83522A
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBERS

This manual applies directly to HP Model 83522A RF Plug-ins having serial number prefix 2040A or 2127A.

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

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MANUAL PART NO. 83522-90003
Microfiche Part No. 83522-90004

Printed: JULY 1981

HEWLETT PACKARD

S E R V I C E N O T E

SUPERSEDES **None**

83522A RF Plug-in

Serial Numbers: 0000A00000/2528A99999

HP 83522A Marker Assembly Retrofits

Duplicate Service Note: 83525A-07

Situation:

HP 83522A RF Plug-ins with serial prefixes listed above may experience problems when replacing the marker assembly if a compatible motherboard and ALC assembly are not currently installed.

Solution/Action:

Marker assemblies with HP P/N 83525-60092 have new logic circuitry which will allow a new signal 'SQ MOD 2' to be fed to the ALC assembly 'SQ MOD Delay Circuit' to reduce Band 0 overshoot. However, this capability is only available if the new marker assembly is used with a revised motherboard and new ALC assembly.

If a new marker assembly is installed in a unit with the incorrect motherboard and ALC assembly, the -40V supply will be pulled down and the unit will not function properly.

Continued

DATE 15 May 1990

ADMINISTRATIVE INFORMATION

SERVICE NOTE CLASSIFICATION:

INFORMATION ONLY

AUTHOR:	ENTITY:	ADDITIONAL INFORMATION:
JG	4500	

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If marker assembly 83525-60092 is installed in an HP 83522A that does NOT have motherboard 83522-60084 AND ALC assembly 83522-60098, then remove interconnect jumper W1 from the marker assembly. With jumper W1 removed, the new marker assembly will function the same as previous marker assemblies.

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of delivery. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

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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.

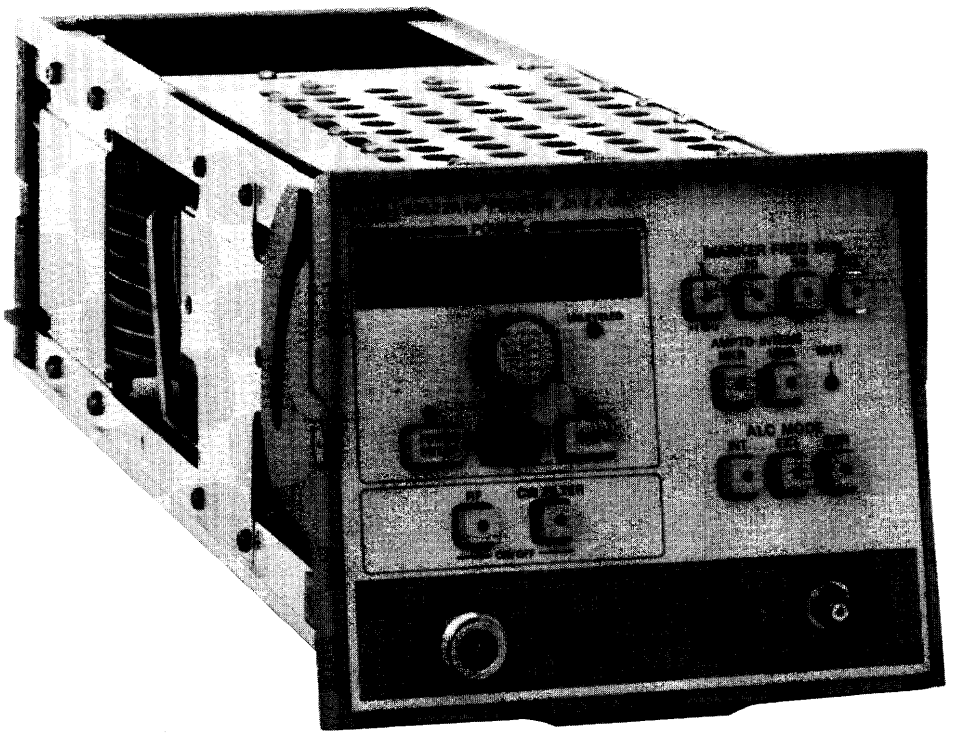


Figure 1-1. Model 83522A RF Plug-in.

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 83522A RF Plug-in. Figure 1-1 shows the Model 83522A.

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 resolution characteristics of the RF plug-in in CW and swept frequency modes. Operating instructions include a front panel FREQUENCY CALIBRATION procedure, 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 83522A 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 front cover 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 4- by 6-inch 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 83522A 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.

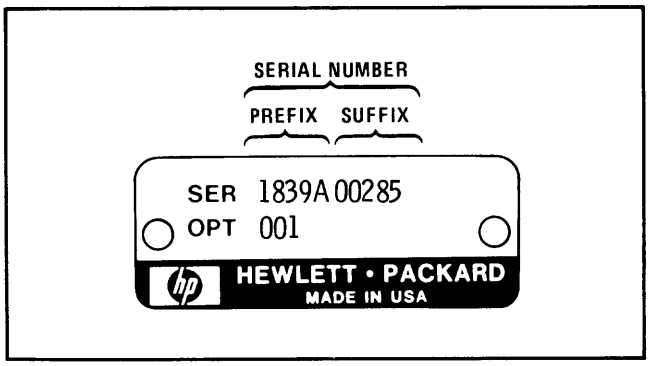


Figure 1-2. Typical Serial Number Plate

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 83522A is an RF plug-in which has been designed for use with the Model 8350A Sweep Oscillator. The Model 83522A covers the frequency range of 0.01 to 2.4 GHz. A YIG oscillator is used as the tunable RF frequency source and a fixed 3.8 GHz oscillator is mixed with the YIG oscillator to generate a 0.01 to 2.4 GHz RF output.

1-18. Model 83522A 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 ramp according to the mode of operation (CW, START/STOP, CF/ΔF). This voltage ramp is scaled and offset by the Model 83522A to provide a voltage ramp which is proportional to the YIG oscillator frequency in the Model 83522A. The Model 83522A then converts the tuning ramp voltage to a current which drives the YIG oscillator tuning coil.

1-19. The Model 83522A offers a maximum leveled RF output power of +13 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 83522A 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 83522A Installed in Model 8350A (1 of 2)

FREQUENCY[1]

Range 0.01 to 2.4 GHz

Accuracy[2] (25°C ± 5°C)

CW Mode ±5 MHz

All Sweep Modes (Sweep time >100 ms) ±15 MHz

Frequency Markers (Sweep time >100 ms) ±15 MHz ±0.5% of sweep width

Stability

With 10% Line Voltage Change ±20 kHz

With 10 dB Power Level Change ±100 kHz

With 3 : 1 Load SWR ±10 kHz

With Time (In a 10 minute period after one hour warmup) ±100 kHz

Residual FM, Peak (10 Hz to 10 kHz Bandwidth) <5 kHz

POWER OUTPUT[1]

Maximum Leveled Output Power:[3] +13 dBm (25°C ± 5°C)

With Option 002: +13 dBm

Power Level Accuracy:[9] ±1.0 dB (Internally Leveled)

With Option 002:[6] ±1.2 dB (at 0 dB attenuator step)

Calibrated Range: 15 dB

With Option 002: 85 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: ±0.25 dB

Externally Leveled:

Negative Crystal Detector:[4] ±0.1 dB

Power Meter:[5] ±0.1 dB

	0.01 to 2.1 GHz	2.1 to 2.4 GHz
Residual AM in 100 kHz Bandwidth (in dB below carrier and at specified maximum leveled power)	≥50 dB	≥50 dB
Spurious Signals (at specified maximum leveled power)		
Harmonics (in dB below carrier)	≥25 dB	≥25 dB
Non-Harmonics (in dB below carrier)	≥30 dB	≥25 dB
Output VSWR (internally leveled)	<1.5	<1.5

Power Sweep[8]

Calibrated Range:[7] ≥15 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 83522A 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

CRYSTAL MARKER CAPABILITY[1]

Internal Crystal Markers (+3 to +13 dBm power level and ≤10 markers/sweep): Harmonic Markers of 10 MHz and 50 MHz are available up to 2.4 GHz; 1 MHz harmonic markers are available below 1 GHz. Markers are output as intensity spots through the POS Z BLANK connector on the 8350A or as amplitude dips on the RF output.

Marker Indicator Light: LED lights when coincident with crystal or external marker for accurate CW calibration.

GENERAL SPECIFICATIONS[1]

Minimum Sweep Time (over full band): 10 ms

RF Output Connector: Type N Female

FOOTNOTES

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

2 Accuracy when calibrated using internal crystal markers and FREQ. CAL. adjustment.

3 For temperatures greater than 30°C, maximum leveled output power typically degrades 0.1 dB/degree C.

4 Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −200 mV at specified maximum leveled power.

5 Use HP Model 432A/B/C Power Meter. Sweep duration ≥50 seconds.

6 Attenuator switch points are every 10 dB starting at −2 dBm indicated power.

7 With Option 002, in power sweep or slope functions, power can exceed attenuator step by 5 dB.

8 Power Sweep and Slope Compensation total must not exceed 15 dB.

9 Includes internally leveled power variations.

Table 1-2. Supplemental Performance Characteristics for Model 83522A 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[2]
(25°C ± 5°C)

CW Mode, typically:
0.01 to 2.4 GHz: ±1.5 MHz

Manual Sweep
0.01 to 2.4 GHz: ±40 MHz

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

Sweep Mode Linearity[3]
0.01 to 2.4 GHz: ±1 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 83522A Installed in Model 8350A (2 of 2)

Spurious Signals (in dB below carrier)

Harmonics: 0.01 to 2.4 GHz

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: ≥30 dB

Impedance: 50 Ohms

Power Sweep[5]

Accuracy (including linearity): Typically ±1.0 dB

Resolution (displayed): 0.1 dB

Slope Compensation[5]

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

Square Wave modulation up to 30 kHz is allowable.

External FM

Sensitivity (switch selectable)

FM Mode: Typically −20 MHz/V

Phase-Lock Mode: Typically −6 MHz/V

Input Impedance: 2000 Ohms nominal

CRYSTAL MARKER[1] (Operation when RF power set between +3 to +13 dBm and ≤10 markers per sweep)

Accuracy of Center Frequencies (at 25°C): $\pm 5 \times 10^{-6}$

Typical Marker Width Around Center Frequency

1 MHz Markers: ±100 kHz

10 MHz Markers: ±200 kHz

50 MHz Markers: ±300 kHz

External Markers: ±300 kHz

Temperature Stability: Typically $\pm 2 \times 10^{-6}$/°C

GENERAL CHARACTERISTICS[1]

External Marker Input: Generates amplitude or Z-axis marker when sweep frequency equals external input frequency.

Frequency Range: 0.01 to 2.4 GHz

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

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

FOOTNOTES

[1] Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0° to 55°C.
[2] Accuracy when calibrated using internal crystal markers and FREQ CAL adjustment.
[3] With respect to the SWEEP OUT voltage.
[4] With Option 002, in power sweep or slope functions, power can exceed attenuator step by 5 dB.
[5] Power Sweep and Slope Compensation must not exceed 15 dB.
[6] External marker input power typically between −10 dBm and +10 dBm (over limited power range).

1-20. Internal crystal referenced frequency markers are available to provide Z-axis intensity markers from the Model 8350A rear panel POZ Z BLANK BNC output or 1 dB amplitude marker dips on the RF output. Harmonic markers of 10 and 50 MHz are available up to 2.4 GHz and 1 MHz markers are available up to 1 GHz. A rear panel BNC connector accepts an external marker reference frequency. Marker operation is selected by the front panel controls or through HP-IB control via the Model 8350A.

1-21. A power sweep function allows the RF output power to be swept at least 15 dB during CW mode or swept frequency modes. 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 83522A 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.

1-22. The RF output may be internally or externally amplitude modulated, or externally frequency modulated. Internal square wave amplitude modulation frequency is selectable by a Model 8350A internal jumper to be 1 kHz or 27.8 kHz (for use with the Model 8755 Swept Amplitude Analyzer). 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 83522A. Refer to Section III, Operation, of this manual for detailed information on the configuration switch.

1-23. 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).

1-24. 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 FREQ CAL and CAL adjustments, may be set or altered by computer control via the HP-IB bus connection on the Model 8350A.

1-25. OPTIONS

1-26. Option 002, 70 dB Attenuator

1-27. 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.

1-28. Option 004, Rear Panel RF Output

1-29. 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.

1-30. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-31. To have a complete operating sweep oscillator unit, the Model 83522A 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.

1-32. EQUIPMENT AVAILABLE

1-33. Service Accessories

1-34. A Service Accessory Kit (HP Part No. 08350-60020) is available for servicing the Model 83522A RF Plug-in and the Model 8350A Sweep Oscillator. HP Part Numbers for the individual parts of the kit are provided in Table 1-3.

1-35. The Service 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 connectors in the Model 83522A and in the Model 8350A as well.

- An RF Plug-in extender cable set that provides all electrical connections to the RF plug-in when it 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 repairs.
- One 16-pin and one 20-pin integrated circuit test clip.

1-36. A listing of sevice accessories available including service cables, wrenches, adapters, and extender boards is given in Table 1-3.

1-37. Model 8410B/8411A Network Analyzer

1-38. The Model 8350A Sweep Oscillator, with the Model 83522A 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/83522A combination is capable of operation from 110 MHz to 2.4 GHz within this range. The Model 8410B has an Auto-Frequency

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).

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 83522A 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.

1-39. Model 8755 Frequency Response Test Set

1-40. The Model 8350A Sweep Oscillator with the Model 83522A 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 AM 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.

1-41. Power Meters and Crystal Detectors

1-42. 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 83522A external leveling systems.

1-43. RECOMMENDED TEST EQUIPMENT

1-44. 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.

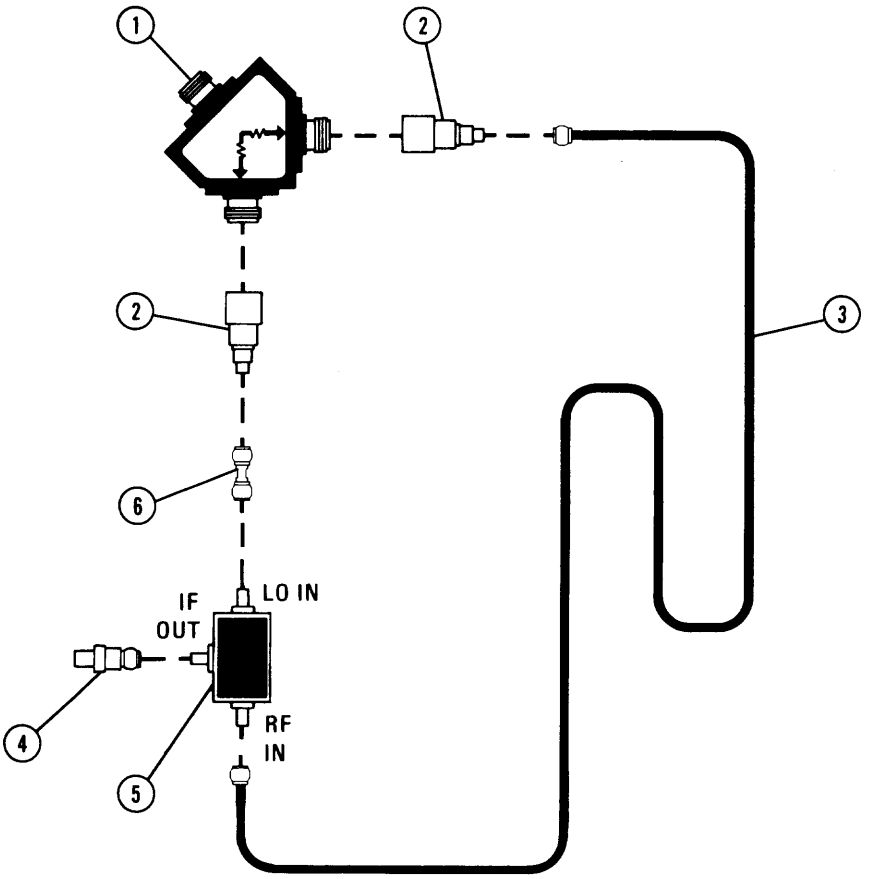
Table 1-4. Recommended Test Equipment (1 of 2)

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	HP 3455A	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: 0.01 to 2.4 GHz	HP 5343A	P,A
Spectrum Analyzer	Frequency Range: 0.01 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: 0.01 to 2.4 GHz Power Range: −20 to +10 dBm	HP 11664A	P,A
Storage-Normalizer	Compatible with Display Mainframe and Swept Amplitude Analyzer	HP 8750A	P
RF Marker Source	CW Frequency: 1.2 GHz Output Power Level: ≥−10 dBm	HP 8350A/83522A	A
Frequency Meter	Frequency Accuracy: ≤0.17% Calibration Increments: ≤2 MHz Frequency Range: 0.96 to 4.0 GHz	HP 536A	P

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

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: 0.01 to 2.4 GHz Maximum SWR: $\leqslant$ 1.75	HP 478A	P,A
Power Meter	Power Range: 1 μW to 100 mW	HP 436A	P,A
Power Sensor (Used with HP 436A)	Frequency Range: 0.01 to 2.4 GHz	HP 8481A	P,A
Crystal Detector	Frequency Response: 0.01 to 2.4 GHz Maximum Input Power: 100 mW	HP 423B	P
Attenuator	Attenuation: 10 $\pm$ 0.5 dB Frequency Range: 0.01 to 2.4 GHz Maximum Input Power: $\geqslant$ +20 dBm Type-N Connector	HP 8491A Option 010	P,A
Power Splitter	Frequency Range: 0.01 to 2.4 GHz Output Port Tracking: $\leqslant$ 0.25 dB Maximum Input Power: +20 dBm	HP 11667A	P,A
1:1 Probe	General Purpose Probe	HP 10007B	A
DC Power Supply	DC Output: 0 to 6.5 Vdc $\pm$ 0.05 Vdc	HP 6213A	A
50 Ohm Termination	Type N, 50 Ohms $\pm$ 0.5 Ohms	HP 909A	P,A
Delay Line Discriminator	Refer to Figure 1-3.		A

[1] P = Performance Test; A = Adjustments; T = Troubleshooting



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

II - Installation

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides installation instructions for the Model 83522A RF Plug-in. This section also includes information about initial inspection, 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 83522A 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 83522A 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 of the separate switches corresponds to a separate RF plug-in function such as FM sensitivity selection, FM modulation input coupling selection (direct coupled or cross-over), RF power level at power on (minimum or maximum), 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 83522A RF Plug-in to 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 Wiring List in Section VIII, Service, of this manual. Figures 2-1 and 2-2 provide the connector configuration and associated signal mnemonics.

2-12. Mating Connectors

2-13. All of the externally mounted connectors on the Model 83522A 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.

2-16. Humidity. The instrument may be operated in environments with humidity from 5% to 80% relative at +25°C to +40°C. However,

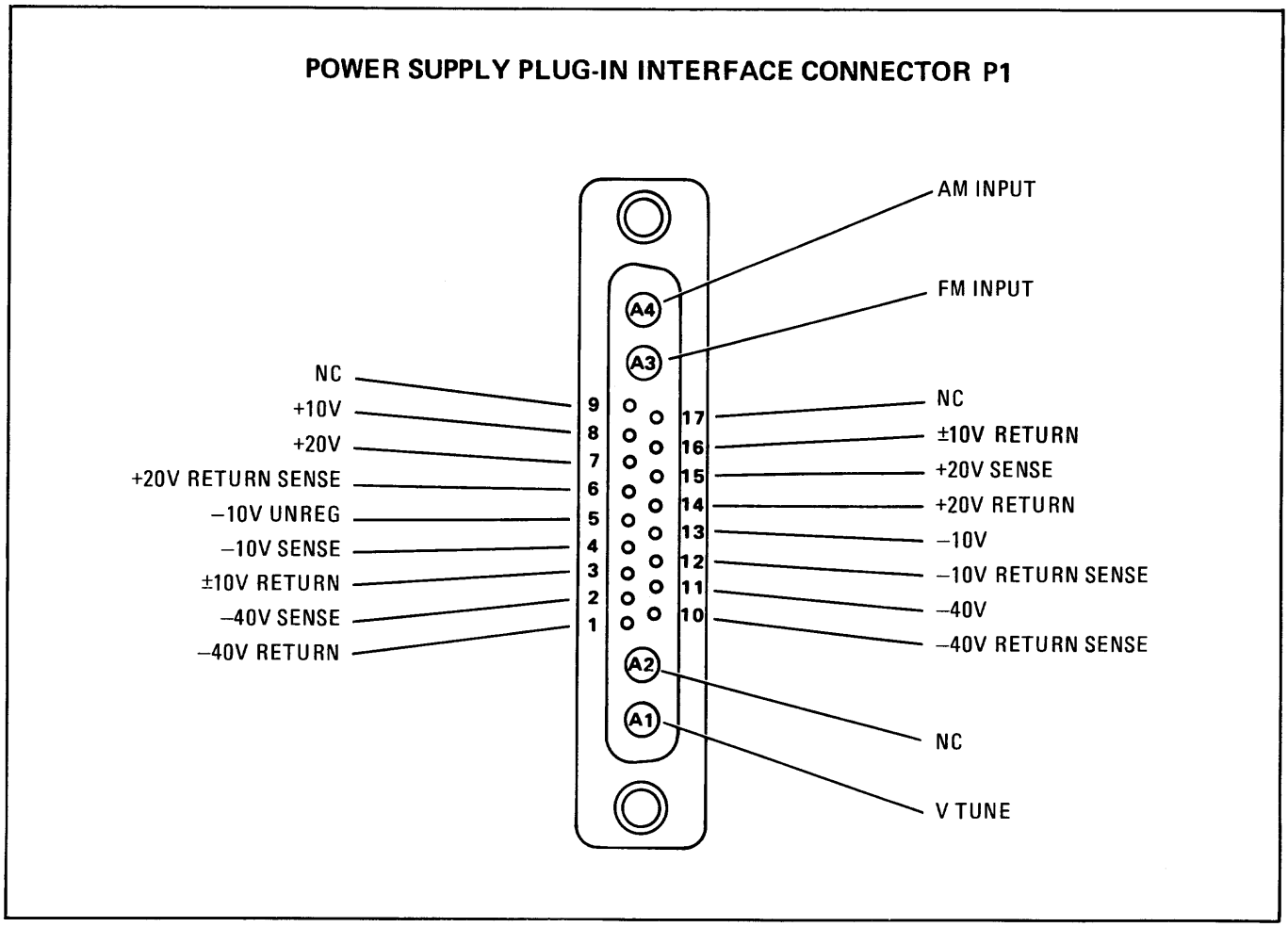


Figure 2-1. Interface Signals on Connector P1

Table 2-1. Mating Connectors

83522A 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 EXT MKR	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J4 1V/GHz	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J5 PULSE IN	BNC (f)	1250-0256	Specialty Connector 25-P118-1

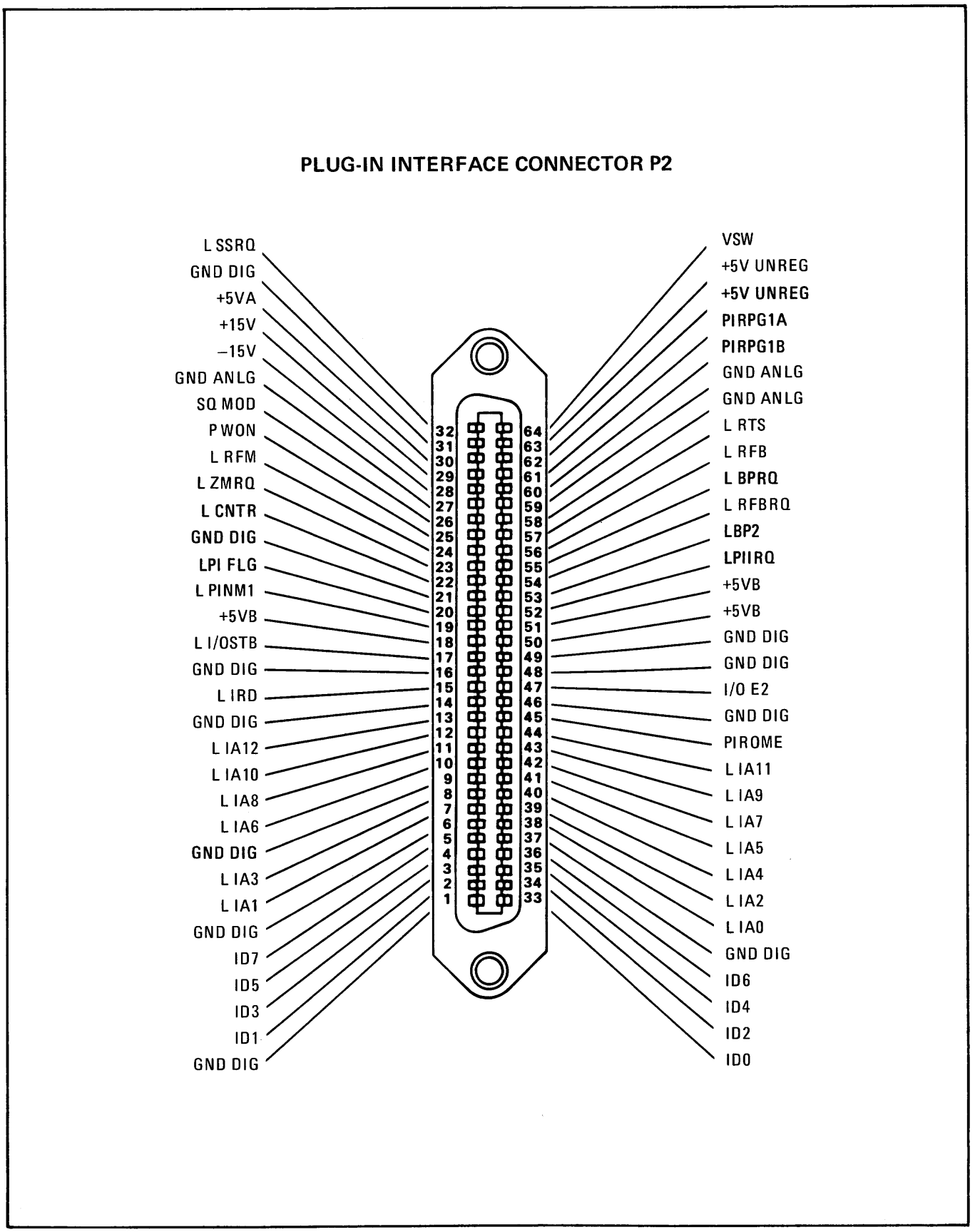


Figure 2-2. Interface Signals on Connector P2

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 83522A 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 83522A 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 83522A RF Plug-in must be installed in a Model 8350A Sweep Oscillator. To install the Model 83522A 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 83522A 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 towards 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 83522A 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.

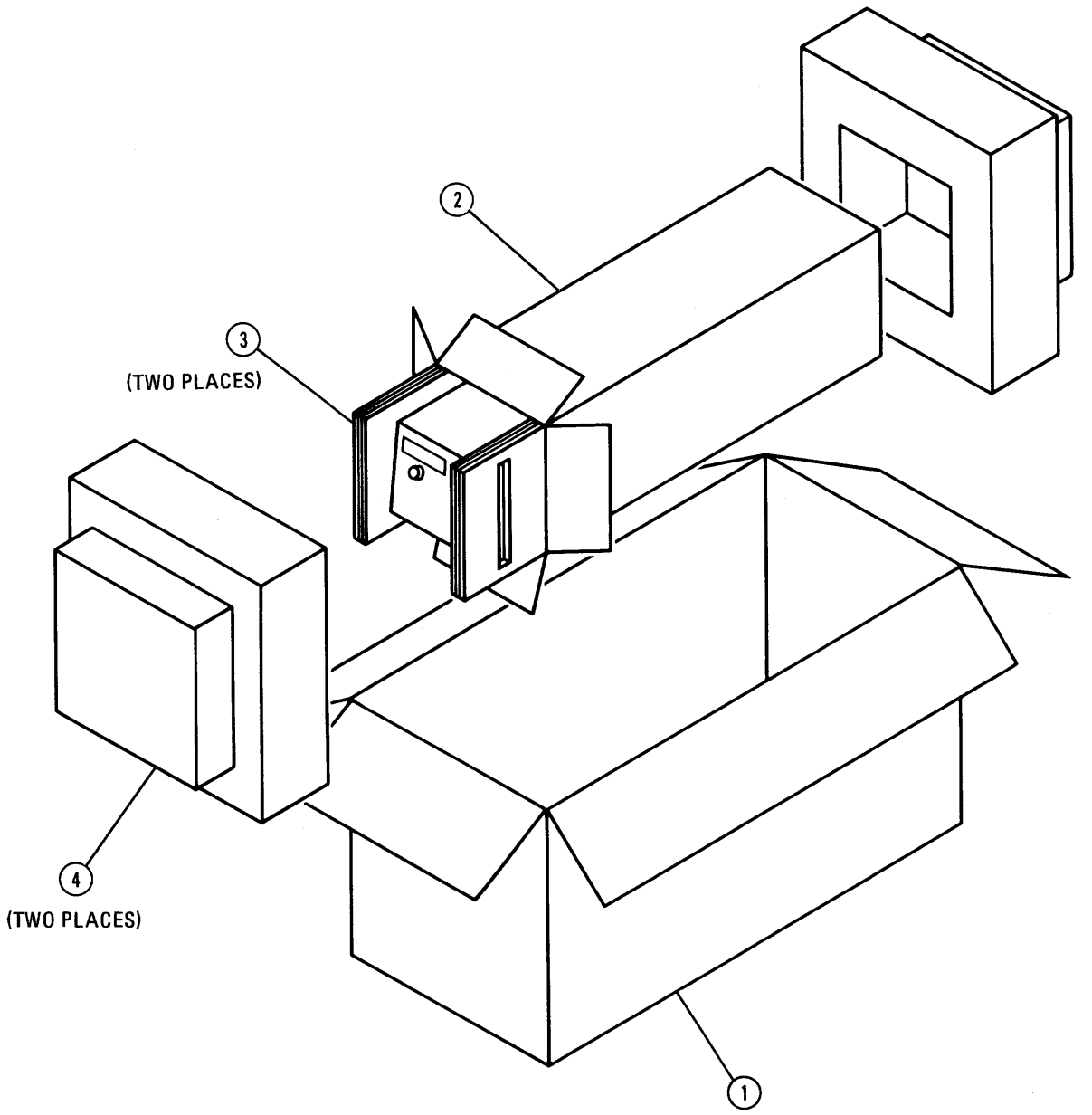
b. Use a strong shipping container.

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
Not Shown	1	9222-0352	6	Poly Bag – to cover instrument

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

III – Operation

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section is divided into four major sections. Operating Characteristics explains the frequency resolution characteristics in CW and swept modes. Front and rear Panel Features are shown with illustrated descriptions. Operating Instructions provide a front panel frequency calibration procedure, configuration switch setting instructions, and crystal detector and power meter leveling instructions. 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; input resolution and displayed resolution. Input resolution refers to the number of bits (8 bits = 256 points) internally used in the digital to analog converters (DACs) used 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	0.606 MHz
Vernier	40 μV	9.45 kHz
ΔF 1 – 1/8 of band	10 mV	2.43 MHz
ΔF 1/8 – 1/64 of band	1.25 mV	0.303 MHz
ΔF $\leq$1/64 of band	0.156 mV	38.0 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 with a summed voltage input 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 $\pm$0.005% of bandwidth.

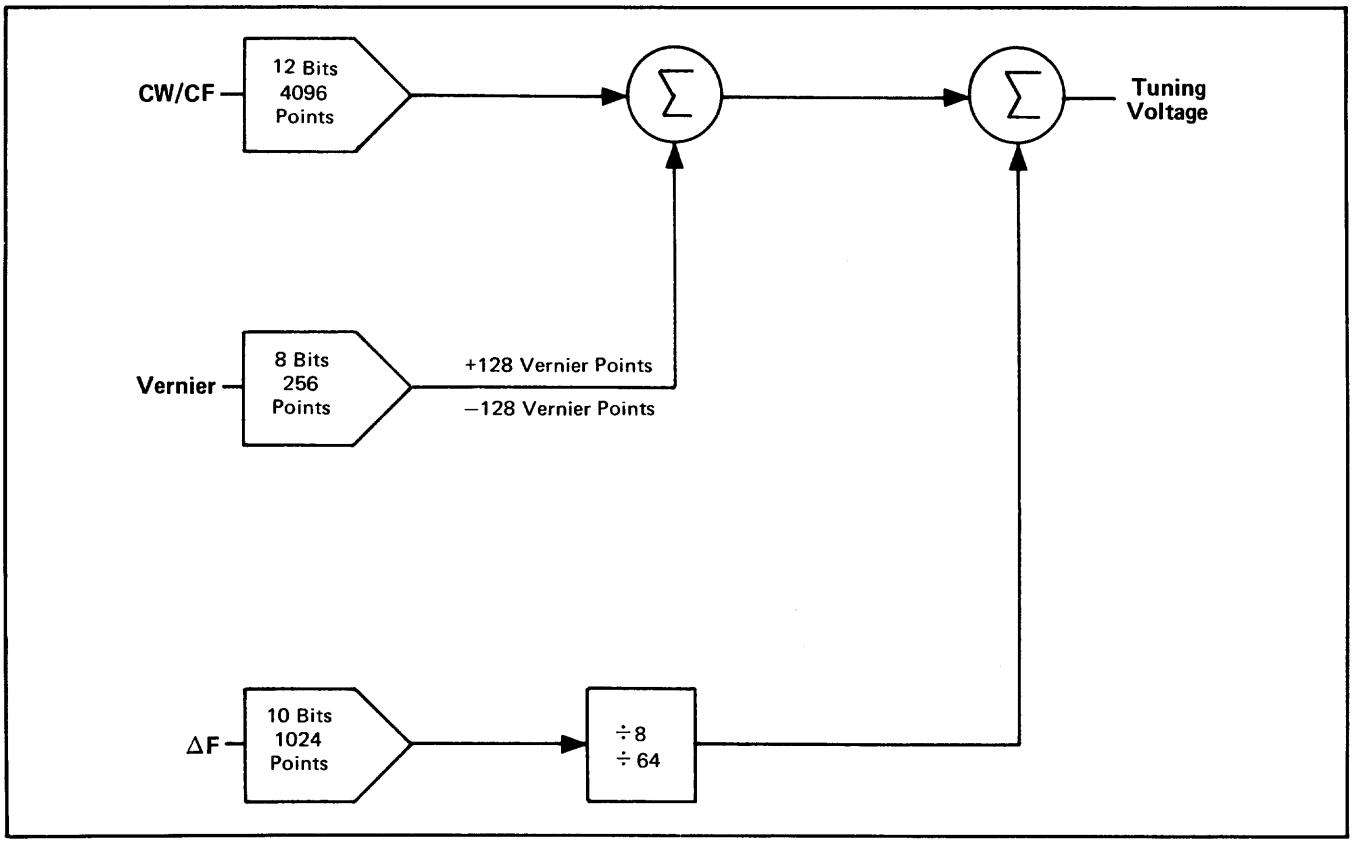


Figure 3-1. Simplified Tuning Voltage Block Diagram

3-9. The ΔF DAC has 10 bits (1024 points). The analog output from this DAC 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. For sweep widths less than 1/8, but greater than 1/64 of the full band range, the resolution is improved to 0.012% of the full band. For sweep widths less than 1/64 of the full band range, the resolution is improved to 0.0015% of the full band.

3-10. Center Frequency 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 ΔF mode displayed resolution values versus displayed ΔF frequency sweep widths.

3-11. PANEL FEATURES

3-12. Front and rear panel features are described in Figure 3-3 and 3-4, respectively. Description numbers match the numbers on the illustration.

3-13. OPERATOR'S CHECKS

3-14. The Operator's Checks (local and remote) in the 8350A Sweep Oscillator manual provide a quick evaluation of 8350A and 83522A main functions. Error codes 50 to 99 indicate plug-in related problems. The 8350A Local Check covers the sweep oscillator and RF plug-in, therefore, if the correct indications are not obtained, trouble may be in either of the units. If the RF plug-in is suspected, follow the trouble-shooting information in Section VIII, Service, in this manual to isolate the problem.

3-15. OPERATING INSTRUCTIONS

3-16. Front Panel FREQ CAL

NOTE

The 83522A RF Plug-in may not meet the frequency accuracy specifications unless the front panel FREQ CAL (frequency calibration) procedure is performed.

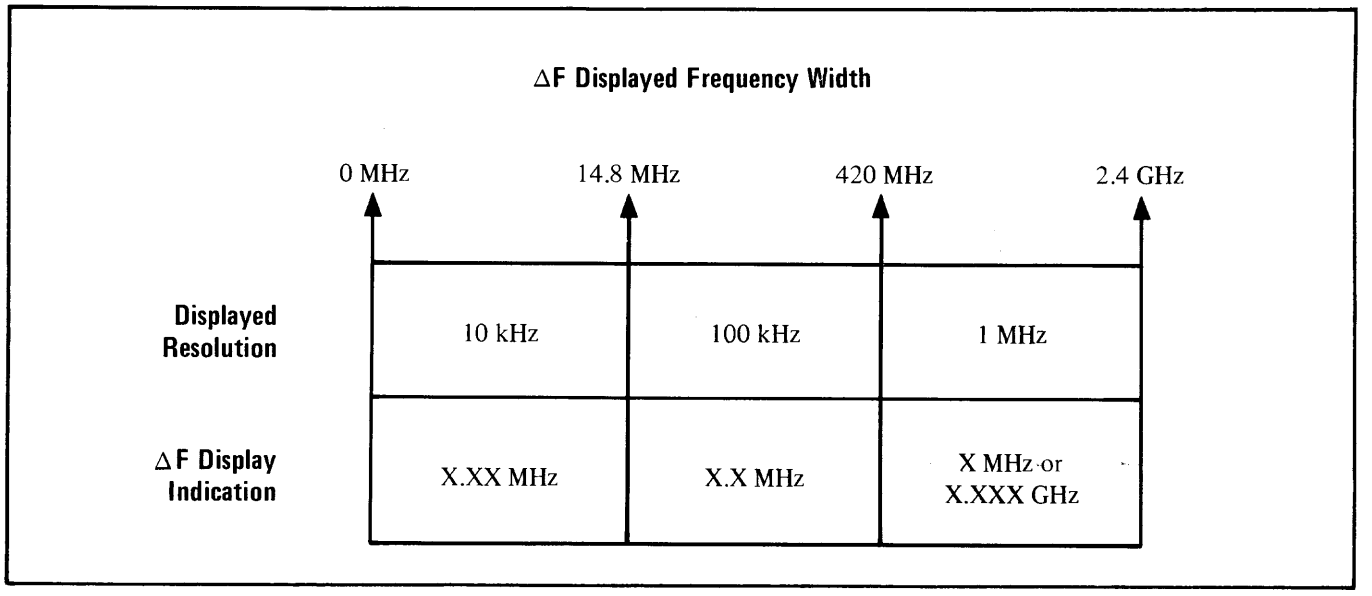


Figure 3-2. Model 83522A ΔF Sweep Mode Displayed Resolution

3-17. The front panel FREQ CAL procedure, shown in Figure 3-5, should be performed after the instrument has warmed up for at least one hour. Performing this procedure adjusts the RF Output frequency to the crystal marker frequency.

3-18. Internal Leveling

3-19. 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).

3-20. External Crystal Detector Leveling

3-21. RF Output power may also be leveled externally using a power splitter (or external directional coupler) and a crystal detector. This leveling system uses a power splitter to sample a portion of the RF Output signal with a crystal detector to produce a dc voltage proportional to the RF signal level. The detector output voltage is compared with an internal reference voltage, and the difference voltage changes the output power level to keep it constant at the output. 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 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 3-6 illustrates a typical crystal detector leveling setup.

3-22. External Power Meter Leveling

3-23. RF Output power may also be leveled with a power meter and power splitter (or directional coupler) as shown in Figure 3-7. 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 83522A 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 3-7 illustrates a typical power meter leveling setup.

3-24. External Frequency Modulation

3-25. The 83522A RF output signal can be frequency modulated using an external modulating signal applied to the 8350A rear panel 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 3-8 lists the available configuration switch settings. The configuration switch settings override 8350A Sweep Oscillator non-volatile memory settings at Instrument Preset.

3-26. External Amplitude Modulation

3-27. 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 is turned off. RF power may be square wave modulated at repetition rates up to 30 kHz at any power setting. 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.

3-28. 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., +5.5 dBm for a plug-in with calibrated power control from −2 to +13 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.

3-29. RF Power Control

3-30. The RF power selected at power-up (Instrument Preset) may be either maximum power (+13 dBm) or power OFF as chosen on the configuration switch (A3S1); refer to Figure 3-8 for this setting. The configuration switch also has switch settings for the model plug-in and use of 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.

3-31. Option 002 Step Attenuator

3-32. With Option 002 installed, when the selected POWER setting goes below −2 dBm, the step attenuator increments as required in 10 dB steps to a maximum attenuation of 70 dB (which sets minimum power to −72 dBm). Within the individual 10 dB steps of the attenuator, the ALC loop adjusts the power output to the power level programmed by the front panel POWER control.

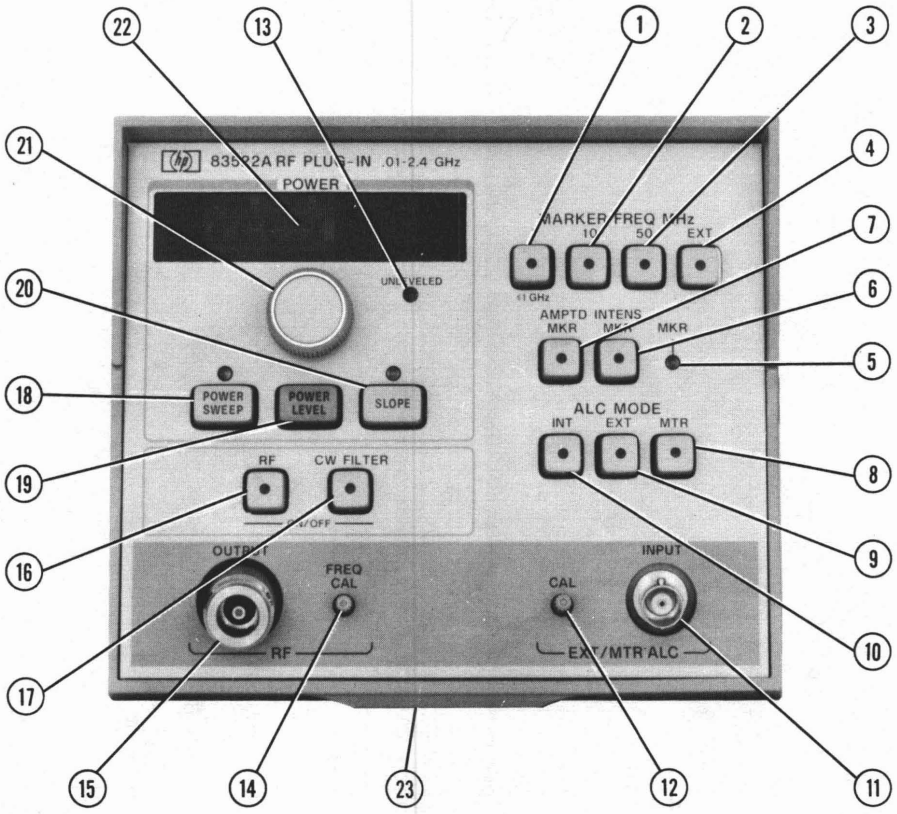
3-33. Alternate Sweep Mode With Option 002

3-34. If Option 002 attenuator is installed, and alternate sweep mode is selected, a slow sweep default condition of 1 second/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 second per attenuator change to prevent damage to the attenuator coils due to overheating.

3-35. Phase-Lock Operation

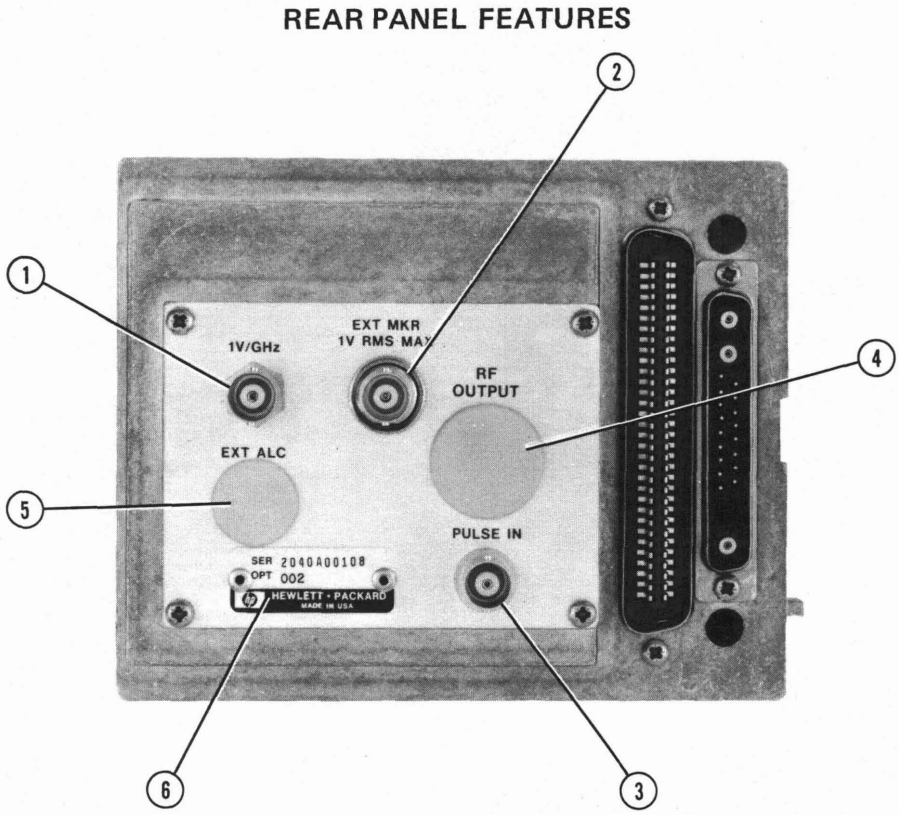
3-36. The 83522A RF plug-in RF Output (CW) signal may be phase-locked using an external phase-lock signal applied to the 8350A Sweep Oscillator FM INPUT connector (rear panel). The phase-lock function provides a means of obtaining a very stable CW frequency by transferring the frequency stability of the reference oscillator to the source. 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 the RF Output CW frequency is determined by the stability of the reference oscillator. The CW filter should be turned off in phase lock operation.

FRONT PANEL FEATURES



1. 1 MHz Crystal frequency marker enable key.
2. 10 MHz Crystal frequency marker enable key.
3. 50 MHz Crystal frequency marker enable key.
4. External frequency marker enable (input on plug-in rear panel).
5. MKR lamp indicates when RF Output frequency equals a marker pulse frequency.
6. Enables plug-in crystal markers in intensity mode.
7. Enables plug-in crystal markers in amplitude mode.
8. Power meter automatic leveling control selection (HP 432 only).
9. External (crystal detector) automatic leveling control selection (negative crystal output).
10. Internal leveling control selection.
11. Connector (BNC) for power meter or external crystal leveling inputs (rear panel on option 004).
12. Power level CAL adjust, for setting external (MTR or EXT) ALC.
13. UNLEVELED lamp lights if output power is unleveled.
14. Fine frequency adjust used for front panel frequency calibration.
15. Type-N 50-ohm RF output connector (rear panel on option 004).
16. RF on-off key. Used for zeroing a power meter or referencing an X-Y recorder.
17. CW FILTER enables an oscillator tune voltage filter when in CW mode.
18. POWER SWEEP allows setting an increase in power per sweep (dB/SWP).
19. POWER LEVEL allows setting of output power for all ALC modes (may be calibrated for external leveling).
20. SLOPE allows setting of the frequency slope compensation in dB/GHz (for lossy devices).
21. Power control knob for controlling power sweep, power level, or slope.
22. Plug-in display provides readout of selected power mode in dBm, dB/GHz, or dB/SWP to a tenth of a dB/dBm.
23. Plug-in latch handle is used to remove, install, and latch the RF plug-in in the sweep oscillator.

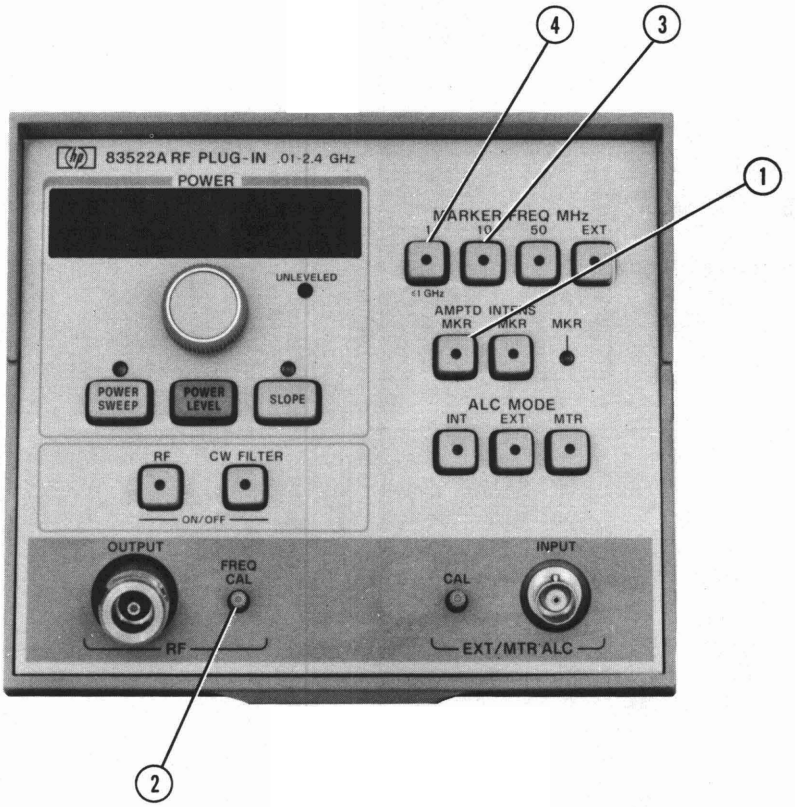
Figure 3-3. Front Panel Features



1. 1V/GHz connector provides a frequency reference output of approximately 1 volt dc per GHz.
2. EXT MKR (1V RMS MAX) input connector allows use of external marker when plug-in EXT marker is engaged.
3. PULSE IN connector is used to input external pulse or squarewave modulation.
4. RF OUTPUT connector replaces front panel RF output connector in Option 004 plug-ins.
5. EXT ALC connector 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

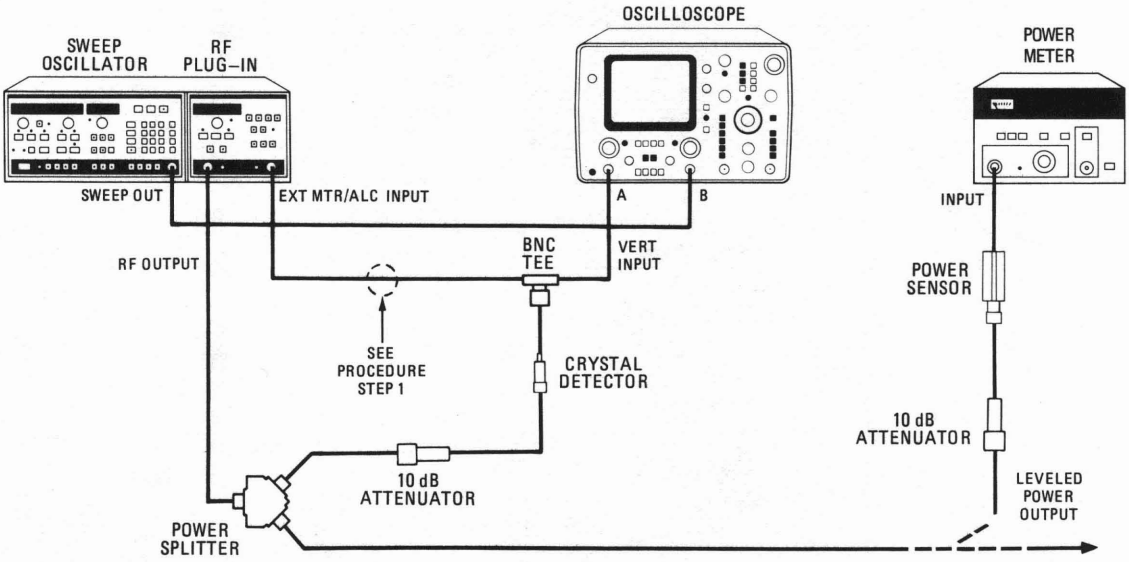
FREQ CAL PROCEDURE



1. Press 8350A INSTR PRESET CW 5 0 MHz
2. Press 83522A AMPTD MKR ① (50 MHz MARKER FREQUENCY switches on automatically).
3. Adjust FREQ CAL ② control until MKR lamp is on.
4. Press 8350A 1 0 MHz.
5. Press 83522A 10 MHz ③ Marker.
6. Fine adjust FREQ CAL ② control (if needed) until MKR lamp is on.
7. Press 83522A 1 MHz ④ Marker.
8. A small adjustment of FREQ CAL ② control may be needed for MKR lamp to light.

