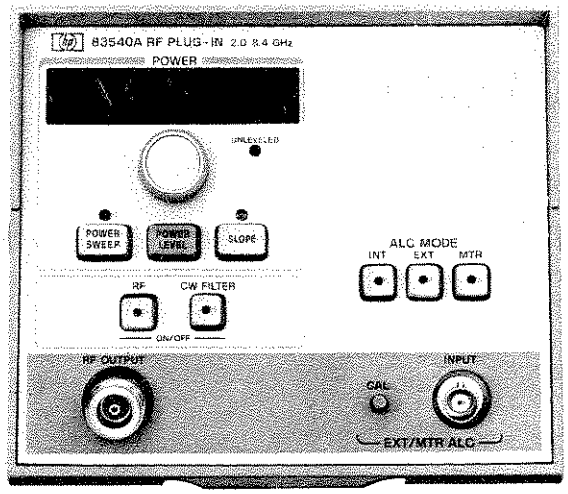
OPERATING AND SERVICE MANUAL

83540A
RF PLUG-IN
2.0 to 8.4 GHz



HEWLETT PACKARD

83540A
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBERS

This manual applies directly to HP Model 83540A RF Plug-in having serial number prefixes 2040A and 2127A.

For additional information about serial numbers, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CA., 95404 U.S.A.

MANUAL PART NO. 83540-90003
MICROFICHE PART NO. 83540-90004

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HEWLETT PACKARD

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SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

Indicates hazardous voltages.

Indicates earth (ground) terminal.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

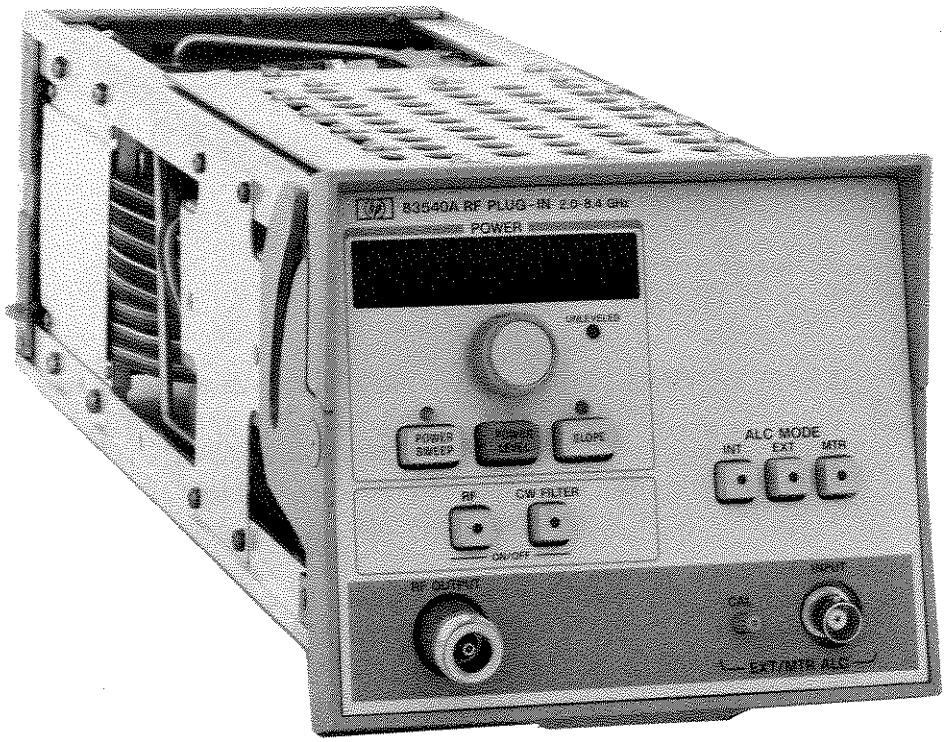


Figure 1-1. Model 83540A RF Plug-in

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 83540A RF Plug-in. Figure 1-1 shows the Model 83540A.

1-3. This manual is divided into eight major sections which provide the following information:

a. SECTION I, GENERAL INFORMATION, includes a brief description of the instrument, safety considerations, specifications, supplemental characteristics, instrument identification, options available, accessories available, and a list of recommended test equipment.

b. SECTION II, INSTALLATION, provides information for initial inspection, preparation for use, storage, and shipment.

c. SECTION III, OPERATION, explains the frequency resolution characteristics of the RF plug-in in CW and swept frequency modes. Operating instructions include FM switch parameter settings, and crystal and power meter leveling instructions. A description of front and rear panel features and plug-in error codes is also given.

d. SECTION IV, PERFORMANCE TESTS, presents procedures required to verify that performance of the RF Plug-in is in accordance with published specifications.

e. SECTION V, ADJUSTMENTS, presents procedures required to properly adjust and align the Model 83540A RF Plug-in after repair.

f. SECTION VI, REPLACEABLE PARTS, provides information required to order all parts and assemblies.

g. SECTION VII, MANUAL BACKDATING CHANGES, provides backdating information required to make this manual compatible with earlier shipment configurations.

h. SECTION VIII, SERVICE, provides an overall instrument block diagram with troubleshooting and repair procedures. Each assembly within the instrument is covered on a separate Service Sheet which contains a circuit description, schematic diagram, component location diagram, and troubleshooting information to aid in the proper maintenance of the instrument.

1-4. Supplied with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of the manual which should be kept with the instrument for use by the instrument operator.

1-5. On the title page of this manual is a "Microfiche" part number. This number may be used to order 10- by 15-centimeter (4- by 6-inch) microfilm transparencies of the manual. Each microfiche contains up to 60 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes sheet as well as all pertinent Service Notes.

1-6. Refer any questions regarding this manual, the Manual Changes sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a worldwide listing of HP Sales/ Service Offices.

1-7. SPECIFICATIONS

1-8. Listed in Table 1-1 are the specifications for the Model 83540A RF Plug-in. These specifications are the performance standards, or limits, against which the instrument may be tested.

Table 1-2 lists the RF Plug-in supplemental performance characteristics. Supplemental performance characteristics are not specifications but are typical characteristics included as additional information for the user.

1-9. SAFETY CONSIDERATIONS

1-10. This product has been manufactured and tested in accordance with international safety standards. Before operation, this product and related documentation must be reviewed for familiarization with safety markings and instructions. A complete listing of Safety Considerations precedes Section I of this manual.

1-11. INSTRUMENTS COVERED BY MANUAL

1-12. Attached to the rear panel of the instrument is a serial number plate. A typical serial number plate is shown in Figure 1-2. The serial number is in two parts. The first four digits followed by a letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The content of this manual applies directly to instruments having the same serial number prefix as those listed on the title page of this manual under SERIAL NUMBER.

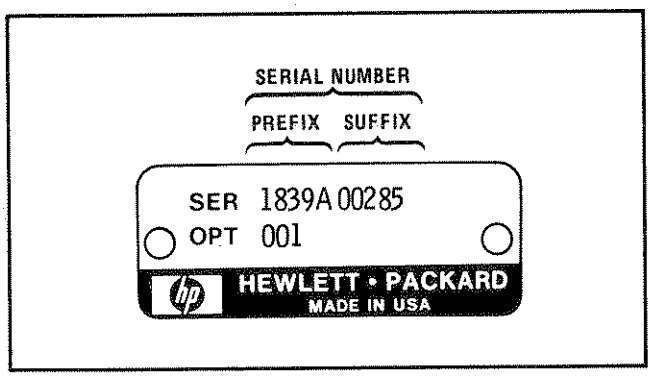


Figure 1-2. Typical Serial Number Plate

1-13. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. An unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for the instrument is then supplied with a Manual Changes supplement that contains information which documents the differences.

1-14. In addition to change information, the Manual Changes supplement contains information for correcting errors in the manual. To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to the manual's print date and part number, both of which appear on the title page. Complimentary copies of the Manual Changes supplement are available on request from Hewlett-Packard.

1-15. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes Supplement, contact your nearest Hewlett-Packard Sales/Service Office.

1-16. DESCRIPTION

1-17. The Model 83540A is an RF plug-in which has been designed for use with the Model 8350A Sweep Oscillator. The RF frequency source for the 83540A is a solid-state tunable YIG Oscillator with a frequency range of 2 to 8.4 GHz.

1-18. Model 83540A front panel functional controls, pushbuttons, and the Rotary Pulse Generator (RPG), are monitored by the Model 8350A via the RF plug-in interface circuits. The Model 8350A generates a tuning voltage according to the mode of operation (CW, START/STOP, CF/ΔF). This signal is scaled and offset by the plug-in to provide a voltage ramp (in swept modes) proportional to the YIG oscillator frequency. The Model 83540A tuning circuits accept the tuning ramp output from the Model 8350A and convert it to a current which drives the YIG oscillator tuning coil.

1-19. The Model 83540A offers a maximum leveled RF output power of +16 dBm. Internal (INT), External (EXT), and Power Meter (MTR) leveling is available as selected by the front panel pushbuttons. A front panel EXT/MTR ALC input connector and gain control (CAL) are provided to use with an external leveling loop. A front panel LED indicates when the RF output becomes unleveled. The RF output level is controlled by the Model 83540A RPG, the Model 8350A data entry controls (keypad and step keys), or through HP-IB control via the Model 8350A.

Table 1-1. Specifications for Model 83540A Installed in Model 8350A (1 of 2)

FREQUENCY[1]

Range 2.0 to 8.4 GHz

Accuracy (25°C ± 5°C)

CW Mode	±15 MHz
All Sweep Modes (Sweep time ≥100 ms)	±20 MHz
Frequency Markers (Sweep time ≥100 ms)	±20 MHz ±0.5% of sweep width

Stability

With 10% Line Voltage Change	±20 kHz
With 10 dB Power Level Change	±1 MHz
With 3 : 1 Load SWR	±250 kHz
With Time (In a 10 minute period after one hour warmup)	±200 kHz
Residual FM, Peak (10 Hz to 10 kHz Bandwidth)	<9 kHz

POWER OUTPUT[1]

Maximum Leveled Output Power[2] (25°C ± 5°C) +16 dBm

With Option 002 +15 dBm

Power Level Accuracy[3] (Internally Leveled) ±1.5 dB

With Option 002[4] (At 0 dB attenuator step) ±1.7 dB

Calibrated Range 15 dB

With Option 002 84 dB

Attenuator Accuracy (± dB referenced from the 0 dB setting):

	Attenuator Setting (dB)						
	10	20	30	40	50	60	70
Attenuator Accuracy	0.5	0.7	0.9	1.2	1.5	1.8	2.1

Power Variation (at specified Maximum Leveled Power or below)

Internally Leveled	±1 dB
Externally Leveled[5]	
Negative Crystal Detector[6]	±0.1 dB
Power Meter[7]	±0.1 dB

Residual AM in 100 kHz Bandwidth (in dB below carrier and at specified maximum leveled power) ≥50 dB

Spurious Signals (at specified maximum leveled power)

Harmonics (in dB below carrier)	≥20 dB
Non-Harmonics (in dB below carrier)	≥60 dB

Output VSWR (internally leveled) <1.6

Power Sweep[8]

Calibrated Range: ≥15 dB
with Option 002:[9] ≥14 dB

MODULATION[1]

External AM

Maximum Input: 15V

Internal AM

Selectable (by internal jumper in 8350A) to 1 kHz or 27.8 kHz square wave modulation. The 27.8 kHz modulation allows operation with HP Model 8755A/B/C Swept Amplitude Analyzer.

On/Off Ratio: ≥30 dB below specified maximum leveled power

Symmetry: 40/60

Table 1-1. Specifications for Model 83540A Installed in Model 8350A (2 of 2)

External FM

Maximum Deviations for Modulation Frequencies:

	Cross Over Coupled	Direct Coupled
DC to 100 Hz:	±75 MHz	±12 MHz
100 Hz to 1 MHz:	± 7 MHz	± 7 MHz
1 MHz to 2 MHz:	± 5 MHz	± 5 MHz
2 MHz to 10 MHz:	± 1 MHz	± 1 MHz

Frequency Response (DC to 2 MHz): ±3 dB

GENERAL SPECIFICATIONS[1]

Minimum Sweep Time (over full band): 10 ms

RF Output Connector: Type N Female

1 Unless otherwise noted, all specifications are at the RF OUTPUT connector and at 0° to 55°C.
2 For temperatures greater than 30°C, maximum leveled output power typically degrades 0.1 dB/degree C.
3 Includes internally leveled power variation.
4 Attenuator switch points are every 10 dB starting at +1 dBm indicated power.
5 With Option 002 at 0 dB attenuator step.
6 Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −200 mV at specified maximum leveled power.
7 Use HP Model 432A/B/C Power Meter. Sweep duration ≥50 seconds.
8 Power Sweep and Slope Compensation total must not exceed 15 dB (14 dB for Option 002).
9 With Option 002, in power sweep or slope functions, power can exceed attenuator step by 4 dB.

Table 1-2. Supplemental Performance Characteristics for Model 83540A Installed in Model 8350A (1 of 2)

NOTE
Values in this table are not specifications, but are typical characteristics included for user information.

FREQUENCY CHARACTERISTICS[1]

Accuracy (25°C ± 5°C)

CW Mode Typically:
2 to 8.4 GHz: ±3.5 MHz

Manual Sweep
2 to 8.4 GHz: ±30 MHz

All sweep modes (Sweep time 10 ms to 100 ms):
±25 MHz

Sweep Mode Linearity:[2]
2 to 8.4 GHz: ±3 MHz

Stability With Temperature: ±200 kHz/°C

OUTPUT CHARACTERISTICS[1]

Power Output

Resolution (Displayed): 0.1 dB

Remote Programming (settable):
Typically ± 0.01 dB

Stability With Temperature (at maximum specified leveled power): ±0.02 dB/°C

Table 1-2. Supplemental Performance Characteristics for Model 83540A Installed in Model 8350A (2 of 2)

Spurious Signals (in dB below carrier)

Harmonics:

At specified maximum leveled power: Typically ≥25 dB

At power level of +10 dBm: Typically ≥30 dB

Non harmonics at specified maximum leveled power: Typically ≥60 dB

Impedance: 50 Ohms

Power Sweep[3]

Accuracy (including linearity): Typically ±1.5 dB

Resolution (displayed): 0.1 dB

Slope Compensation[3]

Linearity: Typically <0.2 dB

Calibrated Range:[4] Up to 5 dB/GHz; up to 15 dB for full sweep range

Resolution (displayed): 0.01 dB/GHz

MODULATION CHARACTERISTICS[1]

External AM

Frequency Response: Typically 100 kHz

Input Impedance: Approximately 10k Ohm

Range of Amplitude Control: Typically 15 dB

Sensitivity: Typically 1 dB/V

Pulse In

TTL Compatible: Logic HIGH=RF ON
Logic LOW=RF OFF

Rise/Fall Time: Typically 20 ns

Minimum Pulse Width:

Leveled: Typically 1 μs

Unleveled (power level set to +25 dBm): Typically 100 ns

External FM

Sensitivity (switch selectable)

FM Mode: Typically −20 MHz/V

Phase-Lock Mode: Typically −6 MHz/V

Input Impedance: 2000 Ohms nominal

GENERAL CHARACTERISTICS

Frequency Reference Output: 1 V/GHz ±25 mV (over full sweep range) rear panel BNC output.

Weight: Net 4.5 kg (10 lb.), Shipping 7.7 kg (17 lb.)

1 Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0° to 55°C.

2 With respect to the SWEEP OUT voltage.

3 Power Sweep and Slope Compensation must not exceed 15 dB, (14 dB for Option 002).

4 With Option 002, in power sweep or slope functions, power can exceed attenuator step by 4 dB.

1-20. A power sweep function allows the RF output power to be swept at least 15 dB during CW mode or swept frequency modes. (The calibrated range of the power sweep function in Option 002 instruments is at least 14 dB.) Power sweep is selected by the front panel POWER SWEEP pushbutton. Slope compensation control is also available by selecting the SLOPE pushbutton and rotating the Model 83540A RPG or manipulating the Model 8350A data entry controls. The power sweep function and slope compensation may both be selected and modified through HP-IB control via the Model 8350A.

1-21. The RF output may be internally or externally amplitude modulated, or externally frequency modulated. Internal square wave modulation frequency is selectable by a Model 8350A internal jumper to be either 1 kHz or 27.8 kHz (for use with the Model 8755 Swept Amplitude Analzer). Rear panel BNC connectors accept an external AM or FM frequency. FM coupling (direct coupled or cross-over) and sensitivity is selected by an internal configuration switch in the Model 83540A. Refer to Section III Operation of this manual for detailed information on the configuration switch.

1-22. A rear panel 1V/GHz signal corresponds to the RF output frequency. This output voltage may by used as a reference for pretuning external equipment in phase locking applications. (The Model 8410B/8411A Network Analyzer utilizes this output in such a configuration.)

1-23. The RF output may be turned off by the RF ON/OFF pushbutton. RF power ON is indicated by the LED in the center of the pushbutton. Additionally, in CW mode, the CW FILTER, when selected, places a capacitor across the YIG oscillator tuning coil to filter high frequency noise which would appear at the RF output. All front panel functions, with the exception of the EXT/MTR ALC CAL adjustment, may be set or altered by computer control via the HP-IB bus connection on the Model 8350A.

1-24. OPTIONS

1-25. Option 002, 70 dB Attenuator

1-26. Option 002 instruments contain a digitally controlled attenuator just before the RF output. Up to 70 dB of attenuation in 10 dB steps is automatically selected as required to attenuate the RF output power to the indicated level. The continuously variable power level function operates as in a standard instrument with the data entry controls. Maximum leveled RF output power is specified at +15 dBm in Option 002 instruments.

1-27. Option 004, Rear Panel RF Output

1-28. Option 004 instruments have the Type N RF output connector and the BNC EXT/MTR ALC input connector on the rear panel instead of the front panel.

1-29. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-30. To have a complete operating sweep oscillator unit, the Model 83540A RF plug-in must be installed in a Model 8350A Sweep Oscillator. Refer to Section II Installation in this manual for a detailed description of RF plug-in installation.

1-31. EQUIPMENT AVAILABLE

1-32. Service Accessories

1-33. A Service Accessory Kit (HP Part Number 08350-60020) is available for servicing the Model 83540A RF plug-in and the Model 8350A Sweep Oscillator. HP Part Numbers for the individual pieces of the kit are provided in Table 1-3. The accessory kit includes:

- Two 44-pin printed circuit board extenders. These boards have keyed slots which allow them to be used in each of the keyed pc board receptacles in the Model 83540, and in the Model 8350A as well.
- An RF Plug-in extender cable set that provides all electrical connections when the RF Plug-in is removed from the sweep oscillator. The RF Plug-in Interface connector (P2) and the Power Supply Interface connector (P1) are extended by separate cables.
- One Hex Balldriver for use in Model 8350A front panel repairs.
- One 16-pin and one 20-pin I.C. Test Clip for probing integrated circuits.

1-34. A listing of service accessories available including service cables, wrenches, adapters, and extender boards is given in Table 1-3.

1-35. Model 8410B/8411A Network Analyzer

1-36. The Model 8350A Sweep Oscillator, with the Model 83540A RF Plug-in installed, is compatible with the HP Model 8410B Network Analyzer system. The combination of the Model 8410B Network Analyzer, the Model 8411A Frequency Converter, and an appropriate display plug-in forms a phasemeter and a ratiometer for direct phase and amplitude ratio measurement on RF voltages. These measurements can be made on single frequencies and on swept frequencies from 110 MHz to 18 GHz. The Model 8350A/83540A combination is capable of operation from 2 GHz to 8.4 GHz within this range. The Model 8410B has an Auto-Frequency range mode which gives it the capability of automatically tracking the Model 8350A Sweep Oscillator over octave and multi-octave frequency bands. Two interconnections to the Model 8350A are necessary to ensure that the Model 8410B will phase lock properly. The Model 8410B Source Control Cable (HP 08410-60146) connects the Model 8410B rear panel SOURCE CONTROL connector to the Model 8350A rear panel PROGRAMMING CONNECTOR. Additionally, the Model 83540A RF Plug-in rear panel 1V/GHz output connects to the Model 8410B rear panel FREQ REF INPUT. The Model 8410B Source Control Cable connector pins and signals are illustrated in the Model 8350A Sweep Oscillator Operating and Service Manual.

Table 1-3. Service Accessories Available

NAME	HP PART NUMBER	DESCRIPTION
44-pin printed circuit board extender	08350-60031*	Extends printed circuit boards
RF Plug-in Extender Cables	08350-60034* 08350-60035*	Extends RF Plug-in Interface connector (P2) Extends RF Plug-in Power Supply Interface connector (P1)
Adjustment Tool	8830-0024	Fits miniature adjustment slot on potentiometers
Wrenches	08555-20097 8710-0946	5/16" slotted box/open end 15/64" open end
Service Cables	8120-1578 83525-60019	18" coax with SMA (m) connector on each end 10" coax with SMB snap on (f) and SMA (m)
Adapters	1250-0777 1250-0082 1250-1404 1250-1158 1250-0674 1250-0675 1250-0069	Type N (f) to BNC (m) Type N (m) to BNC (m) Type N (f) to SMA (f) SMA (f) to SMA (f) SMA (f) to SMB (m) SMA (f) to SMC (m) SMB snap on (m) to SMB snap on (m)
Hex Balldriver	8710-0523*	Removes front panel hold down plate hex screws in 8350A
IC Test Clip	1400-0734* 1400-0979*	16-pin IC test clip 20-pin IC test clip

*These items are included in a Service Accessories Kit HP Part No. 08350-60020 (2 board extenders are included in this kit).

1-37. Model 8755 Frequency Response Test Set

1-38. The Model 8350A Sweep Oscillator with the Model 83540A RF Plug-in installed is compatible with the Model 8755 Frequency Response Test Set for broadband swept scalar measurements. The Model 8350A provides internal 27.8 kHz square wave amplitude modulation of the RF output, eliminating unnecessary cable connections to the Model 8755 or the use of an external modulator. The Model 8350A can also produce alternate sweeps through use of the ALT n function which works in conjunction with the channel switching circuits in the Model 8755C. This permits Channel 1 on the Model 8755C to respond only to the Model 8350A current state and Channel 2 to the alternate state. A single cable (HP Part Number 8120-3174) connects between the Model 8350A rear panel ALT SWP INTERFACE connector and the Model 8755C front panel ALT SWP INTERFACE connector.

1-39. Power Meters and Crystal Detectors

1-40. The RF output can be externally leveled using the HP Model 432 Power Meter or negative polarity output crystal detectors. Refer to Section III Operation of this manual for detailed information on leveling techniques that may be used with the Model 8350A/RF Plug-in combination.

NOTE

The Model 435A and 436A Power Meters should not be used in Model 8350A/ Model 83540A external leveling systems.

1-41. RECOMMENDED TEST EQUIPMENT

1-42. Equipment required for testing and adjusting the instrument is listed in Table 1-4. Other equipment may be substituted if it meets or exceeds the critical specifications indicated in the table.

Table 1-4. Recommended Test Equipment (1 of 3)

Instrument	Critical Specifications	Recommended Model	Use[1]
Sweep Oscillator	No substitute	HP 8350A	P,A,T
Digital Voltmeter (DVM)	Range: –50V to +50V Accuracy: ±0.01% Input Impedance: ⩾10M Ohms	HP3455A	P,A,T
Oscilloscope	Dual Channel Bandwidth: dc to 100 MHz Vertical Sensitivity: ⩽5 mV/Div Horizontal Sweep Rate: ⩽0.1 μ S/Div X vs. Y Display Mode	HP 1740A	P,A,T
Frequency Counter	Frequency Range: 2.0 to 8.4 GHz	HP 5343A	P,A
Spectrum Analyzer	Frequency Range: 2.0 to 18 GHz Residual FM: ⩽100 Hz Must have auxiliary IF output when used with the HP 8901A Modulation Analyzer	HP 8565A or HP 8566A	P,T
Modulation Analyzer	(May be used in addition to Spectrum Analyzer). Frequency Range: Must cover auxiliary IF Output frequency of Spectrum Analyzer used. Residual FM: ⩽10 Hz	HP 8901A	P,T
Swept Amplitude Analyzer	Capable of Transmission and Reflection measurements. Power Resolution: ⩽0.25 dB/Div	HP 8755C	P,A
Display Mainframe	Compatible with HP 8755C Swept Amplitude Analyzer and HP 8750A Storage-Normalizer	HP 182T, TR	P,A
Detector	Compatible with Swept Amplitude Analyzer Frequency Range: 2.0 to 8.4 GHz Power Range: –20 to +10 dBm	HP 11664A	P,A
Storage-Normalizer	Compatible with Display Mainframe and Swept Amplitude Analyzer	HP 8750A	P,A
Frequency Meter	Frequency Accuracy: ⩽0.17% Calibration Increments: ⩽2 MHz Frequency Range: 2.0 to 4.0 GHz 4.0 to 8.4 GHz	HP 536A HP 537A	P,A P,A

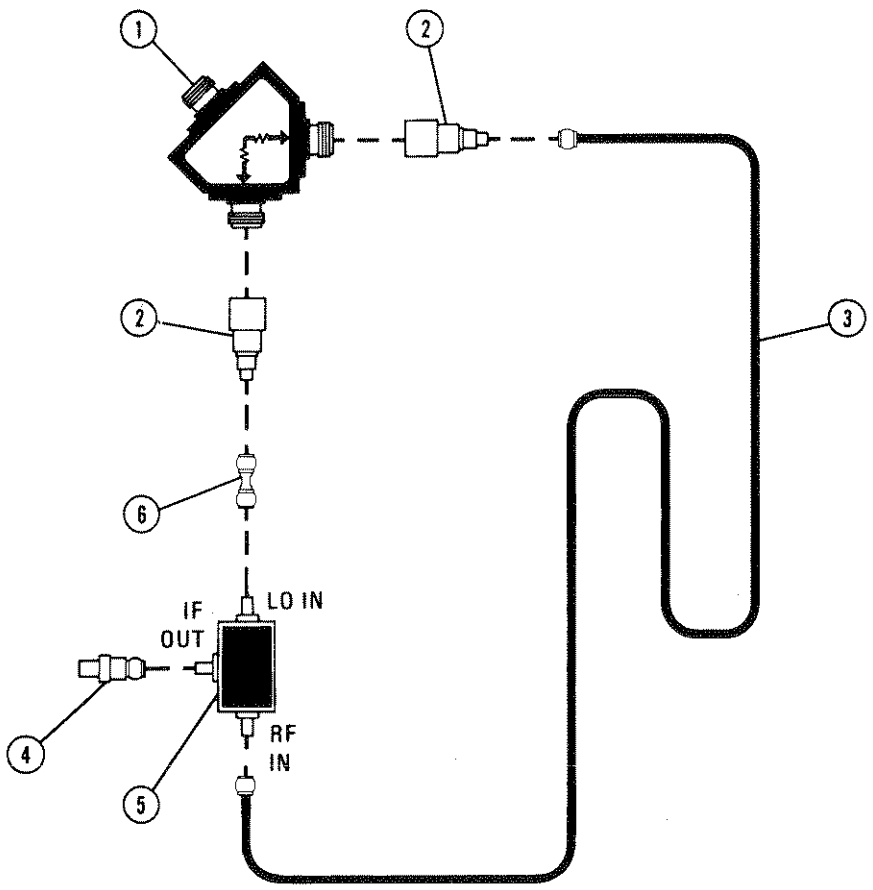
Table 1-4. Recommended Test Equipment (2 of 3)

Instrument	Critical Specifications	Recommended Model	Use[1]
Attenuator	Attenuation: 3 dB ± 0.5 dB Frequency Range: 2.0 to 8.4 GHz Maximum Input Power: ⩾+20 dBm Type-N Connector	HP 8491B Option 003	P
Attenuator	Attenuation: 6 dB ± 0.5 dB Frequency Range: 2.0 to 8.4 GHz Maximum Input Power: ⩾+20 dBm Type-N Connector	HP 8491B Option 006	P
Attenuator	Attenuation: 10 ± 0.5 dB Frequency Range: 2.0 to 8.4 GHz Maximum Input Power: ⩾+20 dBm Type-N Connector	HP 8491B Option 010	P,A
Attenuator	Attenuation: 20 ± 0.5 dB Frequency Range: 2.0 to 8.4 GHz Maximum Input Power: ⩾+20 dBm Type-N Connector	HP 8491B Option 020	P
Adjustable Short	Frequency Range: 1.8 to 12.4 GHz Impedance: 50 ± 1.5 Ohms	Maury Microwave[2] 1953-2	P
Adapter	APC-7 to Type N(m)	HP 11525A	P
Adapter	APC-3.5(f) to Type N(m)	Amphenol[3] 131-7018	P
Directional Coupler	Frequency Range: 2 to 8.4 GHz Mean Output Coupling: ⩾ 20 dB Output Coupling Variation: ⩽ ± 1 dB Minimum Directivity: ⩾ 26 dB	HP 779D	P
RMS Voltmeter	dB Range: –20 to –70 dBm (0 dBm = 1 mW into 600 Ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: ±5% of full scale	HP 3400A	P
Air Line Extension (2 required)	Impedance: 50 Ohms Frequency Range: dc to 8.4 GHz Reflection Coefficient: 0.018 + 0.001 (times the frequency in GHz)	HP 11567A	P
Step Attenuator	Frequency Range: dc to 8.4 GHz Incremental Attenuation: 0 to 70 dB in 10 dB steps Calibration Accuracy: ⩽ ± 0.1 dB at all steps	HP 8495A Option 890	P

Table 1-4. Recommended Test Equipment (3 of 3)

Instrument	Critical Specifications	Recommended Model	Use[1]
Function Generator	Frequency Range: 0.1 Hz to 10 MHz Sine wave and square wave output Output Level: 10 V p-p into 50 Ohms Output Level Flatness: $\leqslant \pm 3\%$ from 10 Hz to 100 kHz $\leqslant \pm 10\%$ from 100 kHz to 10 MHz	HP 3312A	P,A,T
Power Meter	Power Range: –20 to +10 dBm (No substitute when used for external power meter leveling).	HP 432A	P,A
Thermistor Sensor (Used with HP 432A)	Frequency Range: 2.0 to 8.4 GHz Maximum SWR: $\leqslant 1.75$	HP 8478B	P,A
Power Meter	Power Range: 1 μW to 100 mW	HP 436A	P,A
Power Sensor (Used with HP 436A)	Frequency Range: 2.0 to 8.4 GHz	HP 8481A	P,A
Crystal Detector	Frequency Response: 2.0 to 8.4 GHz Maximum Input Power: 100 mW	HP 423B	P,A
Power Splitter	Frequency Range: 2.0 to 8.4 GHz Output Port Tracking: $\leqslant 0.25$ dB Maximum Input Power: +20 dBm	HP 11667A	P,A
Band Pass Filters	Frequency Range: 4 to 8 GHz 6 to 8 GHz 8 to 12.4 GHz	HP Part No. 0960-0402 HP Part No. 0960-0200 HP Part No. 0960-0403	A A A
DC Power Supply	DC Output: 0 to 6.5 Vdc ± 0.05 Vdc	HP 6213A	A
50 Ohm Termination	Type N, 50 Ohms ± 0.5 Ohms	HP 909A	P,A
Delay Line Discriminator	Refer to Figure 1-3.		
PC Board Extender	44-pin, extends printed circuit boards	HP Part Number 08350-60031 (each)	T
RF Plug-in Extender Cable	Extends RF Plug-in Interface Connector (J2)	HP Part Number 08350-60034	T
RF Plug-in Extender Cable	Extends RF Plug-in Power Supply Interface Connector (J3)	HP Part Number 08350-60035	T

[1] P = Performance Test; A = Adjustments; T = Troubleshooting
[2] Mauray Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730
[3] Amphenol North America, Bunker-Ramo Corp., RF Operations, 33 E. Franklin St., Danbury, CT 06810



Item	Description	HP Part Number
1	Power Splitter	HP 11667A
2	Adapter: Type N Male to SMA Female (2 required)	1250-1250
3	Delay Line: >1 meter (3 feet) in length, SMA male connectors	08503-20038
4	Adapter: BNC Female to Male SMA	1250-1200
5	Mixer: Double Balanced 1 to 12 GHz: RHG Electronics Part No. DM 1-12 1 to 18 GHz: RHG Electronics Part No. DM 1-18 RHG Electronics Laboratories, Inc. Deer Park, NY 11729	 0960-0451 0960-0543
6	Adapter: SMA Male to SMA Male	1250-1159

Figure 1-3. Delay Line Discriminator

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides installation instructions for the Model 83540A RF Plug-in. This section also includes information about initial inspection, and damage claims, preparation for use, packaging, storage, and shipment.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV, Performance Tests, in the Model 8350A Operating and Service Manual. Performance Test limits are given in Section IV of this manual. If the instrument combination does not pass the electrical Performance Tests, refer to Section V, Adjustments, of this manual. If, after the adjustments have been made, the instrument combination still fails to meet specifications, and a circuit malfunction is suspected, refer to troubleshooting procedures in Section VIII, Service, in this manual. If the instrument does not pass the above electrical tests, if the shipment contents are incomplete, or if there is mechanical damage or defect, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or if the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. When the Model 83540A RF Plug-in is properly installed, it obtains all power through the rear panel interface connector from the Model 8350A Sweep Oscillator.

2-8. RF Plug-in Configuration Switch

2-9. The Model 83540A RF Plug-in has a configuration switch (A3S1) located on the A3 Digital Interface Board. This switch must be preset prior to RF Plug-in operation in the Model 8350A. The configuration switch is an 8-section multiple switch. Each separate switch corresponds to a separate RF plug-in function such as FM sensitivity selection, FM input coupling selection (direct coupled or cross-over), RF power level at power on (maximum or off), and Option 002 Step Attenuator operation. Refer to Section III, Operation, in this manual for a complete description of the configuration switch and instructions on how to set the switches.

2-10. Interconnections

2-11. There are two rear panel interconnections on the Model 83540A RF Plug-in and the Model 8350A Sweep Oscillator. These are the RF Plug-in Interface connector (P2) and the Power Supply Interface Connector (P1). A complete listing of pins and associated signals and voltages for these connectors are listed on the Motherboard Wiring List in Section VIII, Service, of this manual. Figures 2-1 and 2-2 provide the connector configurations and associated signal mnemonics. For convenience, these figures are repeated in Section VIII, preceding the Motherboard Wiring List.

2-12. Mating Connectors

2-13. All of the externally mounted connectors on the Model 83540A are listed in Table 2-1. Opposite each connector is an industry identification, the HP part number of a mating connector, and the part number of an alternate source for the mating connector. For HP part numbers of the externally mounted connectors themselves, refer to Section VI, Replaceable Parts, of this manual.

2-14. Operating Environment

2-15. Temperature. The instrument may be operated in temperatures from 0°C to +55°C.

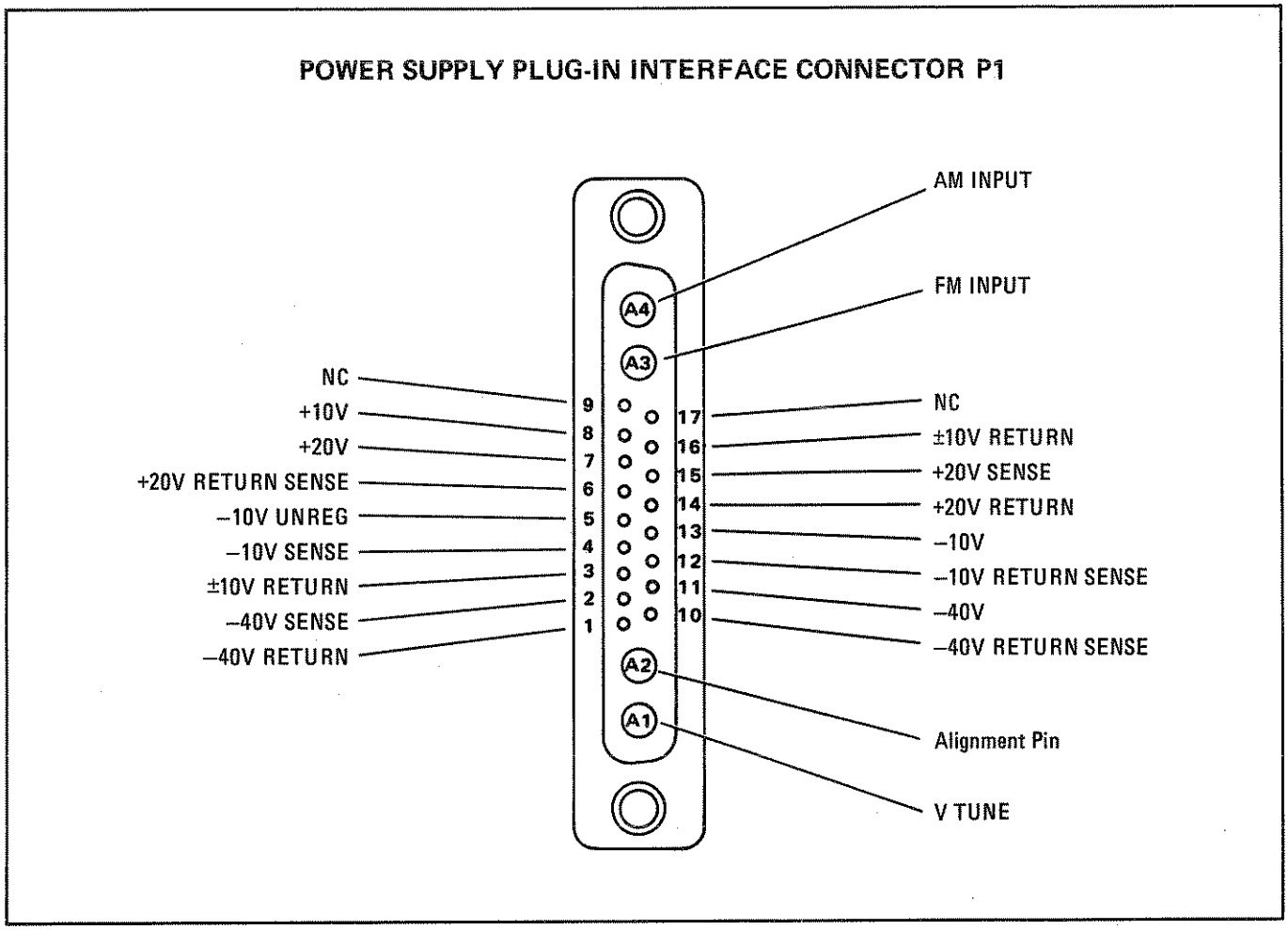


Figure 2-1. Interface Signals on Connector P1

Table 2-1. Mating Connectors

83540A Connector		Mating Connector	
Connector Name	**Industry Identification**	**HP Part No.**	**Alternate Source**
J1 RF INPUT	TYPE N (f)	1250-0882	Specialty Connector 25-P117-2
J2 EXT/MTR ALC INPUT	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J3			Not Used
J4 1V/GHz	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J5 PULSE IN	BNC (f)	1250-0256	Specialty Connector 25-P118-1

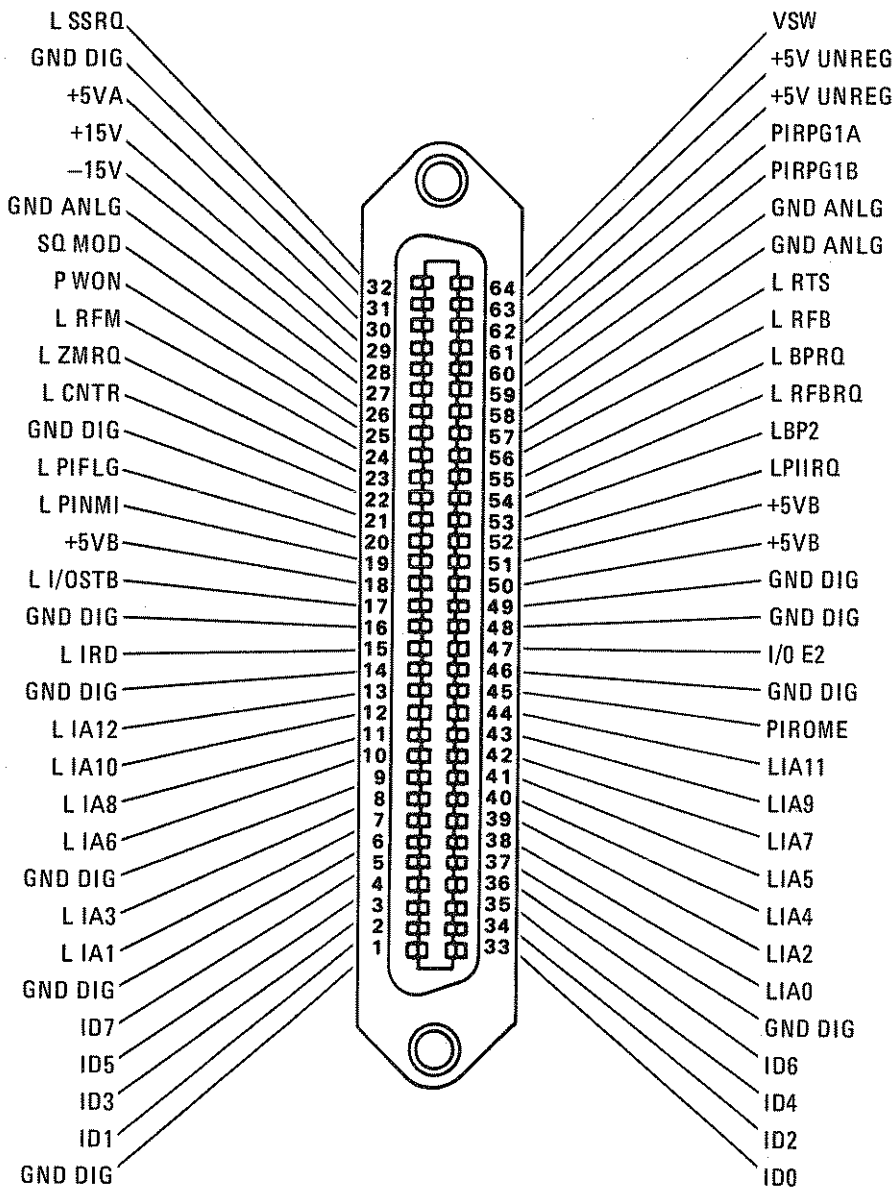


Figure 2-2. Interface Signals on Connector P2

2-16. Humidity. The instrument may be operated in environments with humidity from 5% to 80% relative at +25°C to +40°C. However, the instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-17. Altitude. The instrument may be operated at altitudes up to 4572 meters (approximately 15,000 feet).

2-18. Cooling. When the Model 83540A RF Plug-in is properly installed in the Model 8350A Sweep Oscillator, it obtains all of its cooling airflow by forced ventilation from the fan in the Model 8350A. A diagram showing the various cooling airflow paths within the sweep oscillator is given in Section II, Installation, of the Model 8350A Sweep Oscillator Operating and Service Manual. Ensure that all airflow passages in the Model 8350A and the Model 83540A are clear before installing the RF Plug-in in the Sweep Oscillator.

2-19. Installation Instructions

2-20. To operate as a completely functional sweep oscillator, the Model 83540A RF Plug-in must be installed in a Model 8350A Sweep Oscillator. To install the Model 83540A RF plug-in in the Model 8350A Sweep Oscillator:

a. Set the Model 8350A mainframe LINE switch to OFF.

b. Remove all connectors and accessories from the front and rear panel connectors of the Model 83540A to prevent them from being damaged.

c. Position the RF plug-in unit latching handle in the fully raised position. The latching handle should spring easily into the raised position and be held by spring tension.

d. Ensure that the Model 8350A RF plug-in channel is clear, align the RF plug-in in the channel and slide it carefully into place toward the rear of the channel. It should slide easily without binding.

e. The drawer latch handle slot will engage with the locking pin just before the RF plug-in is fully seated in position.

f. Press the latch handle downward, while still pushing in on the RF plug-in, until the drawer latch is fully closed and the front panel of the RF plug-in is aligned with the sweep oscillator front panel.

2-21. STORAGE AND SHIPMENT

2-22. Environment

2-23. The instrument may be stored or shipped in environments within the following limits:

Temperature.....	−40°C to +75°C
Humidity.....	5% to 95% relative at 0° to +40°C
Altitude	Up to 15240 meters (approximately 50,000 feet)

2-24. The instrument should also be protected from temperature extremes which may cause condensation in the instrument.

2-25. Packaging

2-26. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. A complete diagram and listing of packaging materials used for the Model 83540A is shown in Figure 2-3. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number (located on rear panel serial plate). Mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-27. Other Packaging. The following general instructions should be used for repackaging with commercially available packaging materials:

a. Wrap the instrument in heavy paper or plastic. If shipping to a Hewlett-Packard Office or Service Center, attach a tag indicating the type of service required, return address, model number, and full serial number.

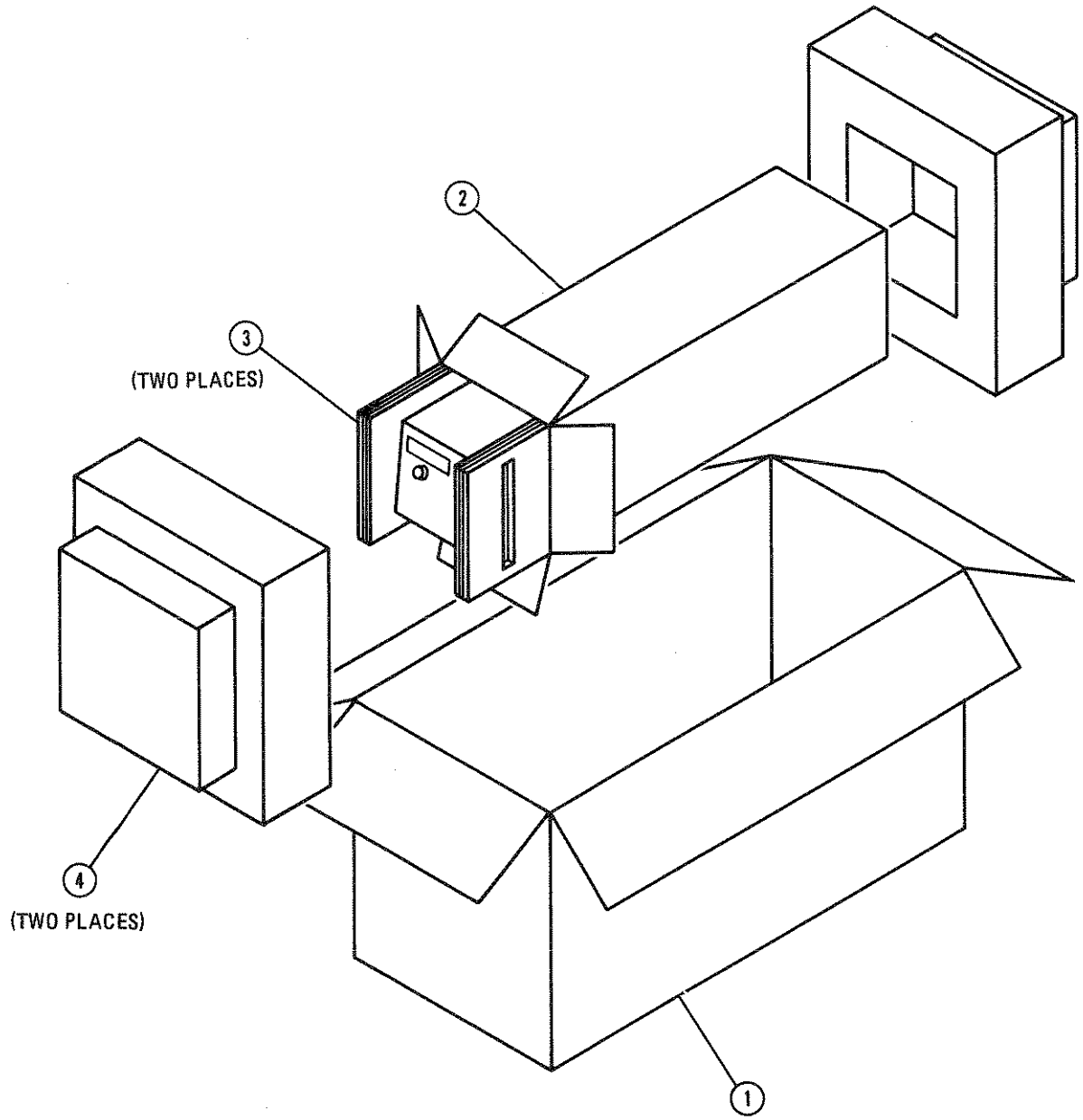
b. Use a strong shipping container.

c. Use enough shock-absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

f. In any correspondence, refer to the instrument by model number and full serial number.



