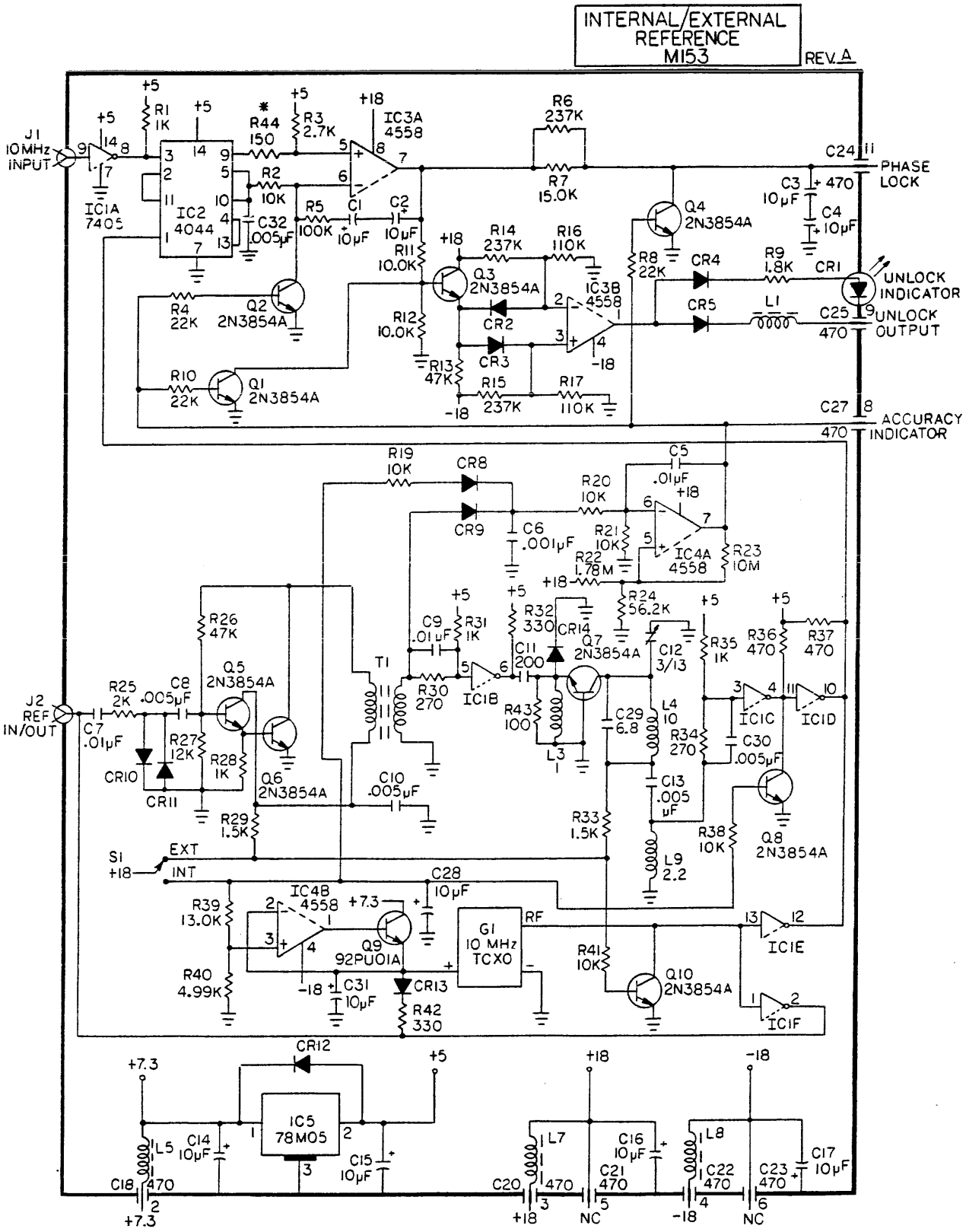
WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	INT/EXT REF,M153	1114-00-0314	C
		PAGE: 2	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R02 R20 R21 R38 R41	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K	ASE	4700-15-1002	5
R03	RES, C, 1/4W, 5%, 2.7K RC103-227	CF1/4-2.7K	ASE	4700-15-2701	1
R04 R08 R10	RES, C, 1/4W, 5%, 22K RC103-322	CF1/422K	ASE	4700-15-2202	3
R05	RES, C, 1/8W, 5%, 100K RC101-410	CF1/8-100K	ASE	4700-05-1003	1
R06 R14 R15	RES, MF, 1/8W, 1%, 237K RF214-237	MF55K-237K	ASE	4701-03-2373	3
R07	RES, MF, 1/8W, 1%, 15K RF213-150	MF55K-15K	ASE	4701-03-1502	1
R11 R12	RES, MF, 1/8W, 1%, 10K RF213-100	MF55K10K	ASE	4701-03-1002	2
R13 R26	RES, C, 1/8W, 5%, 47K RC101-347	CF1/8-47K	ASE	4700-05-4702	2
R16 R17	RES, MF, 1/8W, 1%, 110K RF214-110	MF55K-110K	ASE	4701-03-1103	2
R19	RES, C, 1/8W, 5%, 10K -OHM	CF1/8-10K	ASE	4700-05-1002	1
R22	RES, MF, 1/8W, 1%, 1.78M RF215-178	RN60D-1.78M	MILSP	4701-03-1784	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R23	RES, C, 1/4W, 5%, 10M RC103-610	CB1065	A-B	4700-15-1005	1
R24	RES, MF, 1/8W, 1%, 56.2K RF213-562	MF55K-56.2K	ASE	4701-03-5622	1
R25	RES, C, 1/4W, 5%, 2K RC103-220	CF1/4-2K	ASE	4700-15-2001	1
R27	RES, C, 1/4W, 5%, 12K RC103-312	CF1/4-12K	ASE	4700-15-1202	1
R28	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	1
R29 R33	RES, C, 1/4W, 5%, 1.5K RC103-215	CF1/4-1.5K	ASE	4700-15-1501	2
R30 R34	RES, C, 1/4W, 5%, 270 RC103-127	CF1/4-270	ASE	4700-15-2700	2
R32 R42	RES. 1/8W, 5, 330-OHM	CF1/8-330	ASE	4700-05-3300	2
R36 R37	RES. C. 1/8W 5% 470	CF1/8-470	ASE	4700-05-4700	2
R39	RES, MF, 1/8W, 1%, 13.0K RF213-130	MF55K-13.0K	ASE	4701-03-1302	1
R40	RES, MF, 1/8W, 1%, 4.99K RF212-499	MF55K-4.99K	ASE	4701-03-4991	1
R43	RES, C, 1/4W, 5%, 100 RC103-110	CF1/4-100	ASE	4700-15-1000	1

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R44*	RES, C, 1/4W, 5%, 150 RC103-115	CF1/4-150	ASE	4700-15-1500	1
S01	SWITCH, TOGGLE ST000-003	MTA106D	ALC	5106-00-0002	1
T01	RF XFMR FROM: 1813-00-0007	1210-40-0018	W-I	1210-40-0018	1

WAVETEK PARTS LIST	TITLE	ASSEMBLY NO.	REV
	INT/EXT REF,M153	1114-00-0314 PAGE: 5	C


INTERNAL/EXTERNAL REFERENCE M153
REV. A
J1 10MHz INPUT
IC1A 7405
IC2 4044
R1 1K
R44 150
R3 2.7K
IC3A 4558
R6 237K
R7 15.0K
C24
PHASE LOCK
C3 10µF
C4 10µF
Q4 2N3854A
R2 10K
R5 100K
C1
C2 10µF
C32 .005µF
R11 10.0K
R14 237K
R16 110K
Q3 2N3854A
R8 22K
CR4
R9 1.8K
CR1
UNLOCK INDICATOR
R4 22K
Q2 2N3854A
CR2
CR3
IC3B 4558
CR5
L1
C25 470
UNLOCK OUTPUT
R12 10.0K
R13 47K
R15 237K
R17 110K
R10 22K
Q1 2N3854A
C27 470
ACCURACY INDICATOR
R19 10K
CR8
CR9
C5 .01µF
R20 10K
C6 .001µF
R21 10K
R22 1.78M
IC4A 4558
R23 10M
R24 56.2K
R26 47K
C9 .01µF
R31 1K
R32 330
CR14
Q7 2N3854A
C11 200
C12 3/13
R35 1K
R36 470
R37 470
T1
R30 270
IC1B
IC1C
IC1D
J2 REF IN/OUT
C7 .01µF
R25 2K
C8 .005µF
Q5 2N3854A
R43 100
L3
C29 6.8
L4 10
R34 270
C30 .005µF
R27 12K
R28 1K
CR10
CR11
Q6 2N3854A
C10 .005µF
C13 .005 µF
R33 1.5K
R38 10K
Q8 2N3854A
L9 2.2
R29 1.5K
S1
EXT
INT
C28 10µF
IC4B 4558
R39 13.0K
Q9 92PU01A
G1 10 MHz TCXO
RF
IC1E
R41 10K
Q10 2N3854A
R40 4.99K
C31 10µF
CR13
R42 330
IC1F
CR12
IC5 78M05
C14 10µF
C15 10µF
L5
C18 470
L7
C16 10µF
C21 470
C20 470
L8
C22 470
C23 470
C17 10µF
+7.3
+5
+18
-18
-18
NC
NC

OPTION 6

HIGH-STABILITY REFERENCE

INTRODUCTION

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.