Figure 3-5. Front Panel FREQ CAL Procedure

EXTERNAL CRYSTAL DETECTOR LEVELING



EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83525A
Oscilloscope	HP 1740A
Power Meter	436A
Power Sensor	HP 8482A
Crystal Detector	HP 423B
Power Splitter	HP 11667A
10 dB Attenuator (2 required)	HP 8491A, Option 010
BNC Tee	HP 1250-0781

PROCEDURE:

NOTE

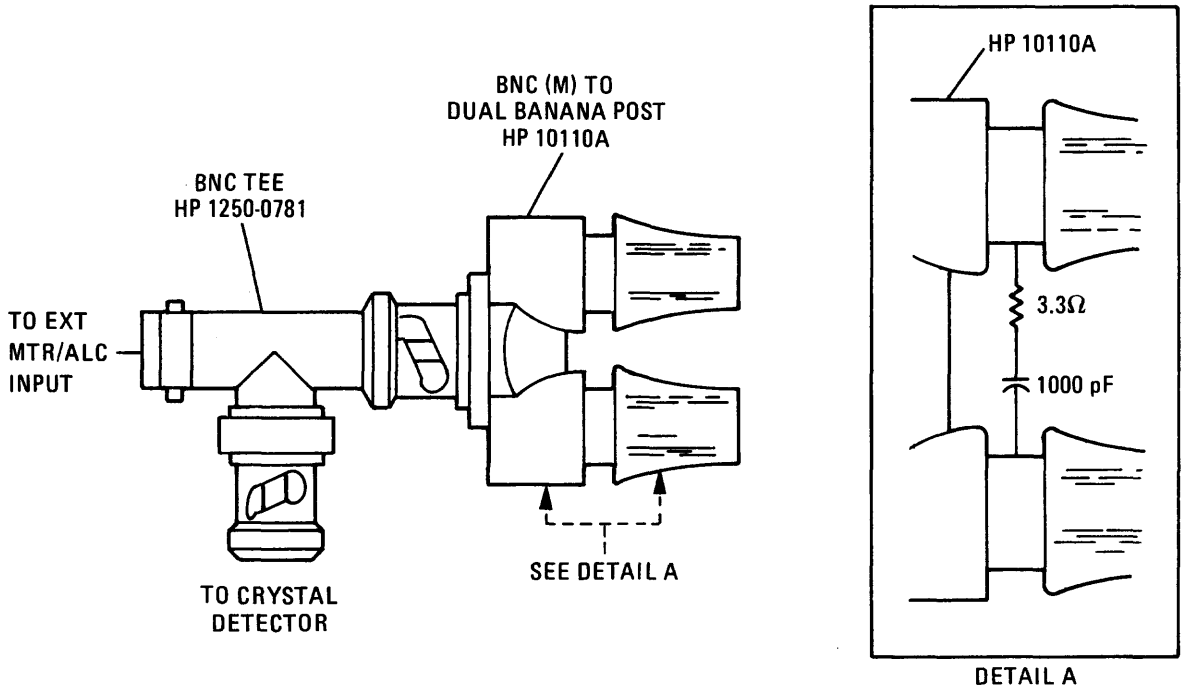
Crystal output signal must be between −10 mVdc and −200 mVdc.

1. Connect equipment as shown in test setup.

Figure 3-6. External Crystal Detector Leveling (1 of 2)

NOTE

Between 10 MHz and 50 MHz RF feedthrough as high as 3 dB may be observed on the envelope of the video output. During external leveling at 10 to 50 MHz, the RF feedthrough may be damped out by insertion of the circuit shown below in the test setup. The circuit may be inserted in the line to the EXT INPUT of the RF Plug-in.



2. Switch on 8350A LINE switch. Press **INSTR PRESET** key. The START and STOP indicators should be on.

3. Set controls as follows:

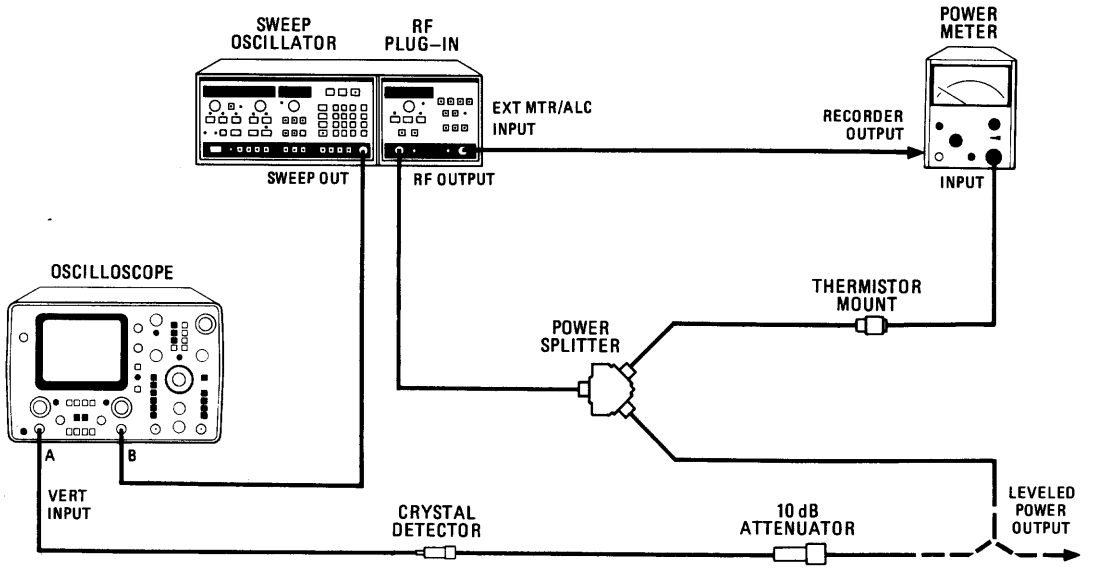
   83522A:
   ALC MODE ..... EXT

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 3-6. External Crystal Detector Leveling (2 of 2)

EXTERNAL POWER METER LEVELING



EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83522A
Power Meter	HP 432A
Thermistor Mount	HP 8478A
Oscilloscope	HP 1740A
Crystal Detector	HP 423B
10 dB Attenuator	HP 8491A, Option 010
Power Splitter	HP 11667A

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.

PROCEDURE:

1. Connect equipment as shown in test setup.

Figure 3-7. Power Meter Leveled (1 of 2)

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

   83522A: Set power to maximum specified.
   ALC MODE ..... MTR

4. Select +10 dBm range on power meter.

5. Adjust 83522A EXT/MTR ALC CAL for a +7 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 3-7. Power Meter Leveled (2 of 2)

3-37. OPERATOR'S MAINTENANCE

3-38. Plug-in Error Codes

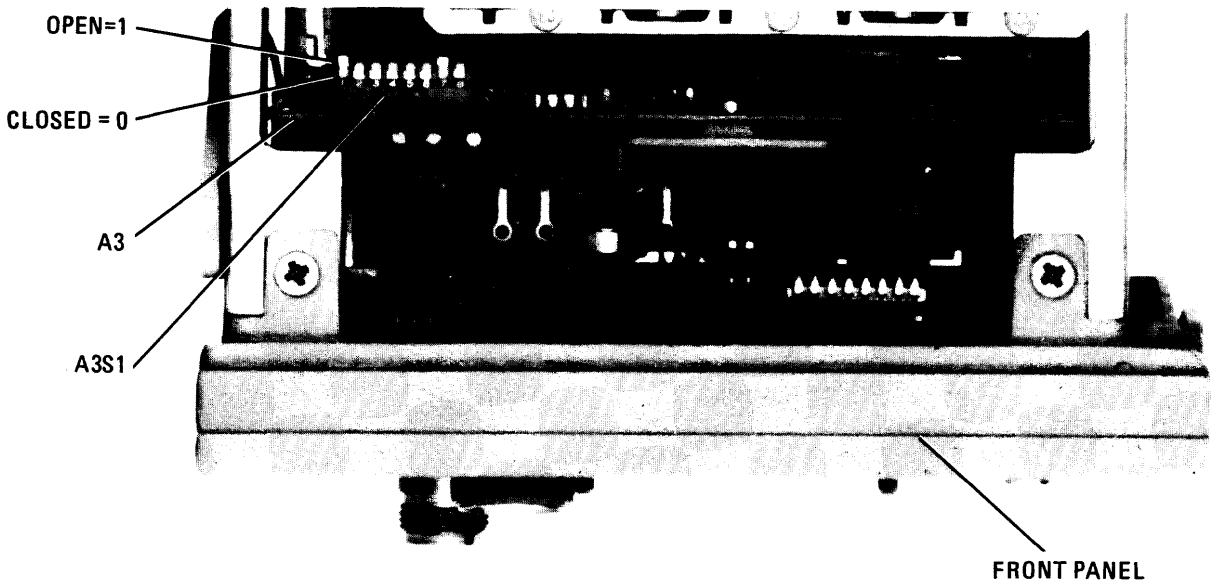
3-39. The 8350A FREQUENCY display will indicate RF plug-in error codes (50 to 99) or sweep oscillator error codes. Information on plug-in error codes may be found in Section VIII, Service, of this manual.

3-40. Fuses

3-41. Power circuits for the Model 83522A RF Plug-in are fused in the 8350A Sweep Oscillator. See the 8350A Sweep Oscillator Operating and Service Manual for fuse locations and replacement instructions.

3-42. Blue Service Tags

3-43. If the 83522A 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 Section III in this manual. Record any error codes noted on the FAILURE SYMPTOMS / SPECIAL CONTROL SETTINGS section of the tag.



Description	Switch Number							
	1	2	3	4	5	6	7	8
†Code for 83522A Plug-in (Note 4)	0	0	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	0	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 3-8. Configuration Switch

IV – Performance Tests

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. However, information specific to the performance testing of the HP 83522A can be found on the following pages (refer to paragraph 4-6).

4-3. Performance tests unique to this plug-in are also found in this section. None of the tests performed in this section expose the operator to hazardous voltage, nor do they require that any protective covers be removed.

4-4. EQUIPMENT REQUIRED

4-5. Equipment required for testing or adjusting the 83522A 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.

4-6. TEST RECORD

4-7. Table 4-2 provides a tabulated index of the performance tests, their acceptable limits, and a column for recording actual measurements.

4-8. 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 columns entitled "STEP" and "TEST CONDITIONS". The number in the STEP column refers to the procedure step in the 8350A manual; the information in the TEST 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 83522A.

4-9. RELATED ADJUSTMENTS

4-10. 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	83522A Adjustment	8350A Adjustment
4-13. Frequency Range and Accuracy		
CW Accuracy	5-17	5-19
Swept Frequency Accuracy	5-15 thru 5-18	
Marker Accuracy	5-15 thru 5-18	5-20
4-14. Output Amplitude		
Power Meter Leveling	5-25	
Power Variations	5-20 thru 5-22	
Power Level Accuracy	5-20, 5-22	
Power Sweep	5-24	
Slope Compensation	5-21	
4-15. Frequency Stability		5-11
4-16. Residual FM		5-11
4-19. Residual AM		5-11
4-21. FM Response	5-26	
4-16.* Internal Crystal Markers	5-27	

*Refers to paragraph number 4-16 in the 83522A manual.

4-11. CALIBRATION CYCLE

4-12. The performance tests listed in Table 4-2 should be performed in intervals of one year or less.

4-13. OPERATION VERIFICATION

4-14. 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.

4-15. PERFORMANCE TESTS

NOTE

Allow one hour warm-up of instrument before attempting the following tests.

PERFORMANCE TESTS

4-16. INTERNAL CRYSTAL MARKERS

SPECIFICATION:

Conditions: RF power level = +3 to +13 dBm; ≤10 markers/sweep. Harmonic markers of 10 and 50 MHz are available up to 2.4 GHz; 1 MHz harmonic markers are available below 1 GHz. Markers are available as intensity spots or as amplitude dips on the RF output.

DESCRIPTION:

The RF output is detected and displayed on a CRT. Sweep widths are selected to accomodate 10 harmonic markers generated by the internal 50 MHz crystal. Both amplitude and intensity markers are verified. The procedure is repeated for 1 and 10 MHz harmonic markers.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Oscilloscope	HP 1740A
Crystal Detector	HP 423B
10 dB Attenuator	HP 8491A OPT. 010

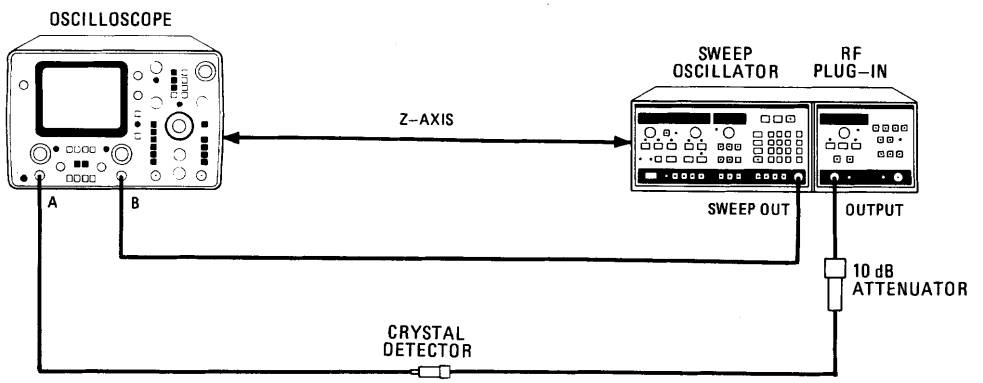


Figure 4-1. Crystal Marker Test Setup

4-16. INTERNAL CRYSTAL MARKERS (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-1.

2. Set oscilloscope for an A vs. B measurement. Set Channel B gain at 1V/DIV. Set Channel A gain as necessary.

3. On the 8350A press **INSTR PRESET** . Set 83522A power output between +3 and +13 dBm. Adjust oscilloscope POSITION control to center trace on screen.

50 MHz Markers

4. Press 8350A **CF** and at DATA ENTRY enter 260 MHz. Press **ΔF** and at DATA ENTRY enter 500 MHz. On the 83522A select **AMPTD MKR** and **50** MHz markers.

5. Verify the presence of 10 equally spaced and stable markers. Disengage **AMPTD MKR** and engage **INTENS MKR** . If necessary, decrease CRT beam intensity to verify that markers are operational as intensity spots.

6. Press 8350A **CF** . Press 83522A **AMPTD MKR** . Monitor markers while slowly rotating the left RPG until CF equals 2150 MHz. Verify that amplitude markers are equally spaced and stable across the frequency band.

10 MHz Markers

7. On the 8350A, press **CF** and at DATA ENTRY enter 60 MHz. Press **ΔF** , and at DATA ENTRY enter 100 MHz. On the 83522A, press **10** MHz markers and **AMPTD MKR** .

8. Verify the presence of 10 equally spaced and stable markers.

9. On the 8350A, press **CF** . Monitor markers while slowly rotating the left RPG until CF equals 2350 MHz. Verify that amplitude markers are equally spaced and stable across the frequency band.

1 MHz Markers

10. Press 8350A **CF** and at DATA ENTRY enter 15 MHz. Press **ΔF** and at DATA ENTRY enter 10 MHz. On the 83522A, press **1** MHz markers.

11. Verify the presence of 10 equally spaced and stable markers.

12. On the 8350A press **CF** . Monitor markers while slowly rotating left RPG until CF equals 995 MHz. Verify that amplitude markers are equally spaced and stable across the frequency band.

Table 4-2. Model 83522A Performance Test Record Card (1 of 3)

83522A 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		**NOTE: Perform FREQ CAL adjustment in Section III before proceeding with test.**			
CW Mode					
0.01–2.4 GHz: ±5 MHz	4.	Start frequency = 10 MHz		_____	10 MHz
	5.	Stop frequency = 2.4 GHz	2.4 GHz	_____	
	6.	CW frequency = 10 MHz	5 MHz	_____	15 MHz
		CW frequency = 1.00 GHz	0.995 GHz	_____	1.005 GHz
		CW frequency = 2.00 GHz	1.995 GHz	_____	2.005 GHz
Swept Frequency Accuracy					
0.01–2.4 GHz: ±15 MHz	8.	Start frequency = 10 MHz	0 MHz	_____	25 MHz
	8A.	Start frequency = 1 GHz	0.985 GHz	_____	1.015 GHz
	9.	Stop frequency = 2.4 GHz	2.385 GHz	_____	2.415 GHz
Marker Accuracy	12.	Sweep width: 0.01–2.4 GHz			
0.01–2.4 GHz:		M1 = 100 MHz*	73 MHz	_____	127 MHz
±15 MHz ±0.5% of sweep width		M2 = 500 MHz*	473 MHz	_____	527 GHz
		M3 = 1.0 GHz	0.973 GHz	_____	1.027 GHz
		M4 = 1.6 GHz	1.573 GHz	_____	1.627 GHz
		M5 = 2.2 GHz	2.173 GHz	_____	2.227 GHz
		*Not used for alternate test method.			
4-14. Output Amplitude					
Pwr. Mtr. Leveled: ±0.1 dB	9.			_____	<0.2 dB
Pwr. Lvl. Accuracy: ±1.0 dBm	12.	Power = +13.0 dBm	+12.0 dBm	_____	+14.0 dBm
Opt. 002: ±1.2 dBm	13.	+12.0	+11.0	_____	+13.0
Calibrated Range: ≤15 dB		+11.0	+10.0	_____	+12.0
Opt. 002: ≤85 dB		+10.0	+ 9.0	_____	+11.0
		+ 9.0	+ 8.0	_____	+10.0
NOTE		+ 8.0	+ 7.0	_____	+ 9.0
For Opt. 002, extend upper and lower limits in step 13 by 0.2 dB.		+ 7.0	+ 6.0	_____	+ 8.0
		+ 6.0	+ 5.0	_____	+ 7.0
		+ 5.0	+ 4.0	_____	+ 6.0
		+ 4.0	+ 3.0	_____	+ 5.0
		+ 3.0	+ 2.0	_____	+ 4.0
		+ 2.0	+ 1.0	_____	+ 3.0
		+ 1.0	0.0	_____	+ 2.0
		0.0	− 1.0	_____	+ 1.0
		− 1.0	− 2.0	_____	0.0
		− 2.0	− 3.0	_____	− 1.0
Max. Leveled Power: +13 dBm	15.			_____	+13.5 dBm
Internal Leveled: ±0.25 dB					
Power Sweep: ≤15 dB/SWP	17.	Power level = −2 dBm	≤15dB/SWP	_____	

Table 4-2. Model 83522A Performance Test Record Card (2 of 3)

SPECIFICATION TESTED: LIMITS	STEP	TEST CONDITIONS	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-15. Frequency Stability					
+5 to −10% V Line Change:	2.	CW frequency = 1.0 GHz			
0.01–2.4 GHz: ±20 kHz	3.	Low line voltage		_____	±20 kHz
	4.	High line voltage		_____	±20 kHz
Time (10 minutes):	5.	Power = +13 dBm			
0.01–2.4 GHz: ±100 kHz		CW frequency = 1.00 GHz			
	7.			_____	±100 kHz
10 dB Power Change:	9.	Power = +13 dBm			
0.01–2.4 GHz: ±100 kHz		CW frequency = 1.0 GHz			
	10.	Reduce power to +3 dBm		_____	±100 kHz
3:1 Load SWR:	13.	Power = +13 dBm			
0.01–2.4 GHz: ±10 kHz		CW Frequency = 1.3 GHz			
	14.			_____	≤20 kHz
4-16. Residual FM					
0.01–2.4 GHz: <5 kHz	2.	CW frequency = 1 GHz			
	5.			_____	<5 kHz
4-17. Spurious Signals					
Harmonic:					
0.01–2.4 GHz: ≤20 dB	3.	In dB below carrier	≤20 dB	_____	
Non-harmonic:					
0.01–2.1 GHz ≤30 dB			≤30 dB	_____	
2.1–2.4 GHz: ≤25 dB			≤25 dB	_____	
4-18. Output VSWR					
0.01–2.4 GHz: <1.5	6.	Range: 0.01–2.4 GHz		_____	<1.5
4-19. Residual AM					
0.01–2.4 GHz: ≤50 dB	3.	Power = +13 dBm			
		CW frequency = 1.0 GHz			
	5.	Measure relative to carrier	≤50 dB	_____	
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	±7 MHz	_____	
		previous setting	±5 MHz	_____	
			±1 MHz	_____	

Table 4-2. Model 83522A Performance Test Record Card (3 of 3)

SPECIFICATION TESTED: LIMITS	STEP	TEST CONDITIONS	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-21. FM Frequency Response					
DC–2 MHz: ±3 dB	5.	Test limits measured by display divisions.	2.9 div.	_____	5.6 div.
4-22. AM On/Off Ratio Square-Wave Symmetry					
On/Off Ratio:	1.	CW frequency = 1 GHz			
≤30 dB below specified max leveled power		Power = +13 dBm			
	3.		≤30 dB	_____	
Symmetry of ON/OFF time: 40/60	4.		40%	_____	60%
4-23. Step Attenuator Accuracy					
Attn. Step / Accuracy	1.	CW frequency = 1.0 GHz			
		Power = +7 dBm			
		Reference Attn. = 70 dB			
10 dB ±0.5 dB	4.				
20 dB ±0.7 dB		**Ref Attn Step / Attn Error / Deviation From 0 Ref**			
30 dB ±0.9 dB		70–60 _____ + _____		_____	≤±0.5 dB
40 dB ±1.2 dB		70–50 _____ + _____		_____	≤±0.7 dB
50 dB ±1.5 dB		70–40 _____ + _____		_____	≤±0.9 dB
60 dB ±1.8 dB		70–30 _____ + _____		_____	≤±1.2 dB
70 dB ±2.1 dB		70–20 _____ + _____		_____	≤±1.5 dB
		70–10 _____ + _____		_____	≤±1.8 dB
		70– 0 _____ + _____		_____	≤±2.1 dB
NOTE **The procedure for the following test is found on the pages immediately preceding this test card.**					
4-16. Internal Crystal Markers					
(+3 to +13 dBm; ≤10 mkrs/SWP)	5.		10 Mkrs/SWP	_____	
50 MHz: 10 Mkrs/SWP, <2.4 GHz	6.		10 Mkrs/SWP	_____	
10 MHz: 10 Mkrs/SWP, <2.4 GHz	8.		10 Mkrs/SWP	_____	
1 MHz: 10 Mkrs/SWP, <1 GHz	9.		10 Mkrs/SWP	_____	
	11.		10 Mkrs/SWP	_____	
	12.		10 Mkrs/SWP	_____	

V – Adjustments

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 83522A 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 83522A RF Plug-in and the 8350A Sweep Oscillator to warm up for 30 minutes 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-metalic 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 5-23) 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).
A2R6	BAND 0 OFFSET	5-19	Sets offset of frequency reference (1 V/GHz).
A3S1	Configuration Switch	5-13	Selects plug-in code, power-up power, FM sensitivity, FM modulation coupling, and step attenuator option code.
A4R1	SLP	5-20	Slope adjustment for frequency tracking voltage.
A4R2	0 HI	5-22	Sets power calibration at the high end of the power range (+13 dBm).
A4R4	BIAS	5-20	Sets bias on the internal detector line for 0 volts with RF power off.
A4R6	0 LO	5-20	Sets power calibration at the low end of the power range (0 dBm).
A4R7	0 MD	5-20	Sets power calibration at the middle of the power range (+9 dBm).
A4R9	PM	5-23	Sets power meter leveling calibration.
A4R11	GAIN	5-24	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, 5-22	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	526	Adjusts low frequency for best frequency response flatness through U10.
A5R19	FM	5-26	Sets balance of U10 video amplifier.
A5R34	BP 1	5-21	Breakpoint that works with SL1 (slope 1) for ALC flatness.

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

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A5R36	BP 2	5-21	Breakpoint that works with SL2 (slope 2) for ALC flatness.
A5R38	BP 3	5-21	Breakpoint that works with SL3 (slope 3) for ALC flatness.
A5R40	BP 4	5-21	Breakpoint that works with SL4 (slope 4) for ALC flatness.
A5R41	SL1	5-21	Slope adjustment for best ALC flatness.
A5R42	SL 2	5-21	Slope adjustment for best ALC flatness.
A5R43	SL 3	5-21	Slope adjustment for best ALC flatness.
A5R44	SL 4	5-21	Slope adjustment for best ALC flatness.
A5R48	SLP	5-21	Sets overall slope of internal leveling ALC.
A5R50	PWSP	5-25	Sets range for power sweep.
A5R75	HI	5-26	Works in conjunction with C14 to set frequency response flatness of ALC.
A6R11	G (gain)	5-15	Fine adjustment of tuning voltage from the scaling DAC.
A6R21	−10V	5-16	Sets −10 Volt reference.
A6R25	ZRO (zero)	5-15	Adjusts for gain and offset inaccuracies between +20 Volt frequency reference from U11 and summing amplifier U16.
A6R30	OFS (offset)	5-15	Fine adjustment of drive voltage from offset DAC.
A6R45	SP (Switch Point)	None	Sets the point where the frequency switches during a band crossing (not used in 83522A).
A6S1	OFFSET	5-17	Sets low end of band frequency accuracy.
A6S2	GAIN	5-17	Sets high end of band frequency accuracy.
A7R5	50M	5-27	Sets 50 MHz marker pulse width.
A7R6	10M	5-27	Sets 10 MHz marker pulse width.
A7R7	1M	5-27	Sets 1 MHz marker pulse width.

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

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A7R20	B2	5-14	Sets oscillator bias voltage at high end of band. (Not used in the 83522A.)
A7R21	S2	5-14	Sets break point of bias voltage at high end of band. (Not used in the 83522A.)
A7R26	S1	5-14	Sets break point of bias voltage at low end of band. (Not used in the 83522A.)
A7R27	B1	5-14	Sets oscillator bias voltage at low end of band. (Not used in the 83522A.)
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 frequency end of band.
A7R66	HI	5-18	Sets delay compensation at high frequency end of band.
A8C4	50 MHz	5-17, 5-27	Adjusts frequency of 50 MHz oscillator.
A8R29	1M	5-27	Adjusts bias of the internal mixer when 1 MHz marker is selected.
A8R30	10M	5-27	Adjusts bias of the internal mixer when 10 MHz marker is selected.
A8R31	50M	5-27	Adjusts bias of the internal mixer when 50 MHz marker is selected.
A8R53	1 MHz	5-27	Sets gain of video amplifier U1 when 1 MHz marker is selected.
A8R54	10 MHz	5-27	Sets gain of video amplifier U1 when the 10 MHz marker is selected.
A8R55	50 MHz	5-27	Sets gain of video amplifier U1 when the 50 MHz marker is selected.
A8R67	EXT	5-28	Sets gain of video amplifier U1 when EXTERNAL MARKER is selected.
A12A1R4	HARMONICS	None	Set for minimum harmonic content in RF output signal. (Not used in 83522A.)

Table 5-2. Factory Selected Components

Reference Designator	Adjustment Paragraph	Allowable Range of Values	Basis of Selection
A5R31	5-26	75 to 125 Ohms	Selects scaling of current drive of YIG Oscillator FM coil near 100 kHz.
A6R1	None		
A6R3	None		
A6R38	None		Selected at factory to correct for frequency nonlinearity in YIG Oscillator A12.
A6R39	None		
A6R40	None		
A6R41	None		
A7R4	5-27	Typ=1200 Ohms	Allows maximum marker OFF pulse without overlapping the ON pulse.
A8C3	5-27	5 to 12 pf	Center the range of 50 mHz frequency adjustment.
A8R28	5-28	Typ=3160 Ohms Max=5110 Ohms	Minimizes feedthrough of 27.8 kHz square wave into the external marker birdie.
A12A1R1	None		Factory selected to optimize A12 YO band-width, power, and harmonics (not field replaceable).
A12A1R2	None		

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 5-24
A5 FM	A4, A5	5-20 thru 5-26
A6 YO Driver	A6, A2, A7	5-14 thru 5-17, 5-19
A7 Marker	A6, A7, A8	5-14, 5-16, 5-18, 5-27
A8 Sampler	A7, A8	5-17, 5-27, 5-28
A12 YIG Oscillator	A6, A7, A2, A12, A5	5-14, 5-15, 5-16, 5-19, 5-20 thru 5-24, 5-26
A14 Amplifier	A4, A5	5-20 thru 5-24
A15 DC Return	A4, A5	5-20 thru 5-24
A16 Cavity Oscillator	A4, A5	5-20 thru 5-24
A17 Modulator/Mixer	A4, A5	5-20 thru 5-24
DC1 Directional Detector	A4, A5	5-20 thru 5-24

Table 5-5. Adjustments

Paragraph	Adjustments
5-13	Configuration Switch A3S1
5-14	Oscillator Bias on A7
5-15	-10V Reference on A6 YO Driver
5-16	YO Driver Board A6 DAC Calibration
5-17	Frequency Accuracy
5-18	Delay Compensation
5-19	Frequency Reference 1 V/GHz Output
5-20	ALC Adjustment
5-21	Internal Leveled Flatness
5-22	Power Calibration
5-23	Power Meter Leveling Calibration
5-24	ALC Gain Adjustment
5-25	Power Sweep
5-26	FM Driver
5-27	Marker and Sampler Adjustments
5-28	External Marker Adjustment

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 are selected by setting the eight switches 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 the 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.

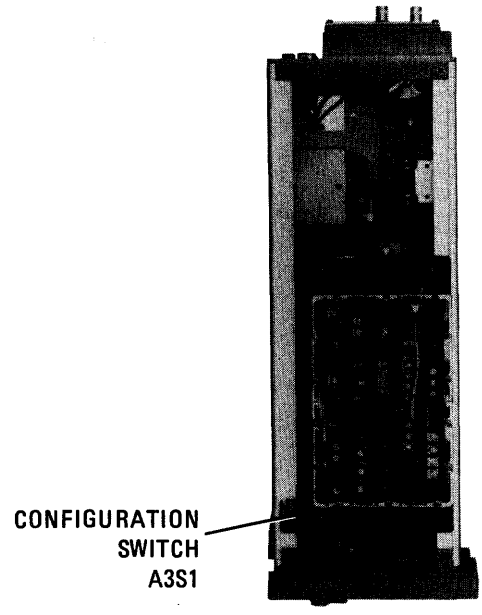


Figure 5-1. Configuration Switch A3S1 Location

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 83522A	0	0	0	x	x	x	x	x
Minimum 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 Modulation	x	x	x	x	x	1	x	x
Cross-Over Coupled FM Modulation	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

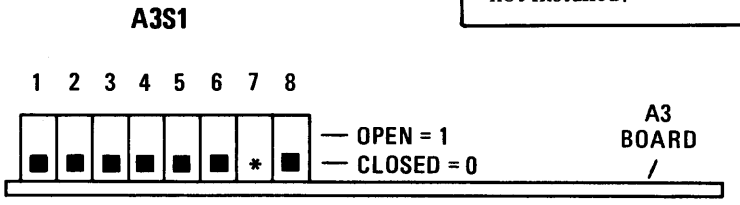
NOTES

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	0
3	0
4	0
5	0
6	0
7	*
8	x

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



■ = DEPRESSED SWITCH POSITION

5-14. OSCILLATOR BIAS ON A7

REFERENCE:

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

DESCRIPTION:

Oscillator bias breakpoints are not required in the 83522A. Setting A7R27 (B1) and A7R20 (B2) fully counterclockwise removes any shaping effects the A7 Oscillator Bias Shaping Control circuit has on the YO DRIVE Voltage.

PROCEDURE:

1. Adjust A7R27 (B1) fully counterclockwise. A7R26 (S1) should then have no effect. Refer to Figure 5-2 for the adjustment location.

2. Adjust A7R20 (B2) fully counter clockwise. A7R21 (S2) should then have no effect.

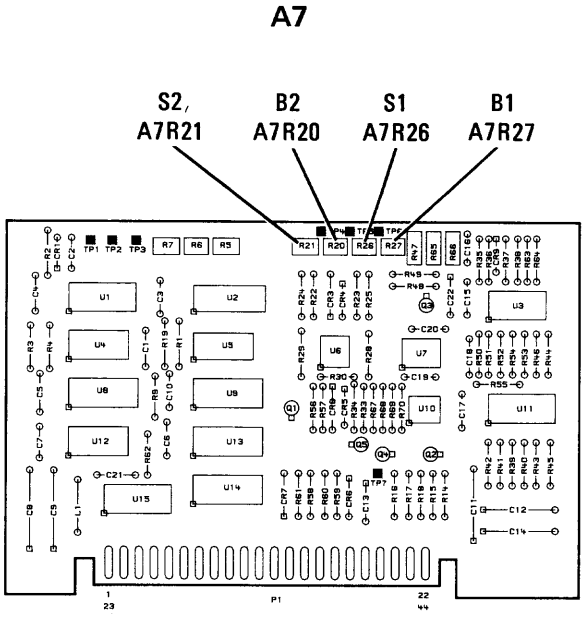


Figure 5-2. Oscillator Bias Test Point and Adjustment Location

5-15. −10V REFERENCE ON A6 YO DRIVER

REFERENCE:

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

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

DESCRIPTION:

The −10V REF in A6 is used as a reference voltage for the OFFSET DAC in A6, and in A4 ALC board, it is used as OFFSET REF for the power level reference circuit.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Digital Voltmeter (DVM)	HP 3455A

PROCEDURE:

1. Connect DVM to A6TP3 (−10V REF) and common to A6TP5 (Figures 5-3 and 5-4).
2. Adjust "−10" control A6R21 for −10.000 Vdc ±0.001 Vdc.

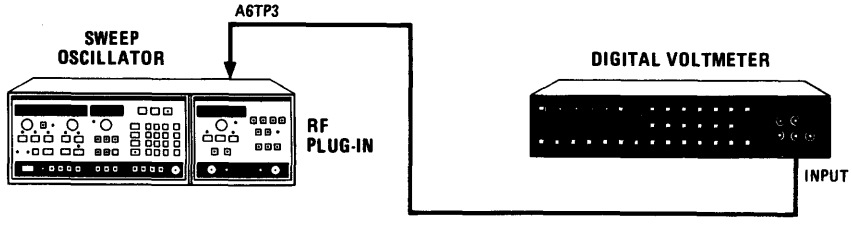


Figure 5-3. −10 Volt Reference Test Setup

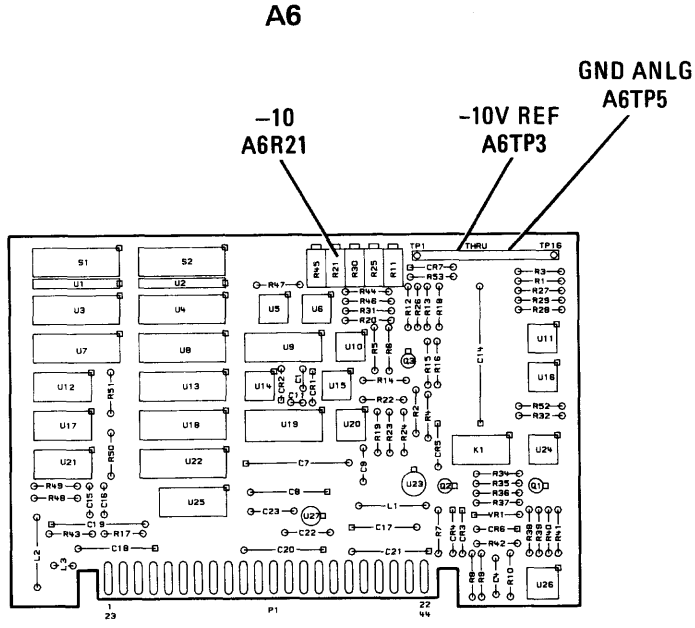


Figure 5-4. A6TP3 −10 Volt Reference Test Point Location

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.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Digital Voltmeter (DVM)	HP 3455A

PROCEDURE:

NOTE

YO Driver Board adjustments should be avoided if possible. Set up equipment as shown in Figure 5-8 and perform step 23 in Paragraph 5-17 to check frequency accuracy and sweep linearity across the band. If frequencies are within ±5 MHz tolerance, do not make these YO Driver Board adjustments.

1. Connect the equipment as shown in Figure 5-5 with the DVM connected to A6P1 pin 4 (FREQ CAL) and common connected to A6TP5 (GND ANLG).

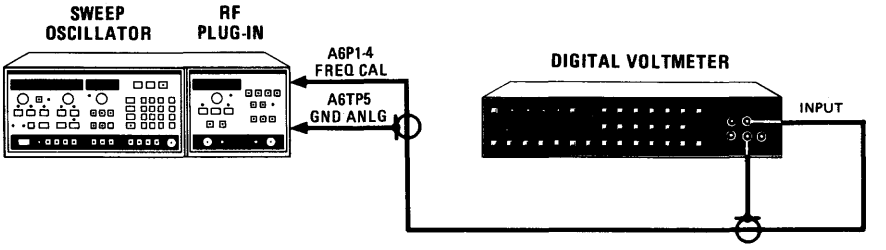


Figure 5-5. YO Driver Board Adjustment Test Setup

2. Press INSTR PRESET .
3. Adjust the 83522A front panel FREQ CAL knob for a DVM reading of 0.000 ± 0.010 Vdc. This sets the FREQ CAL control to the electrical center of its range.
4. Float ground on DVM and connect floating ground to A6TP13 (+20 V FREQ. REF.). Connect measurement lead of DVM to A6TP16. (See Figure 5-5 and 5-6.)

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

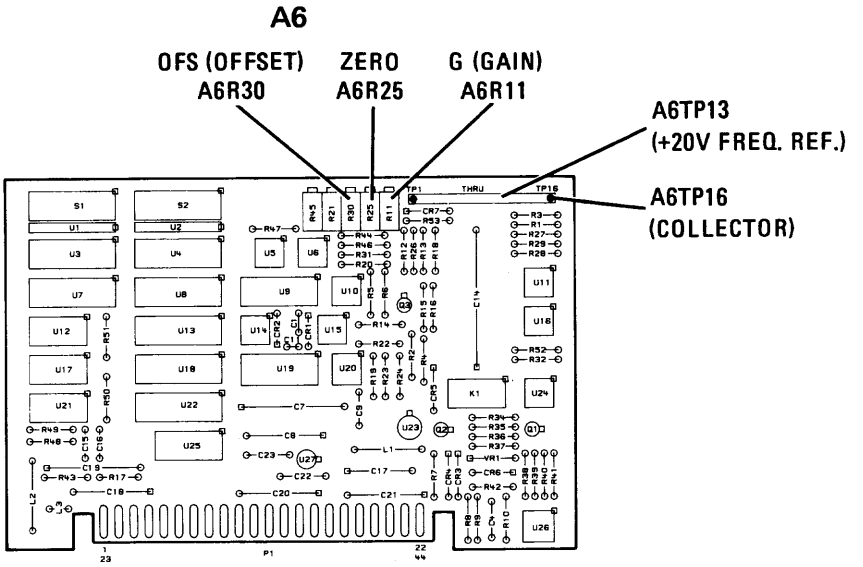


Figure 5-6. YO Driver Board Test Points

5. Press **CW** , then DATA ENTRY of 2.4 GHz.

NOTE

SHIFT 00 selects data entry, making key M1 function as address code entry, and key M2 as data code entry.

6. Press **SHIFT** , then DATA ENTRY of 00.

7. Make DATA ENTRY of 2C80. (Refer to HEX entry key diagram in Figure 5-7 for location of "C".)

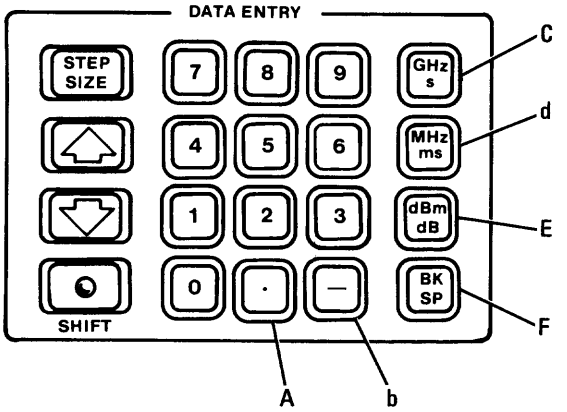


Figure 5-7. Front Panel Hexadecimal Entry Keys

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

8. Press M2 , then DATA ENTRY of 00.

9. Press ◄ to shift address to 2C81.

10. Press M2 , then DATA ENTRY of 40.

11. Press ◄ to shift address to 2C82.

12. Press M2 , then DATA ENTRY of 00. If the DVM indication is not −6.250 ± 0.010 Vdc, adjust A6R11 "G" (gain) to set it to −6.250 ± 0.010 Vdc. Note the actual DVM reading to within ± 0.1 mVdc accuracy. This value will be used in step 16 of this procedure.

NOTE

The accuracy of the adjustment in steps 12 through 16 is dependent upon the relative difference between the value noted in step 12 and the adjustment value in step 16. The absolute value of the voltage set in step 12 is selected to ensure that the A6 YO Driver circuits are operating within the correct range as the adjustments are made. If −6.250 ± 0.010 Vdc cannot be achieved when adjusting A6R11 (G) in step 12, set it as close as possible and note this value for use in step 16.

13. Press M2 then DATA ENTRY of FF.

14. Press ► to shift address to 2C81.

15. Press M2 then DATA ENTRY of 4F.

16. Add −12.9968 to the value previously noted in step 12. If the voltage in step 12 was set to exactly −6.250 Vdc, this new value would then be −19.2468 Vdc (−6.2500 + −12.9968 = −19.2468). Adjust A6R30 "G" to this new value ± 0.1 mVdc.

NOTE

If it was not possible to set the voltage to −6.250 Vdc in step 12, add −12.9968 to the value noted in step 12. Adjust A6R30 "OFS" to this new value. If there is insufficient range to adjust it to the new value, a circuit malfunction exists. Refer to troubleshooting procedures in Section VIII to correct the problem.

17. Press M2 then DATA ENTRY of 0F. Adjust A6R25 "ZERO" for −12.6218 Vdc ±0.1 mVdc.

18. Press M2 then DATA ENTRY C0.

19. Press ◄ to shift address to 2C82.

20. Press M2 then DATA ENTRY of 00.

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

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

22. Repeat steps 4 through 21 to check for the 12.9968 volt difference between steps 12 and 16 with no further adjustment.

5-17. FREQUENCY ACCURACY

REFERENCE:

Performance Test: 8350A Paragraph 4-13
Service Sheet: A6 and A8

DESCRIPTION:

The frequency accuracy of the marker reference oscillator is first set to 50 MHz using a frequency counter. The frequency accuracy of the RF plug-in band is then set by selecting special calibration modes (shift 90 for the low end of band and shift 91 for the high end). In these calibration modes, the RPG acts as the calibration adjustment and a resulting frequency error code is displayed on the front panel FREQUENCY display as the RF output frequency is monitored with a frequency counter. This error code is then entered into the A6 calibration switches (A6S1 for the low end and A6S2 for the high end). After the frequency accuracy is set, the 50 MHz markers are roughly checked for accuracy at the center of the band within the range of the the FREQ CAL control.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Digital Voltmeter	HP 3455A
Frequency Counter	HP 5343A
10 dB Attenuator	HP 8491A Option 010
1 : 1 Probe	HP10007B

PROCEDURE:

50 MHz Oscillator Calibration

NOTE

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

1. Press 8350A INSTR PRESET , set STOP frequency to 2 GHz, and press 83522A AMPTD MKR . Connect Frequency Counter to A8TP1 through the 1 : 1 probe (Figures 5-8 and 5-9) and check that output frequency is 50.000 MHz ±250 Hz. If not, adjust A8C4 50 MHz Oscillator for correct frequency. If necessary, select A8C3 for correct adjustment range. Refer to Adjustment paragrapgh 5-27.

5-17. FREQUENCY ACCURACY (Cont'd)

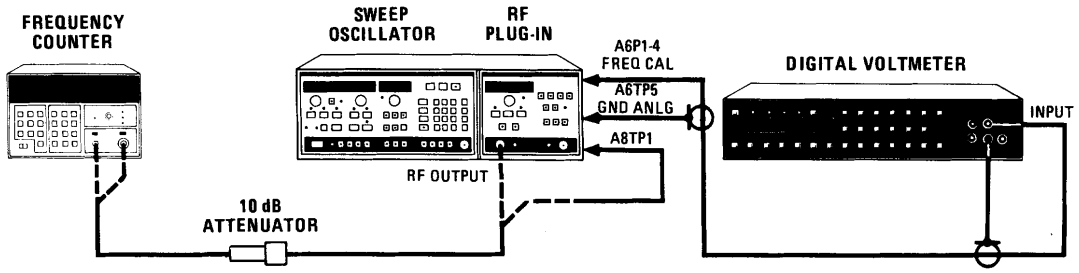


Figure 5-8. Test Setup for Frequency Accuracy Adjustments

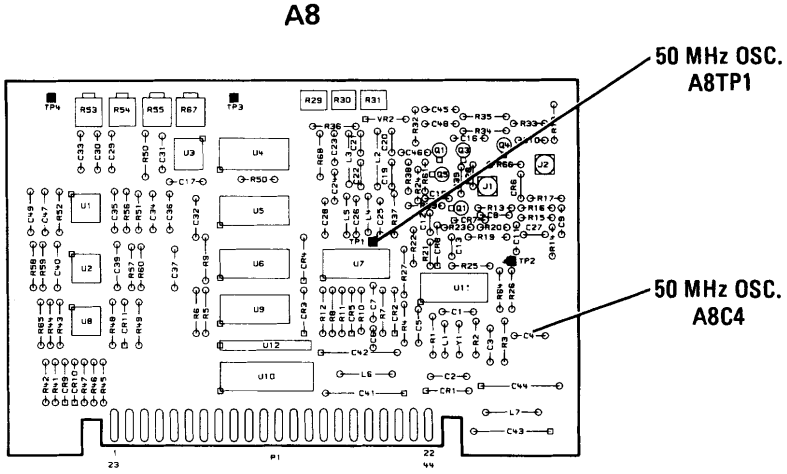


Figure 5-9. 50 MHz Oscillator Output and Adjustments

Frequency Accuracy Calibration

2. Connect equipment as shown in Figure 5-8 with frequency counter and 10 dB attenuator connected to RF OUTPUT. Connect the DVM to A6P1 pin 4 (FREQ CAL) and common to A6TP5 (GND ANLG).

3. Press INSTR PRESET

4. Adjust FREQ CAL knob for a DVM reading of 0.000 ± 0.010 Vdc. This sets the FREQ CAL adjustment to the electrical center of its range.

5. Press CW , then at DATA ENTRY enter 50 MHz.

6. Press SAVE then 1 .

5-17. FREQUENCY ACCURACY (Cont'd)

7. Press CW , then at DATA ENTRY, press 2.4 GHz.
8. Press SAVE then 2 .
9. Press CW , then at DATA ENTRY enter 1.2 GHz.
10. Press SAVE 3 .
11. Press RECALL 1 and 50 MHz should be displayed.
12. Press SHIFT , then 90. (This selects low end frequency calibration mode.)
13. Adjust POWER RPG control for a reading of 50 MHz on external frequency counter.
14. Set switch A6S1 (Figure 5-10) for the value displayed in POWER window. Refer to the diagram in Figure 5-11.

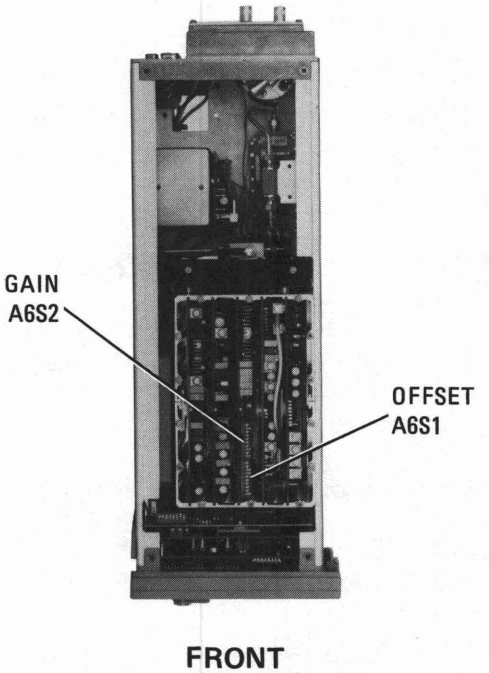


Figure 5-10. Frequency Calibration Adjustments Location

5-17. FREQUENCY ACCURACY (Cont'd)

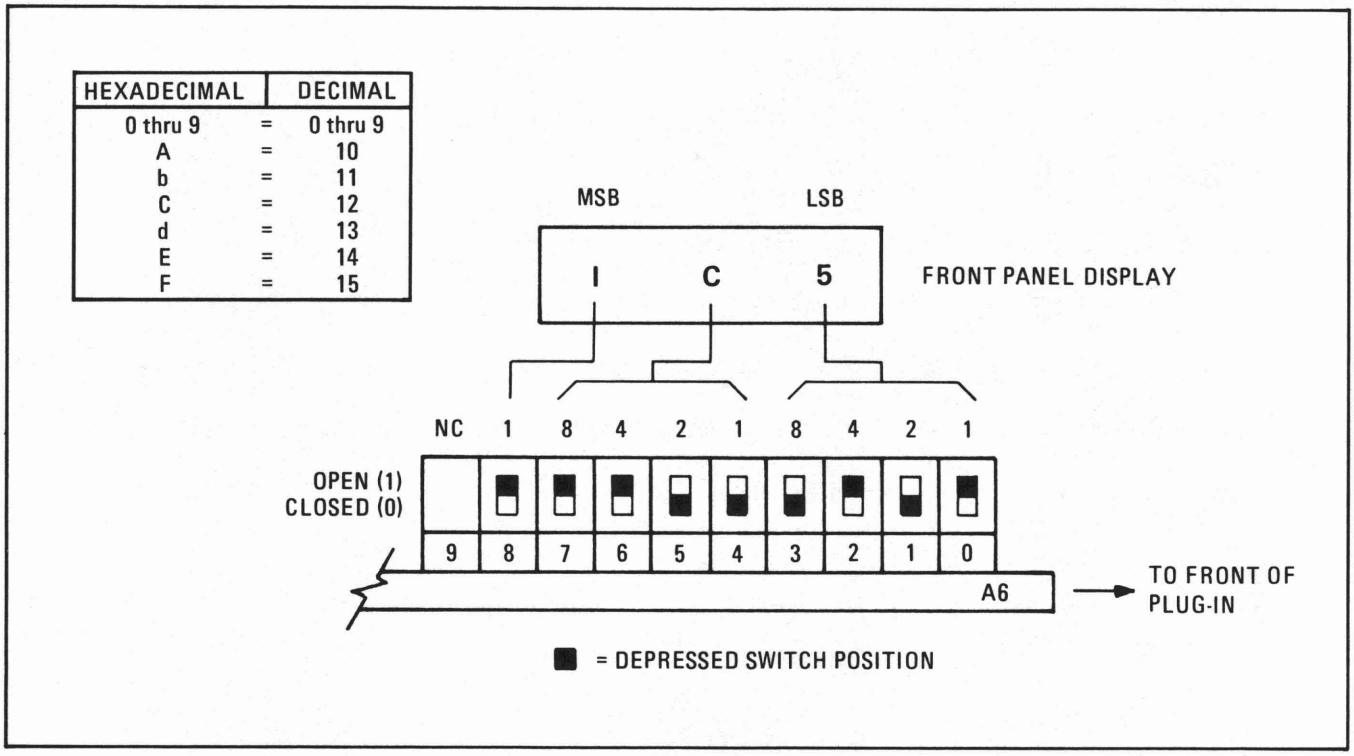


Figure 5-11. A6S1 and A6S2 Frequency Calibration Switch Configuration

15. Press INSTR PRESET , then RECALL 1 .
16. Verify that a setting of 50 MHz on 8350A produces a 50 MHz ± 5 MHz indication on the external frequency counter.
17. Press RECALL 2 and 2.400 GHz should be displayed.
18. Press SHIFT , then 91. (This selects high end frequency calibration mode.)
19. Adjust POWER RPG control for a reading on the external frequency counter of 2.400 GHz.
20. Set A6S2 (Figure 5-10) for the reading displayed in the POWER window.
21. Press INSTR PRESET , then RECALL 2 .
22. Verify that a setting of 2.400 GHz on 8350A produces an 2.400 GHz ±5 MHz indication on the external frequency counter.
23. Manually adjust FREQUENCY across high band and check for corresponding external counter readings ±5 MHz. Check at 100 MHz, 500 MHz, 1.0 GHz, 1.5 GHz, and 2.0 GHz.

5-17. FREQUENCY ACCURACY (Cont'd)

50 MHz Marker Accuracy Check

24. Press RECALL 1 and 50 MHz should be displayed.

25. Press 50 MHz MARKER then INTENS MKR .

26. Adjust FREQ CAL control so the MKR lamp lights.

27. Press RECALL 3 and 1.200 GHz should be displayed. The external frequency counter should read 1.200 GHz ±5 MHz. This indicates that the Frequency Accuracy Adjustments have been properly performed.