Item	Quantity	HP Part Number	C D	Description
1	1	9211-3515	6	Outer Carton
2	1	9211-3514	5	Inner Carton
3	2	9220-3409	6	Side Pads – Corrugated Cardboard
4	2	9220-3406	3	Foam Pads
	1	9222-0352	6	Poly Bag – to cover instrument

Figure 2-3. Packaging for Shipment Using Factory Packaging Materials

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section is divided into four major parts. Operating Characteristics explains the frequency resolution characteristics in continuous wave (CW) and swept modes. Front and rear Panel Features are shown with descriptions. Operating Instructions provide configuration switch setting instructions, and crystal detector and power meter leveling procedures. Operator's Maintenance includes information on the plug-in error codes, fuses, and service tags.

3-3. OPERATING CHARACTERISTICS

3-4. Frequency Resolution

3-5. Two areas relating to frequency resolution must be considered; these are input resolution and displayed resolution. Input resolution refers to the number of bits (8 bits = 256 points) used in the digital to analog converters (DACs) to generate the tuning voltage for a particular mode of operation. Table 3-1 cross references input resolution with each DAC used. Displayed frequency resolution refers to the number of digits shown on the 8350A FREQUENCY displays.

Table 3-1. Input Resolution

DAC Used	Voltage Resolution	Frequency Resolution
CF	2.5 mV	1.63 MHz
Vernier	40 μV	25.4 kHz
ΔF 1-1/8 of band	10 mV	6.5 MHz
ΔF 1/8–1/64 of band	1.25 mV	0.81 MHz
ΔF $\leq$1/64 of band	0.156 mV	101.6 kHz

3-6. Figure 3-1 is a simplified block diagram of the frequency tuning circuits. The net tuning voltage results from the summation of the three DAC outputs. With this DAC configuration the START/STOP sweep mode is computed by the microprocessor into a center frequency and a ΔF sweep width. Therefore the operation of all sweeps are set with a center frequency and sweep width. The center frequency is specified by the center frequency (CF) DAC and the Vernier DAC, and the sweep width is determined by the ΔF DAC.

3-7. The CF DAC has 12 bits, hence 4096 points across the plug-in frequency band (including overrange). The analog output ranges from zero to ten volts, which is used to coarsely specify the center frequency output of the plug-in. These parameters give the CF DAC a resolution of 0.024% (2.5mV) over the full band (including overrange).

3-8. Resolution of Center Frequency is enhanced by a summed voltage generated by an 8-bit (256 points) Vernier DAC. Vernier range is set to $\pm$0.05% of RF plug-in bandwidth (including overrange). In multiband plug-ins, total range of the vernier will vary with each band sweep. Vernier resolution is determined by dividing $\pm$0.05% bandwidth by 256 points (128 points either side of CF). The voltage range of the total 256 points on the Vernier DAC is equal to four points on the 12-bit CF DAC (two points on either side of CF). This increases CF resolution from 0.024% (2.5mV) to 0.00038% (.04mV), and improves the relative accuracy of the CF by a similar factor.

NOTE

When adjusting the vernier through its zero-point, the CF DAC is incremented or decremented by the total value of the vernier (2 points on the CF DAC). At this time the accuracy of the Center Frequency is again entirely dependent on the CF DAC, 0.005% of bandwidth.

3-9. The ΔF DAC has 10 bits (1024 points). The analog conversion ranges from -5 to $+5$ volts to produce an even sweep on either side of the center frequency. The ΔF resolution improves with narrower sweep widths. For broad sweeps, the resolution is 0.1% of the full band. Greater resolution is provided for sweep widths less than 1/8 of the full band range. At these sweep widths, the resolution is improved to 0.012% of the full band.

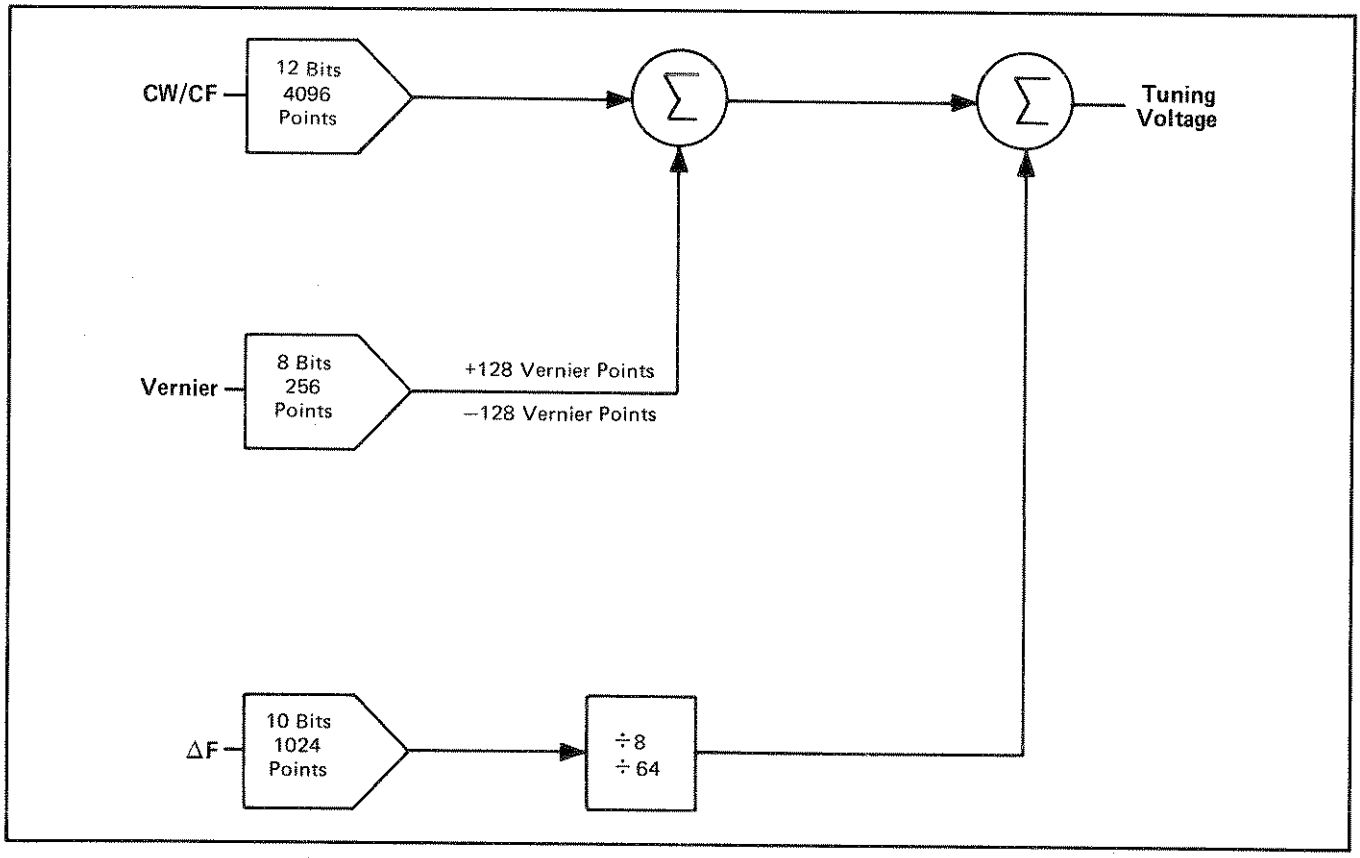


Figure 3-1. Simplified Tuning Voltage Block Diagram

3-10. Center Frequency (CF) is always displayed with 1 MHz resolution. Likewise, Vernier values are always displayed at 10 kHz resolution. Display resolutions for ΔF values vary with sweep width. Figure 3-2 illustrates the relationship of ΔF mode display resolution and ΔF sweep widths.

3-11. PANEL FEATURES

3-12. Front and rear panel features are described in Figure 3-3 and 3-4, respectively. Each feature is depicted by number designators; descriptions are provided below each figure.

3-13. OPERATORS CHECKS

3-14. The Operator's Checks (local and remote) in the 8350A sweep oscillator manual provide a quick evaluation of both 8350A and 83540A main functions. Error codes 50 to 99, displayed on the 8350A FREQUENCY display, indicate plug-in related problems. The 8350A Local Check covers the sweep oscillator and RF plug-in. If the correct indications are not obtained, trouble may be in either of the units. If the RF plug-in is suspected, follow the troubleshooting information in Section VIII, Service, in this manual, to isolate the problem.

3-15. OPERATING INSTRUCTIONS

3-16. Internal Leveling

3-17. The most convenient method of RF output leveling is internal leveling. A portion of the RF output is coupled out of an internal directional detector, producing a dc voltage proportional to the RF output signal. This detected dc voltage is applied to the automatic leveling control circuit (ALC).

3-18. External Crystal Detector Leveling

3-19. RF ouput power may also be leveled externally using a power splitter (or directional coupler) and external crystal detector. This leveling system uses a power splitter to sample the RF output signal and a crystal detector to produce a dc voltage proportional to the RF power level. The detector output voltage is compared with an internal reference voltage, and the difference voltage changes the output power level to maintain a constant output level. A directional coupler may be used instead of a power splitter to sample the RF signal for the leveling loop. Directional couplers are usually narrow band, whereas the power splitter is flat

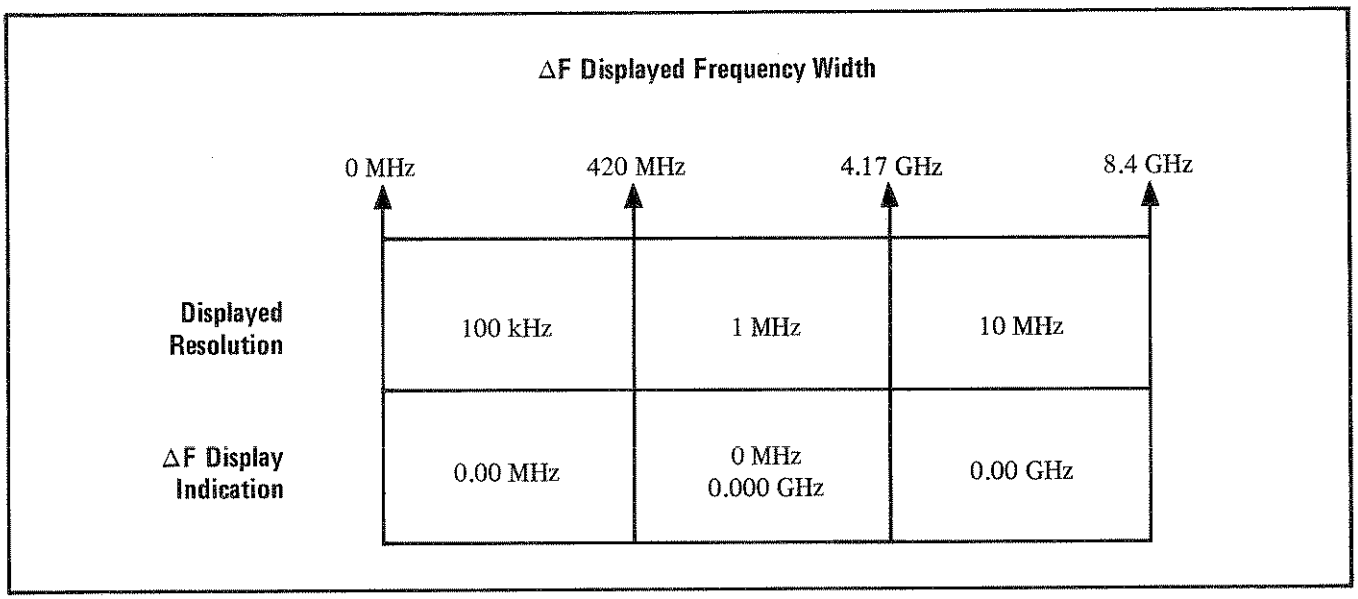


Figure 3-2. Model 83540A ΔF Sweep Mode Displayed Resolution

over a wide frequency range. The advantage of a directional coupler is that it does not have the 6 dB loss like the power splitter, therefore, a higher maximum leveled power output may be obtained. Figure 3-5 illustrates a typical crystal detector leveling setup.

3-20. External Power Meter Leveling

3-21. RF output power may also be leveled with a power meter and power splitter (or directional coupler) as shown in Figure 3-6. The sweep time is limited to greater than 50 seconds when this leveling method is used. A sample of the RF output signal is routed to a power meter which produces a dc output voltage proportional to the RF signal level. This dc voltage is applied to the 83540A ALC circuits and compared with an internal reference voltage. A difference voltage is produced and amplified by the ALC amplifier before being applied, as modulator drive, to a PIN Modulator. Figure 3-6 illustrates a typical power meter leveling setup.

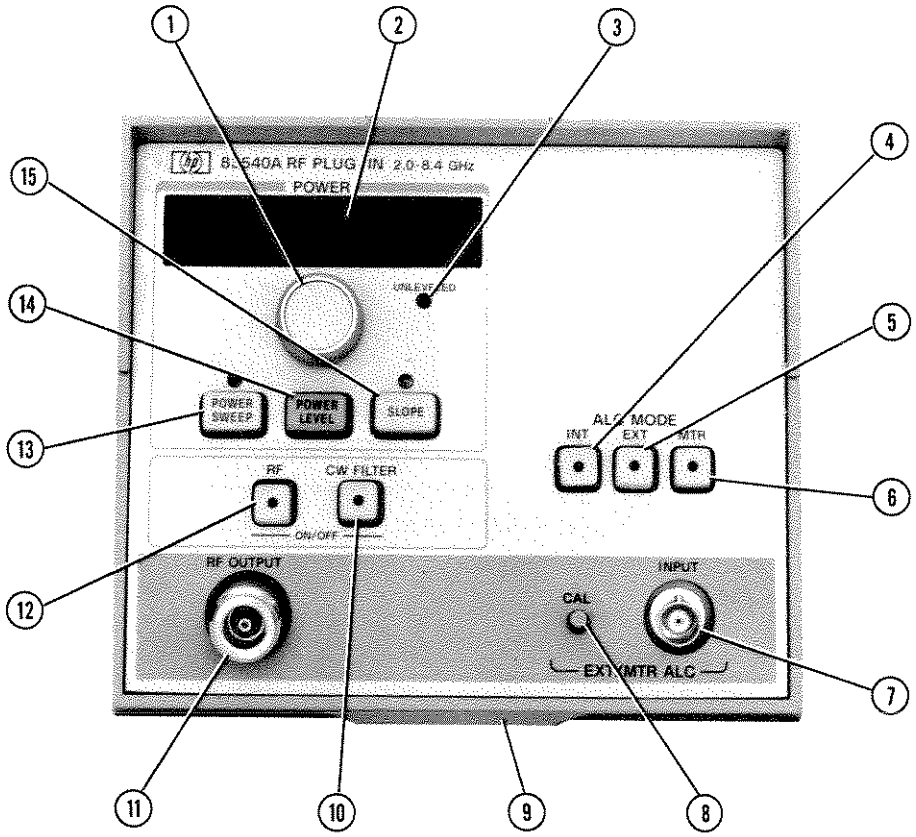
3-22. External FM

3-23. The 83540A RF output signal can be frequency modulated using an external modulating signal applied to the 8350A FM INPUT connector. The external FM function provides a means of obtaining an output frequency that varies under the control of an external modulating signal. A positive going voltage at the FM INPUT causes output frequency to decrease while a negative going voltage causes output frequency to increase. The sensitivity and coupling of the modulating signal may be set via configuration switch (A3S1). Figure 3-7 lists the available configuration switch settings. The configuration switch settings override Sweep Oscillator non-volatile memory settings at Instrument Preset.

3-24. External Amplitude Modulation

3-25. Pulse Modulation (PULSE IN Connector on Plug-in). The PULSE IN connector provides pulsed or square wave modulation, where the RF output is switched on and off. This input provides an on/off power ratio of greater than 30 dB below specified maximum leveled power. The PULSE IN input is normally at a TTL HIGH (approximately +3 Volts dc). When a TTL LOW signal (approximately 0 Volts dc) is applied, the RF output power is turned off. To get the best pulse modulation performance, the RF output power should be set at +25 dBm. With this power setting, pulse repetition rates up to 1 MHz are achievable. With leveled power, pulse repetition rates may be up to 100 kHz. The input impedance for TTL level signals is approximately 500 Ohms. If the PULSE IN circuit is driven beyond TTL levels, the input impedance is reduced to approximately 200 Ohms due to diode clamping action. See the specifications and supplemental characteristics in Section I for more details on the modulation characteristics when using this input.

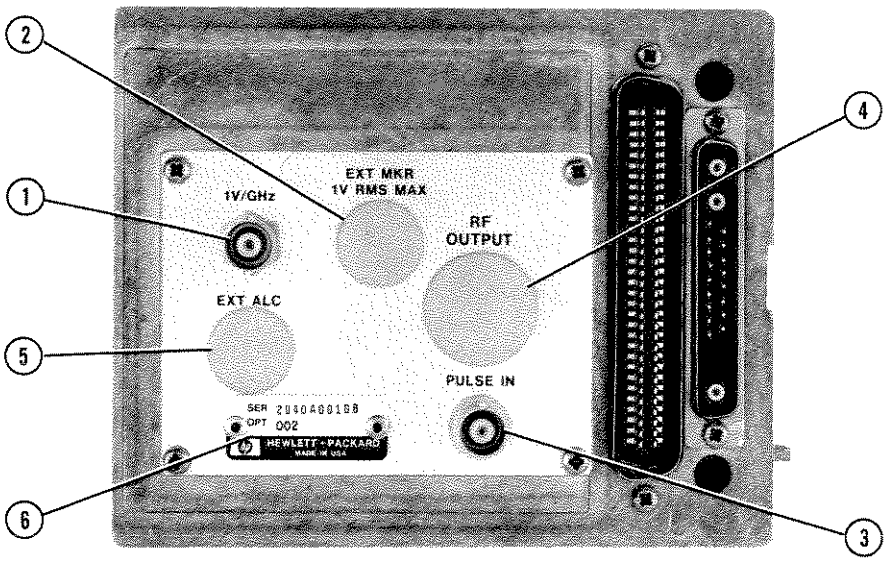
FRONT PANEL FEATURES



1. Power control knob for controlling power sweep, power level, or slope.
2. Plug-in display provides readout of selected power mode in dBm, dB/GHz, or dB/SWP to a tenth of a dB/dBm.
3. UNLEVELED lamp lights if output power is insufficient to level to desired reference.
4. Internal leveling control selection.
5. External leveling control selection (negative crystal detector).
6. Power meter leveling control selection (HP 432 Power Meter only).
7. BNC connector (J2) for power meter or external crystal leveling inputs. (For Option 004 instruments, see Rear Panel features.)
8. Offset control for calibrating output power with external ALC loop.
9. Plug-in latch handle is used to remove, install, and latch the RF plug-in in the sweep oscillator.
10. CW FILTER enables an oscillator tuning voltage filter when in CW mode.
11. Type N 50-ohm RF output connector (J1). (For Option 004 instruments, see Rear Panel features.)
12. RF On/Off key is used for zeroing a power meter or referencing an X-Y recorder.
13. POWER SWEEP allows power to increase relative to sweep (dB/SWP), depending on the value input via RPG or DATA ENTRY keys.
14. POWER LEVEL enables setting of output power for all ALC modes (may be calibrated for external leveling).
15. SLOPE allows setting of the frequency slope compensation in dB/GHz (for lossy devices).

Figure 3-3. Front Panel Features

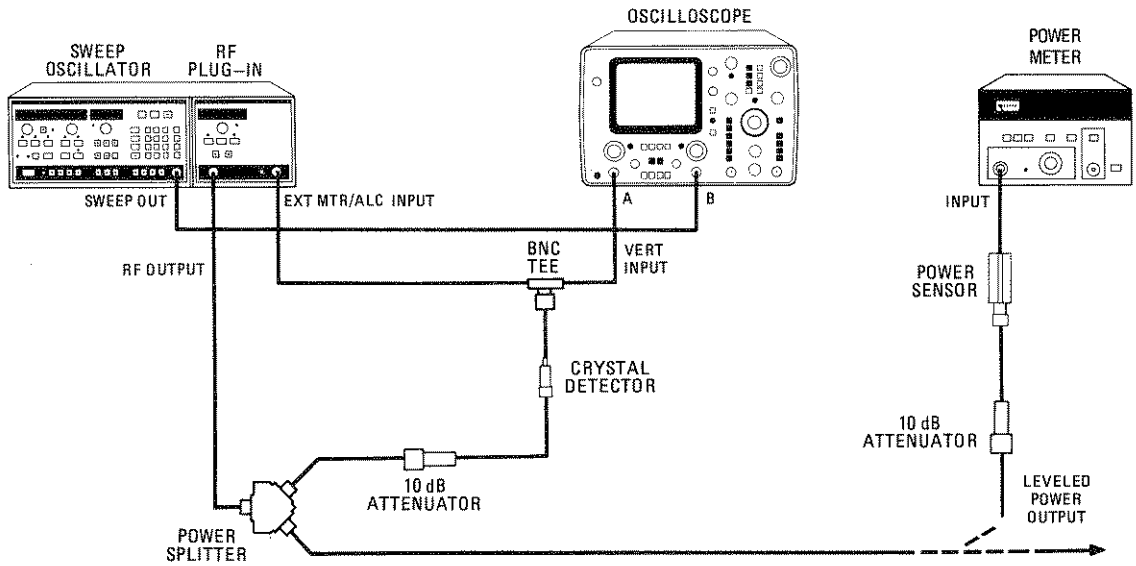
REAR PANEL FEATURES



1. 1V/GHz connector (J4) provides a frequency reference output of approximately 1 volt dc per GHz.
2. EXT MKR (J3) is not used in this plug-in.
3. PULSE IN connector (J5) receives external pulse or squarewave modulation signals.
4. RF OUTPUT connector (J1) replaces front panel RF output connector in Option 004 plug-ins.
5. EXT ALC connector (J2) replaces front panel EXT ALC connector on Option 004 plug-ins.
6. Serial Number Plate has a ten digit serial number (used in any correspondence concerning plug-in) and Option number if applicable.

Figure 3-4. Rear Panel Features

EXTERNAL CRYSTAL DETECTOR LEVELING



EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83540A
Oscilloscope	HP 1740A
Power Meter	436A
Power Sensor	HP 8481A
Crystal Detector	HP 423B
Power Splitter	HP 11667A
10 dB Attenuator (2 required)	HP 8491A, Option 010
BNC Tee	HP 1250-0781

PROCEDURE:

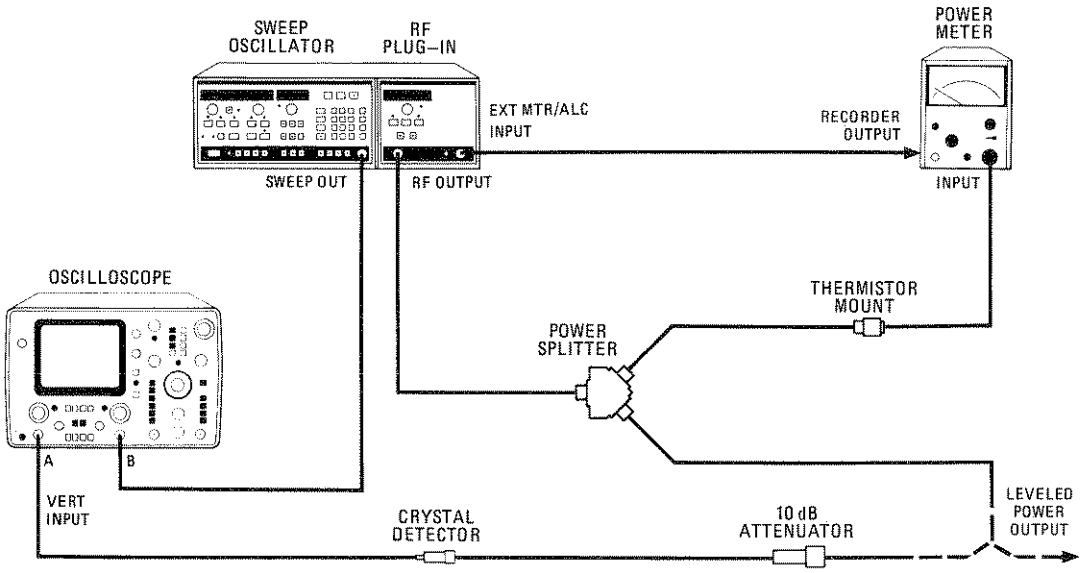
NOTE

Crystal output signal must be between −10 mVdc and −200 mVdc.

1. Connect equipment as shown in test setup.
2. Switch 8350A LINE switch to ON. Press INSTR PRESET key. The START and STOP indicators should be on.
3. Press 83540A ALC MODE EXT .
4. Adjust EXT/MTR ALC CAL for a power meter reading equal to the front panel output power.
5. To use leveled RF power output for testing external equipment, make connection at point marked "Leveled Power Output".

Figure 3-5. External Crystal Detector Leveling

EXTERNAL POWER METER LEVELING



EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83540A
Power Meter	HP 432A
Thermistor Mount	HP 8478B
Oscilloscope	HP 1740A
Crystal Detector	HP 423B
10 dB Attenuator	HP 8491A, Option 010
Power Splitter	HP 11667A

PROCEDURE:

NOTE

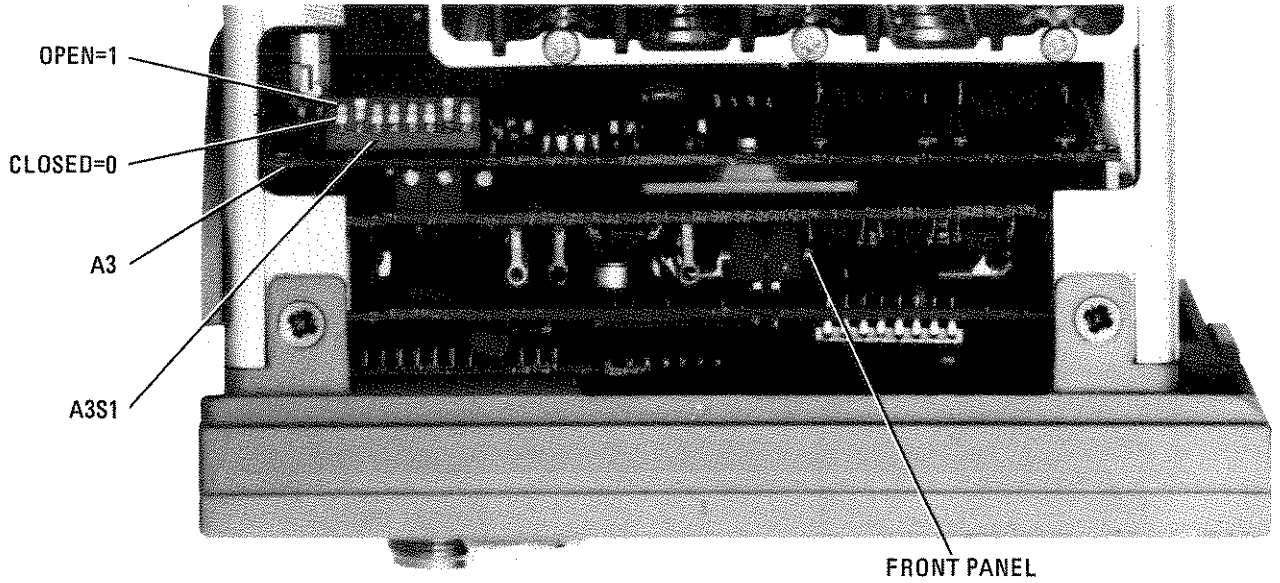
For power meter leveling, sweep rates should be slower than 50 sec/sweep to ensure proper leveling due to the slow response of the thermistor mount. The HP 435 and 436 power meters will not power meter level this plug-in. Only an HP 432 may be used.

1. Connect equipment as shown in test setup.
2. Set LINE switch to turn on sweep oscillator. The START and STOP indicators should light, indicating the START/STOP mode is selected.
3. Set controls as follows:

   8350A: Press INSTR PRESET
   SWEEP TIME ..... 50 sec

   83540A: Set power to maximum specified.
   ALC MODE..... MTR
4. Select +10 dBm range on power meter.
5. Adjust 83540A EXT/MTR ALC CAL for a +10 dBm reading on the 432A power meter. Press 8350A SWEEP TRIGGER SINGLE key twice to set single sweep mode and start a sweep.
6. To use level RF power output for testing external equipment, make connection at point marked "Leveled Power Output".

Figure 3-6. Power Meter Leveling



Description	Switch Number							
	1	2	3	4	5	6	7	8
†Code for 83540A Plug-in (Note 4)	0	1	0	X	X	X	X	X
RF Power Off at Instrument Preset	X	X	X	1	X	X	X	X
Maximum RF Power at Instrument Preset	X	X	X	0	X	X	X	X
–6 MHz/V FM Sensitivity	X	X	X	X	1	X	X	X
–20 MHz/V FM Sensitivity	X	X	X	X	0	X	X	X
Direct-Coupled FM (Note 3)	X	X	X	X	X	1	X	X
Crossover- Coupled FM	X	X	X	X	X	0	X	X
†Step Attenuator Option 002 Installed (Note 4)	X	X	X	X	X	X	1	X
†No Step Attenuator (Note 4)	X	X	X	X	X	X	0	X

NOTES

1. Switch Positions
   1 = Switch Open = High
   0 = Switch Closed = Low (Ground)
   x = Don't Care
   * = Varies; 1 if Opt. 002, 0 if no Opt. 002

2. Switch is set at the factory as follows:

Switch No.	1	2	3	4	5	6	7	8
Position	0	1	0	0	0	0	*	X

3. When direct-coupled FM is selected, FM sensitivity is –20 MHz/V and switch Number 5 is overridden.

4. Switches with † should not be changed from Factory setting.

Figure 3-7. Configuration Switch

3-26. Amplitude Modulation (AM INPUT Connector on 8350A). The AM INPUT connector provides linear amplitude changes (up to approximately 15 dB) proportional to the modulating input voltage. It is limited to a frequency response of about 100 kHz. For maximum depth of modulation (i.e., maximum modulation index), the RF power level should be set to the middle of the control range (e.g., +8.5 dBm for a plug-in with calibrated power control from +1 to +16 dBm). For plug-ins equipped with Option 002 (70 dB Step Attenuator), the middle of the attenuator range should be selected. The center of the power control range may be selected with the front panel power control knob or by applying a dc bias voltage on the external modulating signal. A positive (+) dc voltage into the AM INPUT causes a decrease in RF output power; a negative (−) dc voltage causes an increase in RF output power.

3-27. RF Power Control

3-28. The RF power set at power-up (Instrument Preset) may be either maximum power (+16 dBm; +15 dBm in Option 002 instruments) or RF power OFF as selected on the configuration switch (A3S1). Refer to Figure 3-7 for this setting. The configuration switch also has switch settings for the model plug-in used and Option 002 Step Attenuator. The configuration switch settings override Sweep Oscillator non-volatile memory settings at Instrument Preset. Switch numbers 1, 2, 3, and 7 are set at the factory and should not be changed.

3-29. Option 002 Step Attenuator

3-30. With Option 002 installed, the RF output power may be continuously controlled from +15 dBm to −69 dBm. When the selected POWER setting goes below +1 dBm, the step attenuator increments, as required, in 10 dB steps to a maximum attenuation of 70 dB. Within the individual 10 dB steps of the attenuator, the ALC loop adjusts the power output to the power level programmed at the front panel POWER control.

3-31. Alternate Sweep Mode With Option 002

3-32. If Option 002 attenuator is installed, and alternate sweep mode is selected, a slow sweep default condition of 1 sec/sweep may occur. This default condition only occurs when the POWER settings of the two alternate sweeps require the attenuator to switch after each sweep. The program prevents the attenuator from switching faster than 1 step per second. This prevents damage to the attenuator coils due to overheating.

3-33. Phase Lock Operation

3-34. The 83540A RF plug-in RF output (CW) signal may be phase-locked to an external reference oscillator by using an external phase-lock signal applied to the 8350A sweep oscillator FM INPUT connector (rear panel). The phase-lock function provides a means of obtaining a very stable CW frequency by transferring the frequency stability of the reference oscillator to the 8350A Sweep Oscillator. If the CW frequency starts to drift, the phase difference between the CW frequency and the reference frequency (reference oscillator) is detected, producing a dc voltage. The dc voltage is a correction signal which restores the CW frequency to its previous point. Stability of this CW frequency is thus determined by the stability of the reference oscillator. The CW filter should be turned off in phase lock operation.

3-35. OPERATOR'S MAINTENANCE

3-36. Plug-in Error Codes

3-37. The 8350A FREQUENCY display will indicate RF plug-in error codes (50 to 99) or sweep oscillator error codes. Information necessary to interpret plug-in error codes may be found in section VIII, Service, of this manual.

3-38. Fuses

3-39. Power circuits for the Model 83540A RF Plug-in are fused in the 8350A sweep oscillator. See the 8350A Sweep Oscillator Operating and Service Manual for fuse location and replacement instruction.

3-40. Blue Service Tags

3-41. If the 83540A RF Plug-in requires service, the instrument may be sent to your local HP service organization as described in Section II, Installation, in this manual. Before sending the instrument back, fill out and attach one of the blue service tags located at the rear of this section. Record any error codes observed under FAILURE SYMPTOMS / SPECIAL CONTROL SETTINGS section of the tag.

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The 83500-series RF plug-ins must be used in conjunction with the 8350A Sweep Oscillator. In order to maintain a high degree of consistency, procedures for testing the electrical performance of the RF plug-ins are found in Section IV of the 8350A Operating and Service Manual.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for testing or adjusting the 83540A is listed in Section I, Table 1-4. Any equipment which satisfies the critical specifications listed in Table 1-4 may be substituted for the recommended model.

4-5. TEST RECORD

4-6. Table 4-2 provides a tabulated index of the performance tests, their acceptable limits, and a column for recording actual measurements.

4-7. The test procedures in Section IV of the 8350A Operating and Service Manual frequently refer the operator to the Test Record Card in this section. Measurement conditions unique to this plug-in are tabulated under the column entitled "TEST: Step/Conditions." The number in the Step column refers to the procedure step in the 8350A manual; the information in the Conditions column corresponds to the instructions given within that step. For example, in the Frequency Accuracy Test, 8350A Operating and Service Manual, step 6 instructs the operator to set CW frequencies at "three points in each band as shown on the test card". The corresponding Step 6 on the test card provides three CW frequencies specifically for the 83540A.

4-8. RELATED ADJUSTMENTS

4-9. If a test offers marginal results, go to Section V and perform the associated adjustment. Table 4-1 correlates adjustments and performance tests.

Table 4-1. Related Adjustments

Performance Test (In 8350A O&S Manual)	83540A Adjustment	8350A Adjustment
4-13. Frequency Range and Accuracy		
CW Accuracy	5-17	5-19
Swept Frequency Accuracy	5-15 through 5-19	
Marker Accuracy	5-15 through 5-18	
4-14. Output Amplitude		
Power Meter Leveling	5-24	
Power Variations	5-20 through 5-23	
Power Level Accuracy	5-20, 5-23	
Power Sweep	5-26	
Slope Compensation	5-22	
4-15. Frequency Stability		5-11
4-16. Residual FM		5-11
4-17. Harmonics	5-21	
4-19. Residual AM		5-11
4-21. FM Response	5-27	

4-10. CALIBRATION CYCLE

4-11. The performance tests listed in Table 4-2 should be performed in intervals of one year or less.

4-12. OPERATION VERIFICATION

4-13. Operation Verification is a subset of the performance tests, providing reasonable assurance that the 8350A Sweep Oscillator and RF plug-in are operating properly. Paragraph 4-5 in the 8350A Operating and Service Manual specifies these tests and includes an HP-IB Operation Verification program for use with a 9825A/B Desktop Computer.

Table 4-2. Model 83540A Performance Test Record Card (1 of 3)

83540A PERFORMANCE TEST RECORD CARD

NOTE
Unless otherwise indicated, procedures for the following tests are found in the 8350A Operating and Service Manual.

SPECIFICATION TESTED: LIMITS	STEP	TEST CONDITIONS	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-13. Frequency Range and Accuracy					
Range:					
2–8.4 GHz	4.	Start frequency = 2 GHz		_____	2 GHz
CW Mode	5.	Stop frequency = 8.4 GHz	8.4 GHz	_____	
2–8.4 GHz: ±15 MHz	6.	CW frequency = 2.1 GHz	2.085 GHz	_____	2.115 GHz
		CW frequency = 6.0 GHz	5.985 GHz	_____	6.015 GHz
		CW frequency = 8.4 GHz	8.385 GHz	_____	8.415 GHz
Swept Frequency Accuracy	8/A.	Start frequency = 2 GHz	1.980 GHz	_____	2.020 GHz
2–8.4 GHz: ±20 MHz	9.	Stop frequency = 8.4 GHz	8.380 GHz	_____	8.420 GHz
Marker Accuracy	12.	Sweep width: 2–8.4 GHz			
2–8.4 GHz:		M1 = 2.5 GHz	2.448 GHz	_____	2.552 GHz
±20 MHz ±0.5% of sweep width		M2 = 3.6 GHz	3.548 GHz	_____	3.652 GHz
		M3 = 4.7 GHz	4.648 GHz	_____	4.752 GHz
		M4 = 8.0 GHz	7.948 GHz	_____	8.052 GHz
		M5 = 8.2 GHz	8.148 GHz	_____	8.252 GHz
4-14. Output Amplitude					
Power Meter Leveled: ±0.1 dB	9.			_____	≤0.2 dB
Power Level Accuracy: ±1.5 dBm	12.	Power = +16.0 dBm	+14.5 dBm	_____	+17.5 dBm
Opt. 002: ±1.7 dBm		(Opt. 002 power = +15 dBm)			
Calibrated Range: ≥15 dB					
Opt. 002: ≥84 dB	13.	+15.0	+13.5	_____	+16.5
		+14.0	+12.5	_____	+15.5
NOTE		+13.0	+11.5	_____	+14.5
For Opt. 002, extend upper limits in step 13 by 0.2 dB.		+12.0	+10.5	_____	+13.5
		+11.0	+ 9.5	_____	+12.5
		+10.0	+ 8.5	_____	+11.5
		+ 9.0	+ 7.5	_____	+10.5
		+ 8.0	+ 6.5	_____	+ 9.5
		+ 7.0	+ 5.5	_____	+ 8.5
		+ 6.0	+ 4.5	_____	+ 7.5
		+ 5.0	+ 3.5	_____	+ 6.5
		+ 4.0	+ 2.5	_____	+ 5.5
		+ 3.0	+ 1.5	_____	+ 4.5
		+ 2.0	+ 0.5	_____	+ 3.5
		+ 1.0	− 0.5		+ 2.5

Table 4-2. Model 83540A Performance Test Record Card (2 of 3)

SPECIFICATION TESTED: LIMITS	STEP	TEST CONDITIONS	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
Maximum Leveled Power: +16 dBm	15.				
Option 002: +15 dBm				_____	+18 dBm
Internal Leveled: ±1 dB				_____	+17 dBm
Power Sweep: ≥15 dB/SWP	17.	Power level = +1 dBm	≥15 dB/SWP	_____	
Option 002: ≥14 dB/SWP			≥14 dB/SWP	_____	
4-15. Frequency Stability					
+5 to −10% V Line Change:	2.	CW frequency = 4.0 GHz			
2–8.4 GHz: ≤±20 kHz	3.	Low line voltage		_____	≤±20 kHz
	4.	High line voltage		_____	≤±20 kHz
Time (10 minutes):	5.	Power = +16 dBm			
2–8.4 GHz: ≤±200 kHz		(Opt. 002: power = +15 dBm)			
		CW Frequency = 4.0 GHz			
	7.			_____	≤±200 kHz
10 dB Power Change:	9.	Power = +16 dBm			
2–8.4 GHz: ≤±1 MHz		(Opt. 002: Power = +15 dBm)			
		CW frequency = 4.0 GHz			
	10.	Reduce power to +6 dBm		_____	≤±1 MHz
		(Opt. 002: reduce power to +5 dBm)			
3 : 1 Load SWR:	13.	Power = +16 dBm)			
2–8.4 GHz: ≤±250 kHz		(Opt. 002: Power = +15dBm)			
		CW Frequency = 8.4 GHz			
	14.			_____	≤500 kHz
4-16. Residual FM					
2–8.4 GHz: <9 kHz	2.	CW frequency = 6.0 GHz			
	5.			_____	<9 kHz
4-17. Spurious Signals					
Harmonic:					
2–8.4 GHz: ≥20 dB	3.	In dB below carrier	≥20 dB	_____	
Non-harmonic:					
2–8.4 GHz ≥60 dB			≥60 dB	_____	
4-18. Output VSWR					
2–8.4 GHz: <1.6	11.	Range: 2–8.4 GHz		_____	<1.6
4-19. Residual AM					
2–8.4 GHz: ≥50 dB	3.	Power = + 16 dBm			
		(Opt. 002: Power = +15)			
		CW frequency = 4.0 GHz			
	5.	In dB below carrier	≥50 dB	_____	

Table 4-2. Model 83540A Performance Test Record Card (3 of 3)

SPECIFICATION TESTED: LIMITS	STEP	TEST CONDITIONS	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-20. External FM					
Direct coupled:	1.	A3S1: Close switch 5, open 6.			
DC–100 Hz: ≥±12 MHz	3.		≥±12 MHz	_____	
Cross Over Coupled:	4.	A3S1: Close switch 6.			
DC–100 Hz: ≥±75 MHz			≥±75 MHz	_____	
Direct/Cross Over coupling					
100 Hz–1 MHz: ≥±7 MHz	9.		≥±7 MHz	_____	
1–2 MHz: ≥±5 MHz	10.		≥±5 MHz	_____	
2–10 MHz: ≥±1 MHz			≥±1 MHz	_____	
	11.	A3S1: Change switch 6 from previous setting	≥±7 MHz	_____	
			≥±5 MHz	_____	
			≥±1 MHz	_____	
4-21. FM Frequency Response					
DC–2 MHz: ±3 dB	5.	Test limits measured by display divisions.	2.9 div.	_____	5.3 div.
4-22. AM On/Off Ratio Square-Wave Symmetry					
On/Off Ratio:	1.	CW frequency = 4 GHz			
≥30 dB below specified max leveled power		Power = +16 dBm (Opt. 002: Power = +15)			
Symmetry of ON/OFF time:	3.		≥30 dB	_____	
40/60	4.		40%	_____	60%
4-23. Step Attenuator Accuracy					
Attn. Step Accuracy	1.	CW frequency = 4.0 GHz			
10 dB ±0.5 dB		Power = +10 dBm			
20 dB ±0.7 dB	2.	Reference Attenuation = 70 dB			
30 dB ±0.9 dB					
40 dB ±1.2 dB	4.	Reference Attn. = 70 dB			
50 dB ±1.5 dB		**Ref Attn Step / Attn Error / Deviation From 0 Ref**			
60 dB ±1.8 dB		70–60 _____ + _____		_____	≤±0.5 dB
70 dB ±2.1 dB		70–50 _____ + _____		_____	≤±0.7 dB
		70–40 _____ + _____		_____	≤±0.9 dB
		70–30 _____ + _____		_____	≤±1.2 dB
		70–20 _____ + _____		_____	≤±1.5 dB
		70–10 _____ + _____		_____	≤±1.8 dB
		70– 0 _____ + _____		_____	≤±2.1 dB

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 83540A RF Plug-in. These procedures should not be performed as routine maintenance but should be used (1) after replacement of a part or component, or (2) when performance tests show that the specifications of Table 1-1 cannot be met. Table 5-1 lists all of the adjustments by reference designation, adjustment name, adjustment paragraph, and description. Each procedure includes a test setup illustration and one or more adjustment location illustrations.

NOTE

Allow the 83540A RF Plug-in and the 8350A Sweep Oscillator to warm up for one hour prior to making any adjustments.

5-3. SAFETY CONSIDERATIONS

5-4. Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by a skilled person who is aware of the hazard involved.

WARNING

Adjustments in this section are performed with power supplied to the instrument while protective covers are removed. There are voltages at points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Adjustments should be performed only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged, even if the instrument has been disconnected from its source of supply.

NOTE

Use a non-metallic adjustment tool whenever possible.

5-5. EQUIPMENT REQUIRED

5-6. Table 1-4 lists the equipment required for the adjustment procedures. If the test equipment recommended is not available, other equipment may be used if its performance meets the critical specifications listed in Table 1-4. The specified equipment required for each adjustment is referenced in each procedure.

5-7. FACTORY-SELECTED COMPONENTS

5-8. Table 5-2 contains a list of factory-selected components that include the reference designation, the related adjustment procedure, the allowable range of values, and the basis of selection. Nominal values are given for the factory-selected components, designated by an asterisk (*), on the schematic diagram and in the replacement parts list. HP Part Numbers for selected values are given in Table 5-3.

5-9. RELATED ADJUSTMENTS

5-10. Interactive adjustments are noted in the adjustment procedures. Table 5-4 indicates by paragraph numbers the adjustments that must be performed if an assembly has been repaired or replaced or if an adjustment has been made to an assembly. Table 5-5 lists the adjustment procedures included in this section.

5-11. ADJUSTMENT PROCEDURE

5-12. Adjustment procedures are given in the proper sequence to allow for interrelated adjustments. However, adjustments having to do with the leveling loop (paragraph 5-20 through 5-25) are interactive and should be performed as a group.

Table 5-1. Adjustable Components (1 of 3)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A2R1	GAIN (V/GHz)	5-19	Sets gain of frequency reference to 1 V/GHz output.
A2R4	OFFSET	5-19	Sets offset of frequency reference (1 V/GHz).
A3S1	Configuration Switch	5-13	Selects plug-in code. Presets power, FM sensitivity, FM coupling, and step attenuator option code.
A4R3	1 HI	5-20, 5-23	Calibrates high end of power range (+16 dBm). Adjusts detector deviation from square-law.
A4R5	1 LO	5-20, 5-23	Calibrates low end of power range (+1 dBm).
A4R8	1 MD	5-20, 5-23	Calibrates midrange power (+12 dBm).
A4R9	PM	5-24	Sets power meter leveling calibration.
A4R11	GAIN	5-25	Sets the gain of the main ALC amplifier.
A4R47	OFS 1	5-20	Adjusts for zero offset through U7–Q6 log amplifier circuit.
A4R56	OFS 2	5-20	Adjusts for zero offset through U5 log amplifier circuit.
A4R59	OFS 3	5-20	Adjust for zero offset through U8–Q1 Sample and Hold circuit.
A4R67	OFS 4	5-20	Adjust for zero offset through U11 Main ALC amplifier.
A5C14	LO	5-27	Compensates FM Coil response flatness in conjunction with A5R75 and A5R19.
A5R19	FM	5-27	Sets DC offset of U10 video amplifier.
A5R34	BP 1	5-22	Breakpoint that works with SL1 (slope 1) for ALC flatness.
A5R36	BP 2	5-22	Breakpoint that works with SL2 (slope 2) for ALC flatness.
A5R38	BP 3	5-22	Breakpoint that works with SL3 (slope 3) for ALC flatness.

Table 5-1. Adjustable Components (2 of 3)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A5R40	BP 4	5-22	Breakpoint that works with SL4 (slope 4) for ALC flatness.
A5R41	SL 1	5-22	Slope adjustment for best ALC flatness.
A5R42	SL 2	5-22	Slope adjustment for best ALC flatness.
A5R43	SL 3	5-22	Slope adjustment for best ALC flatness.
A5R44	SL 4	5-22	Slope adjustment for best ALC flatness.
A5R48	SLP	5-22	Sets overall slope of internal leveling ALC.
A5R50	PWSP	5-26	Sets range for power sweep.
A5R75	HI	5-27	Works in conjunction with C14 to compensate frequency response flatness of FM Coil.
A6R11	G (gain)	5-16	Fine adjustment of tuning voltage from the scaling DAC.
A6R21	−10V	5-15	Sets −10 Volt reference.
A6R25	ZRO (zero)	5-16	Adjusts for gain and offset inaccuracies between +20 Volt frequency reference from U11 and summing amplifier U16.
A6R30	OFS (offset)	5-16	Fine adjustment of drive voltage from offset DAC.
A6R45	SP		NOT USED
A6S1	OFFSET	5-17	Sets low end frequency.
A6S2	GAIN	5-17	Sets high end frequency.
A7R20	B2	5-14	Sets oscillator bias voltage at high end of band.
A7R21	S2	5-14	Sets break point of bias voltage at high end of band.
A7R26	S1	5-14	Sets break point of bias voltage at low end of band.
A7R27	B1	5-14	Sets oscillator bias volage at low end of band.