SPECIFICATIONS

Output Frequency	5 MHz
Output Level	TTL
Temp Stability (1 hr. warm-up over 10° to 40° C range.	0.05 ppm
Aging	0.005 ppm/day 0.05 ppm/mo. 0.3 ppm/yr.
Typical Overall Accuracy (within 3 months of calibration)	0.2 ppm

OPERATION

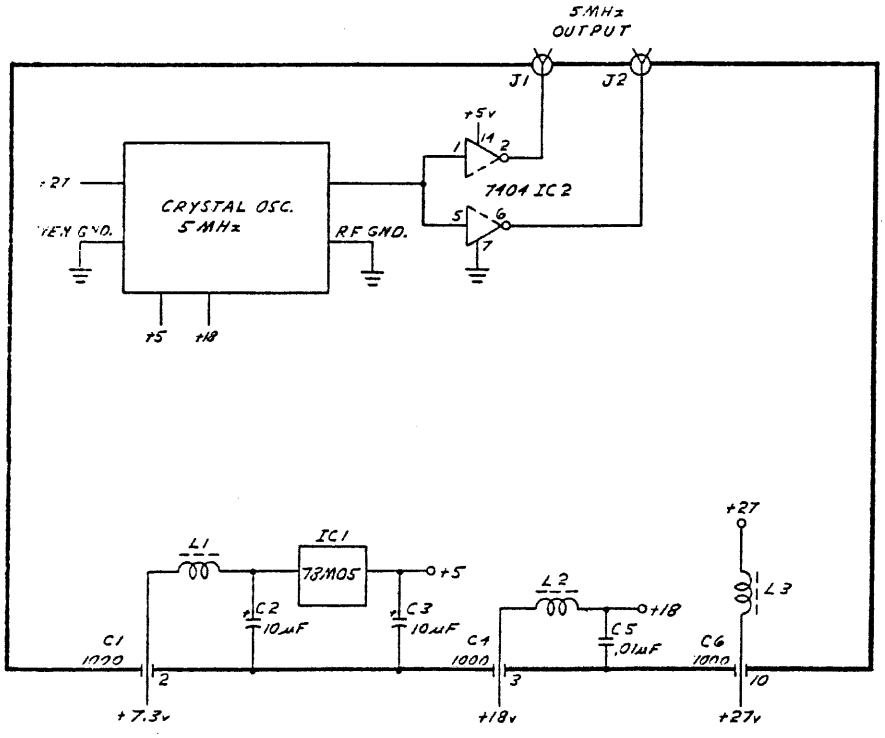
Option 5 (External Reference) is necessary for driving a Wavetek 3000 Series instrument with this High Stability Reference. The instrument Wiring Diagram (Schematic 1) and the instrument Top View (Figure 5-6 shows the incorporation of this option into the unit. The necessary circuitry is housed in the M40 module.

An RF cable takes the High Stability Reference output (5 MHz) to a rear-panel BNC connector. Another cable connects this output to the External Reference input of Option 5, thus referencing the instrument's Crystal Reference to the High Stability Reference.

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1 C4 C6	CAP,CER,F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	3
C2 C3	CAP,TANT,10MF,25V CE120-010	162D106X0025DD2	SPR	1510-21-7100	2
C5	CAP,CER,.01MF,100V CD103-310	68U103M	MDC	1510-10-2103	1
IC1	IC,IC000-011	78M05UC	FCD	7000-78-0500	1
IC2	IC,IC000-012	SN7404N	T-I	8000-74-0400	1
J1 J2	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2
L1 L2 L3	FERRITE CHOKE LA009-010	T1255-2	HYT	1810-05-0002	3
NONE	OSCILLATOR,XTAL,5MHZ MX003-001	JKTO-88-5	CKI	2310-00-0001	1

WAVETEK PARTS LIST	TITLE HI STAB REF,M40	ASSEMBLY NO. 1114-00-0056 PAGE: 1	REV A

M40
HIGH STABILITY
REFERENCE



OPTION 7

LOW LEAKAGE

INTRODUCTION

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.

OPERATION

There is no change in operation from the standard instrument.

CIRCUIT DESCRIPTION

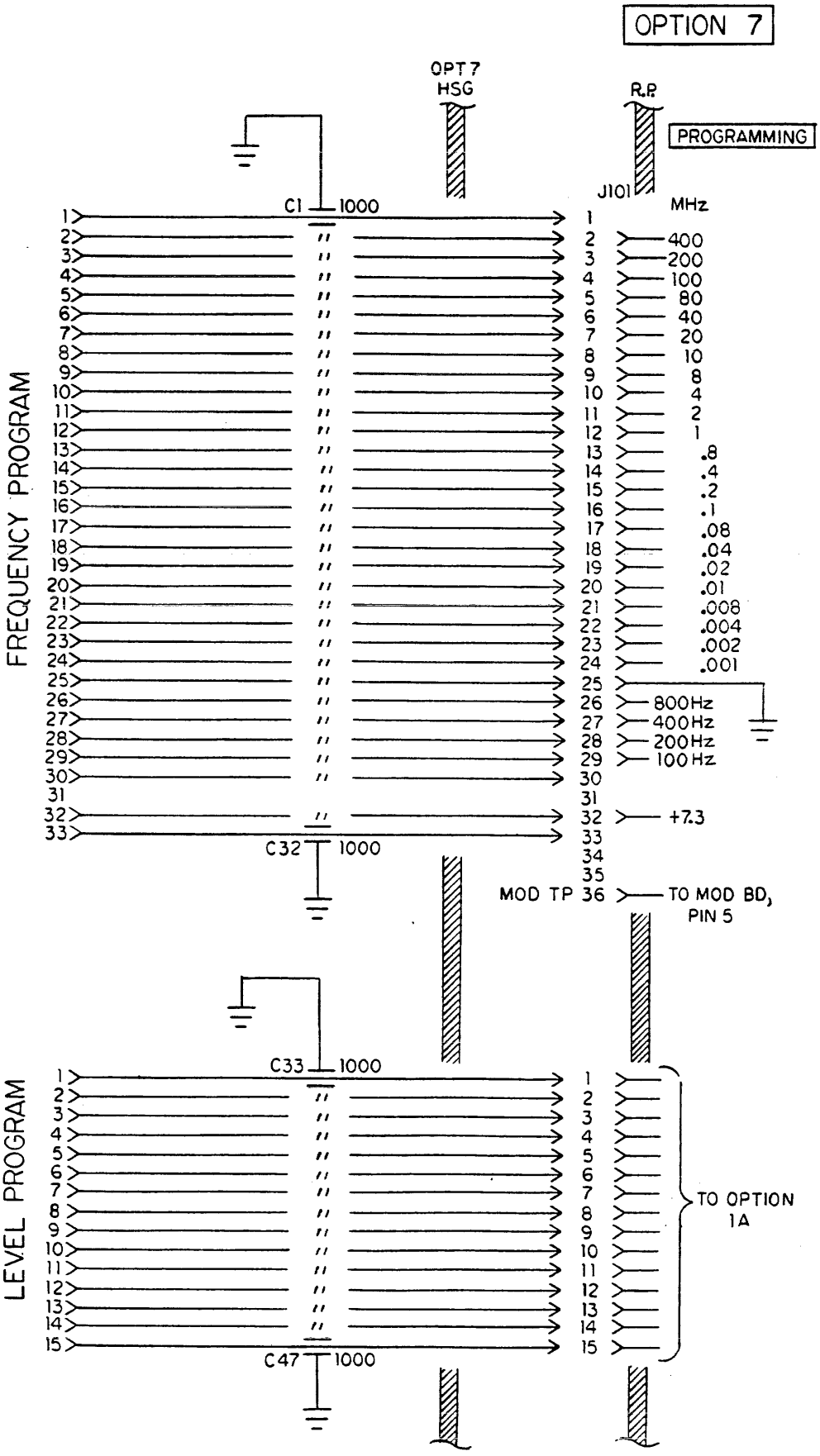
For Option 7, the standard M9W Sweep Oscillator is replaced with an M9W-2. The operation of the M9W-2 is identical to the M9W; the difference is additional shielding and filtering in the M9W-2. Also, additional shielding, filtering for the PROGRAMMING jack inputs, filtering for the LEVEL PROGRAM jack inputs (for Option 1A), and an AC line filter are added to the rear panel of the instrument.

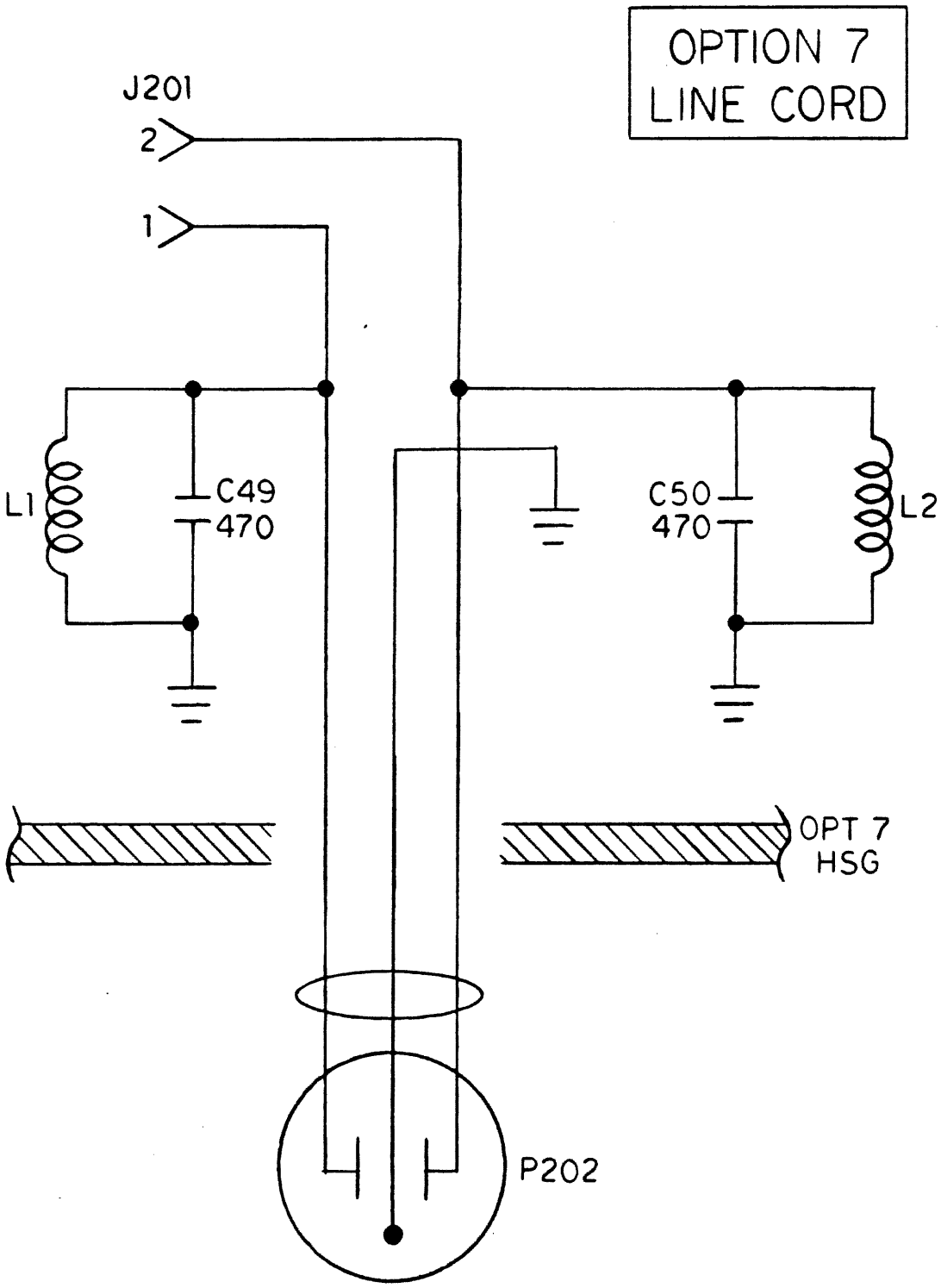
NOTE

If Option 4, Auxilliary RF Output, is also installed, the Sweep Oscillator is an M9W-3.