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. The Frequency Calibration procedure is first done to ensure that the proper frequencies are referenced during the adjustment procedure. An 8350A amplitude marker is used as the frequency reference (which will not change as sweep time is modified). At a slow (0.5 second) sweep time, the 8350A amplitude marker is set adjacent to an 83522A 50 MHz crystal marker at the frequency of interest. Sweep time is then decreased to 10 milliseconds and delay in the YO is observed as a shift in the spacing between the 8350A amplitude marker and the 83522A crystal marker. At sweep speeds faster than 100 milliseconds, delay should not exceed ±5 MHz (the difference between CW and Swept Frequency accuracies).

EQUIPMENT:

Sweep Oscillator	HP 8350A
Digital Voltmeter	HP 3455A
Oscilloscope	HP 1740A

5-18. DELAY COMPENSATION (Cont'd)

PROCEDURE:

NOTE

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

1. Connect the equipment as shown in Figure 5-12 with the DVM connected to A6TP6 (DELAY COMP) and common to A6TP5 (GND ANLG).

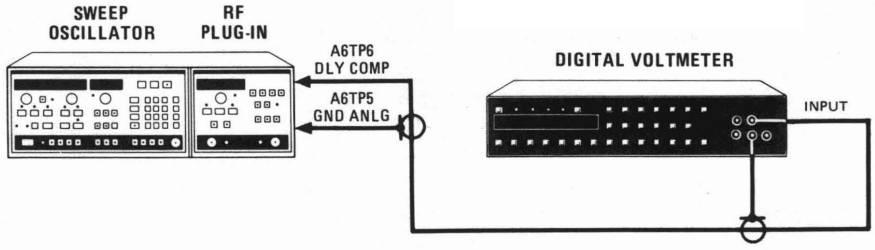


Figure 5-12. Delay Compensation Offset Adjustment Test Setup

2. On the 8350A, press INSTR PRESET .
3. On the 8350A, select CW mode and with the DVM, measure and note the voltage at A6TP6 (DELAY COMP).
4. Press CF , then ΔF . At DATA ENTRY, enter 0 MHz.
5. Adjust A7R47 (Z) for the same reading at A6TP6 as was obtained in step 3. Refer to Figure 5-13 for the adjustment location. Remove the DVM test leads.
6. On the 8350A, press INSTR PRESET CW 5 0 MHz .
7. On the 83522A, press AMPTD MKR . (50 MHz Marker Frequency switches on automatically at Instrument Preset.)
8. Adjust the 83522A FREQ CAL control until the MKR lamp is on.
9. On the 8350A, press 1 0 MHz .
10. On the 83522A, press 10 MHz marker.
11. Fine adjust the FREQ CAL control (if needed) until the MKR lamp is on.
12. On the 83522A, press 1 MHz marker.

5-18. DELAY COMPENSATION (Cont'd)

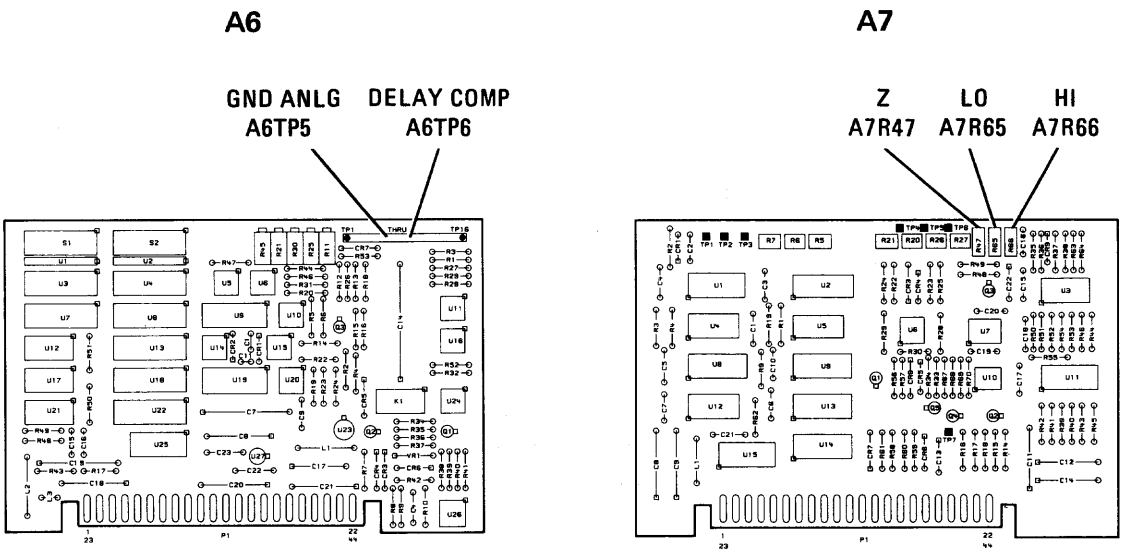


Figure 5-13. Delay Compensation Adjustment Locations

13. A small adjustment of the **FREQ CAL** control may be necessary for the MKR lamp to light. The RF output frequency (and crystal marker frequency) is now calibrated accurately. Do not change the position of the FREQ CAL control for the remainder of the test or the frequency calibration will be lost.

14. Connect the equipment as shown in Figure 5-14. On the 8350A, press **INSTR PRESET**, then **CF**, **M1 1 5 0 MHz**, **SWEEP TIME .5 S**.

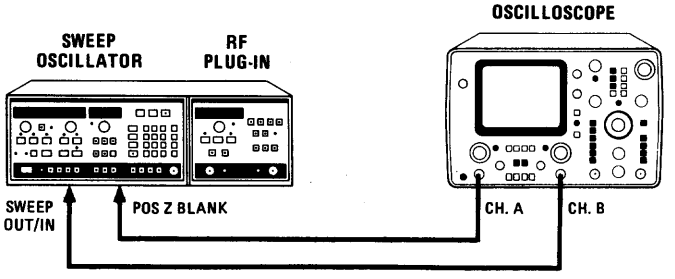


Figure 5-14. Delay Compensation Adjustment Test Setup

5-18. DELAY COMPENSATION (Cont'd)

15. On the 83522A, ensure that the power is set to +13 dBm and press INTENS MKR .

16. Set the oscilloscope controls as follows:

Display Mode	A vs.B
Display	MAG X10
Ch. A Vertical Sensitivity	2V/DIV
Ch. B Vertical Sensitivity	1V/DIV

Adjust the HOIZONTAL POSITION control to set the start of sweep exactly on the leftmost graticule.

NOTE

Although the HP 1740A is the specified oscilloscope, the use of an oscilloscope with a variable persistance screen may be advantageous in order to more clearly see the 50 MHz markers when the sweep speed is decreased to 10 milliseconds.

17. On the 8350A, press SHIFT OFFSET . Rotate the VERNIER to place the third crystal marker (150 MHz marker) exactly 0.4 divisions to the left of the leading edge of the 8350A amplitude marker as shown in Figure 5-15. It may be necessary to fine adjust the oscilloscope horizontal position control and the Channel A vertical position control to move the leading edge of the 8350A amplitude marker and the desired crystal marker to a convenient graticule which may be used as a point of reference.

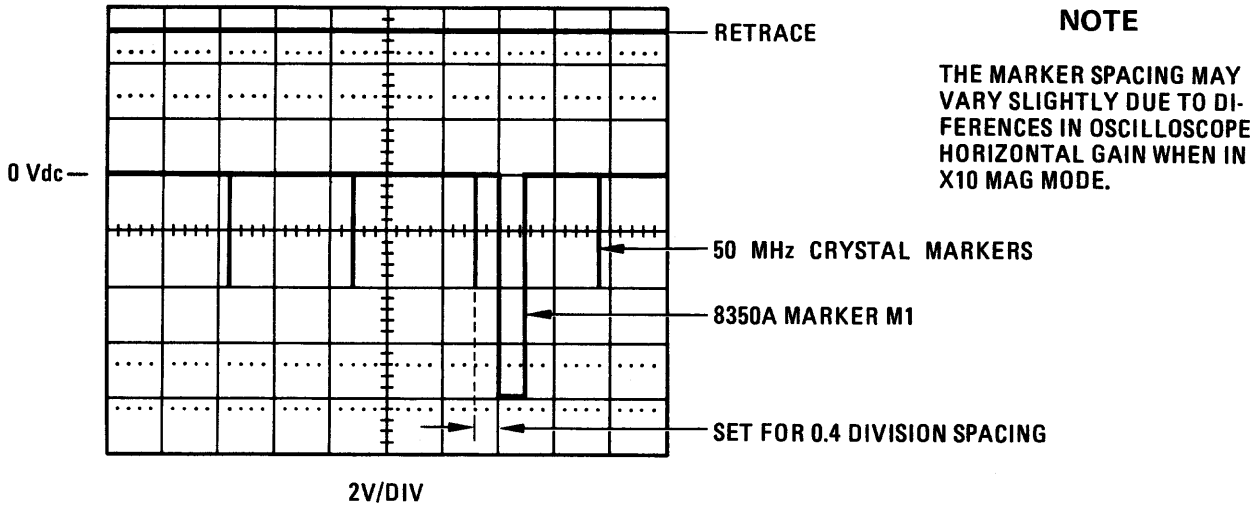


Figure 5-15. Delay Compensation Adjustment Waveform

5-18. DELAY COMPENSATION (Cont'd)

18. On the 8350A, press SWEEP TIME 10 mSEC .

19. Adjust A7R65 "LO" (low end of band) to again place the third crystal marker exactly 0.4 divisions to the left of the 8350A amplitude marker. It may be necessary to fine adjust the oscilloscope horizontal position control to reset the 8350A amplitude marker to the reference graticule selected in step 17.

20. Rotate the 8350A FREQUENCY/TIME vernier to change the sweep time from 10 milliseconds to 0.5 seconds. The spacing between the 8350A amplitude marker and the crystal marker used should not vary greater than ±5 MHz from its original position set in step 17 (determined by ±1/10 the distance between 50 MHz markers).

21. On the 8350A, press SWEEP TIME S S .

22. Adjust the oscilloscope HORIZONTAL POSITION control to look at the highest frequency crystal marker possible (up to 2.4 GHz).

NOTE

The highest frequency marker available may be limited by the gain of the oscilloscope horizontal deflection amplifiers when used in the X10 magnification mode. Sufficient accuracy may be obtained by using any marker greater than 1.6 GHz.

23. On the 8350A, press M1 . Rotate the 8350A FREQUENCY/TIME vernier to place the marker near center screen on the oscilloscope. Temporarily removing the oscilloscope from X10 magnification will aid in finding and moving the marker. Reset the oscilloscope to X10 magnification before proceeding.

24. On the 8350A, press SHIFT OFFSET . Rotate the VERNIER to place the desired crystal marker exactly 0.4 divisions to the left of the leading edge of the 8350A amplitude marker as shown in Figure 5-15. It may be necessary to fine adjust the oscilloscope horizontal position control to move the leading edge of the 8350A amplitude marker to a convenient graticule which may then be used as a point of reference.

25. On the 8350A, press SWEEP TIME 10 mSEC .

26. Adjust A7R66 "HI" (high end of band) to again place the crystal marker selected in step 24 exactly 0.4 divisions to the left of the 8350A amplitude marker. A slight readjustment of the oscilloscope horizontal position control may again be necessary.

27. Rotate the 8350A FREQUENCY/TIME vernier to change the sweep time from 10 milliseconds to 0.5 seconds. The spacing between the 8350A amplitude marker and the crystal marker used should not vary greater than ±5 MHz from its original position set in step 24 (determined by ±1/10 the distance between 50 MHz markers).

5-19. FREQUENCY REFERENCE 1V/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 output. Example: 1 GHz = 1 Volt; 2.4 GHz = 2.4 Volts, etc.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Digital Voltmeter	HP 3455A

PROCEDURE:

NOTE

Frequency accuracy must be adjusted accurately (Paragraph 5-17) before adjusting Frequency Reference 1 V/GHz output.

1. Connect a DVM to A2TP1 (Figure 5-16).

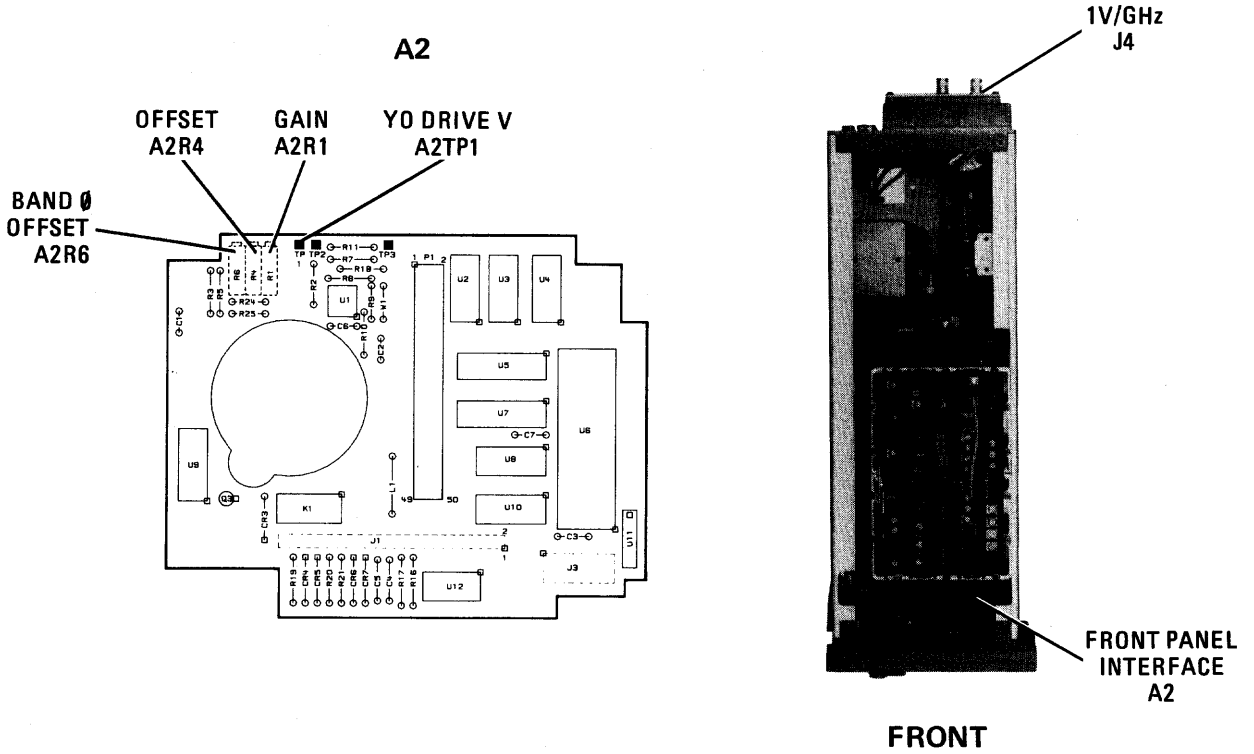


Figure 5-16. Frequency Reference Adjustments Location

5-19. FREQUENCY REFERENCE 1V/GHz OUTPUT (Cont'd)

2. Adjust A2R6 "Band 0 Offset" to the center of its mechanical range.
3. Connect the DVM to the rear panel 1V/GHz Frequency Reference connector, J4.
4. Press CW , then at DATA ENTRY enter 2.4 GHz.
5. Adjust A2R4 "OFFSET" for a DVM reading of 2.400 Vdc ±2 mVdc.
6. Press CW , then at DATA ENTRY enter 10 MHz.
7. Adjust A2R1"GAIN" for a DVM reading of 10 mVdc ±2 mVdc.
8. Repeat steps 3 through 7 until there is no change.

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 5-24. 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 amplifier. Power is roughly calibrated and low band flatness is optimized.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Digital Voltmeter	HP 3455A
Power Meter	HP 436A
Power Sensor	HP 8481A
Swept Amplitude Analyzer	HP 8755C/HP 182T
Detector	HP 11664A
Extender Board	HP 08350-60031
10 dB Pad	HP 8491A Opt. 010

5-20. ALC ADJUSTMENT (Cont'd)

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), and at the 8350A Sweep Oscillator, 27.8 kHz square wave modulation is selected.

1. Remove A5 FM Driver board. Place A4 assembly on an extender board. Set A4R1 (SLP) fully counterclockwise. Sweep the full range of the plug-in at any leveled power.

2. Connect the digital voltmeter to A4TP12 with floating ground on A4TP14. Refer to Figure 5-18. Adjust A4R47 OFS 1 (offset 1) for 0.000V ± 0.001V.

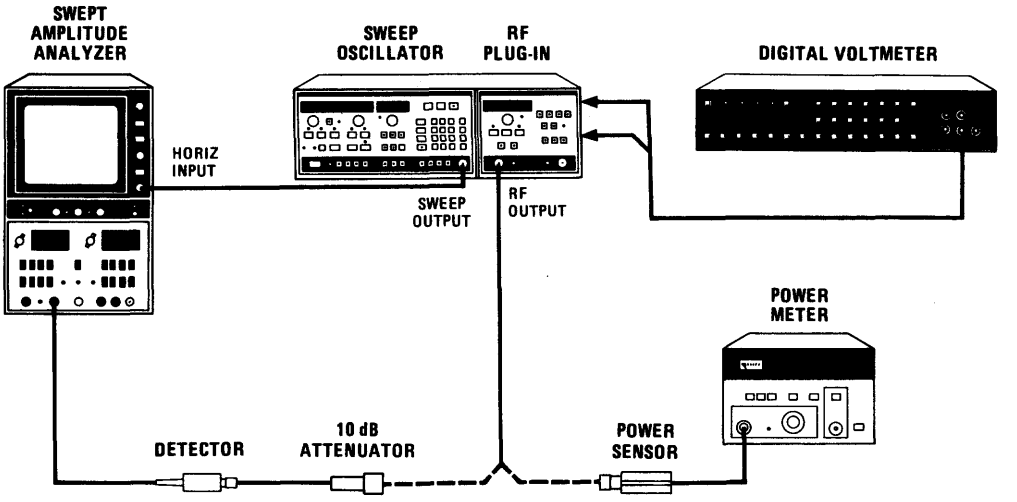


Figure 5-17. ALC Adjustments Test Setup

5-20. ALC ADJUSTMENT (Cont'd)

A4

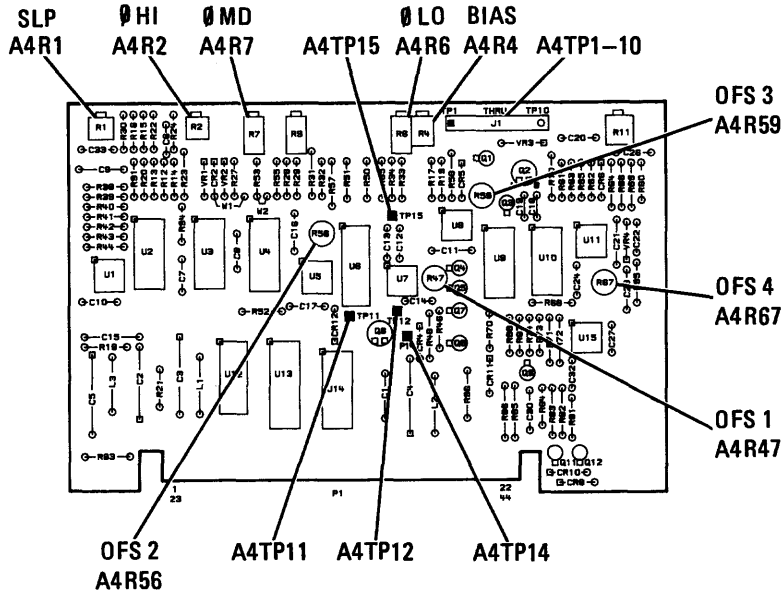


Figure 5-18. ALC Adjustments Location

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 low to A4TP15 (floating ground) and connect DVM high to A4TP12. Adjust A4R59 OFS 3 (offset 3) for 0.002V ± 0.001V.

5. Press 8350A front panel **CW** and ensure that the power is leveled (83522A UNLEVELED light off). Connect DVM high to A4TP7 and DVM low to A4TP15 (floating ground). Adjust A4R67 OFS 4 (offset 4) for 0.000V ± 0.001V.

6. Set CW frequency to 50 MHz. Turn off **RF** power. Connect DVM to A4TP10 and adjust A4R4 (BIAS) for 0.000V ± 0.001V. Turn on **RF** power.

7. 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 to 83522A RF OUTPUT.

8. Set **POWER** for plug-in front panel reading of +0 dBm at 50 MHz. Adjust A4R6 0 LO (low power) for an RF OUTPUT power at the 83522A connector of +0 dBm ± 0.1 dB.

9. Set **POWER** for plug-in front panel reading of +9 dBm. Adjust A4R7 0 MD (mid power) for an RF OUTPUT power at the 83522A connector of +9 dBm ± 0.1 dB.

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

5-20. ALC ADJUSTMENT (Cont'd)

11. Set POWER for plug-in front panel reading of +13 dBm. Adjust A4R2 0 HI (high power) for an RF OUTPUT power at the 83522A connector of +13 dBm ± 0.1 dB.

12. Disconnect power meter and monitor the RF output with the 8755C. Press 8350A INSTR PRESET to sweep the full range of the plug-in. Select 8350A ⊔⊓ MOD for compatibiliy with the 8755C. Set power for front panel reading of +0 dBm. Select RF BLANK . Press SAVE 1 .

13. Adjust A4R1 SLP (slope) for best overall flatness from 10 MHz to 2.4 GHz as observed on the 8755C.

NOTE

The FM PC Board will be reinstalled in Paragraph 5-21.

5-21. 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 5-24. 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.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Swept Amplitude Analyzer	HP 8755C/HP 182T
Detector	HP 11664A
10 dB Attenuator	HP 8491A Option 010

5-21. INTERNAL LEVELED FLATNESS (Cont'd)

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 the A5 FM Driver Assembly. Connect equipment as shown in Figure 5-19, with the 8755C monitoring the RF output. Select 8350A ⊔⊓ MOD . Sweep the full range of the plug-in.

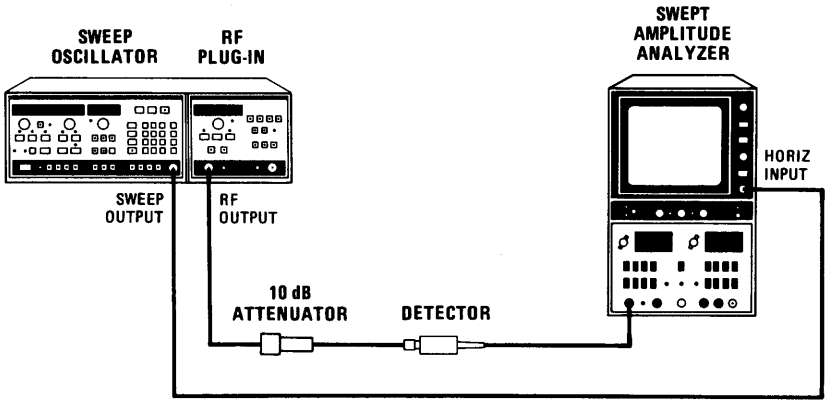


Figure 5-19. Internal Leveling Adjustment Setup

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 5-20. This effectively removes the circuit from the leveling loop.

5-21. INTERNAL LEVELED FLATNESS (Cont'd)

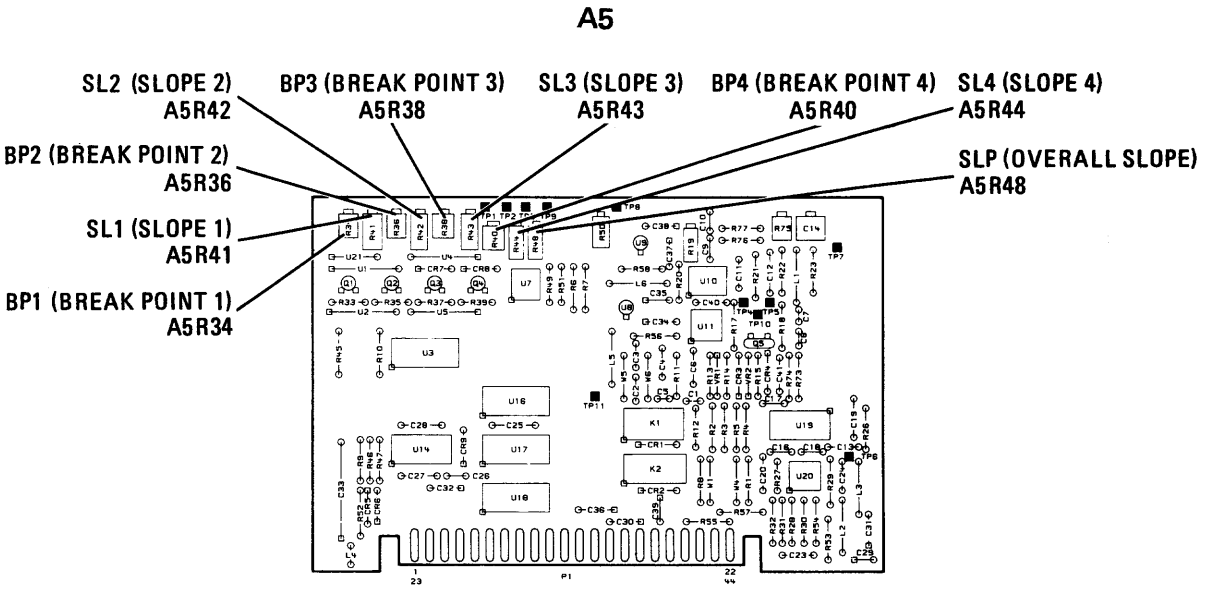


Figure 5-20. Internal Leveling Adjustments Location

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.

NOTE

If flatness does not meet specification and some or all of the breakpoint and slope adjustments are ineffective, center all nine potentiometers and repeat the procedure.

5-22. POWER CALIBRATION

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-24. Deviation from this routine may cause improper leveling and/or flatness problems.

5-22. POWER CALIBRATION (Cont'd)

REFERENCE:

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

DESCRIPTION:

Power is calibrated on a power meter at three breakpoints over the leveled power range: 0, +9, and +13 dBm.

EQUIPMENT

Sweep Oscillator	HP 8350A
Swept Amplitude Analyzer	HP 8755C/HP 182T
Detector	HP 11664A
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), and at the 8350A Sweep Oscillator, 27.8 kHz square wave modulation is selected.

1. Connect equipment as shown in Figure 5-21, with the 8755C monitoring the RF output. Select 8350A ⊓ MOD . Observe the full band trace and select a frequency where the power level is approximately in the center of the power variation range. Select CW mode at that frequency. Set POWER for a front panel indication of +0 dBm.

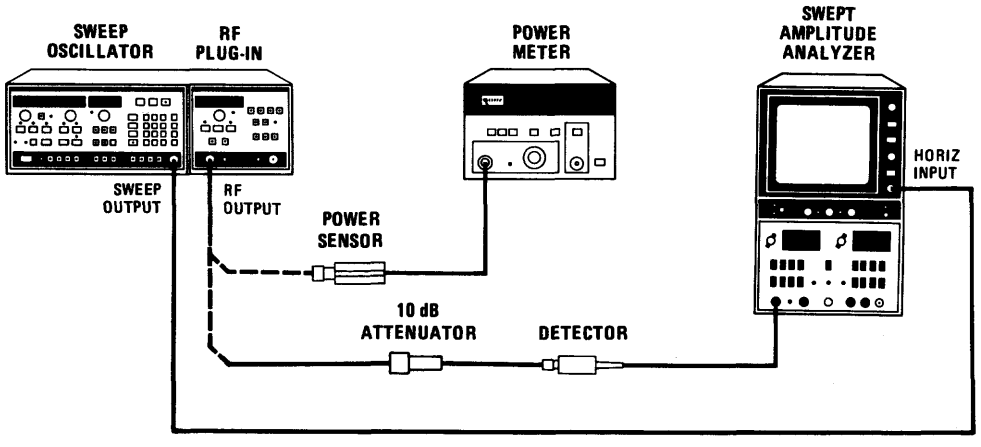


Figure 5-21. Power Calibration Test Setup

5-22. POWER CALIBRATION (Cont'd)

NOTE

If the following steps result in A4R6 and A4R7 being adjusted near the stops, connect DVM low to A4TP15 (floating ground) and DVM high to A4TP12. Adjust A4R59 for −0.2 mV ±0.01 mV.

2. Remove detector and connect power meter to RF OUTPUT. On 8350A, press MOD to turn off modulation (annunciator off). Adjust A4R6 (0 LO) for RF OUTPUT power at the 83522A connector of +0 dBm ±0.1 dBm. Set POWER first to −2 dBm, note power meter reading, then set POWER to +2 dBm and note power meter reading. The deviation from 0 dBm should be equal and opposite. If not, readjust A4R6 (0 LO).

3. Set power for front panel indication of +9 dBm. Adjust A4R7 (0 MD) for RF OUTPUT power at the 83522A connector of +9 dBm ±0.1 dBm.

4. Iterate steps 2 and 3 until low and midpower ranges are calibrated.

5. Set power for front panel indication of +13 dBm. Adjust A4R2 (0 HI) for RF OUTPUT power at the 83522A connector of +13 dBm ±0.1 dBm.

6. Step the RF power in 1 dB intervals from +0 to +13 dBm. RF OUTPUT power at the 83522A connector should be the indicated front panel setting ±0.1 dBm. If necessary, readjust 0 LO, 0 MD, and 0 HI to calibrate power.

A4

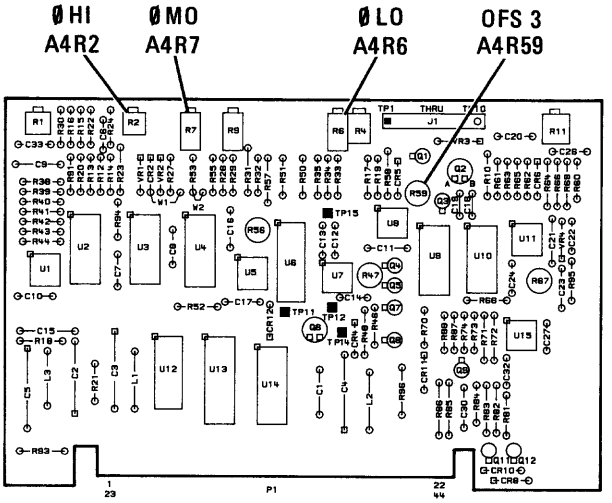


Figure 5-22. Power Calibration Adjustment Location

5-23. POWER METER LEVELING CALIBRATION

NOTE

Complete adjustment of the leveling loop for Power Meter leveling requires several procedures to be performed in the order prescribed from Paragraph 5-20 through 5-24. 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.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Power Meter	HP 432A
Thermistor Mount	HP 478A
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 5-26) counterclockwise. This adjustment will be set in the next procedure.

1. Connect equipment as shown in Figure 5-23. Ensure 8350A ⊓⊓ MOD is off. Press CW and select a frequency at midband.

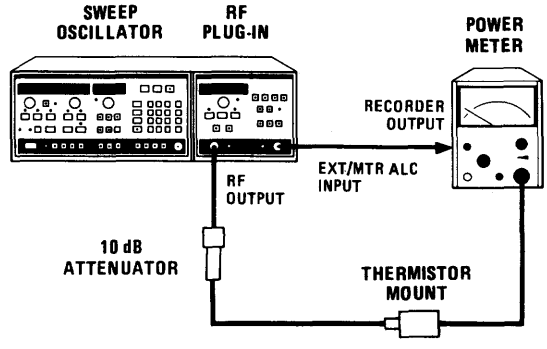


Figure 5-23. Power Meter Leveling Calibration

5-23. POWER METER LEVELING CALIBRATION (Cont'd)

2. Set 83522A **POWER LEVEL** to +5 dBm. Set power meter **RANGE** switch to 0. Adjust 83522A **POWER LEVEL**, if necessary, to obtain a meter reading of −5.

3. Press 83522A **MTR ALC** mode. Adjust 83522A front panel **CAL** knob to return the power meter needle to its previous position at −5.

4. Increase the 83522A **POWER LEVEL** by exactly 5.0 dBm. Adjust A4R9 "PM" (Figure 5-24) for a power meter reading of 0 (83522A front panel power indication should be approximately +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.

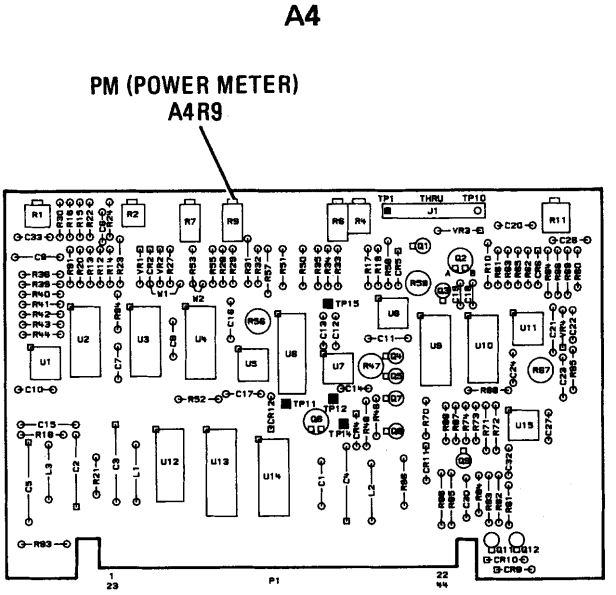


Figure 5-24. Power Meter Leveling Adjustment Location

5-24. 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 5-24. Deviation from this routine may cause improper leveling and/or flatness problems.

REFERENCE:

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

5-24. ALC GAIN ADJUSTMENT (Cont'd)

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.

EQUIPMENT

Sweep Oscillator	HP 8350A
Oscilloscope	HP 1740A
Crystal Detector	HP 423A
Power Meter	HP 432A
Thermistor Mount	HP 478A
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 5-25.

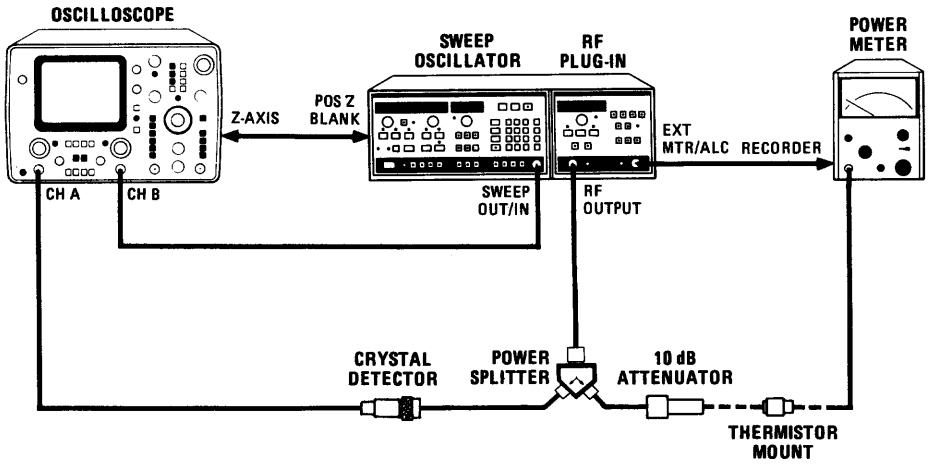


Figure 5-25. ALC Gain Adjustment Test Setup

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.

5-24. ALC GAIN ADJUSTMENT (Cont'd)

4. Set the power meter RANGE switch to +5 dBm. Note the power meter needle position.

5. On the 83522A, press MTR ALC mode.

6. On the 8350A, press SWEEP TIME 50 SEC .

7. If necessary, adjust the output power with the 83522A front panel POWER control 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 −10 dB. This attenuates the output power by 15 dB. The 83522A is now operating at the low end of its calibrated power range, approximately −2 dBm.

8. Observe the trace dot as it sweeps across the CRT. Adjust A4R11 "GAIN" (Figure 5-26) clockwise, increasing the gain of the ALC loop, until the trace dot begins to oscillate. Then, reduce the gain slightly to eliminate oscillations and obtain a focused "dot" trace.

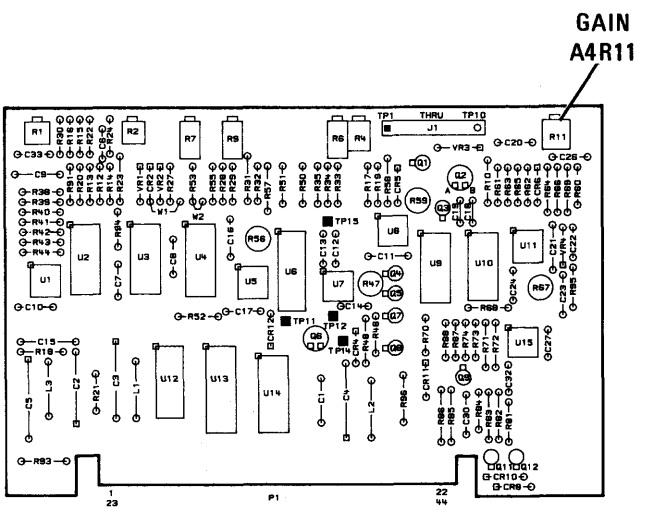


Figure 5-26. ALC Gain Adjustment Location

9. Set the 83522A to the maximum leveled power by returning the power meter RANGE switch to the previous setting of +5 dB. Observe the trace through the entire sweep to ensure no oscillations at high power. If oscillations occur, reduce the gain by adjusting A4R11 "GAIN" counterclockwise.

10. Press 8350A INSTR PRESET . The 83522A should now be internally leveled at the maximum specified power level.

11. On the oscilloscope, adjust Channel A vertical sensitivity to obtain the internally leveled sweep trace at center screen. If oscillations are present, further reduce loop gain by adjusting A4R11 "GAIN" counterclockwise.

12. Reduce the 83522A power level to +2 dBm with the 83522A front panel POWER control. If oscillations occur as the sweep progresses, further reduce gain by adjusting A4R11 "GAIN" counterclockwise.

5-25. 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.

EQUIPMENT:

Sweep Oscillator	HP 8350A
Swept Amplitude Analyzer	HP 8755C/HP 182T
Detector	HP 11664A
10 dB Attenuator	HP 8491A Option 010

PROCEDURE:

NOTE

ALC gain adjustments (paragraph 5-24) must be checked before power sweep adjustment are 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 modulation is selected.

1. Connect equipment as shown in Figure 5-27. Select 8350A ⎍ MOD .

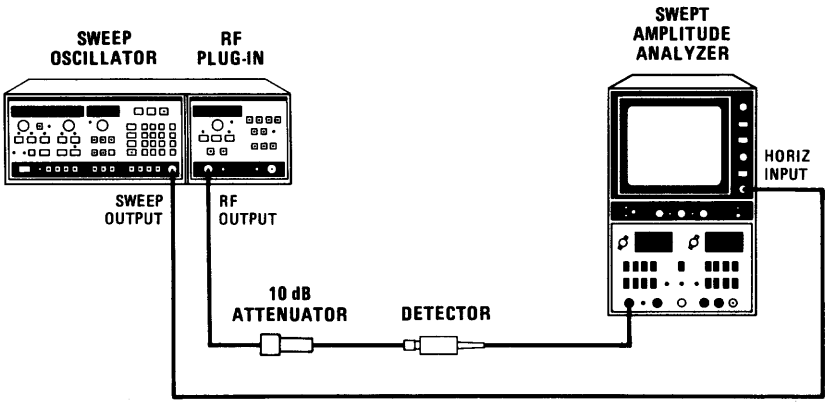


Figure 5-27. Power Sweep Test Setup

5-25. POWER SWEEP (Cont'd)

2. Select SHIFT CW mode and set power level to 0 dBm.
3. Press POWER SWEEP and at DATA ENTRY select 10 dB/sweep.
4. While observing 8755C display of RF output, adjust A5R50 PWSP (power sweep) (Figure 5-28) for 10 dB/sweep.

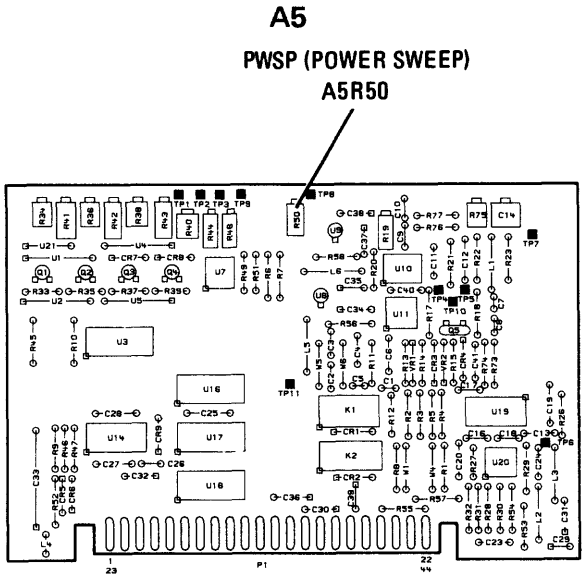


Figure 5-28. Power Sweep Adjustment Location

5-26. 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 modulation applied. A delay-line discriminator is used to detect and display FM modulation 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.

5-26. FM DRIVER (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8350A
Digital Voltmeter (DVM)	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 5-29 except disconnect function generator from rear panel FM INPUT connector.

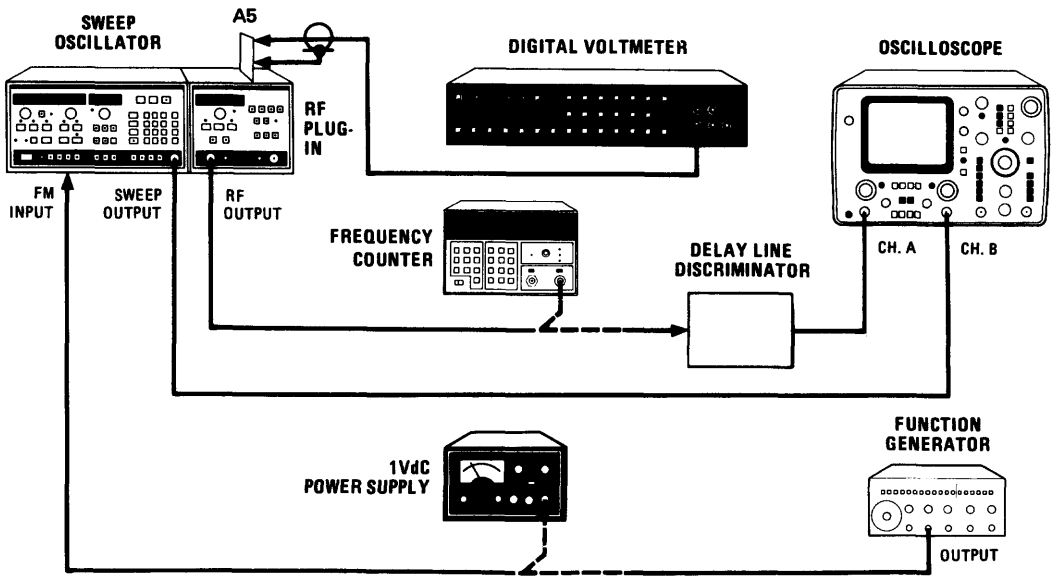


Figure 5-29. Test Setup for FM Driver Adjustments

5-26. FM DRIVER (Cont'd)

2. Place A5 FM Driver on extender board.

3. Connect DVM between A5 board connector pin 21 and A5TP7 (ground). (See Figure 5-30.) Adjust A5R19 "FM OFFSET" control for zero Vdc ±1 mVdc.

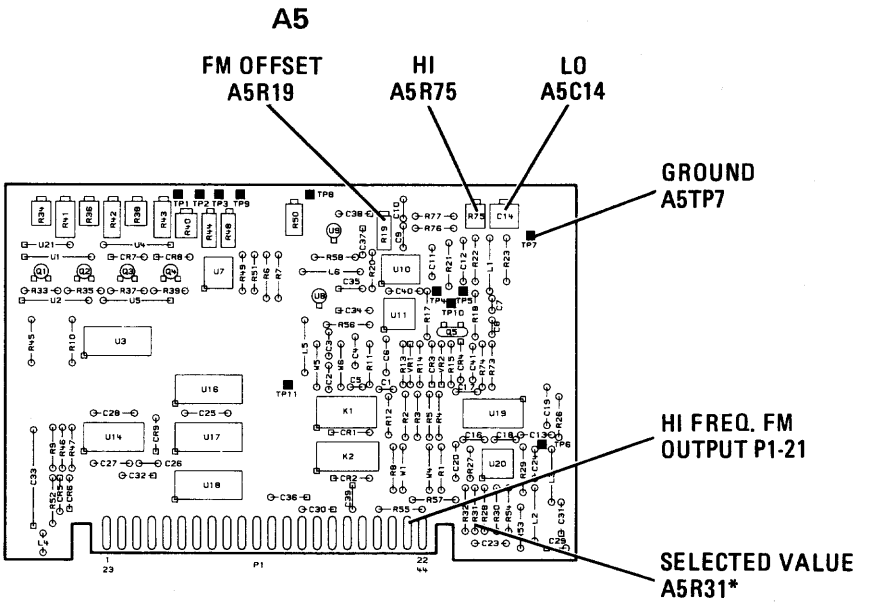


Figure 5-30. A5 FM Driver Adjustment Location

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

CW FREQUENCY ..... 1.2 GHz
FREQUENCY Sweep Mode ..... Press SHIFT CW (swept CW)
CW VERNIER ..... On
SWEEP TRIGGER ..... INT
RF BLANK ..... OFF

83522A RF PLUG-IN

POWER LEVEL ..... +13 dBm
CW FILTER ..... OFF
ALC MODE ..... INT
Configuration switch A3S1 on Digital Interface board (Table 5-6) set as follows:

5-26. FM DRIVER (Cont'd)

Switch No.	1	2	3	4	5	6	7	8
Position	0	0	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 83522A code, maximum RF power at power-up, −20 MHz/V FM sensitivity, cross-over coupled FM modulation (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 ..... 50 Ohms
CHANNEL A V/DIV 0.005V
CHANNEL B INPUT ..... DC
CHANNEL B V/DIV 1

Flatness

6. Connect Frequency Counter to 83522A RF OUTPUT. Connect a +1 Vdc power supply to rear penel 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 modulation sensitivity.) Reconnect Delay Line Discriminator to RF OUTPUT and connect function generator to rear panel FM INPUT connector.

7. Adjust CW FREQUENCY and CW VERNIER for waveform at the center of oscilloscope CRT. Adjust oscilloscope Channel A "CAL" conrol for a trace 4 cm high centered on CRT.

8. Manually sweep function generator frequency from DC to 100 kHz. Select resistor A5R31 (Figure 5-30) so amplitude at 100 Hz and at 100 kHz are the same ±0.2 cm on CRT. Refer to Table 5-2 for the allowable range of values for A5R31.

5-26. FM DRIVER (Cont'd)

9. Manually sweep function generator frequency from DC to 10 MHz. Adjust A5C14 "LO" and A5R75 "HI" controls several times (Figure 5-30) 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 5-31). 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 above and make compromise adjustments in the DC to 2 MHz range to meet flatness requirements.

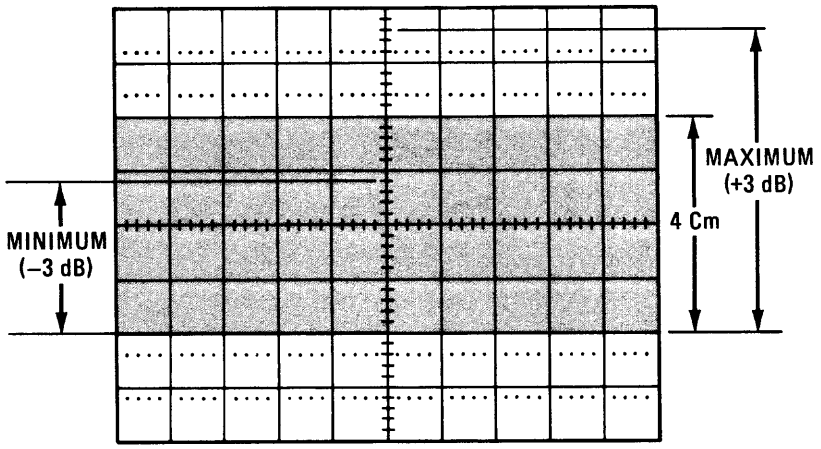


Figure 5-31. FM Flatness Tolerance, DC to 2 MHz

5-27. MARKER AND SAMPLER ADJUSTMENTS

REFERENCE:

Performance Test: Paragraph 4-16
Service Sheets: A7 and A8.

DESCRIPTION:

Internal crystal markers are generated by mixing derivatives of a 50 MHz crystal oscillator with the sweep. Proper marker functioning requires adjustment of the crystal oscillator, the internal mixer, and IF gain for each marker frequency.

5-27. MARKER AND SAMPLER ADJUSTMENTS (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8350A
Oscilloscope	HP 1740A
Frequency Counter	HP 5343A
50 Ohm Termination	HP 909A

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).

1. Place A8 assembly on extender board. Connect equipment as shown in Figure 5-32. Terminate 83522A RF output in 50 Ohms. Set 1740A Oscilloscope to A vs. B sweep mode to obtain horizontal deflection as a function of the 8350A SWEEP OUT.

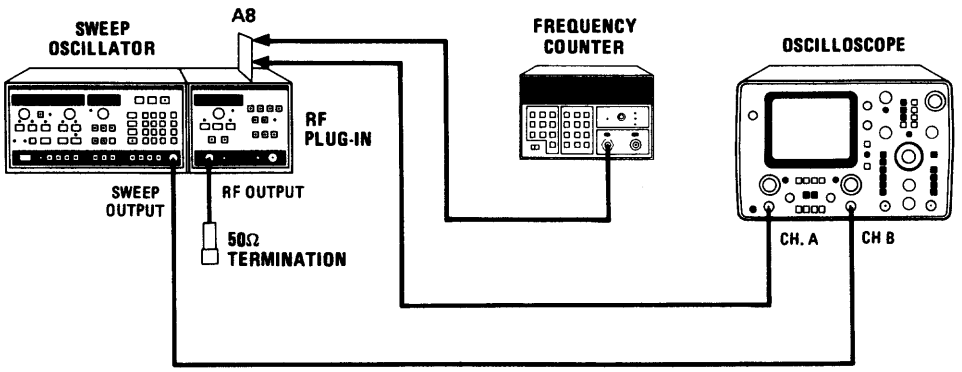


Figure 5-32. Marker Adjustments Test Setup

5-27. MARKER AND SAMPLER ADJUSTMENTS (Cont'd)

2. Set 8350A START/STOP sweep for 10 MHz to 2.4 GHz. Select 83522A AMPTD MARKERS . Connect counter with 1:1 capacitive probe to A8TP1. Adjust A8C4 (Figure 5-33) for frequency counter indication of 50 MHz ±250 Hz. If A8C4 does not have the range required to adjust the 50 MHz crystal oscillator, select a new value for A8C3. (An increase in capacitance will decrease frequency.)

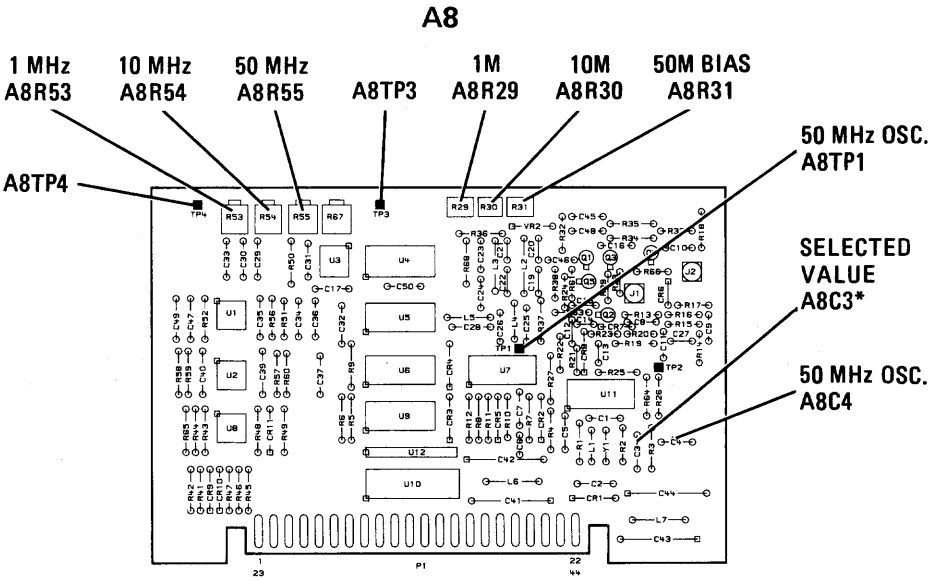


Figure 5-33. Marker Adjustments on A8

3. Select 100 ms Sweep Time. Connect oscilloscope with 1:1 probe to A8TP3 (Figure 5-33). Set 8350A power to +13 dBm and select 1 MHz Markers. Adjust A8R29 (1M) for the flattest envelope height. (See Figure 5-34.) Select 10 MHz Markers. Adjust A8R30 (10M) for the flattest envelope height (Figure 5-33). Select 50 MHz markers. Adjust A8R31 (50M) for the flattest envelope height. (Optimum setting for these adjustments will be ones that provide the most uniform birdie height across the band with the adjustments nearest the center of their range.) Especially note birdie height at the high-frequency end and set the adjustment just before the marker amplitude drops off.