Table 5-1. Adjustable Components (3 of 3)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A7R47	Z (zero)	5-18	Sets offset to minimize the frequency difference between CW and delta F ±0 with delay compensation circuits connected.
A7R65	LO	5-18	Sets delay compensation at low end of band.
A7R66	HI	5-18	Sets delay compensation at high end of band.
A12A1R4	HARMONICS	5-21	Set for minimum harmonic content in RF output signal.
A13A1R2	'4' DRAIN BIAS	5-21	Set for minimum harmonic content.
A13A1R8	'1' GATE BIAS	5-21	Set for minimum harmonic content.
A13A1R10	'2' GATE BIAS	5-21	Set for minimum harmonic content.
A13A1R12	'3' GATE BIAS	5-21	Set for minimum harmonic content.

Table 5-2. Factory Selected Components

Reference Designator	Adjustment Paragraph	Allowable Range of Values	Basis of Selection
A5R31	5-27	75 to 125 Ohms	Selects scaling of current drive of YIG Oscillator FM coil near 100 kHz.
A6R1	None		Selected at factory to correct for frequency nonlinearity in YIG Oscillator A12.
A6R3	None		
A6R38	None		
A6R39	None		
A6R40	None		
A6R41	None		
A12A1R1	None	51.1 to 464 Ohms (.5 watt)	Selected at factory for optimum bandwidth, power, and harmonics.
A12A1R2	None	162 to 619 Ohms. (.5 watt)	Same as above.

Table 5-3. HP Part Numbers of Standard Value Replacement Components

RESISTORS

RANGE: 10 to 464K Ohms
TYPE: Fixed-Film
WATTAGE: .125 at 125°C
TOLERANCE: ±1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
10.0	0757-0346	2	464	0698-0082	7	21.5K	0757-0199	3
11.0	0757-0378	0	511	0757-0416	7	23.7K	0698-3158	4
12.1	0757-0379	1	562	0757-0417	8	26.1K	0698-3159	5
13.3	0698-3427	0	619	0757-0418	9	28.7K	0698-3449	6
14.7	0698-3428	1	681	0757-0419	0	31.6K	0698-3160	8
16.2	0757-0382	6	750	0757-0420	3	34.8K	0757-0123	3
17.8	0757-0294	9	825	0757-0421	4	38.3K	0698-3161	9
19.6	0698-3429	2	909	0757-0422	5	42.2K	0698-3450	9
21.5	0698-3430	5	1.0K	0757-0280	3	46.4K	0698-3162	0
23.7	0698-3431	6	1.1K	0757-0424	7	51.1K	0757-0458	7
26.1	0698-3432	7	1.21K	0757-0274	5	56.2K	0757-0459	8
28.7	0698-3433	8	1.33K	0757-0317	7	61.9K	0757-0460	1
31.6	0757-0180	2	1.47K	0757-1094	9	68.1K	0757-0461	2
34.8	0698-3434	9	1.62K	0757-0428	1	75.0K	0757-0462	3
38.3	0698-3435	0	1.78K	0757-0278	9	82.5K	0757-0463	4
42.2	0757-0316	6	1.96K	0698-0083	8	90.9K	0757-0464	5
46.4	0698-4037	0	2.15K	0698-0084	9	100K	0757-0465	6
51.1	0757-0394	0	2.37K	0698-3150	6	110K	0757-0466	7
56.2	0757-0395	1	2.61K	0698-0085	0	121K	0757-0467	8
61.9	0757-0276	7	2.87K	0698-3151	7	133K	0698-3451	0
68.1	0757-0397	3	3.16K	0757-0279	0	147K	0698-3452	1
75.0	0757-0398	4	3.48K	0698-3152	8	162K	0757-0470	3
82.5	0757-0399	5	3.83K	0698-3153	9	178K	0698-3243	8
90.0	0757-0400	9	4.22K	0698-3154	0	196K	0698-3453	2
100	0757-0401	0	4.64K	0698-3155	1	215K	0698-3454	3
110	0757-0402	1	5.11K	0757-0438	3	237K	0698-3266	5
121	0757-0403	2	5.62K	0757-0200	7	261K	0698-3455	4
133	0698-3437	2	6.19K	0757-0290	5	287K	0698-3456	5
147	0698-3438	3	6.81K	0757-0439	4	316K	0698-3457	6
162	0757-0405	4	7.50K	0757-0440	7	348K	0698-3458	7
178	0698-3439	4	8.25K	0757-0441	8	383K	0698-3459	8
196	0698-3440	7	9.09K	0757-0288	1	422K	0698-3460	1
215	0698-3441	8	10.0K	0757-0442	9	464K	0698-3260	9
237	0698-3442	9	11.0K	0757-0443	0			
261	0698-3132	4	12.1K	0757-0444	1			
287	0698-3443	0	13.3K	0757-0289	2			
316	0698-3444	1	14.7K	0698-3156	2			
348	0698-3445	2	16.2K	0757-0447	4			
383	0698-3446	3	17.8K	0698-3136	8			
422	0698-3447	4	19.6K	0698-3157	3			

Table 5-4. Related Adjustments

Assembly Changed or Repaired	Related Assemblies (in order of Adjustments)	Perform the Following Paragraph Number
A1/A2 front Panel	A6,A2	5-17, 5-19
A3 Digital Interface	A3	5-13
A4 ALC	A4, A5	5-20 thru 5-25
A5 FM	A4, A5	5-20 thru 5-27
A6 YO Driver	A6, A2, A7	5-14 thru 5-17, 5-19
A7 Marker	A6, A7	5-14, 5-16, 5-18
A12 YIG Oscillator	A6, A7, A2, A12, A13, A5	5-14, 5-15, 5-16, 5-19, 5-20 thru 5-25, 5-27
A13 Modulator/Amplifier	A12, A13	5-20 thru 5-25
CR1 Crystal Detector	A4, A5, A12A1, A13A1	5-20 thru 5-25
DC Directional Coupler	A4, A5, A12A1, A13A1	5-20 thru 5-25

Table 5-5. Adjustments

Paragraph	Adjustments	Paragraph	Adjustments
5-13	Configuration Switch A3S1	5-21	Harmonics
5-14	Oscillator Bias on A7	5-22	Internal Leveled Flatness
5-15	−10V Reference on A6 YO Driver	5-23	Power Calibration
5-16	YO Driver Board A6 DAC Calibration	5-24	Power Meter Leveling Calibration
5-17	Frequency Accuracy	5-25	ALC Gain Adjustment
5-18	Delay Compensation	5-26	Power Sweep
5-19	Frequency Reference 1 V/GHz	5-27	FM Driver
5-20	ALC Adjustment		

ADJUSTMENTS

5-13. CONFIGURATION SWITCH A3S1

Reference:

Performance Test: 8350A Paragraph 4-13.
Service Sheet: A3

Description:

Switch A3S1 is set at the factory for a combination of operating modes. (Refer to Table 5-6.) Other operating modes can be selected by resetting switch positions on A3S1.

Procedure:

NOTE

Adjustment procedures and performance tests all assume that A3S1 is set to the factory setting. If other procedures are to be performed, set A3S1 to the factory setting until the procedures are completed, then set A3S1 to any desired operating mode before putting the instrument back in service.

1. Refer to Table 5-6 and determine if factory selected mode set at A3S1 is correct for your application.

2. Set configuration switch A3S1 (Figure 5-1) for the desired operating mode.

NOTE

After modifying configuration switch A3S1, press INSTR PRESET to update the plug-in to the desired operating mode.

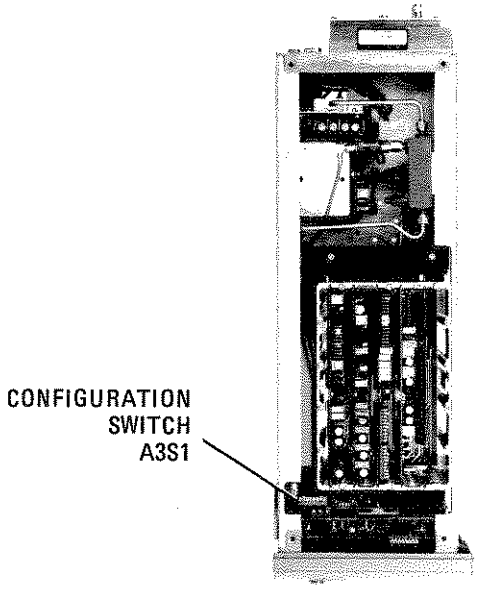


Figure 5-1. Configuration Switch A3S1 Location

Table 5-6. Configuration Switch A3S1 on A3 Digital Interface Board

Description	Switch Number							
	1	2	3	4	5	6	7	8
Plug-in Code for 83540A	0	1	0	x	x	x	x	x
No RF Power at Power-Up	x	x	x	1	x	x	x	x
Maximum RF Power at Power-Up	x	x	x	0	x	x	x	x
– 6 MHz/V FM Sensitivity	x	x	x	x	1	x	x	x
– 20 MHz/V FM Sensitivity	x	x	x	x	0	x	x	x
Direct-Coupled FM	x	x	x	x	x	1	x	x
Cross-Over Coupled FM	x	x	x	x	x	0	x	x
Step Attenuator, Option 002, Installed	x	x	x	x	x	x	1	x
No Step Attenuator, Option 002, Installed	x	x	x	x	x	x	0	x

NOTES

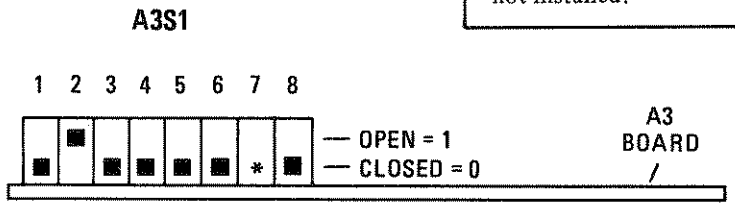
1. Switch Positions:
   1 = Switch Open = High
   0 = Switch Closed = Low (Ground)
   x = Don't Care

2. Switch A3S1 is set from the factory as follows:

Switch No.	Position
1	0
2	1
3	0
4	0
5	0
6	0
7	*
8	x

*"1" if Opt. 002 installed; "0" if Opt. 002 not installed.

3. When direct-coupled FM is selected, FM sensitivity is –20 MHz/V and switch number 5 is overridden.



5-14. OSCILLATOR BIAS ON A7

Reference:

Performance Test: 8350A Paragraph 4-14.
Service Sheet: A7

Description:

Oscillator bias is adjusted in accordance with the voltage requirements noted on the side of YIG Oscillator A12.

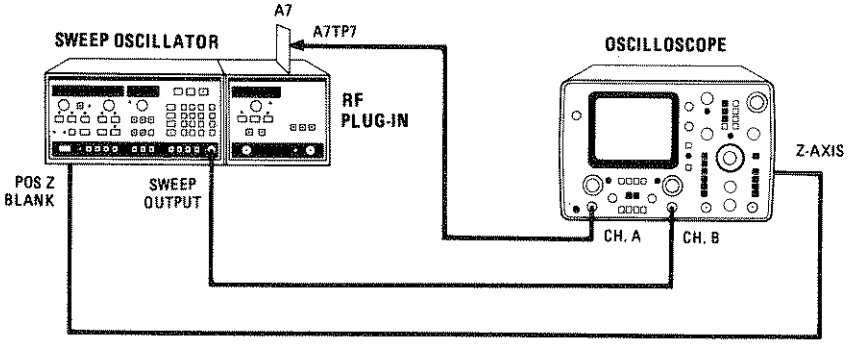


Figure 5-2. Oscillator Bias Adjustment Test Setup

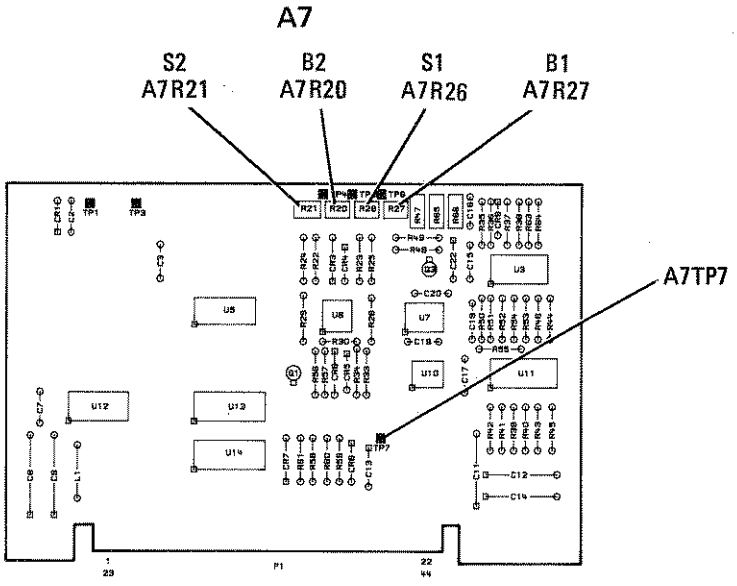


Figure 5-3. Oscillator Bias Test Point and Adjustment Location

Equipment:

Oscilloscope ..... HP 1740A

ADJUSTMENTS

5-14. OSCILLATOR BIAS ON A7 (Cont'd)

Procedure:

NOTE

Turn AC power OFF when removing or installing PC boards.

1. Connect equipment as shown in Figure 5-2 and 5-3. Place A7 Marker board on an extender board, connect oscilloscope probe to A7TP7 oscillator bias, and select A vs. B sweep mode.

2. Note the voltages and frequencies specified on the side of YIG oscillator A12. Correlation between the oscillator notations and the board adjustments are shown in Table 5-7.

Table 5-7. YIG Oscillator Break Point Notations

Notation on YIG Oscillator*	A7 Adjustment Control Name	Description
VL (Voltage Low)	S1	Voltage at low end of band.
FL (Frequency Low)	B1	Sets break point of bias voltage at low end of band. Adjust for break to occur at frequency given on oscillator.
VU (Voltage Upper)	S2	Voltage at high end of band.
FU (Frequency Upper)	B2	Sets break point of bias voltage at high end of band. Adjust for break to occur at frequency given on oscillator.

*When voltages are not indicated on oscillator, turn the associated circuit off. For VL/FL, set B1 fully counterclockwise. For VU/FU, set B2 fully counterclockwise.

3. Set marker 1 to FL (frequency low) and set marker 2 to FU (frequency upper). (See Figure 5-4.) Set START frequency to 2 GHz.

4. Adjust A7R27 (B1) to position the break point at marker 1 (FL). Adjust A7R26 (S1) to position the beginning of the oscilloscope trace at VL (voltage low). Note: If voltage and frequency for VL and FL are not shown, adjust A7R27 (B1) fully counterclockwise. A7R26 (S1) should then have no effect on the display.

5. Adjust A7R20 (B2) to position the break point at marker 2 (FU). Adjust A7R21 (S2) to position the end of the oscilloscope trace at VU (voltage upper). Note: If voltage and frequency for VU and FU are not shown, adjust A7R20 (B2) fully counterclockwise. A7R21 (S2) should then have no effect on the display.

5-14. OSCILATOR BIAS ON A7 (Cont'd)

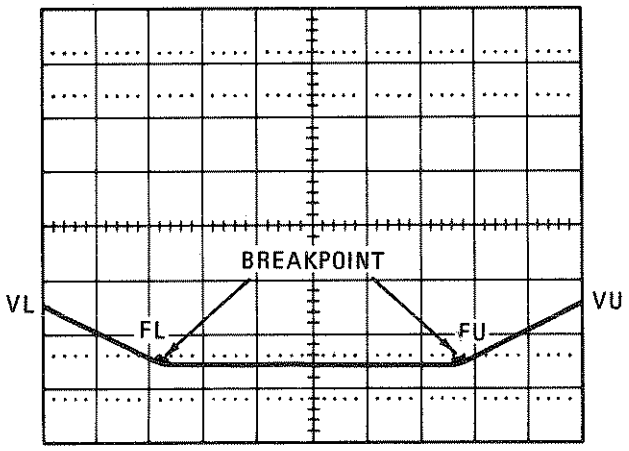


Figure 5-4. Display of Break Points

5-15. −10V REFERENCE ON A6 YO DRIVER

Reference:

Performance Test: 8350A Paragraph 4-14.
Service Sheet: A6

Description:

The −10V REF in A6 is used as a reference voltage for the Offset DAC in A6, and in the Power Level Reference DAC on the A4 assembly.

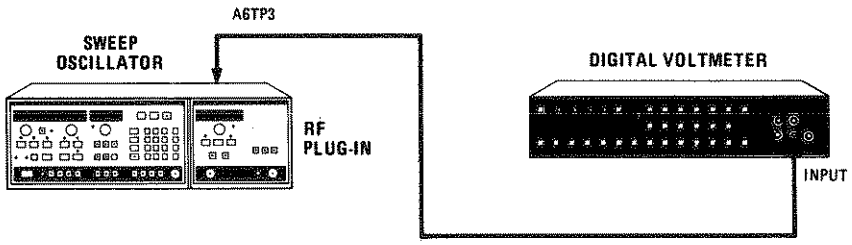


Figure 5-5. −10 Volt Reference Test Setup

Equipment:

Digital Voltmeter (DVM)..... HP 3455A

Procedure:

1. Connect DVM to A6TP3 and common to A6TP5 (Figures 5-5 and 5-6).
2. Adjust "−10," A6R21, for −10.000 Vdc ±0.001 Vdc.

5-15. −10V REFERENCE ON A6 YO DRIVER (Cont'd)

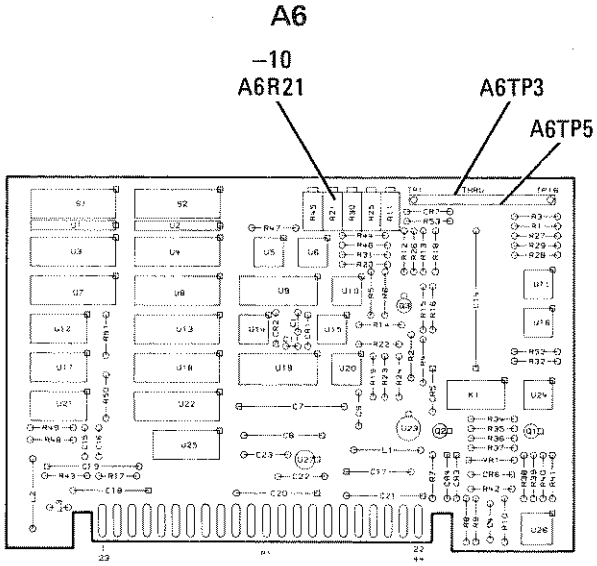


Figure 5-6. A6TP3 "−10" Volt Reference Test Point

5-16. YO DRIVER BOARD A6 DAC CALIBRATION

Reference:

Performance Test: 8350A Paragraph 4-13.
Service Sheet: A6

Description:

Adjustments are made to remove offsets and calibrate OFFSET and SLOPE DAC step sizes.

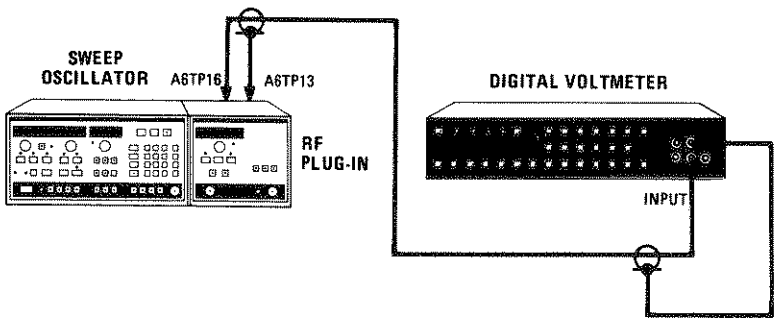


Figure 5-7. YO Driver Board Adjustment Test Setup

5-16. YO DRIVER BOARD A6 DAC CALIBRATION (Cont'd)

Equipment:

Digital Voltmeter ..... HP 3455A

Procedure:

NOTE

YO Driver Board adjustments should be avoided if possible. Set up equipment as shown in Figure 5-10 and perform the last step in Paragraph 5-17 to check frequency accuracy and sweep linearity across the band. If frequencies are within ±15 MHz tolerance, do not make these YO Driver Board adjustments.

1. Float ground on DVM and connect floating ground to A6TP13 (+20 V FREQ. REF.). Connect measurement lead of DVM to A6TP16. (See Figure 5-7 and 5-8.)

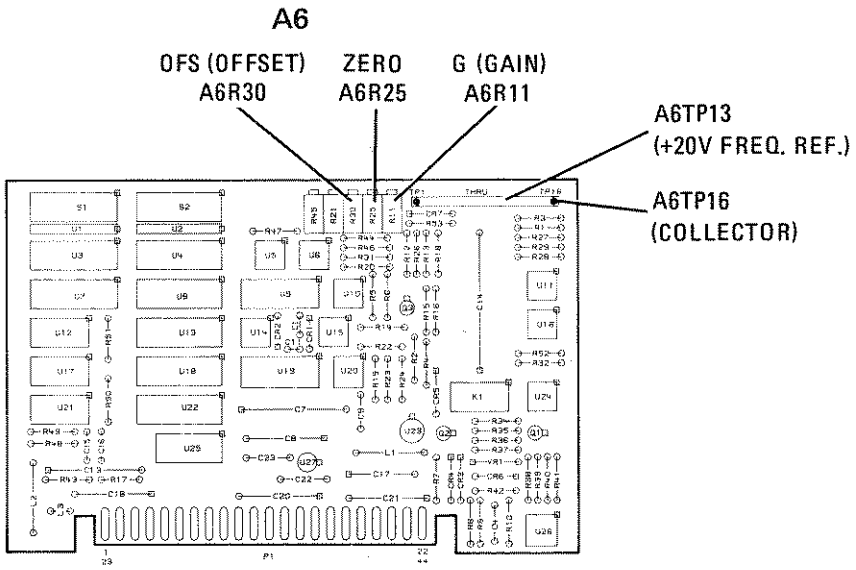


Figure 5-8. YO Driver Board Test Points

2. Press CW , then make DATA ENTRY of 8.4 GHz.

NOTE

SHIFT 00 selects the hex data entry mode, making key M1 function as address code entry, and key M2 as data code entry. For further description of hex programming refer to Paragraph 8-22.

5-16. YO DRIVER BOARD A6 DAC CALIBRATION (Cont'd)

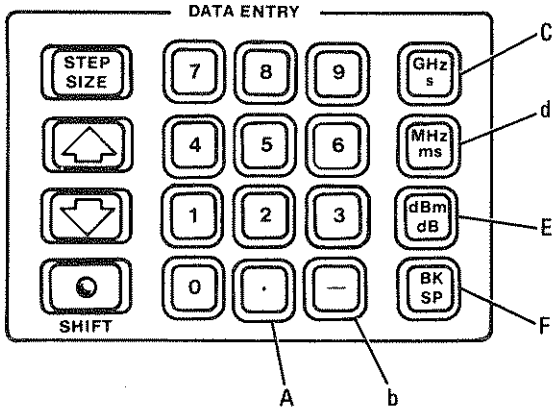


Figure 5-9. Front Panel Hexadecimal Entry Keys

3. Enter:

SHIFT 0 0	Initiates Hex entry mode.
2 GHz s 8 0	Address location 2C80
M2	Enables Data Input
0 0	Hex Data

4. Press ▲ to step to address 2C81.
   Enter hex data 4 0 .

5. Press ▲ to step to address 2C82.
   Enter hex data 0 0 .

6. Note DVM indication. If it is not approximately equal to −6.2500 Vdc, adjust A6R11 "G" (gain) control for −6.2500 Vdc ±1 mVdc. Note the actual value obtained.

7. Enter hex data BKSP BKSP to change data at address 2C82 to FF.

8. Press ▼ to step down to address 2C81.
   Enter hex data 4 BKSP (4F).

9. Adjust A6R30 "OFS" (offset) for a difference between step 6 and step 8 of 12.9968 Vdc ±0.1 mVdc.

10. Enter hex data 0 BKSP (0F).
    Adjust A6R25 "ZERO" for −12.6218 Vdc ±0.1 mVdc.

11. Enter hex data GHz s 0 (C0).

12. Press ▲ to step to address 2C82.
    Enter hex data 0 0 .

13. Adjust A6R11 "G" (gain) for DVM indication of −19.5000 Vdc ±0.1 mVdc.

14. Repeat steps 4 through 13 to check for 12.9968 volt difference between steps 6 and 8 with no further adjustment.

5-17. FREQUENCY ACCURACY

Reference:

Performance Test: 8350A Paragraph 4-13
Service Sheet: A6

Description:

Frequency endpoints are adjusted using calibration modes provided through software. SHIFT 90 (low end) and SHIFT 91 (high end) initiate the frequency calibration mode in which the microprocessor reads the FREQ CAL switches on the A6 assembly and displays the byte in hexadecimal form via the POWER window. As the plug-in RPG is adjusted, plug-in ROM reads the count, adjusts the POWER display, and updates the Offset (low end) or Scaling DAC (high end) to correct the output frequency. When the external counter and 8350A Front Panel FREQUENCY readings match, the hex digits displayed in the POWER window indicate the proper settings for the FREQ CAL switch, A6S1 or A6S2.

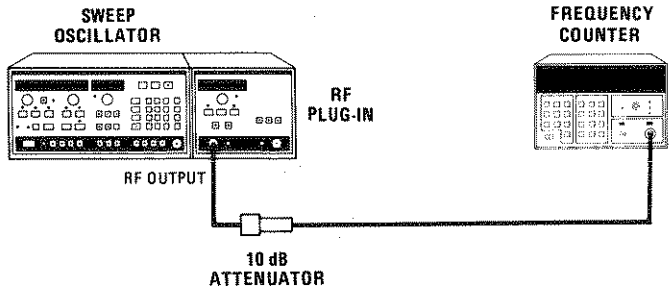


Figure 5-10. Test Setup for Frequency Accuracy Adjustments

Equipment:

Frequency Counter	HP 5343A
10 dB Attenuator	HP 8491A Option 010

Procedure:

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

1. Connect equipment as shown in Figure 5-10 with frequency counter and 10 dB attenuator connected to RF OUTPUT.
2. Press INSTR PRESET .
3. Press CW . At DATA ENTRY enter 2.0 GHz.
4. Press SAVE 1 .
5. Press CW . At DATA ENTRY enter 8.4 GHz.

5-17. FREQUENCY ACCURACY (Cont'd)

6. Press SAVE 2 .

7. Press RECALL 1 and 2.000 GHz should be displayed in the FREQUENCY window.

8. Press SHIFT 9 0 . This selects low end frequency calibration mode.

9. Adjust plug-in RPG for a reading of 2.000 GHz on external frequency counter.

10. Set switch A6S1 (Figure 5-11) for the value displayed in the POWER window. Note the hex number for subsequent verification. Refer to the diagram in Figure 5-12.

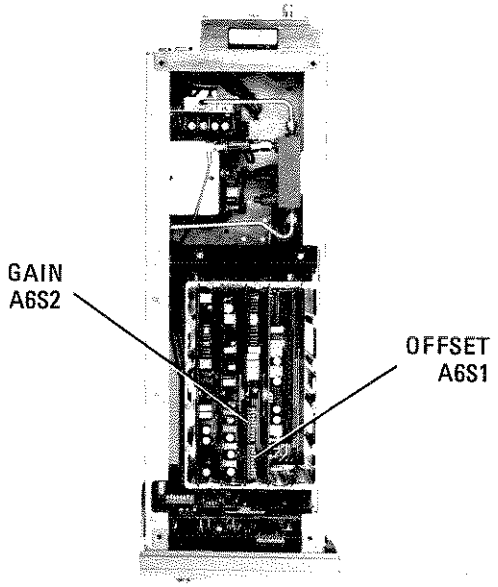


Figure 5-11. Frequency Calibration Adjustments Location

11. Press INSTR PRESET , then RECALL 1 .

12. Verify that a setting of 2.000 GHz on the 8350A produces a 2.000 GHz ± 15 MHz indication on the external frequency counter. (If the frequency displayed does not meet specification, press SHIFT 9 0 . The hex digits displayed in the POWER window correspond to A6S1 switch settings. If this number does not agree with the number obtained in step 10, the switch was not set properly. Repeat the procedure.)

13. Press RECALL 2 and 8.400 GHz should be displayed in the FREQUENCY window.

ADJUSTMENTS

5-17. FREQUENCY ACCURACY (Cont'd)

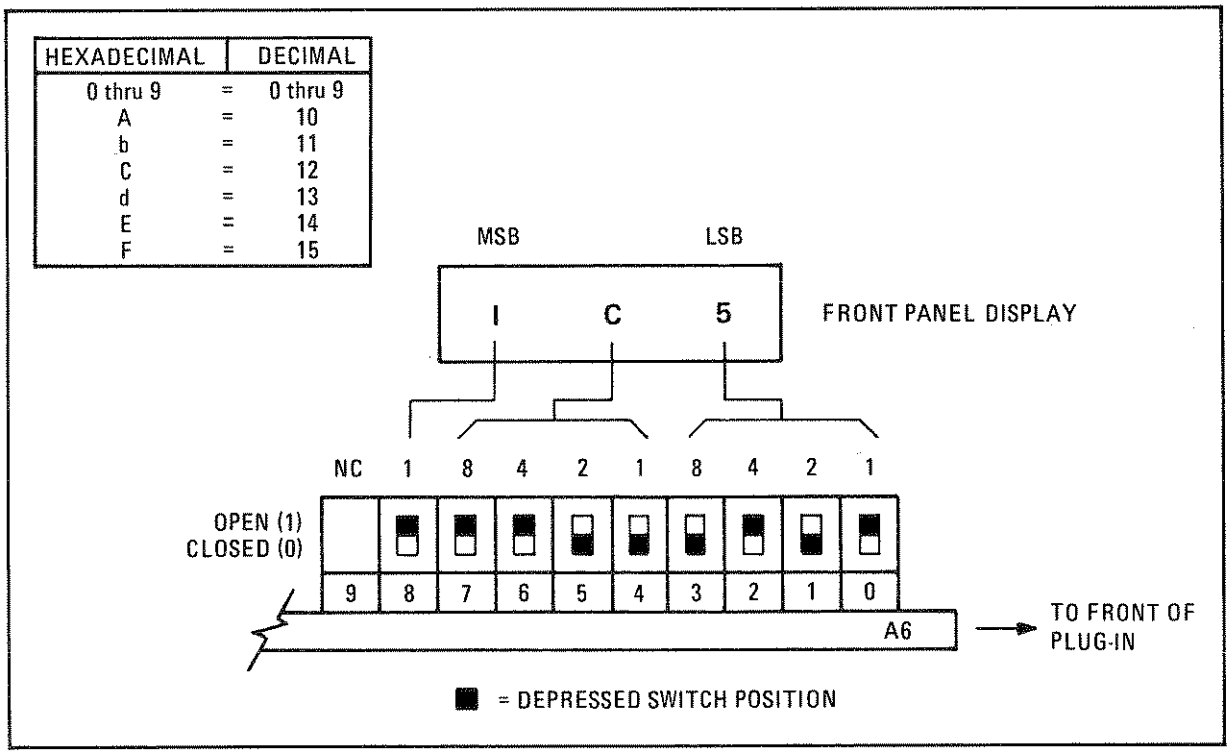


Figure 5-12. A6S1 and A6S2 Frequency Calibration Switch Configuration

14. Press SHIFT 9 1 . This selects high end frequency calibration mode.

15. Adjust plug-in RPG for a reading on the external frequency counter of 8.400 GHz.

16. Set A6S2 (Figure 5-11) for the reading displayed in the POWER window. Note the hex number for subsequent verification.

17. Press INSTR PRESET , then RECALL 2 .

18. Verify that a setting of 8.400 GHz on the 8350A produces an 8.400 GHz ± 15 MHz indication on the external frequency counter. (If the frequency displayed does not meet specification, press SHIFT 9 1 . The hex digits displayed in the POWER window correspond to A6S2 switch settings. If this number does not agree with the number obtained in step 16, the switch was not set properly. Repeat the procedure starting with step 13.)

19. Manually sweep across the band, monitoring the external counter readings. They should match the 8350A CW frequency reading ±15 MHz. Check at 2.2 GHz, 3.8 GHz, 5.8 GHz, 6.8 GHz, and 8.2 GHz.

ADJUSTMENTS

5-18. DELAY COMPENSATION

Reference:

Performance Test: 8350A Paragraph 4-13.
Service Sheet: A7

Description:

This circuit compensates for the delay in the RF sweep output that occurs at faster sweep speeds. An external frequency meter is used to generate a frequency-dependent marker which is aligned with a tuning ramp-dependent marker generated from the 8350A mainframe. Sweep time is increased and delay due to hysteresis in the YO is observed as the difference between the two marker pips.

Delay compensation adjustments are made while observing the shift between the marker pips at a sweep time of 10 milliseconds (worst case). At sweep speeds greater than 100 milliseconds, delay should not exceed ±5 MHz: the difference between CW and Swept Frequency accuracies.

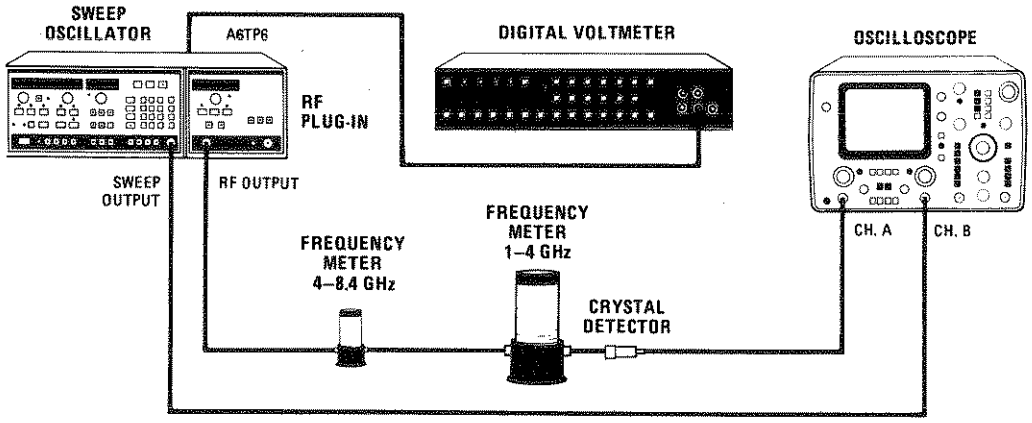


Figure 5-13. Test Setup for Delay Compensation Adjustment

Equipment:

Oscilloscope	HP 1740A
Frequency Meter 1 to 4 GHz	HP 536A
Frequency Meter 4 to 8.4 GHz	HP 537A
Crystal Detector	HP 423B

Procedure:

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

1. Connect equipment as shown in Figure 5-13. At oscilloscope, select A vs. B sweep mode to obtain a CRT trace of amplitude versus frequency.

5-18. DELAY COMPENSATION (Cont'd)

2. Press INSTR PRESET .
3. Select CW mode and with a DVM, measure and note the voltage at A6TP6.
4. Press CF , then ΔF . At DATA ENTRY enter 0 MHz .
5. Adjust "Z" control A7R47 on marker board (Figure 5-14) for the same reading at A6TP6 that was obtained in step 3 above. Remove DVM lead from A6TP6.

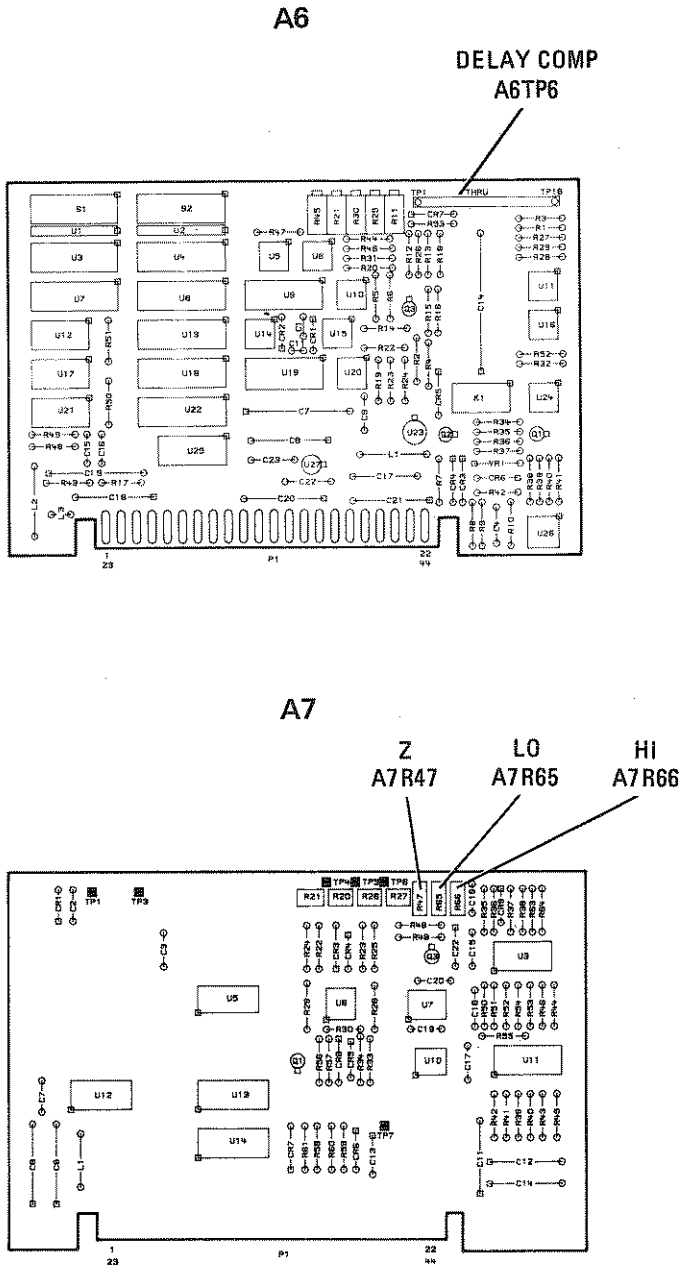


Figure 5-14. Delay Compensation Adjustments

5-18. DELAY COMPENSATION (Cont'd)

6. Press 8350A INSTR PRESET , AMPTD MKR , and RF BLANK . Press MKR M1 . At DATA ENTRY enter 2.30 GHz.

7. Press SAVE 2 .

8. Press SWEEP TIME . At DATA ENTRY enter 200 ms.

9. Press SAVE 1 .

10. Press MKR M2 . At DATA ENTRY enter 6.5 GHz.

11. Press SAVE 3 .

12. Press SWEEP TIME . At DATA ENTRY enter 10 ms.

13. Press SAVE 4 .

14. Press RECALL 1 .

15. Expand the oscilloscope trace at the marker by centering the marker on the screen with the oscilloscope horizontal POSITION control, then selecting "MAG X10." Set wavemeter so the peak of the pip is on the leading edge of the 2.300 GHz marker.

16. Press RECALL 2 .

17. Adjust "LO" A7R65 on marker board (Figure 5-14) so the peak of the wavemeter pip is coincident with the leading edge of the marker.

18. Verify that the delay is accurate by manually adjusting sweep time from 10 to 200 ms. Iterate "LO" adjustment to optimize setting for minimum delay per sweep time. The position of the wavemeter pip should typically stay within ±5 MHz as read on the wavemeter across the 10 to 200 ms range.

19. Disengage "MAG X10." Press RECALL 3 . Center the 6.5 GHz marker on the screen with the oscilloscope horizontal POSITION control. Press "MAG X10."

20. Set wavemeter so the peak of the pip is coincident with the leading edge of the 6.500 GHz marker.

21. Press RECALL 4 .

22. Adjust "HI" A7R66 on marker board (Figure 5-14) so the peak of the wavemeter pip is coincident with the leading edge of the marker.

23. Verify that the delay is accurate by manually adjusting sweep time from 10 to 200 ms. Iterate "HI" adjustment to optimize setting for minimum delay per sweep time. The position of the wavemeter pip should typically stay within ±5 MHz as read on the wavemeter across the 10 to 200 ms range.

ADJUSTMENTS

5-19. FREQUENCY REFERENCE 1 V/GHz OUTPUT

Reference:

Performance Test: 8350A Paragraph 4-13.
Service Sheet: A2

Description:

The frequency reference rear panel output is adjusted for 1 Volt per GHz. Example: 2 GHz = 2 Volts; 4.5 GHz = 4.5 Volts, etc.

Equipment:

Digital Voltmeter..... HP 3455A

Procedure:

1. Connect a DVM to A2TP1 (Figure 5-15).

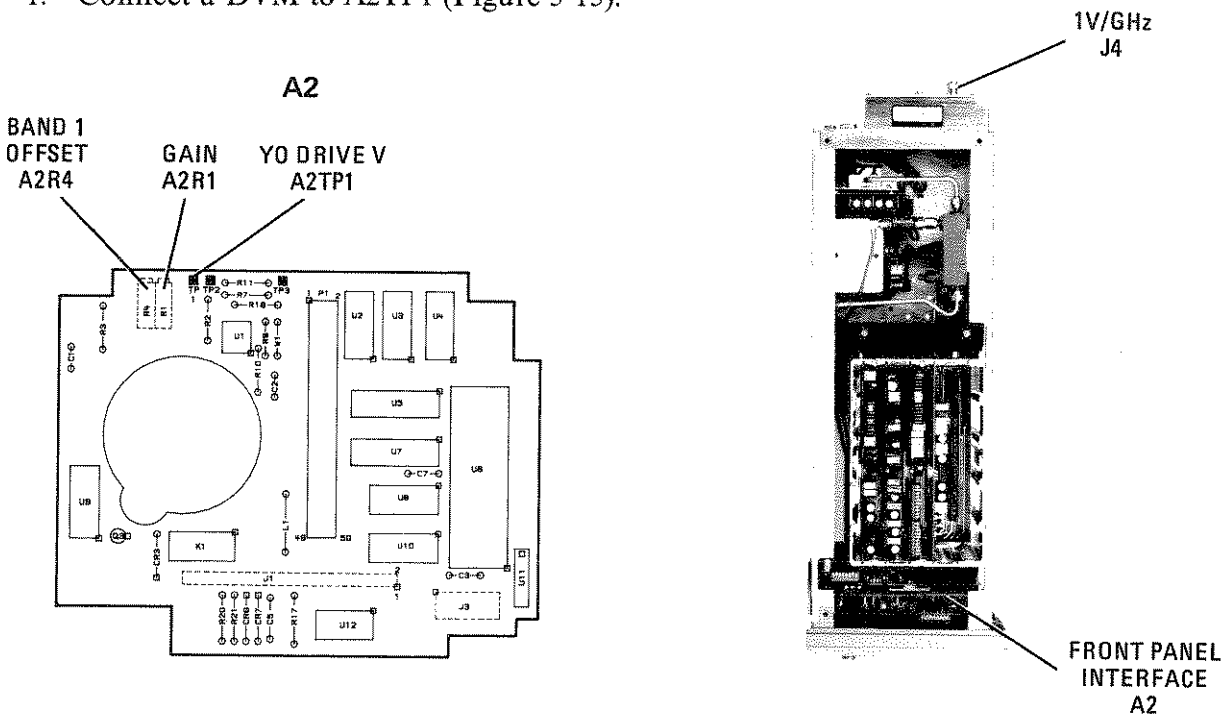


Figure 5-15. Frequency Reference Adjustments Location

2. Select CW and set Frequency for zero Volt indication on DVM.
3. Connect DVM to rear panel 1 V/GHz Frequency Reference connector, J4.
4. Adjust A2R4 "OFFSET" (Figure 5-15) for the voltage that corresponds to the CW frequency (example: 6.4 GHz = +6.4 Vdc).
5. Set CW Frequency to 8.4 GHz. Adjust A2R1 "GAIN" for an output of +8.4 Vdc ±10 mVdc on DVM.
6. Set CW Frequency to 3.0 GHz. Verify 3.0 volts at 1V/GHz connector. If not, repeat steps 1–6.

5-20. ALC ADJUSTMENT

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-25. Deviation from this routine may cause improper leveling and/or flatness problems.

Reference:

Performance Test: 8350A Paragraph 4-14.
Service Sheet: A4

Description:

Adjustments compensate for DC offsets in the detected RF path and the Main ALC amp. Power is roughly calibrated.

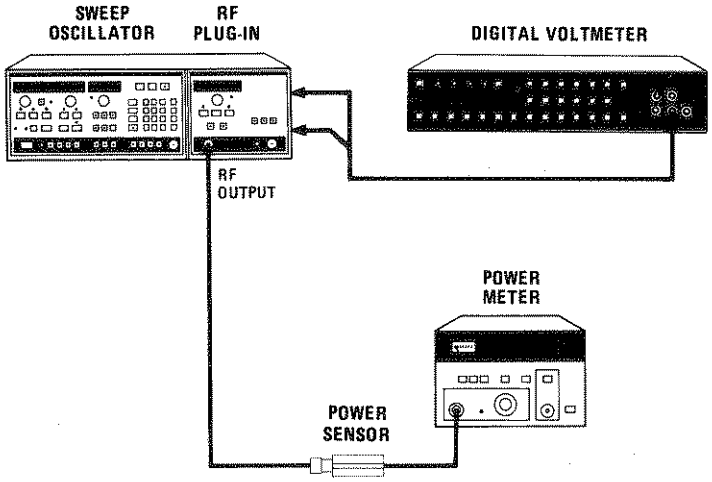


Figure 5-16. ALC Adjustment Test Setup

Equipment:

Digital Voltmeter	HP 3455A
Power Meter	HP 436A
Thermistor Mount	HP 8481A
Extender Board	HP 08350-60031

Procedure:

NOTE

Turn AC power OFF when removing or installing PC boards.

ADJUSTMENTS

5-20. ALC ADJUSTMENT (Cont'd)

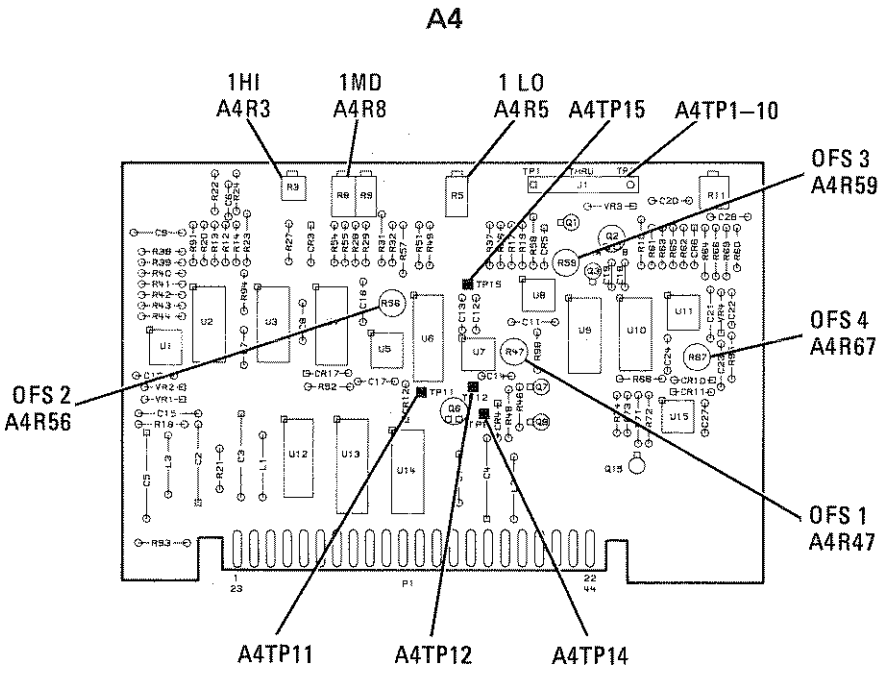


Figure 5-17. ALC Adjustments Location

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

1. Remove A5 FM Driver board. Place A4 assembly on an extender board. Sweep the full range of the plug-in at any leveled power.

2. Float the ground on the digital voltmeter and measure the voltage between A4TP12 and A4TP14 (Figure 5-17). Adjust A4R47 OFS 1 (offset 1) for 0.000V ±0.001V.

3. Attach jumper from A4TP11 to ground. Connect DVM to A4TP5 (reference to ground). Adjust A4R56 OFS 2 (offset 2) for 0.000V ± 0.001V. Remove jumper.

4. Connect DVM between A4TP12 and A4TP15 (floating ground). Adjust A4R59 OFS 3 (offset 3) for 0.000V ± 0.001V.

5. Press 8350A front panel CW and ensure that the power is leveled (UNLEVELED light off). If it isn't, adjust CW to some leveled frequency. Connect DVM to A4TP7 and adjust A4R67 OFS 4 (offset 4) for 0.000V ± 0.001V.

6. Turn instrument LINE power OFF. Remove A4 assembly from the extender board and reinsert A4 directly into the instrument. Turn ON LINE power to instrument. Connect power meter sensor to RF OUTPUT as shown in Figure 5-16.