MAINTENANCE

No calibration or maintenance should be required for this option other than that described in previous sections of this manual.


OPTION 7
OPT 7 HSG
R.P.
PROGRAMMING
J101
MHz
C1 1000
FREQUENCY PROGRAM
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 800Hz
27 400Hz
28 200Hz
29 100Hz
30
31
32 +7.3
33
C32 1000
34
35
MOD TP 36 TO MOD BD, PIN 5
C33 1000
LEVEL PROGRAM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TO OPTION 1A
C47 1000


OPTION 7
LINE CORD
J201
2
1
L1
C49
470
C50
470
L2
OPT 7
HSG
P202

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
14	SWP OSC, M9W-2	M9W-2	W-I	1114-00-0038	1
C49 C50	CAP, CER, 470PF, 1.4KV CD115-147	E61UWAUW471M1.4KV	MDC	1510-11-0471	2
C1 THRU C48	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	48
L1 L2	FERRITE CHOKE LA009-004	T1255-1	HYT	1810-05-0001	2
32	CONN., 5-CKT	07-01-7051	MOL	2113-00-0002	1
33	TERMINAL, MC000-105	05-02-0050	MOL	2113-01-0001	4
24	RECEPTACLE, MC000-016	03-06-1151	MOL	2113-03-0001	1
22	RECEP, 36-PIN MC000-054	03-06-1361	MOL	2113-03-0004	1
25	PLUG, MC000-017	03-06-2151	MOL	2113-04-0001	1
23	PLUG, 36-PIN MC000-055	03-06-2362	MOL	2113-04-0005	1
26	TERMINAL, FEMALE MC000-018	02-06-1131	MOL	2113-05-0001	45
27	TERMINAL, MALE MC000-019	1854	MOL	2113-05-0002	45

WAVETEK PARTS LIST	TITLE OPT 7, RED LEAKAGE	ASSEMBLY NO. 1019-00-0006 PAGE: 1	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C1 C22 C23 C4	CAP, F.T., 6.8PF CF102-R68	FA5C-6892	A-B	1510-30-1689	4
C2	CAP, F.T., 470PF CF101-147	FA5C-4712	A-B	1510-30-0471	1
C3	CAP, F.T., 120PF CF102-112	54-794-001-121K	SPEC	1510-30-1121	1
C5	CAP, CER, 100PF, 1KV CD102-110	60U101M	MDC	1510-10-1101	1
C26 C40 C41 C42 C43 C6 C7 C8 C9	CAP, TANT, .47MF, 50V CE113-447	935	TRW	1510-21-9470	9
C10 C11 C13 C19 C21 C24 C25 C27 C29 C39	CAP, FT, CER, 100PF, 20% CF104-110	4420-100PF	AER	1510-30-3101	10
C12	CAP., CHIP, .1 MF	51C1209-B104Z	CFI	1510-00-3104	1
C14 C15 C16 C17 C33 C34 C35	CAP, Q-C, 10PF, 10%, CG101-310	QC-10PF	Q-C	1510-40-0100	7
C18	CAP, CER, .02UF, 50V	TG-S20	SPR	1510-10-2203	1
C20 C37	CAP, CER, 120PF, 1KV CD102-112	60U121M	MDC	1510-10-1121	2
C28	CAP, FT, 500PF, 20%250V CF104-150	4420-500PF	AER	1510-30-3501	1
C30	CAP, Q.C., .75PF CG101-175	QC-.75PF	Q-C	1510-40-0758	1

WAVETEK PARTS LIST	TITLE SWP OSC, M9W-2	ASSEMBLY NO. 1114-00-0038 PAGE: 1	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C31	CAP, CHIP, 1PF, 100V CC101-R10	3BN100S1R0C(S)	VAR	1510-00-0010	1
C32	CAP, Q.C., 3PF CG101-230	QC-3PF	Q-C	1510-40-0030	1
C36	CAP, Q-C, 2.0PF, 10% CG101-220	QC-2.0PF	Q-C	1510-40-0020	1
C38	CAP, Q.C., 1PF CG101-210	QC-1PF	Q-C	1510-40-0010	1
C44 C45	CAP, CER, F.T. 1000PF CF112-210	54-794-010-102P	SPEC	1510-30-8102	2
CR1 CR2 CR3 CR4 CR5	DIODE DC000-008	BB205	APX	4803-02-0004	5
CR11 CR7 CR9	DIODE DP000-040	MA47980	M-A	4805-02-0001	3
CR10 CR12 CR8	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 J201	CONN JF000-005	37JR116-1	S-C	2110-03-0002	3
L01	TORRID, 4 TURN	LA009-004-1	HYT	1810-05-0003	1
L02	TORRID, 10 TURN	LA009-010-2	HYT	1810-05-0005	1
L03 L22 L23	TORRID, 10 TURN	LA009-010-1	HYT	1810-05-0004	3
L11 L12 L14 L15 L16 L17 L20 L21 L4 L7 L8	RF CHOKE	CHOKE	W-I	1819-99-9999	11

WAVETEK PARTS LIST	TITLE SWP OSC, M9W-2	ASSEMBLY NO. 1114-00-0038 PAGE: 2	REV C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L10 L13 L18 L19 L5 L9	CHOKE .22MH 10% LA005-R02	08NR22K	ASE	1810-03-0228	6
L6	CHOKE, .22MH, 10% LA008-R02	506-000022V1	SYS	1810-04-0228	1
Q1	TRANS QA054-580	2N5458	MOT	4901-05-4580	1
Q2	TRANS QB000-013	A430	APX	4902-00-4300	1
Q3 Q4 Q6 Q7	TRANS QA050-530	2N5053	APX	4901-05-0530	4
Q5	TRANS QA051-090	2N5109	SSS	4901-05-1090	1
R1 R15	RES, C, 1/4W, 5%, 12K RC103-312	CF1/4-12K	ASE	4700-15-1202	2
R2 R40	POT, 5K, RP130-250	89PR5K	BEK	4610-00-2502	2
R3	RES, C, 1/4W, 5%, 100 RC103-110	CF1/4-100	ASE	4700-15-1000	1
R4	RES, C, 1/4W, 5%, 10 RC103-010	CF1/4-10	ASE	4700-15-1009	1
R29 R34 R46 R5 R65	RES, C, 1/4W, 5%, 2.2K RC103-222	CF1/4-2.2K	ASE	4700-15-2201	5
R6	RES, C, 1/4W, 5%, 330 RC103-133	CF1/4-330	ASE	4700-15-3300	1
R43 R7	RES, C, 1/4W, 5%, 47K RC103-347	CF1/4-47K	ASE	4700-15-4702	2

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R8	RES, C, 1/4W, 10%, 10M RC104-610	CB1061	A-B	4700-16-1005	1
R9	RES, 1/4, 5%, 6.2K A-B RC103-262AB	CB6225	A-B	4705-15-6201	1
R10	RES, C, 1/4W, 5%, 33K RC103-333	CF1/4-33K	ASE	4700-15-3302	1
R11	RES, C, 1/4W, 5%, 680 RC103-168	CF1/4-680	ASE	4700-15-6800	1
R12 R16	RES, C, 1/4W, 5%, 8.2K RC103-282	CF1/4-8.2K	ASE	4700-15-8201	2
R13 R14	RES, C, 1/4W, 5%, 1K RC103-210	CF1/4-1K	ASE	4700-15-1001	2
R17 R20 R28 R30 R33 R35 R52 R55 R64 R67	RES, C, 1/4W, 5%, 10K RC103-310	CF1/4-10K	ASE	4700-15-1002	10
R18 R23 R54 R57	RES, C, 1/4W, 5%, 470 RC103-147	CF1/4-470	ASE	4700-15-4700	4
R19 R21 R24 R39 R41 R53 R56 R58	RES, C, 1/4W, 5%, 4.7K RC103-247	CF1/4-4.7K	ASE	4700-15-4701	8
R22 R25 R59 R60	RES, C, 1/4W, 5%, 560 RC103-156	CF1/4-560	ASE	4700-15-5600	4
R26 R50	POT, 20K, RP130-320	89PR20K	BEK	4610-00-2203	2
R27 R32	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
R31 R61	POT, 20K, RP129-320	360S203B	CTS	4610-00-1203	2
R36 R68	RES, C, 1/2W, 5%, 47 RC105-047	EB4705	A-B	4705-25-4709	2
R37	RES, C, 1/4W, 5%, 270 RC103-127	CF1/4-270	ASE	4700-15-2700	1
R38 R66	RES, C, 1/4W, 5%, 47 RC103-047	CF1/4-47	ASE	4700-15-4709	2
R42	RES, C, 1/4W, 5%, 3.3K W-I/RC103-233AB	CB3325	A-B	4705-15-3301	1
R44 R62	RES, C, 1/4W, 5%, 100K RC103-410	CF1/4-100K	ASE	4700-15-1003	2
R45	RES, C, 1/4W, 10%, 1.2K	CB1221	A-B	4705-16-1201	1
R47	RES, C, 1/2W, 5%, 150 RC105-115	CF1/2-150	ASE	4700-25-1500	1
R48	RES, C, 1/4W, 5%, 3.9K RC103-239	CF1/43.9K	ASE	4700-15-3901	1
R49	RES, C, 1/4W, 5%, 5.6K RC103-256	CF1/4-5.6K	ASE	4700-15-5601	1
R51	RES, C, 1/4W, 5%, 1.2K RC103-212	CF1/4-1.2K	ASE	4700-15-1201	1
19	RES, C, 1/4W, 10%, 4.7K RC104-247AB	CB4721	A-B	4705-16-4701	1

WAVETEK PARTS LIST	TITLE SWP OSC, M9W-2	ASSEMBLY NO. 1114-00-0038 PAGE: 5	REV C

RF MIXER ASSEMBLY 1219-00-0055 AND PREAMP ASSEMBLY 1219-00-0054 ARE THE SAME AS FOR THE STANDARD M9W.