4. Connect oscilloscope to A8TP4 (Figure 5-33). Set RF POWER to 0 dBm. Adjust IF gain potentiometers A8R53 (1 MHz), A8R54 (10 MHz), and A8R55 (50 MHz) for each marker frequency to an average envelope height of 1.0 V p-p.

5. Adjust oscilloscope Channel B vernier for a horizontal deflection of exactly 10 divisions. Set 8350A CF = 1 GHz, ΔF = 10 MHz. Select 50 MHz Markers. Center the birdie envelope on the screen with plug-in front panel FREQ CAL control. (See Figure 5-35.) Then select 10 MHz Markers. Change ΔF to 1 MHz. Recenter birdie. Display is now calibrated for 100 kHz/Division.

5-27. MARKER AND SAMPLER ADJUSTMENTS (Cont'd)

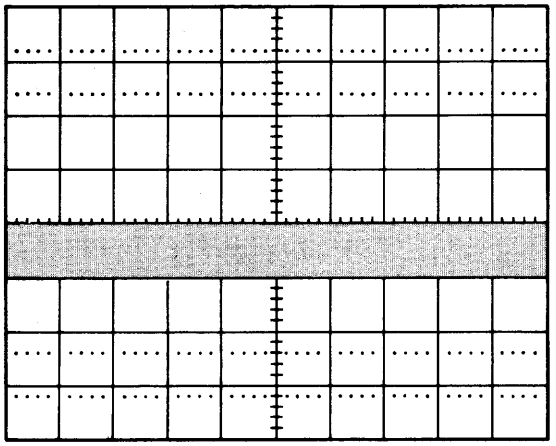


Figure 5-34. Marker Envelope

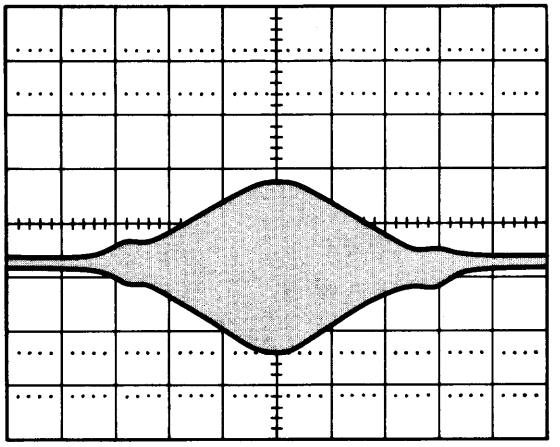


Figure 5-35. 50 MHz Birdie

6. Connect scope probe to A7TP1 (Figure 5-36). Adjust A7 Marker Threshold potentiometers for the proper pulse width of each marker as follows:

NOTE

The previous step calibrates the oscilloscope display to 100 kHz/Division.

50 MHz: Adjust A7R5 (50M) for 600 kHz p-p (6 divisions)
10 Mhz: Adjust A7R6 (10M) for 400 kHz p-p (4 divisions)
1 MHz: Adjust A7R7 (1M) for 200 kHz p-p (2 divisions)

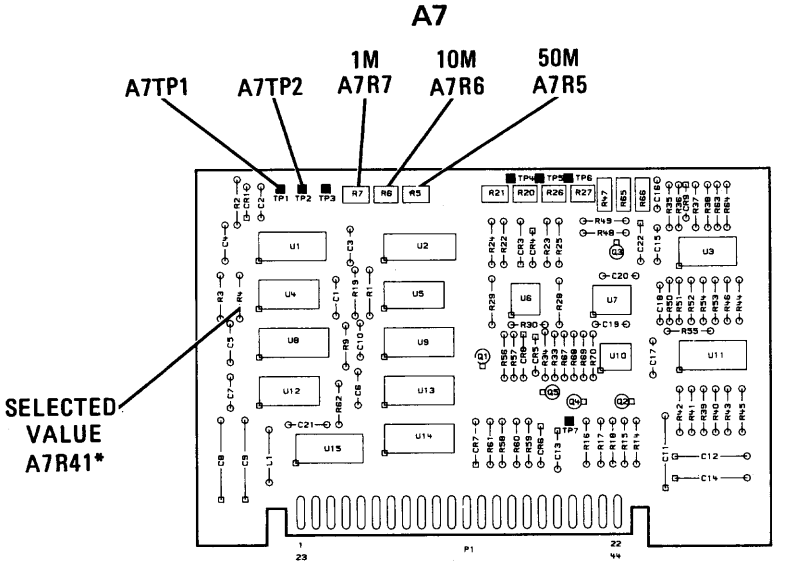


Figure 5-36. Marker Adjustments on A7

5-27. MARKER AND SAMPLER ADJUSTMENTS (Cont'd)

7. Press INTENS MKR . Connect the oscilloscope probe to A7TP2. First, ensure that marker OFF pulses exist on both sides of the marker ON pulse. (Decreasing the oscilloscope BEAM INTENSITY will expose the marker ON pulses.) (See Figure 5-37.) While the crystal markers may function properly without them, the marker-off pulses provide a safeguard against false markers appearing on the display.

8. Secondly, ensure that the marker OFF pulse does not overlap the marker ON pulse. Figure 5-38 illustrates an improper marker OFF pulse. When this occurs, change the value of A7R4 to eliminate overlap. The optimum value for A7R4 allows the maximum number of marker OFF pulses without overlapping the ON pulse. The typical value for A7R4 is 1200 Ohms and the minimum value is 1000 Ohms. (To observe marker OFF pulses, vary RF OUTPUT power between +3 dBm and +13 dBm.)

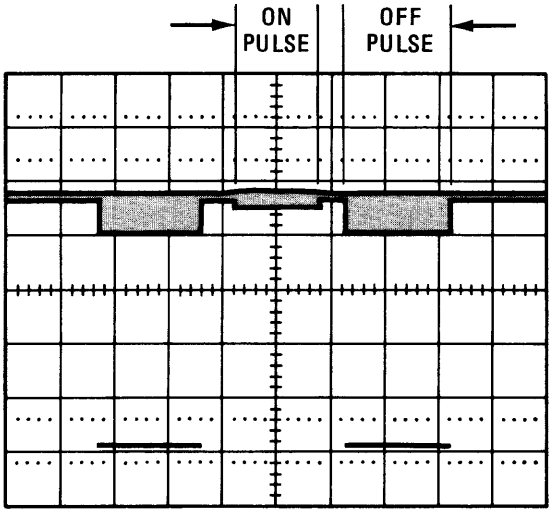


Figure 5-37. On/Off Pulse of Correctly Adjusted Circuit

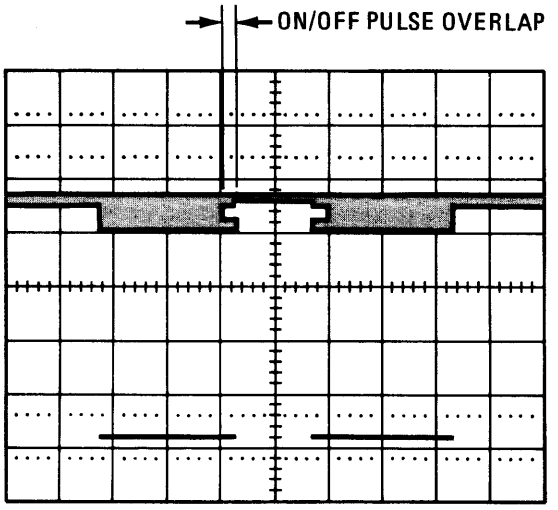


Figure 5-38. On/Off Pulse of Misadjusted Circuit Showing Overlap

5-28. EXTERNAL MARKER ADJUSTMENT

REFERENCE:

Service Sheet: A8

DESCRIPTION:

A rear panel BNC jack is available for external marker sources. A8R67 provides gain adjustment to the video amplifier for marker presence.

When using the 8755C with external markers, factory select resistor A8R28 prevents the feedthrough of 27.8 kHz square wave onto the marker birdie. Increasing the value of A8R28 reduces the feedthrough problem, but degrades internal markers.

5-28. EXTERNAL MARKER ADJUSTMENT (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Marker Source	HP 8350A/83522A
Swept Amplitude Analyzer	HP 8755C
Detector	HP 11664A
Oscilloscope	HP 1740A
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. Connect equipment as shown in Figure 5-39. Set external marker source to a selected marker frequency. Set power level between −10 and +10 dBm.

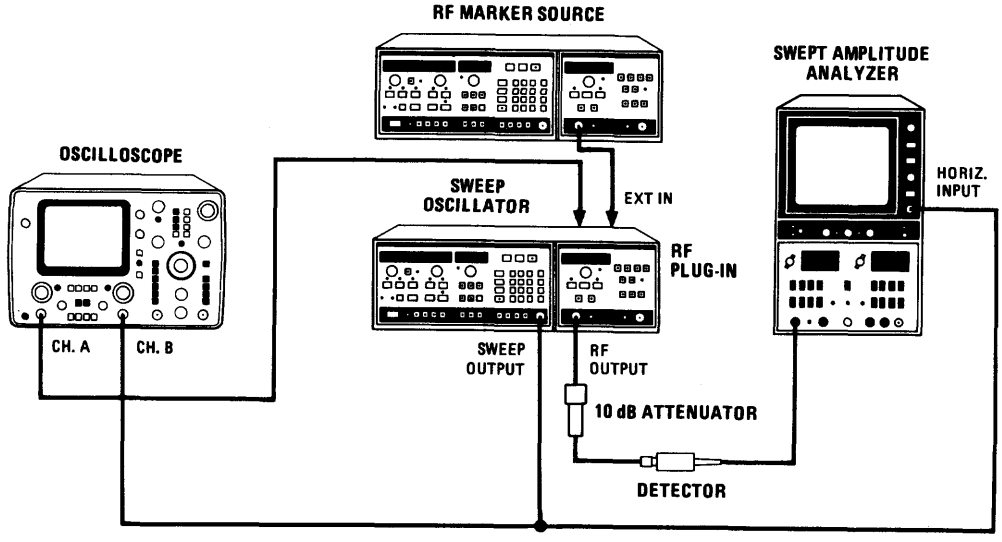


Figure 5-39. External Marker Adjustments Test Setup

5-28. EXTERNAL MARKER ADJUSTMENT (Cont'd)

2. For best external marker operation, set the 8350A to the minimum required sweep width and sweep speed. Select 8350A ⊓ MOD .

3. If no marker is observed on the 8755C, adjust A8R67 (EXT) control (Figure 5-40) until a marker appears on the screen. If the marker does not appear, go to step 4.

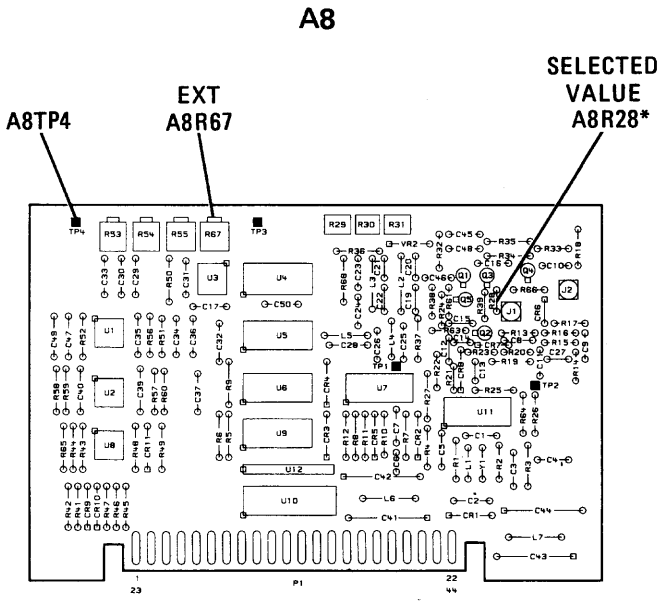


Figure 5-40. External Marker Adjustments Location

4. Verify that the external marker signal (1 to 1.5 V p-p) is present at A8TP3. If not, increase the power level of the external source to +10 dBm. If the marker still does not appear, go to step 5.

5. The 27.8 kHz feedthrough signal at the output of A8Q2 may be obscuring the marker birdie. Connect oscilloscope probe to A8TP4. Observe the birdie amplitude while turning the 8350A ⊓ MOD on and off. If the modulation feedthrough obscures more than half of the birdie (peak value), reduce 83522A output power. The feedthrough level should decrease while the birdie amplitude should remain relatively constant. The marker should appear on the 8755C. If it does not, go to step 6.

6. Increase the value of resistor A8R28 until the marker appears on the screen. However, be aware that larger values of A8R28 will degrade the performance of the 8350A internal crystal markers. Check the internal markers before permanently selecting a value for A8R28. Refer to Table 5-2 for the allowable range of values for A8R28.

NOTE

If external marker harmonics interfere with the measurement, reduce the marker source output power.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. 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.

WARNING

Any service or adjustments performed with the protective covers removed should only be done by qualified service personnel. A shock hazard exists with the covers removed.

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 saving. 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 lists abbreviations used in the parts list and schematics. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always capitals. However, in the schematics, other abbreviation forms are used with both lower case and upper case letters.

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).

Table 6-1. Exchange Parts

Reference Designations	New Part Number	Rebuilt-Exchange Part Number	Description
A12	5086-7331	5086-6331	YO 3.8–6.2 GHz
A14	5086-7217	5086-6217	AMPLIFIER 0.01–2.4 GHz
A17	5086-7219	5086-6219	MODULATOR/MIXER
NOTE **For module exchange procedure, see Paragraph 8-29.**			

c. The total quantity (Qty.) in the major assembly (A1, A2, or A3, etc.).

d. The description of the part.

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

f. The manufacturer's part 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 for each major assembly.

NOTE

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

6-11. The mechanical parts are shown in Figure 6-1. The attaching hardware is given in Figure 6-2.

6-12. ORDERING INFORMATION

6-13. To order a part lised in the replaceable parts table, quote the Hewlett-Packard Part Number (with Check Digit), indicate the quantity required, and address the order to the nearest Hewlett-Packard office. Including the Check Digit will ensure accurate and timely processing of your order.

6-14. 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.

6-15. SPARE PARTS KIT

6-16. 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 are based on failure reports and repair data and provides parts support for one year. A complimentary "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 6-2. 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	TOKYO	JA	
00046	UNITRODE COMPUTER PRODUCTS CORP	METHUEN	MA	53204
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
01921	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	**83525-60008**	**8**	**1**	**BOARD ASSEMBLY-FRONT PANEL** (DOES NOT INCLUDE A1RPG1 ROTARY PULSE GENERATOR)	**28480**	**83525-60008**
A1C1	0160-4084	8	49	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	3	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	11	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	19900486	6	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A1DS7	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS8	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS9	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS10	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS11	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS12	1990-0670	0		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	1990-0670
A1DS13	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
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	2950-0006	3	2	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A1MP2	2950-0006	3		NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A1MP3	2190-0067	4	2	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
A1MP4	2190-0067	4		WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
A1MP5—MP8	0380-1233	9	4	SPACER-SPECIALTY .450 IN LG; .175 IN OD	28480	0380-1233
A1J1	1251-4827	1	3	CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A1R1	0698-3444	1	2	RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-T0-316R-F
A1R2	0698-3444	1		RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-T0-316R-F
A1R3	2100-3766	7	2	RESISTOR-VAR CONTROL CP 10K 10% LIN	28480	2100-3766
A1R4	2100-3766	7		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	14	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	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S8	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S9	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S10	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S11	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
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
A1XDS1-A1XDS16				NOT ASSIGNED		
A1XDS17	1200-0554	6	3	SOCKET-STRP 25-CONT DIP-SLDR	28480	1200-0554
A1XDS18	1200-0554	6		SOCKET-STRP 25-CONT DIP-SLDR	28480	1200-0554
A1XDS19	1200-0554	6		SOCKET-STRP 25-CONT DIP-SLDR	28480	1200-0554
A1XU2	1251-5928	5	1	CONNECTOR 15-PIN M POST TYPE	28480	1251-5928
A2	**83525-60009**	**9**	**1**	**BOARD ASSEMBLY-SUB-PANEL**	**28480**	**83525-60009**
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	0160-0174	9	2	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A2C5	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A2C6	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
A2C7	0160-3879	7	30	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A2CR1				NOT ASSIGNED		
A2CR2				NOT ASSIGNED		
A2CR3	1901-0033	2	19	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
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
A2K1	0490-0916	6	3	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A2L1	9100-1618	1	4	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A2MP1	0380-0773	0	4	SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A2P1	1251-5491	7	2	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	3	RESISTOR 13.3K 1% .125W F TC=0±100	19701	MF4C1/8-T0-1332-F
A2R4	2100-3103	6	2	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A2R5	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A2R6	2100-3103	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	02111	43P103
A2R7	0757-0442	9	27	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A2R8				NOT ASSIGNED		
A2R9	0698-3150	6	2	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	0757-0465	6	4	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A2R17	0757-0465	6		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	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
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	0698-7260	7	9	RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A2R25	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
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	4	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	8	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	4	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	6	WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A2XU6	1200-0552	4	1	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
A3	**83525-60007**	**7**	**1**	**BOARD ASSEMBLY-DIGITAL INT**	**28480**	**83525-60007**
A3C1	0160-0127	2	12	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

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
A3MP1	5040-6852	3	2	BOARD EXTRACTOR-ORANGE	28480	5040-6852
A3MP2	5000-9045	8	1	EXTRACTOR PIN-.031 BOARD	28480	5000-9045
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	7	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	4	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3U8	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U9	1820-1216	3	7	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	**83522-60006**	**6**	**1**	**BOARD ASSEMBLY-ALC**	**28480**	**83522-60006**
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	29	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	0160-0572	1	5	CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A4C20				NOT ASSIGNED		
A4C21	0160-0128	3	1	CAPACITOR-FXD 2.2UF ±20% 50VDC CER	28480	0160-0128
A4C22	0160-3534	1	1	CAPACITOR-FXD 510PF ±5% 100VDC MICA	28480	0160-3534
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	0160-3875	3	1	CAPACITOR-FXD 22PF ±5% 200VDC CER 0±30	28480	0160-3875
A4C27	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C28				NOT ASSIGNED		
A4C29				NOT ASSIGNED		
A4C30	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C31				NOT ASSIGNED		
A4C32	0160-0573	2	2	CAPACITOR-FXD 4700PF ±20% 100VDC CER	28480	0160-0573
A4C33	0160-0570	9		CAPACITOR-FXD 220PF ±20% 100VDC CER	20932	5024EM100RD221M
A4CR1				NOT ASSIGNED		
A4CR2	1901-1098	1	15	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR3				NOT ASSIGNED		
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				NOT ASSIGNED		
A4CR8	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR9				NOT ASSIGNED		
A4CR10	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR11	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
A4CR12	1901-0535	9	8	DIODE-SCHOTTKY	28480	1901-0535

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
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	5	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	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A4Q10				NOT ASSIGNED		
A4Q11	1853-0007	7	2	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4Q12	1854-0404	0	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q13				NOT ASSIGNED		
A4Q14				NOT ASSIGNED		
A4R1	2100-2633	5	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A4R2	2100-2516	3	2	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A4R3				NOT ASSIGNED		
A4R4	2100-2514	1	5	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	30983	ET50W203
A4R5				NOT ASSIGNED		
A4R6	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A4R7	2100-0670	6	3	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A4R8				NOT ASSIGNED		
A4R9	2100-3749	6	2	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A4R10	0757-0416	7	5	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A4R11	2100-2522	1	5	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A4R12	0698-7257	2	2	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	0698-7251	6	2	RESISTOR 4.22K 1% .05W F TC=0±100	24546	C3-1/8-T0-4221-G
A4R15	0698-7236	7	3	RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-G
A4R16	0698-7268	5	2	RESISTOR 21.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-2152-G
A4R17	0698-7253	8	4	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-G
A4R18	0698-7268	5		RESISTOR 21.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-2152-G
A4R19	0698-7260	7	8	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	7	2	RESISTOR 90.9K 1% .125W F TC=0±100	24546	C4-1/8-T0-9092-F
A4R24	0698-7269	6	3	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	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A4R31	0837-0119	7	1	THERMISTOR ROD 5K-OHM TC=+.7%/C-DEG	28480	0837-0119
A4R32	0698-7259	4	3	RESISTOR 9.09K 1% .05W F TC=0±100	24546	C3-1/8-T0-9091-G
A4R33	0698-7269	6	1	RESISTOR 23.7K 1% .05W F TC=0±100	24546	C3-1/8-T0-2372-G
A4R34	0698-7240	3	1	RESISTOR 1.47K 1% .05W F TC=0±100	24546	C3-1/8-T0-1471-G
A4R35	0698-7237	8	1	RESISTOR 1.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1101-G
A4R36				NOT ASSIGNED		
A4R37				NOT ASSIGNED		
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		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*	0698-7197	9	1	RESISTOR 23.7 1% .05W F TC=0±100	24546	C3-1/8-T00-23R7-G
A4R47	2100-2030	6	3	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R48	0757-0421	4	5	RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A4R49				NOT ASSIGNED		
A4R50	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-G
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	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A4R54				NOT ASSIGNED		
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

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
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	0698-7250	5	1	RESISTOR 3.83K 1% .05W F TC=0±100	24546	C3-1/8-T0-3831-G
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	3	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	4	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		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	0698-7269	6		RESISTOR 23.7K 1% .05W F TC=0±100	24546	C3-1/8-T0-2372-G
A4R71	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0±100	24546	C4-1/8-T0-619R-F
A4R72	0698-3447	4	4	RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A4R73	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-G
A4R74	0698-7251	6		RESISTOR 4.22K 1% .05W F TC=0±100	24546	C3-1/8-T0-4221-G
A4R75-A4R80				NOT ASSIGNED		
A4R81	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-G
A4R82	0698-3132	4		RESISTOR 261 1% .125W F TC=0±100	24546	C4-1/8-T0-2610-F
A4R83	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0±100	24546	C4-1/8-T0-1471-F
A4R84	0698-7229	8		RESISTOR 511 1% .05W F TC=0±100	24546	C3-1/8-T0-511R-G
A4R85	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A4R86	0698-3440	7		RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-196R-F
A4R87	0698-7256	1	2	RESISTOR 6.81K 1% .05W F TC=0±100	24546	C3-1/8-T0-6811-G
A4R88	0698-7262	9	2	RESISTOR 12.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1212-G
A4R89				NOT ASSIGNED		
A4R90				NOT ASSIGNED		
A4R91	0698-7276	5	1	RESISTOR 46.4K 1% .05W F TC=0±100	24546	C3-1/8-T0-4642-G
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	0698-3157	3	4	RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A4R97				NOT ASSIGNED		
A4TP1-TP10	1251-4672	4	10	CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A4TP11	0360-0535	0	22	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	2	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
A4W1	8151-0013	4	3	WIRE JUMPER	28480	8151-0013
A4W2	8151-0013	4		WIRE JUMPER	28480	8151-0013
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	1	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

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
A5C11	0140-0198	5		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
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	12	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-TO-1961-F
A5R2	0698-3154	0	4	RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-TO-4221-F
A5R3	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-TO-4221-F
A5R4	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-TO-4221-F
A5R5	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-TO-4221-F
A5R6	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-TO-6811-F
A5R7	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-TO-6811-F
A5R8	0698-3158	4	1	RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-TO-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-TO-4641-F
A5R12	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-TO-1961-F
A5R13	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-TO-383R-F
A5R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-TO-51R1-F
A5R15	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-TO-51R1-F

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
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	6	RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A5R21	0698-3136	8	2	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	7	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	6	RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G
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	3	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		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	8	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		

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
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
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	6	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	7	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		EXTRACTOR-BLUE	28480	5040-6849
A6MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
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*				NOT FIELD REPLACEABLE		
A6R2	0698-8484	9	4	RESISTOR 6.44K .1% .1W F TC=0+4	28480	0698-8484
A6R3*				NOT FIELD REPLACEABLE		
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-TO-1961-F
A6R17	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-TO-1961-F

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
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*				NOT FIELD REPLACEABLE		
A6R39*				NOT FIELD REPLACEABLE		
A6R40*				NOT FIELD REPLACEABLE		
A6R41*				NOT FIELD REPLACEABLE		
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	4	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		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
A6SW1	3101-0471	8	2	SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A6SW2	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A6TP1-16	1251-5924	1	16	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	**83525-60004**	**4**	**1**	**BOARD ASSEMBLY-MARKER**	**28480**	**83525-60004**
A7C1	0160-4811	9	1	CAPACITOR-FXD 270PF ±5% 100VDC CER	28480	0160-4811
A7C2	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A7C3	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A7C4	0160-4824	4	1	CAPACITOR-FXD 680PF ±5% 100VDC CER	28480	0160-4824
A7C5	0160-4824	4	3	CAPACITOR-FXD 680PF ±5% 100VDC CER	28480	0160-4824

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
A7C6	0160-4786	7	1	CAPACITOR-FXD 27PF ±5% 100VDC CER 0±30	28480	0160-4786
A7C7	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A7C8	0180-0229	7	4	CAPACITOR-FXD 33UF±10% 10VDC TA	56289	150D336X9010B2
A7C9	0180-0229	7		CAPACITOR-FXD 33UF±10% 10VDC TA	56289	150D336X9010B2
A7C10	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
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	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
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	0160-4832	4	1	CAPACITOR-FXD .01UF ±10% 100VDC CER	28480	0160-4832
A7C22	0180-2820	8	1	CAPACITOR-FXD .22UF±20% 35VDC TA	28480	0180-2820
A7CR1	1901-0040	1	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A7CR2				NOT ASSIGNED		
A7CR3	1901-0040	1		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
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	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	1853-0314	9		TRANSISTOR PNP 2N2905A SI TO-39 PD=600MW	04713	2N2905A
A7Q3	1855-0423	5		TRANSISTOR MOSFET P-CHAN E-MODE	17856	VN10KM
A7Q4	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A7Q5	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18	04713	2N2222A
A7R1	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A7R2	0757-0290	5	3	RESISTOR 6.19K 1% .125W F TC=0±100	19701	MF4C1/8-T0-6191-F
A7R3	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0±100	24546	C4-1/8-T0-3481-F
A7R4	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0±100	24546	C4-1/8-T0-3481-F
A7R5	2100-2489	9	2	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A7R6	2100-2489	9		RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A7R7	2100-2522	1		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A7R8				NOT ASSIGNED		
A7R9	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0±100	19701	MF4C1/8-T0-6191-F
A7R10				NOT ASSIGNED		
A7R11				NOT ASSIGNED		
A7R12				NOT ASSIGNED		
A7R13				NOT ASSIGNED		
A7R14	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A7R15	0698-3442	9		RESISTOR 237 1% .125W F TC=0±100	24546	C4-1/8-T0-237R-F
A7R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R17	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A7R18	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A7R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R20	2100-2522	1		RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A7R21	2100-2515	2	5	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	2	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

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
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-TO-1961-F
A7R44	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0±100	24546	C4-1/8-TO-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	0757-0123	3	2	RESISTOR 34.8K 1% .125W F TC=0±100	28480	0757-0123
A7R53	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0±100	24546	C4-1/8-T0-681R-F
A7R54	0757-0279	0	3	RESISTOR 3.16K 1% .125W F TC=0±100	24546	C4-1/8-T0-3161-F
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	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
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	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1212-F
A7R68	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-TO-3831-F
A7R69	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-TO-1001-F
A7R70	0698-3446	3		RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-TO-383R-F
A7TP1	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
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	1820-1423	4	3	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A7U2	1826-0720	4	2	IC SWITCH ANLG QUAD 16-DIP-C	06665	SW-02FQ
A7U3	1826-0753	3	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	04713	MC34004BL
A7U4	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
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
A7U7	1826-0758	8	1		28480	1826-0758
A7U8	1820-1423	4		IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A7U9	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A7U10	1826-0458	5	1	IC OP AMP TO-99	27014	LF255H
A7U11	1826-0720	4		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	1820-1423	4		IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A8	**83525-60003**	**3**	**1**	**BOARD ASSEMBLY-SAMPLER**	**28480**	**83525-60003**
A8C1	0160-3877	5	2	CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A8C2	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C3	0160-4794	7	1	CAPACITOR-FXD 5.6PF ±.5PF 100VDC CER	28480	0160-4794
A8C4	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0306-125
A8C5	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C6	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C7	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C8	0160-3872	0	4	CAPACITOR-FXD 2.2PF ±.25PF 200VDC CER	28480	0160-3872
A8C9	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A8C10	0160-3877	5		CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A8C11	0160-3872	0		CAPACITOR-FXD 2.2PF ±.25PF 200VDC CER	28480	0160-3872
A8C12	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C13	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C14	0160-3872	0		CAPACITOR-FXD 2.2PF ±.25PF 200VDC CER	28480	0160-3872
A8C15	0160-3872	0		CAPACITOR-FXD 2.2PF ±.25PF 200VDC CER	28480	0160-3872
A8C16	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C17	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C18				NOT ASSIGNED		
A8C19	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C20	0160-0573	2		CAPACITOR-FXD 4700PF ±20% 100VDC CER	28480	0160-0573
A8C21	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C22	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A8C23	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C24	0160-4808	4		CAPACITOR-FXD 470PF ±5% 100VDC CER	28480	0160-4808

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A8C25	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C26	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C27	0160-4399	8	1	CAPACITOR-FXD .66PF ±.33PF 50VDC CER	28480	0160-4399
A8C28	0160-4800	6	1	CAPACITOR-FXD 120PF ±5% 100VDC CER	28480	0160-4800
A8C29	0160-4805	1	2	CAPACITOR-FXD 47PF ±5% 100VDC CER 0±30	28480	0160-4805
A8C30	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C31	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C32	0160-4808	4		CAPACITOR-FXD 470PF ±5% 100VDC CER	28480	0160-4808
A8C33	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C34	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C35	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C36	0160-4805	1		CAPACITOR-FXD 47PF ±5% 100VDC CER 0±30	28480	0160-4805
A8C37	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C38				NOT ASSIGNED		
A8C39	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A8C40	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A8C41	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A8C42	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A8C43	0180-0229	7		CAPACITOR-FXD 33UF±10% 10VDC TA	56289	150D336X9010B2
A8C44	0180-0229	7		CAPACITOR-FXD 33UF±10% 10VDC TA	56289	150D336X9010B2
A8C45	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C46	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C47	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C48	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C49	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C50	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR6	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A8CR7	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A8CR8	1901-0457	4	1	DIODE-STEP RCVY 30V DO-7	28480	1901-0457
A8CR9	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR10	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A8CR11	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A8J1	1250-0543	8	2	CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A8J2	1250-0543	8		CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0543
A8L1	9100-2247	4	1	INDUCTORRF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A8L2	9100-1626	1	1	INDUCTORRF-CH-MLD 36UH 5% .166DX.385LG	28480	9100-1626
A8L3	9100-1693	2	1	INDUCTORRF-CH-MLD 360UH 5% .2DX.45LG	28480	9100-1693
A8L4	9100-2261	2	1	INDUCTORRF-CH-MLD 2.7UH 10% .105DX.26LG	28480	9100-2261
A8L5	9100-1623	8	1	INDUCTORRF-CH-MLD 27UH 5% .166DX.385LG	28480	9100-1623
A8L6	9100-1618	1		INDUCTORRF-CH-MLD 5.6UH 10%	28480	9100-1618
A8L7	9100-1618	1		INDUCTORRF-CH-MLD 5.6UH 10%	28480	9100-1618
A8MP1	5040-6846	5	1	P.C. BOARD EXTRACTOR	28480	5040-6846
A8MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A8Q1	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8Q2	1855-0049	1	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A8Q3	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A8Q4	1855-0049	1		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A8Q5	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A8R1	0698-3435	0	1	RESISTOR 38.3 1% .125W F TC=0±100	24546	C4-1/8-T0-38R3-F
A8R2	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A8R3	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A8R4	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A8R5	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A8R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R7	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A8R8	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R9	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A8R10	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A8R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R13	0698-7202	7	3	RESISTOR 38.3 1% .05W F TC=0±100	24546	C3-1/8-T00-38R3-G
A8R14	0698-7205	0	4	RESISTOR 51.1 1% .05W F TC=0±100	24546	C3-1/8-T00-51R1-G
A8R15	0698-7202	7		RESISTOR 38.3 1% .05W F TC=0±100	24546	C3-1/8-T00-38R3-G
A8R16	0698-7209	4	1	RESISTOR 75 1% .05W F TC=0±100	24546	C3-1/8-T00-75R0-G
A8R17	0698-7268	5		RESISTOR 21.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-2152-G
A8R18	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0±100	24546	C3-1/8-T00-51R1-G
A8R19	0698-7188	8	1	RESISTOR 10 1% .05W F TC=0±100	24546	C3-1/8-T00-10R-G
A8R20	0698-7202	7		RESISTOR 38.3 1% .05W F TC=0±100	24546	C3-1/8-T00-38R3-G
A8R21	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0±100	24546	C3-1/8-T00-51R1-G
A8R22	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F

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
A8R23	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0±100	24546	C3-1/8-T00-51R1-G
A8R24	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A8R25	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A8R26	0698-7229	8		RESISTOR 511 1% .05W F TC=0±100	24546	C3-1/8-T0-511R-G
A8R27	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R28*	0698-7248	1	2	RESISTOR 3.16K 1% .05W F TC=0±100	24546	C3-1/8-T0-3161-G
A8R29	2100-2515	2		RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A8R30	2100-2515	2		RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A8R31	2100-2515	2		RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A8R32	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A8R33	0698-7249	2	1	RESISTOR 3.48K 1% .05W F TC=0±100	24546	C3-1/8-T0-3481-G
A8R34	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A8R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R36	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A8R37	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A8R38	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G
A8R39	0698-7254	9	1	RESISTOR 5.62K 1% .05W F TC=0±100	24546	C3-1/8-T0-5621-G
A8R40				NOT ASSIGNED		
A8R41	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R42	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0±100	19701	MF4C1/8-T0-9091-F
A8R43	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0±100	19701	MF4C1/8-T0-1332-F
A8R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R45	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0±100	24546	C4-1/8-T0-2371-F
A8R46	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0±100	24546	C4-1/8-T0-1622-F
A8R47	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0±100	24546	C4-1/8-T0-1782-F
A8R48	0757-0459	8	1	RESISTOR 56.2K 1% .125W F TC=0±100	24546	C4-1/8-T0-5622-F
A8R49	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A8R50	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0±100	24546	C4-1/8-T0-1471-F
A8R51	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A8R52	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A8R53	2100-2514	1		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	30983	ET50W203
A8R54	2100-2514	1		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	30983	ET50W203
A8R55	2100-2514	1		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	30983	ET50W203
A8R56	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0±100	24546	C4-1/8-T0-1471-F
A8R57	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A8R58	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A8R59	0698-3260	9		RESISTOR 464K 1% .125W F TC=0±100	28480	0698-3260
A8R60	0757-0466	7		RESISTOR 110K 1% .125W F TC=0±100	24546	C4-1/8-T0-1103-F
A8R61	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A8R62				NOT ASSIGNED		
A8R63	0698-7248	1	1	RESISTOR 3.16K 1% .05W F TC=0±100	24546	C3-1/8-T0-3161-G
A8R64	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A8R65	0698-3452	1	1	RESISTOR 147K 1% .125W F TC=0±100	24546	C4-1/8-T0-1473-F
A8R66	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-G
A8R67	2100-2514	1		RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	30983	ET50W203
A8R68	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A8TP1–4	1251-0600	0	10	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ	28480	1251-0600
A8U1	1820-0306	0	2	IC DIFF AMPL TO-99	01921	CA3028A
A8U2	1820-0475	4	1	IC COMPARATOR HS TO-99	27014	LM306H
A8U3	1820-0306	0		IC DIFF AMPL TO-99	0192B	CA3028A
A8U4	1826-0811	4	1	IC SWITCH	28480	1826-0811
A8U5	1826-0610	1		IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	02180	MUX24FQ
A8U6	1820-1383	5	2	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A8U7	1820-0804	3	1	IC GATE ECL NOR TPL	04713	MC10106P
A8U8	1826-0092	3		IC OP AMP GP DUAL TO-99	28480	1826-0092
A8U9	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A8U10	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A8U11	1820-0809	8	1	IC RCVR ECL LINE RCVR QUAD 2-INP	04713	MC10115P
A8U12	1810-0279	5	1	NETWORK-RES 10-SIP4.7K OHM X 9	01121	210A472
A8VR1				NOT ASSIGNED		
A8VR2	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A8Y1	0410-0594	8	1	CRYSTAL-QUARTZ 50.000 MHZ	28480	0410-0594
A9	**83525-60010**	**2**	**1**	**BOARD ASSEMBLY-TRANSISTOR HEAT SINK**	**28480**	**83525-60010**
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
A9MP2	2360-0115	4	4	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A9MP3	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A9MP4	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A9MP5	2360-0115	4		SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

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
A9MP6	0520-0128	7	2	SCREW-MACH 2-56 .250-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A9MP7	0520-0128	7		SCREW-MACH 2-56 .250-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A9MP8	2190-0014	1		WASHER-LK INTL T NO.2 .089-IN-ID	28480	2190-0014
A9MP9	2190-0014	1		WASHER-LK INTL T NO.2 .089-IN-ID	28480	2190-0014
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
A10	**83522-60001**	**1**	**1**	**BOARD ASSEMBLY-MOTHER**	**28480**	**83522-60001**
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	1251-4966	9	1	CONNECTOR 8-PIN M POST TYPE	28480	1251-4966
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
A10MP1-A10MP5	1251-1115	4	5	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
A10W1	8159-0005	0	1	WIRE JUMPER	28480	8159-0005
A10XA1				NOT ASSIGNED		
A10XA2				NOT ASSIGNED		
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 6-CONT/ROW 2-ROWS	28480	1251-0472
A11				**NOT ASSIGNED**		
A12	**5086-7331**	**1**	**1**	**OSCILLATOR-3.8-6.2 GHZ**	**28480**	**5086-7331**
A12	5086-6331	9		EXCHANGE 5086-7331 OSCILLATOR	28480	5086-6331
A12E1	5001-1559	5	1	INSULATOR	28480	5001-1559
A12MP1	7121-0554	4	1	LABEL-IDOSC 7332AA	28480	7121-0554
A12A1	5061-1069	8	1	BOARD ASSEMBLY-OSCILLATOR BIAS	28480	5061-1069
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
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
A12A1MP2	1251-3172	7	10	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1R1*						
A12A1R2*						
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

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

Table 6-3. Replaceable Parts

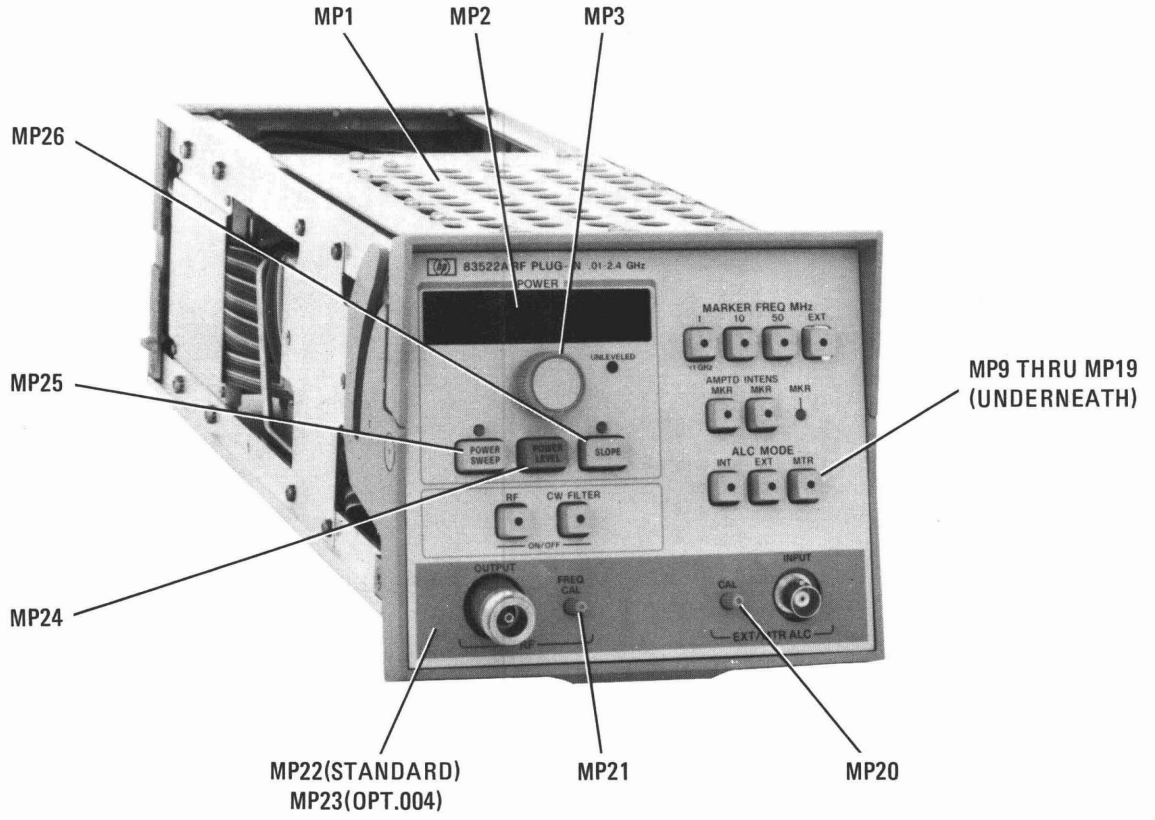
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14	**5086-7217**	**2**	**1**	**AMPLIFIER-.01-2.4 GHZ**	**28480**	**5086-7217**
A14	5086-6217	0		EXCHANGE 5086-7217 AMPLIFIER	28480	5086-6217
A15	**5086-7238**	**7**	**1**	**DC RETURN**	**28480**	**5086-7238**
A16	**86222-60007**	**7**	**1**	**CAVITY OSCILLATOR**	**28480**	**86222-60007**
A16C1	0180-2216	6	1	CAPACITOR-FXD 350 UF +75—10% 16VDC AL	28480	0180-2216
A16C2	0180-2144	9	1	CAPACITOR-FXD 200 UF +75—10% 25VDC AL	28480	0180-2144
A17	**5086-7219**	**4**	**1**	**MODULATOR-MIXER**	**28480**	**5086-7219**
A17	5086-6219	2		EXCHANGE 5086-7219 MODULATOR-MIXER	28480	5086-6219
CR1				NOT ASSIGNED		
CR2	1901-0033	2	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	5086-7220	7	1	DIRECTIONAL DETECTOR	28480	5086-7220
E1	5040-0345	7	2	INSULATOR-CONNECTOR	28480	5040-0345
E2	5040-0345	7		INSULATOR-CONNECTOR	28480	5040-0345
J1	86290-60005	7	1	CONNECTOR ASSEMBLY-TYPE N	28480	86290-60005
				NOTE **SEE FIGURE 6-4 FOR EXPLODED VIEW OF J1.**		
J2	1250-0212	8	1	CONNECTOR-RF BND FEM SGL-HOLE-FR 50 OHM (INPUT EXT MTR/ALC)	28480	1250-0212
J3				PART OF W23 (EXT MKR)		
J4	1250-0118	3	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (1V/GHz)	28480	1250-0118
J5	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (PULSE IN)	28480	1250-0118
				NOTE **SEE FIGURE 6-1 FOR MECHANICAL PARTS (MP) LOCATION.**		
MP1	83525-00005	9	1	COVER-PC SEC	28480	83525-00005
MP2	4040-1695	1	1	WINDOW-DISPLAY	28480	4040-1695
MP3	0370-3023	8	1	KNOB 3/4 JGK .25-IN-ID	28480	0370-3023
MP4 THRU MP8				NOT ASSIGNED		
MP9 THRU MP19	5041-0285	6	11	KEY CAP-QUARTER LITE PIPE	28480	5041-0285
MP20	5040-8823	2	2	KNOB-JADE GRAY	28480	5040-8823
MP21	5040-8823	2		KNOB-JADE GRAY	28480	5040-8823
MP22	83522-00001	2	1	PANEL DRESS	28480	83522-00001
MP23	83522-00002	3	1	PANEL DRESS (OPTION 004 ONLY)	28480	83522-00002
MP24	5041-1924	2	1	KEY CAP-HALF POWER LEVEL	28480	5041-1924
MP25	5041-1925	3	1	KEY CAP-HALF POWER SWEEP	28480	5041-1925
MP26	5041-1926	4	1	KEY CAP-HALF SLOPE	28480	5041-1926
MP27	83525-20055	1	1	CASTING-AS FRAME (RR)	28480	83525-20055
MP28	83525-00006	0	1	BRACKET-COUPLER	28480	83525-00006
MP29	83525-00007	1	1	BRACKET-DETECTOR	28480	83525-00007
MP30	83525-20038	0	1	SHIELD-REAR	28480	83525-20038
MP31 THRU MP34	1400-1095	6	4	CLIP FASTENER-SCREEN .3 X .4 INCH	28480	1400-1095
MP35	83525-20037	9	1	SHIELD-FRONT	28480	83525-20037
MP36	83525-20030	2	1	SIDE RAIL-UP RT	28480	83525-20030
MP37	83525-20039	1	1	CASTING-FRONT	28480	83525-20039
MP38 THRU MP42	0510-1148	2	5	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
MP43				NOT ASSIGNED		
MP44				NOT ASSIGNED		
MP45				NOT ASSIGNED		
MP46	83525-00009	3	1	REAR CONN BRACKET (OPT. 004 ONLY)	28480	83525-00009
MP47	83525-20031	3	1	SIDE RAIL-UP LT	28480	83525-20031
MP48	1460-1851	8	1	SPRING LATCH	28480	1460-1851
MP49	1480-0337	5	1	PIN-ROLL	28480	1480-0337
MP50	83525-20033	5	4	LATCH-SCREW	28480	83525-20033
MP51	3030-0330	7	2	SET SCREW	28480	3030-0330
MP52	83525-20033	5		LATCH-SCREW	28480	83525-20033
MP53	3030-0330	7		SET SCREW	28480	3030-0330
MP54	83525-20040	4	1	LATCH	28480	83525-20040
MP55	83525-00012	8	2	HOLD-DOWN BRACKET	28480	83525-00012
MP56	83525-00011	7	1	BRACKET-ATTEN (OPT. 002 ONLY)	28480	83525-00011
MP57	83525-20029	9	2	SIDE RAIL-LO LT	28480	83525-20029
MP58	83525-00010	6	1	GUARD	28480	83525-00010
MP59	83525-00013	9		WIRE HOLDER	28480	83525-00013

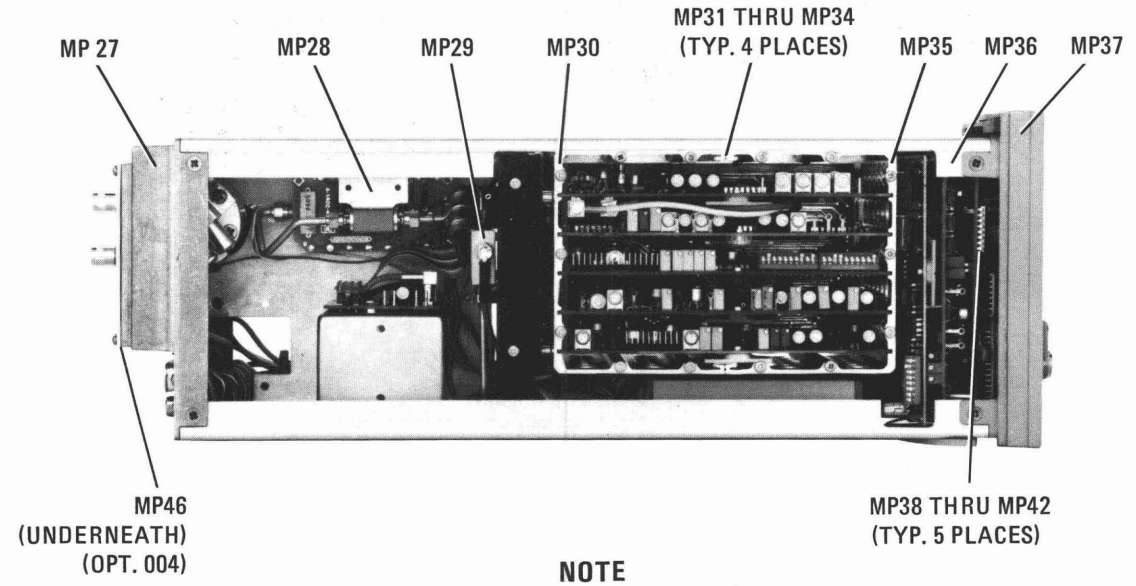
See introduction to this section for ordering information
* Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
MP60	83525-20032	4	1	SIDE RAIL-LR RT	28480	83525-20032
MP61	83525-20022	2	1	CASTING-RF	28480	83525-20022
MP62	83525-00003	7	1	REAR PANEL	28480	83525-00003
MP63	6960-0046	6	1	PLUG-HOLE DOME-HD FOR .688-D-HOLE BRS	28480	6960-0046
MP64	5021-0906	6	3	SLEEVE-RF PIN POS	28480	5021-0906
MP65	5021-0906	6		SLEEVE-RF PIN POS	28480	5021-0906
MP66	5021-0906	6		SLEEVE-RF PIN POS	28480	5021-0906
MP67	6960-0001	3	1	PLUG-HOLE DOME-HD FOR .375-D-HOLE STL	28480	6960-0001
MP68	11869-20020	4	1	ALIGNMENT PIN	28480	11869-20020
MP69	0510-0089	8	1	LOCK RING	28480	0510-0089
W1				NOT ASSIGNED		
W2	83522-20013	8	1	CABLE-DETECTOR/RF OUT	28480	83522-20013
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	83522-60013	2	1	WIRE ASSEMBLY-RF PATH	28480	83522-60013
W6	83525-60019	1	1	CABLE ASSY-COAX, RED	28480	83525-60019
W7	83525-60018	0	1	CABLE ASSY-COAX, YELLOW	28480	83525-60018
W8	83525-60017	9	1	CABLE ASSY-COAX, RED	28480	83525-60017
W9				NOT ASSIGNED		
W10	83525-20017	5	1	CABLE-RF DC RETURN/DIRECTIONAL DETECTOR	28480	83525-20017
W11				NOT ASSIGNED		
W12	83525-60028	2	1	CABLE ASSY-COAX, BLUE, FM OUTPUT	28480	83525-60028
W13				NOT ASSIGNED		
W14				NOT ASSIGNED		
W15	83525-20016	4	1	CABLE-RF AMPLIFIER/DC RETURN	28480	83525-20016
W16				NOT ASSIGNED		
W17	83522-60016	5	1	CABLE ASSY-RIBBON RF PATH	28480	83522—60016
W18				NOT ASSIGNED		
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	83525-60016	8	1	CABLE ASSY-EXT MARKER, YELLOW	28480	83525-60016
W24				NOT ASSIGNED		
W25	83525-20015	3	1	CABLE-RF MODULATOR/AMPLIFIER	28480	83525-20015
W26				NOT ASSIGNED		
W27				NOT ASSIGNED		
W28	83525-20019	7	1	CABLE-RF OSCILLATOR/MODULATOR	28480	83525-20019
W29				NOT ASSIGNED		
W30				NOT ASSIGNED		
W31	83525-60024	8	1	CABLE ASSY-POWER SUPPLY	28480	83525-60024
W32	83525-60056	9	1	CABLE ASSY-REAR CONNECTOR	28480	83525-60056
W33	83525-20027	7	1	CABLE-ATTEN/OUTPUT (OPT. 002 ONLY)	28480	83525-20027
W34				NOT ASSIGNED		
W35				NOT ASSIGNED		
W36				NOT ASSIGNED		
W37	83522-20015	0	1	CABLE-REAR PANEL RF OUT (OPT. 004 ONLY)	28480	83522-20015
W38	83522-20016	1	1	CABLE-RF DETECTOR/ATTENUATOR (OPT. 002/002 AND 004)	28480	83522-20016
W39	83522-20017	2	1	CABLE-ATTENUATOR/REAR PANEL RF OUT (OPT. 002 and 004)	28480	83522-20017
W40	83522-20014	9	1	CABLE-YO/MOD-MIX	28480	83522—20014
				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
W38	83522-20016	1	1	CABLE-DIR DETECTOR/ATTENUATOR	28480	83522-20016
				NOTE		
				DELETE CABLE W2(83522-20013) FOR OPT. 002.		
				OPTION 004 (REAR PANEL RF OUT)		
MP23	83522-00002	6	1	PANEL DRESS (OPT. 004 ONLY)	28480	83522-00002
MP46	83525-00009	3	1	REAR CONNECTOR BRACKET	28480	83525-00009
W37	83522-20015	0	1	CABLE-REAR PANEL RF OUT	28480	83522-20015
W3	83525-60054	4	1	CABLE ASSY-FRONT PANEL (OPT. 004)	28480	83525-60054
				NOTE		
				DELETE W2 (83522-20013) AND DRESS PANEL (83522-00001) FOR OPT. 004 ONLY.		
				OPTION 002 AND 004		
				ALL OPT. 002 & 004 PARTS + THE FOLLOWING:		
W39	83522-20017	2	1	CABLE-RF ATTENUATOR/REAR OUTPUT	28480	83522-20017
				NOTE		
				DELETE CABLES W2 (83522-20013), W33 (83525-20027) AND W37 (83522-20015) FOR OPT. 002 AND 004.		