7. Press 8350A CW . Set POWER for plug-in front panel reading of +1 dBm. Adjust A4R5 "1 LO" for an RF OUTPUT power of +1 dBm ±0.1 dB.

5-20. ALC ADJUSTMENT (Cont'd)

8. Set POWER for plug-in front panel reading of +12 dBm. Adjust A4R8 "1 MD" for an RF OUTPUT power of +12 dBm ±0.1 dB.

9. Iterate steps 7 and 8 until both low and midpower ranges are calibrated.

10. Set POWER for plug-in front panel reading of +16 dBm (+15 dBm for Option 002 instruments). Adjust A4R3 "1 HI" for an RF OUTPUT power of +16 dBm ±0.1 dB. This roughly calibrates the RF power. Fine calibration is documented in a later procedure.

NOTE

The FM PC Board will be reinstalled in Paragraph 5-22.

5-21. HARMONICS

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-25. Deviation from this routine may cause improper leveling and/or flatness problems.

Reference:

Performance Test: 8350A Paragraph 4-17.
Service Sheet: RF Block Diagram and A13A1

Description:

Variable bias resistors set the operating points of the RF amplifier FETs to minimize harmonics. Harmonics are observed using band pass filters to separate harmonics from the fundamental frequency.

5-21. HARMONICS (Cont'd)

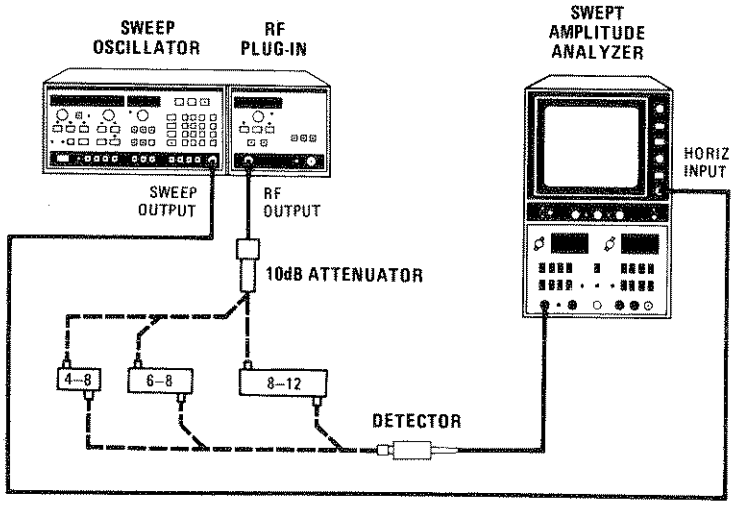


Figure 5-18. Harmonics Test Setup

Equipment:

Swept Amplitude Analyzer	HP 8755C
Detector	HP 11664A
4-8 GHz Band Pass Filter	HP 0960-0402
6-8 GHz Band Pass Filter	HP 0960-0200
8-12.4 GHz Band Pass Filter	HP 0960-0403
10 dB Attenuator	HP 8491A Option 010

Procedure:

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6), and at the 8350A Sweep Oscillator, 27.8 kHz square-wave is selected.

1. Connect equipment as shown in Figure 5-18, with the 4 to 8 GHz band pass filter in the RF path. Select 8350A ⊔⊓ MOD and RF BLANK. Sweep from 2 to 8.4 GHz at a leveled power of +16 dBm (+15 dBm for Option 002 instruments).

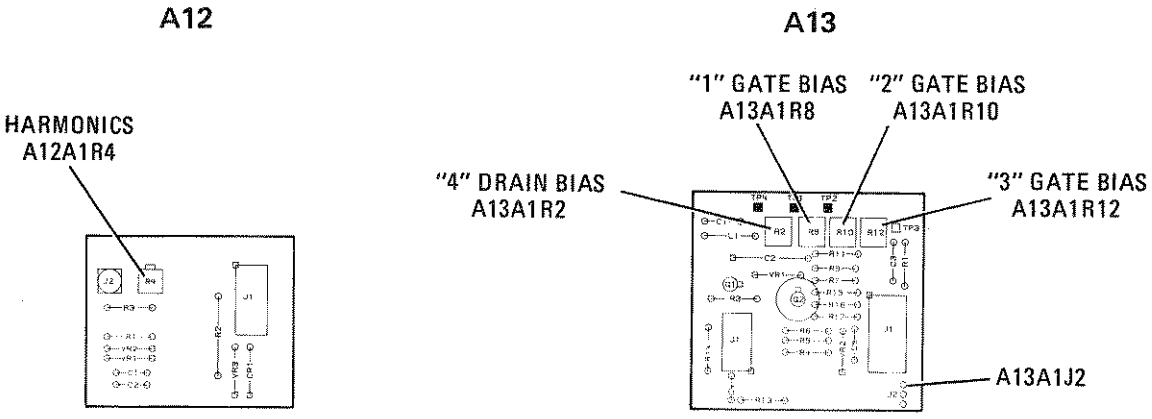


Figure 5-19. Harmonic Adjustments Location

5-21. HARMONICS (Cont'd)

2. Check the band-reject region of the trace. Signals observed above the noise floor of the detector represent the second harmonics of the 2 to 4 GHz swept signal. Four adjustments on the A13A1 Modulator/Amplifier bias assembly and one on the A12A1 (Figure 5-19) are used to optimize harmonic levels. Begin adjustments from left to right along the top of the A13A1 assembly with the drain bias pot, R2 ("4"), followed by three gate bias pots: R8 ("1"), R10 ("2"), and R12 ("3"). Then adjust A12A1R4. Adjust all five pots for optimum harmonic levels.

3. Insert the 6 to 8 GHz Band Pass Filter into the RF path. Signals in the band reject region represent the second harmonics of 3 to 4 GHz, and the third harmonics of 2 to 2.8 GHz. Repeat the adjustments as described in step 2.

4. Insert the 8 to 12 GHz Band Pass Filter into the RF path. Signal levels in the band reject region represent the second harmonic of 4 to 6 GHz and the third harmonic of 2.67 to 2.8 GHz. Adjust the five pots as instructed in step 2. Repeat steps 2 through 4 to ensure minimum harmonic levels. Harmonics should be at least 20 dB below the fundamental.

5-22. INTERNAL LEVELED FLATNESS

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-25. Deviation from this routine may cause improper leveling and/or flatness problems.

Reference:

Performance Test: 8350A Paragraph 4-14.
Service Sheet: A5

Description:

Four parallel circuits on the A5 assembly provide adjustments for ALC flatness. BP1 through BP4 and SL1 through SL4 determine the slope of the flatness compensation signal input to the A4 ALC assembly. Breakpoint potentiometers (BP1-4) determine the frequency at which the corresponding slope potentiometers (SL1-4) begin to affect power output leveling.

5-22. INTERNAL LEVELED FLATNESS (Cont'd)

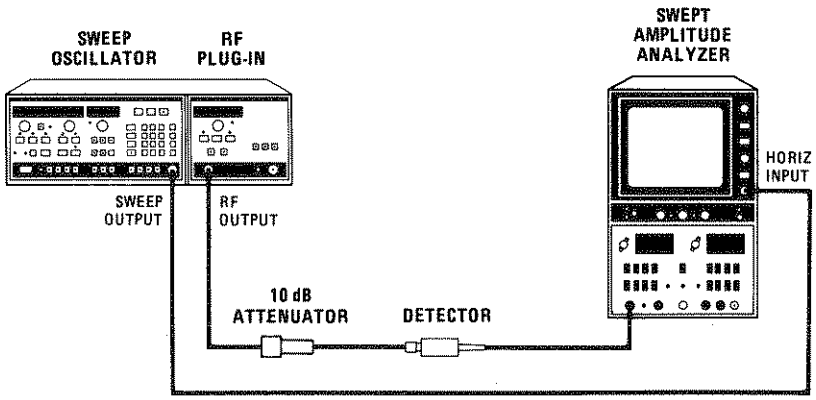


Figure 5-20. Internal Leveling Adjustment Test Setup

Equipment:

Swept Amplitude Analyzer ..... HP 8755C
Detector ..... HP 11664A
10 dB Attenuator ..... HP 8491A Option 010

Procedure:

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6), and at the 8350A Sweep Oscillator, 27.8 kHz square-wave modulation is selected.

1. Reinstall A5 FM Driver assembly. Connect equipment as shown in Figure 5-20, with the 8755C monitoring the RF output. Select 8350A ⌐¬ MOD . Sweep the full range of the plug-in at any leveled power.

NOTE

The following step negates any flatness compensation by effectively removing the ALC Flatness Adjustments from the leveling circuitry. This step may be omitted if RF flatness approaches specified limits.

2. Adjust all breakpoint potentiometers fully clockwise against the stops: A5R34 "BP1", A5R36 "BP2", A5R38 "BP3", and A5R40 "BP4" as shown in Figure 5-21. This effectively removes the circuit from the leveling loop.

3. Adjust A5R48 (SLP) for best overall flatness.

4. Set breakpoint adjustments A5R34, A5R36, A5R38, and A5R40, (BP1-4) and slope adjustments A5R41 through A5R44 (SL1-4) for best overall flatness. (BP1 and SL1 are interdependent adjustments, as are BP2 and SL2, etc.). The Breakpoint potentiometers determine the frequency at which the Slope adjustments will take effect. This is observed as a pivot point on the CRT trace.

ADJUSTMENTS

5-22. INTERNAL LEVELED FLATNESS (Cont'd)

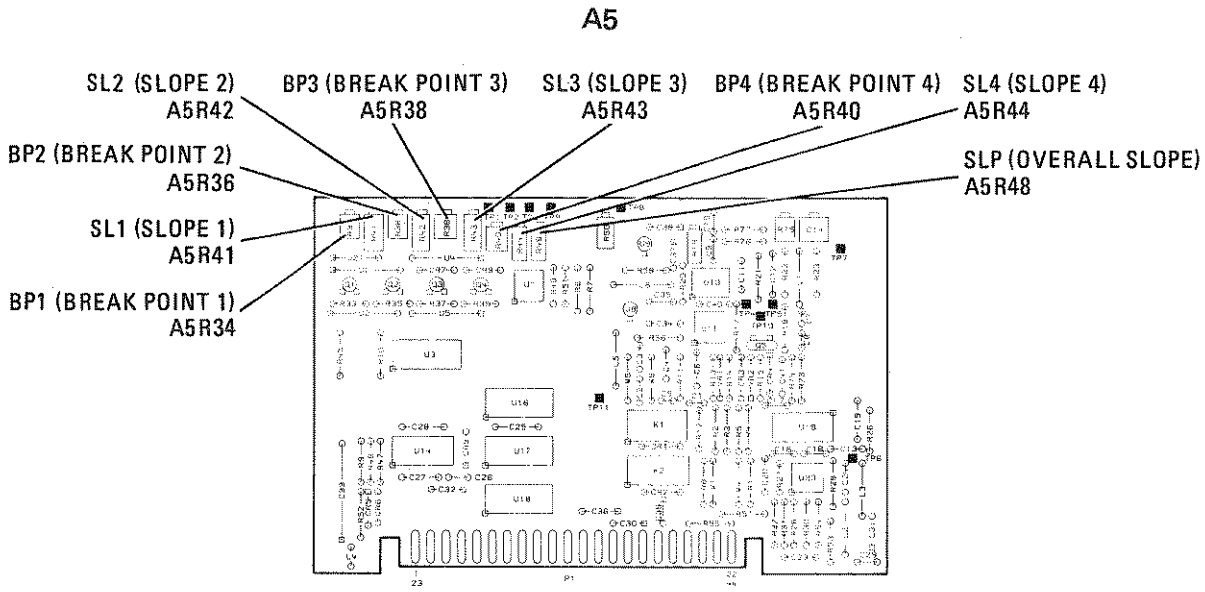


Figure 5-21. Internal Leveling Adjustments Location

5-23. POWER CALIBRATION

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-25. Deviation from this routine may cause improper leveling and/or flatness problems.

Reference:

Performance Test: 8350A Paragraph 4-14.
Service Sheet: A4

Description:

Power is calibrated at a CW frequency which falls in the middle of the power variation range. Adjustments are made at three breakpoints over the leveled power range: +1 to +5 dBm, +12 dBm, and +16 dBm (+15 dBm for Option 002 instruments).

5-23. POWER CALIBRATION (Cont'd)

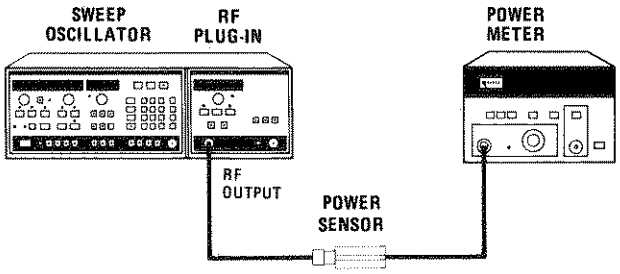


Figure 5-22. Power Calibration Test Setup

Equipment:

Power Meter ..... HP 436A
Power Sensor ..... HP 8481A

Procedure:

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

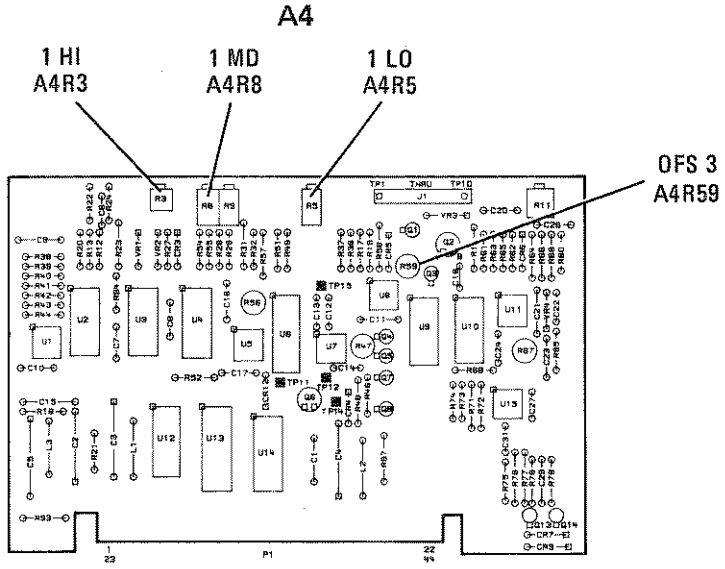


Figure 5-23. Power Calibration Adjustments Location

ADJUSTMENTS

5-23. POWER CALIBRATION (Cont'd)

1. Connect equipment as shown in Figure 5-22. Ensure 8350A ⊓ MOD is off. Select 8350A MAN sweep. Manually sweep through the band and select a frequency where the power is approximately in the center of the power variation range. Select CW at that frequency.

2. Set power for a front panel indication of +1 dBm. Adjust "1 LO" (A4R5) for a power meter reading of +1 dBm ±0.1 dB.

3. Set power for front panel indication of +12 dBm. Adjust "1 MD" (A4R8) for a power meter indication of +12 dBm ± 0.1 dB.

4. Iterate between power settings of +1 dBm and +5 dBm. Compromise the "1 LO" (A4R5) adjustment for best calibration at both settings.

5. Set power for a front panel indication of +12 dBm. Readjust "1 MD" (A4R8) for power meter indication of +12 dBm ± 0.1 dB.

6. Set power for front panel indication of +16 dBm (+15 dBm for Option 002 instruments). Adjust "1 HI" (A4R3) for a power meter reading of +16 dBm ±0.1 dB.

7. Step the RF power in 1 dB intervals from +1 to +16 dBm (+1 to +15 dBm for Option 002 instruments). The power meter reading should match the front panel power setting ±0.2 dB.

5-24. POWER METER LEVELING CALIBRATION

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed from Paragraph 5-20 through 5-25. Deviation from this routine may cause improper leveling and/or flatness problems.

Reference:

Performance Test: 8350A Paragraph 4-14.
Service Sheet: A4

Description:

Power Meter leveling gain potentiometer A4R9 (PM) calibrates loop gain to full-scale deflection of the leveling meter.

ADJUSTMENTS

5-24. POWER METER LEVELING CALIBRATION (Cont'd)

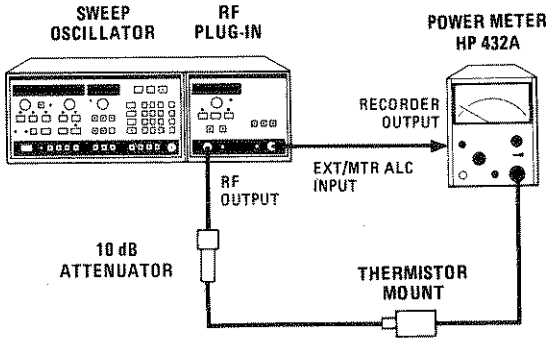


Figure 5-24. Power Meter Leveling Calibration Test Setup

Equipment:

Sweep Oscillator	HP 8350A
Power Meter	HP 432A
Thermistor Mount	HP 8478B
10 dB Attenuator	HP 8491A Option 010

Procedure:

NOTE

If, during the following procedure, ALC loop oscillations occur, reduce loop gain by adjusting A4R11 (Figure 5-25) counterclockwise. This adjustment will be set in the next procedure.

1. Connect equipment as shown in Figure 5-24. Ensure 8350A ⌐¬ MOD is off. Press CW and select a frequency at midband.

2. Set 83540A POWER LEVEL to +5 dBm. Set Power Meter RANGE switch to 0. Adjust 83540A POWER LEVEL, if necessary, to obtain a meter reading of −5.

3. Press 83540A MTR ALC mode. Adjust 83540A front panel CAL knob to return the power meter needle to its previous position at −5.

4. Increase the 83540A POWER LEVEL by exactly 5.0 dBm. Adjust A4R9 "PM" (Figure 5-25) for a meter needle reading of 0 (83540A front panel power indication should approximate +10 dBm).

5. Iterate between power level settings of +5 and +10 dBm, adjusting the CAL knob and A4R9 respectively, until no further adjustment is necessary.

ADJUSTMENTS

5-24. POWER METER LEVELING CALIBRATION (Cont'd)

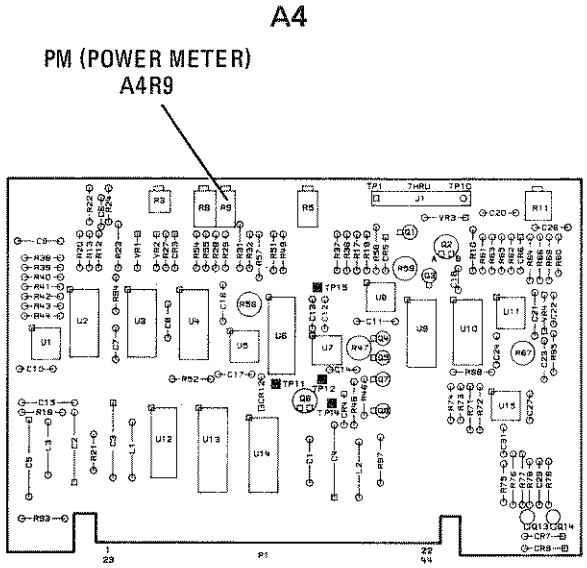


Figure 5-25. Power Meter Adjustment Location

5-25. ALC GAIN ADJUSTMENT

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-25. Deviation from this routine may cause improper leveling and/or flatness problems.

Reference:

Performance test: 8350A Paragraph 4-14.
Service Sheet: A4

Description:

A4R11, at the inverting input of A4U11, adjusts the gain of the Main ALC Amplifier. A4R11 is adjusted for maximum possible gain without producing oscillations.

5-25. ALC GAIN ADJUSTMENT (Cont'd)

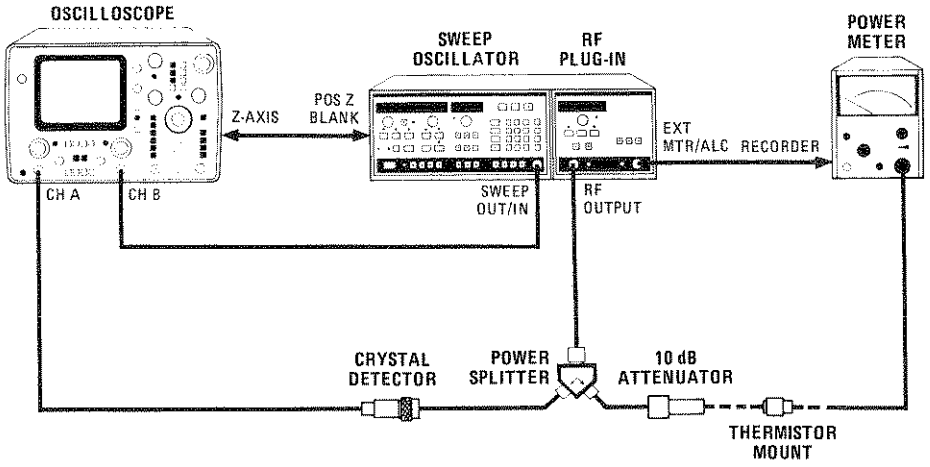


Figure 5-26. ALC Gain Adjustment Test Setup

Equipment:

Sweep Oscillator	HP 8350A
Oscilloscope	HP 1740A
Crystal Detector	HP 423A
Power Meter	HP 432A
Thermistor Mount	HP 8478B
Power Splitter	HP 11667A Option 001
10 dB Attenuator	HP 8491A Option 010

Procedure:

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

1. Connect equipment as shown in Figure 5-26.

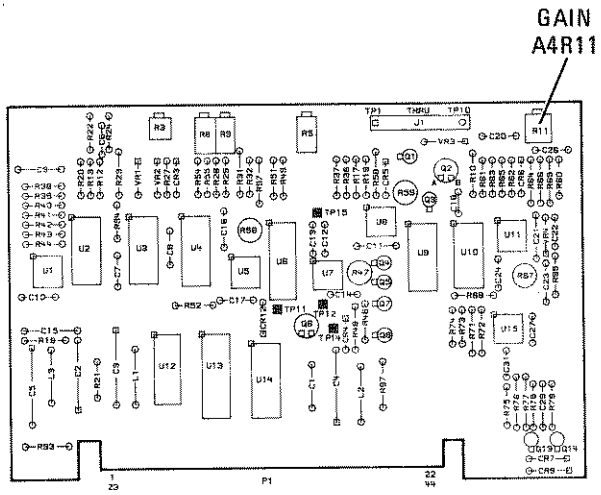


Figure 5-27. Location of ALC Gain Adjustment

5-25. ALC GAIN ADJUSTMENT (Cont'd)

2. Press 8350A INSTR PRESET .

3. On the oscilloscope, select A versus B mode to display a plot of frequency versus amplitude. Set the Channel A vertical sensitivity for 0.05 VOLTS/DIV and AC coupling. Set Channel B for 1 VOLT/DIV. Adjust Horizontal POSITION and Channel A vertical POSN controls for a stable display at mid screen. Then, increase Channel A sensitivity to 0.01 V/DIV.

4. Set the Power Meter Range switch to 0 dBm. Note the power meter needle position.

5. On the 83540A, press MTR ALC mode.

6. On the 8350A, press SWEEP TIME and enter 50 seconds.

7. If necessary, adjust the output power with the 83540A front panel RPG to position the power meter needle to the same reading noted in step 4. Then decrease the power meter range switch by three 5 dB steps to −15 dB. This attenuates the output power by 15 dB, so that the plug-in is now outputting power at the low end of its calibrated power range: approximately +1 dBm.

8. Observe the trace dot as it sweeps across the CRT. Adjust A4R11, GAIN, (Figure 5-27) clockwise, increasing the gain of the ALC loop, until the trace dot begins to oscillate. Then reduce gain to eliminate oscillations and obtain a focused "dot" trace.

9. Set the plug-in to maximum leveled power by returning the power meter range switch to the previous setting of 0 dB. Observe the trace through the entire sweep to ensure no oscillations at high power. If oscillations occur, reduce gain (A4R11).

10. Press 8350A INSTR PRESET . The plug-in should now be internally leveled at maximum specified leveled power.

11. Adjust Channel A vertical sensitivity to obtain the internally leveled sweep trace at center screen. If oscillations are present, further reduce loop gain (A4R11).

12. Reduce plug-in power level to +1 dBm with plug-in RPG. If oscillations occur, further reduce gain (A4R11).

5-26. POWER SWEEP

Reference:

Performance Test: 8350A Paragraph 4-14.
Service Sheet: A5

Description:

A 10 dB/sweep power sweep mode is selected and the resultant is displayed on the 8755C Swept Amplitude Analyzer. Output of the power sweep circuit is adjusted for the correct sweep.

5-26. POWER SWEEP (Cont'd)

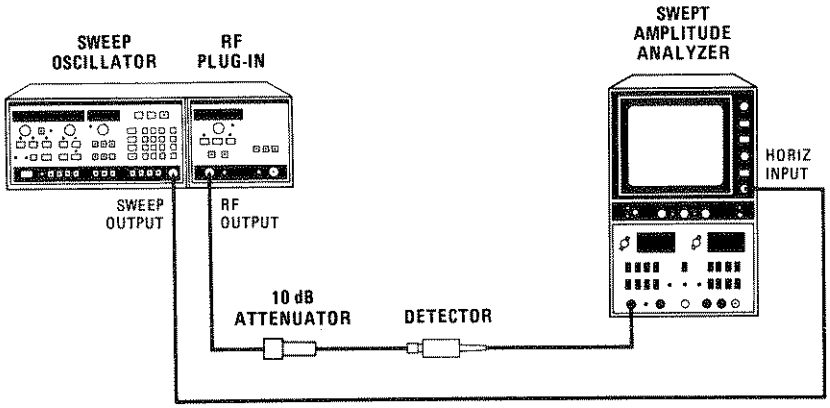


Figure 5-28. Power Sweep Adjustment Test Setup

Equipment:

Swept Amplitude Analyzer	HP 8755C
Detector	HP 11664A
10 dB Attenuator	HP 8491A Option 010

Procedure:

NOTE

ALC calibration adjustments must be checked before power sweep adjustment is made.

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6), and at the 8350A Sweep Oscillator, 27.8 kHz square-wave is selected.

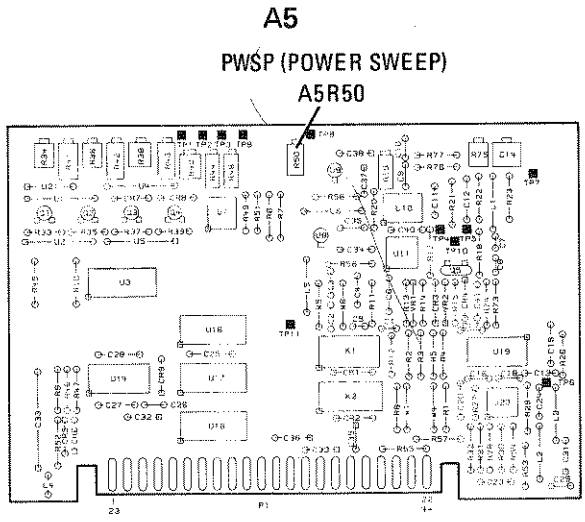


Figure 5-29. Location of Power Sweep Adjustment

5-26. POWER SWEEP (Cont'd)

1. Connect equipment as shown in Figure 5-28. Select 8350A ⊓ MOD .

8755C

CHANNEL 1
Display ..... A
dB/DIV 5
VERNIER ..... ON
REFERENCE POSITION ..... Bottom Line

2. Select SHIFT CW mode and set power level to +1 dBm.
3. Adjust 8755C Channel 1 VERNIER to place trace on bottom line.
4. Press POWER SWEEP and at DATA ENTRY select 10 dB/sweep.
5. While observing 8755C display of RF output, adjust A5R50 PWSP (power sweep) (Figure 5-29) for 10 dB/sweep.

5-27. FM DRIVER

Reference:

Performance Test: 8350A Paragraph 4-21.
Service Sheet: A5

Description:

The FM Driver high frequency offset is adjusted for zero volt drive with no FM applied. A delay-line discriminator is used to detect and display FM on an oscilloscope. Adjustments are for best overall frequency response from DC to 10 MHz. Compliance to a specification of ±3 dB is checked between DC and 2 MHz.

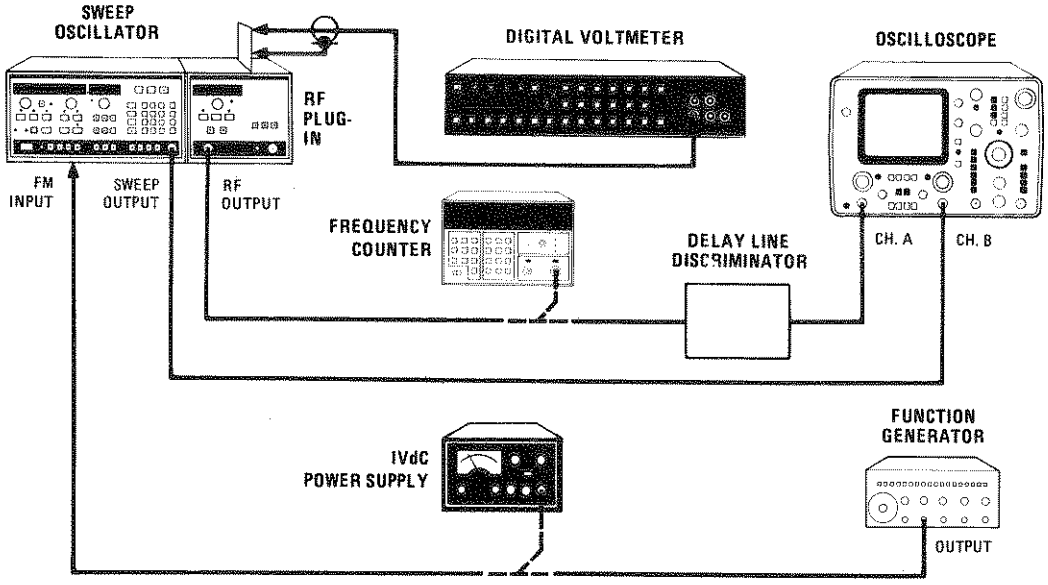


Figure 5-30. Test Setup for FM Driver Adjustments

5-27. FM DRIVER (Cont'd)

Equipment:

Digital Voltmeter	HP 3455A
Oscilloscope	HP 1740A
Function Generator	HP 3312A
Delay Line Discriminator	See Figure 1-3
Frequency Counter	HP 5343A
DC Power Supply	HP 6213A

Procedure:

NOTE

Turn AC power OFF when removing or installing PC boards.

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

FM OFFSET

1. Connect equipment as shown in Figure 5-30 except disconnect function generator from rear panel FM INPUT connector.

2. Place A5 FM Driver on extender board.

3. Connect DVM between A5 board connector pin 21 and A5TP7 (ground). (See Figure 5-31.) Adjust A5R19 "FM OFFSET" control for zero Vdc ±1 mVdc.

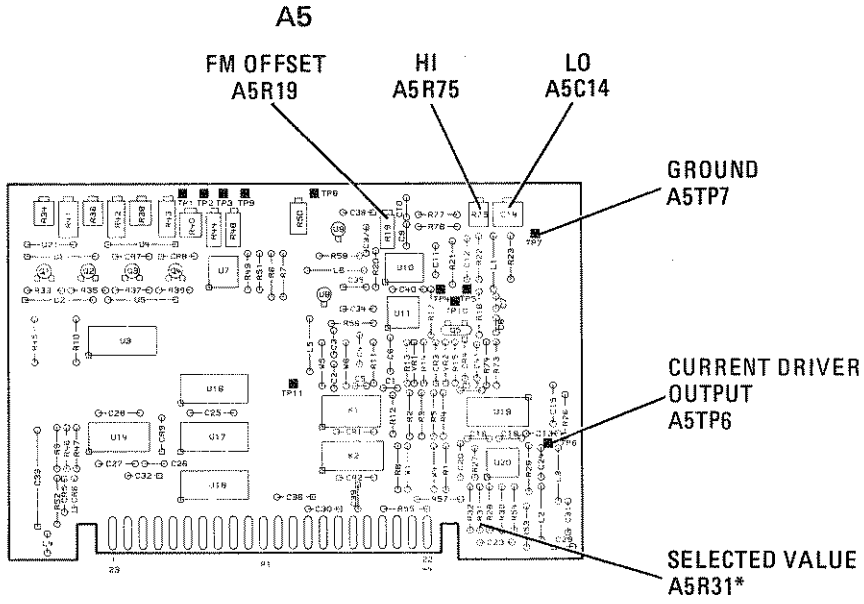


Figure 5-31. Location of A5 FM Driver Adjustments

ADJUSTMENTS

5-27. FM DRIVER (Cont'd)

4. Disconnect DVM from test points, remove extender board, and reinstall A5 FM Driver in instrument.

5. Set instrument controls as follows:

8350A SWEEP OSCILLATOR

FREQUENCY Sweep Mode ..... SHIFT CW (swept CW)
CW FREQUENCY ..... Midband
CW VERNIER ..... On
SWEEP TRIGGER ..... INT
RF BLANK ..... OFF

83540A RF PLUG-IN

POWER LEVEL ..... Any leveled power
CW FILTER ..... OFF
ALC MODE ..... INT
Configuration switch A3S1 on Digital Interface board (Table 5-6) set as follows:

Switch No.	1	2	3	4	5	6	7	8
Position	0	1	0	0	0	0	*	X

Positions: 1=Open; 0=Closed; X=Dont't care
* "0" if no Option 002; "1" if Option 002 installed.

NOTE

The A3S1 switch positions select the 83540A code, maximum RF power at power-up, −20 MHz/V FM sensitivity, cross-over coupled FM (AC coupled), and Option 002 code if installed.

3312A FUNCTION GENERATOR

RANGE ..... 1 MHz
FREQUENCY 10 (10MHz)
FUNCTION ..... Sine Wave
Amplitude ..... Set output for 100 mV p-p as displayed on Oscilloscope with 50 Ohm input

1740A OSCILLOSCOPE

MODE ..... A vs. B
CHANNEL A
  Input 50Ω
  V/Div 0.005
CHANNEL B
  Input ..... DC
  V/Div 1

5-27. FM DRIVER (Cont'd)

FLATNESS

6. Connect Frequency Counter to 83540A RF OUTPUT. Connect a +1 Vdc power supply to rear panel FM INPUT. A shift in frequency of approximately −20 MHz should occur on the Frequency Counter when +1 Vdc is applied. (This shows correct FM sensitivity. If a frequency shift of −6 MHz is indicated, reset switch 5 on A3S1 and press INSTR PRESET .) Reconnect Delay Line Discriminator to RF OUTPUT and connect function generator to rear panel FM INPUT connector.

7. Set ground reference on oscilloscope to center line. Adjust CW FREQUENCY and CW VERNIER for waveform at the center of oscilloscope CRT. Adjust Channel A "CAL" for a trace 4 cm peak-to-peak, centered on CRT. (This sets up 100% amplitude reference.)

8. Manually sweep function generator frequency from DC to 100 kHz. Select resistor A5R31 (Figure 5-31) so amplitude at 100 Hz and at 100 kHz is the same ±0.2 cm on CRT.

9. Manually sweep function generator frequency from DC to 10 MHz. Adjust A5C14 "LO" and A5R75 "HI" controls several times (Figure 5-31) to obtain the most constant overall response from DC to 10 MHz.

10. Check that ±3 dB flatness specification is met between DC and 2 MHz as follows. Manually sweep the function generator frequency between DC and 2 MHz. On the oscilloscope, note maximum and minimum response points (Figure 5-32). Maximum point (+3dB) can be up to 5.6 divisions, and minimum point (−3 dB) can be down to 2.8 divisions.

11. If the flatness specification in step 10 above is not met, repeat step 8 and 9 and make compromise adjustments in the DC to 2 MHz range to meet flatness requirements.

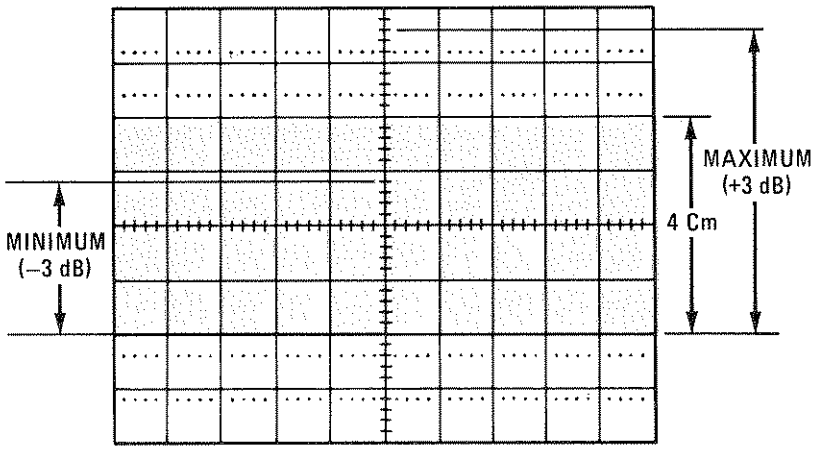


Figure 5-32. FM Flatness Tolerance, DC to 2 MHz

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6—2. This section contains information for ordering parts. Table 6-1 lists the available exchange assemblies. Table 6-2 lists abbreviations used in the parts list and the names and addresses that correspond to the manufacturer's code numbers. Table 6-3 lists all replaceable parts in reference designator order.

6-3. EXCHANGE ASSEMBLIES

6-4. Table 6—1 lists assemblies within the instrument that may be replaced on an exchange basis, thus affording a considerable cost savings. Exchange, factory repaired and tested assemblies are available only on a trade-in basis; therefore, the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number.

6-5. ABBREVIATIONS

6-6. Table 6-2 contains three major sections: Reference Designations expands the designators used in the parts list; Abbreviations defines all abbreviations used in the descriptions of replaceable parts; Manufacturer's Code List references the name and address of a typical manufacturer with the code number provided in the parts list.

6-7. REPLACEABLE PARTS LIST

6-8. Table 6-3 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.

b. Chassis-mounted parts in alpha-numerical order by reference designation.

c. Miscellaneous parts.

6-9. The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. Part number check digit (CD).

c. The total quantity (Qty) in the instrument.

d. The description of the part.

e. A typical manufacturer of the part in a five-digit code.

f. The manufacturer's number for the part.

6-10. The total quantity for each part is given only once — at the first appearance of the part number in the list.

NOTE

Total quantities for optional assemblies are totaled by assembly and not integrated into the standard list.

6-11. ILLUSTRATIONS

6-12. Figure 6-1, Mechanical Parts, provides the location of all replaceable mechanical parts listed in Table 6-3. These parts are denoted with reference designation prefix "MP". Figure 6-2, Attaching Hardware, references the Hewlett-Packard part number for the hardware used, with at least one location within the instrument. Figure 6-3 illustrates the semi-rigid coaxial cables used in both standard and option-inclusive instruments. Figure 6-4 provides an exploded view of the front panel RF output connector and lists the Hewlett-Packard part number for all replaceable items.

6-13. ORDERING INFORMATION

6-14. To order a part listed in the Replaceable Parts List, quote the Hewlett-Packard part number with its check digit (CD), indicate the quantity, and address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

6-15. To order a part that is not listed in the Replaceable Parts List, include the instrument model number, instrument serial number, description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

6-16. SPARE PARTS KIT

6-17. Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has a "Spare Parts Kit" available for this purpose. The kit consists of selected replaceable assemblies and components for this instrument. The contents of the kit and the "Recommended Spares" list for this instrument may be obtained on request and the "Spare Parts Kit" may be ordered through your nearest Hewlett-Packard office.

Table 6-1. Exchange Parts

Reference Designation	New Part Number	Rebuilt-Exchange Part Number	Designation
A12	5086-7373	5086-6373	YO 2.0–8.4 GHz
A13	5086-7249	5086-6249	MODULATOR/AMPL.
NOTE **For module exchange procedure, see Paragraph 8-29.**			

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (1 of 3)

MANUFACTURERS CODE LIST

MFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
00000	ANY SATISFACTORY SUPPLIER			
0003J	NIPPON ELECTRIC CO			
00046	UNITRODE COMPUTER PRODUCTS CORP	METHUEN	MA	01844
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
01928	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	08876
02111	SPECTROL ELECTRONICS CORP	CITY OF IND	CA	91745
03888	KDI PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
06001	GE CO ELEK CAP & BAT PROD DEPT	IRMO	SC	29063
06665	PRECISION MONOLITHICS INC	SANTA CLARA	CA	95050
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
11236	CTS OF BERNE INC	BERNE	IN	46711
13606	SPRAGUE ELECT CO SEMICONDUCTOR DIV	CONCORD	NH	03301
16179	OMNI SPECTRA INC	FARMINGTON	MI	03054
17856	SILICONIX INC	SANTA CLARA	CA	95054
18324	SIGNETICS CORP	SUNNYVALE	CA	94086
19701	MEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
20932	EMCON DIV ITW	SAN DIEGO	CA	92129
24355	ANALOG DEVICES INC	NORWOOD	MA	02062
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
25088	SIEMENS CORP	ISELIN	NJ	08830
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
30983	MEPCO/ELECTRA CORP	SAN DIEGO	CA	92121
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE	CA	92507
34371	HARRIS SEMICON DIV HARRIS-INTERTYPE	MELBOURNE	FL	32901
34649	INTEL CORP	MOUNTAIN VIEW	CA	95051
51642	CENTRE ENGINEERING INC	STATE COLLEGE	PA	16801
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
72116	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC	CT	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON	CA	92634
74970	JOHNSON E F CO	WASECA	MN	56093

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (2 of 3)

REFERENCE DESIGNATIONS

A ..... Assembly
AT ..... Attenuator, Isolator, Limiter, Termination
B ..... Fan, Motor
BT ..... Battery
C ..... Capacitor
CP ..... Coupler
CR ... Diode, Diode Thyristor, Step Recovery Diode (SCR), Varactor
DC ..... Directional Coupler
DL ..... Delay Line
DS ... Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Audible or Visible)
E ..... Miscellaneous Electrical Part
F ..... Fuse
FL ..... Filter
H ..... Hardware
HY ..... Circulator
J ..... Electrical Connector (Stationary Portion), Jack
K ..... Relay
L ..... Coil, Inductor
M ..... Meter
MP ..... Miscellaneous Mechanical Part
P ..... Electrical Connector (Movable Portion), Plug
Q .... Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R ..... Resistor
RT ..... Thermistor
S ..... Switch
T ..... Transformer
TB ..... Terminal Board
TC ..... Thermocouple
TP ..... Test Point
U ..... Integrated Circuit, Microcircuit
V ..... Electron Tube
VR ... Breakdown Diode (Zener), Voltage Regulator
W ..... Cable, Transmission Path, Wire
X ..... Socket
Y ..... Crystal Unit (Piezoelectric, Quartz)
Z ... Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

A ..... Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ ..... Adjust, Adjustment
ALC ..... Alcohol, Automatic Level Control
AM ..... Amplitude Modulation
AMP ..... Amperage
AMPL ..... Amplifier
ANLG ..... Analog
ASSY ..... Assembly
ASTBL ..... Astable
ATTEN ... Attenuation, Attenuator

B

BCD ..... Binary Coded Decimal
BFR ..... Before, Buffer
BNC ..... Type of Connector
BSC ..... Basic

C

C ..... Capacitance, Capacitor, Center Tapped, Centistoke, Ceramic, Cermet, Circular Mil Foot, Closed Cup, Cold, Compression
CER ..... Ceramic
CH ..... Center Hole
CHAM ..... Chamfer
CNTR ..... Container, Counter
COAX ..... Coaxial
COM .... Commercial, Common
CONN .... Connect, Connection, Connector
CONT ..... Contact, Continuous, Control, Controller
CONV ..... Converter
CP ..... Cadmium Plate, Candle Power, Centipoise, Conductive Plastic, Cone Point
CRP ..... Crepe, Crimp
CS .... Case, Centistoke, Cesium, Cross Section

D

D ..... Deep, Depletion, Depth, Diameter, Direct Current
DB ..... Decibel, Double Break
DBL ..... Double
DCDR ..... Decoder
DEG ..... Degree
DIFF ..... Differential
DO ... Package Type Designation
DRVR ..... Driver
DX ..... Duplex

E

E-MODE ... Enhancement Mode
ECL ..... Emitter-Coupled Logic
EPROM ..... Eraseable Programmable Read Only Memory
EXCL ..... Excluding, Exclusive
EXT ..... Extended, Extension, External, Extinguish

F

F ..... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency
FEM ..... Female
FF ... Flange, Female Connection; Flip Flop
FL ..... Flash, Flat, Fluid
FM ... Flange, Male Connection; Foam, Frequency Modulation
FR ..... Folder
FT ..... Current Gain Bandwidth Product (Transition Frequency); Feet, Foot
FXD ..... Fixed

G

GE ..... Germanium
GEN ..... General, Generator
GHZ ..... Gigahertz
GL ..... Glass
GP ..... General Purpose, Group

H

HD ..... Hand, Hard, Head, Heavy Duty
HEX ..... Hexadecimal, Hexagon, Hexagonal

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (3 of 3)

HI..... High
HS.... Heat Sealed, Heat Shrink, High Speed

I

IC..... Collector Current, Integrated Circuit
ID..... Identification, Inside Diameter
IF..... Forward Current, Intermediate Frequency
IN..... Inch, Indium
IN..... Inch, Indium
INP..... Input
INT..... Integral, Intensity, Internal
INTL..... Internal, International
INV..... Invert, Inverter

J

J-FET..... Junction Field Effect Transistor
JFET..... Junction Field Effect Transistor
JGK..... Jade Gray Knob (HP 6009-0021)

K

KB..... Knob

L

LED..... Light Emitting Diode
LG..... Length, Long
LKG..... Leakage, Locking
LKWR..... Lockwasher
LO..... Local Oscillator, Low
LS..... Loudspeaker, Low Power Schottky, Series Inductance
LT..... Left, Light, Liter

M

MA..... Milliampere
MACH..... Machined
MCD..... Millicandela
MISC..... Miscellaneous
MLD..... Mold, Molded
MOD..... Model, Modified, Modular, Modulated, Modulator
MONO/ASTBL..... Monostable/ Astable
MONOSTBL..... Monostable
MOSFET..... Metal Oxide Semiconductor Field Effect Transistor
MTG..... Mounting
MV..... Millivolt, Multivibrator
MW..... Milliwatt

N

N-CHAN..... N-Channel
NAND..... Logic Not-AND
NM.... Nanometer, Nonmetallic
NMOS..... N-Channel Metal Oxide Semiconductor
NO.... Normally Open, Number
NPN... Negative Positive Negative (Transistor)
NS..... Nanosecond, Non-Shorting, Nose

O

OCTL..... Octal
OD..... Olive Drab, Outside Diameter
OP..... Operational
OPT... Optical, Option, Optional

P

PAN-HD..... Pan Head
PC..... Picocoulomb, Piece, Printed Circuit
PCB..... Printed Circuit Board
PD..... Pad, Palladium, Pitch Diameter, Power Dissipation
PF..... Picofarad; Pipe, Female Connection; Power Factor
PL..... Phase Lock, Plain, Plate, Plug
PLSTC..... Plastic
POS..... Position, Positive
POZI..... Pozidriv Recess
PRCN..... Precision
PRP..... Purple, Purpose
PVC..... Polyvinyl Chloride

Q

QUAD..... Set of Four

R

RCVR..... Receiver
RCVY..... Recovery
REF..... Reference
RES..... Research, Resistance, Resistor, Resolution
RETRIG..... Retriggerable
RGLTR..... Regulator
RKR..... Rocker
RND..... Round
RPG.... Rotary Pulse Generator
RT..... Real Time, Right

S

SCR..... Screw, Scrub, Silicon Controlled Rectifier
SEC..... Second, Secondary
SGL..... Single
SHFT..... Shaft
SI..... Silicon, Square Inch
SLDR..... Solder
SM..... Samarium, Seam, Small, Square Meter, Sub Modular, Subminiature
SMB..... Subminiature, B Type (Snap-On Connector)
SNP..... Snap
STAT..... Status
STL..... Steel
SW..... Single Wall, Switch
SZ..... Size

T

TA..... Ambient Temperature, Tantalum
TC..... Thermoplastic
THD..... Thread, Threaded
THK..... Thick
TPG..... Tapping
TPL..... Triple
TRIG..... Trigger, Triggerable, Triggering, Trigonometry
TRMR..... Trimmer
TRN..... Turn, Turns
TTL..... Tan Translucent, Transistor Transistor Logic

U

U/W..... Used With
UF..... Microfarad

V

V..... Vanadium, Variable, Violet, Volt, Voltage
VAR..... Variable
VDC..... Volts, Direct Current
VID..... Video