M29-1/M33-1/M41A/ M10W-6/M10W-8	These modules have been replaced by M29-2/M33-2/ M41A-1/ M10W-9/M10W-10, respectively. In all cases where the former assembly is mentioned in the manual text, the new assembly name should be understood. The schematics and parts lists have been updated.
GENERAL	All 2N3854A transistors (W-I PN 4901-03-8541) have been replaced by 2N3904 (W-I PN 4901-03-9040).
M41A-1	C17 is reversed on the schematic.
M35-1	R15 is 1.8 kohm, W-I PN 4700-15-1801.
3004/3006 W.D.	Pins 1 and 2 of J110 (Mod Bd connector) are reversed. Pin 1 is +18 V; pin 2 is -18 V.
Sec. 5.3.6	The Crystal Reference trimmers should be adjusted ONLY if the M32A pin 14 voltage is outside its allowable (+0.5 to +2.5 V) range.
Pg 3-22	All references to "M22" should be to "M172".
Pg 3-14	Figure 3-14 is in error. The correct figure is shown below. Also delete Table 3-1.

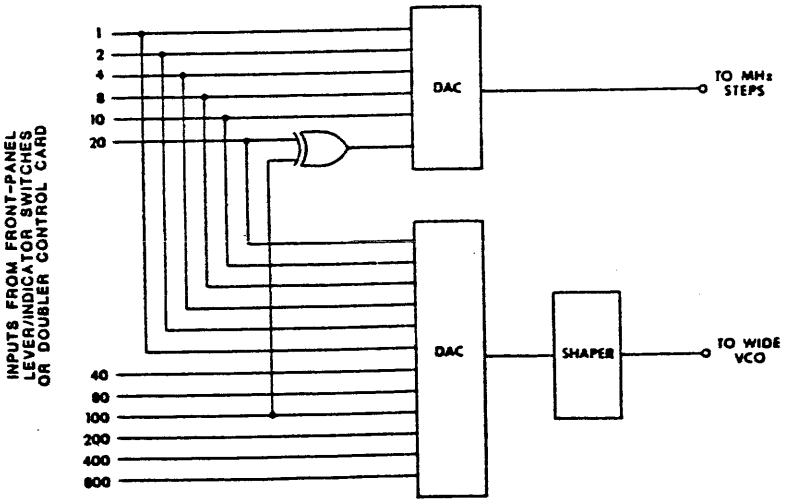


Figure 3-14. M172

Pg 5-10	Bottom line, left column; the reference to "M2M-1" should be to "M172".

MANUAL CHANGES - MODELS 3003-3006

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 changes in the original printing. The following schematics and drawings have been changed.

Rev A M34
11/15/84 M34 Schematic should indicate C13*.

Rev B M9W to M9W-7
11/14/85 The M9W-7 Sweep Oscillator module replaces the M9W module in the Models 3003/3006 Signal Generators. The M9W-7 module uses a control circuit to automatically set the phased-locked loop voltage in PLL3 to zero. This eliminates the Pot "D" adjustment in the M9W module. Disregard the first paragraph of Section 5.3.7 in the manual, since there is no pot "D". The M9W-7 parts list and schematic that replace the M9W documents may be found at the end of the Manual Changes.

Rev C 5.3.6 PHASE-LOCKED LOOP 2 ADJUSTMENT M32A
1/7/86 Revise the first paragraph beginning with line 3 to read:

Connect a digital voltmeter to M32A PIN 14. The DVM should read between +0.5 and +2.5 VDC. If the leveler voltage is within this range, DO NOT adjust the M30-# trimmer capacitors. (The dash number # depends upon the instrument model number.)

If the leveler voltage is not between +0.5 and +2.5 VDC, carefully adjust trimmers A and B on top of the M30-# until the voltage is correct.

CAUTION: If trimmers A and B are adjusted too far, the trimmer screws may fall down into the module. Misadjusted trimmers may cause faulty phase-locked loop 2 operation.

If the M32A leveler voltage cannot be correctly adjusted, proceed as follows. Disconnect the module cable W9 on the 1440 MHz output connector on the M30-#. This connector is next to the A trimmer. Connect the 1440 MHz output to the RF input of a spectrum analyzer, and note the 1440 MHz comb line amplitude. It should be -12 dBm or greater. The adjacent 1320 and 1560 MHz comb lines should be at least 20 dB below the 1440 MHz comb line. Adjust trimmers A and B only if the comb lines are not as stated above. Remove the spectrum analyzer input, and reconnect cable W9 to the 1440 MHz output connector.

Set the Leveler/Indicator switches to 239.000 MHz, and note that the DVM reading is still within the above limits.

If correct M30-# comb lines are obtained, and the M32A leveler is incorrect, the M32A module or cable W9 is faulty. If, after adjustment, the M30-# comb lines are incorrect, the M30-# is faulty. If replacement modules are available, they may be substituted to correct the fault. The M30-# must have the correct dash number.

Rev D
10/29/86
PIN 3469

A programmable attenuator (part number 1113-40-0144) will replace the rotary attenuator currently used in the Models 3003-3006 Signal Generators. The following manual changes must be performed:

Section 6: Parts List 1010-00-0133, SGL GEN 3003:
Parts List 1010-00-0138, SGL GEN 3004:
Parts List 1010-00-0043, SGL GEN 3005:
Delete the line that starts with reference designator "ZA15" and describes "Atten, 50130-01". This item is the rotary attenuator being replaced.

Parts List 1010-00-0044, SGL GEN 3006:
Delete the line that starts with reference designator "ZA16" and describes "Atten, 50130-01". This item is the rotary attenuator being replaced.

The programmable attenuator will be listed as the "50130 Replacement" on the combined parts list for the Chassis Assembly (part number 1111-00-0089, and -0088, -0085, 0070) of the Models 3003-3006. The complete entry to the parts list should be as shown below.

REF DES	PART DESCRIPTION	ORIG-MFGR-PART NO	MFGR	WAVETEK NO.	QTY
AT01	50130 Replacement	5P130SS18	W-I	1113-40-0144	1.000

Section 4.5, OUTPUT LEVEL ACCURACY TESTS:
Change the third paragraph of the METHOD section to read "The flatness is measured in 10 MHz steps between 10 and 520 MHz at +12, +3, and -7 dBm output levels."

Replace the table shown with the table on the following page:

OUTPUT STEP ATTENUATOR POSITION	ACTIVE STEP ATTENUATOR PADS (X)				
dBm	10 dB	20 dB	30 dB	35 dB	35 dB
+ 10					
0					
- 10	x				
- 20		x			
- 30			x		
- 40	x		x		
- 50		x	x		
- 60	x	x	x		
- 70				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

Change the last paragraph in the METHOD section as follows:
The third sentence in the paragraph must read "The two 35 dB pads are measured in combination with other pads."

Section 4.5.2, FLATNESS TEST:
Make the following changes in Steps 1, 4, 5, and 7 of the PROCEDURE section:
Step 1. Change to read:
"Set the instrument controls as shown in step 1 of Section 4.5.1, except disregard the Lever/Indicator switch setting of 050.0000 shown."

Step 4. Replace the paragraph with the following:
Set the Signal Generator Frequency selector to read 10 MHz and step in 10 MHz steps between 10 and 520 MHz. Observe the change in power meter readings. The total deviation shall be not greater than 1.5 dB overall. Record the maximum change to the nearest .05 dB (1/4 division) on line 10 of the PTR.

Step 5. Change to read:
"Set the OUTPUT VERNIER for a +3 dBm power meter reading."

Step 7. Change the first sentence to read:
"Set the OUTPUT step attenuator to 0 dBm."

Section 5, Figures 5-6a through 5-6d, Models 3003-3006 Top Views, respectively:
Item (16) is shown as the 50130-01 STEP ATTEN; Relabel this item the "Programmable Attenuator". (The new attenuator is smaller than the one shown but occupies the same relative position.)

Section 7, Models 3003-3006 Wiring Diagrams:
The block identified as "STEP ATTENUATOR 50130-1" should be relabeled "PROG ATTENUATOR AT01".

Meter Board, C315, Schematic:
Microswitch S101 has been incorporated into the programmable attenuator switch.

Section 8, OPTION 3:
Figure 8/3-2: The block labeled "STEP ATTENUATOR 50130-1" (below the figure) should be relabeled "PROGRAMMABLE ATTENUATOR".

Rev E
3/27/87
PIN 3783

M31A to M31B

The M31A is now obsolete. This module has been replaced with the M31B. Replace all text references to the "M31A" with "M31B".

On the M31A schematic (Wavetek number 0014-40-0061) change IC7 from 74H102 to 74LS112, IC8 from 74H11 to 74LS11, and IC10A and 10B from 4558 to TL082. Add a 100 Ω resistor (R32) between pin 4 of IC10B and the -18 volt supply. Add a 100 Ω resistor (R31) between pin 8 of IC10A and the +18 volt supply.