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

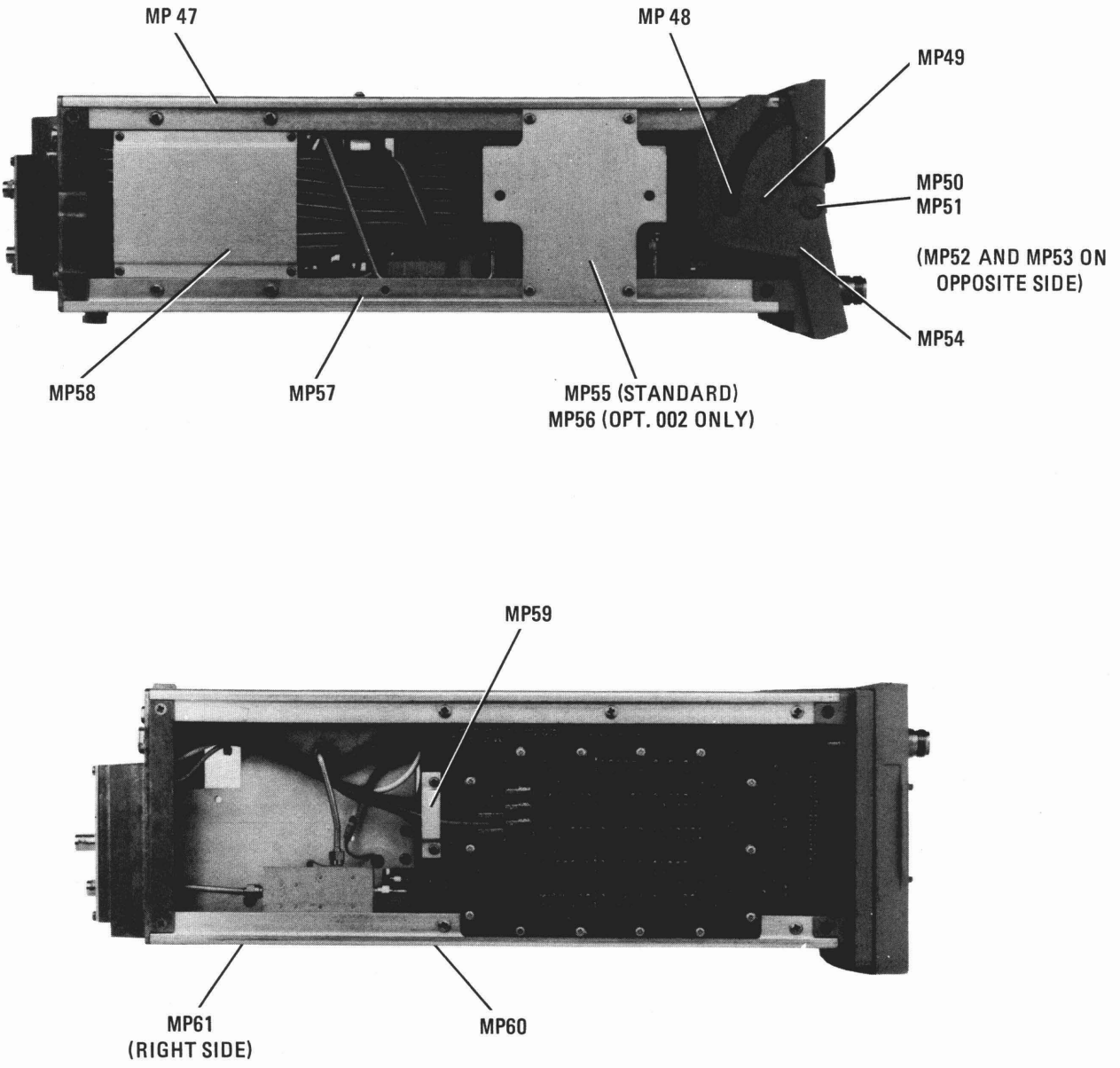




NOTE

Refer to Table 6-3 for mechanical parts listings.

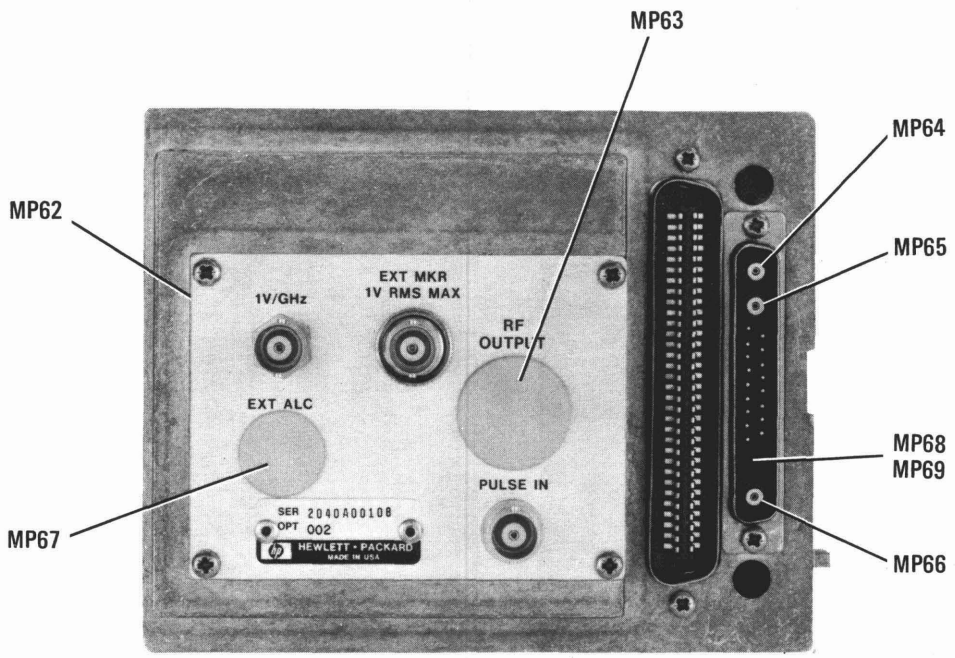
Figure 6-1. Major Mechanical Parts (1 of 3)



NOTE

Refer to Table 6-3 for mechanical parts listings.

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



NOTE

Refer to Table 6-3 for mechanical parts listings.

Figure 6-1. Major 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	12	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
2	2360-0117	6	4	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	2360-0129	0	6	SCREW-MACH 6-32 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
4	2360-0197	2	5	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
5	2360-0333	8	16	SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
6	2200-0103	2	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	2200-0105	4	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	2200-0107	6	10	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	2200-0149	6	2	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
11	2200-0166	7	2	SCREW-MACH 4-40 .312-IN-LG 82 DEC	00000	ORDER BY DESCRIPTION
12	0624-0281	3	30	SCREW-TPG 4-20 .5-IN-LG PAN-HD-POZI STL	28480	0624-0281
13	0520-0127	6	4	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
14	0520-0128	7	4	SCREW-MACH 2-56 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
15	0520-0136	7	4	SCREW-MACH 2-56 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
16	0520-0167	4	2	SCREW-MACH 2-56 .438-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
17	0590-0106	8	4	NUT-HEX-PLSTC LKG 2-56-THD .143-IN-THK	00000	ORDER BY DESCRIPTION
18	0590-1126	4	1	NUT-KNRLD-R 15/32-32-THD .08-IN-THK	00000	ORDER BY DESCRIPTION
19	2260-0009	3	8	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
20	2420-0001	5	6	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
21	2950-0001	8	4	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
22	2950-0132	6	1	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
23	2950-0177	9	1	NUT-HEX-DBL-CHAM 1/4-36-THD .05-IN-THK	28480	2950-0177
24	2190-0016	3	5	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
25	2190-0068	5	1	WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
26	2190-0104	0	1	WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
27	1250-1142	5	1	WASHER	16179	4151
28	3050-0003	3	5	WASHER-FI NM NO 6 .141-IN-ID .375-IN-OD	28480	3050-0003

Figure 6-2. Attaching Hardware (1 of 4)

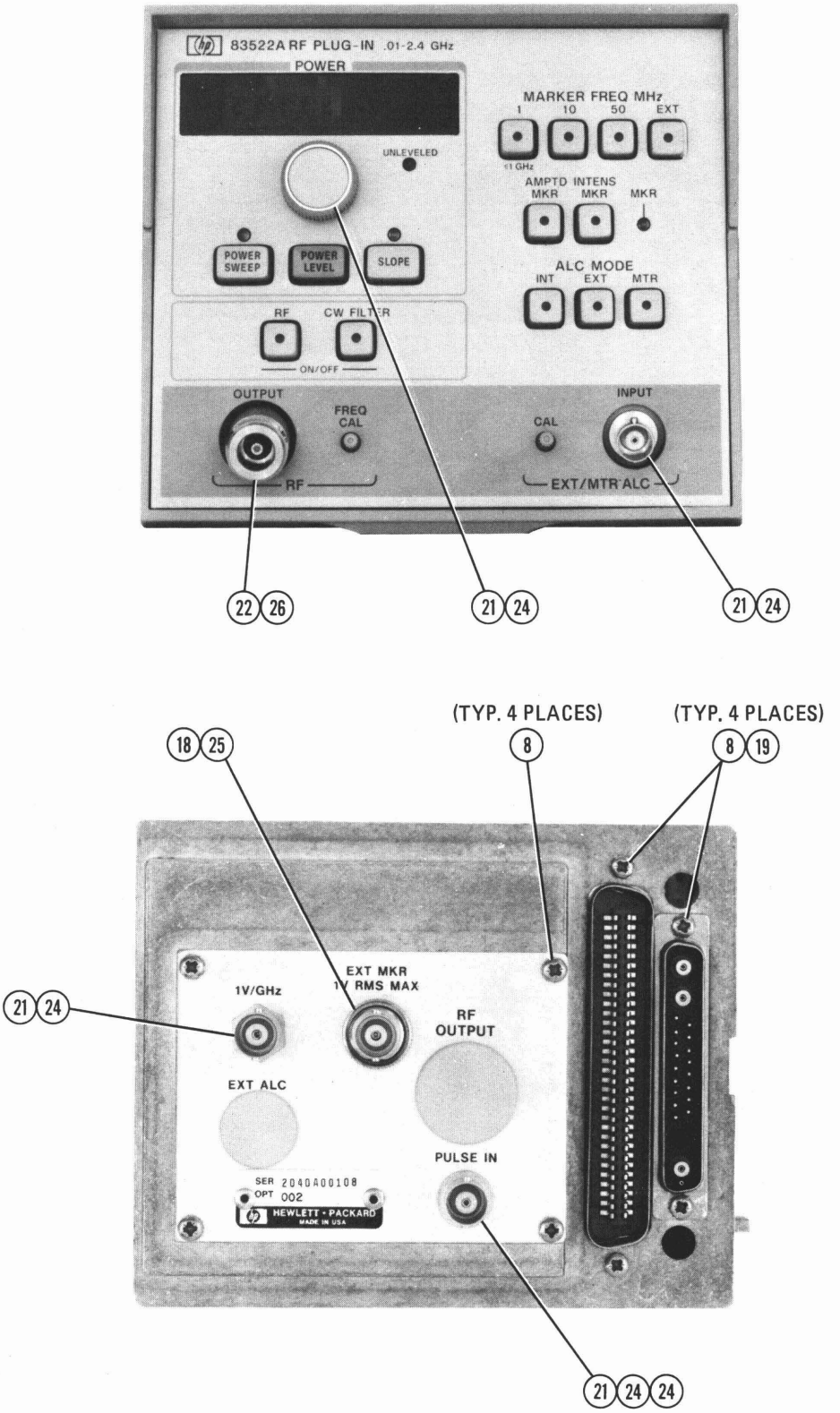


Figure 6-2. Attaching Hardware (2 of 4)

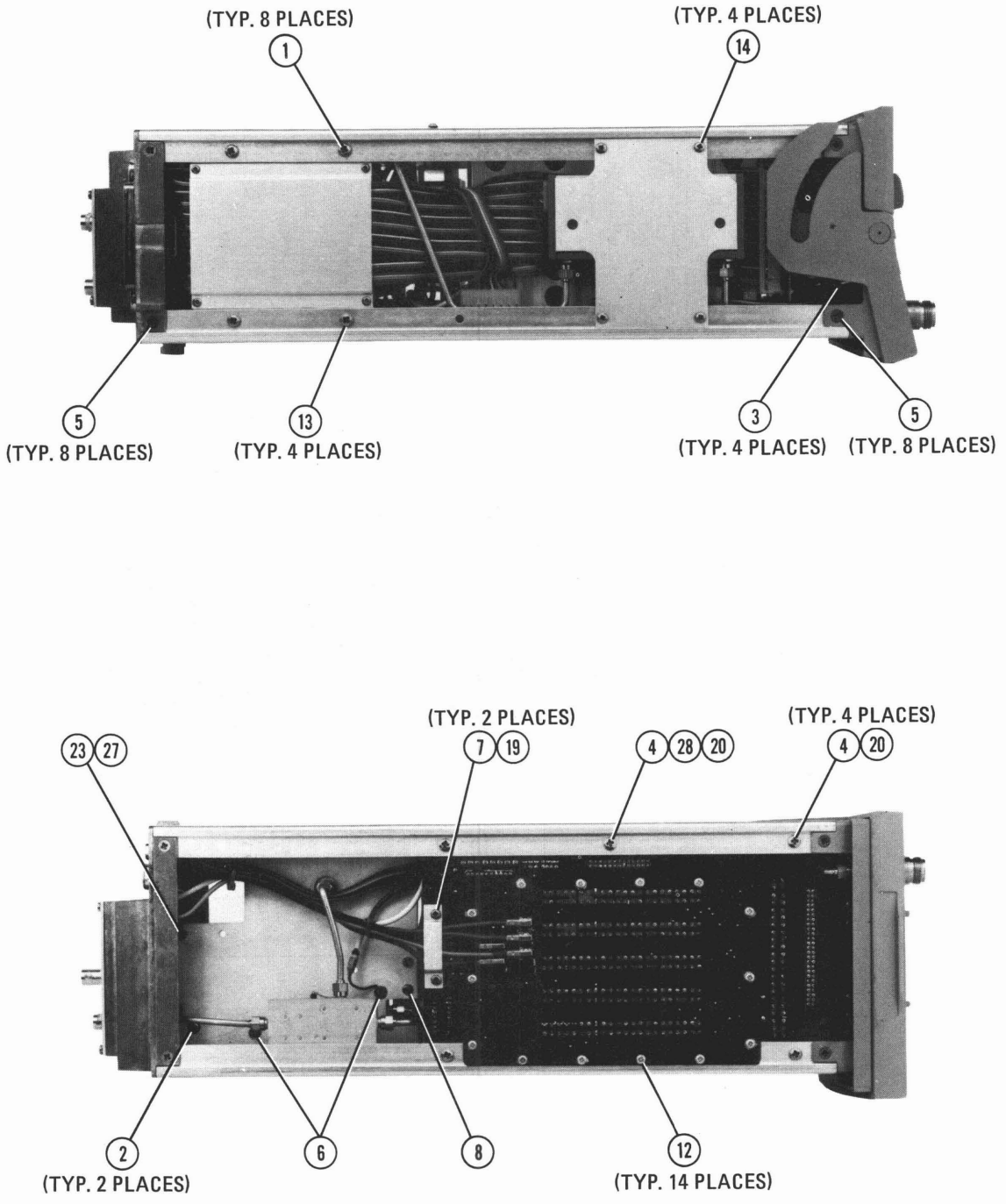


Figure 6-2. Attaching Hardware (3 of 4)

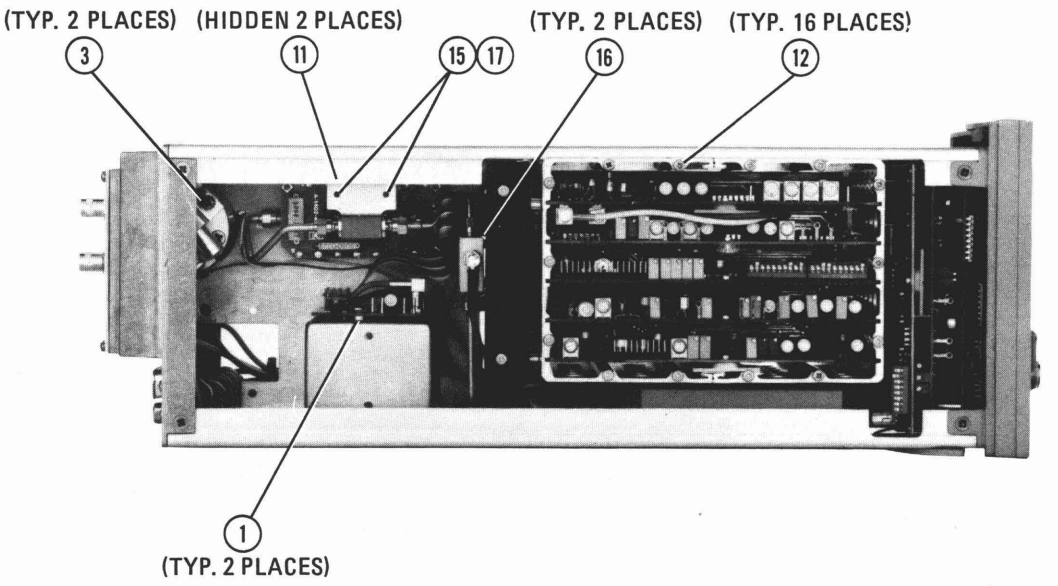


Figure 6-2. Attaching Hardware (4 of 4)

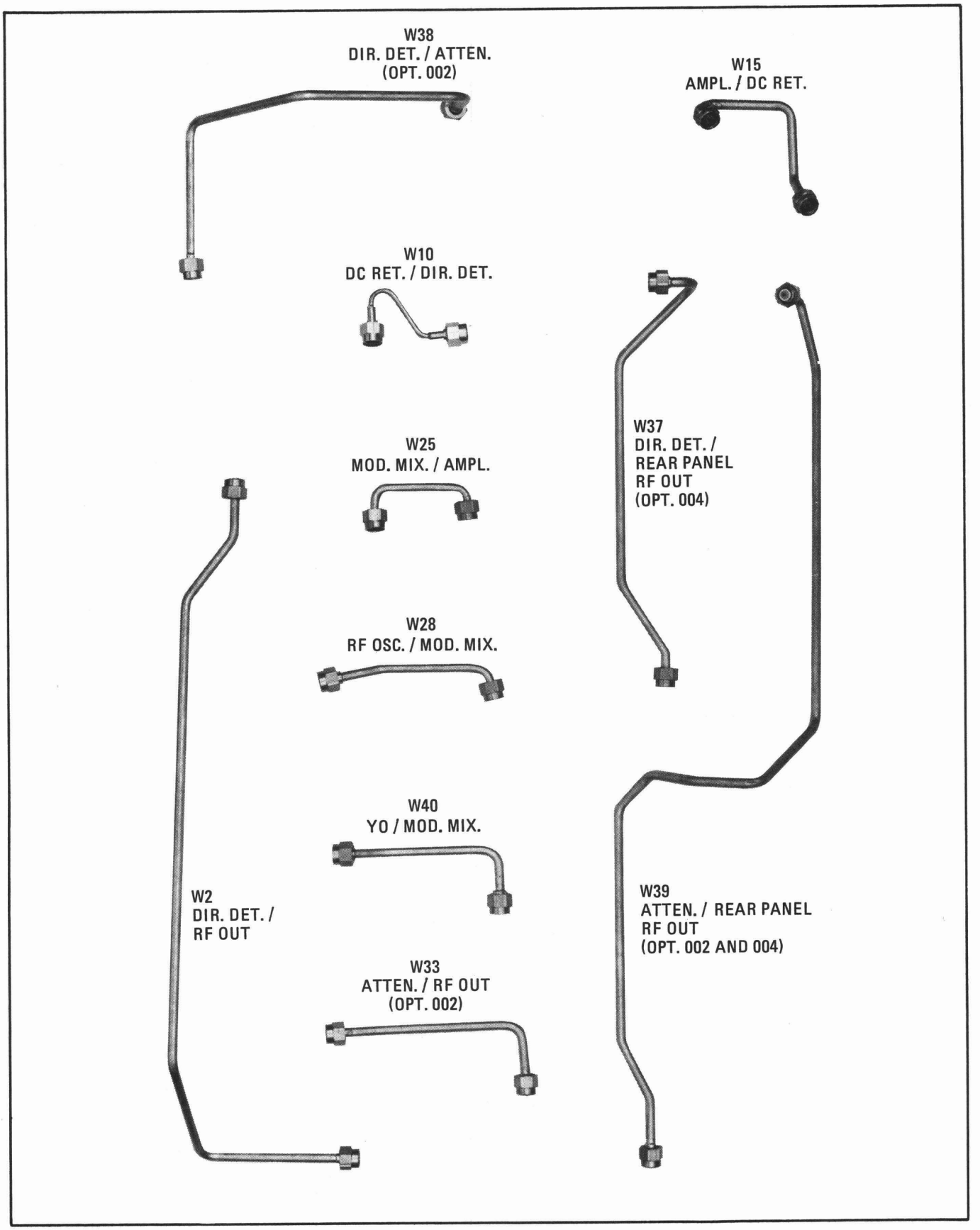
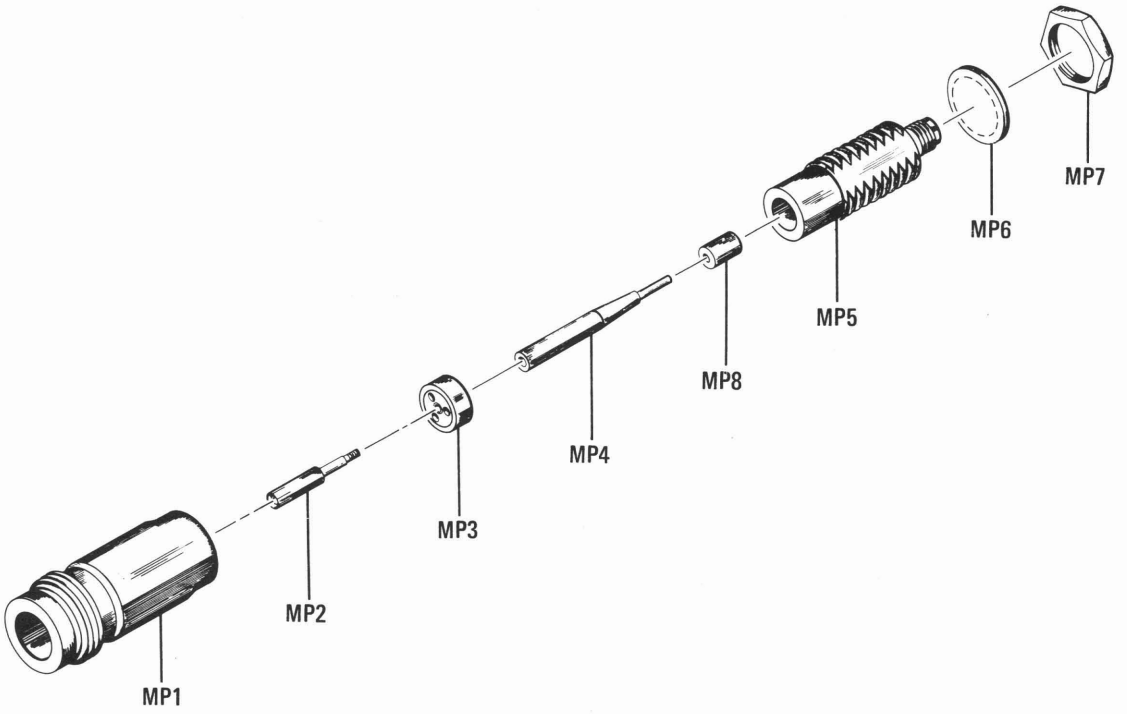


Figure 6-3. Cables in RF Section



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

VII – Manual Backdating

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 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 that 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 83522A 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 listed 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.

MANUAL CHANGES

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

MANUAL IDENTIFICATION

HP Number: HP 83522A
Date Printed: July 1981
Part Number: 83522-90003

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

Two types of information are included:

UPDATES - APPLY TO ALL SERIAL NUMBERS.

NUMBERED CHANGES - UPDATES THAT ARE SERIAL NUMBER PREFIX RELATED.

The information is in the following order: UPDATES, NUMBERED CHANGES in sequential order with applicable illustrations as close as possible to each numbered change.

To use this supplement, make all UPDATES and all appropriate serial number related CHANGES indicated in the following tables.

▶ = NEW ITEM

NOVEMBER 26, 1986

HEWLETT PACKARD

Printed in U.S.A.

▶ = NEW ITEM

HP 83522A

Serial Prefix or Number	Make Manual Changes
2147A	1
2202A	1, 2
2205A, 2222A	1-3
2233A, 2244A	1-4
2307A	1-5
2323A	1-6
2339A	1-7
2411A	1-3, 5-9
2528A	1-3, 5-11
▶ 2647A	1-3, 5-12

▶ = NEW ITEM

Numbered Changes Index

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2147A	1	W32	N/A	None
2202A	2	A5	83525-60043	Replaceable Parts Service
2205A and 2222A	3	A2	83525-60060	Replaceable Parts Service
2233A and 2244A	4	A4	83522-60061	Replaceable Parts Service
2307A	5	A3	83525-60068	Operation Replaceable Parts Service
2323A	6	A10	83522-60062	Replaceable Parts Service
2339A	7	A2	83525-60072	Replaceable Parts Service
2411A	8 and 9	A4 A3	83522-60077 83525-60080	General Information Operation Adjustments Replaceable Parts Service
2528A	10 and 11	Mechanical Parts A7	N/A 83525-60092	Replaceable Parts Service
▶ 2647A	12	A4 A10	83522-60098 83522-60084	Replaceable Parts Service

UPDATES

Inside Cover:

Replace the warranty statement with the following warranty statement:

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of delivery, or, in the case of certain major components listed in section six of this Operating and Service manual, for the specified period. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

UPDATES

Page 1-2:
After paragraph 1-9 add the following:

Manufacturer's Declaration

NOTE

This is to certify that this product meets the radio frequency interference requirements of Directive FTZ 1046/1984. The German Bundespost has been notified that this equipment was put into circulation and has been granted the right to check the product type for compliance with these requirements.

Note: If test and measurement equipment is operated with unshielded cables and/or used for measurements on open set-ups, the user must insure that under these operating conditions, the radio frequency interference limits are met at the border of his premises.

Model **HP 83522A**

NOTE

Hiermit wird bescheinigt, dass dieses Gerät/System in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation für Mess- und Testgeräte:

Werden Mess- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Messaufbauten verwendet, so ist vom Betreiber sicherzustellen, dass die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Page 1-3, Table 1-1:
Under "**Power Variation**, Internally Leveled," add the following specification:
"With Option 002: ±0.35 dB (in 0 dB attenuation step)."
Delete all references to Stability With Time (in a 10 minute period after one hour warmup).

Page 1-4, Table 1-2:
Add the following typical characteristic:
Power Variation
Internally Leveled (Option 002): ±0.5 dB (in 10 dB to 70 dB attenuation steps).
Add STABILITY WITH TIME (in a 10 minute period after one hour warmup at the same frequency setting):
< ± 100 kHz.

Page 4-4, Table 4-2:
Under "**4-14. Output Amplitude**, Internally Leveled: ±.25 dB," add the following:
"Opt. 002: ±0.35 dB."

Page 4-5, Table 4-2, Section 4-15:
Delete all references to Time (10 minutes): specifications.

Page 5-1, Paragraph 5-11:
Replace Paragraph 5-12 with the following:
Adjustment procedures are given in the proper sequence to allow for interrelated adjustments. However, perform Paragraph 5-22 before Paragraph 5-21, all other adjustments should be done in order of appearance. Adjustments having to do with the leveling loop (paragraph 5-20 through 5-24) are interactive and should be performed as a group.

UPDATES

Page 5-14, Paragraph 5-16:
Replace A6R30 "G" in Step 16 with A6R11 "G."

Page 5-28, Paragraph 5-21:
Replace the first NOTE in Paragraph 5-21 with the following:
Perform Paragraph 5-22 before Paragraph 5-21, all other adjustments should be done in order of appearance. Deviation from this routine may cause improper leveling and/or flatness problems.

Page 5-29, Paragraph 5-21:
Add "Set power level to +6 dBm," to the end of Step 1.

Page 5-30, Paragraph 5-22:
Replace the first NOTE in Paragraph 5-22 with the following:
Perform Paragraph 5-22 before Paragraph 5-21, all other adjustments should be done in order of appearance. Deviation from this routine may cause improper leveling and/or flatness problems.

Page 5-34, Paragraph 5-24:
Delete Paragraph 5-24 on pages 5-34 through 5-36 and replace with Paragraph **5-24. ALC GAIN ADJUSTMENT (UPDATES)** contained in this document.

Page 5-42, Paragraph 5-27:
Delete Paragraph 5-27 on pages 5-42 through 5-46 and replace with **5-27. MARKER AND SAMPLER ADJUSTMENTS (UPDATES)**contained in this document.

Page 5-46:
Add Paragraph **5-27a. MARKER GAIN (FINE TUNE) ADJUSTMENT (UPDATES)**contained in this document.

Page 5-46, Paragraph 5-28:
Delete Paragraph 5-28 on pages 5-46 through 5-48 and replace with **5-28. EXTERNAL MARKER ADJUSTMENT (UPDATES)** contained in this document.

Page 6-1, Paragraph 6-7:
Add the following after paragraph 6-7:

Two Year Warranty and Restored Exchange Parts

The microcircuit parts listed in Table 6.0 are provided with either a two-year warranty from the date of purchase and/or a restored exchange parts program.

A two-year warranty applies to both an original component and to one that is purchased as a replacement part either new or restored through the support life of the instrument. The restored exchange parts program allows a defective component to be exchanged for a factory-restored part which provides a substantial reduction in replacement cost. In addition, if the original component is covered by a two-year warranty, the exchanged component will also have a two-year warranty from the date of purchase. Table 6-0 below identifies the components within the instrument that have a two-year warranty as well as those that are available as restored exchange parts.

Table 6-0. Two-Year Warranty and Restored Exchange Parts

Reference Designation	Description	Two-Year Warranty	Restored Exchange Part
A12	YIG Oscillator	Yes	Yes
A14	RF Amplifier	Yes	Yes
A17	Modulator Mixer	Yes	Yes
DC1	Detector	Yes	No

UPDATES, (Cont'd)

Page 6-5, Table 6-3:
Change A1J1 HP and Mfr. Part Number 1251-5926 CD 3 (recommended replacement).
Change A1RPG1 part number to 0960-0683, CD 1 (recommended replacement).

Page 6-6, Table 6-3:
Change A2J1 and A3J1 HP and Mfr. Part Number to 1251-5926 CD 3 (recommended replacement).
Change A3 to 83525-60080 CD 6, DIGITAL INTERFACE ASSEMBLY does not include A3U1 and A3U2).

Page 6-7, Table 6-3:
Change A3U1 to A3U1/A3U2 (not separately replaceable), part number 83525-60074 CD 8, EPROM Replacement Kit (recommended replacement).
Change A3XU1 and A3XU2 to part number 1200-0541 CD 1, SOCKET-IC 24-CONT DIP DIP-SLDR.

Page 6-8, Table 6-3:
Change A4R50 to HP Part Number 0698-7274 CD 3, RESISTOR 38.3K, Mfr. Part Number C3-1/8-TO-3832-G.

Page 6-15, Table 6-3:
Change A7R48 to HP and Mfr. Part Number 0698-3457, CD 6, 316K (recommended replacement).

Page 6-18, Table 6-3:
Change A10J3 to HP and Mfr. Part Number 1251-3196, CD 5.

Page 6-19, Table 6-3:
Change MP2 Part Number to 83522-20028, CD 5.
Change MP27 to HP and Mfr. Part Number 0050-2032, CD 9.

Page 6-20, Table 6-3:
Change the CD number to W32 to 6.

Page 6-20, Table 6-3:
Change A19 to HP and Mfr. Part Number 83525-60096, CD 4.

Page 8-35:
Add *Table 8-8* from this document, adjacent to Figures 8-22 and 8-23.

Page 8-45, Figure 8-35:
In Block **E LOG AMPLIFIER** change the value of R50 to 38.3K.

Page 8-63, Figure 8-60:
Change Block I U11A PIN 13 voltage supply to +15VF.
Delete the "OW" in (LOW = −10V) in block J at P1-40.

5-24. ALC GAIN ADJUSTMENT (UPDATES)

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-24. Deviation from this routine may cause improper leveling and/or flatness problems.

REFERENCE:

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

DESCRIPTION:

A4R15 in the input leg of A4U9 adjusts the gain of the Main ALC Amplifier. A4R15 is adjusted for maximum possible gain without producing oscillations.

EQUIPMENT

Function Generator	HP 3312A
Oscilloscope	HP 1740A
Detector	HP 8473C
10 dB Attenuator	HP 8491A Option 010

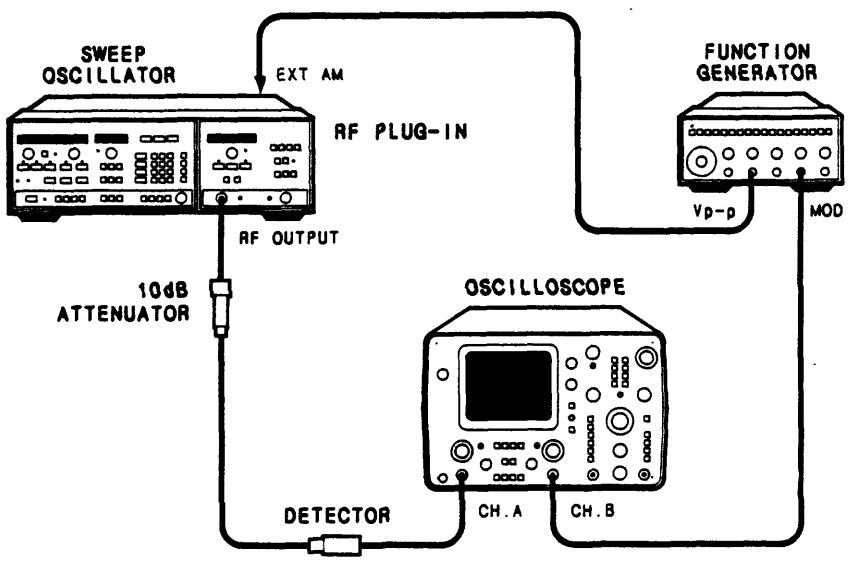


Figure 5-25. ALC Gain Adjustment Test Setup

5-24. ALC GAIN ADJUSTMENT (UPDATES) (Cont'd)

NOTE

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

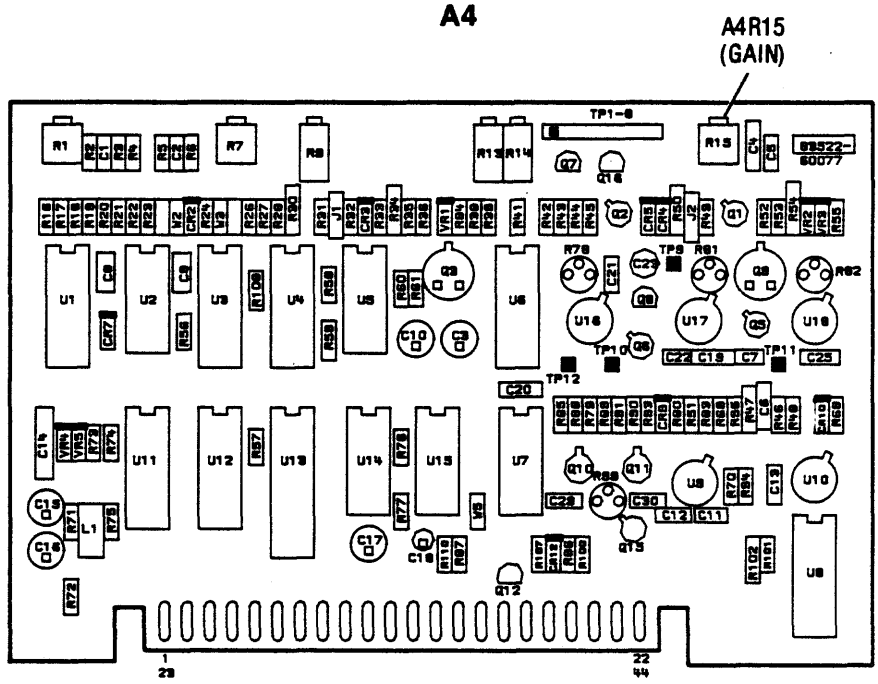


Figure 5-26. ALC Gain Adjustment Location

PROCEDURE:

1. Connect Vp-p output on HP 3312A to 1740 CHANNEL A INPUT.
2. Set instrument controls as follows:

8350A/B SWEEP OSCILLATOR

START ..... 10 MHz
STOP ..... 8.4 GHz
SWEEP MODE ..... MANUAL

83522A RF PLUG-IN

POWER LEVEL ..... −2 dB
ALC ..... INT

3312A FUNCTION GENERATOR

MODULATION ..... SWP
MODULATION RANGE Hz (KNOB) 0
VERNIER 0
FUNCTION ..... [~]
RANGE Hz (BUTTON) 100K
FREQUENCY 5
AMPLITUDE 1
VERNIER 1

5-24. ALC GAIN ADJUSTMENT (UPDATES) (Cont'd)

1740A OSCILLOSCOPE

MODE ..... MAIN
CHANNEL A INPUT ..... AC
CHANNEL A V/DIV ..... ½V
CHANNEL B INPUT ..... DC
CHANNEL B V/DIV 1V
DISPLAY ..... A

3. Adjust 1740A vertical and horizontal position knobs for waveform at the center of oscilloscope CRT. Adjust START knob, below SWP button, for 10 kHz as displayed on oscilloscope. Turn MODULATION RANGE Hz to 100 and VERNIER to 10K.
4. Connect equipment as shown in Figure 5-25.
5. On 1740A select A vs B MODE and set CHANNEL A to .005/DIV.
6. Adjust the far left side of the signal for 2 divisions pk-pk by using the CAL on the CHANNEL A knob.
7. While monitoring CHANNEL A, manually sweep the entire plug-in frequency range and adjust the ALC "GAIN" (A4R15) for 4 divisions of peaking at the plug-in frequency where the highest gain peaking occurs. (See Figure 5-26a)

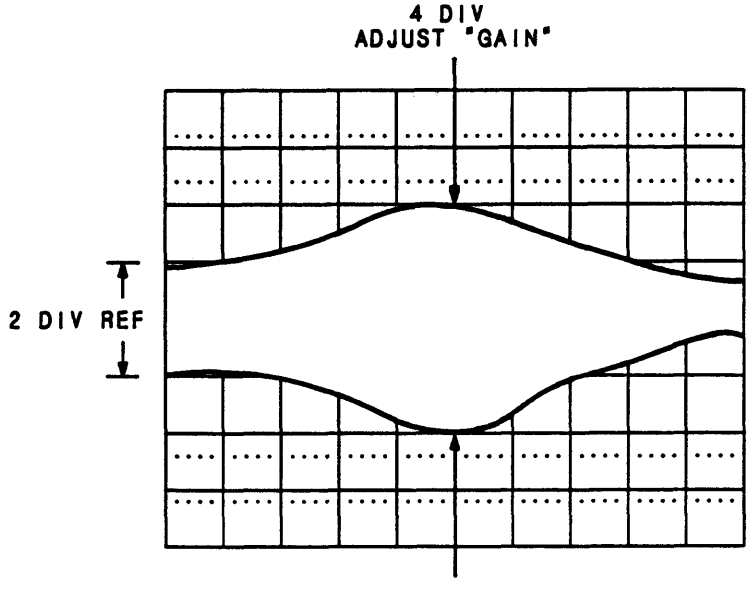


Figure 5-26a. ALC Gain Adjusted Correctly (Worst Case)

5-27. MARKER AND SAMPLER ADJUSTMENTS (UPDATES)

NOTE

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

REFERENCE

Performance Test: Paragraph 4-16
Service Sheets: A7 and A8

DESCRIPTION

Internal crystal markers are generated by mixing derivatives of a 50 MHz crystal oscillator with the low band sweep. Proper marker functioning requires adjustment of the crystal oscillator, the internal mixer, and IF gain for each marker frequency.

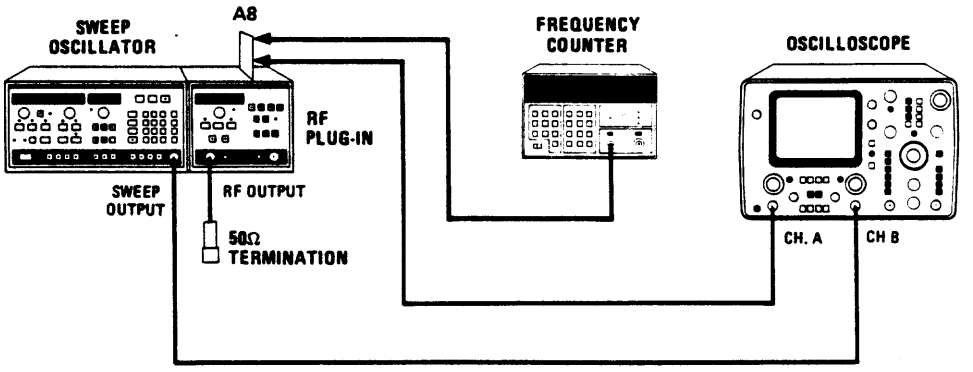


Figure 5-32. Marker Adjustments Test Setup

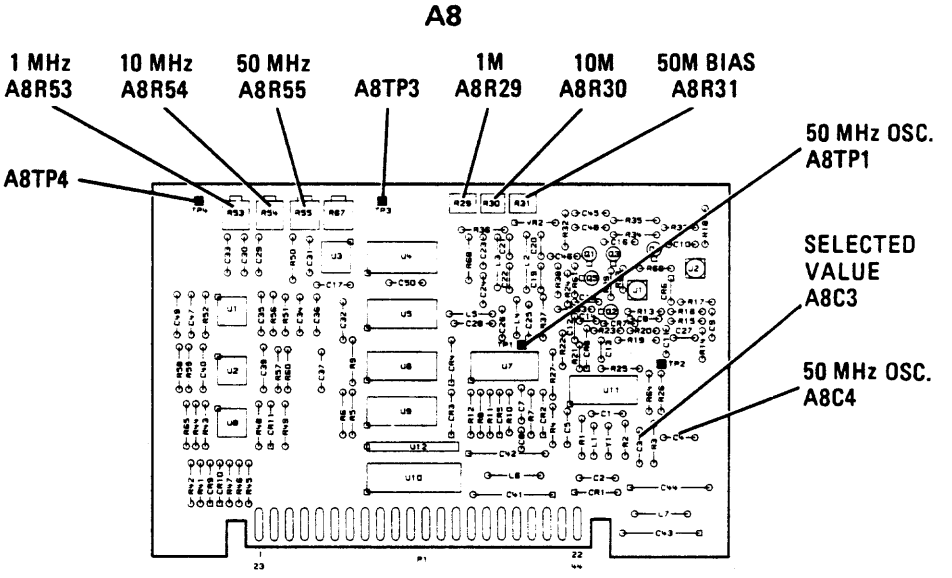


Figure 5-33. Marker Adjustments on A8

5-27. MARKER AND SAMPLER ADJUSTMENTS (UPDATES) (Cont'd)

EQUIPMENT:

FREQUENCY COUNTER	HP 536A
OSCILLOSCOPE	HP 436A

PROCEDURE:

NOTE

Turn ac power off when removing or installing PC boards.

1. Place A8 assembly on extender board. Connect equipment as shown in Figure 5-32. For all adjustments and test point locations refer to Figure 5-33 Marker Adjustments on A8 or Figure 5-36 Marker Adjustments on A7. Terminate 83522A RF output in 50 Ohms. Set 1740A oscilloscope to A vs B sweep mode to obtain horizontal deflection as a function of the 8350A/B SWEEP OUT.

2. Set 8350A/B START/STOP sweep for 10 MHz to 2.0 GHz. Select 83522A AMPTD MARKERS. Connect counter with 1:1 capacitive probe to A8TP1. Adjust A8C4 start for frequency counter indication of 50 MHz ±250Hz. If A8C4 does not have the range required to adjust the 50 MHz crystal oscillator, select a new value for A8C3. (An increase in capacitance will decrease frequency).

3. Select 100ms Sweep Time. Connect oscilloscope with 1:1 capacitive probe to A8TP4. Set 8350A/B power to +13 dBm and select 1 MHz Markers. Adjust A8R29 for the flattest envelope height (See Figure 5-34). Select 10 MHz Markers. Adjust A8R30 for the flattest envelope height. Select 50 MHz Markers. (This waveform appears like a comb.) Adjust A8R31 for the flattest envelope height. (Optimum setting for these adjustments will be ones that provide the most uniform height across the band. Especially note height at the high-frequency end and set the adjustment just before the slight rise drops off.)

4. Set RF POWER to 0 dBm. Adjust IF gain potentiometers for each marker frequency to an average envelope height of 1.5 V p-p.

5. Adjust oscilloscope Channel B vernier for a horizontal deflection of exactly 10 divisions. Set 8350A/B CF=1GHz, ΔF=10 MHz. Select 50 MHz Markers. Center the birdie envelope on the screen with plug-in front panel FREQ CAL control. (See Figure 5-35.) Then select 10 MHz Markers. Change ΔF to 1 MHz. Recenter birdie. Display is now calibrated for 100 kHz/Division.

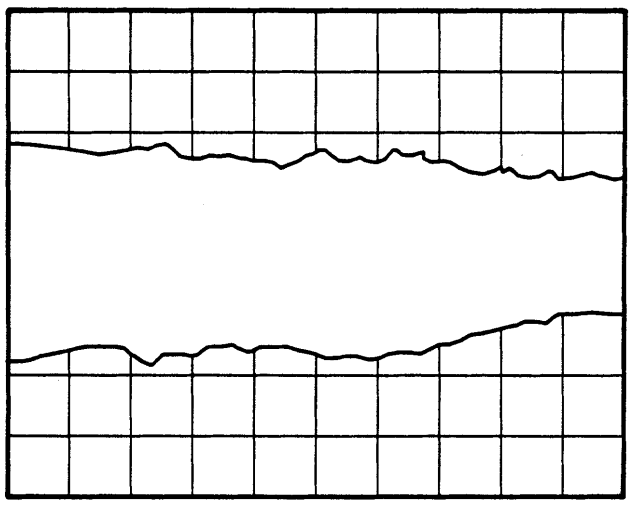


Figure 5-34. 10 MHz Marker Envelope at A8TP4

5-27. MARKER AND SAMPLER ADJUSTMENTS (UPDATES) (Cont'd)

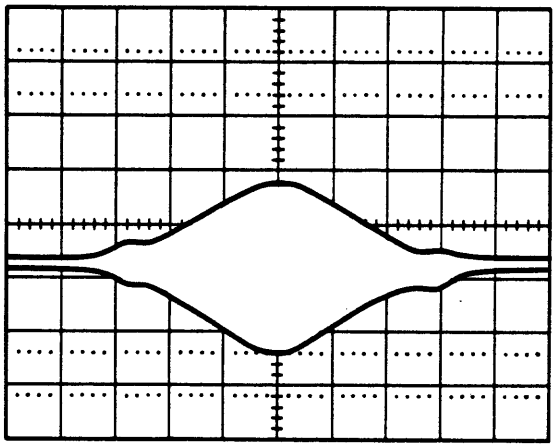


Figure 5-35. 50 MHz Birdie

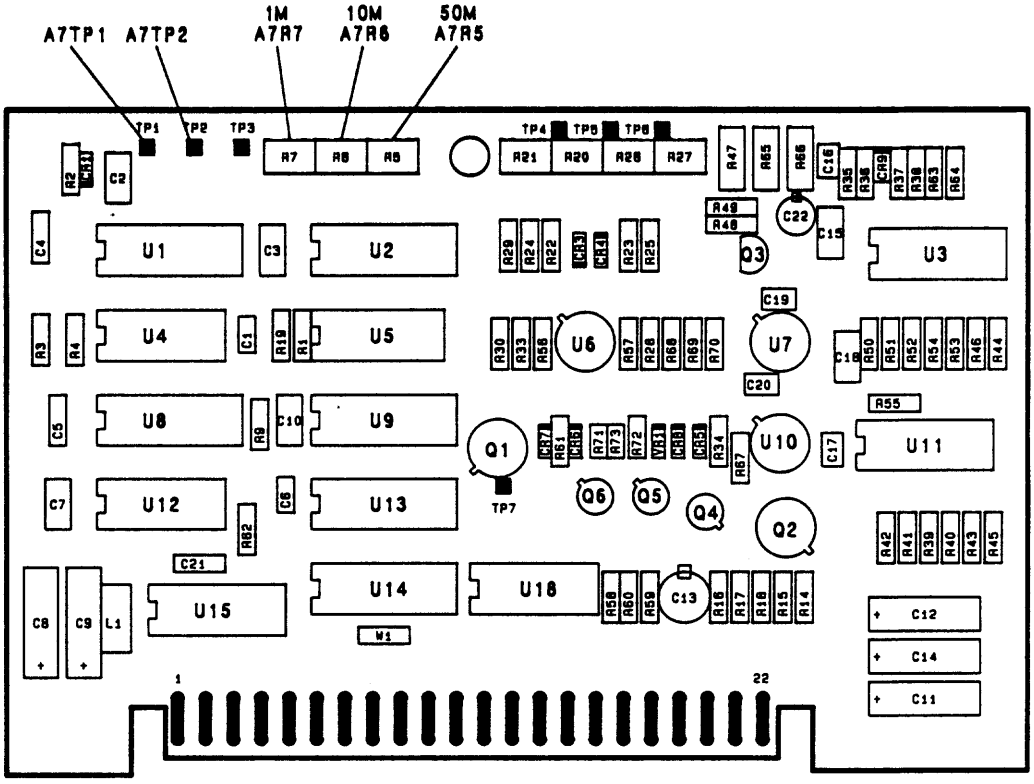


Figure 5-36. Marker Adjustments on A7

5-27. MARKER AND SAMPLER ADJUSTMENTS (UPDATES) (Cont'd)

6. Connect scope probe to A7TP1. Adjust A7 marker threshold potentiometers for the proper pulse width of each marker as follows:

NOTE

The previous step calibrates the oscilloscope display to 100 kHz/ Division.

50 MHz: Adjust A7R5 (50M) for 600 kHz p-p (6 divisions)

10 MHz: Adjust A7R6 (10M) for 400 kHz p-p (4 divisions)

1 MHz: Adjust A7R7 (1M) for 200 kHz p-p (2 divisions)

7. Press INTENS MKR. Connect the oscilloscope probe to A7TP2. First, ensure that marker OFF pulses exist on both sides of the marker ON pulse. (Decreasing the oscilloscope BEAM INTENSITY will expose the marker ON pulses.) (See Figure 5-37.) While the crystal markers may function properly without them, the marker-off pulses provide a safeguard against false markers appearing on the display.

8. Secondly, ensure that the marker OFF pulse does not overlap the marker ON pulse. Figure 5-38 illustrates an improper marker OFF pulse. When this occurs, change the value of A7R4 to eliminate overlap. The optimum value for A7R4 allows the maximum number of marker OFF pulses without overlapping the ON pulse. The typical value for A7R4 is 1200 Ohms and the minimum value is 1000 Ohms. (To observe marker OFF pulses, vary RF OUTPUT power between +3 dBm and +13 dBm.)

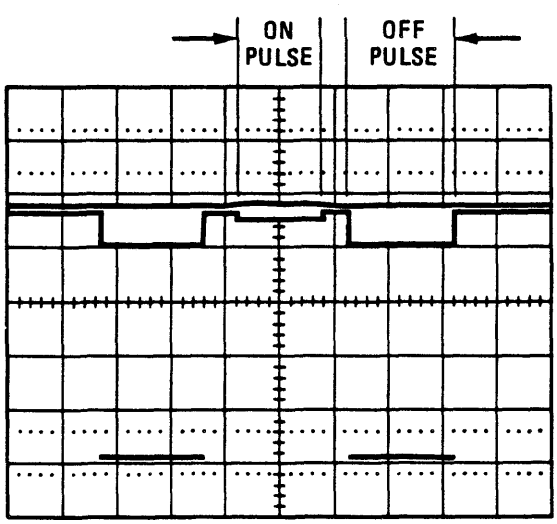


Figure 5-37. On/Off Pulse of Correctly Adjusted Circuit

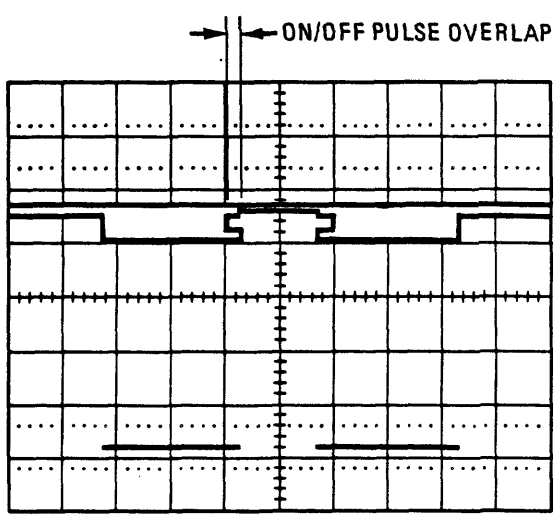


Figure 5-38. On/Off Pulse of Misadjusted Circuit Showing Overlap

5-27A. MARKER GAIN ADJUSTMENT (Fine Tune) (UPDATES)

REFERENCE:

SERVICE SHEET: A8.