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	**83540-60008**	**7**	**1**	**BOARD ASSEMBLY-FRONT PANEL** (DOES NOT INCLUDE A1RPG1 ROTARY PULSE GENERATOR)	**28480**	**83540-60008**
A1C1	0160-4084	8	28	CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A1C2	0180-2811	7	1	CAPACITOR-FXD 10UF±20% 35VDC TA	28480	0180-2811
A1C3	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A1C4	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A1C5	0180-0552	9	1	CAPACITOR-FXD 220UF±20% 10VDC TA	28480	0180-0552
A1DS1				NOT ASSIGNED		
A1DS2	1990-0487	7	2	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A1DS3	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A1DS4	1990-0670	0	5	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS5	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS6	1990-0486	6	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A1DS7–A1DS13				NOT ASSIGNED		
A1DS14	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS15	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS16	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS17	1990-0699	3	3	LED-VISIBLE LUM-INT=7MCD IF=30MA-MAX	28480	1LM1-2350
A1DS18	1990-0699	3		LED-VISIBLE LUM-INT=7MCD IF=30MA-MAX	28480	1LM1-2350
A1DS19	1990-0699	3		LED-VISIBLE LUM-INT=7MCD IF=30MA-MAX	28480	1LM1-2350
A1J1	1251-4827	1	3	CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A1MP1				NOT ASSIGNED		
A1MP2	2950-0006	3	1	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A1MP3				NOT ASSIGNED		
A1MP4	2190-0067	4	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
A1MP5–MP7	0380-1233	9	3	SPACER-SPECIALTY .450 IN LG; .175 IN OD	28480	0380-1233
A1R1				NOT ASSIGNED		
A1R2	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-T0-316R-F
A1R3				NOT ASSIGNED		
A1R4	2100-3766	7	1	RESISTOR-VAR CONTROL CP 10K 10% LIN	28480	2100-3766
A1R5				NOT ASSIGNED		
A1R6	0698-8820	7	1	RESISTOR 4.64 1% .125W F TC=0±100	28480	0698-8820
A1R7	0757-0398	4	4	RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A1R8	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A1R9	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A1RPG1	5060-9444	7	1	ROTARY PULSE GENERATOR	28480	5060-9444
A1S1	5060-9436	7	8	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S6–A1S11				NOT ASSIGNED		
A1S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1U1	1810-0124	9	1	NETWORK-RES 16-DIP200.0 OHM X 8	11236	761-3-R200
A1U2	1990-0738	1	1	NUMERIC DISPLAY-.15 HI	28480	1990-0738
A1U3	1810-0403	7	1	NETWORK-RESISTOR R1-R15: 330 OHM±2%	01121	316A331
A1XDS17	1200-0901	7	3	SOCKET-STRP 8-CONT DIP-SLDR	28480	1200-0901
A1XDS18	1200-0901	7		SOCKET-STRP 8-CONT DIP-SLDR	28480	1200-0901
A1XDS19	1200-0901	7		SOCKET-STRP 8-CONT DIP-SLDR	28480	1200-0901
A1XU2	1251-5928	5	1	CONNECTOR 15-PIN M POST TYPE	28480	1251-5928
A2	**83540-60009**	**8**	**1**	**BOARD ASSEMBLY-SUB-PANEL**	**28480**	**83540-60009**
A2C1	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A2C2	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A2C3	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A2C4				NOT ASSIGNED		
A2C5	0160-0174	9	1	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A2C6				NOT ASSIGNED		
A2C7	0160-3879	7	23	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A2CR1				NOT ASSIGNED		
A2CR2				NOT ASSIGNED		
A2CR3	1901-0033	2	13	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR4				NOT ASSIGNED		
A2CR5				NOT ASSIGNED		
A2CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2J1	1251-4827	1		CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A2J2				NOT ASSIGNED		
A2J3	1200-0508	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2K1	0490-0916	6	3	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A2L1	9100-1618	1	2	INDUCTORRF-CH-MLD 5.6UH 10%	28480	9100-1618
A2P1	1251-5491	7	1	CONNECTOR 25-PIN F POST TYPE	28480	1251-5491
A2Q1				NOT ASSIGNED		
A2Q2				NOT ASSIGNED		
A2Q3	1854-0474	4	1	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A2R1	2100-3056	8	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A2R2	0698-3161	9	1	RESISTOR 38.3K 1% .125W F TC=0±100	24546	C4-1/8-T0-3832-F
A2R3	0757-0289	2	2	RESISTOR 13.3K 1% .125W F TC=0±100	19701	MF4C1/8-T0-1332-F
A2R4	2100-3103	6	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A2R5				NOT ASSIGNED		
A2R6				NOT ASSIGNED		
A2R7	0757-0442	9	24	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A2R8				NOT ASSIGNED		
A2R9	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0±100	24546	C4-1/8-T0-2371-F
A2R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A2R11	0757-0437	2	1	RESISTOR 4.75K 1% .125W F TC=0±100	24546	C4-1/8-T0-4751-F
A2R12				NOT ASSIGNED		
A2R13				NOT ASSIGNED		
A2R14				NOT ASSIGNED		
A2R15				NOT ASSIGNED		
A2R16				NOT ASSIGNED		
A2R17	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A2R18	0698-4008	5	1	RESISTOR 40K 1% .125W F TC=0±100	24546	C4-1/8-T0-4002-F
A2R19				NOT ASSIGNED		
A2R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A2R21	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A2R22				NOT ASSIGNED		
A2R23				NOT ASSIGNED		
A2R24				NOT ASSIGNED		
A2R25				NOT ASSIGNED		
A2TP1	0360-0124	3	7	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A2TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A2TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A2U1	1826-0092	3	3	IC OP AMP GP DUAL TO-99	28480	1826-0092
A2U2	1858-0047	5	3	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A2U3	1858-0047	5		TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A2U4	1820-1416	5	5	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A2U5	1820-1730	6	7	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A2U6	1820-2150	6	1	IC MICPROC-ACCESS NMOS	34649	D8279-5
A2U7	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A2U8	1820-1196	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A2U9	1826-0417	6	3	IC SWITCH ANLG QUAD 16-DIP-C	27014	LF13333D
A2U10	1858-0047	5		TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A2U11	1810-0368	3	1	NETWORK-RES 6-SIP10.0K OHM X 5	01121	206A103
A2U12	1826-0205	0	1	IC TIMER TTL	18324	NE556A
A2W1	8159-0005	0	5	WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A2XU6	1200-0552	4	1	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
	0380-0773	0	4	SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A3	**83525-60007**	**7**	**1**	**BOARD ASSEMBLY-DIGITAL INT**	**28480**	**83525-60007**
A3C1	0160-0127	2	10	CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C2	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C3	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C4	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C5	0160-3537	4	1	CAPACITOR-FXD 680PF ±5% 100VDC MICA	28480	0160-3537
A3C6	0180-0500	7	1	CAPACITOR-FXD 47UF±20% 20VDC TA	28480	0180-0500
A3J1	1251-4827	1		CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A3MP1	5040-6852	3	1	BOARD EXTRACTOR-ORANGE	28480	5040-6852
A3MP2	5000-9043	6	1	PIN: PC BOARD EXTRACTOR	28480	5000-9043
A3R1	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0±100	24546	C4-1/8-T0-1621-F
A3R2	0698-3153	9	2	RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-T0-3831-F
A3R3	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-T0-3831-F
A3R4	0698-7212	9	4	RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A3S1	3101-2243	6	1	SWITCH-RKR DIP-RKR-ASSY 8-1A .05A 30VDC	28480	3101-2243
A3U1	5081-8166	2	1	IC NMOS 32K EPROM PROGRAMMED	28480	5081-8166
A3U2	5081-8167	3	1	IC NMOS 32K EPROM PROGRAMMED	28480	5081-8167
A3U3	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	04713	MC1455P1
A3U4	1820-2081	2	1	IC NMOS	04713	MC68A21P
A3U5	1820-2005	0	1	IC TIMER NMOS	0003J	UPD8253D
A3U6	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3U7	1820-1197	9	3	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3U8	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U9	1820-1216	3	6	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3U10	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U11	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U12	1810-0338	7	3	NETWORK-RES 16-DIP100.0 OHM X 8	11236	761-3-R100
A3U13	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3U14	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A3U15	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U16	1810-0338	7		NETWORK-RES 16-DIP100.0 OHM X 8	11236	761-3-R100
A3U17	1820-2075	4	2	IC MISC TTL LS	01295	SN74LS245N
A3U18	1820-2075	4		IC MISC TTL LS	01295	SN74LS245N
A3U19	1810-0338	7		NETWORK-RES 16-DIP100.0 OHM X 8	11236	761-3-R100
A3XU1	1200-0565	9	2	SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A3XU2	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A4	**83540-60006**	**5**	**1**	**BOARD ASSEMBLY-ALC**	**28480**	**83540-60006**
A4C1	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A4C2	0180-0374	3	5	CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C3	0180-0374	3		CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C4	0180-0374	3		CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C5	0180-0374	3		CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C6	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C7	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C8	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C9	0160-3821	9	1	CAPACITOR-FXD .33UF ±20% 50VDC CER	28480	0160-3821
A4C10	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C11	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C12	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C13	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C14	0160-3874	2	3	CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A4C15	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A4C16	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C17	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C18	0160-0570	9	2	CAPACITOR-FXD 220PF ±20% 100VDC CER	20932	5024EM100RD221M
A4C19				NOT ASSIGNED		
A4C20	0160-0574	3	2	CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A4C21	0160-0128	3	1	CAPACITOR-FXD 2.2UF ±20% 50VDC CER	28480	0160-0128
A4C22	0160-0945	2	2	CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
A4C23	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C24	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C25				NOT ASSIGNED		
A4C26	0160-4387	4	1	CAPACITOR-FXD 47PF ±5% 200VDC CER 0±30	28480	0160-4387
A4C27	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C28				NOT ASSIGNED		
A4C29	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C30				NOT ASSIGNED		
A4C31	0160-0572	1	4	CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A4C32				NOT ASSIGNED		
A4C33				NOT ASSIGNED		
A4CR1				NOT ASSIGNED		
A4CR2				NOT ASSIGNED		
A4CR3	1901-1098	1	11	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR4	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR6	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR8				NOT ASSIGNED		
A4CR9	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR10				NOT ASSIGNED		
A4CR11				NOT ASSIGNED		
A4CR12	1901-0535	9	4	DIODE-SCHOTTKY	28480	1901-0535
A4J1	1251-4672	4	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A4L1	9140-0210	1	3	INDUCTORRF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L2	9140-0210	1		INDUCTORRF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L3	9140-0210	1		INDUCTORRF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4MP1	5040-6848	7	1	EXTRACTOR-YELLOW	28480	5040-6848
A4MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A4Q1	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A4Q2	1854-0295	7	2	TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A4Q3	1855-0414	4	1	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A4Q4	1855-0423	5	5	TRANSISTOR MOSFET P-CHAN E-MODE	17856	VN10KM
A4Q5	1855-0423	5		TRANSISTOR MOSFET P-CHAN E-MODE	17856	VN10KM
A4Q6	1854-0295	7		TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A4Q7	1855-0423	5		TRANSISTOR MOSFET P-CHAN E-MODE	17856	VN10KM
A4Q8	1855-0423	5		TRANSISTOR MOSFET P-CHAN E-MODE	17856	VN10KM
A4Q9				NOT ASSIGNED		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4Q10				NOT ASSIGNED		
A4Q11				NOT ASSIGNED		
A4Q12				NOT ASSIGNED		
A4Q13	1854-0404	0	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q14	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4R1				NOT ASSIGNED		
A4R2				NOT ASSIGNED		
A4R3	2100-2515	2	3	RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A4R4				NOT ASSIGNED		
A4R5	2100-3611	1	6	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A4R6				NOT ASSIGNED		
A4R7				NOT ASSIGNED		
A4R8	2100-0670	6	2	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A4R9	2100-3749	6	3	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A4R10	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A4R11	2100-2522	1	4	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A4R12	0698-7257	2	1	RESISTOR 7.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-7501-G
A4R13	0698-7258	3	1	RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3-1/8-T0-8251-G
A4R14				NOT ASSIGNED		
A4R15				NOT ASSIGNED		
A4R16				NOT ASSIGNED		
A4R17	0698-7253	8	3	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-G
A4R18	0698-7268	5	1	RESISTOR 21.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-2152-G
A4R19	0698-7260	7	4	RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A4R20	0698-7263	0	1	RESISTOR 13.3K 1% .05W F TC=0±100	24546	C3-1/8-T0-1332-G
A4R21	0698-7274	3	1	RESISTOR 38.3K 1% .05W F TC=0±100	24546	C3-1/8-T0-3832-G
A4R22	0698-7261	8	1	RESISTOR 11K 1% .05W F TC=0±100	24546	C3-1/8-T0-1102-G
A4R23	0757-0464	5	1	RESISTOR 90.9K 1% .125W F TC=0±100	24546	C4-1/8-T0-9092-F
A4R24	0698-7269	6	1	RESISTOR 23.7K 1% .05W F TC=0±100	24546	C3-1/8-T0-2372-G
A4R25				NOT ASSIGNED		
A4R26				NOT ASSIGNED		
A4R27	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A4R28	0698-7227	6	1	RESISTOR 422 1% .05W F TC=0±100	24546	C3-1/8-T0-422R-G
A4R29	0698-6846	3	1	RESISTOR 5.42K .5% .125W F TC=0±50	24546	NC55-1/8-T2-5421-D
A4R30				NOT ASSIGNED		
A4R31	0837-0119	7	1	THERMISTOR ROD 5K-OHM TC=+.7%/C-DEG	28480	0837-0119
A4R32	0698-7259	4	2	RESISTOR 9.09K 1% .05W F TC=0±100	24546	C3-1/8-T0-9091-G
A4R33				NOT ASSIGNED		
A4R34				NOT ASSIGNED		
A4R35				NOT ASSIGNED		
A4R36	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A4R37	0698-7243	6	4	RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A4R38	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A4R39	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A4R40	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A4R41	0698-7283	4	1	RESISTOR 90.9K 1% .05W F TC=0±100	24546	C3-1/8-T0-9092-G
A4R42	0698-7267	4	1	RESISTOR 19.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-1962-G
A4R43	0698-7272	1	1	RESISTOR 31.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-3162-G
A4R44	0698-7275	4	1	RESISTOR 42.2K 1% .05W F TC=0±100	24546	C3-1/8-T0-4222-G
A4R45				NOT ASSIGNED		
A4R46	0698-7207	2	1	RESISTOR 61.9 1% .05W F TC=0±100	24546	C3-1/8-T00-61R9-G
A4R47	2100-2030	6	3	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R48	0757-0274	5	1	RESISTOR 1.21K 1% .05W F TC=0±100	24546	C3-1/8-T0-1211-G
A4R49	0698-7273	2	1	RESISTOR 34.8K 1% .05W F TC=0±100	24546	C3-1/8-T0-3482-G
A4R50				NOT ASSIGNED		
A4R51	0698-7282	3	1	RESISTOR 82.5K 1% .05W F TC=0±100	24546	C4-1/8-T0-8252-G
A4R52	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A4R53				NOT ASSIGNED		
A4R54	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A4R55	0698-7254	9	2	RESISTOR 5.62 1% .05W F TC=0±100	24546	C3-1/8-T0-5621-G
A4R56	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R57	0757-0280	3	25	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A4R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A4R59	2100-1986	9	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A4R60	0698-0083	8	12	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A4R61	0698-7259	4		RESISTOR 9.09K 1% .05W F TC=0±100	24546	C3-1/8-T0-9091-G
A4R62	0698-7270	9	1	RESISTOR 26.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-2612-G
A4R63	0757-0447	4	2	RESISTOR 16.2K 1% .125W F TC=0±100	24546	C4-1/8-T0-1622-F
A4R64	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A4R65	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A4R66	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A4R67	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R68	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-G
A4R69	0698-3440	7	3	RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-196R-F
A4R70				NOT ASSIGNED		
A4R71	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0±100	24546	C4-1/8-T0-619R-F
A4R72	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A4R73	0698-7277	6	1	RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-G
A4R74	0698-7251	6	1	RESISTOR 4.22K 1% .05W F TC=0±100	24546	C3-1/8-T0-4221-G

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R75	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-G
A4R76	0698-3440	7		RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-1960-F
A4R77	0757-1094	9	3	RESISTOR 1.47K 1% .125W F TC=0±100	24546	C4-1/8-T0-1471-F
A4R78	0698-7229	8	1	RESISTOR 511 1% .05W F TC=0±100	24546	C3-1/8-T0-511R-G
A4R79	0757-0394	0	3	RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A4R80				NOT ASSIGNED		
A4R81				NOT ASSIGNED		
A4R82				NOT ASSIGNED		
A4R83				NOT ASSIGNED		
A4R84				NOT ASSIGNED		
A4R85				NOT ASSIGNED		
A4R86				NOT ASSIGNED		
A4R87				NOT ASSIGNED		
A4R88				NOT ASSIGNED		
A4R89				NOT ASSIGNED		
A4R90				NOT ASSIGNED		
A4R91				NOT ASSIGNED		
A4R92				NOT ASSIGNED		
A4R93	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A4R94	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-G
A4R95	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0±100	24546	C3-1/8-T0-261R-G
A4R96				NOT ASSIGNED		
A4R97	0698-3157	3	2	RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A4TP1-TP10				SAME AS A4J1		
A4TP11	0360-0535	0	19	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP13				NOT ASSIGNED		
A4TP14	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP15	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4U1	1826-0261	8	1	IC OP AMP LOW-NOISE TO-99	28480	1826-0261
A4U2	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C	27014	LF13333D
A4U3	1826-0616	7	1	IC OP AMP PRCN QUAD 14-DIP-C	06665	OP-11EY
A4U4	1826-0610	1	2	IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	06665	MUX24FQ
A4U5	1826-0319	7	3	IC OP AMP TO-99	27014	LF356H
A4U6	1826-0610	1		IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	06665	MUX24FQ
A4U7	1826-0319	7		IC OP AMP TO-99	27014	LF356H
A4U8	1826-0021	8	1	IC OP AMP GP TO-99	27014	LM310H
A4U9	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C	27014	LF13333D
A4U10	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A4U11	1826-0319	7		IC OP AMP TO-99	27014	LF356H
A4U12	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A4U13	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A4U14	1826-0752	2	1	IC CONV 12-B-D/A 16-DIP-C	24355	AD7542BD
A4U15	1826-0026	3	2	IC COMPARATOR PRCN TO-99	01295	LM311L
A4VR1	1902-0049	2	3	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A4VR2	1902-0049	2		DIODE-ZNR 6.19V 5%DO-35PD=.4W	28480	1902-0049
A4VR3	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4VR4	1902-0064	1	1	DIODE-ZNR 7.5V 5%DO-35 PD=.4W	28480	1902-0064
A5	**83525-60005**	**5**	**1**	**BOARD ASSEMBLY-FM**	**28480**	**83525-60005**
A5C1	0160-0575	4	2	CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A5C2	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A5C3	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C4	0160-0945	2		CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
A5C5	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A5C6	0160-2247	1	1	CAPACITOR-FXD 3.9PF ±.25PF 500VDC CER	28480	0160-2247
A5C7	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C8	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C9	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C10	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C11	0140-0198	5	1	CAPACITOR-FXD 200PF ±5% 300VDC MICA	72136	DM15F201J0300WV1CR
A5C12	0160-2199	2	1	CAPACITOR-FXD 30PF ±5% 300VDC MICA	28480	0160-2199
A5C13				NOT ASSIGNED		
A5C14	0121-0446	6	1	CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0446
A5C15	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C16	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C17	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C18	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C19				NOT ASSIGNED		
A5C20	0160-2249	3	2	CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2249
A5C21				NOT ASSIGNED		
A5C22				NOT ASSIGNED		
A5C23	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C24	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C25	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C26	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A5C27	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5C28	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C29	0180-2617	1	4	CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C30	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C31	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C32	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C33	0180-2207	5	2	CAPACITOR-FXD 100UF±10% 10VDC TA	56289	150D107X9010R2
A5C34	0180-0474	4	7	CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C35	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C36	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C37	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C38	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C39	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C40	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C41	0160-2249	3		CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2249
A5CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A5CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A5CR3	1901-0047	8	2	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A5CR4	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A5CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A5CR6	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A5CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A5CR8	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A5CR9	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A5K1	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A5K2	0490-1063	6	1	RELAY-REED 2A 500MA 50VDC 5VDC-COIL 10VA	28480	0490-1063
A5L1	9100-1625	0	1	INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1625
A5L2	9100-1619	2	4	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L3	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L4	08503-80001	9	2	COIL-TOROID	28480	08503-80001
A5L5	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L6	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5MP1	5040-6851	2	1	EXTRACTOR	28480	5040-6851
A5MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A5MP3	4330-0145	9	6	INSULATOR-BEAD GLASS	28480	4330-0145
A5MP4	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A5MP5	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A5MP6	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A5MP7	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A5MP8	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A5Q1	1854-0529	0	4	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q2	1854-0529	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q3	1854-0529	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q4	1854-0529	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q5	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A5R1	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R2	0698-3154	0	4	RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R3	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R4	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R5	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R6	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A5R7	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A5R8	0698-3158	4	1	RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R9	0698-6360	6	3	RESISTOR 10K .1% .125W F TC=0±25	28480	0698-6360
A5R10	0698-6360	6		RESISTOR 10K .1% .125W F TC=0±25	28480	0698-6360
A5R11	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0±100	24546	C4-1/8-T0-4641-F
A5R12	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R13	0698-3446	3	3	RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-T0-383R-F
A5R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A5R15	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A5R16				NOT ASSIGNED		
A5R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R19	2100-3749	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A5R20	0757-0458	7	3	RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A5R21	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0±100	24546	C4-1/8-T0-1782-F
A5R22	0698-6360	6		RESISTOR 10K .1% .125W F TC=0±25	28480	0698-6360
A5R23	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0±100	24546	C4-1/8-T0-2871-F
A5R24				NOT ASSIGNED		
A5R25				NOT ASSIGNED		
A5R26	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R27	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R28	0757-0382	6	2	RESISTOR 16.2 1% .125W F TC=0±100	19701	MF4C1/8-T0-16R2-F
A5R29	0757-0382	6		RESISTOR 16.2 1% .125W F TC=0±100	19701	MF4C1/8-T0-16R2-F
A5R30	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A5R31*	0757-0401	0	3	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A5R32	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0±100	24546	C4-1/8-T0-121R-F
A5R33	0698-7280	1	5	RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5R34	2100-2574	3	5	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R35	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G
A5R36	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R37	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G
A5R38	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R39	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G
A5R40	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R41	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A5R42	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A5R43	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A5R44	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A5R45	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R46	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0±100	24546	C4-1/8-T0-751-F
A5R47	0757-0420	3		RESISTOR 750 1% .125W F TC=0±100	24546	C4-1/8-T0-751-F
A5R48	2100-3759	8	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	28480	2100-3759
A5R49	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G
A5R50	2100-3749	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A5R51	0698-7264	1	1	RESISTOR 14.7K 1% .05W F TC=0±100	24546	C3-1/8-T0-1472-G
A5R52	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R53	0757-0346	2	6	RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R54	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R55	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R56	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R57	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R58	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R59-A5R72				NOT ASSIGNED		
A5R73	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A5R74	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A5R75	2100-2522	1		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A5R76	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A5R77	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A5TP1	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5U1	1810-0206	8	1	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A5U2	1810-0208	0	1	NETWORK-RES 8-SIP68.0K OHM X 7	01121	208A683
A5U3	1826-0416	5	1	IC SWITCH ANLG QUAD 16-DIP-C	27014	LF13331D
A5U4	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A5U5	1810-0321	8	1	NETWORK-RES 8-SIP220.0K OHM X 7	01121	208A224
A5U6				NOT ASSIGNED		
A5U7	1826-0092	3		IC OP AMP GP DUAL TO-99	28480	1826-0092
A5U8	1826-0349	3	1	IC V RGLTR TO-39	07263	UA78M06HL
A5U9	1826-0701	1	1	IC V RGLTR 6V	28480	1826-0701
A5U10	1826-0546	2	1	IC WIDEBAND AMPL VID TO-100	18324	NE592K
A5U11	1826-0476	7	1	IC SWITCH ANLG 8-DIP-P	01295	TL601CP
A5U12				NOT ASSIGNED		
A5U13				NOT ASSIGNED		
A5U14	1826-0557	5	1	IC OP AMP GP QUAD 14-DIP-C	27014	LM348J
A5U15				NOT ASSIGNED		
A5U16	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A5U17	1826-0699	6	1	IC CONV 8-B-D/A 16-DIP-C	24355	AD7524AD
A5U18	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A5U19	1826-0700	0	1	IC OP AMP WB 14-DIP-C	34371	HA1-5195-3
A5U20	1820-0224	1	1	IC OP AMP SPCL TO-99	27014	LH0002CH
A5U21	1810-0366	1	1	NETWORK-RES 6-SIP220.0 OHM X 5	01121	206A221
A5VR1	1902-3002	3	2	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A5VR2	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A5W1	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A5W2				NOT ASSIGNED		
A5W3				NOT ASSIGNED		
A5W4	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A5W5	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A5W6	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A6	**83525-60002**	**2**	**1**	**BOARD ASSEMBLY-YO DRIVER** (DOES NOT INCLUDE R1,3,38,39,40,& 41)	**28480**	**83525-60002**
A6C1	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6C2				NOT ASSIGNED		
A6C3				NOT ASSIGNED		
A6C4	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A6C5				NOT ASSIGNED		
A6C6				NOT ASSIGNED		
A6C7	0180-3020	2	1	CAPACITOR-FXD 120UF±10% 50VDC TA	28480	0180-3020
A6C8	0180-2206	4	1	CAPACITOR-FXD 60UF±10% 6VDC TA	56289	150D606X9006B2
A6C9	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A6C10				NOT ASSIGNED		
A6C11	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A6C12				NOT ASSIGNED		
A6C13				NOT ASSIGNED		
A6C14	0180-2186	9	1	CAPACITOR-FXD 300UF±20% 30VDC TA	06001	69F455G7
A6C15	0160-3878	6	3	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C16	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C17	0180-0116	1	5	CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C18	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C19	0180-2207	5		CAPACITOR-FXD 100UF±10% 10VDC TA	56289	150D107X9010R2
A6C20	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C21	0180-0228	6	1	CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A6C22	0160-0574	3	1	CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A6C23	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A6CR1	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A6CR2	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A6CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6K1	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A6L1	9100-1666	9	2	INDUCTORRF-CH-MLD 3.6MH 5% .23DX.57LG	28480	9100-1666
A6L2	9100-1666	9		INDUCTORRF-CH-MLD 3.6MH 5% .23DX.57LG	28480	9100-1666
A6L3	08503-80001	9		COIL-TOROID	28480	08503-80001
A6MP1	5040-6849	8	1	EXTRACTOR--BLUE	28480	5040-6849
A6MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A6MP3	1400-0774	6	1	CLAMP (FOR C14)		
A6Q1	1853-0044	2	2	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A6Q2	1853-0044	2		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A6Q3	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6R1*						
A6R2	0698-8484	9	4	RESISTOR 6.44K .1% .1W F TC=0+4	28480	0698-8484
A6R3*						
A6R4	0698-8484	9		RESISTOR 6.44K .1% .1W F TC=0+4	28480	0698-8484
A6R5	0698-8484	9		RESISTOR 6.44K .1% .1W F TC=0+4	28480	0698-8484
A6R6	0698-8484	9		RESISTOR 6.44K .1% .1W F TC=0+4	28480	0698-8484
A6R7	0698-6217	2	1	RESISTOR 200K .5% .125W F TC=0±100	28480	0698-6217
A6R8	0698-6358	2	1	RESISTOR 100K .1% .125W F TC=0±25	28480	0698-6358
A6R9	0698-3274	5	1	RESISTOR 10K 1% .125W F TC=0±25	28480	0698-3274
A6R10	0698-3219	8	1	RESISTOR 300K .25% .125W F TC=0±50	28480	0698-3219
A6R11	2100-3757	6	2	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A6R12	0699-0517	5	1	RESISTOR 5.621K .1% .1W F TC=0+4	28480	0699-0517
A6R13	0698-3457	6	1	RESISTOR 316K 1% .125W F TC=0±100	28480	0698-3457
A6R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R15	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A6R16	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A6R17	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A6R18	0698-6317	3	1	RESISTOR 500 .1% .125W F TC=0±25	03888	PME55-1/8-T9-500R-B
A6R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A6R20	0698-8486	1	1	RESISTOR 9.84K .1% .1W F TC=0+4	28480	0698-8486
A6R21	2100-3750	9	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A6R22	0698-8479	2	1	RESISTOR 4.16K .1% .1W F TC=0+4	28480	0698-8479
A6R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A6R24	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0±100	24546	C4-1/8-T0-1471-F
A6R25	2100-3753	2	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 17-TRN	28480	2100-3753
A6R26	0698-6384	4	1	RESISTOR 330K 1% .125W F TC=0±25	28480	0698-6384
A6R27	0698-8489	4	2	RESISTOR 15K .1% .1W F TC=0+4	28480	0698-8489
A6R28	0698-6406	1	2	RESISTOR 8.54K .1% .1W F TC=0+4	28480	0698-6406
A6R29	0698-6406	1		RESISTOR 8.54K .1% .1W F TC=0+4	28480	0698-6406
A6R30	2100-3757	6		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A6R31	0699-0518	6	1	RESISTOR 11.489K .1% .1W F TC=0+4	28480	0699-0518
A6R32	0698-8489	4		RESISTOR 15K .1% .1W F TC=0+4	28480	0698-8489
A6R33				NOT ASSIGNED		
A6R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R35	0757-0470	3	1	RESISTOR 162K 1% .125W F TC=0±100	24546	C4-1/8-T0-1623-F
A6R36	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R37	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0±100	24546	C4-1/8-T0-1213-F
A6R38*						
A6R39*						

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R40*						
A6R41*						
A6R42	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A6R43	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A6R44	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0±100	24546	C4-1/8-T0-1622-F
A6R45	2100-3732	7	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R46	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A6R47	0698-8825	2	1	RESISTOR 681K 1% .125W F TC=0±100	28480	0698-8825
A6R48	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A6R49	0757-0421	4	4	RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A6R50	0757-0421	4		RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A6R51	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A6R52	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R53	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	28546	C4-1/8-T0-1001-F
A6S1	3101-0471	8	2	SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A6S2	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A6TP1-16	1251-5924	1	1	CONNECTOR 16-PIN M POST TYPE	28480	1251-5924
A6U1	1810-0277	3	2	NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A6U2	1810-0277	3		NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A6U3	1820-2024	3	3	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U4	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U5	1826-0026	3		IC COMPARATOR PRCN TO-99	01295	LM311L
A6U6	1826-0477	8	2	IC SWITCH ANLG 8-DIP-P	01295	TL610CP
A6U7	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U8	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U9	1826-0684	9	2	IC CONV 12-B-D/A 18-DIP-C	28480	1826-0684
A6U10	1826-0471	2	7	IC OP AMP LOW-DRIFT TO-99	28480	1826-0471
A6U11	1826-0471	2		IC OP AMP LOW-DRIFT TO-99	28480	1826-0471
A6U12	1820-1272	1	1	IC BFR TTL LS NOR QUAD 2-INP	01295	SN74LS33N
A6U13	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U14	1826-0471	2		IC OP AMP LOW-DRIFT TO-99	28480	1826-0471
A6U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99	28480	1826-0471
A6U16	1826-0471	2		IC OP AMP LOW-DRIFT TO-99	28480	1826-0471
A6U17	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U18	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U19	1826-0684	9		IC CONV 12-B-D/A 18-DIP-C	28480	1826-0684
A6U20	1826-0471	2		IC OP AMP LOW-DRIFT TO-99	28480	1826-0471
A6U21	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A6U22	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U23	1826-0330	2	1	V REF PRCN TO-46	27014	LM299H
A6U24	1826-0471	2		IC OP AMP LOW-DRIFT TO-99	28480	1826-0471
A6U25	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U26	1826-0477	8		IC SWITCH ANLG 8-DIP-P	01295	TL610CP
A6U27	1826-0512	2	1	IC 78M15C V RGLTR TO-39	04713	MC78M15CG
A6VR1	1902-0197	1	2	DIODE-ZNR 82.5V 5% DO-15 PD=1W TC=+.082%	28480	1902-0197
A7	**83540-60004**	**3**	**1**	**BOARD ASSEMBLY-MARKER**	**28480**	**83540-60004**
A7C1				NOT ASSIGNED		
A7C2				NOT ASSIGNED		
A7C3				NOT ASSIGNED		
A7C4				NOT ASSIGNED		
A7C5				NOT ASSIGNED		
A7C6				NOT ASSIGNED		
A7C7	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A7C8	0180-0229	7	2	CAPACITOR-FXD 33UF±10% 10VDC TA	56289	150D336X9010B2
A7C9	0180-0229	7		CAPACITOR-FXD 33UF±10% 10VDC TA	56289	150D336X9010B2
A7C10				NOT ASSIGNED		
A7C11	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A7C12	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A7C13	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A7C14	0180-1746	5	1	CAPACITOR-FXD 15UF±10% 20VDC TA	56289	150D156X9020B2
A7C15	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A7C16	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A7C17	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A7C18				NOT ASSIGNED		
A7C19	0160-4389	6	2	CAPACITOR-FXD 100PF ±5PF 200VDC CER	51642	200-200-NP0-101J
A7C20	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	51642	200-200-NP0-101J
A7C21				NOT ASSIGNED		
A7C22	0180-2820	8	1	CAPACITOR-FXD .22UF±20% 35VDC TA	28480	0180-2820
A7CR1				NOT ASSIGNED		
A7CR2				NOT ASSIGNED		
A7CR3	1901-0040	1	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR5	1901-0539	3	5	DIODE-SCHOTTKY	28480	1901-0539
A7CR6	1901-0539	3		DIODE-SCHOTTKY	28480	1901-0539

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7CR7	1901-0539	3		DIODE-SCHOTTKY	28480	1901-0539
A7CR8	1901-0539	3		DIODE-SCHOTTKY	28480	1901-0539
A7CR9	1901-0539	3		DIODE-SCHOTTKY	28480	1901-0539
A7L1	9100-1618	1		INDUCTORRF-CH-MLD 5.6UH 10%	28480	9100-1618
A7MP1	5040-6850	1	1	BOARD EXTRACTOR-VIOLET	28480	5040-6850
A7MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A7Q1	1853-0314	9	1	TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
A7Q2				NOT ASSIGNED		
A7Q3	1855-0423	5		TRANSISTOR MOSFET P-CHAN E-MODE	17856	VN10KM
A7Q4				NOT ASSIGNED		
A7Q5				NOT ASSIGNED		
A7R1– A7R19				NOT ASSIGNED		
A7R20	2100-2522	1		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A7R21	2100-2515	2		RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A7R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R26	2100-2515	2		RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A7R27	2100-2522	1		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A7R28	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A7R29	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A7R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R31				NOT ASSIGNED		
A7R32				NOT ASSIGNED		
A7R33	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A7R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A7R36	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A7R37	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R38	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0±100	24546	C4-1/8-T0-7502-F
A7R39	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A7R40	0699-0071	6	1	RESISTOR 4.64M 1% .125W F TC=0±100	28480	0699-0071
A7R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R42	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R43	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A7R44	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0±100	24546	C4-1/8-T0-4641-F
A7R45	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2872-F
A7R46	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R47	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R48	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0±100	28480	0698-3260
A7R49	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A7R50	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0±100	24546	C4-1/8-T0-1102-F
A7R51	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R52				NOT ASSIGNED		
A7R53				NOT ASSIGNED		
A7R54				NOT ASSIGNED		
A7R55	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0±100	19701	MF4C1/8-T0-1332-F
A7R56	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R57	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A7R59	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0±100	24546	C4-1/8-T0-1471-F
A7R60	0698-3446	3		RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-T0-383R-F
A7R61	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A7R62				NOT ASSIGNED		
A7R63	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0±100	24546	C4-1/8-T0-5621-F
A7R64	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1212-F
A7R65	2100-0544	3	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-104
A7R66	2100-0670	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A7R67				NOT ASSIGNED		
A7R68				NOT ASSIGNED		
A7R69				NOT ASSIGNED		
A7R70	0698-3446	3		RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-T0-383R-F
A7TP1				NOT ASSIGNED		
A7TP2				NOT ASSIGNED		
A7TP3				NOT ASSIGNED		
A7TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7U1				NOT ASSIGNED		
A7U2				NOT ASSIGNED		
A7U3	1826-0753	3	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	04713	MC34004BL
A7U4				NOT ASSIGNED		
A7U5	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A7U6	1826-0092	3		IC OP AMP GP DUAL TO-99	28480	1826-0092

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7U7	1826-0758	8	1		28480	1826-0758
A7U8				NOT ASSIGNED		
A7U9				NOT ASSIGNED		
A7U10	1826-0458	5	1	IC OP AMP TO-99	27014	LF255H
A7U11	1826-0720	4	1	IC SWITCH ANLG QUAD 16-DIP-C	06665	SW-02FQ
A7U12	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A7U13	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A7U14	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A7U15				NOT ASSIGNED		
A7W1	1258-0124	7	1	JUMPER-WIRE	28480	1258-0124
A8				**NOT ASSIGNED**		
A9	**83525-60010**	**2**	**1**	**BOARD ASSEMBLY-TRANSISTOR HEAT SINK**	**28480**	**83525-60010**
				(A9 INCLUDES THE PC BOARD, C1 AND C2 ONLY. ALL OTHER PARTS MUST BE ORDERED SEPARATELY.)		
A9C1	0180-0291	3	1	CAPACITOR-FXD 1UF±10% 35VDC TA	56289	150D105X9035A2
A9C2	0180-1735	2	1	CAPACITOR-FXD .22UF±10% 35VDC TA	56289	150D224X9035A2
A9E1	1200-0043	8	2	INSULATOR-XSTR ALUMINUM	28480	1200-0043
A9E2	1200-0043	8		INSULATOR-XSTR ALUMINUM	28480	1200-0043
A9E3	83525-20034	6	1	BACKING PAD	28480	83525-20034
A9MP1	83525-20036	8	1	HEAT SINK	28480	83525-20036
A9Q1	1854-0080	8	1	TRANSISTOR NPN SI TO-3 PD=100W FT=3MHZ	28480	1854-0080
A9Q2				NOT ASSIGNED		
A9Q3	1820-0430	1	1	IC 309 V RGLTR TO-3	07263	LM309K
A9R1	0811-1058	1	1	RESISTOR-125 OHM 12W	28480	0811-1058
				MISCELLANEOUS PARTS ASSOCIATED WITH A9 ASSEMBLY		
	2360-0115	4	4	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	0520-0128	7	2	SCREW-MACH 2-56 .250-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2190-0014	1	2	WASHER-LK INTL T NO.2 .089-IN-ID	28480	2190-0014
	0340-0171	8	6	INSULATORS		0340-0171
A10	**83525-60001**	**1**	**1**	**BOARD ASSEMBLY-MOTHER**	**28480**	**83525-60001**
A10C1	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C2	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C3	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C4	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C5	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C6	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C7	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10J1	1251-5926	3	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5926
A10J2	1251-5927	4	1	CONNECTOR 26-PIN M POST TYPE	28480	1251-5927
A10J3	1251-3196	5	1	CONNECTOR 8-PIN M POST TYPE	28480	1251-3196
A10J4	1251-5238	0	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-5238
A10J5	1200-0507	9	2	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A10MP2	1251-1115	4	4	POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A10R1	0757-0123	3		RESISTOR 34.8K 1% .125W F TC=0±100	28480	0757-0123
A10R2	0698-8812	7	1	RESISTOR 1 1% .125W F TC=0±100	28480	0698-8812
A10XA3	1251-1365	6	6	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA4	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA5	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA6	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA7	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA8	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA9	1251-0472	4	1	CONNECTOR-PC EDGE 8-CONT/ROW 2-ROWS	28480	1251-0472
A11				**NOT ASSIGNED**		
A12	**5086-7373**	**1**	**1**	**OSCILLATOR 2.0 – 8.4 GHz**	**28480**	**5086-7373**
A12	5086-6373	3		EXCHANGE 5086-7373 OSCILLATOR	28480	5086-6373
A12A1				BOARD ASSEMBLY-OSCILLATOR BIAS NOT FIELD REPLACEABLE		
A12A1C1	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A12A1C2	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A12A1CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A12A1E1	1251-0600	0	6	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1E2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1E3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1E4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1E5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12A1E6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1J1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A12A1J2	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A12A1MP1	1251-3172	7	10	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1R1*				NOT FIELD REPLACEABLE		
A12A1R2*				NOT FIELD REPLACEABLE		
A12A1R3	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-T0-3161-F
A12A1R4	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A12A1VR1	1902-0579	3	2	DIODE-ZNR 5.11V 5% DO-15 PD=1W TC=-.009%	28480	1902-0579
A12A1VR2	1902-0579	3		DIODE-ZNR 5.11V 5% DO-15 PD=1W TC=-.009%	28480	1902-0579
A12A1VR3	1902-0197	1		DIODE-ZNR 82.5V 5% DO-15 PD=1W TC=+.082%	28480	1902-0197
A12A1W1	8151-0013	4	1	WIRE JUMPER	28480	8151-0013
A12E1	5001-1559	5	1	INSULATOR	28480	5001-1559
A12MP1	7121-0554	4	1	LABEL-IDOSC 7333A	28480	7121-0554
A13	**5086-7249**	**0**	**1**	**MODULATOR-AMPLIFIER 2–8.4 GHz** (DOES NOT INCLUDE A13A1)	**28480**	**5086-7249**
A13	5086-6249	8		EXCHANGE 5086-7249 MOD-AMPL	28480	5086-6249
A13A1	83525-60011	3	1	BOARD ASSEMBLY-AMPLIFIER, BAND 1	28480	83525-60011
A13A1C1	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A13A1C2	0180-0374	3		CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A13A1C3	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A13A1C4	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A13A1C5	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A13A1J1	1200-0487	4	1	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0487
A13A1J2	1251-4670	2	1	CONNECTOR 3-PIN M POST TYPE	28480	1251-4670
A13A1L1	9140-0114	4	1	INDUCTORRF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A13A1MP1	1200-0173	5	1	INSULATOR-XSTR DAP-GL	28480	1200-0173
A13A1MP2	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A13A1Q1	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A13A1Q2	1855-0251	7	1	TRANSISTOR MOSFET N-CHAN E-MODE TO-39 SI	28480	1855-0251
A13A1R1	0757-0418	9		RESISTOR 619 1% .125W F TC=0±100	24546	C4-1/8-T0-619R-F
A13A1R2	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A13A1R3	0757-0419	0		RESISTOR 681 1% .125W F TC=0±100	24546	C4-1/8-T0-681R-F
A13A1R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A13A1R5	0757-0421	4		RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A13A1R6	0757-0421	4		RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A13A1R7	0698-0082	7	3	RESISTOR 464 1% .125W F TC=0±100	24546	C4-1/8-T0-4640-F
A13A1R8	2100-2413	9	3	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	30983	ET50X201
A13A1R9	0698-0082	7		RESISTOR 464 1% .125W F TC=0±100	24546	C4-1/8-T0-4640-F
A13A1R10	2100-2413	9		RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	30983	ET50X201
A13A1R11	0698-0082	7		RESISTOR 464 1% .125W F TC=0±100	24546	C4-1/8-T0-4640-F
A13A1R12	2100-2413	9		RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	30983	ET50X201
A13A1R13	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-T0-3161-F
A13A1R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A13A1R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A13A1R16	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0±100	19701	MF4C1/8-T0-6191-F
A13A1R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A13A1TP1	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A13A1TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A13A1TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A13A1TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A13A1U1	1820-1417	6	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS26N
A13A1VR1	1902-3104	6	1	DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104
A14				**NOT ASSIGNED**		
A15				**NOT ASSIGNED**		
A16				**NOT ASSIGNED**		
A17				**NOT ASSIGNED**		
A18				**NOT ASSIGNED**		
CR1	86290-60045	5	1	LBHCD DETECTOR	28480	86290-60045
CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
DC1				NOT ASSIGNED		
DC2	0955-0098	1	1	DIRECTIONAL COUPLER	28480	0955-0098

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
E1	5040-0345	7	2	INSULATOR-CONNECTOR	28480	5040-0345
E2	5040-0345	7		INSULATOR-CONNECTOR	28480	5040-0345
E3	0340-0614	4	1	INSULATOR-TRANSISTOR	28480	0340-0614
J1	86290-60005	7	1	CONNECTOR ASSEMBLY-TYPE N (NOTE: SEE FIGURE 6-4)	28480	86290-60005
J2	1250-0118	3	2	CONNECTOR-RF BNC FEM **EXT/MTR ALC INPUT**	28480	1250-0118
J3				NOT ASSIGNED		
J4	1250-0212	8	1	CONNECTOR-RF BNC FEM **1V/GHZ**	28480	1250-0212
J5	1250-0118	3		CONNECTOR-RF BNC FEM **PULSE IN**	28480	1250-0118
				NOTE SEE FIGURE 6-1 FOR MECHANICAL PARTS (MP) LOCATION.		
MP1	4040-1695	1	1	WINDOW-DISPLAY	28480	4040-1695
MP2	0370-3023	8	1	KNOB 3/4 JGK .25-IN-ID	28480	0370-3023
MP3	83525-00005	9	1	COVER-PC	28480	83525-00005
MP4	83540-00001	4	1	PANEL-DRESS	28480	83525-00001
MP4	83540-00002	5		PANEL-DRESS (OPT. 004 ONLY)	28480	83540-00002
MP5	5041-0285	6	5	KEY CAP-LITE	28480	5041-0285
MP6	5040-8823	2	1	KNOB-JADE GRAY	28480	5040-8823
MP7	5041-1925	3	1	KEY CAP-POWER SWEEP	28480	5041-1925
MP8	5041-1924	2	1	KEY CAP-POWER LEVEL	28480	5041-1924
MP9	5041-1926	4	1	KEY CAP-SLOPE	28480	5041-1926
MP10	0050-2032	9	1	CASTING-REAR FRAME	28480	0050-2032
MP11	83525-00006	0	1	BRACKET-COUPLER	28480	83525-00006
MP12	83525-20038	0	1	SHIELD-REAR	28480	83525-20038
MP13	1400-1095	6	4	CLIP FASTENER-SCREEN .3 X .4 INCH	28480	1400-1095
MP14	83525-20037	9	1	SHIELD-FRONT	28480	83525-20037
MP15	83525-20030	2	1	SIDERAIL-UPPER RIGHT	28480	83525-20030
MP16	83525-20039	1	1	CASTING-FRONT FRAME	28480	83525-20039
MP17	0510-1148	2	5	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
MP18	83525-20031	3	1	SIDERAIL-UPPER LEFT	28480	83525-20031
MP19	86240-00009	5	1	BRACKET-AMPLIFIER	28480	86240-00009
MP20	83525-00009	3		REAR CONN BRACKET (OPT. 004 ONLY)	28480	83525-00009
MP21	83525-00010	6	1	GUARD	28480	83525-00010
MP22	83525-00011	7		BRACKET-ATTEN (OPT. 002 ONLY)	28480	83525-00011
MP23	1460-1851	8	1	SPRING LATCH	28480	1460-1851
MP24	1480-0337	5	1	PIN-ROLL	28480	1480-0337
MP25	83525-20033	5	2	LATCH-SCREW	28480	83525-20033
	3030-0330	7	2	SCREW-SET 4-40 .062-IN-LG SMALL CUP-PT	00000	ORDER BY DESCRIPTION
MP26	83525-20040	4	1	LATCH	28480	83525-20040
MP27	83525-00012	8	1	HOLD-DOWN BRACKET	28480	83525-00012
MP28	83525-20029	9	1	SIDERAIL-LOWER LEFT	28480	83525-20029
MP29	83525-00013	9	1	WIRE HOLDER	28480	83525-00013
MP30	83525-20032	4	1	SIDERAIL-LOWER RIGHT	28480	83525-20032
MP31	83525-20022	2	1	CASTING-RF	28480	83525-20022
MP32	6960-0002	4	1	PLUG-HOLE DOME-HD FOR .5-D-HOLE STL	28480	6960-0002
MP33	6960-0046	6	1	PLUG-HOLE DOME-HD FOR .68-D-HOLE BRS	28480	6960-0046
MP34	5021-0906	6	3	SLEEVE-RF PIN POS	28480	5021-0906
MP35	83525-00003	7	1	PANEL-REAR	28480	83525-00003
MP36	6960-0001	3	1	PLUG-HOLE DOME-HD FOR .375-D-HOLE STL	28480	6960-0001
MP37	11869-20020	4	1	ALIGNMENT PIN	28480	11869-20020
MP38	0510-0089	8	1	LOCK RING	28480	0510-0089
Q1	1854-0456	2	1	TRANSISTOR NPN SI PD=65W FT=3MHZ	01295	TIP41A
W1	83525-20026	6	1	CABLE-RF COUPLER/OUTPUT	28480	83525-20026
W2				NOT ASSIGNED		
W3	83525-60031	7	1	CABLE ASSY-RIBBON, FRONT PANEL	28480	83525-60031
W3	83525-60054	4		CABLE ASSY-RIBBON, FRONT PANEL OPT. 004	28480	83525-60054
W4				NOT ASSIGNED		
W5				NOT ASSIGNED		
W6				NOT ASSIGNED		
W7				NOT ASSIGNED		
W8				NOT ASSIGNED		
W9				NOT ASSIGNED		
W10				NOT ASSIGNED		
W11				NOT ASSIGNED		
W12	83525-60028	2	1	CABLE ASSY-COAX, BLUE, FM OUTPUT	28480	83525-60028
W13				NOT ASSIGNED		
W14	83525-60026	0	1	CABLE ASSY-COAX, GRAY, DETECTOR	28480	83525-60026
W15				NOT ASSIGNED		
W16	83525-60022	6	1	CABLE ASSY-RIBBON, RF PATH	28480	83525-60022
W17				NOT ASSIGNED		
W18	08750-60013	0	1	CABLE ASSY-REGULATOR	28480	08750-60013
W19	83525-60027	1	1	CABLE ASSY-FM IN, GREEN	28480	83525-60027
W20	83525-60014	6	1	CABLE ASSY-AM, BROWN	28480	83525-60014
W21	83525-60029	3	1	CABLE ASSY-V TUNE, ORANGE	28480	83525-60029
W22	83525-60030	6	1	CABLE ASSY-PULSE IN, PURPLE	28480	83525-60030
W23				NOT ASSIGNED		
W24				NOT ASSIGNED		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W25				NOT ASSIGNED		
W26				NOT ASSIGNED		
W27				NOT ASSIGNED		
W28				NOT ASSIGNED		
W29	83540-20013	0	1	CABLE-OSCILLATOR/AMPL	28480	83540-20013
W30	83540-20014	1	1	CABLE-RF AMPL/COUPLER	28480	83540-20014
W31	83525-60024	8	1	CABLE ASSY-POWER SUPPLY	28480	83525-60024
W32	83525-60056	6	1	CABLE ASSY-REAR CONNECTOR	28480	83525-60056
W33	83525-20027	7	1	CABLE-ATTEN/OUTPUT (OPT. 002 ONLY)	28480	83525-20027
W34	83525-20028	8	1	CABLE-COUPLER/ATTEN (OPT. 002 ONLY)	28480	83525-20028
W35	83525-20024	4	1	CABLE-RF COUPLER/REAR OUTPUT (OPT. 004)	28480	83525-20024
W36	83522-20017	2	1	CABLE-RF ATTEN/REAR OUT (OPT. 002 AND 004)	28480	83522-20017
				OPTION 002 (70 dB STEP ATTENUATOR)		
A19	5086-7370	8	1	ATTENUATOR-70DB (OPT. 002 ONLY)	28480	5086-7370
A19MP1	83525-00011	7	1	BRACKET-ATTENUATOR	28480	83525-00011
W33	83525-20027	7	1	CABLE-ATTENUATOR OUTPUT	28480	83525-20027
W34	83525-20028	8	1	CABLE-COUPLER/ATTENUATOR	28480	83525-20028
				NOTE DELETE CABLE W1 (83525-20026) FOR OPT. 002.		
				OPTION 004 (REAR PANEL RF OUT)		
MP28	83525-00002	6	1	PANEL DRESS (OPT. 004 ONLY)	28480	83525-00002
MP30	83525-00009	3	1	REAR CONNECTOR BRACKET	28480	83525-00009
W35	83525-20024	4	1	CABLE-RF COUPLER/REAR OUTPUT	28480	83525-20024
				NOTE DELETE W1 (83525-20026) AND DRESS PANEL (83525-00001) FOR OPT. 004 ONLY.		
				OPTION 002 AND 004 (70 dB STEP ATTENUATOR WITH REAR PANEL RF OUT)		
				ALL OPT. 002 & 004 PARTS + THE FOLLOWING:		
W36	83522-20017	2	1	CABLE-RF ATTENUATOR/REAR OUTPUT	28480	83522-20017
				NOTE DELETE CABLES W1 (83525-20026), W33 (83525-20027) and W35 (83525-20024) FOR OPT. 002 and 004.		