On the parts list titled PC Assy, M31A, assembly number 1114-00-0143, make the following corrections:

1. Replace the line beginning "IC07" with the following line:
   "IC07; DUAL J-K NEG; SN74LS112AN; T-I; 8007-41-1210; 1"

2. Replace the line beginning "IC08" with the following line:
   "IC08; TRIPLE POS AND; SN74LS11N; T-I; 8000-74-1110; 1"

3. Replace the line beginning with "IC10" with the following line:
   "IC10; DUAL OP AMP; TL082CP; T-I; 7000-00-8200; 1"

4. Add the following line:
   "R31 R32; RES, C, 1/4W, 5%, 100; CF 1/4-100; ASE; 4700-15-1000; 2"

WIDE SWEEP OSCILLATOR
1198 TO 1718 MHz
M9W-2/M9W-3

REV. H

CENT

ANALOG TUNING FROM M2M-1

VOLTS	FREQ
+7 TYP	0
0	250
-8 TYP	500

TUNING ≅ -16 SLOW
SPEED UP ≅ +16 FAST
FROM M34 PLL # 4

VOLTS	FREQ
10	+10
0	0
10	-10

FROM M34

VOLTS	FREQ
+10	-0.5
0	0
-10	+0.5

PLL # 3 FROM M33

ANALOG TUNING FROM MOD. PCB

VOLTS	FREQ
+5	-.5
0	0
-5	+.5

SWEEP WIDTH

(LEVEL)

OUTPUT TO M34

J1 LEVELED (1.5 UNLEVELED)

50mV (0 dBm) 1 TO 520 MHz TO OUTPUT AMP

J201

AUX RF OUTPUT (M9W-3)