DESCRIPTION:

Fine tune adjustments of gain peak markers and eliminate unwanted glitches between markers.

EQUIPMENT:

Function Generator ..... HP 3312A
Swept Amplitude Analyzer ..... HP 8755C
Detector ..... HP 11664B
10 dB Attenuator ..... HP 8491B Opt. 010
Oscilloscope ..... HP 1740A

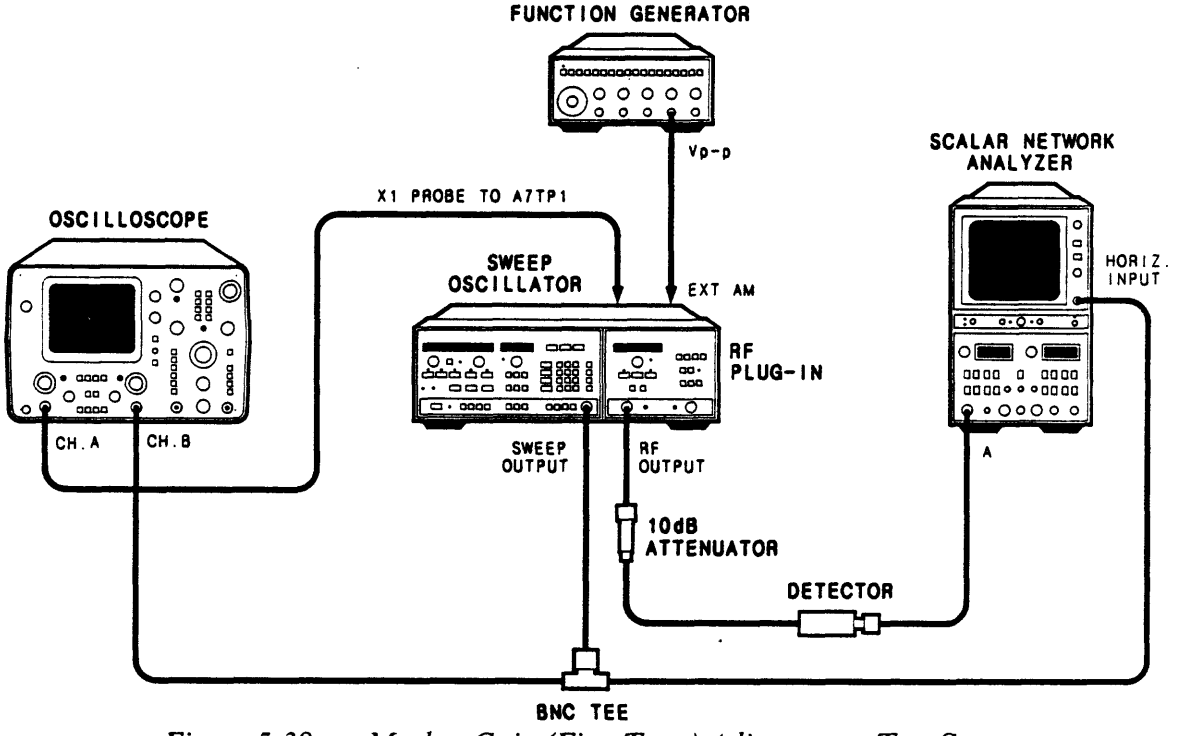


Figure 5-38a. Marker Gain (Fine Tune) Adjustments Test Setup

PROCEDURE:

1. Connect equipment as shown in Figure 5-38a.
2. Set instrument controls as follows:

8350A/B SWEEP OSCILLATOR

CF ..... 15 MHz
CF STEP SIZE ..... 10 MHz
ΔF ..... 10 MHz
[⌐¬MOD] ..... ON
SWEEP TIME ..... 17 ms

83522A RF PLUG-IN

POWER LEVEL ..... 9 dBm
MARKERS ..... AMPTD 1 MHz

5-27A. MARKER GAIN ADJUSTMENT (Fine Tune) (UPDATES) (Cont'd)

3312A FUNCTION GENERATOR

SINE WAVE ..... ON
AMPLITUDE ..... 10 V P-P
FREQUENCY ..... 5 Hz

8755C SWEPT AMPLITUDE ANALYZER

DB/DIV ..... 5 dB
REFERENCE LEVEL ..... −2 dB
VERNIER ..... OFF

PROCEDURE:

3. On the HP 8755C, observe the 1 dB markers riding on a varying power level. Press CF ↑ to step through the band (10 MHz-2.0 GHz). If the markers seem weak, ragged, or start flashing between markers (see Figure 5-38b), adjust gain (A8R53). However, be aware that these adjustments can create double markers or degradation of off pulses. (1 MHz markers are only specified to 1 GHz CF, ie., correctly adjusted, they may start disappearing or having double markers beyond 1 GHz).
4. Iterate Step 3 for 10 MHz markers with CF=60 MHz, CF STEP SIZE=100 MHz, ΔF=100 MHz and the gain adjustment of A8R54.
5. Reiterate Step 3 for 50 MHz markers with CF=260 MHz, CF STEP SIZE=500 MHz, ΔF=500 MHz and the gain adjustment of A8R55.

HP 8755C Display of 1 MHz MKR's

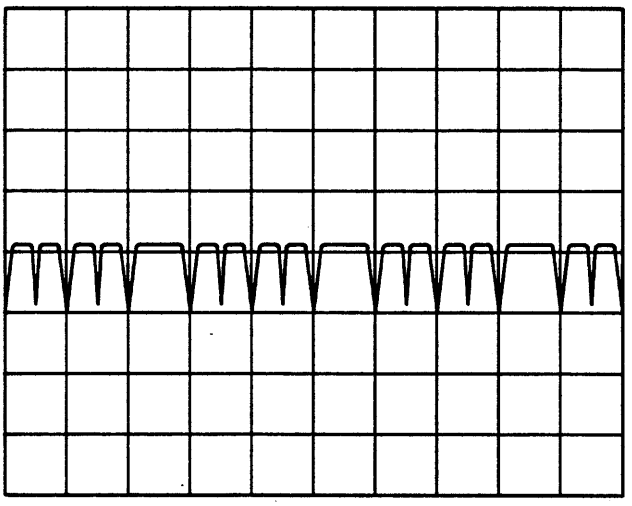


Figure 5-38b. Markers incorrectly adjusted

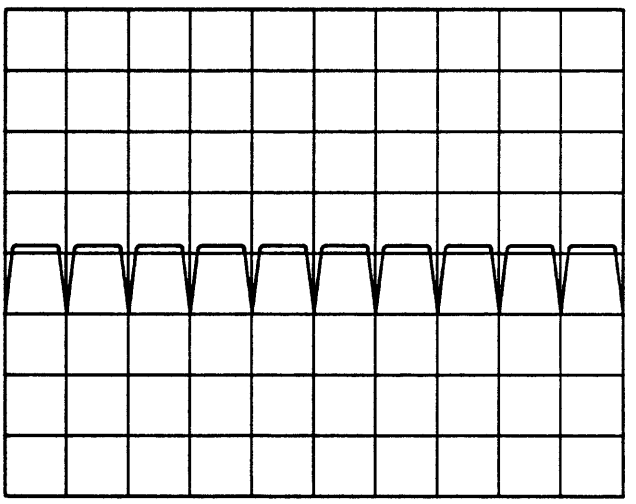


Figure 5-38c. Markers correctly adjusted

5-28. EXTERNAL MARKER ADJUSTMENT (UPDATES)

REFERENCE:

Service Sheet: A8.

DESCRIPTION:

A rear panel BNC jack is available for external marker sources. A8R67 provides gain adjustment to the video amplifier for marker presence.

When using the HP 8755C with external markers, factory select resistor A8R28 reduces the feedthrough, but degrades internal markers.

EQUIPMENT:

RF Marker Source	HP 8350A/B/83522A
Swept Amplitude Analyzer	HP 8755C
Detector	HP 11664B
Oscilloscope	HP 1740A
10 dB Attenuator	HP 8491A Option 010

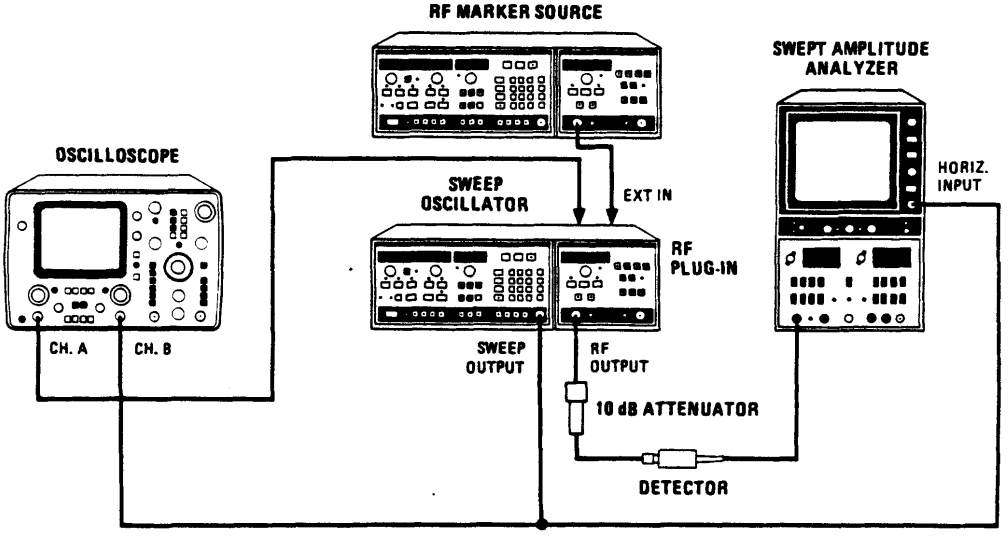


Figure 5-39. External Marker Adjustments Test Setup

PROCEDURE:

NOTE

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

1. Connect the equipment as shown in Figure 5-39. Set external marker source to a CW frequency of 150 MHz. Press AMPTD MKR. Set power level between −10 and +10 dBm.

5-28. EXTERNAL MARKER ADJUSTMENT (UPDATES) (Cont'd)

2. Set RF plug-in to be adjusted in EXT and AMPTD MKR MODES. On the 8350A/B select a START frequency = 50 MHz, STOP frequency = 250 MHz, and a sweep speed = 17 ms.

3. Connect oscilloscope probe to A8TP4 (Figure 5-40). Observe the birdie amplitude and adjust EXT GAIN (A8R67) for 1.5V p-p.

4. Turn HP 8350A/B ⊔⊓ MOD on and check for a single marker on the HP 8755C. The 27.8 kHz feedthrough signal at the output of A8Q2 may cause a problem in detecting a marker. If the marker does not appear on the HP 8755C, go to step 5.

5. Increase the value of resistor A8R28 until the marker appears on the screen. However, be aware that larger values of A8R28 will degrade the performance of the 8350A/B internal crystal markers. Check the internal markers before permanently selecting a value for A8R28. Typical value is 3160 Ohms; suggested maximum value is 5110 Ohms.

NOTE

If external marker harmonics interfere with the measurement, reduce the marker source output power.

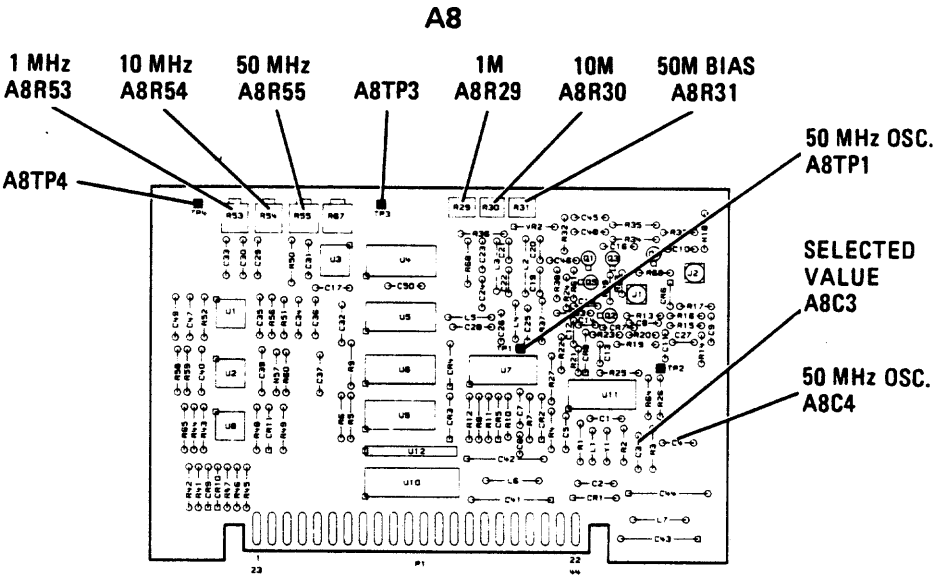


Figure 5-40. External Marker Adjustments Location

CHANGE 1

The 64-pin rear connector cable assembly W32 is now soldered instead of crimped, to minimize the possibility of intermittent open contacts. The part number remains unchanged.

CHANGE 2

This change replaces the A5 FM Driver assembly.

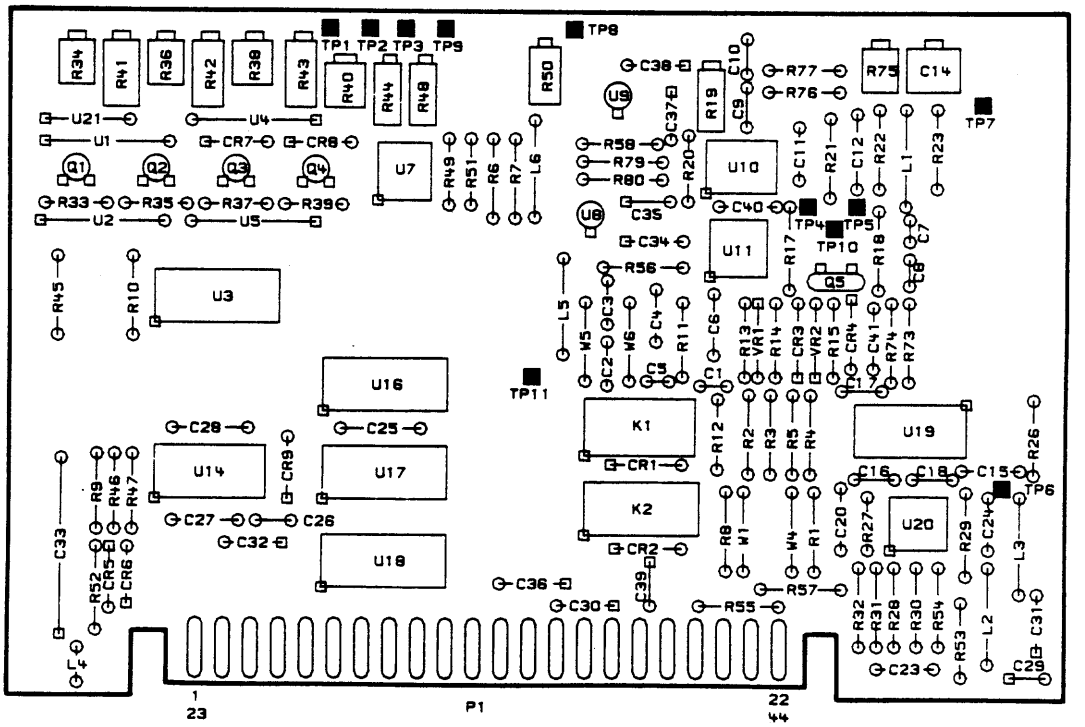
Page 6-9, Table 6-3:
Change the A5 Assembly HP and Mfr. Part Number to 83525-60043, CD 1.

Page 6-11, Table 6-3:
Add A5R79, HP Part Number 0757-0403, CD 2, RESISTOR 121 1% .125W F TC=0±100, Mfr. Code 24546, Mfr. Part Number C4-1/8-TO-121 R-F.
Add A5 R80, HP Part Number 0698-0082, CD 7, RESISTOR 464 1% .125W F TC=0±100, Mfr. Code 24546, Mfr. Part Number C4-1/8-TO-4640-F.

Page 8-51, Figure 8-40:
Replace Figure 8-40 with *A5 FM Driver, Component Locations (CHANGE 2)* from this document.

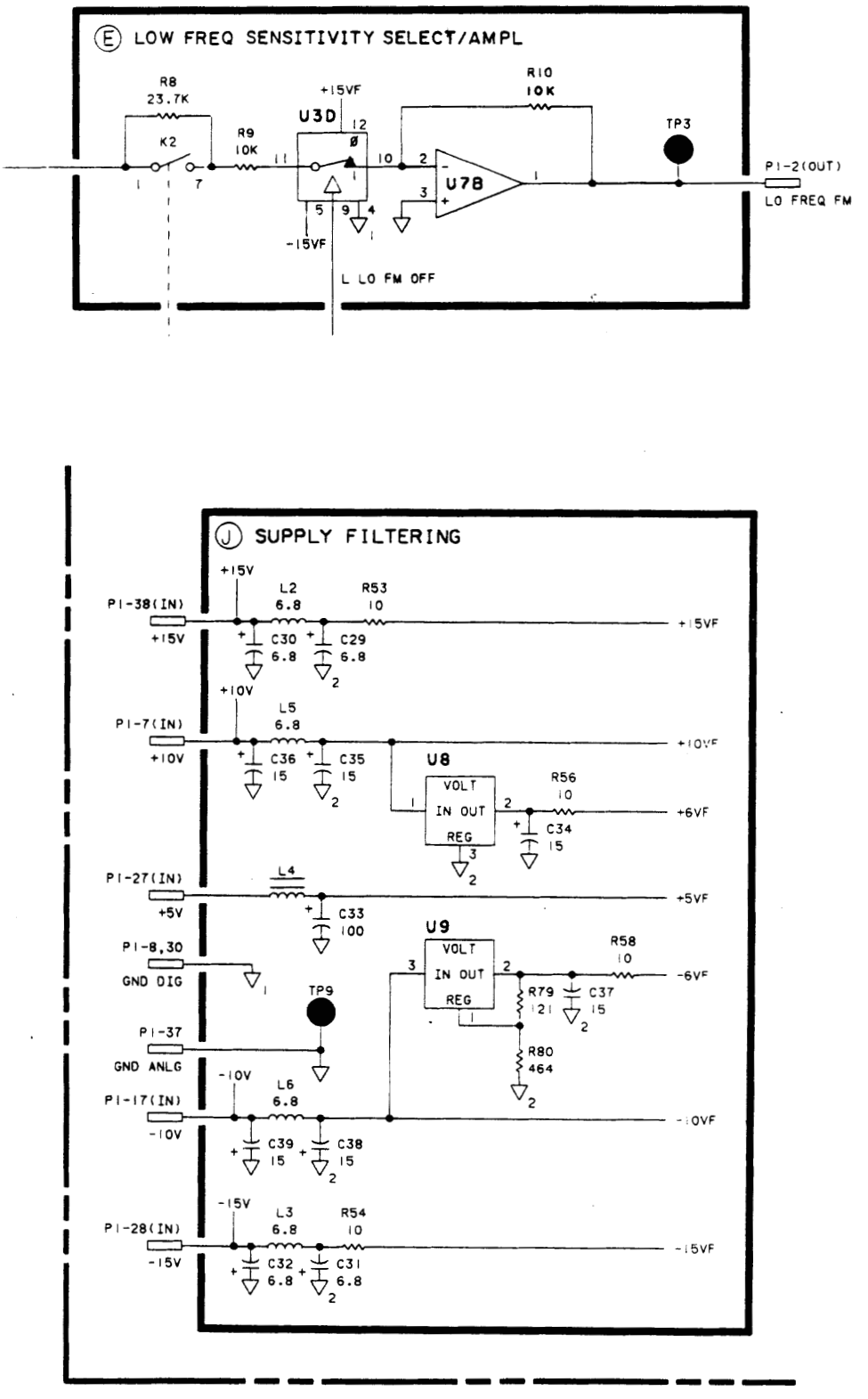
Page 8-51, Figure 8-43:
Change the A5 FM DRIVER part number in the top left-hand corner of the A5 Schematic to 83525-60043.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2202A.
Replace blocks E and J with blocks E and J labeled *P/O A5 FM Driver, Schematic Diagram (CHANGE 2)* from this document.

A5



HP P/N 83525-60043

A5 FM Driver, Component Locations (CHANGE 2)



SERIAL PREFIX: **2202A**

P/O A5 FM Driver, Schematic Diagram (CHANGE 2)

CHANGE 3

This change replaces the A2 Front Panel Interface.

Page 6-5, Table 6-3:
Change A2 to HP and Mfr. Part Number 83525-60060, CD 2.

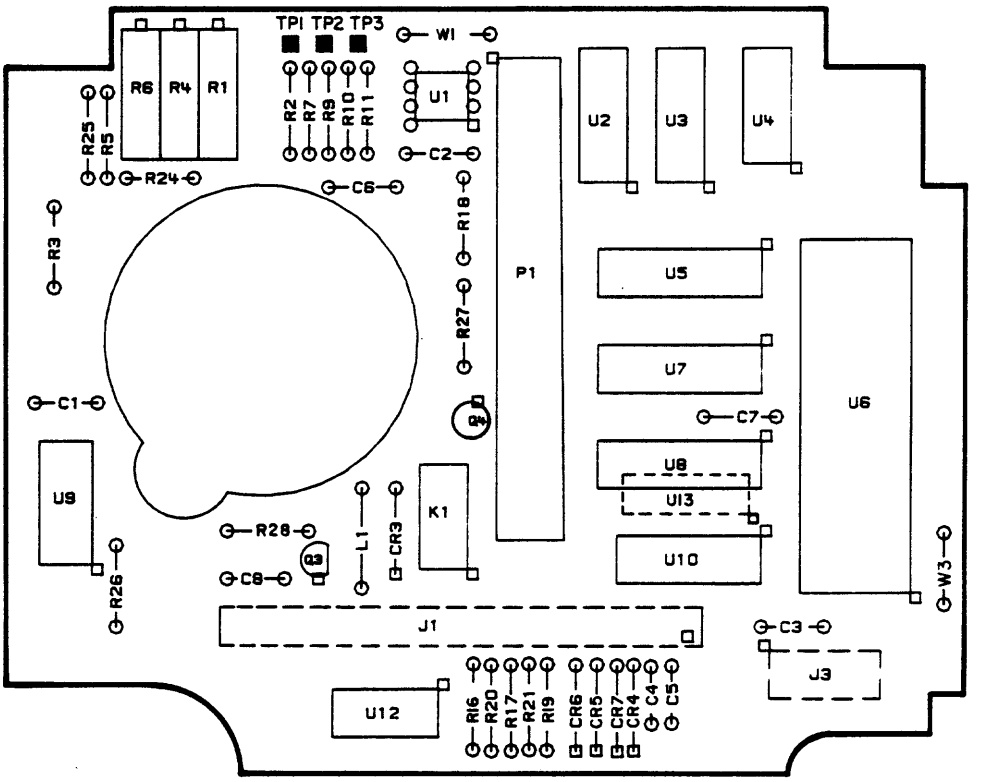
Page 6-6, Table 6-3:
Change A2J1 to HP and Mfr. Part Number 1251-5926, CD 3.
Add A2C8, 0160-3875, Qty 1, CD 3, CAPACITOR-FXD 22PF ±5% 200VDC CER 0±30, 28480, 0160-3875.
Add A2Q4, 1854-0477, Qty 1, TRANSISTOR NPN SI CHIP FT=1.3 GHZ, 02037, SMCS1005.
Add A2R26, 0698-7229, CD 8, Qty 1, RESISTOR 511 1% .05 W F TC=0±100, 24546, C3-1/8-TO-511R-G.
Add A2R27, 0698-7260, CD 7, RESISTOR 10K 1% .05W F TC=0±100, 24546, C3-1/8-TO-1002-G.
Add A2R28, 0698-7205, CD 0, Qty 1, RESISTOR 51.1 OHMS 1% .05W F TC=0±100, 03292, C3-1/8-TO-51R1-F.
Change the Qty for A2U2 to 2.
Change the Qty for A2U5 to 9.
Change A2U8 to 1820-1730, CD 6, IC FF TTL LS D-TYPE POS-EDGE-TRIG COM, 01295, SN74LS273N.
Change A2U10 to 1858-0069, Qty 1, CD 1, TRANSISTOR ARRAY 18-PIN PLSTC DIP, 13606, ULN-2803A.
Add A2W3, 8159-0005, Qty 1, CD 0, RESISTOR-ZERO OHMS 22AWG LEAD DIA, 28480, 8159-0005.

Page 8-31, Figure 8-12:
Replace the FRONT Component Locations diagram with the *A2 Front Panel Interface, Component Locations (CHANGE 3)* diagram from this document.

Page 8-31, Figure 8-13:
Delete the REAR Component Locations diagram.

Note that the potentiometers R1, R4, R6, and R23 have been moved from the circuit side of the board and are now mounted on the component side. J1, J3, and U13 are mounted on the circuit side.

Page 8-31, Figure 8-19:
Change the A2 FRONT PANEL INTERFACE part number in the top left-hand corner of the A2 Schematic to 83525-60060.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2205A.
Replace blocks A and G with the partial schematic *P/O A2 Front Panel Interface, Schematic Diagram (CHANGE 3)* from this document.

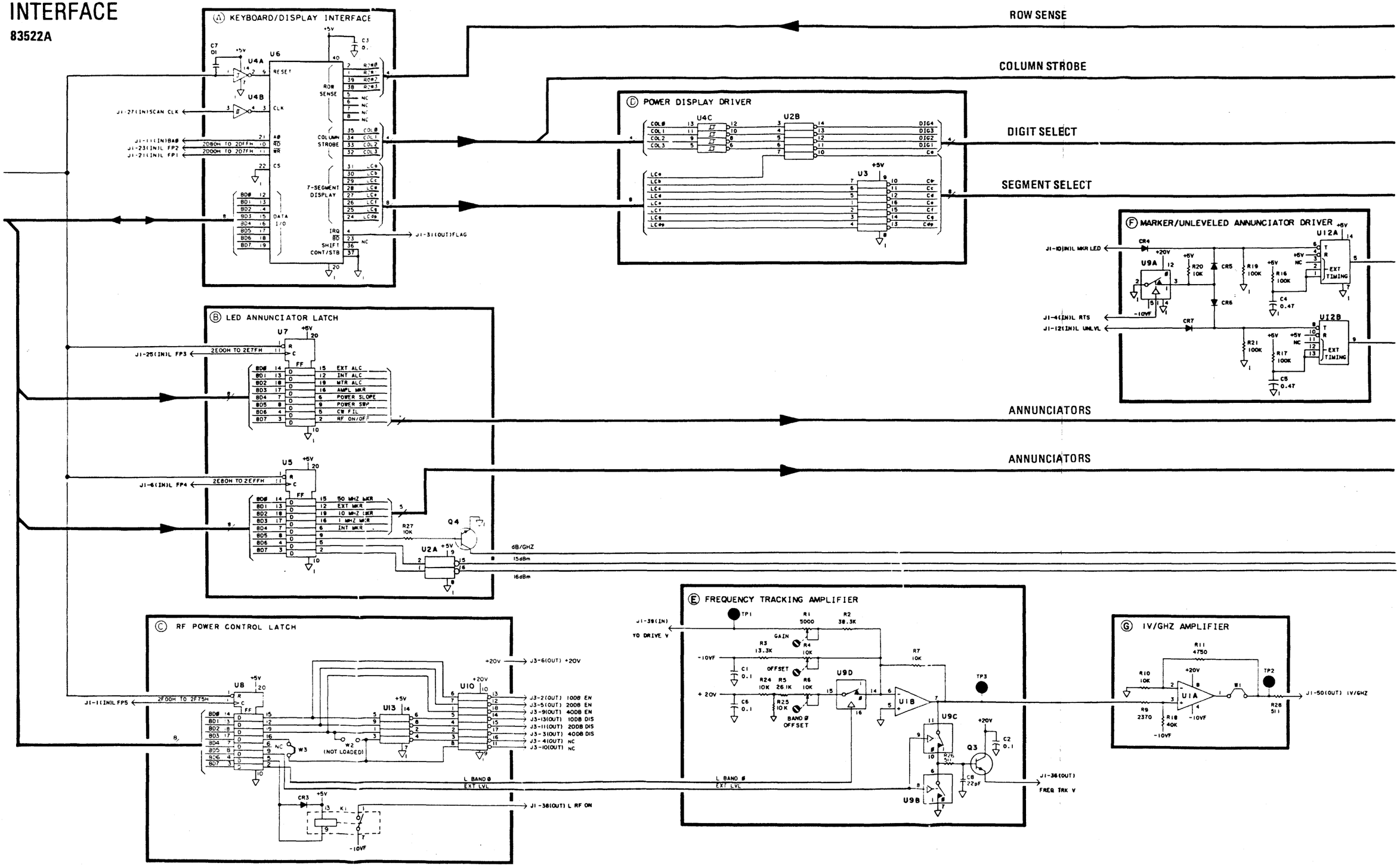


HP P/N 83525-60060

A2 Front Panel Interface Component Location (CHANGE 3)

INTERFACE

83522A



P/O A2 Front Panel Interface, Schematic Diagram (CHANGE 3)

CHANGE 4

This change replaces the A4 ALC Assembly, and documents a change on the Front Panel.

Page 6-5, Table 6-3:
Change A1R3 and A1R4 to HP and Mfr. Part Number 2100-4022, CD 0.

Pages 6-7 to 6-9:
Replace A4 83522-60006 BOARD ASSEMBLY - ALC and its components with the A4 83522-60061 **ALC BOARD ASSEMBLY** parts list in this document.

Page 8-45, Figure 8-30:
Replace the Component Locations Diagram with *Figure 8-30. ALC Component Locations (CHANGE 4)* from this document.

Page 8-45, Figure 8-35:
Replace the A4 Schematic Diagram with *Figure 8-35. A4 ALC Schematic Diagram* from this document.

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	83522--60061	0	1	ALC BOARD ASSEMBLY	28480	83522--60061
A4C1	0160--0127	2	2	CAPACITOR--FXD 1UF ±20% 25VDC CER	28480	0160--0127
A4C2	0180--0374	3	4	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	3	CAPACITOR--FXD .01UF ±20% 100VDC CER	28480	0160--3879
A4C7	0160--4084	8	10	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	1	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	0160--0572	1	1	CAPACITOR--FXD 2200PF ±20% 100VDC CER	28480	0160--0572
A4C20	0160--0574	3	1	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--3534	1	1	CAPACITOR--FXD 510 ±5% 100VDC MICA	28480	0160--3534
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
A4C26	0160--3875	3	1	CAPACITOR--FXD 22PF ±5% 200VDC CER 0±30	28480	0160--3875
A4C27	0160--4084	8		CAPACITOR--FXD .1UF ±20% 50VDC CER	28480	0160--4084
A4C29	0160--4084	8		CAPACITOR--FXD .1UF ±20% 50VDC CER	28480	0160--4084
A4C33	0160--0570	9		CAPACITOR--FXD 220PF ±20% 100VDC CER	20932	5024EM100RD221M
A4CR2	1901--1098	1	9	DIODE--SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR4	1901--0535	9	2	DIODE--SM SIG SCHOTTKY	28480	1901--0535
A4CR5	1901--1098	1		DIODE--SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR6	1901--1098	1		DIODE--SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR7	1901--1098	1		DIODE--SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR9	1901--1098	1		DIODE--SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR11	1901--1098	1		DIODE--SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR12	1901--0535	9		DIODE--SM SIG SCHOTTKY	28480	1901--0535
A4CR16	1901--1098	1		DIODE--SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR17	1901--0518	8	1	DIODE--SM SIG SCHOTTKY	28480	1901--0518

A4 Replaceable Parts (CHANGE 4) (1 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4J1	1258--0124	7	2	PIN--PROGRAMING DUMPER .30 CONTACT	91506	8136--475G1
A4J2	1258--0124	7		PIN--PROGRAMING DUMPER .30 CONTACT	91506	8136--475G1
A4L1	9140--0210	1	2	INDUCTOR RF--CH--MLD 100UH 5% .166DX.385LG	28480	9140--0210
A4L2	9100--2474	9	1	INDUCTOR RF--CH--MLD 5.6UH 1% .166DX.385LG	28480	9100--2474
A4L3	9140--0210	1		INDUCTOR RF--CH--MLD 100UH 5% .166DX.385LG	28480	9140--0210
A4MP1	5040--6848	7	1	BOARD EXTRACTOR--YELLOW	28480	5040--6848
A4MP2	5000--9043	6	1	PIN	28480	5000--9043
A4MP3	1251--4932	9	4	CONNECTOR--SGL CONT SKT .021--IN--BSC--SZ	91506	LSG--1AG14--1
A4MP4	7121--3538	0	1	LABEL--IN 83525	28480	7121--3538
A4MP5	7121--3315	1	1	LABEL--IN 60063	28480	7121--3315
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
A4Q6	1854--0295	7		TRANSISTOR--DUAL NPN PD=400MW	28480	1854--0295
A4Q7	1855--0423	5	5	TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q8	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q9	1853--0451	5	2	TRANSISTOR PNP 2N3799 SI TO--18 PD=360MW	01295	2N3799
A4Q13	1854--0404	0	1	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
A4Q15	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q17	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4R1	2100--2633	5	2	RESISTOR--TRMR 1K 10% C SIDE--ADJ 1--TRN	30983	ET50X102
A4R2	2100--2516	3	1	RESISTOR--TRMR 100K 10% C SIDE--ADJ 1--TRN	32997	3329W--1--104
A4R4	2100--2489	9	1	RESISTOR--TRMR 5K 10% C SIDE--ADJ 1--TRN	30983	ET50X502
A4R6	2100--3611	1		RESISTOR--TRMR 50K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--503
A4R7	2100--0670	6	2	RESISTOR--TRMR 10K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--103
A4R9	2100--3749	6	1	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	2100-2489	9		RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-502
A4R12	0698--7257	2	2	RESISTOR 7.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--7501--F
A4R13	0698--7258	3	2	RESISTOR 8.25K 1% .05W F TC=0+100	24546	C3--1/8--T0--8251--F
A4R14	0698--7251	6	2	RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3--1/8--T0--4221--F
A4R15	0698--7236	7	2	RESISTOR 1K 1% .05W F TC=0+100	24546	C3--1/8--T0--1001--F
A4R16	0698--7268	5	2	RESISTOR 21.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--2152--F
A4R17	0698--7253	8	3	RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3--1/8--T0--5111--F
A4R18	0698--7268	5		RESISTOR 21.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--2152--F
A4R19	0698--7260	7	4	RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R20	0698--7263	0	1	RESISTOR 13.3K 1% .05W F TC=0+100	24546	C3--1/8--T0--1332--F
A4R21	0698--7274	3	1	RESISTOR 38.3K 1% .05W F TC=0+100	24546	C3--1/8--T0--3832--F
A4R22	0698--7261	8	2	RESISTOR 11K 1% .05W F TC=0+100	24546	C3--1/8--T0--1102--F
A4R23	0757--0464	5	1	RESISTOR 90.9K 1% .125W F TC=0+100	24546	C4--1/8--T0--9092--F

A4 Replaceable Parts (CHANGE 4) (2 of 5)

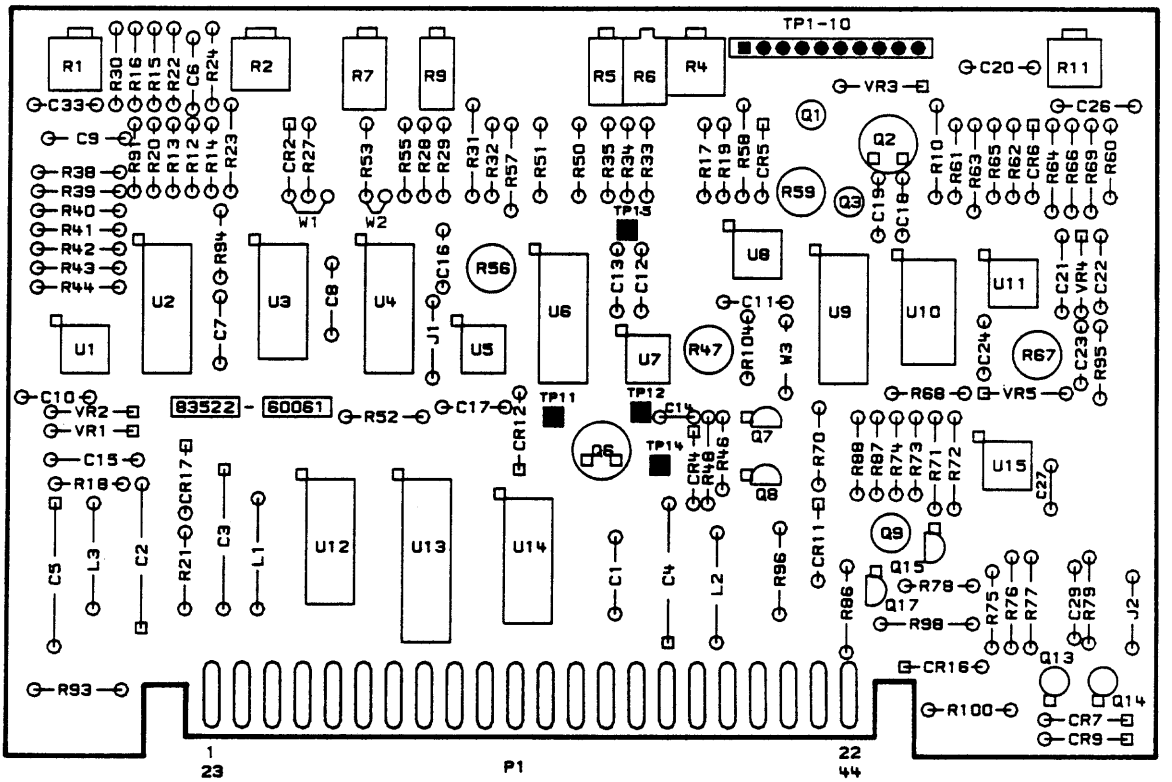
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R24	0698--7266	3	1	RESISTOR 17.8K 1% .05W F TC=0+100	24546	C3--1/8--T0--1782--F
A4R27	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R28	0698--7227	6	1	RESISTOR 422 1% .05W F TC=0+100	24546	C3--1/8--T0--422R--F
A4R29	0698--6846	3	1	RESISTOR 5.42K .5% .125W F TC=0+50	24546	NC55--1/8--T2--5421--D
A4R30	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R31	0837--0119	7	1	THERMISTOR 5K OHM TC+.7%	28480	0837--0119
A4R32	0698--7259	4	3	RESISTOR 9.09K 1% .05W F TC=0+100	24546	C3--1/8--T0--9091--F
A4R33*	0698--7272	1	2	RESISTOR 31.6K 1% .05W F TC=0+100	24546	C3--1/8--T0--3162--F
A4R34	0698--7233	4	1	RESISTOR 750 1% .05W F TC=0+100	24546	C3--1/8--T0--750R--F
A4R35	0698--7243	6	5	RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R38	0698--7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3--1/8--T0--100R--F
A4R39	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R40	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R41	0698--7283	4	1	RESISTOR 90.9K 1% .05W F TC=0+100	24546	C3--1/8--T0--9092--F
A4R42	0698--7267	4	1	RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3--1/8--T0--1962--F
A4R43	0698--7272	1		RESISTOR 31.6K 1% .05W F TC=0+100	24546	C3--1/8--T0--3162--F
A4R44	0698--7275	4	1	RESISTOR 42.2K 1% .05W F TC=0+100	24546	C3--1/8--T0--4222--F
A4R46	0698--7197	9	1	RESISTOR 23.7 1% .05W F TC=0+100	24546	C3--1/8--T0--23R7--F
A4R47	2100--2030	6	3	RESISTOR--TRMR 20K 10% C TOP--ADJ 1--TRN	73138	82PR20K
A4R48	0757--0421	4	1	RESISTOR 825 1% .125W F TC=0+100	24546	C4--1/8--T0--825R--F
A4R50	0698--7268	5	1	RESISTOR 21.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--2152--F
A4R51	0698--7282	3	1	RESISTOR 82.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--8252--F
A4R52	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R53	0698--7254	9	1	RESISTOR 5.62K 1% .05W F TC=0+100	24546	C3--1/8--T0--5621--F
A4R55	0698--7257	2		RESISTOR 7.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--7501--F
A4R56	2100--2030	6		RESISTOR--TRMR 20K 10% C TOP--ADJ 1--TRN	73138	82PR20K
A4R57	0757--0280	3	3	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--7250	5	1	RESISTOR 3.83K 1% .05W F TC=0+100	24546	C3--1/8--T0--3831--F
A4R61	0698--7259	4		RESISTOR 9.09K 1% .05W F TC=0+100	24546	C3--1/8--T0--9091--F
A4R62	0698--7270	9	1	RESISTOR 26.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--2612--F
A4R63	0757--0447	4	1	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--F
A4R66	0757--1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4--1/8--T0--1471--F
A4R67	2100--2030	6		RESISTOR--TRMR 20K 10% C TOP--ADJ 1--TRN	73138	82PR20K
A4R68	0698--7236	7		RESISTOR 1K 1% .05W F TC=0+100	24546	C3--1/8--T0--1001--F
A4R69	0698--3440	7	4	RESISTOR 196 1% .125W F TC=0+100	24546	C4--1/8--T0--196R--F
A4R70	0698--7269	6	1	RESISTOR 23.7K 1% .05W F TC=0+100	24546	C3--1/8--T0--2372--F
A4R71	0698--0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4--1/8--T0--2611--F

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R72	0757--0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+100	24546	C4--1/8--T0--1781--F
A4R73	0698--7277	6	1	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--5112--F
A4R74	0698--7251	6		RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3--1/8--T0--4221--F
A4R75	0698--3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+100	24546	C4--1/8--T0--2871--F
A4R76	0698--3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4--1/8--T0--196R--F
A4R77	0757--0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+100	24546	C4--1/8--T0--1211--F
A4R78	0698--7234	5	1	RESISTOR 825 1% .05W F TC=0+100	24546	C3--1/8--T0--825R--F
A4R79	0757--0394	0	1	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4--1/8--T0--51R1--F
A4R86	0698--3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4--1/8--T0--196R--F
A4R87	0698--7256	1	1	RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3--1/8--T0--6811--F
A4R88	0698--7262	9	1	RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--1212--F
A4R91	0698--7276	5	1	RESISTOR 46.4K 1% .05W F TC=0+100	24546	C3--1/8--T0--4642--F
A4R93	0698--7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3--1/8--T0--100R--F
A4R94	0698--7253	8		RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3--1/8--T0--5111--F
A4R95	0698--7222	1	1	RESISTOR 261 1% .05W F TC=0+100	24546	C3--1/8--T0--261R--F
A4R96	0698--3157	3	2	RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4--1/8--T0--1962--F
A4R98	0837--0085	6	1	THERMISTOR ROD 680--OHM TC=+.7%/C--DEG	28480	0837--0085
A4R100	0757--0419	0	1	RESISTOR 681 1% .125W F TC=0+100	24546	C4--1/8--T0--681R--F
A4R104	0698--7253	8		RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3--1/8--T0--5111--F
A4TP1	1251--4672	4	10	CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP2	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP3	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP4	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP5	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP6	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP7	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP8	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP9	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP10	1251--4672	4		CONNECTOR 10--PIN M POST TYPE	28480	1251--4672
A4TP11	0360--0535	0	4	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP12	0360--0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
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 PKG	28480	1826--0261
A4U2	1826--0417	6	2	IC SWITCH ANLG QUAD 16--DIP--C PKG	27014	LF13333D
A4U3	1826--0616	7	1	IC OP AMP PRCN QUAD 14--DIP--C PKG	06665	OP--11EY
A4U4	1826--0610	1	2	IC MULTIPLXR 4--CHAN--ANLG DUAL 16--DIP--C	06665	MUX24FQ
A4U5	1826--0319	7	2	IC OP AMP LOW--BIAS--H--IMPD TO--99 PKG	04713	LF356G
A4U6	1826--0610	1		IC MULTIPLXR 4--CHAN--ANLG DUAL 16--DIP--C	06665	MUX24FQ
A4U7	1826--0447	2	1	IC OP AMP WB TO--99 PKG	27014	LF257H

A4 Replaceable Parts (CHANGE 4) (4 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4U8	1826--0021	8	1	IC OP AMP GP TO--99 PKG	27014	LM310H
A4U9	1826--0417	6		IC SWITCH ANLG QUAD 16--DIP--C PKG	27014	LF13333D
A4U10	1820--1197	9	1	IC GATE TTL LS NAND QUAD 2--INP	01295	SN74LS00N
A4U11	1826--0319	7		IC OP AMP LOW--BIAS--H--IMPD TO--99 PKG	04713	LF356G
A4U12	1820--1216	3	1	IC DCDR TTL LS 3--TO--8--LINE 3--INP	01295	SN74LS138N
A4U13	1820--1730	6	1	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 PKG	24355	AD7542BD
A4U15	1826--0026	3	1	IC COMPARATOR PRCN TO--99 PKG	01295	LM311L
A4VR1	1902--0049	2	2	DIODE--ZNR 6.19V 5% DO--35 PD=.4W	28480	1902--0049
A4VR2	1902--0049	2		DIODE--ZNR 6.19V 5% DO--35 PD=.4W	28480	1902--0049
A4VR3	1902--0041	4	1	DIODE--ZNR 5.11V 5% DO--35 PD=.4W	28480	1902--0041
A4VR4	1902--3070	5	2	DIODE--ZNR 4.22V 5% DO--35 PD=.4W	28480	1902--3070
A4VR5	1902--3070	5		DIODE--ZNR 4.22V 5% DO--35 PD=.4W	28480	1902--3070
A4W1	8159--0005	0	3	RESISTOR--ZERO OHMS 22 AWG LEAD DIA	28480	8159--0005
A4W2	8159--0005	0		RESISTOR--ZERO OHMS 22 AWG LEAD DIA	28480	8159--0005
A4W3	8159--0005	0		RESISTOR--ZERO OHMS 22 AWG LEAD DIA	28480	8159--0005

A4 Replaceable Parts (CHANGE 4) (5 of 5)



HP P/N 83522-60061

Figure 8-30. ALC Component Locations (CHANGE 4)

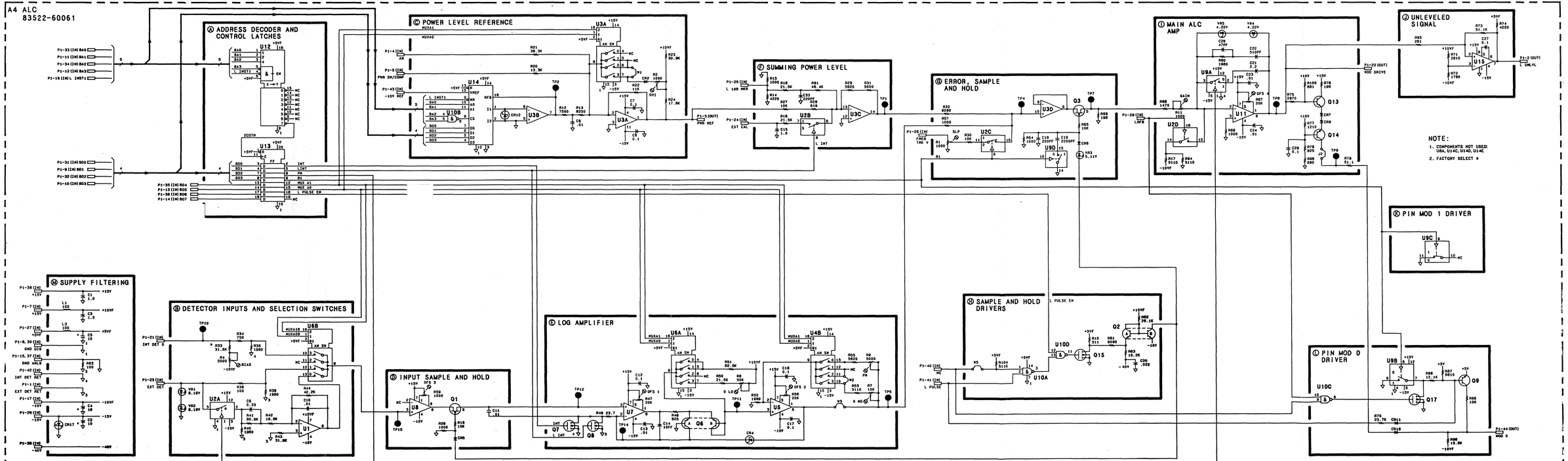


Figure 8-35. A4 ALC Schematic Diagram (CHANGE 4).

CHANGE 5

This change adds two new SHIFT functions and updates the A3 Digital Interface Board with revised firmware (Revision 3).

Page 3-5, Figure 3-3, Front Panel Features:

Change step 18 to read:

"POWER SWEEP allows setting an increase in power per sweep (db/SWP). SHIFT POWER SWEEP (Option 002) latches the Step Attenuator at its current setting. Power level changes are controlled by the ALC loop."

Change step 20 to read:

"SLOPE allows setting of the frequency slope compensation in dB/GHz (for lossy devices). SHIFT SLOPE (Option 002) latches the ALC loop at its current reference level. Power level changes are controlled by the Step Attenuator in 10 dB steps."

Page 6-6, Table 6-3:

Change A3 Board Assembly-Digital Interface to HP and Mfr. Part Number 83525-60068, CD 0.

Page 6-7, Table 6-3:

Change A3U1 to HP and Mfr. Part Number 5081-8176, CD 4.

Change A3U2 to HP and Mfr. Part Number 5081-8177, CD 5.

Page 8-35, Table 8-8:

Replace Table 8-8 with *Table 8-8. Configuration Switch on A3 Digital Interface Board (CHANGE 5)* contained in this document.

Page 8-35, Figure 8-24:

Change the A3 DIGITAL INTERFACE part number in the top left-hand corner of the schematic to 83525-60068.

Change the SERIAL PREFIX in the bottom left-hand corner of the schematic to 2307A.

Table 8-8. Configuration Switch on A3 Digital Interface Board (CHANGE 5)

Description		Switch Number 1	2	3	4	5	6	7	8
Plug-In:	83522A	0	0	0	x	x	x	x	x
	83525A	1	0	0	x	x	x	x	x
	83540A	0	1	0	x	x	x	x	x
	83545A	1	1	0	x	x	x	x	x
	83570A	0	0	1	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 (Note 2)		x	x	x	x	x	1	x	x
Cross-Over Coupled FM		x	x	x	x	x	0	x	x
Step Attenuator Option		x	x	x	x	x	x	1	x

NOTES

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

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

*With the configuration switch set for an Instrument Preset condition of "RF Power OFF", bias is removed from A12 YIG Oscillator and A14 Band 0 Amplifier. In addition, the 8350A microprocessor issues a blanking pulse to the plug-in. L RFB (Low = RF Blank) biases the modulator on hard, closing off the RF signal path. When RF power is manually turned on, via the front panel pushbutton, L RFB remains low for a short period to allow the RF micro circuit components to reach full capacity before releasing the ALC amplifier. This prevents the ALC loop from correcting for a large error voltage at initial power up, thus preventing overshoot.

CHANGE 6

This change replaces the A10 Mother Board and several of its cables.

Page 6-18, Table 6-3:
Change A10 BOARD ASSEMBLY-MOTHER to HP and Mfr. Part Number 83522-60062, CD 1.
Change A10J2 to Part Number 1251-6952, CD 7.
Change A10J3 to Part Number 1251-6343, CD 0.
Change A10J4 to Part Number 1251-7784, CD 5.
Add A10J6, 1250-0257, CD 1, CONNECTOR-RF SMB M PC 50-OHM.
Add A10W3, 8159-0005, CD 0, WIRE 22AWG W PVC 1X22 80C.