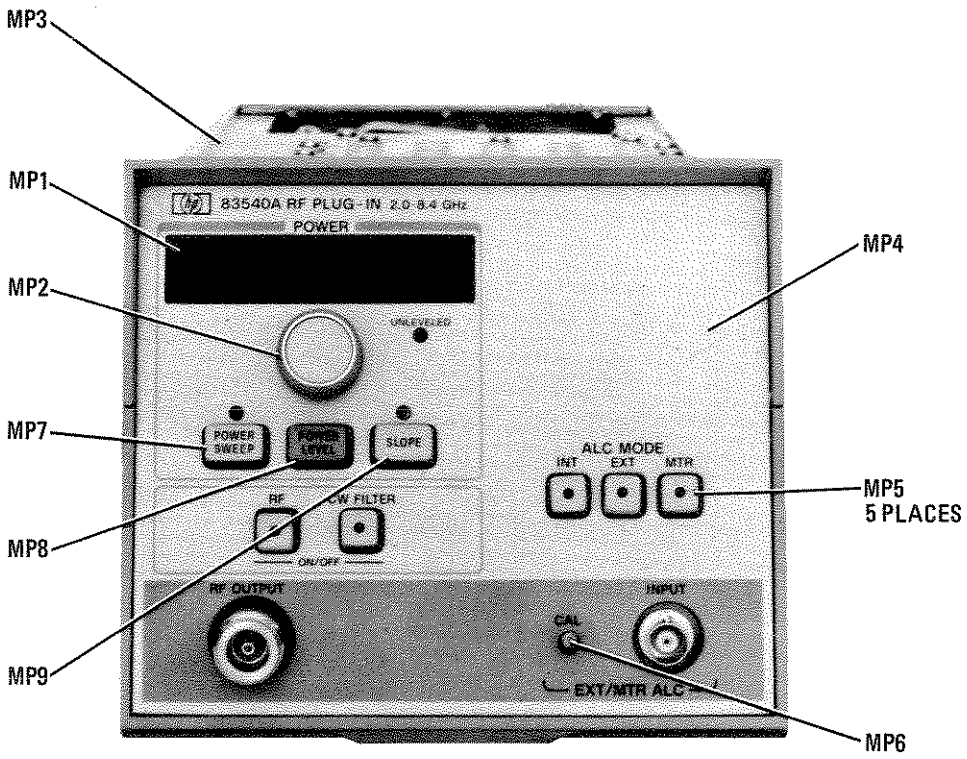


Figure 6-1. Mechanical Parts (1 of 3)

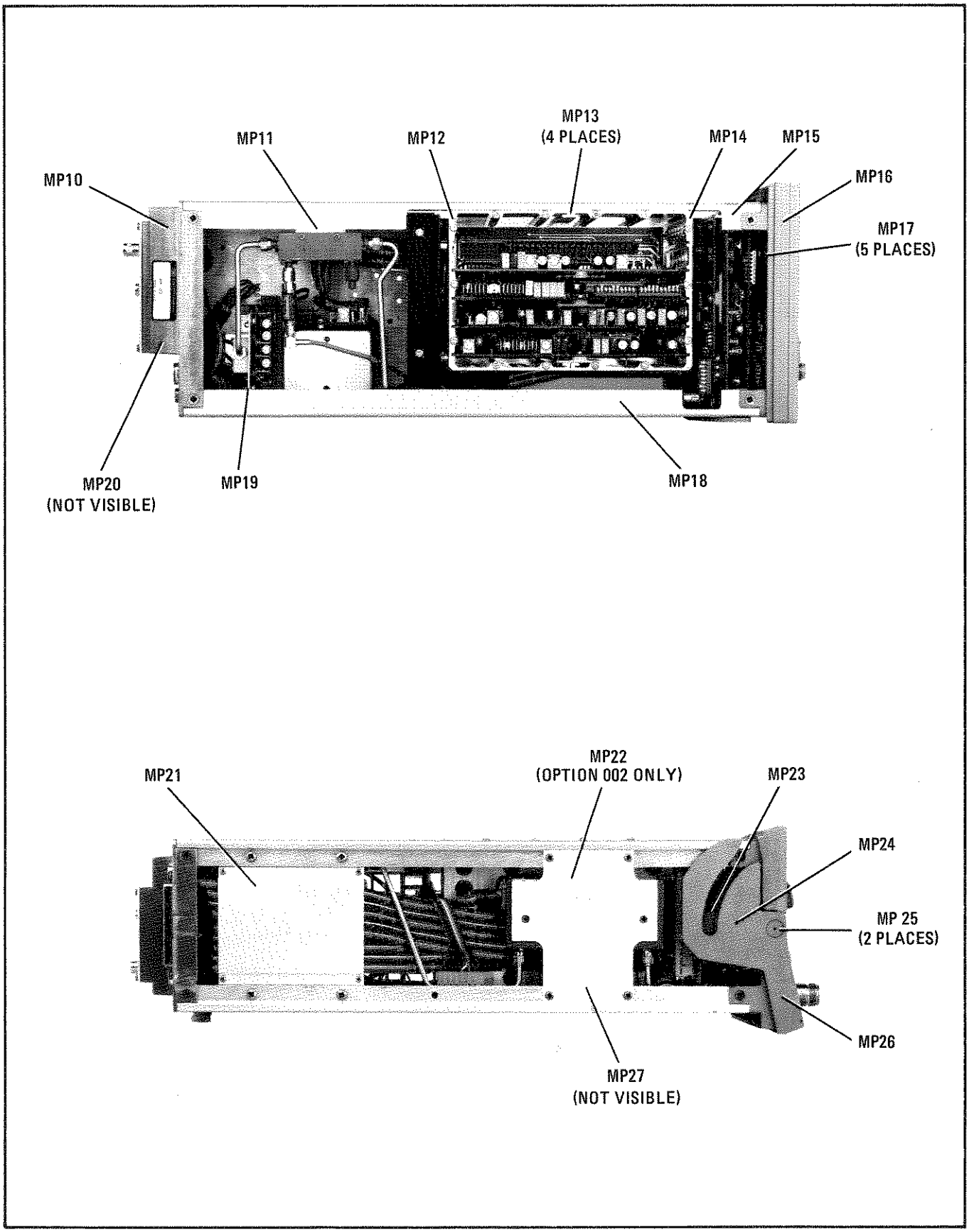
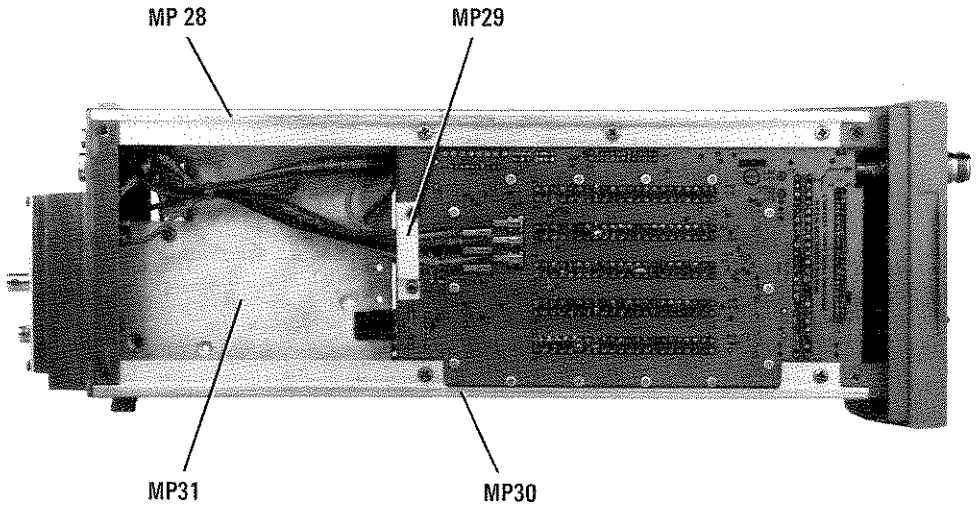


Figure 6-1. Mechanical Parts (2 of 3)



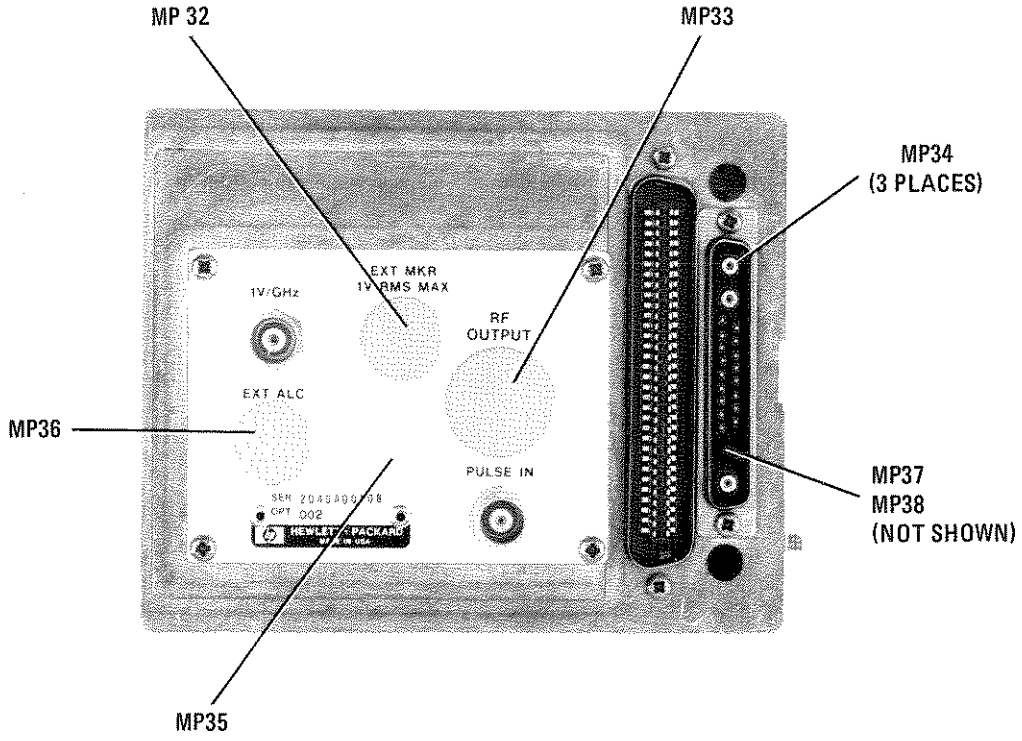
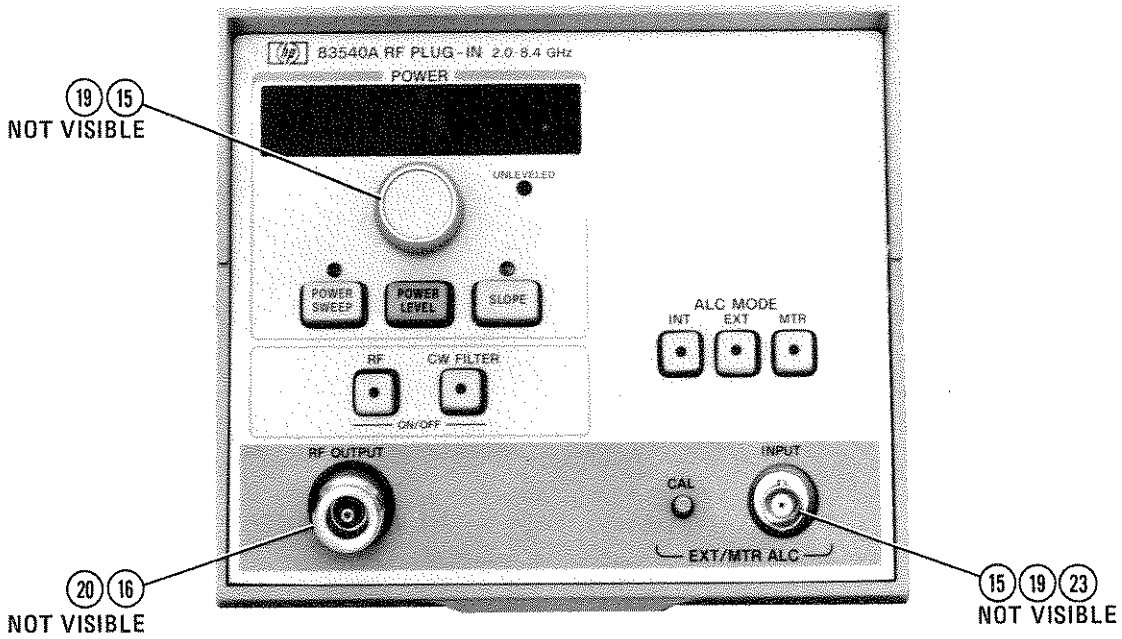


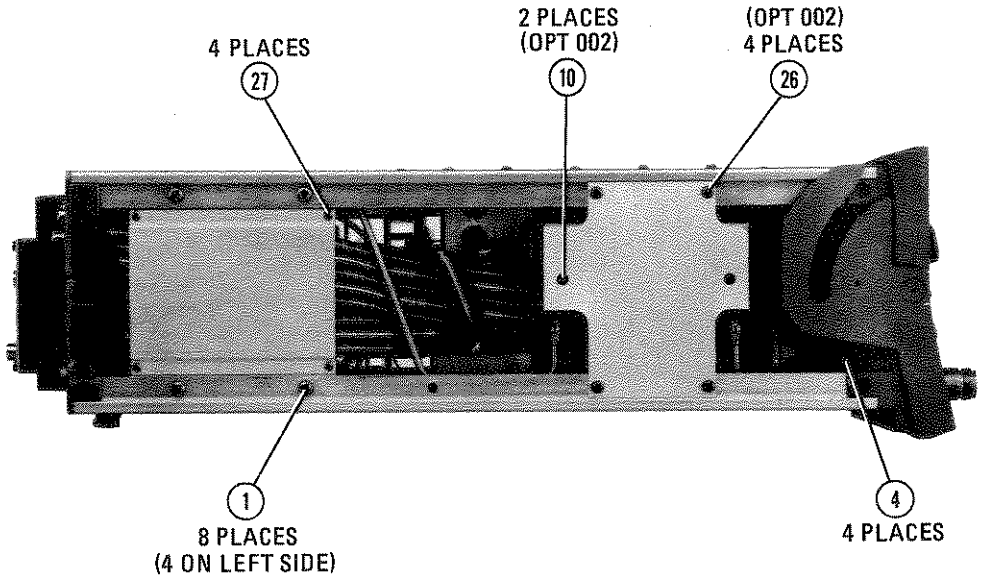
Figure 6-1. Mechanical Parts (3 of 3)



Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				ATTACHING HARDWARE		
				NOTE SEE FIGURE 6-2 FOR ATTACHING HARDWARE LOCATIONS.		
1	2360-0115	4	10	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
2	2360-0117	6	1	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	2360-0121	2	1	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
4	2360-0129	0	4	SCREW-MACH 6-32 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
5	2360-0197	2	5	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
6	2360-0333	8	16	SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
7	2200-0105	4	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	2200-0107	6	12	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
9	2200-0147	4	4	SCREW-MACH 4-40 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
10	2200-0166	7	2	SCREW-MACH 4-40 .312-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
11	0624-0281	3	28	SCREW-TPG 4-20 .5-IN-LG PAN-HD-POZI STL	28480	0624-0281
12	0520-0136	7	2	SCREW-MACH 2-56 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
13	2260-0009	3	6	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
14	2420-0001	5	6	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
15	2950-0001	8	4	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
16	2950-0132	6	1	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
17	2950-0177	9	1	NUT-HEX-DBL-CHAM 1/4-36-THD .05-IN-THK	28480	2950-0177
18	2190-0014	1	2	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
19	2190-0016	3	4	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
20	2190-0104	0	1	WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
21	1250-1142	5	1	WASHER-LK INTL T 1/2 IN .26-IN-ID	16179	4151
22	3050-0005	5	1	WASHER-SHLDR NO. 6 .14-IN-ID .375-IN-OD	28480	3050-0005
23	0360-1190	5	1	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
24	3050-0003	3	1	WASHER-FI NM NO 6 .141-IN-ID .375-IN-OD	28480	3050-0003
25	0360-1632	0	1	TERMINAL-SLDR LUG LK-MTG FOR #3/8-SCR	28480	0360-1632
26	0520-0128	7	4	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
27	0520-0127	6	4	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Figure 6-2. Attaching Hardware (1 of 3)



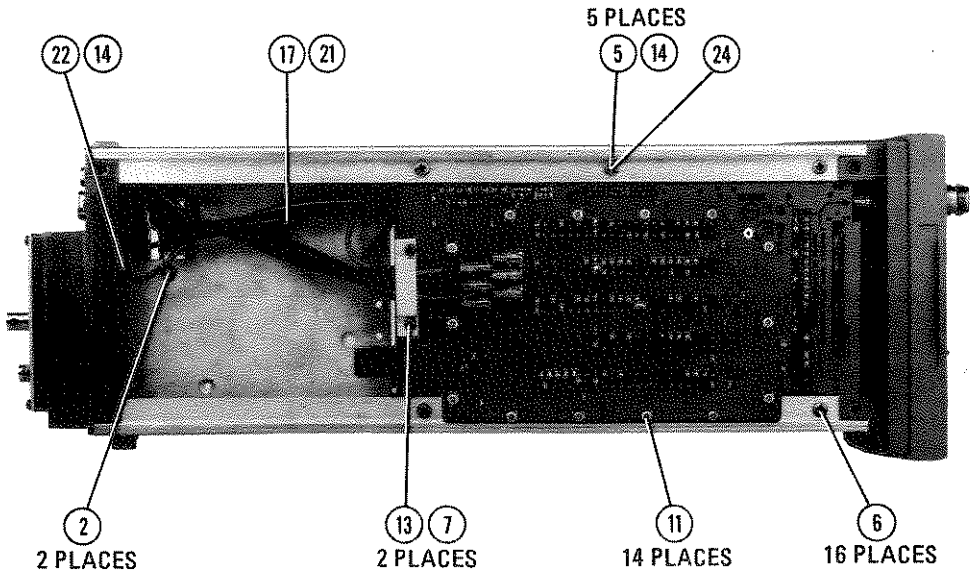
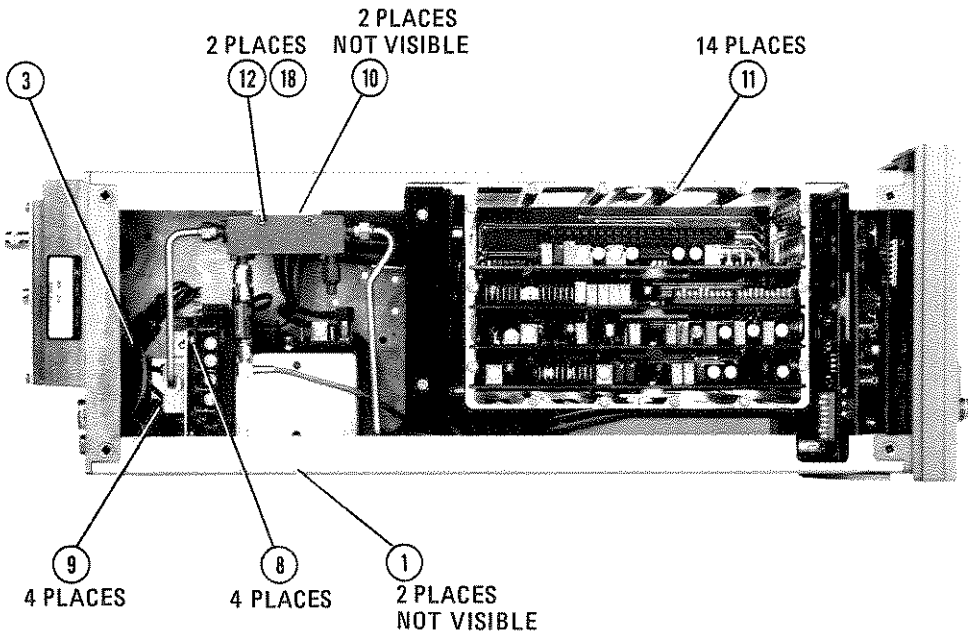


Figure 6-2. Attaching Hardware (2 of 3)



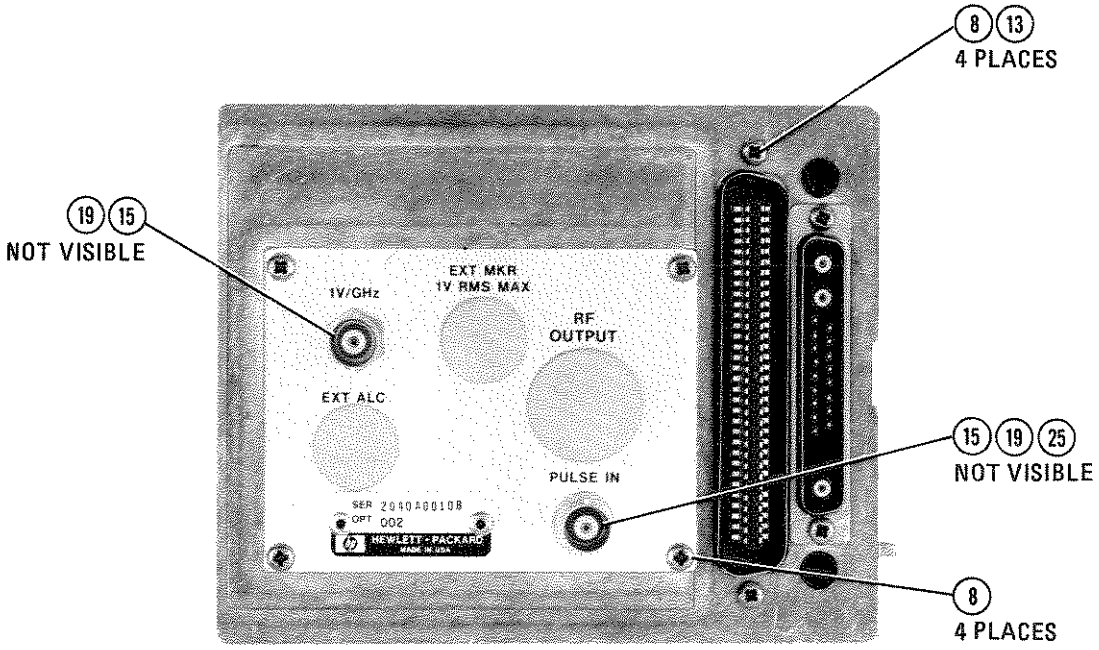


Figure 6-2. Attaching Hardware (3 of 3)

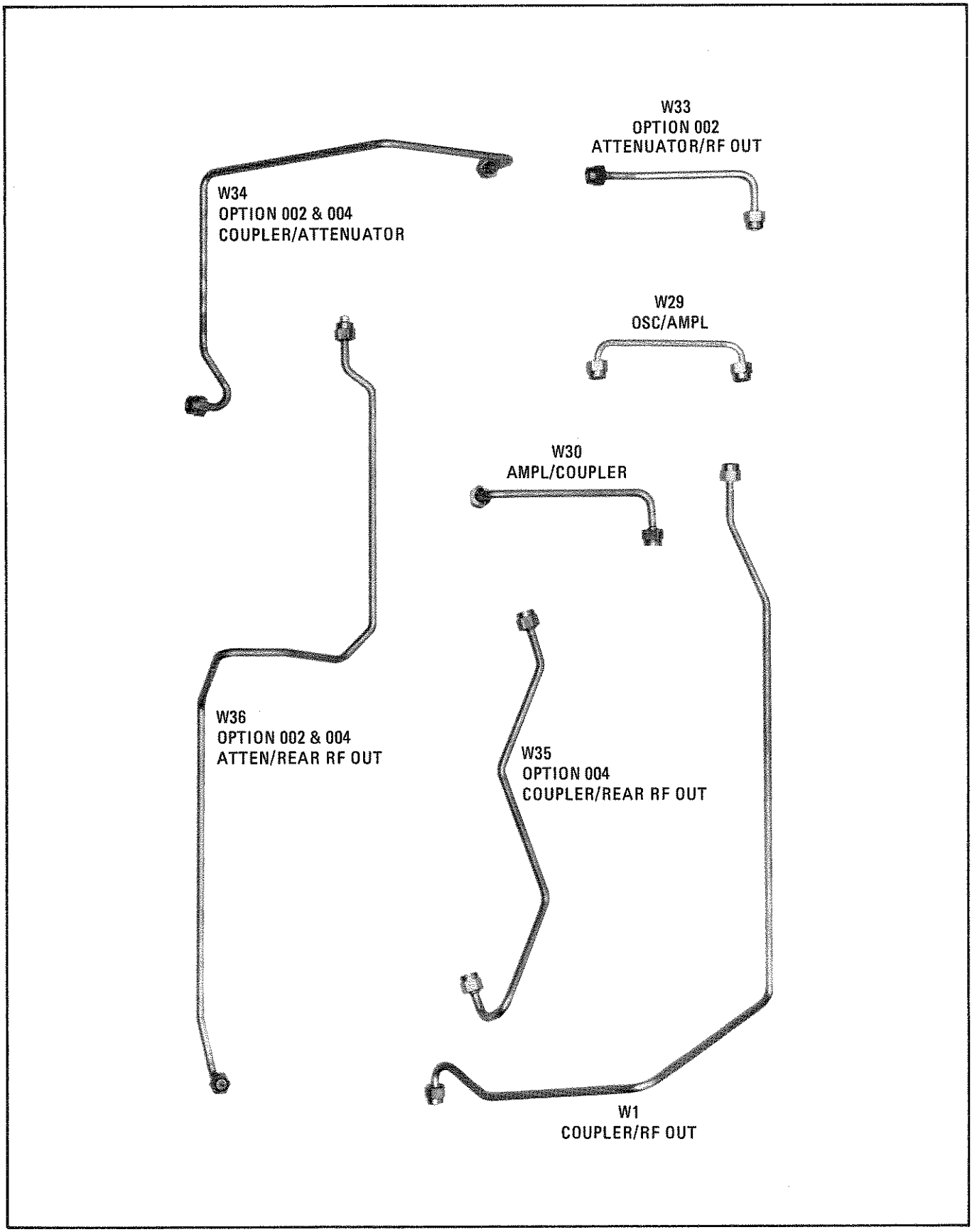
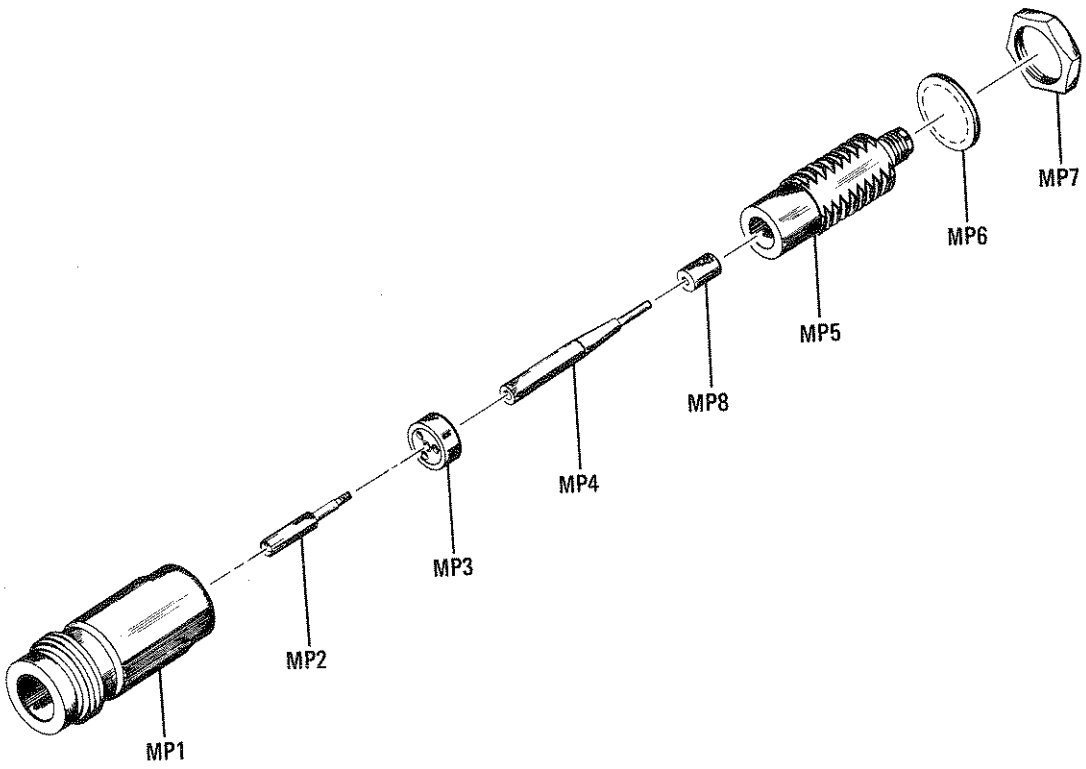


Figure 6-3. Cables in RF Section (Standard and Options)



Reference Designation	HP Part Number	Qty	Description	Mfr. Code	Mfr. Part Number
J1	86290-60005	1	Connector Assy (Type N)	28480	86290-60005
J1MP1	1250-1577	1	Body: RF Connector (Type N)	05879	131-445
J1MP2	1250-0915	1	Contact: RF Connector (Type N)	05879	131-149
J1MP3	5040-0306	1	Insulator	28480	5040-0306
J1MP4	08555-20093	1	Center Conductor	28480	08555-20093
J1MP5	08555-20094	1	Body: Bulkhead	28480	08555-20094
J1MP6	2190-0104	1	Washer: Lock 0.439" ID	00000	OBD
J1MP7	2950-0132	1	Nut: Hex 7/16 – 28	00000	OBD
J1MP8	08761-2027	1	Insulator	28480	08761-2027

Figure 6-4. RF Output Connector J1 Exploded View

SECTION VII
MANUAL BACKDATING CHANGES

7-1. INTRODUCTION

7-2. This manual has been written for and applies directly to instruments with serial numbers prefixed as indicated on the title page. Earlier versions of the instrument (serial number prefixes lower than the one indicated on the title page) may be slightly different in design or appearance. The purpose of this section of the manual is to document these differences. With the information provided in this section, this manual can be corrected so that it applies to any earlier version or configuration of the instrument. Later versions of the instrument (serial number prefixes higher than the one indicated on the title page) are documented in a yellow Manual Changes Supplement.

7-3. Since there are no earlier versions of the HP Model 83540A RF Plug-in, there is no change information provided here. This manual applies directly to instruments with serial numbers prefixed as indicated on the title page. If your instrument serial number is different than the one on the title page, it will be documented in a yellow Manual Changes Supplement. Complimentary copies of this supplement can be obtained from your nearest Hewlett-Packard Office. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for more information about serial number coverage.

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for troubleshooting and repairing the Model 83540A RF Plug-in. Information includes circuit descriptions, troubleshooting procedures, block diagrams, schematics, and component location maps for each PC board assembly.

WARNING

Adjustments or repairs inside the 8350A/ 83540A with the top or bottom cover removed and the ac power connected should be avoided whenever possible. Any procedure requiring a cover to be removed from the instrument and ac power connected to the mainframe SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED. With the ac power cable connected to the instrument, the ac line voltage is present on the terminals of the line power module on the rear panel, and at the LINE power switch, whether the switch is ON or OFF. The ac line voltage on these terminals can, if contacted, produce fatal electrical shock. You must also be aware that capacitors inside the instrument may remain charged even though the instrument has been disconnected from its ac power source.

After you have completed a repair, check the instrument carefully to make sure all safety features are intact and functioning, and that all protective grounds are solidly connected.

8-3. SERVICE SHEETS

8-4. Each service sheet pertains to a specific assembly and they are arranged in assembly number order. Table 8-1 provides a Service Sheet Index.

8-5. Service Sheets fold out and up to facilitate access to reference material. Block diagrams appear on the fold-down apron. Component location maps, PC board pin-edge connections, and pertinent circuit information (e.g., waveforms) are found on the fold-up apron of the service sheet, with the schematic directly below. Circuit description and assembly level troubleshooting are located on pages immediately preceding the service sheet.

8-6. SCHEMATIC DIAGRAM NOTES

8-7. Figure 8-1, Schematic Diagram Notes, provides definitions to schematic symbols.

8-8. MNEMONICS

8-9. Table 8-11, 83540A Motherboard Wiring List, lists alphabetically and defines all 83540A signal mnemonics, references the point-to-point distribution of each signal to and from the PC board sockets and the cable connectors on the A10 Motherboard assembly, and identifies the signal source. This table is located at the end of Section VIII.

8-10. SERVICE AIDS

8-11. Two Extender Cable Assemblies, HP Part Number 08350-60034 (64 pin) and 08350-60035 (17 pin), are designed to power the RF Plug-in when it is removed from the 8350A Sweep Oscillator for troubleshooting. These service aids are recommended for convenience in servicing the 83540A.

8-12. A 44-pin extender board, (HP Part No. 08350-60031) is available to allow access to pc assembly components while maintaining electrical contact with the plug-in. This and other service aids are referenced in Section I, Table 1-3, of this manual.

Table 8-1. Index of Service Sheets

Assembly	Figure Number	Assembly	Figure Number
OVERALL		**A6 YO DRIVER/A9 REF RESISTOR**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Simplfied Overall Block	8-7	Block Diagram	8-44
Overall Block	8-8	A6 Component Locations	8-48
		A9 Component Locations	8-43
		Schematic	8-53
A1/A2 FRONT PANEL		**A7 MARKER**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Block Diagram	8-10	Block Diagram	8-54
Front Panel A1 Component Locations	8-11	Component Locations	8-55
Front Panel Interface A2 Component Locations	8-12	Schematic	8-64
Schematic	8-18		
A3 DIGITAL INTERFACE		**RF SECTION**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Block Diagram	8-19	A12A1 Component Locations	8-65
Component Locations	8-20	A13A1 Component Locations	8-66
Schematic	8-23	RF Section Schematic	8-67
A4 ALC		**A10 MOTHERBOARD**	
Circuit Description/Troubleshooting		Component Locations	8-70
Block Diagram	8-28	Wiring List – Table 8-11	
Component Locations	8-29		
Schematic	8-34		
A5 FM DRIVER		**83540A**	
Circuit Description/Troubleshooting		Cable List – Table 8-12	
Block Diagram	8-38	Major Assemblies Locations	8-71
Component Locations	8-39		
Schematic	8-42		

BASIC COMPONENT SYMBOLOGY

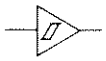
R, L, C	Resistance is in ohms, inductance is in micro-henries, capacitance is in microfarads, unless otherwise noted.
P/O	Part of.
✳	Indicates a factory selected component.
○—	Panel Control.
●	Screwdriver adjustment.
▭	Encloses front panel designation.
⬚	Encloses rear panel designation.
— — —	Circuit assembly borderline.
- - - - - -	Other assembly borderline.
——→	Heavy line with arrows indicates path and direction of main signal.
- - →— -	Indicates path and direction of main feedback.
⏚	Earth ground symbol.
▽	Assembly ground. May be accompanied by a number or letter to specify a particular ground.
⏚	Chassis ground.
n /	Represents n number of transmission paths.
	Test Point: Terminal provided for test probe.
	Pin Edge Connector output of PC board.
	Indicates wire or cable color code. Color code same as resistor color code. First number indicates base color, second and third numbers indicate colored stripes.
	Indicates shielding conductor for cables.
≺ ←	Indicates a plug-in connection.
—○—	Indicates a soldered or mechanical connection.
←	Connection symbol indicating a male connection.
≺	Connection symbol indicating a female connection.
	Resistor.
	Variable Resistor.
	General purpose diode.
	Step recovery diode.
	Schottky diode.
	Breakdown Diode: Zener
	Light-Emitting Diode.
	SCR (Silicon Controlled Rectifier).
	FET: Field Effect Transistor (N-channel).
	FET: Field Effect Transistor-Guarded gate- (N channel).
	Dual Transistor.
	Transistor NPN
	Transistor PNP
	Electrolytic Capacitor.
	Toroid: Magnetic core inductor.
	Operational Amplifier.
	Fuse
	Pushbutton Switch.
	Toggle Switch.
	Thermal Switch.
Σ	Summing Point.
	Oscillator; RPG (Rotary Pulse Generator).
BI	Fan, Motor.
	Toroidal Transformer

LOGIC SYMBOLOGY

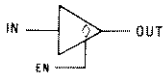
&	AND Gate
≥1	OR Gate
&	NAND Gate
≥1	NOR Gate
=1	Exclusive OR Gate
	Buffer/Amplifier
	Inverter
—○	Negation symbol. Line is active low.
	Indicated edge-sensitive input.

Figure 8-1. Schematic Diagram Notes (1 of 3)

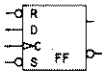
INTEGRATED CIRCUIT SYMBOLOGY



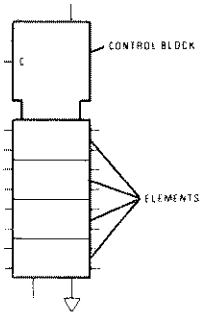
Schmitt Trigger: The gate of the Schmitt Trigger switches at different points for positive - and negative-going signals. The difference between the positive and negative thresholds is defined as hysteresis voltage.



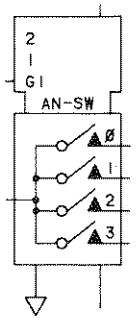
3-State Buffer: Three States:
Enable (EN) Input low: High impedence output.
Enable input high: Output = 0 or
Output = 1



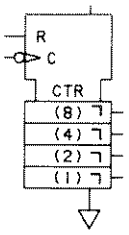
Data Flip-Flop: Set (S) and Reset (R) are asynchronous controls. Active S sets the noninverting output high and the inverting output (○—) low; active R resets both outputs. When S and R are both inactive, the outputs remain latched in the last state. An active clock (⊣▷) enables the D input, at which time the noninverting output = D, and the inverting output = $\bar{D}$.



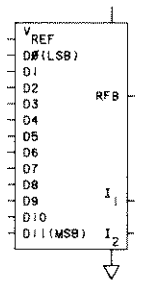
Control Block: All controlling inputs (gates, clocks, inhibits, etc.) connect to the control block.
Elements: Can be one or more of any logic function (flip-flop, counter, gate, RAM, etc.). Data inputs are on the left side of element, data outputs on the right.



Analog Switch: Control lines 1 and 2 decode to select one of four inputs. G1, high=enable.



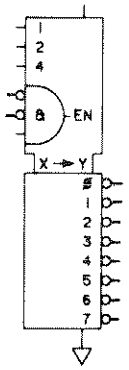
Counter: Binary-weighted registers count on the falling edge of each clock pulse. Active (high) R clears all registers.



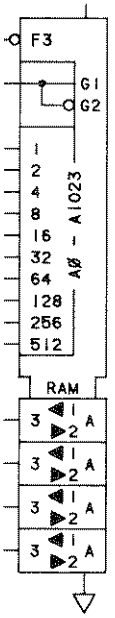
Digital to Analog Converter (DAC): Provides a scaled current output (I_1), the product of V_{REF} and the fractional binary input:

$$D_{11}2^{-1} + D_{10}2^{-2} + D_9 2^{-3} + \ldots D_0 2^{-12}$$

The product of V_{REF} and complement of the binary input appears at I_2.



Decoder: The logic states of the three select lines A, B, and C, and the three enable inputs (EN), determine which one of the eight outputs will be decoded. The selected output will be low, while all others are high.



Random-Access Memory (RAM): Binary addresses (A0 to A9) access one of 1024 registers in RAM. When G1 is high, bits appearing at D0 to D3 will be written to the addressed location (A0 to A9). When G2 is low, bits appearing at D0 to D3 have been accessed from the addressed location.

Figure 8-1. Schematic Diagram Notes (2 of 3)

FUNCTION LABEL ABBREVIATIONS

Σ	Adder	◊	Open Collector	LED	Light-Emitting Diode
	Amplifier/Buffer		Monostable Multivibrator	MUX	Multiplexer
	Schmitt Trigger	BCD	Binary Coded Decimal	RAM	Random-Access Memory
&	AND	CTR	Counter	REG	Register
≥1	OR	DAC	Digital-to-Analog Converter	ROM	Read Only Memory
=1	Exclusive OR	FF	Flip-Flop	RPG	Rotary Pulse Generator
X→Y	Encoder, Decoder	I/O	Input/Output		

LINE LABEL ABBREVIATIONS

CK, C	Clock Input	MSB	Most Significant Bit	T	Trigger Input (Monostable)
D	Data or Delay Input (Flip-Flop)	Q	Output	WR	Write
EN	Enable	$\overline{Q}$	Not Q Complement of Q	+1	Count Up
F	3-State Enable Input	R	Reset or Clear Input	−1	Count Down
G	Gating Input	RD	Read	3-ST	3-State (placed by function)
LSB	Least Significant Bit	S	Set Input		

Figure 8-1. Schematic Diagram Notes (3 of 3)

8-13. TROUBLESHOOTING

CAUTION

Improper methods of discharging the −40 Volt supply may result in damage to the instrument. Refer to the 8350A Sweep Oscillator Operating and Service Manual for these procedures.

8-14. Troubleshooting is generally divided into two maintenance levels in this manual. The first level isolates the problem to a circuit or assembly. SELF-TEST (described in paragraph 8-16) together with the Overall Block Diagram and Troubleshooting hints, helps to isolate the problem source to a particular assembly.

8-15. The second maintenance level isolates the trouble to the component. Operator-initiated tests, schematic diagrams, and circuit descriptions for each assembly aid in troubleshooting to the component level.

8-16. SELF-TEST

8-17. 8350A software provides microprocessor and operator-initiated checks. These checks verify the proper functioning of the majority of the 8350A and 83540A digital circuitry and a portion of the analog devices.

8-18. Whenever the 8350A is powered ON, or the front panel INSTR PRESET pushbutton is pressed, instrument SELF-TEST is initiated. Instrument SELF-TEST checks a number of circuits in both the 8350A and the 83540A. If a failure in the 83540A is detected during SELF-TEST, error code E001 will be displayed. Table 8-2 lists other error codes associated with the 83540A RF Plug-in.

8-19. If the front panel displays an error code, refer to the Overall Block Diagram and Troubleshooting section. This section will help the operator to define the troubled area.

8-20. OPERATOR-INITIATED TESTS

8-21. The 8350A microprocessor services several operator-initiated tests of the 83540A to check functions which are not exercised during SELF-TEST. The tests may be initiated by making the appropriate key entry indexed in Table 8-3.

8-22. Access to most of the 83540A digital circuitry can be achieved through local programming with the following key entry commands:

Table 8-2. Error Codes Associated with 83540A

Error Code	Circuit Tested
E001	Addresses 83545A ROM and reads Check Sum back to 8350A.
E050	Erroneous Front Panel Pushbutton Flag.
E051	Erroneous Front Panel Pushbutton Code received by 8350A Microprocessor.
E052	Checks for Timer failure in A3.
E053	Checks PIA circuits in A3.

NOTE

Error codes E050 through E099 are reserved for the RF Plug-ins, however, not all are used.

Key Entry	Function
SHIFT 0 0 M1 * (enter hex address)	Hex Address Entry
M2 (enter data: two hex digits)	Hex Data Write
M3	Hex Data READ
M4	Hex Data Rotation Write
M5	Hex Addressed Fast Read

*To address a different location, press M1 and enter the new address, or use the increment keys ▲ ▼ to step to the new address.

By entering the Hew address location of a specific device, that device can be exercised. (Addresses are supplied next to the mnemonic on each schematic. Also, circuit descriptions usually include Address Decoder Tables to define the addresses used on that particular assembly.) Hex address entry must be made prior to any of the following:

NOTE

Before addressing an 83540A component, determine whether or not the 8350A microprocessor can READ or WRITE to that particular device. The majority of 83540A digital chips do NOT have both READ and WRITE capabilities.

Press 8350A CW before initiating M2, Hex Data Write, or M3, Hex Data Read, to prevent microprocessor intervention during the hex data routine.

- HEX DATA WRITE, M2, allows the operator to write any combination of hex data bytes to the addressed device. The outputs can then be checked to see if the device is functioning properly.
- HEX DATA READ, M3, allows the operator to read the outputs of an addressed device.
- HEX DATA ROTATION WRITE, M4, strobes a '1' (high state) through a column of zeroes (low states) to the addressed device. In effect, Hex Data Rotation Write is a rapid WRITE mode, exercising the addressed device in real time. The microprocessor inputs the data continuously, without servicing interrupts from the rest of the instrument. Latch enable lines, inputs, and outputs can be checked in this mode. Figure 8-2 illustrates the appropriate waveforms.
- HEX ADDRESSED FAST READ, M5, provides an operator-initiated check for verification of the data bus, in which the addressed device is clocked in real time. Latch outputs can be traced from the onboard location back throuh the data bus to the microprocessor. At each buffer, verify TTL level response to the enable pulse. Enable line waveforms are shown in Figure 8-3.