J99

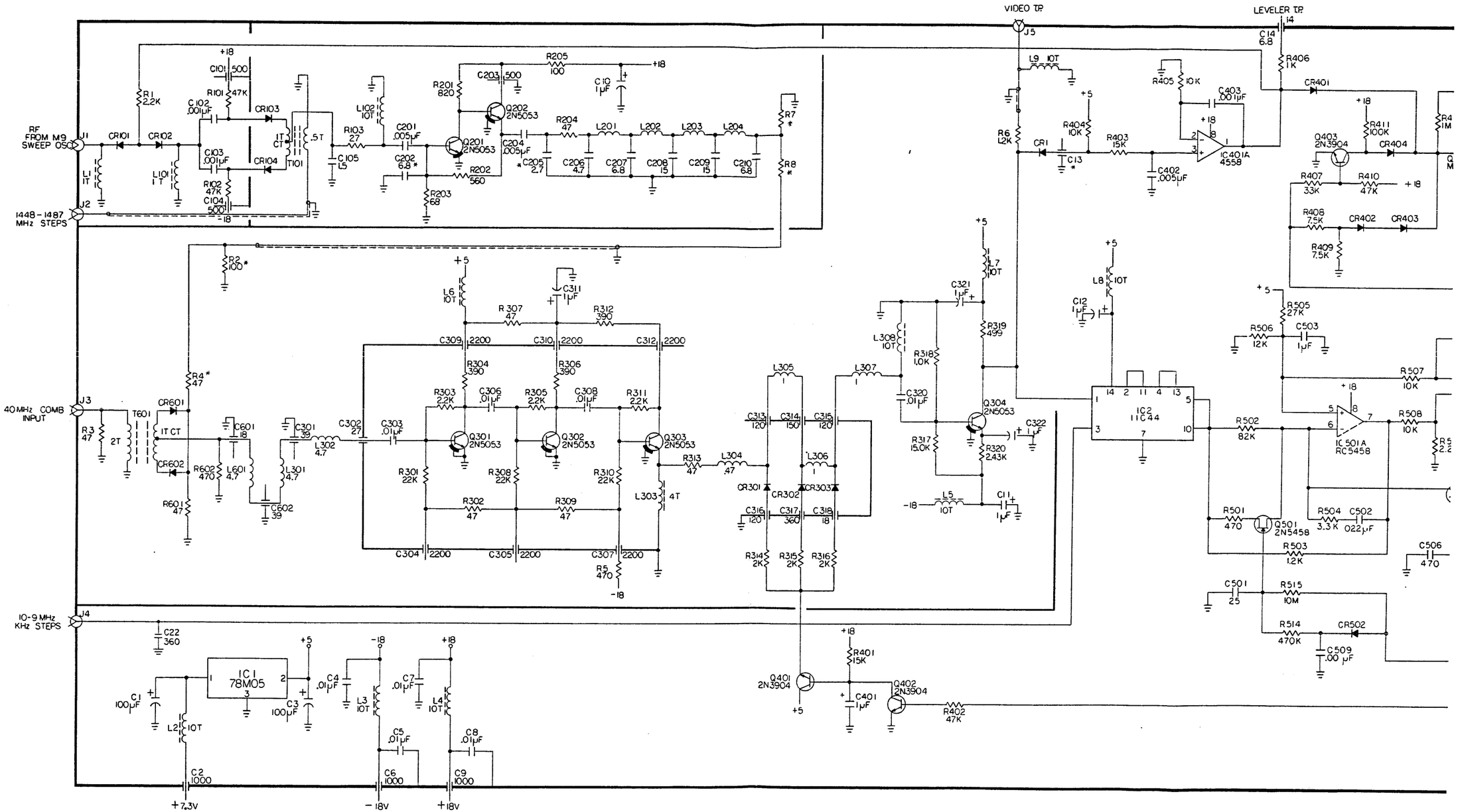
OUTPUT TO NARROW OSC LOCK .2V ± .1

J2

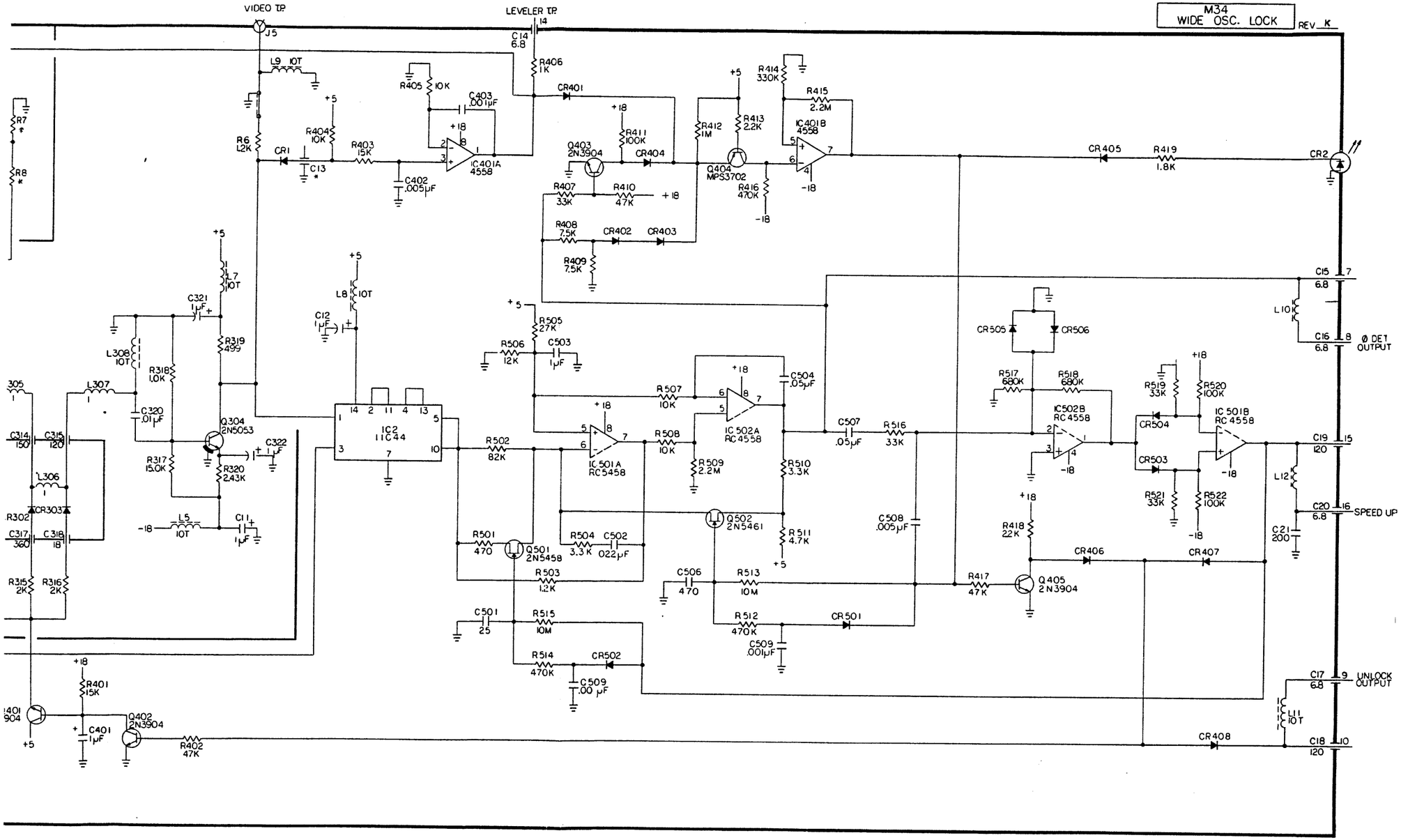
NOTE 1 - FERRITE BEADS MAY BE ADDED AT THIS POINT

▽ NOTE: C99, R99 AND J99 USED ON M9W-3 ONLY

Sheet 1 of 2


RF FROM M9 SWEEP OSC
J1
1448 - 1487 MHz STEPS
J2
40 MHz COMB INPUT
J3
10-9 MHz KHz STEPS
J4
VIDEO TP
J5
LEVELER TP
J6
+18
-18
+5
+7.3V
C101 .500
R101 47K
C102 .001μF
CR103
CR104
C103 .001μF
R102 47K
C104 .500
T101
L101
L102 10T
R103 27
C105 L5
C201 .005μF
C202 6.8 *
R201 820
C203 .500
R202 560
R203 68
Q201 2N5053
R205 100
C10 1μF
Q202 2N5053
C204 .005μF
*C205 2.7
R204 47
L201
L202
L203
L204
C206 4.7
C207 6.8
C208 15
C209 15
C210 6.8
R7 *
R8 *
R1 2.2K
R2 100 *
R4 * 47
R3 47
2T
CR601
CR602
T601
C601 18
C602 39
R601 47
R602 470
L601 4.7
L301 4.7
C301 39
C302 27
L302 4.7
C303 .01μF
R301 22K
R302 47
R303 2.2K
R304 390
C306 .01μF
R305 2.2K
R306 390
C308 .01μF
R308 22K
R309 47
R310 22K
R311 2.2K
R312 390
R313 47
L303 4T
L304 .47
Q301 2N5053
Q302 2N5053
Q303 2N5053
C304 2200
C305 2200
C307 2200
C309 2200
C310 2200
C312 2200
C311 1μF
L6 10T
R5 470
C22 360
C1 100μF
L2 10T
C2 1000
C3 100μF
IC1 78M05
C4 .01μF
L3 10T
C5 .01μF
C6 1000
C7 .01μF
L4 10T
C8 .01μF
C9 1000
L305
L306
L307
C313 120
C314 150
C315 120
C316 120
C317 360
C318 18
CR301
CR302
CR303
R314 2K
R315 2K
R316 2K
C321 1μF
L7 10T
R319 499
L308 10T
R318 1.0K
C320 .01μF
R317 15.0K
Q304 2N5053
R320 2.43K
C322 1μF
L5 10T
C11 1μF
L8 10T
C12 1μF
IC2 11C44
L9 10T
R6 1.2K
CR1
C13 *
R404 10K
R403 15K
R405 10K
C403 .001μF
C402 .005μF
IC401A 4558
C14 6.8
R406 1K
CR401
R411 100K
Q403 2N3904
CR404
R407 33K
R410 47K
R408 7.5K
CR402
CR403
R409 7.5K
R505 27K
R506 12K
C503 1μF
R507 10K
R508 10K
IC501A RC5458
R502 82K
R501 470
Q501 2N5458
R504 3.3K
C502 .022μF
R503 1.2K
C506 470
C501 25
R515 10M
R514 470K
CR502
C509 .00 μF
Q401 2N3904
R401 15K
C401 1μF
Q402 2N3904
R402 47K

Sheet 2 of 2


M34
WIDE OSC. LOCK
REV K
VIDEO TP
LEVELER TP
J5
14
C14 6.8
L9 10T
R405 10K
C403 .001μF
R406 1K
CR401
R6 12K
CR1
R404 10K
R403 15K
C13 *
C402 .005μF
IC401A 4558
R7 *
R8 *
+5
+18
-18
R411 100K
R412 1M
R413 2.2K
R414 330K
R415 2.2M
IC401B 4558
Q403 2N3904
Q404 MPS3702
CR404
R407 3.3K
R410 47K
R416 470K
R408 7.5K
CR402
CR403
R409 7.5K
CR405
R419 1.8K
CR2
C15 6.8
L10
C16 6.8
Ø DET OUTPUT
L7 10T
C321 1μF
L8 10T
C12 1μF
R319 499
L308 10T
R318 1.0K
305
L307
C320 .01μF
C314 150
C315 120
L306
CR303
R302
C317 360
C318 18
R315 2K
R316 2K
Q304 2N5053
C322 1μF
R317 15.0K
R320 2.43K
L5 10T
C11 1μF
IC2 11C44
R505 27K
R506 12K
C503 1μF
R507 10K
R502 82K
R508 10K
R509 2.2M
IC501A RC5458
IC502A RC4558
C504 .05μF
R510 3.3K
C507 .05μF
R516 33K
C508 .005μF
Q502 2N5461
R511 4.7K
R501 470
Q501 2N5458
R504 3.3K
C502 .022μF
R503 1.2K
C501 25
R515 10M
R514 470K
CR502
C509 .00 μF
C506 470
R513 10M
R512 470K
CR501
C509 .001μF
R417 47K
Q405 2N3904
CR505
CR506
R517 680K
R518 680K
IC502B RC4558
R418 22K
CR406
CR407
R519 33K
R520 100K
IC 501B RC 4558
CR504
CR503
R521 33K
R522 100K
IC 501B RC 4558
L12
C19 120
C20 6.8
SPEED UP
C21 200
C17 6.8
UNLOCK OUTPUT
L11 10T
CR408
C18 120
R401 15K
Q401 2N3904
C401 1μF
Q402 2N3904
R402 47K
0014-40-0016

M9W-7 / M9W-8
SWEEP OSCILLATOR
REV____

NOTE 1: FERRITE BEAD MAY BE ADDED AT THIS POINT.

NOTE ▽ C45, R67 AND J3 ARE USED ON M9W-8 ONLY.

REVISIONS			REVISIONS		
	ECN'S	BY		ECN'S	BY
F			A		
G			B		
H			C		
I			D		
J			E		

WAVETEK

DRAWN BY | DATE | NUMBER

APP'D

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q05	TRANS QB000-018	SD1006	SSS	4902-01-0060	1.000
R01 R14	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	2.000
R02	POT,5K,RP130-250	89PR5K	BEK	4610-00-2502	1.000
R03	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1.000
R04 R27 R29 R60	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	4.000
R05	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R06	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R07	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	1.000
R08	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R09	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	1.000
R10	RES,C,1/4W,5%,680	CF1/4-680	ASE	4700-15-6800	1.000
R11 R15	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	2.000
R12 R13	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	2.000
R16 R22 R28 R32 R33 R34 R50 R54 R59 R61	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	10.000
R17 R20 R23 R38 R48 R51 R55	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	7.000
R18 R24 R52 R56	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	4.000
R19 R21 R49 R53	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	4.000
R25 R46	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	2.000
R26 R31	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	2.000
R30 R57	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	2.000
R35 R62	RES,C,1/2W,5%,47 RC105-047	EB4705	A-B	4705-25-4709	2.000
R36 R63	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	2.000
R37	RES,C,1/4W,5%,6.2K	CF1/4-6.2K	ASE	4700-15-6201	1.000
R40	RES,C,1/4W,5%,51K	CF1/4-51K	ASE	4700-15-5102	1.000
R41 R58	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R43	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	1.000
R44	RES,C,1/2W,5%,150	CF1/2-150	ASE	4700-25-1500	1.000
R45	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	1.000
R64	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	1.000
R65	RES,C,1/4W,10%,1.2K	CB1221	A-B	4705-16-1201	1.000
R66	RES,1/4,5%,6.2K A-B RC103-262AB	CB6225	A-B	4705-15-6201	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MIXER,M9W	M9W-MIXER	W-I	1219-00-0423	1.000
A02	PREAMP,M9W	M9W-PREAMP	W-I	1219-00-0424	1.000
A03	MECH SUBAY,L,M9W-7	MECH L-M9W-7	W-I	1216-00-0220	1.000
A04	PLL3 AUTO CENTER BD	PLL3-AUTO CENTER	W-I	1218-00-2220	1.000
C05	CAP,COMP,500V,2PF	QC-2.0PF	Q-C	1510-40-0020	1.000
C06 C07 C08 C09 C24 C38 C40 C41 C42	CAP,TANT,50V,.47UF	T310A474050AS	UNCAR	1510-21-9470	9.000
C13	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	1.000
C14 C15 C16 C17 C32 C33 C34	CAP,COMP,500V,10PF	QC-10PF	Q-C	1510-40-0100	7.000
C18 C35	CAP,DISC,1KV,120PF	60U121M	MDC	1510-10-1121	2.000
C19	CAP,DISC,100V,.02UF	TG-S20	SPR	1510-10-2203	1.000
C27	CAP,COMP,500V,1PF	QC-1PF	Q-C	1510-40-0010	1.000
C29	CAP,COMP,500V,.75PF	QC-.75PF	Q-C	1510-40-0758	1.000
C30	CAP,CHIP,1PF,100V CC101-R10	03C109CT	RPBLC	1510-00-0010	1.000
C31	CAP,COMP,500V,3PF	QC-3PF	Q-C	1510-40-0030	1.000
C44	CAP,DISC,1KV,100PF	60U101M	MDC	1510-10-1101	1.000
CR01 CR02 CR03 CR04 CR09	DIODE,VARACTOR STATIC SENSITIVE #2	BB205B	APX	4803-02-0004	5.000
CR05 CR07 CR10	DIODE,PIN STATIC SENSITIVE #2	MA47980	M-A	4805-02-0001	3.000
IC01 IC02 IC03 IC04	OP AMP	NE741T	SIG	7000-57-4101	4.000
L01 L21 L22	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	3.000
L02	TOROID,10T,1-1/2L	LA009-010-2	W-I	1810-05-0005	1.000
L03 L07 L08 L11 L12 L14 L15 L16 L17 L20	RF CHOKE,REF ONLY	CHOKE	W-I	1819-99-9999	10.000
L04	CHOKE,8T,32 GA FROM:4705-16-4701	1210-33-0001	W-I	1210-33-0001	1.000
L05 L09 L10 L13 L18 L19 L24	CHOKE,COATED,.22UH	08NR22	JEF	1810-03-0228	7.000
L06	CHOKE,.22MH,10% LA008-R02	506-0000220V1	SYS	1810-04-0228	1.000
L23	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	1.000
Q01	TRANS 2E000-013	M430	APX	4902-00-4300	1.000
Q02	TRANS 2N5458	2N5458	MOT	4901-05-4580	1.000
Q03 Q04 Q06 Q07	TRANS 2N5911	2N5911	APX	4901-05-0530	4.000

3003-3006 Manual Changes

NOTE THAT THERE ARE PARTS LISTS AND A SCHEMATIC THAT GO WITH THIS ADDENDUM!!!

1114-00-0530 ✓ 1114-00-0225
1216-00-0046
1218-00-2607

0014-30-0406

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 changes in the original printing. The following schematics and drawings have been changed.

REVISIONS A THROUGH E ARE CONTAINED IN THE MANUAL CHANGE SECTION BOUND INSIDE THE MANUAL.

Rev E1
12/14/87
PIN 4267

REPLACE M31A MODULE WITH M31B MODULE

The M31A module is now obsolete. It has been replaced with the M31B. Replace all text references to the "M31A" with "M31B". Change "M31A" to "M31B" on the Model 3003, Model 3004, Model 3005, and Model 3006 wiring diagram schematics.