Page 6-20, Table 6-3:
Add W1, 83592-60021, CD 6, CABLE ASSY-EXT ALC.
Add W1, 83592-60024, CD 9, CABLE ASSY-EXT ALC (OPT. 004).
Change W3 CABLE ASSY-RIBBON, FRONT PANEL to Part Number 83592-60025, CD 0.
Change W3 CABLE ASSY-RIBBON, FRONT PANEL (OPT. 004) to Part Number 83592-60025, CD 0 (same as standard instrument).
Change W5 WIRE ASSEMBLY-RF PATH to Part Number 83522-60067, CD 6.
Change W12 CABLE ASSY-FM OUTPUT to Part Number 83525-60069, CD 1.
Change W31 CABLE ASSY-POWER SUPPLY to Part Number 83525-60066, CD 8.
Under OPTION 004, change W3 to Part Number 83592-60025, CD 0.
Under OPTION 004, add W1, 83592-60024, CD 9, CABLE ASSY-EXT ALC (OPT. 004).

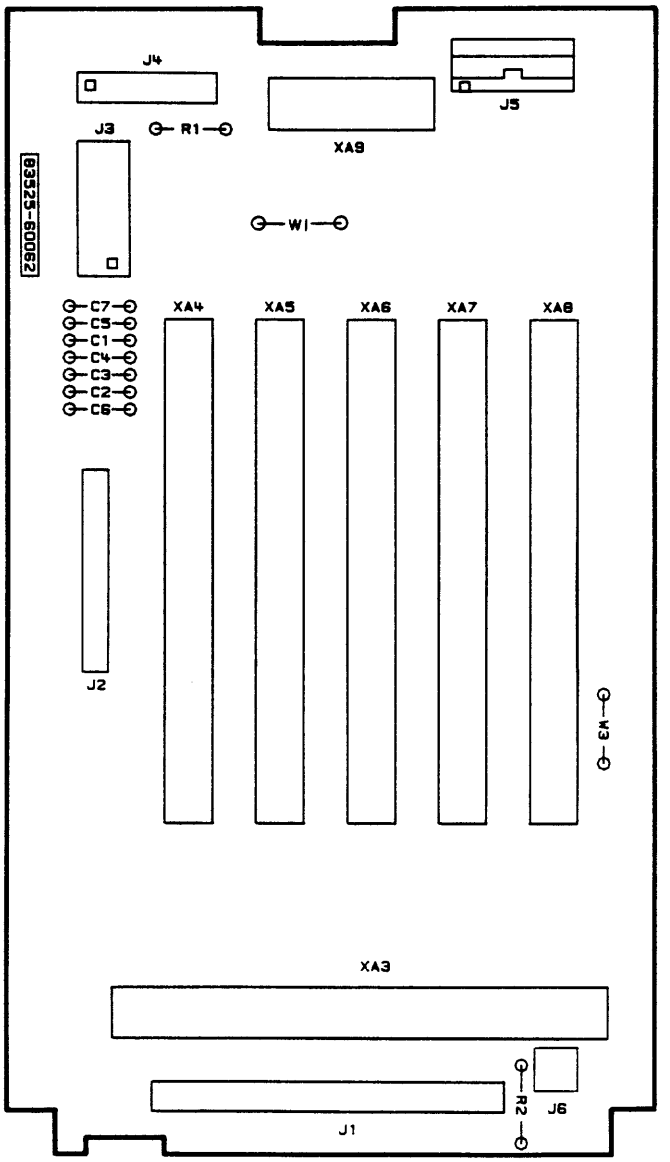
Page 8-63, A7P1 Pin I/O Table:
Change Pin 6 to No Connection.
Change Pin 39 to HI FREQ FM, A5P1, NOT USED.

Page 8-72, Figure 8-68:
Replace Figure 8-68 with *Figure 8-68. A10 Motherboard Component Locations (CHANGE 6)* from this document.

Page 8-74, Table 8-13:
At the cross-reference of **HI FREQ FM** and **Marker A7P1**, add 39.

Page 8-77, Table 8-13:
Replace *Table 8-13. 83522A Motherboard Wiring List (5 of 5)* with *P/O Table 8-13. 83522A Motherboard Wiring List (5 of 5) (CHANGE 6)* in this document.

Page 8-78, Table 8-14:
Add W1 Cable Assembly, Coax, EXT ALC: A10J6-Motherboard, and J2-Front Panel.



HP P/N 83522-60062

Figure 8-68. A10 Motherboard Component Locations (CHANGE 6)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-in Interface P2	Dig Interface A3P1	Dig Interface A3J1	ALC A4P1	FM A5P1	YO A6P1	Marker A7P1	Sampler A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	RF Wiring Harness A10J4	RF Ribbon Cable A10J5	Miscellaneous
+20V +20V RET +20V RET SENSE +20V SENSE	P1-7 P1-14 P1-6 P1-15	+20V Regulated +20V Return +20V Return Sense +20V Sense	7 14 6 15				16*	16*	16	16*	16*	3,11	42		3 14 6 15	10	9	C7,R1
+15V	P2-29	+15V Regulated		29			38	38	38	38	38			15				C6
+10V +10/−10V RET	P1-8 P1-3, 16	+10V Regulated +/−10V Return	8 3				7	7	7	7	7		46		8 3, 16		5,11	C5
+5V +5VA +5VB	A3P1-6,7 P2-30 P2-18,50,51	+5V Internal for RF Plug-in +5V for 8350A +5V for RF Plug-in		30 18,50,51	6,7	35, 36, 38	27	27	27	27	27*		2					
+5V REG +5V UNREG	A9P1-7 P2-62, 63	+5V Regulated +5V Unregulated		62, 63						44	22	7 12		18,20			7	C4
−10V −10V RET SENSE −10V SENSE −10V UNREG	P1-13 P1-12 P1-4 P1-5	−10V Regulated −10V Return Sense −10V Sense −10V Unregulated	13 12 4 5				17	17	17	17	17		40		13 12 4 5	1	10	C3
−15V	P2-28	−15V Regulated		28			28	28	28	28	28			13				C2
−40V −40V RET −40V RET SENSE −40V SENSE	P1-11 P1-1 P1-10 P1-2	−40V Regulated −40V Return −40V Return Sense −40V Sense	11 1 10 2				6*, 39		6, 39		6*, 39*				11 1 10 2		12	C1
GND ANLG	P2-27,58,59	Analog Ground					15, 37	15*,37	19, 37	15, 37	15,37* 40,41,42, 43,44	6	48	10,11,12	1,3,6,10, 12, 14, 16	3, 4	1, 2, 13	C1-C7,R2,W1 E1-S[2], E5-S[2]
GND DIG	P2-1, 6, 14, 16, 21, 31, 37, 46, 48, 49	Digital Ground		1, 6, 14, 16, 21, 31, 37, 46, 48, 49	4, 5	1,10,11, 17,27,28, 31,32,34 41	8, 30	8, 30	8, 30	8, 30	8*, 30*		8					R2

[1] Coaxial Cable - Center Conductor

[2] Coaxial Cable - Shield

* Not used on this assembly

P/O Table 8-13. Motherboard Wiring List (CHANGE 6)

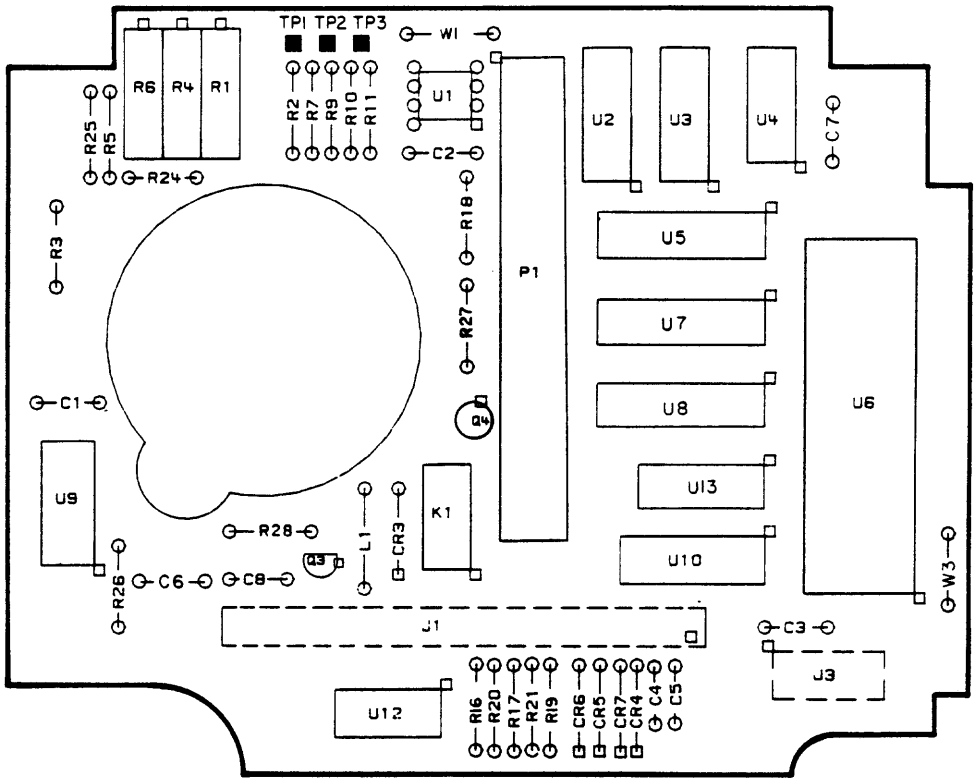
CHANGE 7

(Supersedes CHANGE 3 Board Assembly Part Number.)

New A2 Front Panel Interface.

Page 6-5, Table 6-3:
Change A2 BOARD ASSEMBLY-SUB-PANEL to part number 83525-60072, CD 6.

Page 8-31, Figure 8-12:
Replace the Component Locations Diagram with *A2 Front Panel Interface Component Locations (CHANGE 7)* diagram from this change sheet. Note that U13 is now mounted on the front of the board. Also, the locations of C6, C7, U5, U7 and U8 have been changed. There are no schematic changes.



HP P/N 83525-60072

A2 Front Panel Interface Component Locations (CHANGE 7)

CHANGE 8

(Supersedes CHANGE 4)

This change introduces a new ALC board. The RF plug-in can now be power meter leveled using the HP 436A and HP 438A Power Meters as well as the HP 432A.

Page 1-4, Table 1-1, Note 5:

Replace with the following: "Use the HP 432A/B/C, HP 436A, or HP 438A power meters. Both the HP 436A and 438A must be used on the top three (least sensitive) ranges. However, the HP 438A may also be used on the fourth range by programming the response of the power meter's filter as follows: Set the HP 438A to range two, and press **[MANFILTER] [1] [ENTER]**. See the HP 438A Operating and Service Manual for further instructions. Sweep time ≥50 seconds."

Page 1-8, Paragraph 1-42:

Replace the first sentence with the following: "The RF output can be externally leveled using HP Model 432A/B/C, 436A, or 438A power meters or negative polarity output crystal detectors."

Delete the note below the paragraph.

Page 1-10, Table 1-4:

In the first listing for "Power Meter" under **Critical Specifications** delete: "(No substitute when used for external power meter leveling)." Change the Recommended Model to HP 432A/B/C, 436A, 438A.

In the listing for "Thermistor Sensor," delete "(Used with HP 432A)." Under **Recommended Model**, delete HP 8478B, and replace with "Unit compatible with power meter being used."

Delete the second listing for Power Meter.

Delete the listing for Power Sensor.

Page 3-3, Paragraph 3-23:

Add the following: "For power meter leveling (**ALC MODE [MTR]**), the power meter is used in conjunction with the internal leveling loop. Low frequency variations are handled by the power meter, and high frequency variations are handled by the internal leveling loop."

Page 3-5, Figure 3-3, Number 8:

Delete: "(HP 432 only)."

Pages 3-10 to 3-11, Figure 3-7:

Under EQUIPMENT change the Power Meter listing to: "HP 432A/B/C, 436A, 438A." Change the Thermistor Mount listing to: "Any sensor compatible with the power meter being used."

Under the **NOTE**, delete: "The HP 435 and 436 power meters will not power meter level this plug-in. Only an HP 432 may be used." Add: "When using an HP 436A power meter, enable [RANGE HOLD] to lock the power meter in one range."

Under PROCEDURE, step 5, delete "432A."

Page 5-2, Table 5-1:

Add A4C23 (SYM 1). Under **Description**, add "Minimizes square wave overshoot."

Change A4R2 to A4R7.

Change A4R4 to A4R14.

Change A4R6 to A4R13.

Change A4R7 to A4R9.

Delete the line beginning with A4R9.

Change A4R11 to A4R15.

Change A4R47 to A4R81. Under **Description**, change U7-Q6 to U17-Q9.

Change A4R56 to A4R82. Under **Description**, change U5 to U18.

Change A4R59 to A4R78. Under **Description**, change U8-Q1 to U16-Q6.

Delete the line beginning with A4R67.

Add A4R99 (SYM 2). Under **Description**, add "Minimizes square wave overshoot."

Page 5-7, Table 5-5:

Delete "5-23. Power Meter Leveling Calibration."

CHANGE 8 (Cont'd)

Pages 5-26 to 5-28, Paragraph 5-20:
Replace Paragraph 5-20 on pages 5-25 to 5-28 with **5-20. ALC ADJUSTMENT PROCEDURE (CHANGE 8)** from this document.

Pages 5-31 to 5-32, Paragraph 5-22:
Replace the PROCEDURE and Figure 5-22 with **5-22. POWER CALIBRATION PROCEDURE (CHANGE 8)** from this document.

Pages 5-33 to 5-34:
Delete Paragraph **5-23. POWER METER LEVELING CALIBRATION**, Figure 5-23,and Figure 5-24.

Pages 5-34 to 5-36, **ALC GAIN ADJUSTMENT**:
Replace all reference to A4R11 with A4R15.
In DESCRIPTION, change A4U11 to A4U9.
Under EQUIPMENT change the Power Meter listing to: "HP 432A/B/C, 436A, 438A." Change the Thermistor Mount listing to: "Any sensor compatible with the power meter being used."
Replace Figure 5-26 with *Figure 5-26. ALC Gain Adjustment Location (CHANGE 8)* from this document.

Pages 6-7 to 6-9, Table 6-3:
Replace the parts list for the A4 Assembly with *A4 Replaceable Parts (CHANGE 8)* from this document.

Page 8-18, **A4 ALC Assembly**:
Add the following paragraph at the end of the A4 ALC assembly description:
"In the ALC MODE [MTR], the A4 assembly uses both the power meter and the internal leveling loop to level the power. Each loop has a separate log amplifier. The output of the 'internal log amplifier is sent through a high pass R-C filter and combined with the output of the power meter log amplifier. This composite signal represents the actual RF power. The power meter leveling loop responds to low frequency variations, while the internal loop responds to high frequency variations."

Page 8-36, **A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION**:
Replace pages 8-36 to 8-44 with *A4 ALC CIRCUIT DESCRIPTION AND TROUBLESHOOTING (CHANGE 8)* from this document.

Page 8-45, A4 Service Sheet

Figure 8-30:
Replace with *Figure 8-30. A4 ALC Component Locations (CHANGE 8)* from this document.

Table 8-10:
Replace with *Table 8-10. Leveling Control Lines (CHANGE 8)* from this document.

A4P1 Pinout Table:
Replace with *A4P1 Pinout Table (CHANGE 8)*from this change sheet.

Figure 8-33:
Under **NOTE**, change the middle paragraph to read: "Adjustment of the EXT/MTR ALC CAL screw will affect the waveforms at TP8 and TP5 Adjust the CAL screw until the correct waveforms are obtained."

Figure 8-34:
Replace with *Figure 8-34. Open Loop Waveforms (CHANGE 8)* from this document.

Figure 8-35:
Replace with *Figure 8-35. A4 ALC Schematic Diagram (CHANGE 8)* from this document.

5-20. ALC ADJUSTMENT (CHANGE 8)

NOTE

Complete adjustment of the ALC leveling loop requires procedures to be performed in the order prescribed, from Paragraph 5-20 through 5-27. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

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

DESCRIPTION:

Adjustments compensate for DC offsets in the detected RF path and the Main ALC Amplifier. Power is roughly calibrated and low band flatness is optimized.

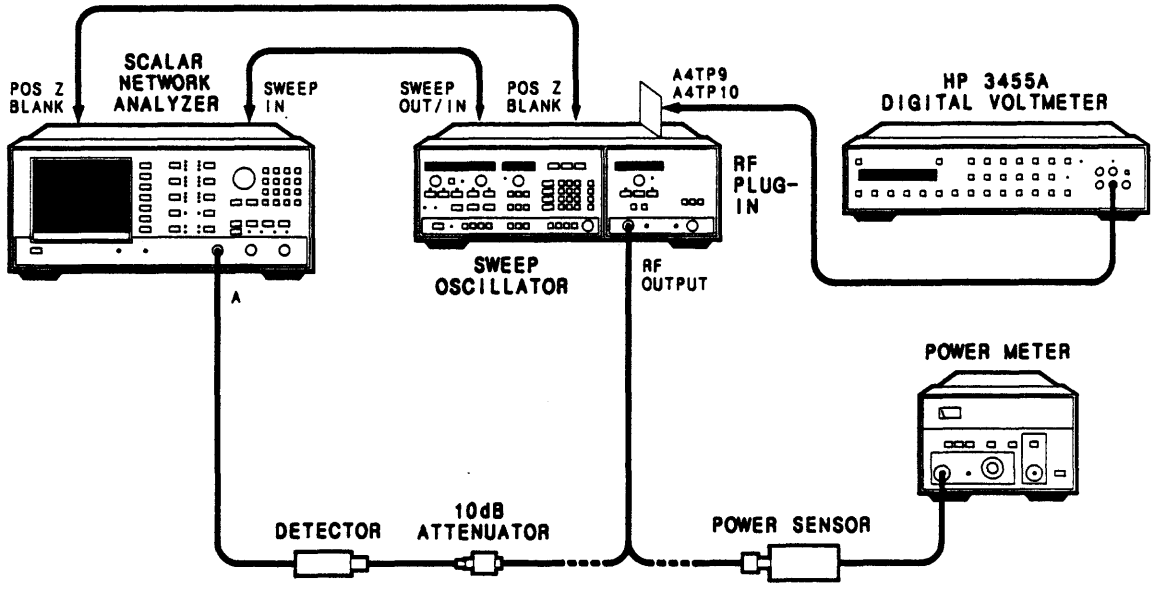


Figure 5-17. ALC Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3455A
Power Meter	HP 436A
Thermistor Mount	HP 8485A
Scalar Network Analyzer	HP 8756A
Detector	HP 11664B
Extender Board	HP 08350-60031
10 dB Attenuator	HP 8493C-010
Sweep Oscillator	HP 8350A

5-20. ALC ADJUSTMENT (CHANGE 8) (Cont'd)

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).

1. Remove the A5 FM Drive board. Put the A4 assembly on an extender board. Press **[INSTR PRESET] [CW]**. Sweep the full range of the plug-in at any leveled power. Preset the following adjustments as indicated:

A4R81 (OFS 1)	Midrange
A4R82 (OFS 2)	Midrange
A4R78 (OFS 3)	Midrange
A4R15 (GAIN)	Midrange
A4R7 (0 HI)	Fully CW
A4R14 (BIAS)	Midrange
A4R1 (SLP)	Midrange

2. Float the ground on the Digital Voltmeter and measure the voltage between A4TP9 and A4TP10. Refer to Figure 5-18 for adjustment locations. Adjust A4R81 (OFS 1) for 0.000 ± 0.001 Vdc.

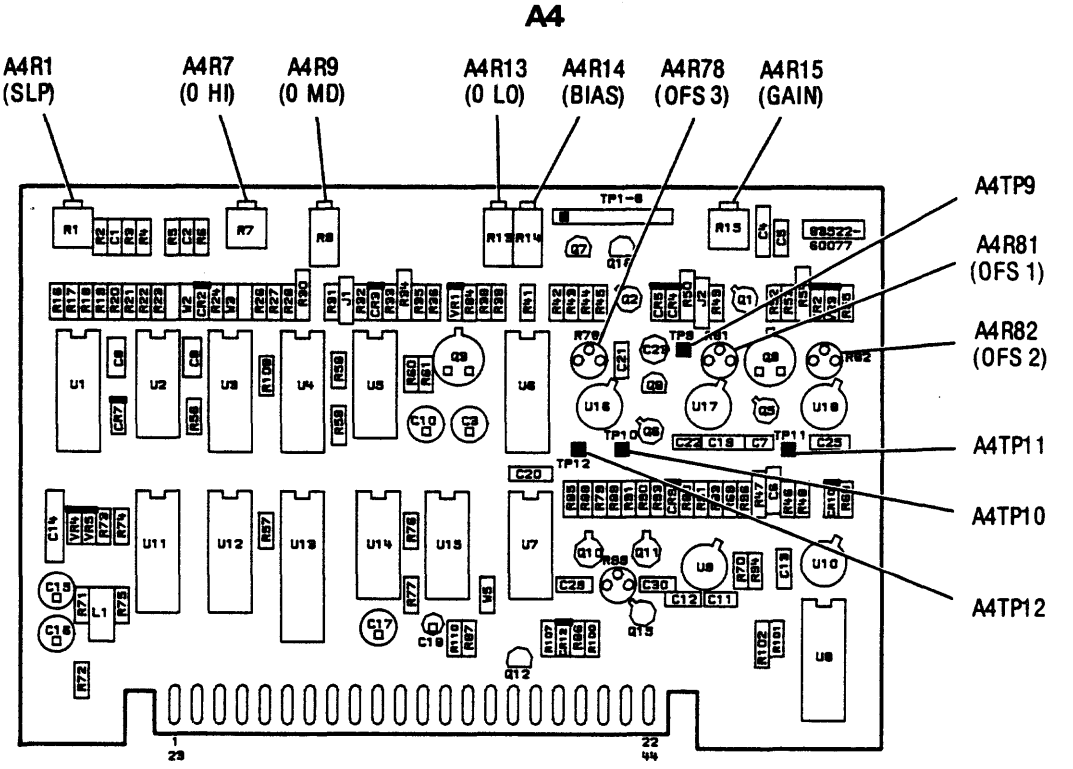


Figure 5-18. ALC Adjustment Locations

5-20. ALC ADJUSTMENT (CHANGE 8) (Cont'd)

3. Attach a jumper from A4TP11 to ground. Connect the DVM to A4TP4 (reference to ground) and adjust A4R82 (OFS 2) for a DVM reading of 0.000 ± 0.001 Vdc. Remove the jumper.

4. Connect the DVM between A4TP12 and A4TP9 (floating ground). Adjust A4R78 (OFS 3) for a DVM reading of 0.000 ± 0.001 Vdc.

5. On the HP 8350A/B, press **[CW] [5] [0] [MHz]**. Turn OFF the HP 83522A RF power. Connect the DVM to A4TP7 (ground to P1 pin 42) and adjust A4R14 (BIAS) for a DVM reading of 0.000 ± 0.001 Vdc. Turn ON the HP 83522A RF power.

6. Set the HP 8350A/B LINE power to OFF. Remove the A4 assembly from the extender board and reinsert the A4 assembly directly into the instrument. Set the HP 8350A/B LINE power to ON and press **[CW] [5] [0] [MHz]**. Connect the Power Meter to the HP 83522A RF OUTPUT.

7. Set the HP 83522A for a POWER reading of −2 dBm. Adjust A4R13 (0 LO) for an RF output power at the HP 83522A connector of −2 ± 0.1 dBm.

8. Set the HP 83522A for a POWER reading of +6 dBm. Adjust A4R9 (0 MD) for an RF output power at the HP 83522A connector of +6 ± 0.1 dBm.

9. Iterate between steps 7 and 8 until both low and midpower ranges are calibrated and no readjustment is necessary.

10. Set the HP 83522A for a POWER reading of +13 dBm. Adjust A4R7 (0 HI) for an RF output power at the HP 83522A connector of +13 ± 0.1 dBm.

11. Disconnect the Power Meter and monitor the RF output with the HP 8756A Scalar Network Analyzer. Press HP 8350A/B **[INSTR PRESET]** to sweep the full range of the plug-in. Press HP 8350A/B **[⊔⊓ MOD]** for compatibility with the HP 8756A. Set the HP 83522A for a POWER reading of 0dBm. Press **[RF BLANK] [SAVE] [1]**.

12. Adjust A4R1 (SLP) for best overall flatness from 10 MHz to 2.4 GHz as observed on the HP 8756A.

13. Reinstall the A5 FM board assembly.

5-22. POWER CALIBRATION PROCEDURE (CHANGE 8)

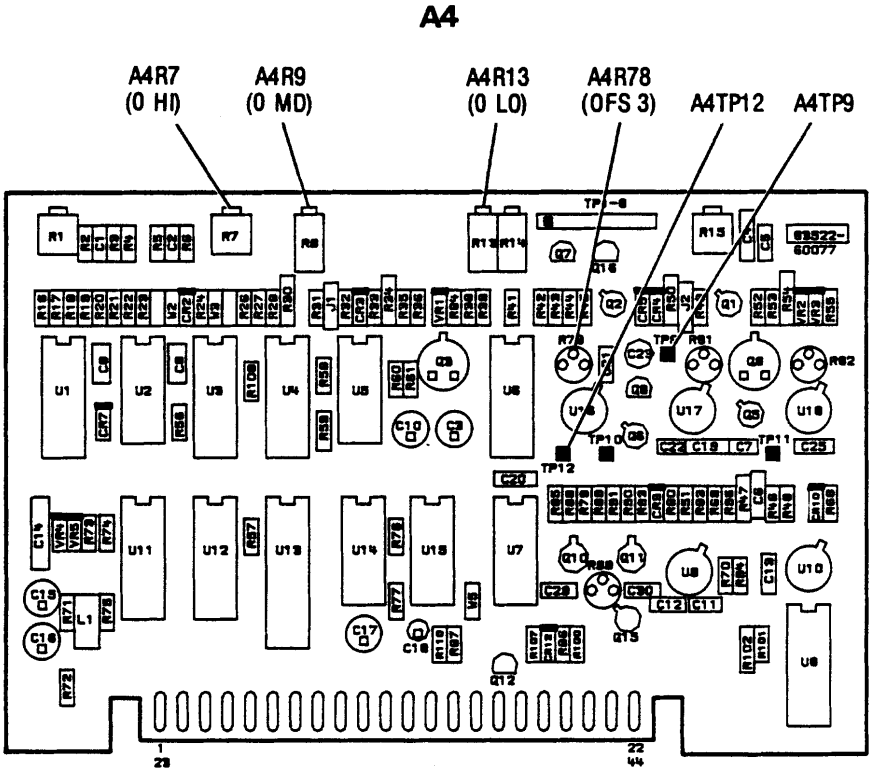


Figure 5-22. Power Calibration Adjustment Locations (CHANGE 8)

PROCEDURE:

NOTE

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

If the following steps result in A4R13 and R9 being adjusted near the stops, connect DVM low to A4TP12 (floating ground) and connect DVM high to A4TP9. Adjust A4R78 for −2mV ±0.1mV.

1. Connect power meter to RF output.
2. On the 8350A/B select a CW frequency of 1.1 GHz.
3. Set the power to −2 dBm as indicated on the plug-in display. Adjust "0 LO" (A4R13) for a measured power of −2 dBm.
4. Set the power to +6 dBm as indicated on the plug-in display. Adjust "0 MD" (A4R9) for a measured power of +6 dBm.
5. Set the power to −2 dBm and note the power meter reading, then set the power to +2 dBm and note the power meter reading. The deviation from the power levels set should be equal and opposite. If note, readjust "0 LO" (A4R13).

5-22. POWER CALIBRATION PROCEDURE (CHANGE 8) (Cont'd)

6. Set the power level to +6 dBm, readjust "0 MD" (A4R9) to equal +6 dBm measured power.
7. Iterate between steps 5 and 6 until both low and midpower ranges are calibrated and no readjustment is necessary.
8. Set the power to +13 dBm as indicated on the plug-in display. Adjust "0 HI" for a measured power of +13 dBm.
9. Step the RF power in 1 dB intervals from −2 to +13 dBm. The RF power at the 83522A connector as read on the power meter should equal the indicated front panel ±.1 dBm. If necessary, readjust "0 LO," "0 MID," and "0 HI" to calibrate power.

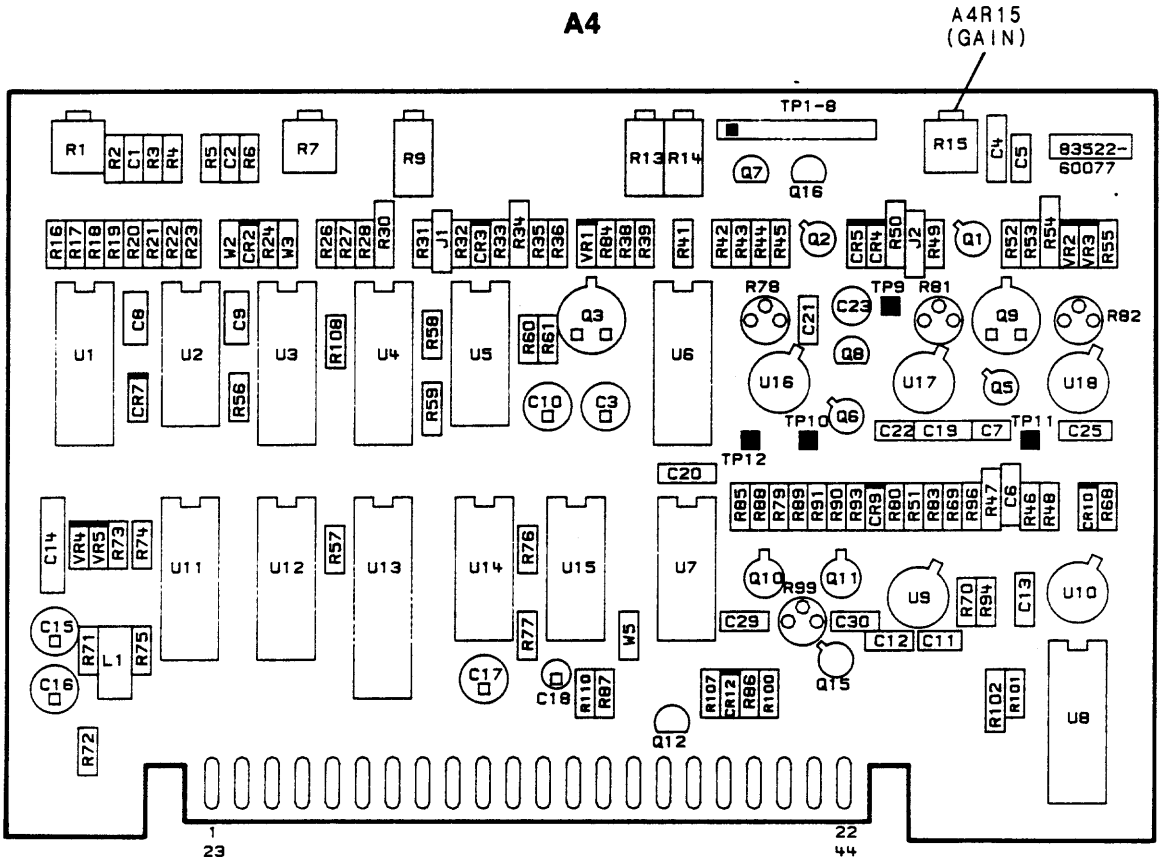


Figure 5-26. ALC Gain Adjustment Location (CHANGE 8)

Table 6-3. Replaceable Parts (1 of 3) (CHANGE 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	83522-60077	8	1	BOARD ASSEMBLY - AUTOMATIC LEVELING CONTROL	28480	83522-60077
A4C1	0160-3879	7	4	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A4C2	0160-0570	9		CAPACITOR-FXD 220PF +20% 100VDC CER	28480	0160-0570
A4C3	0180-2617	1	1	CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A4C4	0160-0945	2	1	CAPACITOR-FXD 910PF +5% 100VDC MICA	28480	0160-0945
A4C5	0160-4387	4		CAPACITOR-FXD 47PF ±5% 200 VDC CER 0±30	28480	0160-4387
A4C6	0160-4084	8	7	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A4C7	0160-3874	2	2	CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A4C8	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C9	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C10	0180-2697	7	4	CAPACITOR-FXD 10UF±10% 25VDC TA	28480	0180-2697
A4C11	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A4C12	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C13	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C14	0160-0127	2	1	CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A4C15	0180-2697	7		CAPACITOR-FXD 10UF±10% 25VDC TA	28480	0180-2697
A4C16	0180-2697	7		CAPACITOR-FXD 10UF±10% 25VDC TA	28480	0180-2697
A4C17	0180-2697	7		CAPACITOR-FXD 10UF±10% 25VDC TA	28480	0180-2697
A4C18	0180-2661	5	1	CAPACITOR-FXD 1UF±10% 50VDC TA	25088	D1R0GS1A50K
A4C19	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C20	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C21	0160-0573	2	2	CAPACITOR-FXD 4700PF +20% 100VDC CER	28480	0160-0573
A4C22	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A4C23	0121-0452	4	1	CAP-V TRMR-CER 1.3-5.4PF 63V PC-MTG	28480	0121-0452
A4C25	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C29	0160-3873	1	2	CAPACITOR-FXD 4.7PF ±.5PF 200VDC CER	28480	0160-3873
A4C30	0160-3873	1		CAPACITOR-FXD 4.7PF ±.5PF 200VDC CER	28480	0160-3873
A4CR2	1901-1098	1		DIODE SWITCHING 1N415 50V 200MA 4NS	28480	1901-1098
A4CR3	1901-0535	9	4	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR4	1901-1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098
A4CR5	1901-1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098
A4CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR9	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR10	1901-1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098
A4CR12	1901-1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098
A4J1	1258-0124	7	2	PIN-PROGRAMING DUMPER .30 CONTACT	91506	8136-475G1
A4J2	1258-0124	7		PIN-PROGRAMING DUMPER .30 CONTACT	91506	8136-475G1
A4L1	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4MP2	5040-6848	1	1	BOARD EXTR YELLOW	28480	5040-6848
A4MP3	5000-9043	6	1	PIN	28480	5000-9043
A4MP4	1251-4932	9	1	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	91506	LSG-1AG14-1
A4MP5	7121-1233	8	1	LABEL-IDENTIFICATION 83522	28480	7121-1233
A4Q1	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4Q2	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q3	1854-0295	7	2	TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A4Q5	1855-0386	9	2	TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A4Q6	1855-0386	9		TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	2N4392
A4Q7	1855-0423	5	5	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q8	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q9	1854-0295	7		TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A4Q10	1853-0316	1	2	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A4Q11	1853-0316	1		TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A4Q12	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q15	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A4Q16	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4R1	2100-2633	5	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A4R2	0698-7267	4	2	RESISTOR 19.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-1962-F
A4R3	0698-7251	6		RESISTOR 4.22K 1% .05W F TC=0±100	24546	C3-1/8-TO-4221-F
A4R4	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-TO-1001-F
A4R5	0698-7268	5		RESISTOR 21.5K 1% .05W F TC=0±100	24546	C3-1/8-TO-2152-F
A4R6	0698-7276	5		RESISTOR 46.4K 1% .05 W F TC=0±100	24546	C3-1/8-TO-4642-F
A4R7	2100-2516	3	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A4R9	2100-0670	6	3	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A4R13	2100-0544	3	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-104
A4R14	2100-0670	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A4R15	2100-2489	9	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A4R16	0698-7253	8	2	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A4R17	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A4R18	0698-7257	2	1	RESISTOR 7.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-7501-F
A4R19	0698-7263	0	2	RESISTOR 13.3K 1% .05W F TC=0±100	24546	C3-1/8-T0-1332-F

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

Table 6-3. Replaceable Parts (2 of 3) (CHANGE 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R20	0698-7258	3	1	RESISTOR 8.25K 1% .05W F TC=0+100	24546	C3-1/8-T0-8251-F
A4R21	0698-7261	8	3	RESISTOR 11K 1% .05W F TC=0+100	24546	C3-1/8-T0-1102-F
A4R22	0698-7266	3	2	RESISTOR 17.8K 1% .05W F TC=0+100	24546	C3-1/8-T0-1782-F
A4R23	0698-7283	4	1	RESISTOR 90.9K 1% .05W F TC=0+100	24546	C3-1/8-T0-9092-F
A4R24	0698-7262	9		RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1212-F
A4R26	0698-7260	7	9	RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R27	0698-7231	2	1	RESISTOR 619 1% .05W F TC=0+100	24546	C3-1/8-T0-619R-F
A4R28	0698-7254	9	2	RESISTOR 5.62K 1% .05W F TC=0+100	24546	C3-1/8-T0-5621-F
A4R30	0837-0119	7	1	THERMISTOR ROD 5K-OHM TC=+.7%/C-DEG	28480	0837-0119
A4R31	0698-7279	8	1	RESISTOR 61.9K 1% .05W F TC=0+100	24546	C3-1/8-T0-6192-F
A4R32	0698-7264	1	1	RESISTOR 14.7K 1% .05W F TC=0+100	24546	C3-1/8-T0-1472-F
A4R33	0698-7247	0	2	RESISTOR 2.87K 1% .05W F TC=0+100	24546	C3-1/8-T0-2871-F
A4R34	0698-3457	6	1	RESISTOR 316K 1% .125W F TC=0+100	28480	0698-3457
A4R35	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R36	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R38	0698-7243	6	6	RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R39	0698-7282	3	1	RESISTOR 82.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-8252-F
A4R41	0698-8615	8	1	RESISTOR 75K 1% .05W F TC=0+100	24546	C3-1/8-T0-7503-F
A4R42	0698-7256	1	4	RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3-1/8-T0-6811-F
A4R43	0698-7272	1	2	RESISTOR 31.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-3162-F
A4R44	0698-7233	4	1	RESISTOR 750 1% .05W F TC=0+100	24546	C3-1/8-T0-750R-F
A4R45	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R46	0698-7234	5	2	RESISTOR 825 1% .05W F TC=0+100	24546	C3-1/8-T0-825R-F
A4R47	0837-0085	6	1	THERMISTOR ROD 680-OHM TC=+.7%/C-DEG	28480	0837-0085
A4R48	0698-7238	9	1	RESISTOR 1.21K 1% .05W F TC=0+100	24546	C3-1/8-T0-1211-F
A4R49	0698-7205	0	3	RESISTOR 51.1 1% .05W F TC=0+100	24546	C3-1/8-TO-51R1-F
A4R50	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A4R51	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A4R52	0698-7229	8	2	RESISTOR 511 1% .05W F TC=0+100	24546	C3-1/8-TO-511R-F
A4R53	0698-7232	3	2	RESISTOR 681 1% .05W F TC=0+100	24546	C3-1/8-TO-681R-F
A4R54	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+100	24546	C4-1/8-T0-2871-F
A4R55	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R56	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R57	0698-7249	2		RESISTOR 3.48K 1% .05W F TC=0+100	24546	C3-1/8-T0-3148-F
A4R58	0698-7256	1		RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3-1/8-T0-6811-F
A4R59	0698-7229	8		RESISTOR 511 1% .05W F TC=0+100	24546	C3-1/8-TO-511R-F
A4R60	0698-7247	0	2	RESISTOR 2.87K 1% .05W F TC=0+100	24546	C3-1/8-T0-2871-F
A4R61	0698-7219	6	1	RESISTOR 196 1% .05W F TC=0+100	24546	C3-1/8-TO-196R-F
A4R68	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0+100	24546	C3-1/8-TO-261R-F
A4R69	0698-7277	6	1	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A4R70	0698-7246	9	1	RESISTOR 2.61K 1% .05W F TC=0+100	24546	C3-1/8-T0-2611-F
A4R71	0698-7268	5	1	RESISTOR 21.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-2152-F
A4R72	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-TO-100R-F
A4R73	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-TO-100R-F
A4R74	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R75	0698-7274	3	1	RESISTOR 38.3K 1% .05W F TC=0+100	24546	C3-1/8-T0-3832-F
A4R76	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R77	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R78	2100-1986	9	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A4R79	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R80	0698-7210	5		RESISTOR 82.5 1% .05W F TC=0+100	24546	C3-1/8-TO-82R5-F
A4R81	2100-2030	6	2	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R82	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R83	0698-7234	5		RESISTOR 825 1% .05W F TC=0+100	24546	C3-1/8-T0-825R-F
A4R84	0698-7232	3		RESISTOR 681 1% .05W F TC=0+100	24546	C3-1/8-TO-681R-F
A4R85	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R86	0698-7256	1	2	RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3-1/8-T0-6811-F
A4R87	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3-1/8-T0-5111-F
A4R88	0698-7264	1	2	RESISTOR 14.7K 1% .05W F TC=0+100	24546	C3-1/8-T0-1472-F
A4R89	0698-7263	0		RESISTOR 13.3K 1% .05W F TC=0+100	24546	C3-1/8-T0-1332-F
A4R90	0698-7264	1		RESISTOR 14.7K 1% .05W F TC=0+100	24546	C3-1/8-T0-1472-F
A4R91	0698-7240	3	1	RESISTOR 1.47K 1% .05W F TC=0+100	24546	C3-1/8-T0-1471-F
A4R93	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R94	0698-7242	5	1	RESISTOR 1.78K 1% .05W F TC=0+100	24546	C3-1/8-T0-1781-F
A4R96	0698-7251	6		RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3-1/8-T0-4221-F
A4R99	2100-1738	9	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A4R100	0698-7262	9		RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1212-F
A4R101*	0698-7267	4	4	RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A4R102	0698-3440	7	2	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A4R107	0698-7269	6		RESISTOR 23.7K 1% .05W F TC=0+100	24546	C3-1/8-T0-2372-F
A4R108	0698-8827	4	1	RESISTOR 1M 1% .125W F TC=0+100	28480	0698-8827
A4R110	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4TP1-8	1251-5618	0	1	CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A4TP9	0360-0535	0	4	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

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

Table 6-3. Replaceable Parts (3 of 3) (CHANGE 8)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4U1	1826-0417	6	3	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A4U2	1826-0616	7	2	IC OP AMP PRCN QUAD 14-DIP-C PKG	06665	OP-11EY
A4U3	1826-0610	1	2	IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	06665	MUX24FQ
A4U4	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A4U5	1826-0616	7		IC OP AMP PRCN QUAD 14-DIP-C PKG	06665	OP-11EY
A4U6	1826-0610	1		IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	06665	MUX24FQ
A4U7	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A4U8	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A4U9	1826-0319	7	2	IC OP AMP LO-BIAS-HI-IMPD TO-99 PKG	A3500	LF356G
A4U10	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A4U11	1826-0752	2	1	IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A4U12	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A4U13	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A4U14	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A4U15	1820-1198	0	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS03N
A4U16	1826-0021	8	1	IC OP AMP GP TO-99 PKG	27014	LM310H
A4U17	1826-0447	2	1	IC OP AMP WB TO-99 PKG	27014	LF257H
A4U18	1826-0319	7		IC OP AMP LO-BIAS-HI-IMPD TO-99 PKG	A3500	LF356G
A4VR1	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4VR2	1902-3070	5	1	DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1902-3070
A4VR3	1902-0111	9	1	DIODE-ZNR 1N753A 6.2V 5% DO-7 PD=.4W	28480	1902-0111
A4VR4	1902-0049	2	2	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A4VR5	1902-0049	2		DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A4W2	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A4W3	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A4W5	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

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

A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION (CHANGE 8)

The A4 Automatic Leveling Control (ALC) assembly is part of a closed loop power leveling function, designed to control the amplitude of the RF output power. The **General** section below describes loop operation, including some components external to the A4 assembly. The rest of this operational theory is devoted to detailed description of the circuits found on the A4 assembly.

General

The circuits which accomplish power control and power leveling can be divided into two categories: internal loop circuitry, and external components of the loop. Figure 8-25 illustrates this theme.

The Power Level Reference leg of the ALC establishes the desired power level. This is accomplished by pressing the plug-in **[POWER LEVEL]** pushbutton and rotating the RPG or entering the desired reference on the Model 8350A/B front panel DATA ENTRY keys. This leg of the ALC is not an interdependent part of the loop, as shown in Figure 8-25.

The Detector leg of the ALC loop samples the actual RF output power and produces a voltage proportional to RF amplitude. This voltage is converted to log scale and compared with the Power Level Reference signal. If the voltages at the summing junction are not of equal magnitude an error voltage is generated. This error voltage is amplified and converted to a current drive for the RF modulators, which vary the transmitted RF power to correct the error and achieve the desired RF power level.

Address Decoder and Control Latches A

U12 is a 3-to-8 decoder, selecting address 2C07H when it is present on the address bus. This address serves as a chip enable for octal latch U13. Information on the data bus is then latched into U13 and used throughout the A4 assembly. U14 and U15 have been added to provide the proper outputs for all 3 ALC leveling modes.

Detector Inputs and Selection Switches B

Control lines MUX A0B and MUX A1B are encoded with leveling mode and band selection information. The lines are decoded in Table 8-10. U6 decodes these control lines to select the proper detector input for the desired operating mode.

R43 and R14 BIAS adjustment offset the Band 0 internal detector so that 0 volts at TP7 corresponds to no RF power.

EXT/MTR ALC input provides external crystal leveling capability within the -10 to -200 mV range and power meter leveling capability within the 0 to $+1$V range. VR4 and VR5 provide protection against transients. Two Schottky diodes, CR1 and CR2, are mounted between the EXT/MTR ALC connector and the front panel casting for similar protection.

When **MTR** (power meter) leveling is selected, the power meter (HP 432A/B/C, 436A, or 438A) is used in conjunction with the internal leveling detector. U1A routes the power meter signal to a separate POWER METER LOG AMPLIFIER. The internal leveling detector is routed through U6B and the input sample and hold to the main log amplifier. The internal leveling detector compensates for the response of the power meter and prevents instability while at the same time permitting reasonable sweep times.

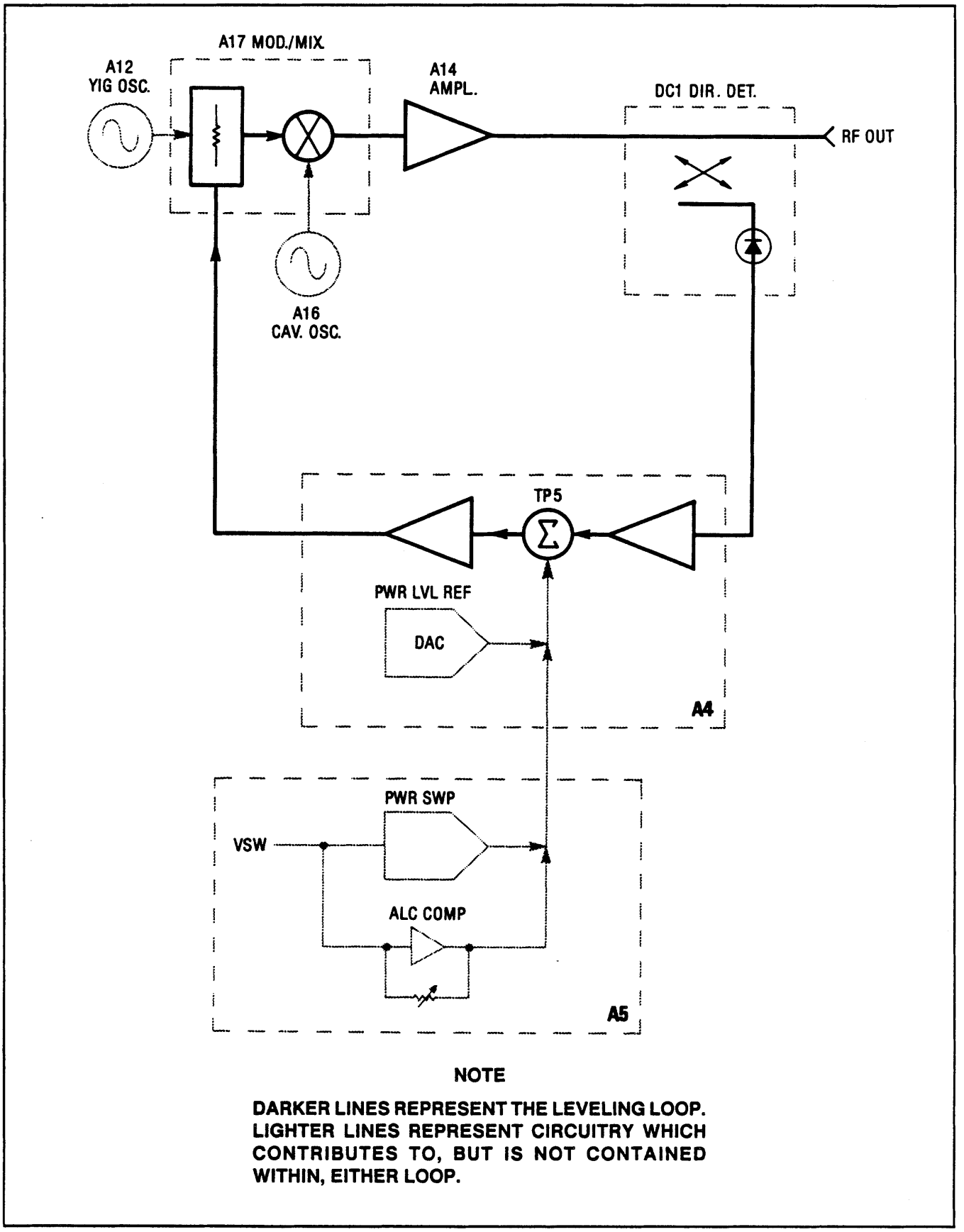


Figure 8-25. Simplified ALC Block Diagram (CHANGE 8)

A4 (ALC), CIRCUIT DESCRIPTION (CHANGE 8) (Cont'd)

Sample and Hold Drivers K

Q10 and Q11 act as complementary pairs, controlling the Input Sample and Hold, and Error Sample and Hold circuits respectively. The complementary pairs improve action of the sampling FETS Q5 and Q6 by reducing the error signal passed through gate to source capacitance. The sample and hold function of the ALC loop is used in conjunction with pulse and square wave modulation. When L PULSE ENABLE is high, and L PULSE input is low, Q10A and Q11B turn on causing Q10B and Q11A to turn off, thereby initializing the HOLD mode.

The frequency of the sampling mode is dependent on the L PULSE input. When the system is used with the HP 8756A Scalar Network Analyzer, the L PULSE input is a 27.8 kHz square wave, controlling the gates of Q5 (Block **I**) and Q6 (Block **E**). (Refer to Model 8350A/B Operating and Service Manual, Section V, for 27.8/1 kHz Oscillator adjustment). The sample level is maintained during the OFF pulse, thus preventing saturation of the Log and Main ALC amplifiers.

Input Sample and Hold E

The Input Sample and Hold function prevents the Log Amplifier from saturating during pulse and squarewave modulation.

U16 is a unity gain follower with internal feedback which buffers the detector input. R78 compensates for the offset voltage of the operational amplifier. Q6 and C21 perform the sample and hold function.

Power Meter Log Amplifier F

The Power Meter Log Amplifier is used in conjunction with the Log Amplifier in **ALC MODE [MTR]**. The Power Meter Log Amplifier sets the power level and takes care of low frequency variations, while the Log Amplifier takes care of the high frequency variations.

U5B is a unity gain follower which buffers the input of R5D. Logarithmic scaling is performed by Q3A in the feedback loop of U5D. The base-emitter voltage of Q3A is exponentially related to its collector current, hence the logarithmic action of the amplifier. Q3B compensates the Log Amp over temperature. U5A is a standard non-inverting amplifier, with its gain controlled by R33 and R32. CR3 prevents oscillation in the Log Amplifier.

Log Amplifier G

The logarithmic scaling function is performed by Q9A in the feedback loop of U17. Q9A collector current is proportional to the voltage at TP10 and exponentially related to its base-emitter voltage. Therefore, Q9A emitter voltage is logarithmically related to the input voltage at TP10.

Q9B compensates the Log Amp against changes in reverse saturation current with temperature.

CR9 clamps the output of U18 to 0.6V above the input voltage to U17, preventing oscillations.

A4 (ALC), CIRCUIT DESCRIPTION (CHANGE 8)(Cont'd)

U6A decodes MUX A0B and MUX A1B (Table 8-10) to select the proper offset voltage for power calibration at the low end of the plug-in power range. In EXTernal ALC, the power level calibration is set with the front panel EXT CAL potentiometer.

U18 amplifies the logged output for comparison with the Power Level Summing Signal (Block **H**). R9 adjusts the gain of U18, and calibrates midrange power level.

Guarded-gate FETs Q7, Q8 and Q16 select the appropriate detector return for INTernal, EXTernal, and PM (power meter) leveling.

Power Level Reference C
Power Level Summing H

U11 is a 12-bit microprocessor-compatible digital to analog converter (DAC), which latches data in three 4-bit nibbles. The −10V REF input sets the DAC for a maximum outut (TP2) of +10V. The voltage at TP2 is the product of −10V REF and the fractional binary input of the DAC.

The voltage at TP1 is the sum of several voltages, depending on the operating mode of the plug-in. U2A sums PWR SWP/COMP and AM inputs. In addition, selected feedback resistor R7 reduces gain to compensate for detector deviation from square-law at the upper limits of the plug-in power range.

The EXT CAL input is summed through amplifier U2C. R30, in the feedback loop of U2C, provides temperature compensation for the Log Amplifier and detectors.

Error, Sample and Hold I

The Error, Sample and Hold function prevents the Main ALC Amp from saturating during pulse and square wave modulation.