8-23. HEXADECIMAL

8-24. Hexadecimal is the number system used to locally address the 8350A and 83540A logic components. Available programmed checks are indexed in Table 8-3.

Table 8-3. Operator Initiated Self Test Routines Available

Data Entry	Test	Assembly*	Test Point for Waveform
SHIFT 50	Power Level DAC	A4	A4TP2
SHIFT 51	Power Sweep DAC	A5	A5TP8
SHIFT 52	Scale/Offset DACs	A6	A6TP1/A6TP2
SHIFT 53	Address Decoder; checks major address decoder lines	A3	A3U6, A3U7, A3U9, A3U13
SHIFT 54	Address Decoder; checks individual board address decoders	A4, A5, A6, A7	Address Decoders
SHIFT 55	Interrupt Control	A3	A3U4-38

*Refer to troubleshooting procedure of the appropriate assembly for waveforms and detailed procedures.

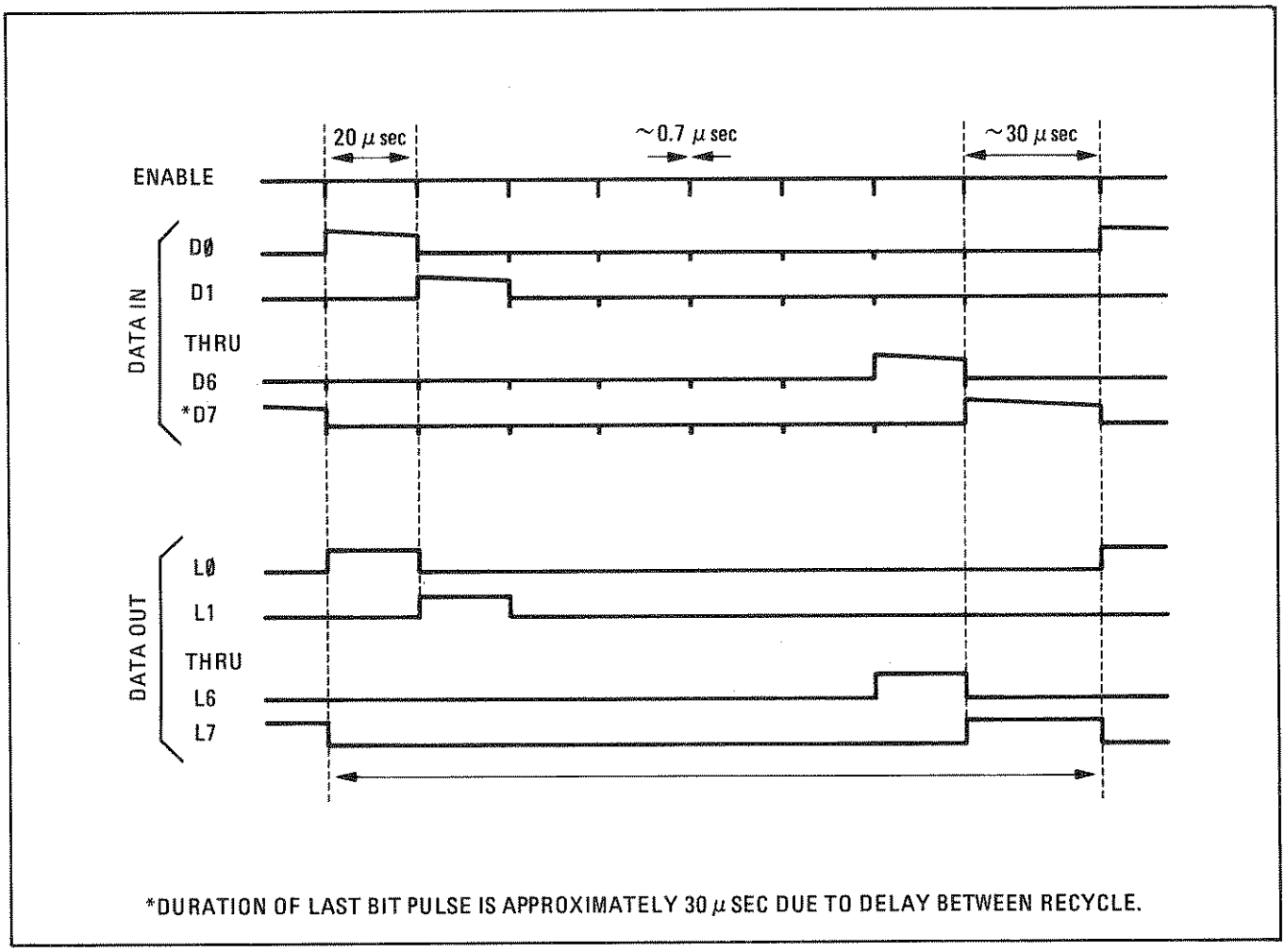


Figure 8-2. Hex Data Rotation Write-Bit Pattern

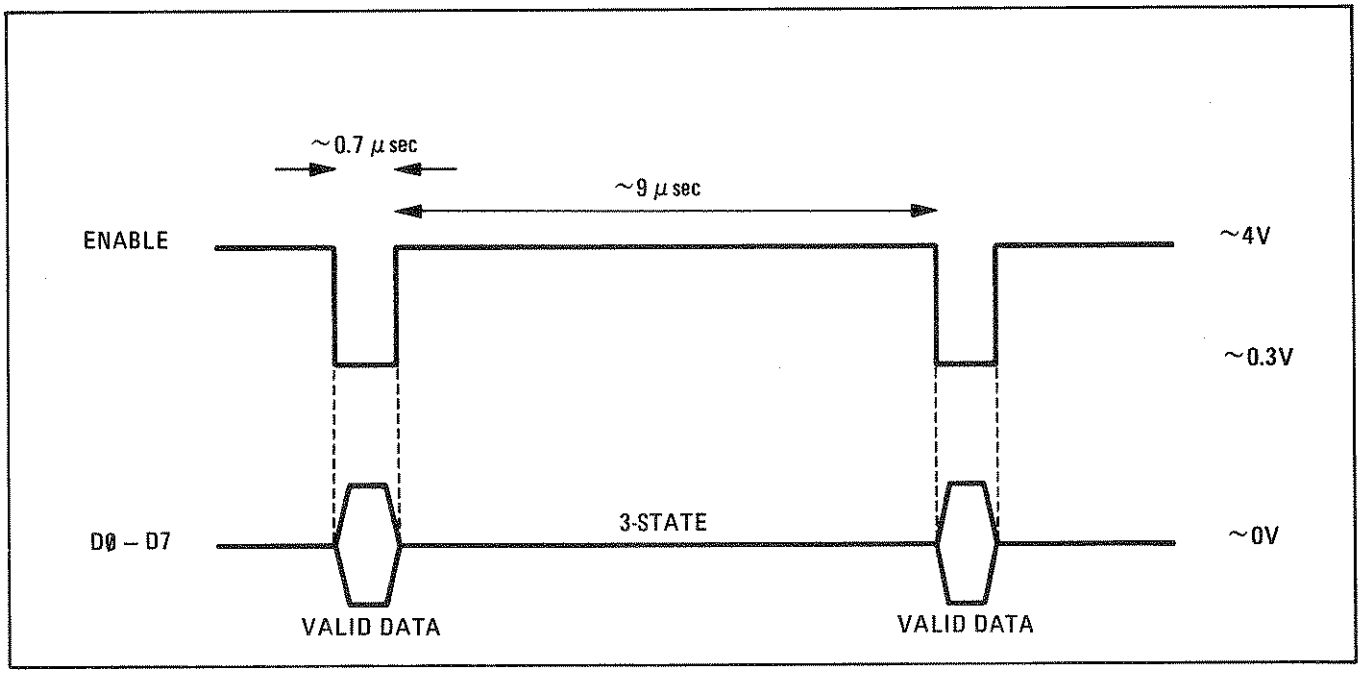


Figure 8-3. Hex Addressed Fast Read-Timing Diagram

8-25. The hexadecimal system uses 16 digits: 0 through 9 and A through F. Since 16 is the fourth power of two, four-bit binary numbers can be expressed with one hexadecimal digit, making local programming easier. Table 8-4 provides hexadecimal conversion.

Table 8-4. Hexadecimal Equivalents

Hexidecimal	Binary	Decimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
A	1010	10
b	1011	11
C	1100	12
d	1101	13
E	1110	14
F	1111	15

8-26. When the 8350A is in the Hex Data WRITE mode (refer to paragraph 8-22), several front panel keyboard pushbuttons function as hexadecimal digits. The Hex numbers assigned to the DATA ENTRY keys are shown in Figure 8-4.

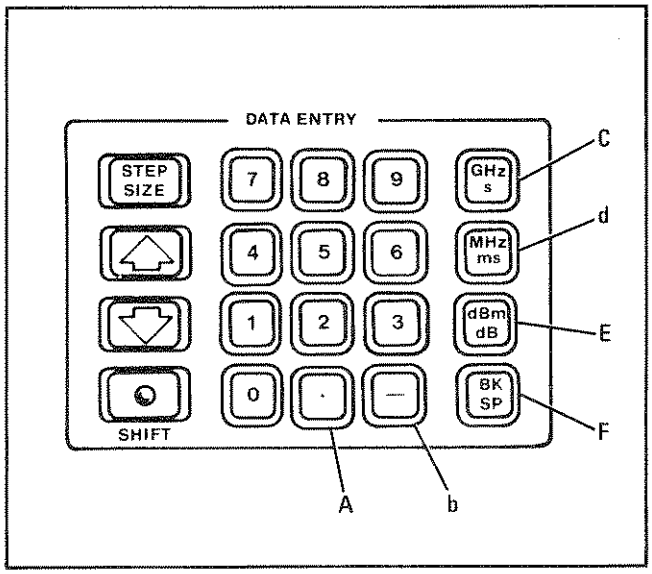


Figure 8-4. Hex Entry Keys

8-27. RECOMMENDED TEST EQUIPMENT

8-28. Test equipment required to maintain the Model 83540A is listed in Section I. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

8-29. REPAIR

8-30. Module Exchange Program

8-31. This instrument may be quickly repaired by replacing a defective module with a restored-exchange module. To support the module repair concept, Hewlett-Packard has set up a module exchange program.

8-32. The procedure for using the module exchange program is given in Figure 8-5. When you locate the defective module, order a replacement module through the nearest Hewlett-Packard sales office. The restored-exchange module will be sent immediately, directly from a customer service replacement parts center. When you receive the exchange module, return the defective module in the same special carton in which the exchange module was received. DO NOT return a defective module to Hewlett-Packard until you receive the exchange module.

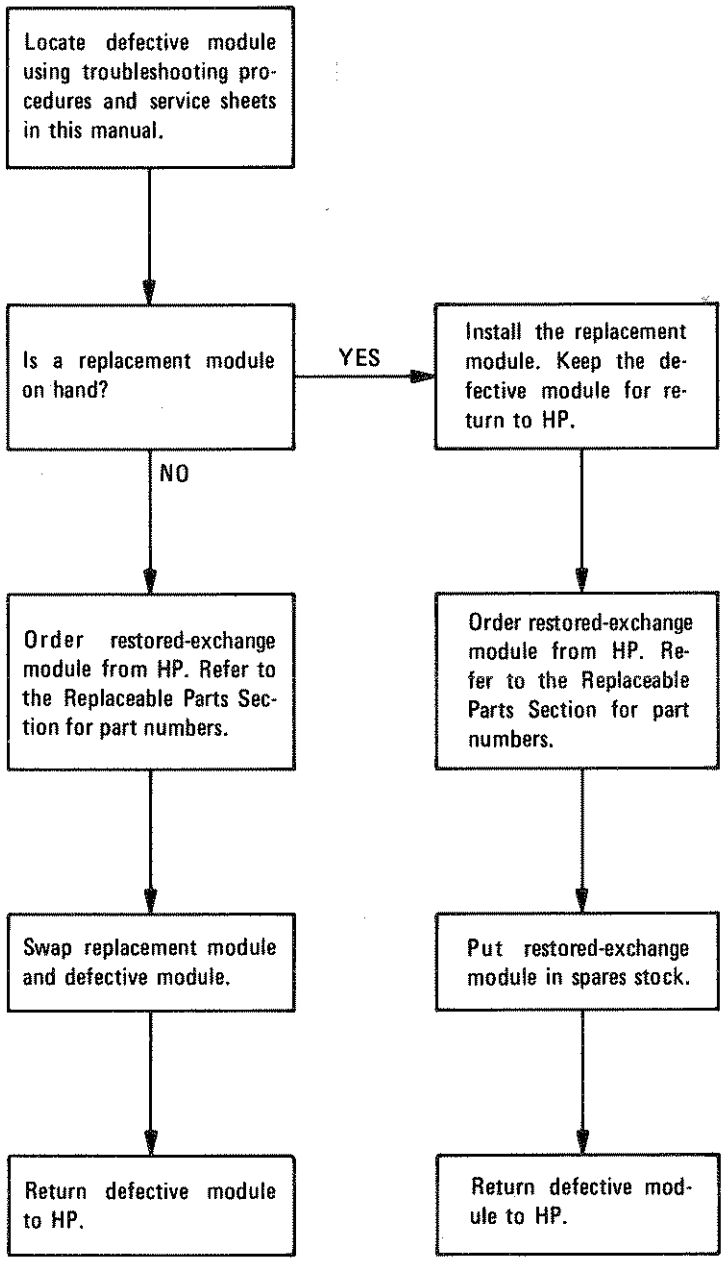
8-33. If you are not going to return the defective module to Hewlett-Packard, or if you are ordering a module for spare parts stock, etc., order a new module using the new module part number listed in Table 6-3.

8-34. The Hewlett-Packard module exchange program allows you to obtain a fully tested and guaranteed restored-exchange module at a reduced price. (The reduced price is contingent upon return of the defective module to Hewlett-Packard.) Assemblies available for module exchange are listed in Table 6-1.

8-35. Replacing YIG Oscillator A12 or YO Driver A6

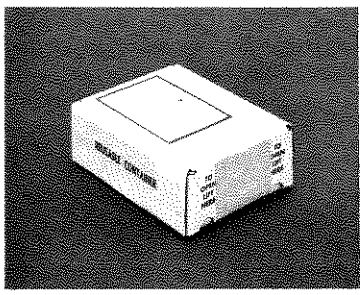
8-36. Each YIG Oscillator requires a unique set of six resistors to be installed in YO Driver A6 for proper YIG coil drive. The value of these resistors is documented on a label attached to the side of

The module exchange program described here is a fast, efficient, economical method of keeping your Hewlett-Packard instrument in service.



*HP pays postage on boxes mailed in U.S.A.

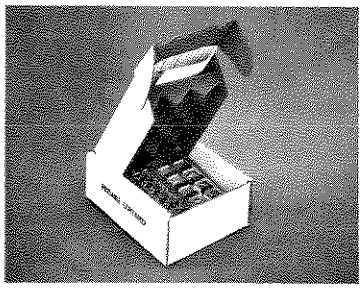
A.



Restored-exchange modules are shipped individually in boxes like this. In addition to the circuit module, the box contains:

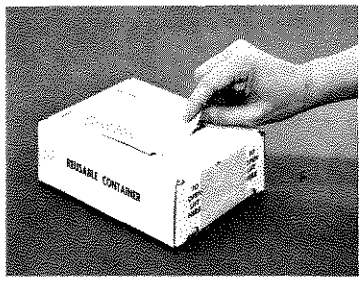
Module repair report
Return address label
Tape for resealing box

B.



Open box carefully - it will be used to return defective module to HP. Complete repair report. Place it and defective module in box. Be sure to remove enclosed return address label.

C.



Seal box with tape provided. Inside U.S.A.*, stick preprinted return address label over label already on box, and return box to HP. Outside U.S.A., do not use address label: instead, address box to the nearest HP office.

Figure 8-5. Module Exchange Procedure

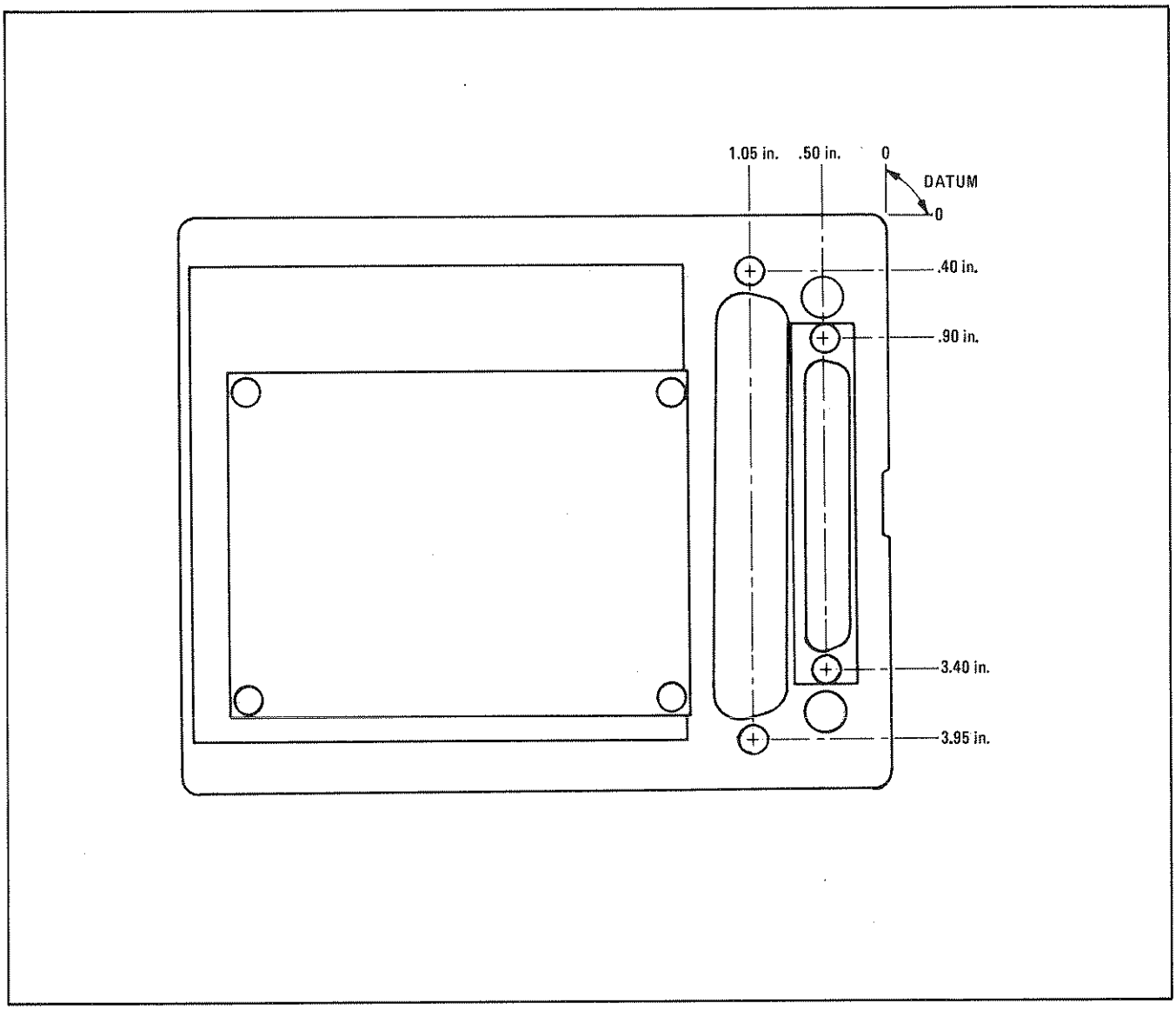


Figure 8-6. Rear Panel Connector Alignment Diagram

the 83540A near the RF section. If A6 is replaced, these six resistors (A6R1, A6R3, A6R38, A6R39, A6R40, and A6R41) must be removed from the old board and installed on the new board. Also, if YIG Oscillator A12 is replaced, the six new resistors shipped with the oscillator must be installed on A6 in place of the old resistors. (In some cases, some of the resistors may be deleted, depending on the drive requirements of the individual oscillator.)

8-37. Rear Panel Connector Replacement

8-38. When replacing rear panel connector P1, connector P2 also must be partially removed to remove P1 from the rear panel casting.

8-39. When reassembling rear panel connectors P1 and P2 into the casting, alignment is very critical to ensure proper interface with the mating 8350A connectors. Align the center of the attaching bolts with a steel rule and tighten in place in accordance with the placement drawing in Figure 8-6.

8-40. AFTER-SERVICE PRODUCT SAFETY CHECKS

8-41. Visually inspect interior of instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy the cause of any such condition.

83540A RF PLUG-IN SIMPLIFIED BLOCK DIAGRAM DESCRIPTION

The operating principles of the 83540A RF Plug-in are described in two levels. The Functional Block Diagram Description describes major functional areas of the instrument. The Detailed Block Diagram Description discusses the theory in greater depth, and outlines the breakdown of functions among the various instrument assemblies.

FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

The HP Model 83540A RF Plug-In, used with the 8350A Sweep Oscillator, covers the 2.0 to 8.4 GHz frequency range with +16 dBm of leveled RF power (+15 dBm for Option 002 instruments). In addition to internal leveling, external detectors or power meters can be used to level the RF power. Furthermore, the 83540A can sweep power proportional to either frequency or sweep.

The 83540A can be broken down into four functional sections:

- Digital Control and Front Panel
- Frequency Control
- Power Control (ALC)
- RF Section

The functional description for each of these four functions is described briefly below.

Digital Control/Front Panel

The entire 83540A is digitally controlled by the 8350A microprocessor. It must be emphasized that nearly all functions are commanded by the 8350A; very few activities take place without microprocessor intervention.

The Digital Control section of the 83540A is the focal point of all communication between plug-in and 8350A. It receives commands ordered by the microprocessor along the 8350A's instrument bus. Once in the 83540A, these commands are decoded and routed to the appropriate part of the plug-in to control virtually every capability. The Digital Control section also contains a block of Read Only Memory (ROM), which provides the microprocessor with the constants and program software tailored to the plug-in. The Digital Control section, then, is the "control center" for the entire plug-in.

The Front Panel Interface is the communication link between the Front Panel displays or controls and, via the 8350A microprocessor, the rest of the plug-in. It receives and stores information to be presented by the numerical display or annunciators through the Digital Control block, and continuously refreshes the display. It also receives the user's commands through the Front Panel pushbuttons and Rotary Pulse Generator (RPG), and sends them back through the Digital Control block to the 8350A microprocessor. Certain analog signals, such as EXT CAL, pass through the Front Panel Interface to the appropriate part of the 83540A.

Frequency Control

The Frequency Control block is responsible for converting the tuning ramp (VTUNE) from the 8350A Sweep Oscillator into a drive current controlling the YIG Oscillator (YO) frequency. The tuning voltage is digitally scaled and offset to yield a voltage proportional to the YO's frequency. A delay compensation signal is summed in with the scaled tuning voltage to compensate for response delays in the YO. Lastly, low-frequency components of external frequency modulation (FM) are filtered and also summed in to produce a total YO control voltage. However, the YO is current controlled, so a Current Driver converts the control voltage to a drive current for the YIG Oscillator.

The high-frequency FM components cannot be summed in with the drive current due to the limited dynamic response of the YO's main tuning coil. Instead, they are filtered off and sent to a separate coil built into the YO to allow smaller, but faster, frequency modulation.

The Sweep Interrupt block receives the Retrace Strobe, LRTS, from the 8350A mainframe and sets a flag to the microprocessor. Delay compensation circuits are then updated for the start of the next sweep.

Power Leveling (ALC)

The Power Control circuits determine the RF output power level, and ensure that the power is constant across the sweep. A feedback loop detects the RF power level, compares it with a reference voltage, and adjusts the PIN modulator in the RF path to correct for amplitude errors.

The power level is digitally programmed from the 8350A Sweep Oscillator. A scaled sweep ramp to provide the power slope or power sweep function is added, yielding a reference power level.

An internal RF detector provides a voltage proportional to the actual RF power level. This is then compared to the desired reference power level voltage to produce an error voltage. The error is then amplified to drive the PIN modulator and correct the output power level.

RF Section

The RF Section includes the high-frequency microcircuits and their bias components which produce, amplify, and control the amplitude of the RF output.

The YIG Oscillator (YO) is the tunable source, covering a frequency range of 2.0 to 8.4 GHz. The YO output is received by a modulator/amplifier, housed in one microcircuit package. This unit levels and amplifies the RF output.

A directional coupler/detector senses the RF power level and sends a voltage to the ALC circuits for internal power leveling.

In Option 002 instruments, a programmable step attenuator is included to provide up to −70 dB of additional output power control range.

DETAILED BLOCK DIAGRAM DESCRIPTION

DIGITAL CONTROL/FRONT PANEL

A3 Digital Interface

The A3 Digital Interface Assembly acts as the 83540A's distribution center, receiving digital commands from the 8350A Sweep Oscillator and routing them to the appropriate assembly within the plug-in.

The Buffer receives the digital control (including timing), data, and address signals from the 8350A Sweep Oscillator's Instrument Bus. The control and address lines are uni-directional and pass only to the plug-in, whereas the data lines are bi-directional and carry information both to and from the plug-in. A single buffer returns the plug-in flag (L PIFLG) to the 8350A, indicating that a plug-in front-panel key was pushed.

The Address Decoder provides the major control lines which eventually direct data to the correct part of the plug-in. Address and control lines are decoded to produce enable lines: two for ROM; three for the Configuration Switches/Interrupt Control; five for the Front Panel; and two for the remainder of the plug-in assemblies.

The ROM (Read Only Memory) stores program software and constants used by the 8350A microprocessor while executing routines dedicated to the plug-in. Two address decoding lines, plus twelve address lines, select the byte of data to be sent back to the 8350A.

The Configuration Switch/Interrupt Control circuits serve a dual purpose. The Configuration Switch encodes information about the plug-in (including frequency range, power, etc.), options used, and certain user-defined parameters. During INSTR PRESET and power-on, the switch positions are read by the 8350A microprocessor, then used to display the correct frequencies, power, and other parameters which vary from plug-in to plug-in. As Interrupt Control, the circuits monitor the L SIRQ line, and send an interrupt (L PIIRQ) to the 8350A to update Delay Compensation circuits for the start of the next sweep.

The RF Plug-in Interface buffers the data and address lines for use throughout the rest of the RF plug-in. The data bus is bi-directional, so that the 8350A can read information from the A2 Front Panel Interface and A6 YO Driver assemblies. The control lines, which complete the internal bus, come directly from the Address Decoder. This internal bus sends controls messages and data for DACs to Digital Interface circuits on each assembly. These digital interface circuits are essentially buffers between the digital and analog circuits.

A2 Front Panel Interface
A1 Front Panel

NOTE

Due to their strong functional interrelation, the A2 Front Panel Interface and A1 Front Panel assemblies are discussed together.

The A2 Front Panel Interface and A1 Front Panel assemblies are primarily responsible for displaying the status and power level of the RF plug-in, and transmitting pushbutton and RPG commands back to the 8350A Sweep Oscillator for processing. Front panel analog adjustments, and the analog 1V/GHz rear-panel output, are also processed on these assemblies.

The Keyboard/Display Interface performs two functions. As a Keyboard Interface, it strobes the columns of the Pushbutton Switch Matrix, while sensing the row lines. When a key is pushed, the row line tracks the strobed column line corresponding to that key. The Keyboard Interface detects this, sets the FLAG line to alert the microprocessor, and transmits the encoded key information back to the 8350A for processing. As a Display Interface, the same column strobes are buffered and used to drive the digits of the Power Display. While a digit is enabled, the appropriate seven-segment data, stored inside the Display Interface, is buffered to drive the segments. The scanning is done at a fast rate to avoid flickering.

The Annunciator Interface stores data to drive the LED Annunciators which display the status of various functions. The UNLEVELED annunciator is not digitally controlled, but is driven from a separate circuit which monitors the ALC assembly.

The Power Control Interface digitally controls several functional areas. Three of the lines are buffered by the Attenuator Control, which operates the A19 Step Attenuator in instruments equipped with Option 002. The RF On circuit controls the biasing for the A12 YIG Oscillator. When the RF is turned off, bias is removed, shutting off the oscillator.

The Frequency Tracking Amplifier and 1V/GHz blocks are the only active analog circuits on the A2 and A1 assemblies. The Frequency Tracking Amplifier monitors the YO DRIVE V, a voltage proportional to the YO's frequency. Its output tracks the RF output frequency, and is used to compensate for frequency-dependent nonlinearities in the ALC loop. The 1V/GHz circuit further processes this signal to produce a rear panel output supplying 1 Vdc per GHz of output frequency for use with external equipment.

Miscellaneous front panel controls must pass through the A1 and A2 assemblies. The RPG produces pulses when rotated, and sends them directly back to the 8350A Sweep Oscillator to be decoded and processed to adjust the power. The EXT/MTR ALC CAL adjusts the absolute power level when external detector or power meter leveling is used.

FREQUENCY CONTROL

The Frequency Control section of the plug-in is responsible for determining the actual RF output frequency. Based on the tuning voltage, VTUNE, and digital data, the correct current is developed to tune the A12 YIG Oscillator. Frequency modulation is also processed in these circuits.

A6 YO Driver
A9 Reference Resistor Assembly

The A6 YO Driver and A9 Reference Resistor assemblies scale and offset the tuning voltage from the 8350A Sweep Oscillator, converting it into a current for controlling the A12 YIG Oscillator frequency.

The tuning voltage, VTUNE, is buffered and inverted before being scaled, offset, and summed with various correction signals to produce the tuning current for the A12 YIG Oscillator.

The 0 to 10V VTUNE is scaled and offset relative to the 2.0 to 8.4 GHz bandwidth. The Scaling and Offset DACs are also used to compensate for small differences in oscillator sensitivities. The amount of scaling and offset can be set by the Frequency Cal switches. At power-on or Instrument Preset, the status of the Cal switches is read by the 8350A and stored in RAM. This information is then used along with frequency range information to program the DACs. The −10V Ref generates a stable voltage source used as a reference on both the A6 YO Driver and A4 ALC assemblies.

The +20V Tracking circuit monitors the +20V supply, producing an output which follows this voltage. The current through the YO is referenced to this supply, thus preventing power supply drift or noise from creating frequency errors.

The summing junction adds together the scaled tuning voltage, offset, +20V tracking voltage, and offset compensation. The Delay Compensation from the A7 Marker assembly and LO FREQ FM from the A5 FM Driver assembly (both described below) are also added. The result is the YO DRIVE V, a signal proportional to the YO frequency.

The remainder of the A6 circuits and the A9 components convert the YO DRIVE V to a current to control the YO frequency. The final current drive transistor (A9Q1) is controlled by the A6 assembly. The current through this transistor, and hence the YO, generates a proportional voltage across the Reference Resistor, which is monitored and compared to the YO DRIVE V. Any errors between the two are corrected in a closed loop, producing a current proportional to the YO DRIVE V. Compensation elements (Comp) correct for nonlinearities in the YO. If the YO is replaced, this section of circuitry may also require changing.

In CW mode, a relay connects a large capacitor across the YO's coil. The capacitor resists changes in the YO current to reduce residual FM noise.

The Freq Cal Switches/Status block has two functions. During INSTR PRESET, the Freq Cal Switches, set when the plug-in is calibrated, are read for use in setting the Scale and Offset DACs. This information sets frequency end-point accuracy. This section also reads the sweep status and unleveled condition for use by the microprocessor.

A7 Marker

The Delay Compensation circuit on the A7 Marker assembly produces a signal to compensate for time delay in the YIG Oscillator response. The coils in the YO are used to set up a strong controlled magnetic field to control the RF frequency. Due to inductive and magnetic delays of the electromagnets, there is a delay between the applied voltage and resultant current flow through the coils. The Delay Compensation circuitry monitors the scaled tuning voltage, and from its amplitude and slope produces a signal which is added to the YO DRIVE V to compensate for swept frequency errors that would occur because of the response delays.

The Oscillator Bias section produces the bias voltage needed by the A12 YIG Oscillator. The YO's correct bias point is dependent on its frequency, so the YO DRIVE V is used to make these frequency-dependent adjustments. The L RFON line will turn off the bias and shut down oscillations altogether when the RF is turned off.

A5 FM Driver

The A5 FM Driver assembly splits the external FM signal, passed through the mainframe, into two paths. One is added to the main coil tuning voltage; the other is routed to a separate coil inside the YO and dedicated to high-frequency FM.

One FM path is lowpass filtered, removing high-frequency components; the other is highpass filtered, removing low-frequency components. The filters are matched in stop-band response, such that one picks up where the other leaves off. Both paths are amplified, and include Sensitivity Select circuits which determine the FM sensitivity (i.e. MHz of deviation per volt) and select either cross-over or direct coupling. The LO FREQ FM is eventually added to the YO DRIVE V, and modulates the output frequency through the YO's main coils. However, the main coil cannot respond to fast deviations due to inductive and magnetic delays. Hence, a completely separate, small, but fast-acting FM coil is built into the YIG Oscillator. The HI FREQ FM is sent to this coil, allowing limited high-frequency FM.

ALC / POWER CONTROL

The A4 ALC assembly, and parts of the A5 FM Driver assembly, are responsible for power level control. Power leveling is accomplished by detecting the output RF power level, comparing it to a fixed reference voltage, and adjusting the RF modulator to correct for power errors. This results in constant RF power level across the entire sweep. The absolute RF power is digitally controlled, and can be set between +16 and +1 dBm. (Instruments with Option 002 use an RF Step Attenuator to achieve power control from +15 dBm to −69 dBm. However, this is not part of the leveling loop.) The power sweep and power slope functions are obtained by adding a scaled voltage ramp offset to the reference power level.

A4 ALC Assembly

The A4 ALC assembly receives its inputs from the various detectors, and selects one of them for leveling. The sources include CR1 Detector (Internal), or the "External" input which accepts negative external detector voltages or inverts the positive polarity associated with power meter detection. The selected detector voltage is proportional to the peak RF amplitude. The Input Sample & Hold stores the detected level during pulse modulation. This prevents subsequent circuits from saturating when the RF power drops out during blanking or pulse modulation. The Logger amplifier produces a voltage proportional to the log of peak RF amplitude, and essentially represents the RF power level in dB.

The reference, or desired, power level is established digitally by a 12-bit DAC, scaling the −10V REF from the A6 assembly. This establishes a voltage proportional to the desired output level in dBm. The External AM signal from the 8350A Sweep Oscillator, and the PWR/SWP COMP signal from the A5 FM Driver assembly (described below), are summed in to produce PWR REF.

The second summing junction adds External Cal, an offset voltage from the front panel used to calibrate absolute power when external leveling is used. The final product of the power reference chain is a reference voltage representing the desired RF output amplitude.

The ultimate goal of the leveling loop is to make the actual RF power equal to the desired RF power. A third summing junction compares the voltages representing these two quantities, and yields a signal representing the error between actual and desired power. This error voltage is sampled and held during pulse modulation to prevent subsequent circuits from saturating. The held error signal is amplified, and the RF blanking signal added to modulate the RF power for pulse modulation, without saturating any other components in the path. The Modulator driver then provides the current drive needed to control the diode modulator in the RF path. An additional circuit monitors the input to the modulator driver, and lights a front panel UNLEVELED LED if this voltage exceeds the normal range for leveled power.

A5 FM Driver

The A5 FM Driver assembly includes circuits to produce the PWR/SWP COMP signal added to yield the PWR REF. The Power Sweep function is achieved by scaling the VSW sweep voltage with a DAC. By programming the appropriate scale factor, a voltage representing dB/GHz or dB/Sweep is produced.

The ALC Compensation is a four breakpoint, adjustable slope network which compensates for fixed frequency-dependent nonlinearities in the RF path, typically the couplers and detectors. Its input is FREQ TRK V, a voltage exactly proportional to frequency. This signal drives an array of four transistors whose outputs are summed together to yield the ALC compensation signal. The gain of each transistor, and the voltage at which that transistor begins to conduct, are adjustable. A ninth adjustment adds the FREQ TRK V directly. In this way, a complicated compensation function, approximated by five straight lines, is produced.

The Power Sweep DAC adds a ramp voltage to the power reference signal when the Power Sweep or Power Slope functions are activated. Its input, VSW, is a sweep ramp that essentially tracks the tuning voltage but always runs from 0 to 10 Vdc. A digitally programmable multiplying DAC scales this voltage according to the dB/SWP or dB/GHz value selected. (If these functions are disabled, the DAC is set to its minimum value.) This ramp is added to the ALC Compensation signal described above, and added to the Power Ref signal on the A4 assembly.

A7 Marker Assembly

The Pulse Modulation circuit is found on the A7 Marker assembly and functions essentially to combine two pulse sources: Square Mod from the 8350A, and Pulse Input from the plug-in rear panel. The output (L PULSE) shuts off the RF, acting on the A13 Modulator/Amplifier directly.

RF SECTION

The RF Section includes the microcircuits and their bias boards that produce the actual RF output power. These components include A12, A13, A19 (Option 002), DC2, and CR1.

The A12 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is the frequency-controllable microwave source for the 83540A RF Plug-in, ranging from 2.0 to 8.4 GHz. Frequency is determined by the current flowing through the YO's large electromagnetic coils. This current is the result of summing and scaling operations performed by the A6 YO Driver and A9 Reference Resistor assemblies. Due to the response-time limitations of the main coils, a smaller coil with a much faster response, but limited range, is used to modulate the output frequency.

The A13 Modulator/Amplifier receives the YO output. This microcircuit levels and amplifies the direct 2.0 to 8.4 GHz output for front panel use. The A13A1 Modulator/Amplifier Bias assembly provides biasing and modulation signals for the microciruit. Several on-board potentiometers minimize harmonic distortion. Q1 is a chassis-mounted transistor used to regulate bias.

DC2 Directional Coupler directs a portion of the RF energy to CR1 Detector, producing a voltage proportional to RF power level for internal leveling.

The RF output is finally directed to the front panel RF Output connector. On instruments with Option 004, different RF cabling takes the output to the rear panel connector. On instruments with Option 002, the A19 RF Step Attenuator is included, providing from 0 to 70 dB of attenuation in 10 dB steps. This attenuated output is then routed to the front panel connector (Option 002 only) or rear panel connector (Option 002 with Option 004).

83540A OVERALL TROUBLESHOOTING

The purpose of this troubleshooting information is to provide an aid in isolating a problem in the 83540A to a specific assembly. Further troubleshooting information is supplied with each service sheet to isolate the problem to the component level.

The first step in overall troubleshooting is to identify the symptom(s) and determine under what conditions the problem exists. If the problem is an RF plug-in error code (E001 or E050 through E053) refer to the Error Code section of this troubleshooting procedure. Also ensure that the 8350A used with the 83540A is calibrated and operating properly.

A failure in the 83540A normally affects one of the following functions.

- Front Panel/Digital Control – Probable symptoms are error code E001, incorrect annunciator or digit displays, inability to control operation from front panel, or erratic instrument response to front panel entries. The problem is generally on the A1, A2, or A3 assemblies, or with the RF Plug-in/8350A interface.

- Frequency Control – Frequency control problems include frequency inaccuracy, and sweep control problems. If the 8350A VTUNE output and power supplies are verified, the problem is most likely on the A5, A6, or A9 assemblies, or in the RF Section. If a frequency accuracy problem occurs only during swept operation, and the inaccuracy increases with faster sweep times, the problem is most likely with the Delay Compensation circuit on the A7 Marker assembly.

- Power Control – Typical problems are no RF Output, maximum unleveled RF output, or excessive power level variations. The problem is most likely with the A4, A5, or RF Section. If the trouble is limited to power sweep and slope control, the problem is most likely with the Power Sweep DAC on the A5 assembly.

- RF Path – Problems associated with high-frequency microcircuits include spurious or harmonic distortion, no RF power, or full unleveled RF power. For a harmonic distortion problem, refer to Section V, Adjustments. For power problems, refer to the A4 ALC Troubleshooting before suspecting the RF components.

Once the problem is identified, exercise the RF plug-in to determine under what conditions the problem exists. Some important conditions to check are:

- Sweep Mode related – Is problem only for swept modes of operation, or does it also exist in CW operation? If the problem still exists in CW operation, troubleshoot in this mode (it is easier to check waveforms and voltages in CW operation).

- Control related – Try different methods of entering data (i.e. RPG, Data Entry Keys, or increment/decrement keys). If the problem is related to a specific control, troubleshoot that control and its respective circuits. If the problem is related to a specific type of control (i.e. pushbuttons), refer to the A1/A2 service sheet and troubleshoot the respective interface circuit.

- Sweep Time related – Swept frequency accuracy problems that get worse with faster sweep times are probably caused by the Delay Compensation circuit on the A7 assembly.

Error Codes

RF Plug-in error codes are displayed in the 8350A left FREQUENCY display. The error codes may be generated as a result of the Instrument Preset self test (E001, E052, or E053), or during normal instrument operation (error codes E050 or E051). A description of each error code is provided in Table 8-5. Further troubleshooting information for each error code follows.

Table 8-5.. 83540A Error Codes

Error Code	Function Tested	Operator Initiated Test	Troubleshooting Hints
E001	8350A/83540A		Check the RF plug-in connections and cable connections to A3. Do Hex Data Write to front panel and Hex Data Read of A3S1 Configuration switch. See E001 Troubleshooting in this procedure for specifics.
E050	Plug-in keyboard		Check PIFLG
E051	Invalid key code	SHIFT 04	See A1/A2 service sheets for further troubleshooting.
E052	Interval Timer	SHIFT 55	See A3 service sheet for further troubleshooting.
E053	PIA	SHIFT 55	See A3 service sheet for further troubleshooting.

Error Code E001. Error code E001 indicates that the 8350A microprocessor is unable to properly read plug-in ROM. Initial checks should be made to verify proper mating of rear panel connectors with the 8350A. Also check cable connections to the A3 Digital Interface and ensure A3 is properly installed. Refer to the A3 service sheet for specific troubleshooting information.

Error Code E050. Error code E050 is generated when the 8350A microprocessor responds to an RF Plug-in keyboard flag (L PIFLG) and no key has been pressed. Check the logic state of the FLAG input to the A3 Digital Interface (A3P1 pin 42). It should be a stable logic low until a front panel key is pressed (when it is briefly strobed high). If it is not a stable low, refer to the A2 service sheet for further troubleshooting. If FLAG is a stable low, check that the L PIFLG output of A3 (A3J1 pin 39) is a stable high and pulses low when a front panel key is pressed. If necessary, trace the logic state of PIFLG on the 8350A A3 Microprocessor.

Error Code E051. Error code E051 indicates that an invalid keycode has been received by the 8350A microprocessor. Refer to the A1/A2 service sheet to troubleshoot the keyboard matrix and Keyboard/Display Interface circuit.

Error Code E052. Error code E052 is generated if there is a problem with the Interval Timer on the A3 Digital Interface. A test routine is run at power-on or when Instrument Preset self test is initiated. If error code E052 is generated, refer to the A3 Digital Interface service sheet for further troubleshooting.

Error Code E053. Error Code E053 is generated at power-on or Instrument Preset when there is a problem with the Peripheral Interface Adapter (PIA) on the A3 Digital Interface. If error code E053 is generated, refer to the A3 Digital Interface service sheet for further troubleshooting.

Digital Control/Front Panel

A digital control problem usually affects the entire plug-in, but may disable only a section of the instrument. Generally, a digital control problem is indicated by a front panel failure. If the problem is limited to a specific type of control (pushbutton or RPG) or display (annunciator or digital display), the indication is that of a front panel failure. An RPG failure may indicate problems on the front panel assemblies of the 8350A mainframe, where RPG pulses are decoded. If multiple front panel functions are inoperative or erratic, the problem is most likely a digital control problem. Detailed troubleshooting procedures for checking front panel operation are provided in the A1/A2 service sheet. For digital control problems, refer to the A3 Digital Interface service sheet, and check the address, data, and control line outputs of the A3 assembly.

When there is a problem with a digital-to-analog interface (i.e. DAC), the symptom is generally a discontinuity in the analog response.

Frequency Control

Troubleshooting a frequency control problem can be greatly simplified by first defining the conditions under which the problem exists. When troubleshooting, the RF Plug-in should be operating in the least complicated mode that exhibits the frequency control problem. For instance, a CW frequency is less complicated than a swept mode.

NOTE

To ensure accurate frequency counter readings, check for adequate RF output power.

Incorrect Frequency Display after Instrument Preset. If the frequency range displayed corresponds to the frequency range of another RF plug-in, verify that Configuration Switch A3S1 is set correctly. Otherwise, there is a digital problem.

Frequency Accuracy Problem. The YO DRIVE V on the A6 YO Driver can be checked by selecting the CW mode and comparing the rear panel 1V/GHz output with the RF output frequency. Connect a digital voltmeter to the rear panel 1V/GHz output. Compare the digital voltmeter indication with the 8350A FREQUENCY display and the actual RF output frequency. If the voltage corresponds to the actual output frequency, perform the Frequency Accuracy adjustment in Section V before further troubleshooting.

Swept Frequency Accuracy Problem. A frequency accuracy problem that occurs only during swept frequency modes is typically a delay compensation problem. Refer to the A7 Marker for further troubleshooting.

Power Control

Power control problems normally fall into one of the following categories.

- No RF Output Power
- Maximum Unleveled RF Output Power (no power control)
- Excessive power variations

No RF Output Power. Remove the A4 ALC assembly; the RF output power should go to a maximum level. If not, the trouble is in the RF Section. If the RF output goes to maximum, the problem is in the A4 ALC assembly.

Maximum Unleveled RF Output Power. Check leveling in External and Meter leveling modes. If power is leveled for these modes, the problem is with the internal detector. Otherwise, refer to the troubleshooting information for the A4 ALC assembly.

Excessive Power Variations. Refer to the troubleshooting information for the A4 ALC assembly.

RF Section

RF Section problems are usually indicated by No RF Power, full unleveled RF power, excessive harmonics, or spurious responses. For an RF power problem refer to the Power Control section of this troubleshooting information. Excessive harmonics might be corrected by performing the Harmonics adjustment in Section V. Otherwise, refer to the RF Section service sheet for further troubleshooting.

If this test indicates further troubleshooting, remove the front panel to make A2 accessible while connections between the front panel, plug-in, and mainframe are still intact.

If the numerical display is blank, check power supplies on A2.

Check U6, pin 3, for the 200 kHz SCAN CLK signal. If it is missing, trace the problem back through U4B to the A3 Digital Interface assembly.

Initiate Hex Data Rotation Write and check the L FP2 line for activity:

SHIFT 0 0	Hex Data mode
2 MHz ms 8 0	Address location 2d80 (U6)
M4	Hex Data Rotation Write

The data line inputs should also be checked in this mode. The pattern should match that shown in Figure 8-2.

Check the COL0 through COL3 lines for sequential low pulses, as shown in Figure 8-13.

If the patterns are absent, but the 200 kHz clock is present, the problem is probably U6. Ensure that problems in U4B or the A1 assembly are not tieing the lines down.

If the column strobes are present, probe both the column and row line corresponding to the key in question at U6. Observe the traces while pushing the button. The two lines should track each other. If they track, but the microprocessor can't read the codes from U6, and the data bus is good, the problem is probably in U6.

If row and column do not track, separate the A1 and A2 assemblies and troubleshoot the keyboard matrix with a continuity tester.

Rotary Pulse Generator (RPG)

The RPG is a means of converting rotational information into digital signals which can be read by the microprocessor. The hardware components needed to decode the plug-in RPG (counter and sign latch) are located on the 8350A A2 Front Panel Interface assembly. Some failures which appear to be in the plug-in RPG, (e.g., 'run-away' POWER display or a locked-up sign) are likely to be caused by failures in the 8350A.

If the plug-in RPG appears to be dead, remove the bottom cover of the 8350A and probe A10J1, pins 34 and 36. Check for the waveforms shown in Figure 8-14, while slowly rotating the RPG. If the signals are present, trace the PIRPGA and PIRPGB lines through the 8350A to the mainframe A2 assembly. Refer to 8350A A2 Service Sheet for more information.

If the signals are absent in the plug-in, check for the +5V at A10J1, pin 2. Then remove the front panel and check for +5VR directly at the point where the RPG leads are soldered to the A1 Front Panel assembly. Then probe the two RPG output leads for the waveforms in Figure 8-14. If they are absent, check that the output leads are not shorted to ground. If not, replace the RPG.

Analog Circuitry

Analog circuitry on the A2 Front Panel Interface processes the YO DRIVE V signal to produce the 1V/GHz rear panel output and FREQ TRK V, used in the ALC loop.