Replace the M31A schematic (Wavetek number 0014-40-0061) with the M31B schematic (0014-30-0406) from the following section.

On parts lists SGL GEN 3003 (1010-00-0133), SGL GEN 3004 (1010-00-0138), SGL GEN 3005 (1010-00-0043), and SGL GEN 3006 (1010-00-0044), change the ORIG-MFGR-PART-NO column entry from "M31A" to "M31B" on the line for reference designator ZA07 and change the Wavetek part number column entry from "1114-00-0143" to "1114-00-0530". Replace parts list KHZ STEPS, M31A, (1114-00-0143) with parts list KHZ STEPS, M31B (1114-00-0530) and add parts list PC ASSY, M31B (1218-00-2607) and MECH B, M31A (1216-00-0046) from the following section.

Rev F
02/26/88
PIN 4301

CAPACITOR ADDITION, M31B MODULE

The "1000pF" capacitor shown at J1 (the 1 kHz reference input) on the M31B schematic (Wavetek number 0014-30-0406) is a star value component of nominal value 1000 pF. It will be absent on most units.

PIN 4661
1/23/89

REPLACE .1 UF CAPACITORS IN PARTS LISTS

In parts lists numbers 1112-00-0461, 1112-18-0601, 1114-00-0038, 1114-00-0302, 1114-00-0460, 1114-00-0469, and 1114-00-0514, replace the .1UF capacitors with part numbers "1510-00-3104" and "1510-05-0104" by .1 UF capacitors with part number "1510-06-7104". Change the manufacturer information shown in the parts lists to show the following (column entries separated by semicolons):

Ref designator(s) as required;CAP,CER,.1UF,50V,20%;12015C104MAT050M;AVX;1510-06-7104;Quantity (QTY) as required

REV G — REPLACE VARACTOR DIODE IN PARTS LISTS

1/23/89

PIN 4666 The Varactor diode with Wavetek Part Number 4889-00-0001 has been replaced because it is no longer manufactured. In parts lists number 1114-00-0003, replace the line beginning "CR08 CR09" with the following (column entries separated by semicolons):

"CR08 CR09;DIODE,VAR,CAP,UHF,AXIAL,V=28,IO=20mA,T/R;BB405B T/R;APX; 4803-02-0004;2.000"

Rev H — FLATNESS TEST, SECTION 4.5.2

2/23/89

PIN 4670 Replace step 4 of this test with the following:
"Set the signal generator frequency selector in 10 MHz steps from 10 MHz to 520 MHz. Observe the change in power meter reading. Note the maximum and minimum power reading. Subtract the minimum power reading from the maximum reading and divide by two. The result should be .75 dB or less. Record the change on the PTR (Performance Test Record) at the end of section 4.

REV I — REPLACE RF CKT BKR, M35-1 PARTS LISTS

3/10/89 Replace RF CKT BKR, M35-1 Parts List 1114-00-0010 in section 8

PIN 4675 (Option -3) with RF CKT BKR, M35-2 Parts List 1114-00-0225 located at the rear off this addendum. Update the associated RF CIRCUIT BREAKER M35-1/M35-2 schematic according to the new parts lists.

5/5/89 The new M31B kHz Steps circuitry added earlier (Rev E1, PIN 4267),

PIN 4707 has been changed. On the new M31B schematic at the rear of this addendum, change IC9 to an "MC4044P". On parts list PC ASSY, M31B at the rear of this addendum, replace the line beginning "IC09" with the following line (column entries separated by semicolons):

"IC09;PHASE DETECTOR*SS*;MC4044P;MOT;8000-40-4400;1.000"

REFERENCE DESIGNATORS	PART DESCRIPTION ><	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	PC ASSY, M31B	M31B-PC	W-I	1218-00-2607	1.000
A02	MECH,B,M31A	MECH-B-M31A	W-I	1216-00-0046	1.000
C17	CAP,ALM,100UF,16V 20%,AXL.312"DX.687"L	TT16M100A	MAL	1510-21-2101	1.000
C18	CAP,ALM,100UF,6.3V 20%,AXL.312"DX.687"L	KE1-100/6.3	FRK	1510-21-1101	1.000
C19 C20 C25 C28 C32 C37	CAP,TNT,10uF,25V, 20%,AXL,D=3% .18"x.345"	173D106X0025W	SPR	1510-21-7100	6.000
CR04	LED,RED,T-1-3/4 V=5.0V,IF=70mA Int=1.5mcd,*SS*	HLMP-3300	H-P	4810-02-0001	1.000
IC13	POS. VOLT REG-3 TERM PLAS,TO-220AB,5 VOLT 500mA,7 W,5%,3-TERM	S78M05CV	SIG	7000-78-0500	1.000
J01 J02	SMC,SCREW-ON,50 OHM BULKHEAD,RECEPTACLE	37JR116-1	S-C	2110-03-0002	2.000
L01 L02 L03 L04 L05 L06 L07 L08 L09 L10 L11 L12	TOROID,10T	LA009-010	W-I	1810-05-0002	12.000
L13 L14 L15 L16	TOROID,10T,3-1/4L	LA009-010-4	W-I	1810-05-0007	4.000
R30	(O)RES,C,1/4W,5%1.8K USE P/N:4701-03-1821	CF1/4-1.8K	KOA	4700-15-1801	1.000

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,1000PF,500V +100%,-0%,FT,X5U D=2%,.28"X.19"	2450-023-X5U0-102PA	TUSNX	1510-30-8102	16.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C21 C22 C27 C29	CAP,FILM,.12uF,100V 5%,RAD.36"Hx.40"LS	MC124JIC	NPC	1510-60-8124	4.000
C23 C24 C26	CAP,CER,1uF,50V 20%,RAD,Z5U .36"H,.20"LS	CZ30C105M	C-L	1510-11-3105	3.000
C30	CAP,MICA,1000PF,100V 5%,RAD.40"HX.23"LS	DM15-102J	ARC	1510-50-6102	1.000
C31	CAP,CER,10PF,1KV 5%,RAD,NPO,T/R .30"DX.16"T,.25LS	10TCCQ10	SPR	1510-10-0100	1.000
C33 C34	CAP,MICA,180pF,500V 5%,RAD.46"Hx.23"LS	DM15-181J	ARC	1510-50-0181	2.000
C35	CAP,CER,1000pF,1KV 10%,RAD,Z5R,T/R .39"Dx.16"T,.25"LS	5GAD10	SPR	1510-10-1102	1.000
C36	CAP,CER,.01uF,100V 20%,RAD,Z5U,T/R .39"Dx.16"T,.25"LS	TGS10	SPR	1510-10-2103	1.000
CR01	(O)DIODE,HI CAP,VART TO-92,CT=120pF,*SS*	MV2301	MOT	4803-02-0008	1.000
CR02 CR03 CR05	DIODE,SIGNAL,GP AXIAL,V=75V,IO=10mA CT=4pF,*SS*	1N914	G-E	4807-01-0914	3.000
IC01 IC02 IC12	HEX,INV,TTL PLAS,DIP-14*SS*	SN7404N	T-I	8000-74-0400	3.000
IC03 IC04 IC05 IC06	CNTR/LCH/PRS,DECADE, PLAS,DIP-14, LW SCHOTTKY,*SS*	SN74LS196N	T-I	8007-41-9610	4.000
IC07	DUAL J-K, NEG, FLIP-FLOP	SN74LS112AN	T-I	8007-41-1210	1.000
IC08	TRIPLE POS AND*SS*	SN74LS11N	T-I	8000-74-1110	1.000
IC09	PHASE DET,FCD ONLY *SS*	11C44DC ONLY	FCD	8000-11-4400	1.000
IC10	OP AMP,JFET INPUT PLAS,DIP-8,18Vdc 13V/uS,*SS*	TL082CP	T-I	7000-00-8200	1.000
IC11	OP AMP,HIGH PERF PLAS,DIP-8,18Vdc .5V/uS,Vos=2mV,*SS*	N5741CV	SIG	7000-57-4100	1.000
L17	CHOKE,COATED,2.2UH 10%,D=0.120IN L=0.300IN,I=395MA	08N2R2	JEF	1810-03-0229	1.000
L18	CHOKE,COATED,0.47UH 10%,D=0.120IN L=0.300IN,I=650MA	08NR47	JEF	1810-03-0478	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION ><	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L19	CHOKE,COATED,0.22UH 10%,D=0.120IN L=0.300,I=1025MA	09CR22K	JEF	1810-03-0228	1.000
Q01	JFET-N,TO-92,GP AMP AUDIO,V=25,Igss=-1nA P=310mW,NF=2.5,SS#1	2N5458	MOT	4901-05-4580	1.000
Q02	NPN,TO-98,AMP F=60M,V=25,Icbo=100n P=400mW,hFE=7K,*SS*	2N5306	G-E	4901-05-3060	1.000
Q03 Q04	NPN,TO-92,GP AMP/SW F=300,V-40,Icex=50nA P=625mW,hFE=100,*SS*	2N3904	NAT	4901-03-9049	2.000
R01 R02	(O)REC,C,1/4W,5%4.7K USE P/N:4701-03-4751	CF1/4-4.7K	KOA	4700-15-4701	2.000
R03 R04 R06 R07 R26	(O)RES,C,1/4W,5%,30K USE P/N:4701-03-3012	CF1/4-30K	KOA	4700-15-3002	5.000
R05	(O) SEE P/N 4610-00-1202	4610-00-4202	W-I	4610-00-4202	1.000
R08 R27	(O)RES,C,1/4W,5%,47K USE P/N:4701-03-4752	CF1/4-47K	KOA	4700-15-4702	2.000
R09	(O)RES,C,1/4W,5%,68K USE P/N:4701-03-6812	CF1/4-68K	KOA	4700-15-6802	1.000
R10 R11 R14	(O)RES,C,1/4W,5%6.8K USE P/N:4701-03-6811	CF1/4-6.8K	KOA	4700-15-6801	3.000
R12	(O)RES,C,1/4W,5%3.3K USE P/N:4701-03-3321	CF1/4-3.3K	KOA	4700-15-3301	1.000
R13 R22 R25	(O)RES,C,1/4W,5%,10K USE P/N:4701-03-1002	CF1/4-10K	KOA	4700-15-1002	3.000
R15	(P)RES,MF,30.1K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-30.1K-F-T/R	KOA	4701-03-3012	1.000
R16	(S)RES,MF,4.32K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-4.32K-F-T/R	KOA	4701-03-4321	1.000
R17 R18	(P)RES,MF,19.6K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-19.6K-F-T/R	KOA	4701-03-1962	2.000
R19	(P)RES,MF,2.10K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-2.10K-F-T/R	KOA	4701-03-2101	1.000
R20	(O)RES,C,1/4W,5%1.8K USE P/N:4701-03-1821	CF1/4-1.8K	KOA	4700-15-1801	1.000
R21	(O)RES,C,1/4W,5%,1K USE P/N:4701-03-1001	CF1/4-1K	KOA	4700-15-1001	1.000
R23	(O)RES,C,1/4W,5%,15K USE P/N:4701-03-1502	CF1/4-15K	KOA	4700-15-1502	1.000
R24	(O)RES,C,1/4W,5%2.7K USE P/N:4701-03-2741	CF1/4-2.7K	KOA	4700-15-2701	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R28	(O)RES,C,1/4W,5%160K USE P/N:4701-03-1583	CF1/4-160K	KOA	4700-15-1603	1.000
R29	(O)RES,C,1/4W,5%,20K USE P/N:4701-03-2002	CF1/4-20K	KOA	4700-15-2002	1.000
R31 R32	(O)RES,C,1/4W,5%,100 USE P/N:4701-03-1000	CF1/4-100	KOA	4700-15-1000	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION ><	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	2.000
C02 C08 C09 C10 C11	CAP,CER,470pF,300V 20%,FT, Z5P,LEADLESS .22"DX.25"L	2482-006-Z5P0-501K	TUSNX	1510-30-3501	5.000
C03 C04	CAP,CER,.01uF,100V 20%,RAD,Z5U,T/R .39"Dx.16"T,.25"LS	TGS10	SPR	1510-10-2103	2.000
C05 C06 C07	CAP,TNT,10uF,25V, 20%,AXL,D=3% .18"x.345"	173D106X0025W	SPR	1510-21-7100	3.000
C16	CAP,CER,.15uF,100V 20%,RAD,Y5V .20"H,.10"LS	CY20A154M	C-L	1510-11-1154	1.000
CR01	DIODE,GE PT CONTACT AXIAL,V=60,IO=50mA SUR I=500mA,*SS*,T/R	IN34A T/R	HIT	4807-01-0034	1.000
CR02 CR03	DIODE,RECT,GP DO-15,V=400V,IO=1.0A *SS*,TAPE&REEL	1N4004	P-C	4806-01-4004	2.000
CR04	DIODE,SIGNAL,GP AXIAL,V=75V,IO=10mA CT=4pF,*SS*	1N914	G-E	4807-01-0914	1.000
IC01	OP AMP,HIGH PERF PLAS,DIP-8,18Vdc .5V/uS,Vos=2mV,*SS*	N5741CV	SIG	7000-57-4100	1.000
IC02	TIMING CIRCUIT, PLAS,DIP-8,18Vdc HIGH STABILITY,*SS*	MC1455P1	MOT	7000-14-5500	1.000
J01 J02	CONN,SMA-F,50,PANEL	2056-0000	O-S	2110-02-1003	2.000
K01	RF RELAY 2PDT MR000-003	35BS5002K1	G-E	4510-00-0003	1.000
L01 L02	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	2.000
Q01 Q02	NPN,TO-92,GP AMP/SW F=300,V-40,Icex=50nA P=625mW,hFE=100,*SS*	2N3904	NAT	4901-03-9040	2.000
Q03	PNP,TO-92,Amplifier F=100,V=25,Icbo=100n P=625mW,hFE=300,*SS*	MPS3702	MOT	4902-03-7020	1.000
R01	(S)RES,MF,51.1,1% 1/8W,AXL,TC=100ppmT/R	MF55D-51.1-F-T/R	KOA	4701-03-5119	1.000
R03 R09	(P)RES,MF,47.5K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-47.5K-F-T/R	KOA	4701-03-4752	2.000
R04*	(P)RES,MF,12.1K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-12.1K-F-T/R	KOA	4701-03-1212	1.000
R05	(S)RES,MF,357,1% 1/8W,AXL,TC=100ppmT/R	MF55D-357-F-T/R	KOA	4701-03-3570	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION ><	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R06	(S)RES,MF,4.75K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-4.75K-F-T/R	KOA	4701-03-4751	1.000
R07	RES,C,1/4W,10%,4.7K	CB4721	A-B	4705-16-4701	1.000
R08 R13	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	2.000
R10	RES,C,1/4W,10%,22M	CB2261	A-B	4700-16-2205	1.000
R11	(P)RES,MF,100K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-100K-F-T/R	KOA	4701-03-1003	1.000
R12	RES,C,1/4W,10%,4.7M	CB4751	A-B	4700-16-4704	1.000
R14	(S)RES,MF,221,1% 1/8W,AXL,TC=100ppmT/R	MF55D-221-F-T/R	KOA	4701-03-2210	1.000
R15	(P)RES,MR,1.82K,1% 1/8W,AXL,TC=100 PPM T/R	MF55D-1.82K-F-T/R	KOA	4701-03-1821	1.000
R17	(P)RES,MF,1K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-1K-F-T/R	KOA	4701-03-1001	1.000
S01	SWITCH,SM000-007	30-1	G-H	5111-00-0002	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MIXER,M9W	M9W-MIXER	W-I	1219-00-0423	1.000
A02	PREAMP,M9W	M9W-PREAMP	W-I	1219-00-0424	1.000
A03	MECH SUBAY,L,M9W-7	MECH L-M9W-7	W-I	1216-00-0220	1.000
A04	PLL3 AUTO CENTER BD	PLL3-AUTO CENTER	W-I	1218-00-2220	1.000
C05	CAP,COMP,500V,2PF	QC-2.0PF	Q-C	1510-40-0020	1.000
C06 C07 C08 C09 C24 C38 C40 C41 C42	CAP,TANT,50V,.47UF	T310A474050AS	UNCAR	1510-21-9470	9.000
C13	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	1.000
C14 C15 C16 C17 C32 C33 C34	CAP,COMP,500V,10PF	QC-10PF	Q-C	1510-40-0100	7.000
C18 C35	CAP,DISC,1KV,120PF	60U121M	MDC	1510-10-1121	2.000
C19	CAP,DISC,100V,.02UF	TG-S20	SPR	1510-10-2203	1.000
C27	CAP,COMP,500V,1PF	QC-1PF	Q-C	1510-40-0010	1.000
C29	CAP,COMP,500V,.75PF	QC-.75PF	Q-C	1510-40-0758	1.000
C30	CAP,CHIP,1PF,100V CC101-R10	03C109CT	RPBLC	1510-00-0010	1.000
C31	CAP,COMP,500V,3PF	QC-3PF	Q-C	1510-40-0030	1.000
C44	CAP,DISC,1KV,100PF	60U101M	MDC	1510-10-1101	1.000
CR01 CR02 CR03 CR04 CR09	DIODE,VARACTOR STATIC SENSITIVE #2	BB205B	APX	4803-02-0004	5.000
CR05 CR07 CR10	DIODE,PIN STATIC SENSITIVE #2	MA47980	M-A	4805-02-0001	3.000
IC01 IC02 IC03 IC04	OP AMP	N5741T	SIG	7000-57-4101	4.000
L01 L21 L22	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	3.000
L02	TOROID,10T,1-1/2L	LA009-010-2	W-I	1810-05-0005	1.000
L03 L07 L08 L11 L12 L14 L15 L16 L17 L20	RF CHOKE,REF ONLY	CHOKE	W-I	1819-99-9999	10.000
L04	CHOKE,8T,32 GA FROM:4705-16-4701	1210-33-0001	W-I	1210-33-0001	1.000
L05 L09 L10 L13 L18 L19 L24	CHOKE.COATED,.22UH	08NR22	JEF	1810-03-0228	7.000
L06	CHOKE,.22MH,10% LA008-R02	506-000022V1	SYS	1810-04-0228	1.000
L23	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	1.000
Q01	TRANS QB000-013	A430	APX	4902-00-4300	1.000
Q02	TRANS QA054-580	2N5458	MOT	4901-05-4580	1.000
Q03 Q04 Q06 Q07	TRANS QA050-530	2N5053	APX	4901-05-0530	4.000

REFERENCE DESIGNATORS	PART DESCRIPTION	MFGR PART NO	MFGR	WAVETEK NO	QTY
Q05	TRANS GB000-018	SD1046	SES	4902-21-0050	1.000
R01 R14	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	2.000
R02	POT,5K,RP130-250	89PR5K	BEK	4610-00-2502	1.000
R03	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1.000
R04 R27 R29 R60	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	4.000
R05	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R06	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R07	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	1.000
R08	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R09	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	1.000
R10	RES,C,1/4W,5%,680	CF1/4-680	ASE	4700-15-6800	1.000
R11 R15	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	2.000
R12 R13	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	2.000
R16 R22 R28 R32 R33 R34 R50 R54 R59 R61	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	10.000
R17 R20 R23 R38 R48 R51 R55	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	7.000
R18 R24 R52 R56	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	4.000
R19 R21 R49 R53	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	4.000
R25 R46	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	2.000
R26 R31	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	2.000
R30 R57	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	2.000
R35 R62	RES,C,1/2W,5%,47 RC105-047	EB4705	A-B	4705-25-4709	2.000
R36 R63	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	2.000
R37	RES,C,1/4W,5%,6.2K	CF1/4-6.2K	ASE	4700-15-6201	1.000
R40	RES,C,1/4W,5%,51K	CF1/4-51K	ASE	4700-15-5102	1.000
R41 R58	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R43	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	1.000
R44	RES,C,1/2W,5%,150	CF1/2-150	ASE	4700-25-1500	1.000
R45	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	1.000
R64	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	1.000
R65	RES,C,1/4W,10%,1.2K	CB1221	A-B	4705-16-1201	1.000
R66	RES,1/4,5%,6.2K A-B RC103-262AB	CB6225	A-B	4705-15-6201	1.000