Check that the YO DRIVE V signal is present at TP1. It should resemble the waveform shown in Figure 8-15. If it doesn't, trace the problem back to the A6 YO Driver assembly.

If it is present, check TP3 for the waveform shown in Figure 8-16. If it is present on the A2 assembly, but FREQ TRK V is missing on the A5 board, probe the emitter of Q3 for the same waveform offset by approximately 0.6 Vdc.

Analog switches U9B and U9C are controlled by latch U8. These switches turn off FREQ TRK V when external leveling is used. These can be exercised by using Hex Data Write. Press 8350A CW and enter:

SHIFT 0 0	Hex Data mode
2 BKSP 0 0	Address location 2F00 (U8)
M2	Hex Data Write
0 0	Enters hex byte 00
BKSP BKSP	Enters hex byte FF

Note that these switches are not identical. U9B is open for logic 0, while U9C is closed.

The 1V/GHz Amplifier adds one more stage of gain to FREQ TRK V, producing a scaled tuning ramp to follow the RF output frequency at exactly 1 Vdc per GHz. Check the rear panel 1V/GHz BNC output jack for the ramp. If it is absent, check TP2 for the waveform shown in Figure 8-17. If there is no signal at TP2, but there is a ramp at TP3, the problem is in U1A.

RF Power Control Latch

U8 stores commands for the RF Step Attenuator (Option 002 only) and the RF ON line, which supplies −10V bias for components in the RF path. It also controls analog switches used for the signals mentioned above.

Hex Data Rotation Write can be used to verify the outputs of U8.

NOTE

In Option 002 plug-ins, disconnect the attenuator cable at A2J3 before initiating Hex Data Rotation Write. The bit pattern shifts too fast to actuate the attenuator properly, and may damage it.

Initiate the check as follows:

SHIFT 0 0	Hex Data mode
2 BKSP 0 0	Address location 2F00 (U8)
M4	Hex Data Rotation Write

Check L FP5 line for activity. Check data lines for patterns illustrated in Figure 8-2.

To check the RF ON relay, K1, make the same key entries as above, except enter M2 for Hex Data Write. Then alternate between data input: 0 0 and BKSP BKSP (FF). The RF ON line should toggle from 0 Vdc to −Vdc. If there is no change, check U8, pin 12, for high and low levels. If the output is locked high, check the protection diode, CR3, before replacing U8. However, if CR3 is open, U8 may be damaged by actuating the relay. If the output at pin 12 is locked low, replace U8. If U8 pin 12 changes levels properly, replace relay K1.

Miscellaneous

The EXT/MTR ALC CAL offset is generated by potentiometer A1R4 with the wiper running between +10 Vdc and −10 Vdc. If the signal is absent, check for the +10V and −10V supplies. If the offset voltage still cannot be produced, replace R4.

In the 8350A, check cables beween the Motherboard and the 8350A chassis connectors, J2 and J3 leading to the plug-in, for damage or loose connections. Likewise, in the plug-in, check the cabling between chassis P1 and P2 and the A10 Motherboard or A3 Digital Interface. Next, check the individual pins and sockets of the 8350A/plug-in interface connectors for bent or missing pins.

Make sure that the A3 assembly is firmly seated into its motherboard socket, and that ribbon cable connections are making good contact.

Perform the Hex Data Read by entering:

SHIFT 0 0	Enters the Hex Data command
4 0 0 0	Address location 4000
M3	Hex Data Read

The 8350A FREQUENCY/TIME display should indicate 55. Increment the address to 4001 by pressing ▲. The FREQUENCY/TIME display should indicate AA. If these numbers are read, the data lines and the 4000H ROM enable line are functional.

If these tests do not execute, run the Hex Data Rotation Write by entering:

SHIFT 0 0	Enters the Hex Data command
4 0 0 0	Address location 4000
M4	Hex Data Rotation Write

Check the 4000H line to U1 for activity, and troubleshoot the address decoding circuitry if there is none. Repeat the above key sequence substituting address location 5 0 0 0 . Check the 5000H line to U2 for activity.

The address lines can be checked by using the Hex Data Write feature of the 8350A. Alternate ones and zeros are written on the address lines when writing to address location 5555H or 2AAAH. By performing a Hex Data Write to each address location, all thirteen address lines are pulsed high and low.

On the 8350A, enter:

SHIFT 0 0	Enters the Hex Data command
5 5 5 5	Address location 5555
M4	Hex Data Rotation Write

Check that all even address lines (A0, A2, . . . A12) are pulsed high, and all odd address lines (A1, A3, . . . A11) are pulsed low.

On the 8350A, enter:

SHIFT 0 0	Enters the Hex Data command
2 . . .	Address location 2AAA
M4	Hex Data Rotation Write

Check that all odd address lines are pulsed high and all even address lines are pulsed low.

Other Error Codes

Error Codes E052 and E053 indicate a failure on the A3 Digital Interface assembly. These codes, along with troubleshooting hints related to that error, are listed below.

Error Code E052

Error Code E052 indicates a failure in Triple Programmable Timer U5 or the 200 kHz Clock.

First check the 200 kHz Clock. The SCAN CLK line is accessible at U3 pin 3, at the top of the A3 assembly, so it is not necessary to remove the A3 board to test it. The output frequency should be approximately 200 kHz. The pulse train is NOT symmetrical, and has TTL levels. If no clock signal is found, suspect U3.

If the SCAN CLK is present, yet E052 occurs, then the failure is probably with U5. Press SHIFT 5 5 , and check the LWR and LRD lines for the waveforms shown in Figure 8-21. If either control line is inactive, troubleshoot the address decoder U9. If the control lines are working, check the CTR 0 and CTR 1 waveforms as shown in Figure 8-21. If they are incorrect, replace U5.

Error Code E053

E053 generally indicates a failure in the PIA, U4. However, the problem might be in the output stages of U5. Enter SHIFT 5 5 , and check CTR 0 and CTR 1 waveforms as shown in Figure 8-21. If they are correct, U5 is functional. Next, check the L PIAE line as shown in Figure 8-21, and make sure the L WRITE line shows activity. If not, troubleshoot the appropriate address decoding circuitry or buffer. Then, check L PIIRQ for the squarewave shown in Figure 8-21. If it is inactive, replace U4.

No Error Code

If no error code occurs and the 8350A displays show the correct start and stop frequencies of the plug-in, the Plug-in Self Test passed successfully. This verifies the Instrument Bus to the plug-in, data and address busses on the A3 Digital Interface assembly, and plug-in ROM. Any plug-in failures which are traced back to the A3 assembly are due to failures in one or more of the following areas:

- Address Decoding
- Plug-in Buffers
- Interrupt Control/Configuration Switch
- Miscellaneous Control Lines

If the 8350A displays show the wrong frequencies, first check configuration switch S1 against Table 8-8, and then troubleshoot the PIA, U4.

Address Decoder

The primary address decoding for the plug-in occurs on the A3 assembly. The enable lines are then passed on to the rest of the instrument. The Major Address Decoder Test can be utilized to check all these lines. Enter:

SHIFT 5 3

Then check the outputs of U6B, U6C, U7B, U9, and U13 for the signals shown in Figure 8-22. The address lines have been verified by the Self Test. Therefore, if the LPIAE or ROM enable lines are faulty, troubleshoot the discrete address decoding logic involving U6, U7, U8, and U10, and replace the defective component. If other pulses are missing or displaced, replace the appropriate decoder, U9 or U13.

Plug-In Interface

U14 and U17 buffer the address and data lines for use throughout the plug-in. The address and data busses on the A3 assembly have been verified by the Instrument Preset Self Test. Therefore, if an address or data is not being passed to another assembly, the fault lies with U14, U17, U6A, or a motherboard connection.

The address lines can be exercised by performing the Minor Address Decoder Test. On the 8350A, enter:

SHIFT 5 4	Minor Address Decoder Test

Verify both high and low pulses on each of the buffered address lines (BA0 – BA3), as well as activity on the L INST1 and L INST2 lines.

Data lines can be verified by performing a Data Rotation Write to any address location between 2C00H and 2FFFH. On the 8350A, enter:

CW	Set 8350A into CW mode
SHIFT 0 0	Enters the Hex Data command
2 GHz s 0 0	Address location 2C00
M4	Hex Data Rotation Write

Check for activity on each of the buffered data lines (BD0 – BD7), and check for shorts between lines.

Interrupt Timer/PIA

The PIA is responsible for two functions:

- Reading the Configuration Switch
- Routing the L SIRQ Interrupt from the A6 Assembly

NOTE

Before changing the Configuration Switch settings, write down the switch positions and return the switches to their original settings after troubleshooting.

The PIA's read capability can be checked by entering:

CW	Sets the 8350A into CW mode
SHIFT 0 0	Enters the Hex Data command
2 9 0 0	Address location 2900
M3	Hex Data Read

Check that the display changes as each section of the Configuration Switch is toggled.

The Triple Timer and PIA's interrupt masking capability are tested using a special routine at INSTR PRESET or power-on. Error Codes E052 or E053 are displayed if a failure is detected. If these error codes are found, or if either U4 or U5 are suspect for other reasons, a special test pattern can be accessed by entering:

SHIFT 5 5	Interrupt Control Test

The waveforms shown in Figure 8-21 should be observed. Refer to "Other Error Codes" for details on these errors codes and the SHIFT 5 5 Operator Initiated Self Test.

UNLEVELED (LED). Comparator A4U15 enables the front panel UNLEVELED LED when the voltage at its noninverting input drops below approximately +4 Vdc, indicating that the RF output power is insufficient to level to the desired power reference.

- Before inspecting loop components, determine whether the UNLEVELED light is on during forward sweep or retrace. Enter a sweep time of 5 seconds. If the UNLEVELED light is on coincident with retrace (SWEEP light off), then the problem is probably in the front panel annunciator drivers. Refer to A1/A2 troubleshooting.

- If the UNLEVELED LED is on for the entire forward sweep, check the RF output power with a power meter. If minimal RF output power is recorded, refer to the section entitled NO POWER.

- If the UNLEVELED light flashes briefly during the sweep, but does not imply any of the above failure modes, check power flatness. See below.

Flatness/Oscillations (Power Drop-outs). Monitor the RF output with the HP 8755C as shown in Figure 8-25.

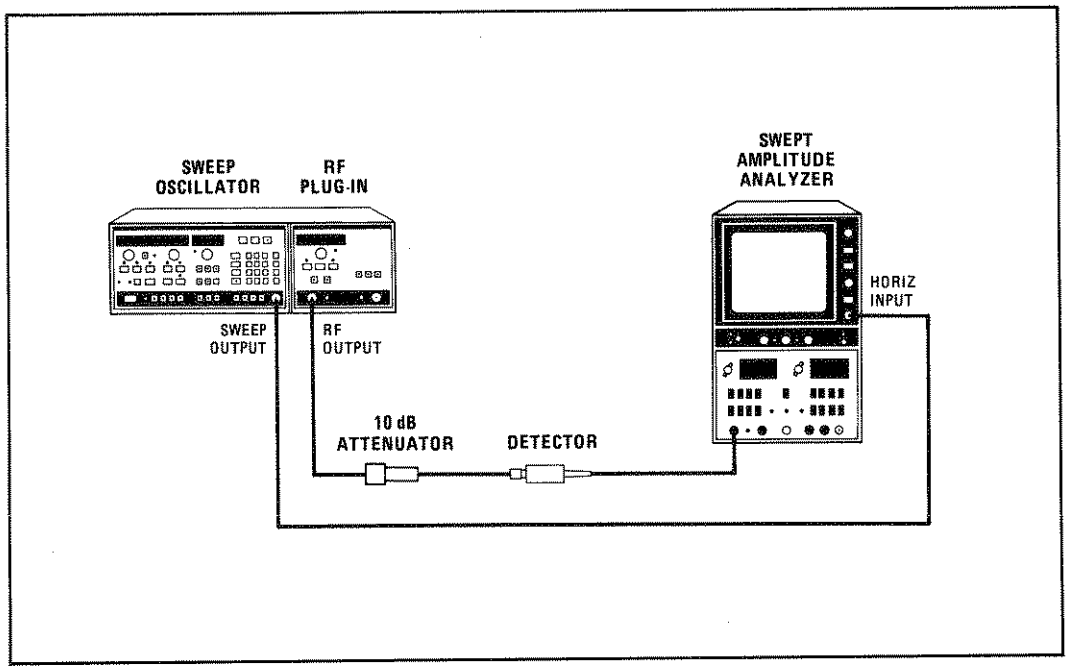


Figure 8-25. Typical ALC Troubleshooting Setup

- If the power level is constant across the sweep within approximately 5 dB, then the plug-in may only require ALC flatness adjustments. Refer to Section V, Adjustments, in this manual, for the Internal Leveled Flatness adjustment procedure.

- If the measured power level lies between +16 and +1 dBm, but can't be controlled via the front panel, refer to the Digital Control section under Troubleshooting Diagnostics.

- If the trace appears chopped or broken the loop may be oscillating. Refer to Section V, Adjustments, in this manual, and perform the ALC Gain adjustment procedure.

Full Unleveled Power. If power is unleveled, continue to sweep the plug-in's full range.

- Attempt to level the power externally using the HP 432 Power Meter as shown in Figure 8-26. Select MTR leveling, and enter a slow (at least 30 seconds) sweep time. If the RF power is now leveled then the failure is most likely in the detectors or the Detector Selection Switch, A4U6. Refer to the following paragraph. If this does not prove to be the case, the problem may be in the two analog switches U4B and U6A; or it may be necessary to perform the ALC adjustments in Section V of this manual.

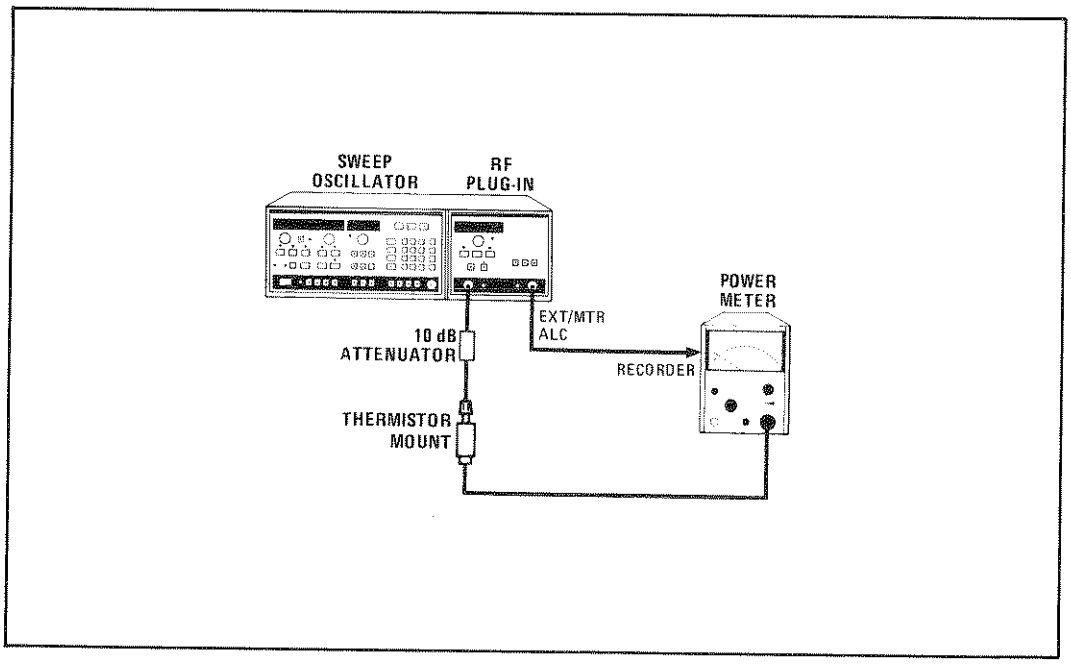


Figure 8-26. Power Meter Leveling Setup

- Check the Detector Selection Switch by entering a CW frequency within the leveling mode in question and trace the detector voltage through U6B. If the input to be selected doesn't match the output, check the MUXA0 and MUXA1 lines (see Table 8-10). Also check U12 and U13 as described under Digital Control.

- Check the voltage at TP6. If it is at +7.5 Vdc, suspect the Mod Driver or Modulator. If it is below +4 Vdc, suspect the Detector and Detector Leg.

No Power.

NOTE

Turn off line switch before removing or installing any assembly.

- To check the RF components, remove the A4 ALC assembly from its socket. This removes bias from the modulator, and should allow maximum power through the RF path. If full power (over +17 dBm) is then detected, the A13 RF amplifier and A12 YO are verified. Suspect primarily the detector or detector cable. Also inspect the modulator, as well as the A4 Mod Driver and Detector Selection Switch.

- If the detector appears to be functioning properly, reinstall the A4 board and check A4TP6. If less than +4 Vdc is found, check continuity from A4TP6 to the Mod Driver circuit. If A4TP6 is at +7.5 Vdc, suspect any circuitry between the Detector Selection Switch and A4TP6, particularly the Log Amp.

- Refer to Figure 8-30 and check the L RFB line, A4P1-29. If it is stuck low, the loop will shut down the RF.

- If the failure has not been located, suspect components of the RF path. Refer to RF Troubleshooting for details.

Power Sweep/Flatness. If power increases smoothly with frequency, and POWER SWEEP is NOT selected, suspect problems with the A5 FM Driver assembly.

NOTE

Turn off line power before removing or installing any assembly.

- Remove the A5 board from the plug-in. If the situation improves, suspect a failure on the A5 assembly.

- If the RF power is leveled within approximately 5 dB, refer to Section V, Adjustments, in this manual, and perform the Internal Leveled Flatness adjustment procedure.

Troubleshooting Diagnostics

The troubleshooting information below is organized into functional areas:

Digital Control (A)
Reference Power Level (C) (F)
Detector/Detector Selection Switch (B), **CR1**
Detector Leg (D) (E)
Modulator Leg (G) (I)
Mod Driver (K)
Modulator A13

Digital Control (A) Address Decoder U12 and Control Latch U13 control digital switches throughout the A4 assembly. Their operation can be confirmed by performing the Hex Data Rotation Write at address 2C07 Hex. Enter the following key strokes:

SHIFT 0 0	Enters Hex Data Command
2 GHz s 0 7	Address location 2C07 (U13)
M4	Hex Data Rotation Write

Check the outputs of U13 for the waveforms shown in Figure 8-2.

- If any output signal is missing or misplaced, check the data lines against Figure 8-2. If no output is found, look for activity at U13 pin 11. Check for L INST1 and BA3 to pulse low, while BA0, BA1, and BA2 pulse high. If these pulses are missing, trace the problem back to A3 Digital Interface.

If the Digital Control section is working, the primary outputs of U13 are easily controlled by selecting the appropriate front panel function while in the CW sweep mode. (e.g., selecting MTR leveling holds the PM line high, etc.).

Reference Power Level (C) (F) The Reference Power Level Leg produces a voltage proportional to the "desired" power level. This signal is a summation of the absolute power reference, ALC compensation, AM, ALC compensation, and power sweep signals.

The ALC compensation and power sweep signals are generated on the A5 FM Driver assembly. If an A5 failure is suspected, refer to troubleshooting information on the A5 Service Sheet. Unless A5 is suspect, simplify A4 troubleshooting by turning off the line power and removing the A5 assembly. Although power sweep will be disabled and slope compensation will be lost, the ALC loop should still level without the signals provided by the A5 assembly.

DAC U14 establishes the absolute power level. The −10V REF from the A6 assembly is scaled to yield from 0 Vdc (+1 dBm displayed) to +10 Vdc (+25 dBm displayed) at TP2. (This breaks down to a voltage step of 0.42 Vdc per 1.0 dB of power over the dynamic range, or 6.25 Vdc at +16 dBm.)

A self-test routine is available to exercise the ALC DAC. Enter:

SHIFT 5 0

The waveform in Figure 8-31 should be seen at TP2. Note that the exercise routine for the 12-bit DAC yields a staircased waveform with 13 levels. The first step shows the maximum +10 Vdc output with all bits high. The following levels represent the voltage at TP2 with successive bits loaded high in order from the Most Significant Bit to the Least Significant Bit.

- If the waveform at TP2 is not correct, check for −10V REF, and trace any problem back to the A6 assembly. Look for activity on L INST 1, BA0, and BA1. BA2 and BA3 should pulse high as each new DAC value is loaded, pulsing the CS line (U14 pin 8) low. If any of these lines, or a data line, appears dead, trace the problem back to the A3 assembly.

U3A adds PWR SWP/COMP and AM, and provides detector flatness compensation at higher power levels with CR3. Use the EXT ALC mode to bypass this diode while troubleshooting.

U3C adds the front panel amplitude adjustment (EXT CAL) used with external leveling. The following levels should be seen at TP1 with A5 removed and [INT] leveling selected: +0.3 Vdc for +1 dBm, and +7.0 Vdc for +25 dBm. An amplitude modulation (AM) signal of 1.0 Vp-p at P1-4 will produce roughly 260 mV p-p at TP1. (Note that U4A and CR3 in the feedback path around U3A change the gain depending on the desired power level.)

Detector/Detector Selection Switch (B), CR1 The CR1 detector is tested simply by checking the output voltage under full leveled power or full unleveled power conditions. Table 8-9 provides the approximate signal levels.

If no RF output power is measured, turn off the line power and remove the A4 assembly. Return power to the instrument. (If there is still no RF power, suspect components of the RF path. Refer to RF Troubleshooting.) If full unleveled RF power is obtained, check the detector voltage against those supplied in Table 8-9.

Table 8-9. Detector Voltages

	Full Leveled +17 dBm	Full Unleveled ~ +20 dBm
A4P1-20	–200 to –300 mV	–300 to –500 mV

If the detector is working and the Detector Selection Switch is suspected, monitor TP15 for the voltage seen at the selected input of U6B.

If the EXT/MTR ALC INPUT circuits are suspected, select the desired mode and supply a test signal (low-level DC or sine wave) in the front panel BNC connector, and trace it through U6B at A4TP15.

Detector Leg. The "Detector Leg" of the ALC loop includes components between the Detector Selection Switch and the Error Summing Amplifier U3D.

Before troubleshooting the Detector Leg, be sure the Detector and Detector Selection Switch are working correctly. See above.

The Detector Leg can be effectively tested by using the Open Loop method of troubleshooting. This procedure utilizes the external leveling mode [EXT] by supplying an external DC voltage or sine wave to the EXT/MTR ALC INPUT connector. This method breaks the ALC loop and allows waveforms to be checked against known test signals. See Figure 8-32.

Modulator Leg. The "Modulator Leg" includes the Error Sample & Hold and the Main ALC Amp.

U3D is a noninverting unity-gain summing amplifier. Under leveled conditions, both TP4 and TP7 should be nearly 0.0 Vdc. In most cases, TP4 and TP7 should be at the same voltage. During the Hold mode of the Sample and Hold circuit, these test points may differ. However, pins 10 and 8 of U3D should always be equal. If not, suspect U3D, Q3, or the Sample & Hold Driver.

U11 forms an inverting integrator. When TP7 is positive, TP6 should be at −0.6 Vdc. If not, suspect U2D or U11. When TP7 is negative, TP6 should be at +7.5 Vdc. If this is not the case, suspect U11.

- To establish bias levels for the Mod Driver, (A4TP6 can be forced high: +7.5 Vdc; and low: −0.6 Vdc) perform the following steps:

1. Ground A4TP11.
2. Press 8350A CW .
3. Press 83540A EXT ALC and enter an RF power level of +1 dBm via front panel controls.
4. Rotating the EXT/MTR ALC CAL knob to the extremes of its range will result in positive and negative saturation of the ALC integrator. Full clockwise rotation should yield a voltage level of +7.5 Vdc at A4TP6 (UNLEVELED light off). Full clockwise rotation of the CAL knob should render A4TP6 at −0.6 Vdc with the UNLEVELED light on.

To check U3D, initiate the procedure above. Monitor TP4 and TP7 while adjusting the EXT/MTR ALC CAL knob between the extremes of its range. Both TP4 and TP7 should vary between approximately +0.5 and −0.5 Vdc.

Verify U11 by adjusting the CAL knob as described above and monitoring TP6. Since U11 is an integrator, TP6 should saturate and clamp (due to VR4) at −0.6 Vdc and +7.5 Vdc, respectively.

Further troubleshooting of the Modulator Leg can be continued by following the Open Loop procedure outlined in Figure 8-32 and checking for the waveforms provided in Figure 8-33.

Modulator Driver. The Mod Driver provides the voltage-to-current conversion and current gain needed to drive the modulator. As the voltage increases at TP6 so does the current to the Modulator, shunting more RF energy to ground and allowing less to pass through. Since the modulator is essentially current-controlled, the voltages measured at TP9 and P1-19 do not vary much over a wide range of modulator attenuations.

The Mod Driver is an emitter-follower followed by a common-base stage, with two diodes in between. Check the biases and base-emitter voltages to check for damaged transistors.

- To check signal levels within the Mod Driver circuit, follow the procedure outlined under **Modulator Leg**. High and low bias levels can be established for troubleshooting purposes.

Modulator. The internal modulator for this plug-in is housed in a combination microcircuit package with the RF amplifier, A13 Mod/Amp. Figure 8-27 provides a simplified schematic for this positive-bias shunt-type attenuator. As more current is supplied through the modulator bias pin, the shunt diode turns on harder, sinking more RF power to ground and allowing less to reach the front panel.

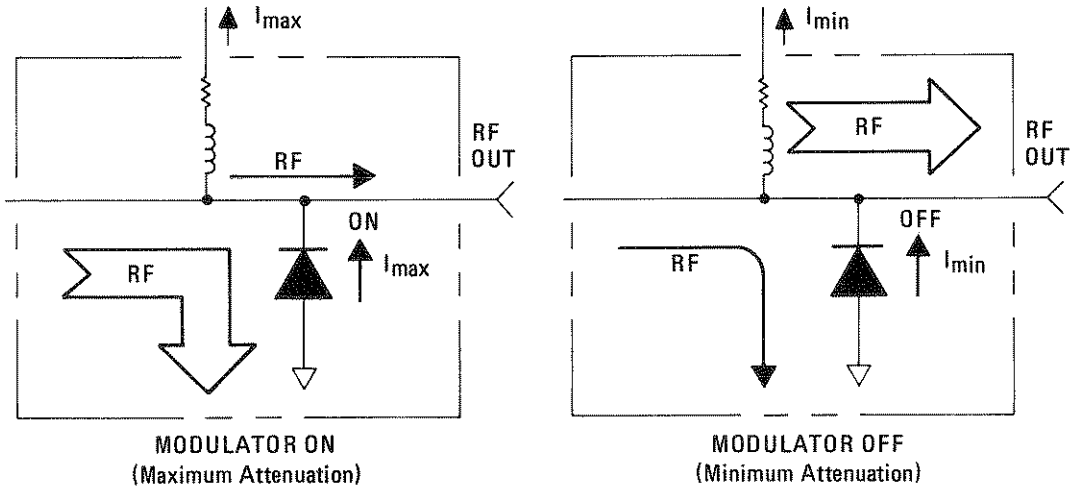


Figure 8-27. Simplified Modulator Schematic

The modulator is checked simply by noting whether the actual RF attenuation is appropriate to the modulation bias present:

NOTE

Turn off line power before removing or installing any assembly.

- If low or no RF power is observed, remove modulator bias current simply by removing the A4 assembly from the motherboard. With no bias current, the RF power should pass through the modulator unhindered. If this is not the case, check the modulator diode by performing the procedure outline under **Modulator Leg**. Rotate the EXT/MTR ALC CAL knob fully clockwise. This should result in −0.6 Vdc at TP6, essentially removing bias from the modulator. Check TP9 for −10 Vdc. If this is not the case, isolate the modulator from the drive circuitry by applying a piece of cellophane tape to the pin edge connection, P1-19. If TP9 now measures −10 Vdc, the modulator diode is probably shorted.

NOTE

Remove any tape applied to the pin edge connectors in the previous procedure.

- If the modulator appears to be functioning properly, check the following RF levels with a power meter or spectrum analyzer. When checking power levels internal to the RF signal path, ensure that all critical ports are terminated in 50 ohms.

  1. If power is minimal, check the RF level directly out of A12 YO. Refer to the RF Schematic Diagram at the end of Section VIII for the proper levels.

  2. Check the RF levels around A13 Mod/Amp with no modulation. A13 should output approximately +20 dBm with about +13 dBm at the input.

- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted) by performing the procedure outlined under **Modulator Leg** and rotating the EXT/MTR ALC CAL knob fully counter-clockwise. The voltage level at TP6 should be +7.5 Vdc. Concurrently, the voltage levels at the output of the Mod Driver, P1-19, should be approximately +0.6 Vdc to +0.8 Vdc.

  1. If the voltages are significantly higher than this, the modulator diode is probably open.

  2. Check TP9 for approximately +2.0 Vdc. The difference between the test point and the corresponding pin-edge connector gives an indication of how much current is flowing to the modulator.

Control Latches. Control latch U16 is checked by performing a hexadecimal data rotation write to U16, and then checking the outputs for the waveforms shown in Figure 8-2. The oscilloscope should be triggered from U16 pin 15.

Exercise U16 with Hex Data Rotation Write. Enter:

SHIFT 0 0	Enters Hex Data command
2 GHz s 0 4	Address location 2C04 (U16)
M4	Hex Data Rotation Write

Check the outputs of U16 against waveforms shown in Figure 8-2.

Relays K1 and K2. A known FM input is applied and the waveform at TP4 is monitored. The Hex Data Write feature of the 8350A is used to control relays K1 and K2. Connect equipment as shown in Figure 8-40. Adjust the function generator for a 500 Hz 1 V peak-to-peak output with a +0.5 Vdc offset (use function generator offset control).

To check relay K1, enter on the 8350A:

SHIFT 0 0	Enters Hex Data command
2 GHz s 0 4	Address location 2C04 (U16)
M2 . 8	Hex Data Write A8

Relay K1 should be open. Verify that there is a signal centered around 0 Vdc at TP4.

On the 8350A, enter:

M2 8 8	Hex Data Write 88

Relay K1 should now be closed. Verify that the signal at TP4 is offset from being centered around 0 Vdc.

To check relay K2, enter on the 8350A:

M2 BK SP 8	Hex Data Write F8

Relay K2 should be closed. Note the level of the signals at TP3 and TP4.

Open relay K2 by entering on the 8350A:

M2 dBm dB 0	Hex Data Write E8

Relay K2 should now be open. Verify that the level of the signals at TP3 and TP4 is less than previously noted.

Analog Switches U3D and U11. The analog switches are checked by using the Hex Data Write feature of the 8350A to control the switches. A known FM input is applied and switch operation is verified.

Connect equipment as shown in Figure 8-40. Adjust the function generator for a 500 Hz 1V peak-to-peak output.

On the 8350A, enter:

SHIFT 0 0	Enters the Hex Data command
2 GHz 0 4	Address location 2C04 (U16)
M2 dBm dB 8	Hex Data Write E8

Analog switch U3D should be closed. Verify a signal at TP3.

On the 8350A, enter:

M2 dBm dB 0	Hex Data Write E0

Analog switch U3D should be open. Verify that there is no signal at TP3.

On the 8350A, enter:

M2 dBm dB 8	Hex Data Write E8

Analog switch U11 should be set to the zero position. Verify that a signal is present at TP6.

On the 8350A, enter:

M2 dbm dB GHz s	Hex Data Write EC

Analog switch U11 should be set to the one position. Verify that no signal is present at TP6.

Power Sweep/ALC Adjustments Troubleshooting

The most likely indication of a failure in these circuits is either incorrect or no operation of the Power Sweep function or inability to adjust the output power flatness. The Power Sweep DAC U17 is exercised by initiating the Power Sweep DAC self test, and the DAC output is checked at TP8. On the 8350A, enter:

SHIFT 5 1	Initiate Power Sweep DAC self test

Verify the waveform at TP8 corresponds with the waveform in Figure 8-37.

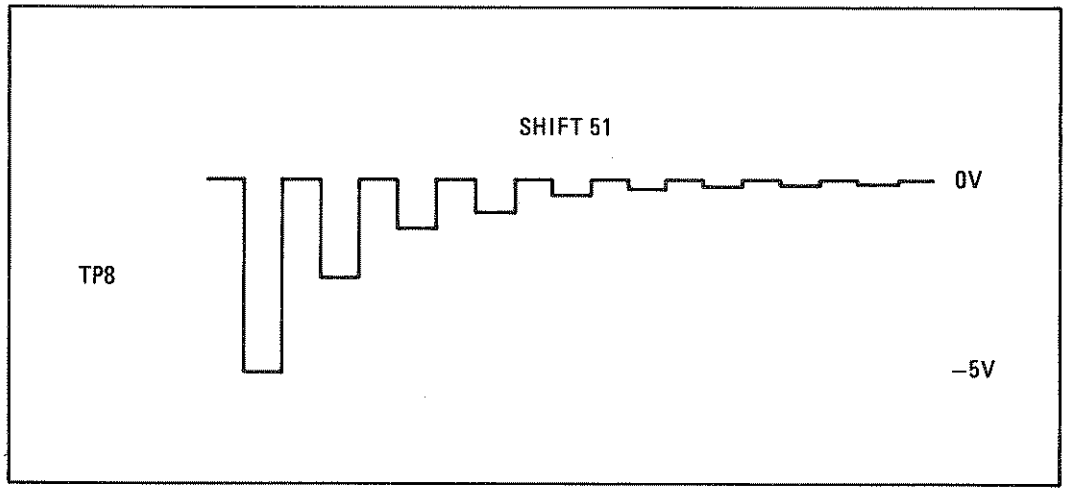


Figure 8-37. Power Sweep DAC Self Waveform

2. If BVTUNE is correct, check SCVTUNE (TP1) against the waveform shown in Figure 8-49. If it appears to be bad, run the Scale DAC Test by setting a CW frequency of 8.4 GHz and pressing SHIFT 5 2 . Check that U9 pin 17 is at −10 Vdc. Then check TP1 for the waveform shown in Figure 8-52. If this fails, check address decoding and the DAC latches using the Digital Control troubleshooting below.

3. Check +20V FREQ REF (TP13) for +20 Vdc ±10 mV. If it is not, trace the supply voltage back to the 8350A. Then check that SUPPLY VOLTAGE CORRECTION (TP15) is at approximately −11.4 Vdc. If it is not, troubleshoot U11.

4. Finally, check that the summing junction, U16 pin 2, is at 0 Vdc. If it is not, troubleshoot U16.

YO Drive Circuits

1. Check +20V FREQ REF at TP13 for +20V ±10 mV. If it is not, troubleshoot back to the mainframe supply.

The circuitry surrounding U24 and A9Q1 is responsible for converting the YO DRIVE V to a drive current for the YO coil. A failure here will usually result in gross frequency errors.

2. Press INSTR PRESET to sweep the entire range of the plug-in. Check TP12 for the waveform shown in Figure 8-47. This represents the voltage (not the current) across the YO's main coil, and will give an indication as to whether current is passing through the coil. If this waveform is correct, suspect the YIG oscillator. Refer to the RF Section Service Sheet.
3. Check TP16. This voltage should track the YO DRIVE V (Figure 8-45). If it does not, troubleshoot U24, Q1, Q2, A9R1, and A9Q1.
   a. To verify proper operation of U24, ground TP16 (R1 is a 12 Watt resistor). Press 8350A CW . Vary the voltage at U24 pin 3 by changing the CW frequency as indicated on the front panel (8.4 GHz = −6V; 2 GHz = +15V). With TP16 at 0 Vdc, U24 pin 6 should be at approximately +20 Vdc for positive input voltages, and approximately −10 Vdc for negative input voltages. If it is not, replace U24.
   b. A9R1 should be checked by removing the A9 assembly from the instrument. The ohmmeter reading should be approximately 125 ohms.
   c. While the A9 assembly is removed from the instrument, check the collector-base and base-emitter junctions of A9Q1 with an ohmmeter. These junctions should show only a few hundred ohms when forward biased, and a high impedance in the reverse direction. If A9Q1 is found to be shorted or opened, make sure that protection diodes VR1 and CR6 are good before replacing the transistor.
   d. Q1 and Q2 can be checked, using the procedure above, while they are still in the circuit. The line power should be off.

Interrupt Control

Symptoms of an interrupt failure may include loss of sweep, portions of the sweep trace missing, or a false bandswitch.

1. Place the A6 assembly on an extender board. With an oscilloscope check L SSRQ (P1-23) for approximately +4.5V. Since bandswitch circuitry is

disabled, the only time L SSRQ should be low is when used in conjunction with external equipment requiring a stop sweep, or when programmed through the 8350A auxiliary programming connector.

a. If L SSRQ is low, check that U5 pin 3 is at ground. If it is not, check the L BSE line for approximately +4.5V. Then troubleshoot switch U26.

b. If U26 is good, ensure that U17A pin 5 is not held high. If it is good, chances are that other lines are pulling L SSRQ low. Refer to 8350A Operating and Service Manual to determine the source of the error.

2. Check edge-connector pins P1-3 (L SIRQ) and P1-1 (L RTS).

   a. L RTS should appear as illustrated in Figure 8-49, with a low pulse occurring at the end of each forward sweep. If L RTS is not correct, trace the problem back through the plug-in interconnects to the 8350A.

   b. L SIRQ should pulse low briefly for end-of-sweep interrupts as illustrated in Figure 8-49. If these pulses are missing, but L RTS is present, suspect U21C, U17B, or control lines from U22.

   c. If L SIRQ stays low, or the pulses are exceptionally wide, check U22 with the procedure outlined under **Digital Control** section. If U22 is functioning, the 8350A microprocessor probably did not receive the interrupt. Trace this signal back to the 8350A.

Digital Control

The Address Decoder, Input Data Latches, and Frequency Cal Switches/Output Data Buffers comprise the digital control for the A6 assembly. A failure in these components usually results in large frequency errors, and will often disable the bandswitch circuitry.

To check the address decoding circuitry enter SHIFT 5 4 and perform the following:

1. Examine L INST 2 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.
2. If L INST 2 is functional, check each of the LENn lines (U25) for the pulses shown in Figure 8-51. If these are incorrect, but the address lines show activity, replace U25. If the address lines seem locked high or low, troubleshoot the address buffer on the A3 assembly.

NOTE

U3, U4, and U7 are checked by reading data while changing switch settings. Before altering the switch settings on A6S1 and A6S2, write down the present configuration. Return the switches to their original status after troubleshooting. If this is not done, the frequency end points will have to be recalibrated.

3. To check status buffer U7, press INSTR PRESET . Set the 8350A for a 5-second sweep rate and make the following key entry:

SHIFT 0 0	Enters the Hex Data command
2 GHz s 8 6	Address location 2C86 (U7)
M3	Hex Data Read

The hex digits displayed in the 8350A front panel FREQUENCY/TIME window should change as the status read by U7 changes between forward sweep and retrace. Raising the power level until the UNLEVELED light comes on should also change the status bit being read by U7. Switches S1 and S2 can be toggled to test the two last bits.

4. U3 and U4 can each be checked with Hex Data Read (see above) at address 2C84 or 2C85. The hex digits should change when the corresponding Freq Cal switches are changed.

5. Exercise U22 with Hex Data Rotation Write. Enter:

SHIFT 0 0	Enters Hex Data command
2 GHz s 8 3	Address location 2C83 (U22)
M4	Hex Data Rotation Write

Check the outputs of U22 against the waveforms shown in Figure 8-2.

6. The remaining three latches—U8, U13, and U18—can be checked by selecting a CW frequency of 8.4 GHz and pressing SHIFT 5 2 , to initiate the Scaling/Offset DAC Test. The waveforms at TP1 and TP2 should be checked against those in Figure 8-52.

   a. If these are faulty, check the outputs of the latches, and replace them if necessary. If the bit patterns are correct, but the waveforms are not, replace the appropriate DAC.

−10V REF

Check TP3 for −10 Vdc ±1 mV. If this voltage is incorrect, perform the −10V Reference adjustment procedure provided in Section V of this manual. If the adjustment cannot be made, check U23 pin 2 for −6.95 Vdc ±0.15 mV. If this voltage is incorrect, replace U23. Check U20 pins 2 and 3 for −6.95 Vdc ±0.15 mV. If either measurement is incorrect, troubleshoot U20 and associated circuitry.

5V Regulator

Check A9Q3 pin 1 for slightly over +5 Vdc, and trace the line back to the 8350A if it is missing. Remove A7 and RF ribbon cable W16 to check for the possibility of excess loading. Then check A9Q3 pin 2 for +5 Vdc. If incorrect, replace A9Q3.

CW Filter

Relay K1 and C14 reduce residual FM by filtering the noise from the YO Coil current. The relay is actuated by a line from U22. To check the data line, press 8350A CW . Enter:

SHIFT 0 0	Enters Hex Data command
2 GHz s 8 3	Address location 2C83 (U22)
M2	Hex Data Write
0 0 / BKSP BKSP	Enters hex data 00 and FF

Alternate between 00 and FF. Check U22, pin 6. If it is dead, make sure protection diode CR5 is good. Then replace U22.

If U22 is working, alternate between 00 and FF, as described above, and verify that contacts in relay K1 are opening and closing.

A9P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 7	BASE +5V REG	IN OUT	A6P1-22 A10J5-7	M L
2 8	COLLECTOR NC	OUT	A6P1-41	M
3 9	+20V NC	IN	P1-7	L
4 10	EMITTER/COIL NC	OUT	A6P1-20	M
5 11	+20V FREQ REF NC	OUT	A6P1-21	M
6 12	GND ANLG +5V UNREG	IN	P2-27,58,59 P2-62,63	L L

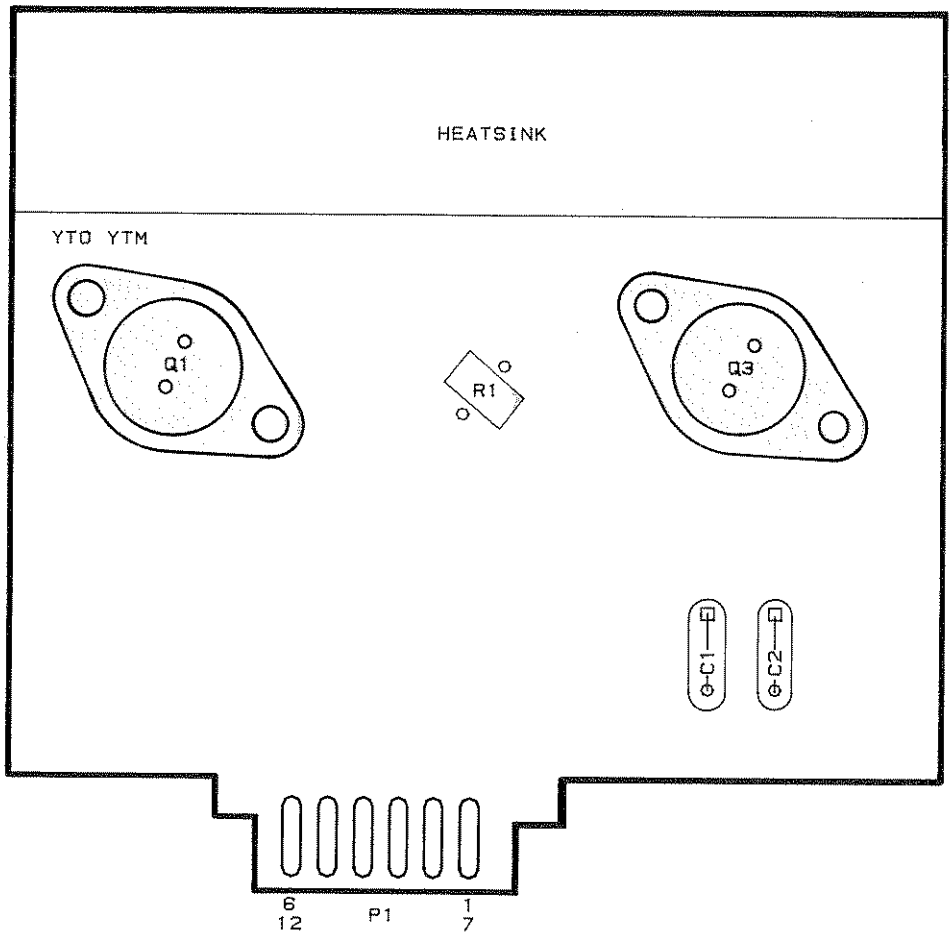


Figure 8-43. A9 Reference Resistor Component Locations

The general approach to troubleshooting is:

1) Make sure that all power supply voltages are present. If not, trace the problem back through the 83540A to the 8350A.

2) Make sure all bias and control signals are present. If not, trace the problem back to the supplying assemblies.

3) Check the RF levels into the suspected microcircuit. If faulty, trace the problem back through the RF path.

4) Check the RF levels out of the suspected microcircuit. If faulty, replace the assembly.

IN EVERY CASE, check power supply voltages. Make sure control signals and bias voltages are being supplied from the other circuits before replacing any microcircuit. Refer to the Service Sheet appropriate to the assembly supplying the control signals for voltage levels and waveforms.

A12 YIG OSCILLATOR

Check RF output directly from the YO for about +14 dBm. For power drop-outs, check OSC BIAS for −10 Vdc, properly shaped. For improper harmonic levels, refer to Section V, Adjustments, and perform the necessary adjustments.

A13 MODULATOR/AMPLIFIER

Ensure that A12 YO transmits approximately +12 to +14 dBm RF power. Check MOD 1 for about +0.7 Vdc. If it is much greater than +2.0 Vdc, the modulator is probably open. If MOD 1 is at 0.0 Vdc while A4TP6 is at +7.5 Vdc, the modulator diode is probably shorted. Troubleshoot the A4 Mod Driver before replacing the microcircuit. A4 Troubleshooting provides detailed procedures to isolate problems in this area.

NOTE

A13 and A13A1 are separately replaceable. A13A1 is NOT supplied with A13. It must be ordered separately.

DC2 DIRECTIONAL COUPLER

Insertion loss through the coupler should be less than 1 dB. Failures here are extremely unlikely.

CR1 DETECTOR

Check the detector output for approximately −0.08 Vdc when leveled at +16 dBm, and slightly more negative when unleveled. This measurement can be taken at the detector output using an SMC Tee or by probing A4P1−20 (accessible on the underside of motherboard A10).

A19 STEP ATTENUATOR (Option 002 Only).

Check the output of DC2 for approximately +15 dBm. Verify that A3 Configuration Switch is set for Option 002 (see A3 Service Sheet, Table 8-8). Set the 8350A front panel step keys, ◆◆, for 10 dB steps. Increment the power setting with the step keys to run the attenuator through its 70 dB range. (Power meters will typically NOT have the dynamic range to verify this operation.) The control circuits can be manually exercised by operating the sweep oscillator in the CW mode and performing a Hex Data Write to address 2F00. Enter two hex digits in the format "0x", where 00 equates with 0 dB attenuation, 01 with 10 dB attenuation, 02 with 20 dB attenuation, and so on.

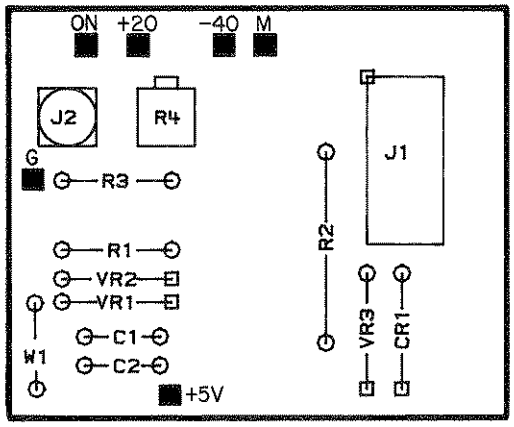


Figure 8-65. A12A1 YO Bias, Component Locations

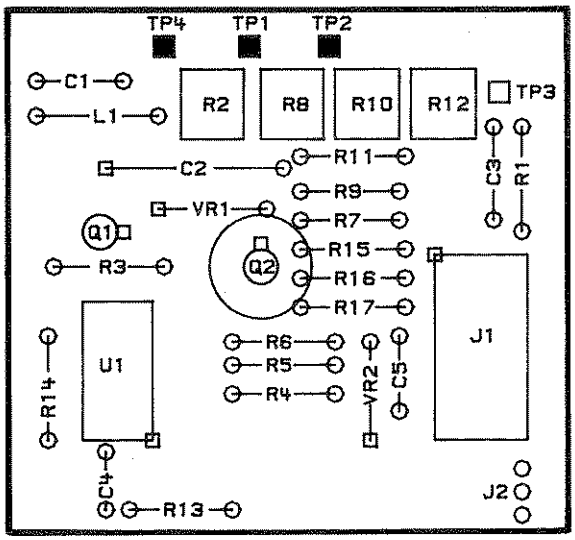


Figure 8-66. A13A1 Modulator/Amplifier Bias, Component Locations