U2D pin 10 is the summing junction for the Power Level Summing output, Log Amplifier output, and FREQ TRK V is a 0 to +6 volt ramp proportional to the YO DRIVE Voltage. R1 (SLP) adjusts the overall flatness.

Under leveled power conditions, the voltage at U2D pin 10 is zero. A non-zero voltage represents an error and forces a change in modulator current until power is again level.

U2D buffers the error voltage. Q5 and the following integrating circuit (U9) perform the sample and hold. C7 eliminates error due to the gate to source capacitance of Q5.

Log Amplifier Selector J

The Log Amplifier Selector circuit selects through path for the Log Amplifier, or combines its output with that of the Power Meter Log Amplifier (MTR). In MTR, R84 and C3 act as a high pass filter, to shape the output of the Log Amplifier, which is then combined with the Power Meter Log Amplifier output. The combination of the two prevents instability when using certain power meters.

In switch U4: A and B are open, C is closed in INT or EXT DET mode. The opposite is true in MTR mode.

A4 (ALC) CIRCUIT DESCRIPTION (CHANGE 8) (Cont'd)

Main ALC Amp L
Unleveled Signal M

Both inputs to integrator U9 are at virtual ground under leveled power conditions, allowing for immediate response to an input error voltage.

R15 optimizes the speed at which the loop responds to power level changes.

When Model 8350A/B RF BLANK is selected, L RFB goes low during retrace and U1D closes, pulling current through C4, forging TP5 high and turning on the PIN modulator.

Under unleveled conditions, VR2 and VR3 will clamp the output of U9 at approximately +5 and −7 volts, preventing negative or positive saturation. When the output of U9 approaches −2 volts, comparator U10 activates the front panel LED indicating unleveled power.

U8D is not used.

Collector current in common-base transistor Q1 is exponentially related to the base-emitter voltage. The PIN modulator is driven exponentially to maintain constant loop gain.

Emitter-follower Q2, CR5 and CR4 control the gain of the exponential current drive.

PIN Mod 0 Driver O

R101 compensates for the loss of modulator sensitivity with increasing bias current.

Q12 provides squarewave modulation, when selected.

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

NOTE

To ensure that Option 002 plug-ins remain in the same attenuator setting during troubleshooting, press [SHIFT] [POWER SWEEP]. This allows full ALC control without changing attenuator settings.

Since the Automatic Leveling Control (ALC) function of the Model 83522A RF Plug-In includes many individual components arranged in a highly interdependent closed loop, the scope of the A4 ALC Troubleshooting section extends well beyond the limits of the A4 assembly. Portions of the A5 FM Driver assembly, and several microcircuit components which contribute to the power leveling function, are discussed below.

The ALC loop is a complex feedback loop which monitors the RF output power and continuously corrects for any deviation from the desired power level. Because it is a closed system, it is difficult to isolate cause from effect when a problem arises. Therefore, the key to troubleshooting is to examine individual components, correlating the expected output for a particular input signal.

This troubleshooting outline is organized into two major sections: Troubleshooting Symptoms, and Troubleshooting Diagnostics. The section entitled "Symptoms" (1) characterizes possible failure modes, (2) provides some general troubleshooting hints, and (3) refers the reader to more detailed procedures found under "Diagnostics."

Troubleshooting Symptoms

The procedures outlined below help to systematically characterize the failure as quickly as possible. The following failure symptoms are discussed:

RPG/POWER DISPLAY FAILURE
UNLEVELED (LED)
FLATNESS/OSCILLATIONS (Power Dropouts)
FULL UNLEVELED POWER
NO POWER
POWER SWEEP/FLATNESS

Evaluating the specific failure may require an HP 432A/B/C, 436A, or 438A Power Meter or the HP 8756A Scalar Network Analyzer with the Model 11664B Detector. (However, a crystal detector with an "A vs B" oscilloscope may often be substituted.) Figure 8-26 configures a typical test setup. Initiate all tests with the **[INSTR PRESET]** condition.

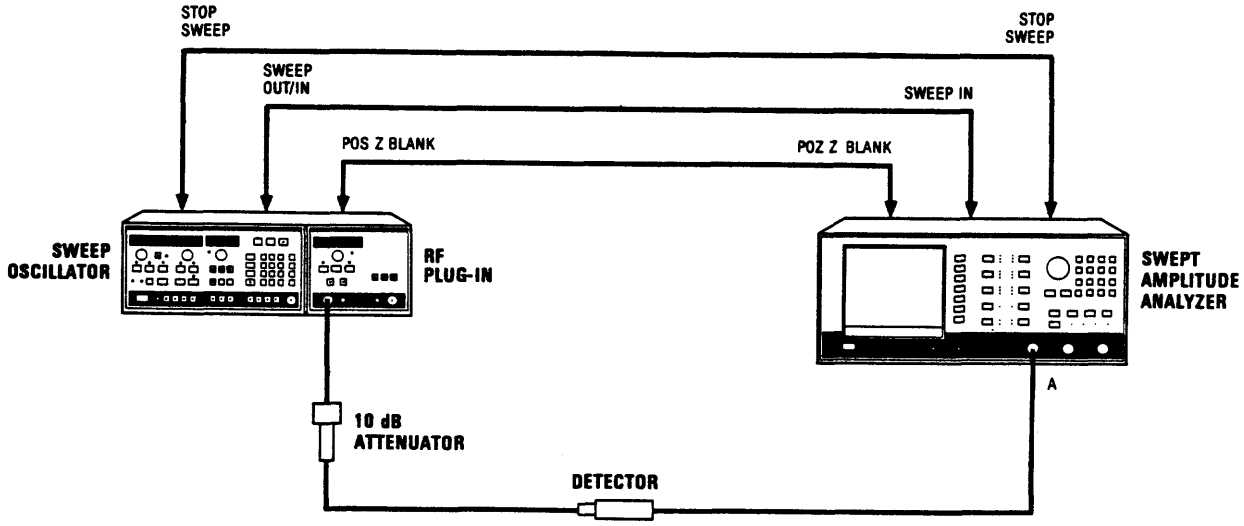


Figure 8-26. Typical ALC Troubleshooting Setup

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

RPG / POWER DISPLAY FAILURE

Check that the POWER display changes when either the RPG is rotated or data is entered via the Model 8350A/B keyboard. This verifies that the digital information is reaching the mainframe, is properly processed, and is then displayed.

- If the display is flashing rapidly or showing random patterns, refer to A1/A2 Front Panel or A3 Digital Interface Troubleshooting. If the RPG causes a change in the measured RF power level, but the POWER display remains the same, refer to A1/A2 Troubleshooting. If the RPG produces no response whatsoever, or if the front panel display is blank, refer to A1/A2 Troubleshooting, and trace the problem back to the Model 8350A/B mainframe.

UNLEVELED (LED)

If the UNLEVELED light turns on during the sweep, enter a sweep time of 2.4 seconds (i.e. one second per GHz). Observe the SWP light on the Model 8350A/B Sweep Oscillator, and determine at which times during the sweep the UNLEVELED light turns on.

- If the UNLEVELED light remains lit during retrace, suspect problems in the front panel annunciator drivers. Refer to A1/A2 Troubleshooting.

- If the UNLEVELED light blinks briefly at the beginning of the sweep, the plug-in may be sweeping through 0 Hz and causing an ALC drop-out. Check this by slowly increasing the start frequency. If the UNLEVELED light stops blinking, enter a CW frequency of 50 MHz and adjust the Model 83522A front panel FREQ CAL screw until the MKR light stays on. Press **[INSTR PRESET]** and observe the UNLEVELED light. A frequency counter may be used to check frequency accuracy at 10 MHz or 50 MHz. If necessary, refer to Section V, Adjustments, in this manual, and perform the Frequency Accuracy calibration procedure.

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

FLATNESS / OSCILLATIONS (Power Dropouts)

Monitor the RF output with the HP 8756A as shown in Figure 8-26.

- 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 +13 and −2 dBm, but cannot 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.

A4 TROUBLESHOOTING (CHANGE 8) (Cont'd)

FULL UNLEVELED POWER (One or Both Bands)

Set the HP 83522A to sweep the full frequency range.

- Attempt to level the power externally using the HP 432A/B/C, 436A, or 438A Power Meter as shown in Figure 8-27. Select **MTR** leveling, and enter a slow (at least 30 seconds) sweep time. If the RF power is now leveled, 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 U3B and U6A. It may be necessary to perform the ALC adjustments in Section V of this manual.

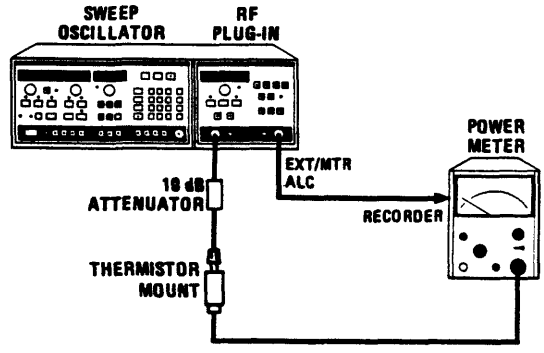


Figure 8-27. Power Meter Leveling Setup

- Check the Detector Selection Switch by entering a CW frequency within the band or leveling mode in question and trace the detector voltage through U6B. If the input to be selected does not match the output, check the MUX A0 and MUX A1 lines (see Table 8-10). Also check U12 and U13 as described under Digital Control.

- Check the voltage at TP5. If it is greater than or equal to +5 Vdc, suspect the Mod Drivers or Modulators. If it is below −2 Vdc, suspect the Detectors and Detector Leg.

NOTE

Turn off LINE switch before removing or installing any assembly.

With the ALC assembly removed from the plug-in, 27.8 kHz squarewave modulation from the Model 8350A/B is not available. However, the HP 8756A 27.8 kHz squarewave can be connected to the rear panel PULSE IN connector to maintain HP 8756A compatibility.

- To check the RF components, remove the A4 ALC assembly from its socket. This removes all bias from the modulator, and should allow maximum power through the RF path in all bands. If full power (over +15 dBm) is then detected, the RF Amplifier A14, the Cavity Oscillator, A16, and the DC Return A15 are verified. Suspect primarily the detector. Also inspect the modulator, as well as the A4 PIN Mod Driver and Detector Selection Switch.

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

- If power is still missing, enable the plug-in markers and check that the MKR light flashes. If it does, the failure must be limited to Directional Detector DC1. If the markers do not work, check the A12 YIG Oscillator, A17 Modulator/Mixer, A16 Cavity Oscillator, and A14 Amplifier.

- If removing the A4 assembly causess full unleveled RF power to appear, reinstall the board and check A4TP5. If less than −2 Vdc is present, verify that the voltage across R49 is zero. If A4TP5 is greater than +5 Vdc, suspect any circuitry between the Detector Selection Switch and A4TP5, particularly the Log Amp.

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.

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

Troubleshooting Diagnostics

The troubleshooting information below is organized into functional areas:

DIGITAL CONTROL A
REFERENCE POWER LEVEL C H
DETECTORS / DETECTOR SELECTION SWITCH B, DC1
DETECTOR LEG E F G
MODULATOR LEG I L
MOD DRIVER O
MODULATOR / MIXER A17

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 keystrokes:

[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 agains 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 H

The Reference Power Level Leg produces a voltage proportional to the desired power level. This signal is a summation of the absolute power reference, AM, RF plug-in amplitude markers, ALC compensation, and power sweep signals.

The ALC compensation and power sweep signals are generated on the A% 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 the power flatness will be lost, the ALC loop should still level without the signals provided by the A5 assembly.

DAC U11 establishes the absolute power level. The −10V REF from the A6 assembly is scaled to yield from 0 Vdc (−2 dBm displayed) to the +10 Vdc (+22 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 +13 dBm.

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

[SHIFT] [5] [0]

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

The waveform in Figure 8-32 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 A8 assembly. Look for activity on L INST1, 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.

U2A adds PWR SWP/COMP and AM, and provides detector flatness compensation at higher power levels with CR2 and CR1. Use the EXT MTR mode to bypass these diodes while troubleshooting.

U2C adds the amplitude markers (L 1 DB MKR), and 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 −2 dBm, and +7.0 Vdc for +22 dBm. Amplitude markers produce a 250 mVdc dip when the MKR light is on. An amplitude modulation (AM) signal of fl.k0 V p-p at P1-4 will produce roughly 260 mV p-p at TP1.

DETECTORS / DETECTOR SELECTION SWITCH B, DC1

The detector DC1 is tested simply by checking its output voltage under full leveled power or full unleveled power conditions. The A4 assembly must be installed for troubleshooting as it supplies bias current to the detector.

NOTE

The 27.8 kHz modulation signal required for HP 8756A compatibility is not available from the Model 8350A/B when the A4 assembly is removed from the plug-in, and must be supplied from the HP 8756A through one of its rear panel MODULATOR DRIVE connectors.

- If no 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, apply a narrow strip of cellophane tape to the pin-edge connector at P1-44 to isolate the output of the modulator driver from the modulator. Reinstall the A4 board. This removes bias from the modulators, allowing full RF power transmission, while providing detector bias.

- If full leveled power (+13 dBm) or full unleveled power (at least +15 dBm) is measured, sweep the full band and check the voltage at the detector input against the values shown in Table 8-9. (Use high impedance 10:1 probes.)

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

Table 8-9. Detector Voltages

	Full Leveled +13 dBm	Full Unleveled +20 dBm
A4P1-21	−150 to −200 mV	−300 to −400 mV

- If the detector is working and the Detector Selection Switch is suspected, sweep the full band and monitor TP12 for the voltages 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 A4TP12.

NOTE

Remove any tape applied to edge connector pins in the previous procedure.

DETECTOR LEG E F G

The Detector Leg of the ALC loop includes components between the Detector Selection Switch and the Error Summing Amplifier U2D.

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 8-33, Open Loop Procedure.

MODULATOR LEG I L

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

U2D is a non-inverting unity-gain summing amplifier. Under leveled conditions, both U2D pin 10 and TP8 should be nearly 0.0 Vdc. Under any conditions (except during "hold"), U2D pin 10 and TP8 should be at the same voltage. If not, suspect U2D, Q5, or the Sample & Hold Driver.

U9 forms an inverting integrator. When TP8 is positive, TP5 should be at −7 Vdc. If not, suspect U1D or U9. When TP8 is negative, TP5 should be at +5 Vdc. If this is not the case, suspect U9.

- The following procedure can be used to check U2D and U9:

1. Use a jumper to ground A4TP11.
2. Set power for −2 dBm at any CW frequency.
3. Press Model 83522A **[EXT]** ALC.

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

4. To check U2D, monitor U2D pin 10 and TP8 while adjusting the EXT/MTR ALC CAL screw between the extremes of its range. Both U2D pin 10 and TP8 should vary between approximately +0.5 and −0.5 Vdc.

5. Verify U9 by adjusting the CAL screw as described above and monitoring TP5. Since U9 is an integrator, TP5 should saturate and clamp (due to VR2 and VR3) at −7 Vdc and +5 Vdc, respectively.

6. Remove jumper from A4TP11.

Further troubleshooting of the Modulator Leg can be continued by following the Open Loop procedure outlined in Figure 8-33 and checking for the waveforms provided in Figure 8-34.

MODULATOR DRIVER Q

The voltage-to-current conversion and current gain needed to drive the modulator is provided by Q2 and Q1 on the output of the Main ALC Amplifier. As the voltage increases at TP5 so does the current to the modulators, shunting more RF energy to ground and allowing less to pass through. Since the modulator is essentially current-controlled, the voltages measured at TP6 and P1-44 do not vary much over a wide range of modulator attenuations.

Q2 is an emitter-follower followed by a common-base stage (Q1), with two diodes in between. Check the biases and base-emitter voltages to see if the transistors are damaged.

- To establish a bias level for the Mod Driver state, TP5 can be forced high (+5 Vdc). Jumper A4TP1 to ground. Press Model 8350A/B **[CW]** and select any CW frequency. Select **[EXT]** ALC, and enter an RF power level of −2 dBm via front panel controls. Rotate the EXT/MTR ALC CAL screw fully counterclockwise. Verify a signal level of approximately +5 Vdc at TP5. Remove the jumper from TP11.

MODULATOR / MIXER A17

The internal modulator for this plug-in is housed in a combination microcircuit package: A17 Modulator/Mixer. Figure 8-28 provides a simplified schematic for this positive bias, shunt-type attenuator. As more current is supplied through the modulator bias pin, the shunt turns on harder, sinking more RF power to ground and allowing less to reach the front panel.

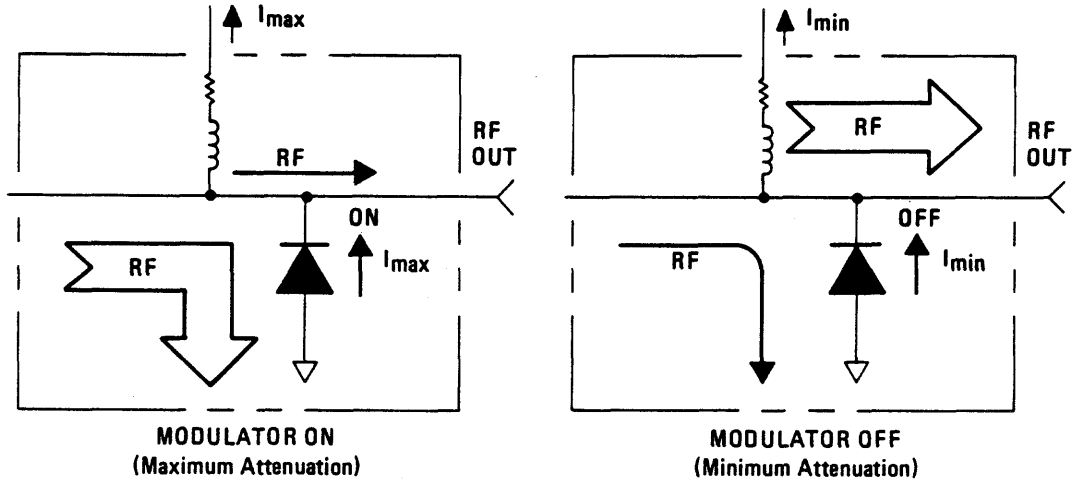


Figure 8-28. Simplified Modulator Schematic

A4 ALC TROUBLESHOOTING (CHANGE 8) (Cont'd)

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 all 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 as follows:

  1. Select HP 83522A **[EXT]** ALC. Ground TP11. Enter −2 dBm RF power, and select any CW frequency. Rotate the EXT/MTR ALC CAL screw fully clockwise. This should result in −7 Vdc at TP5, essentially removing bias from the modulator. Measure the voltlage across R49. It should be 0V. If this is not the case, isolate the modulator from its drive circuitry by applying a piece of cellophane tape to the pin edge connection, P1-44. If the voltage across R49 now measures 0V, the modulator diode is probably shorted. If the voltage across R49 still does not measure 0V, suspect the band blanking circuitry, U8B and Q15. Remove the jumper from TP11.

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.

  2. If power is low, check the RF level directly out of the YFO A12. Refer to the RF Schematic Diagram at the end of Section VIII for the proper levels. Measure the RF levels around the A17 Modulator/Mixer. With no modulation, approximately +13 dBm should be measured at the input of A17, with approximately −10 dBm at the output. If no output is measured, make sure the Cavity Oscillator A16 is yielding at least +8 dBm.

- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted). Select HP 83522A **[EXT]** ALC. Ground TP11. Enter −2 dBm RF power, and select a CW frequency. Turn the EXT/MTR ALC CAL screw fully counterclockwise. The voltage level at TP5 should be +5 Vdc. Concurrently, the voltage level at the output of the Mod Driver, P1-44, should be approximately +0.6 Vdc to +0.8 Vdc.

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

  2. Check TP6 for approximately +2.0 Vdc. The difference between the test point and the pin-edge connector gives an indication of how much current is flowing to the modulator.

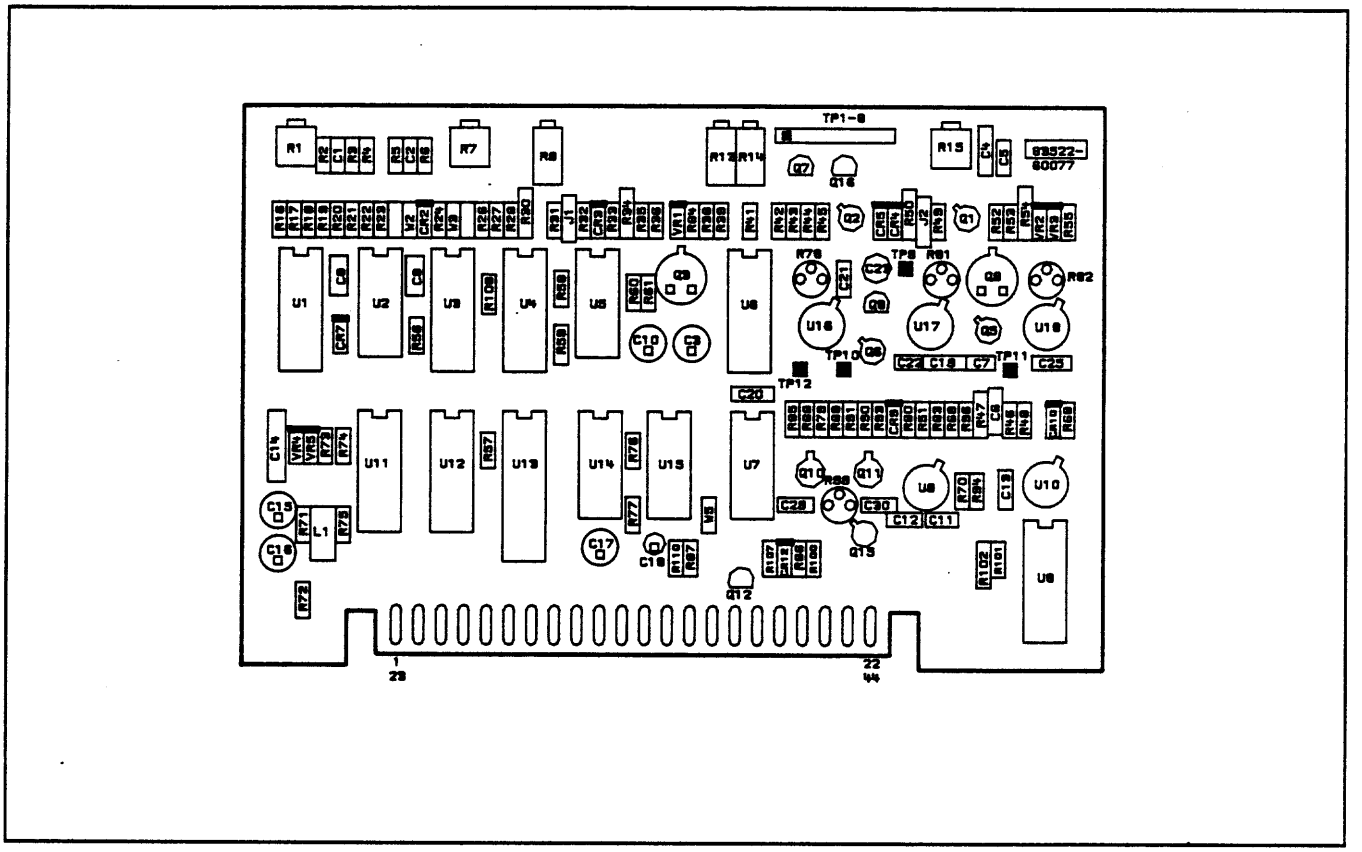


Figure 8-30. A4 Component Locations (CHANGE 8)

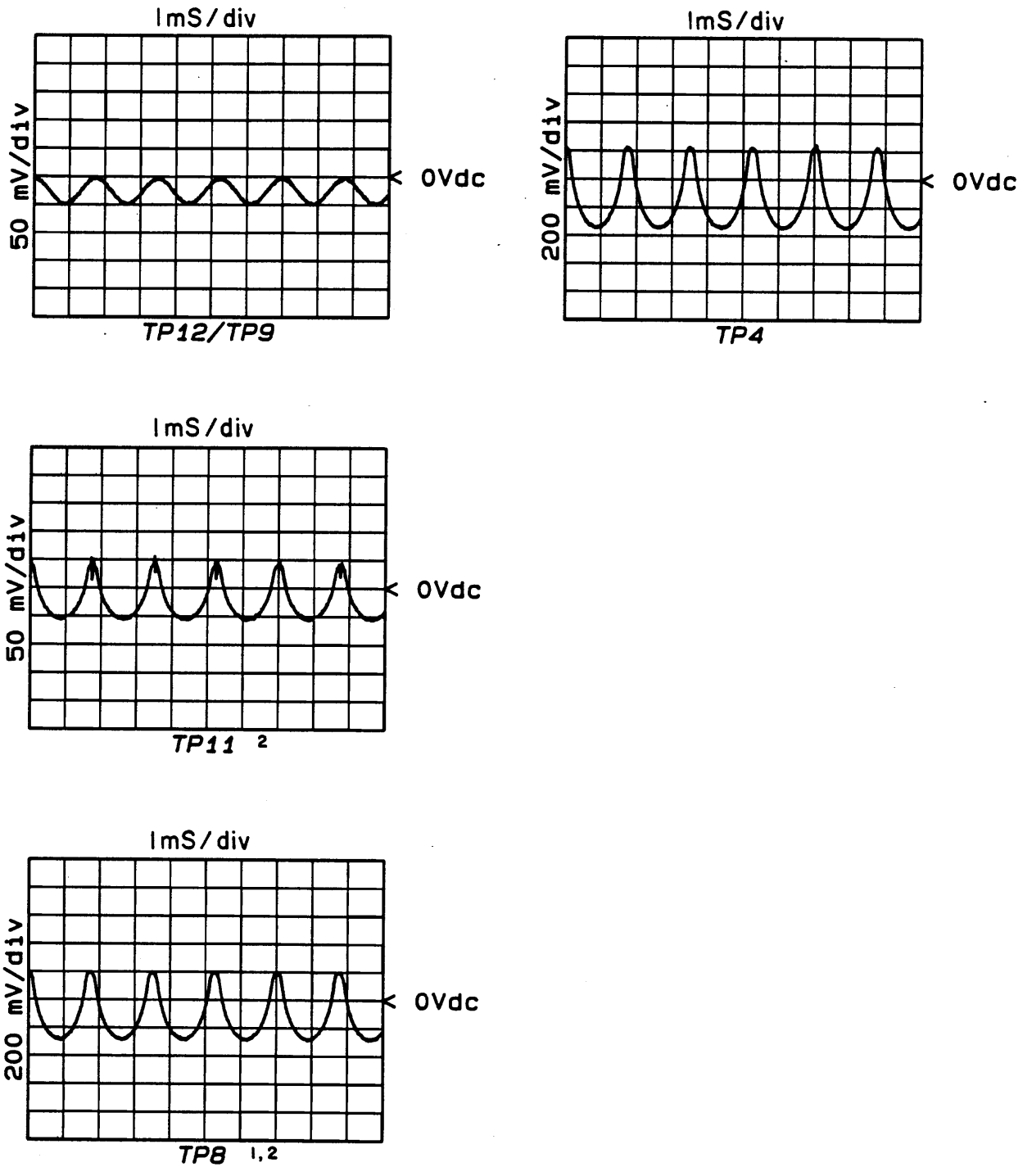
Table 8-10. Leveling Control Lines (CHANGE 8)

DATA BUS					Leveling Mode
Mux A0	Mux A1	Mux A0B	Mux A1B	PM	
H	H	H	H	L	INT 0
L	H	L	H	L	INT 1 (not valid)
H	L	H	L	L	EXT
L	L	H	H	H	PM 0
L	L	L	H	H	PM 1 (not valid)

A4P1 Pinout Table (CHANGE 8)

A4P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 23	EXT DET RET EXT DET	IN IN	A10J1-43 A10J1-47	P B
2 24	L UNLVL EXT CAL	OUT IN	A6P1-40, A10J1-12 A10J1-41	M H
3 25	PWR REF L 1 dB MKR	OUT IN	A8P1-26 A7P1-24	C H
4 26	AM FREQ TRK V	IN IN	P1-A4 A10J1-36	C I
5 27	PWR SW/COMP +5V	IN IN	A5P1-23 A3P1-6,7	C P
6 28	 −15V	 IN	NOT USED P2-28	 P
7 29	+10V L RFB	IN IN	P1-8 P2-56	P L, O
8 30	GND DIG GND DIG			P P
9 31	BD1 BD0	IN IN	A3P1-9 A3P1-31	A, C A, C
10 32	BD3 BD2	IN IN	A3P1-10 A3P1-32	A, C A, C
11 33	BA1 BA0	IN IN	A3P1-11 A3P1-33	A, C A, C
12 34	BA3 BA2	IN IN	A3P1-12 A3P1-34	A, C A, C
13 35	BD5 BD4	IN IN	A3P1-13 A3P1-35	A A
14 36	BD7 BD6	IN IN	A3P1-14 A3P1-36	A A
15 37	GND ANLG GND ANLG			P P
16 38	 +15V	 IN	NOT USED P2-29	 P
17 39	−10V −40V	IN IN	P1-13 P1-11	P P
18 40	L INST1 SQ MOD	IN IN	A3P1-8 P2-26	A, C K, O
19 41	MOD 1 L PULSE	 IN	NOT USED A7P1-4	 K, O
20 42	INT DET 1 INT DET RET	IN IN	NOT USED NOT USED	
21 43	INT DET 0 −10V REF	IN IN	A10-E4 A6P1-5	B C
22 44	MOD DRIVE MOD 0	OUT OUT	NOT USED A10J4-2	L O



1. POWER: 10 dBm. Offset depends on power level and EXT/MTR ALC CAL.
2. CW mode.

Figure 8-34. Open Loop Waveforms (CHANGE 8)

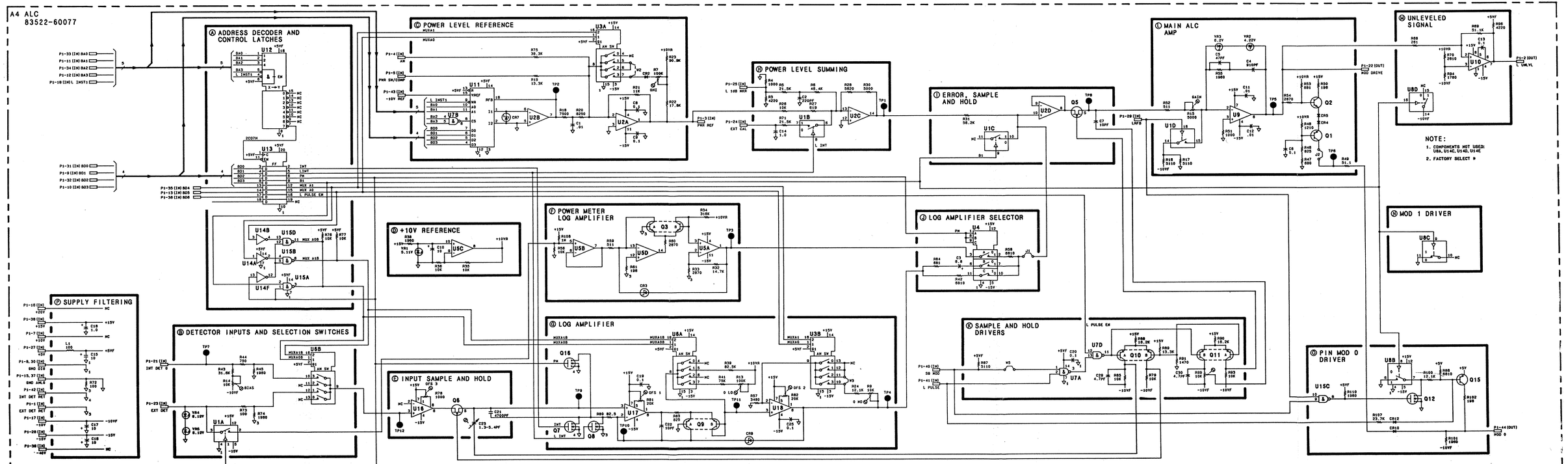


Figure 8-35. A4 ALC Schematic Diagram (CHANGE 8).

CHANGE 9

(Supersedes CHANGE 5 Board Assembly Part Number.)

This change installs Rev. 6 firmware, making the RF plug-in compatible with the HP 8510 Network Analyzer.

Page 6-6 to 6-7, Table 6-3:

Change A3 to 83525-60080 CD 6, DIGITAL INTERFACE ASSEMBLY (does not include A3U1 and A3U2).
Change A3U1 part number to 5081-8196 CD 8.
Change A3U2 to part number 5081-8197 CD 9.

▶CHANGE 10

This change documents a new front panel casting and dress panel.

Page 6-19, Table 6-3:

Change MP22, PANEL-DRESS to HP and Mfr. Part Number 83522-00006, CD 7.
Change MP37, CASTING FRONT to HP and Mfr. Part Number 83545-20081, CD 7.
Change MP38 through MP42, RETAINER to HP and Mfr. Part Number 83525-20069, CD 7, Qty 2.
Delete MP51, SET SCREW, HP and Mfr. Part Number 3030-0330, CD 7.
Change MP52, LATCH SCREW, HP and Mfr. Part Number 83525-60029, CD 3.
Delete MP53, SET SCREW, HP and Mfr. Part Number 3030-0330, CD 7.

CHANGE 11

This change documents a revision to the A7 Marker Board assembly.

Page 6-13, Table 6-3:
Change A7 to HP and Mfr. Part Number 83525-60092, CD 0.

Page 6-14, Table 6-3:
Add Q6, HP and Mfr. Part Number 1854-0447, CD 7, TRANSISTOR NPN 2N2222A SI TO-18 PD=500 mw.

Page 6-15, Table 6-3:
Change R48 to HP and Mfr. Part Number 0698-3457, CD 6, RESISTOR 316K 1% .125W F TC=0±100.
Add R71, HP and Mfr. Part Number 0698-7241, CD 4, RESISTOR 1.62K 1% .05W TC=0±100.
Add R72, HP and Mfr. Part Number 0698-7280, CD 1, RESISTOR 68.1K 1% .05W F TC=0±100.
Add R73, HP and Mfr. Part Number 0698-7260, CD 7, RESISTOR 10K 1% .05W F TC=±100.
Add U18, HP and Mfr. Part Number 1820-1197, CD 9, IC GATE TTL LS NAND QUAD 2-INP.
Add VR1, HP and Mfr. Part Number 1902-0025, CD 4.
Add W1, HP and Mfr. Part Number 8159-0005, CD 0, JUMPER WIRE.

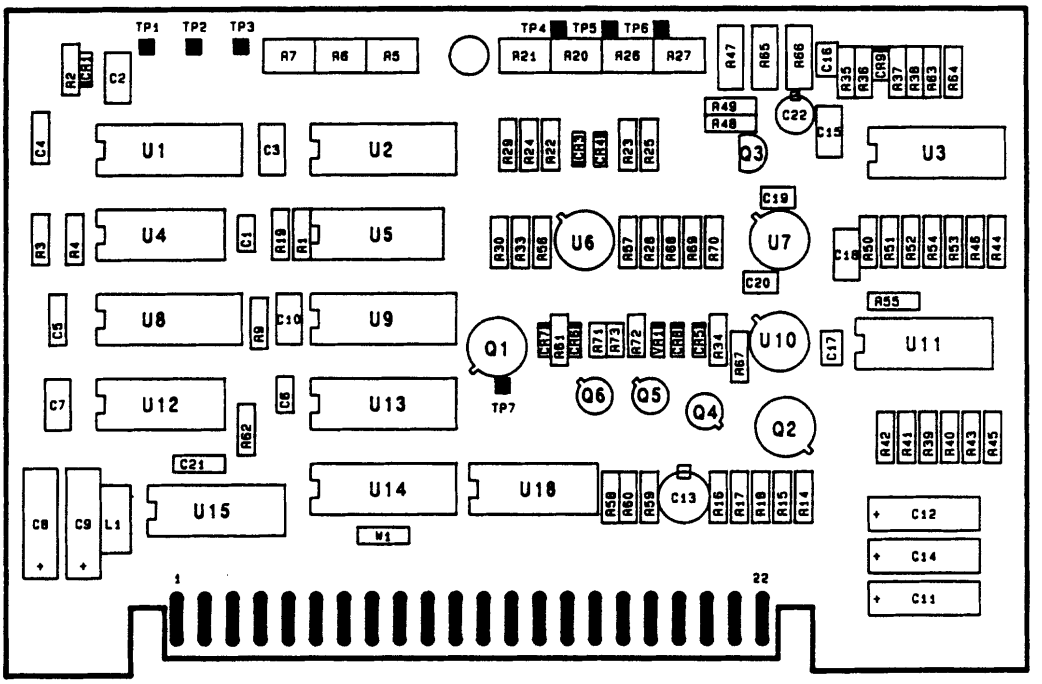
Page 8-63, Figure 8-56:
Replace *Figure 8-56 A7 Marker Component Locations* with *Figure 8-56, A7 Marker Component Locations (CHANGE 11)* contained in this document.

Page 8-63, Figure 8-60:
Replace *Figure 8-60. A7 Marker Schematic* with *Figure 8-60. A7 Marker (CHANGE 11)* contained in this document.

Page 8-63, A7P1 Pin Out Table:
Replace *A7P1 Pin Out Table* with*A7P1 Pin Out Table (CHANGE 11)* contained in this document.

Page 8-76, Table 8-13:
Replace *Table 8-13. 83522A Motherboard Wiring List* with *Table 8-13. 83522A Motherboard Wiring List (CHANGE 11)* contained in this document.

A7



HP P/N 83525-60092

Figure 8-56. A7 Marker, Component Locations (CHANGE 11)

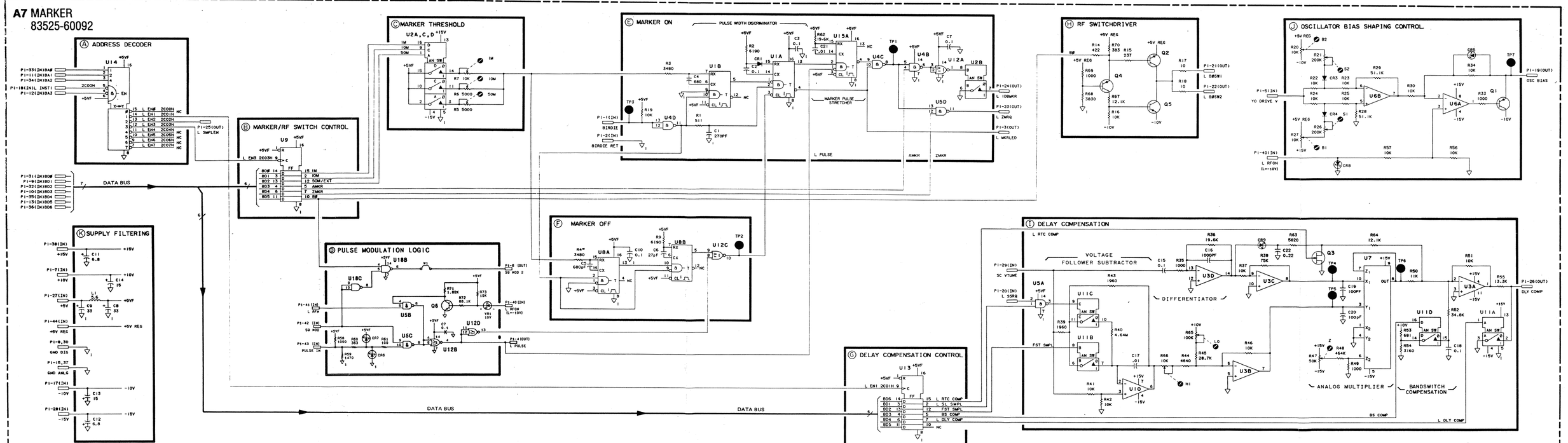


Figure 8-60. A7 Marker, Schematic Diagram (CHANGE 11)

A7P1 Pinout Table (CHANGE 11)

A7P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1	BIRDIE	IN	A8P1-1	E
23	L ZMRQ	OUT	P2-23	E
2	BIRDIE RET	OUT	A8P1-2	E
24	L 1DBMKR	OUT	A4P1-25	E
3	L MKRLED	OUT	A2J1-10	E
25	L SMPL EN	OUT	A8P1-25	A
4	L PULSE	OUT	A8P1-23	D
26	DLY COMP	OUT	A6P1-26	I
5	YO DRIVE V	IN	A6P1-42	J
27	+5V	IN	A3P1-6,7	K
6	SQMOD 2	OUT	P1-6	NOT USED
28	−15V	IN	P2-28	K
7	+10V	IN	P1-8	K
29	SC VTUNE	IN	A6P1-29	I
8	GND DIG			K
30	GND DIG			K
9	BD1	IN	A3P1-9	B,G
31	BD0	IN	A3P1-31	B
10	BD3	IN	A3P1-10	B,G
32	BD2	IN	A3P1-32	B,G
11	BA1	IN	A3P1-11	A
33	BA0	IN	A3P1-33	A
12	BA3	IN	A3P1-12	A
34	BA2	IN	A3P1-34	A
13	BD5	IN	A3P1-13	B,G
35	BD4	IN	A3P1-35	B,G
14	BD7	IN	A3P1-14	B,G
36	BD6	IN	A3P1-36	G
15	GND ANLG			K
37	GND ANLG			K
16	+20V	IN	P1-7	NOT USED
38	+15V	IN	P2-29	K
17	−10V	IN	P1-13	K
39	−40V	IN	P1-11	NOT USED
18	L INST 1	IN	A3P1-8	A
40	L RFON	IN	A2J1-38	J
19	OSC BIAS	OUT	A12A1J1-6	J
41	L RFM	IN	P2-24	D
20	L SSRQ	IN	A6P1-23	I
42	SQ MOD	IN	P2-26	D
21	L B0SW1	OUT	A18(SW1)	H
43	PULSE IN	IN	J5(BNC)	D
22	L B0SW2	OUT	A11(SW2)	H
44	+5V REG	IN	A9P1-7	K

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-in Interface P2	Digital Interface A3P1	Digital Interface A3J1	ALC A4P1	FM A5P1	YO A6P1	Marker A7P1	Sampler A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	RF Wiring Harness A10J4	RF Ribbon Cable A10J5	Miscellaneous
SCAN CLK	A3P1-38	F.P. Scan Clock			38								27					
SC VTUNE	A6P1-29	Scaled Tune Voltage							29	29								
L SIRQ	A6P1-3	L = Sweep Interrupt Request			18				3									
L SMPLEN	A7P1-25	L = Sampler Latch Enable								25	25							
SQMOD	P2-26	Square Modulation (27.8/1.0 kHz)		26						42				9				
SQMOD2	A7P1-6	Square Modulation Two								6*								
L SSRQ	A6P1-23	L = Stop Sweep Request		32					23*	20				21				
L UNLVL	A4P1-2	L = Unleveled					2		40				12					
VSW	P2-64	Sweep Voltage		64				25						22				
VTUNE	P1-A1	Tune Voltage	A1-C[1]						44									E5-C[1]
VTUNE RET	P1-A1	Tune Voltage Return	A1-S[2]						43									E5-S[2]
YO DRIVE V	A6P1-42	YO Drive Voltage							42	5			39					
L ZMRQ	A701-23	L = Intensity Marker Request		23						23				3				
L 1DBMKR	A7P1-24	L = 1dB Amplitude Marker					25			24								
1V/GHZ	A10J1-50	1V per GHz Output											50	23				J4(BNC)
−10V REF	A6P1-5	−10V Reference Voltage					43		5									
+20V FREQ REF	A9P1-5	+20V Frequency Reference Sense							21			5						

[1] Coaxial Cable - Center Conductor

[2] Coaxial Cable - Shield

* Not used on this assembly

Table 8-13. 83522A Motherboard Wiring List (4 of 5) (CHANGE 11)

▶ CHANGE 12

This change documents the addition of a jumper and a resistor to the A4 ALC assembly. The addition of these parts together with a revised A10 Motherboard assembly eliminate band 0 overshoot. Change 8 in this document is assumed to be incorporated prior to making the changes written in this change (Change 12).

Section VI, Replaceable Parts:

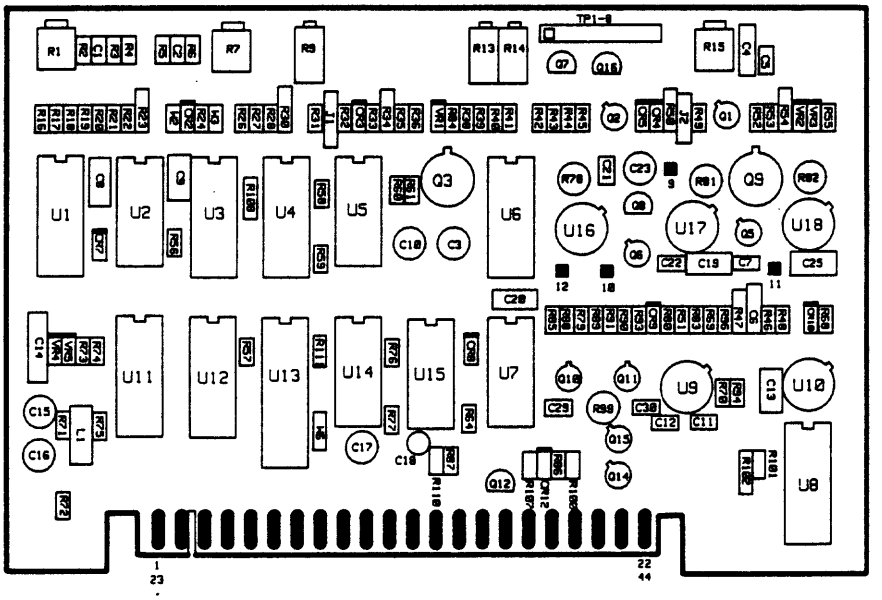
Change A4 ALC assembly to HP and Mfr. Part Number 83522-60098, CD 3.
Add A4W6, HP and Mfr. Part Number 8159-0005, CD 0, RESISTOR-ZERO OHMS 22 AW6 LEAD DIA.
Add A4R111, HP and Mfr. Part Number 0698-7253, CD 8, RESISTOR 5.11K 1% .05W.
Change A10 Motherboard assembly to HP and Mfr. Part Number 83522-60084, CD 7.

Page 8-45, Figure 8-30:

Replace the component locations diagram with *Figure 8-30. A4 ALC, Component Locations (CHANGE 12)* provided in this document.

Page 8-45, Figure 8-35:

Replace the schematic diagram with *Figures 8-35. A4 ALC Schematic Diagram (CHANGE 12).*



HP P/N 83522-60098

Figure 8-30. A4 Component Locations (CHANGE 12)

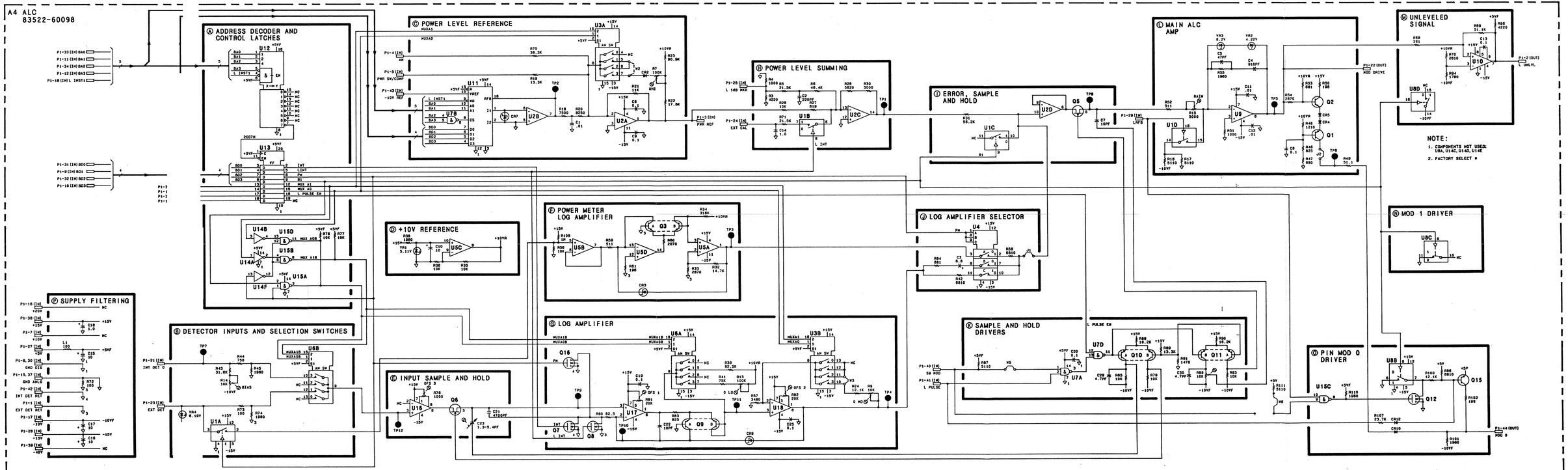


Figure 8-35. A4 ALC Schematic Diagram (CHANGE 12).

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for troubleshooting and repairing the Model 83522A RF Plug-in. Information includes circuit descriptions, troubleshooting procedures, block diagrams, schematics, and component location maps for each printed circuit (PC) board assembly.

WARNING

Adjustments or repairs inside the 8350A/ 83522A 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. Service sheets 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. A circuit description with assembly level troubleshooting is located on the 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 8-13 alphabetically lists and defines all 83522A 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 on the A10 Service Sheet.

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 83522A.

8-12. A 44-pin extender board (HP Part No. 08350-60031) is available to allow access to printed circuit board 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	Fig. No.	Assembly	Fig. No.
OVERALL		**A6 YO DRIVER** **A9 REFERENCE RESISTOR**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Simplified Overall Block	8-7	Ref. Resistor A9 Component Locations	8-44
Overall Block Diagram	8-8	Block Diagram	8-45
		YO Driver A6 Component Locations	8-49
		Schematic	8-54
A1/A2 FRONT PANEL		**A7 MARKER**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Block Diagram	8-10	Block Diagram	8-55
Front Panel A1 Component Locations	8-11	Component Locations	8-56
Front Panel Interface A2 Component Locations	8-12,13	Schematic	8-60
Schematic	8-19		
A3 DIGITAL INTERFACE		**A8 SAMPLER**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Block Diagram	8-20	Block Diagram	8-61
Component Locations	8-21	Component Locations	8-62
Schematic	8-24	Schematic	8-63
A4 ALC		**RF SECTION**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Block Diagram	8-29	A12A1 Component Locations	8-64
Component Locations	8-30	RF Section Schematic	8-65
Schematic	8-35		
A5 FM DRIVER		**A10 MOTHERBOARD**	
Circuit Description/Troubleshooting		Component Locations	8-68
Block Diagram	8-39	Wiring List	Table 8-13
Component Locations	8-40		
Schematic	8-43		
		83522A	
		Cable List	Table 8-14
		Major Assemblies Locations	8-69

BASIC COMPONENT SYMBOLOGY

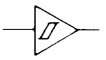
R, L, C	Resistance is in ohms, inductance is in micro-henries, capacitance is in microfarads, unless otherwise noted.
P/O	Part of.
✳	Indicates a factory selected component.
○–	Panel Control.
⊘	Screwdriver adjustment.
▭	Encloses front panel designation.
⬚	Encloses rear panel designation.
— - - —	Circuit 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.
92	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

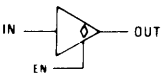
&	AND Gate
≥1	OR Gate
&	NAND Gate
≥1	NOR Gate
=1	Exclusive OR Gate
	Buffer/Amplifier
	Inverter
—○	Negation symbol. Line is active low.
—▷	Indicated edge-sensitive input.

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

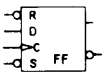
INTEGRATED CIRCUIT SYMBOLOGY



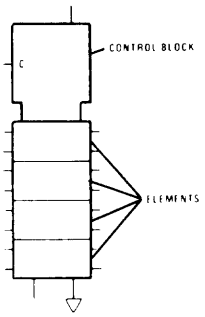
Schmitt Trigger: The gate of the Schmitt Trigger switches at different points for positive - and negative-going signals. The difference between the positive and negative thresholds is defined as hysteresis voltage.



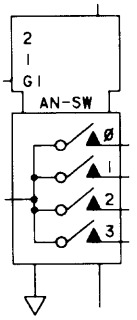
3-State Buffer: Three States:
Enable (EN) Input low: High impedence output.
Enable input high: Output = 0 or Output = 1



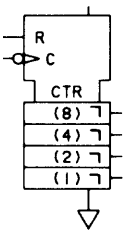
Data Flip-Flop: Set (S) and Reset (R) are asynchronous controls. Active S sets the noninverting output high and the inverting output (○—) low; active R resets both outputs. When S and R are both inactive, the outputs remain latched in the last state. An active clock (⊣▷) enables the D input, at which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



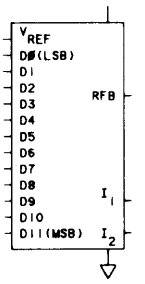
Control Block: All controlling inputs (gates, clocks, inhibits, etc.) connect to the control block.
Elements: Can be one or more of any logic function (flip-flop, counter, gate, RAM, etc.). Data inputs are on the left side of element, data outputs on the right.



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



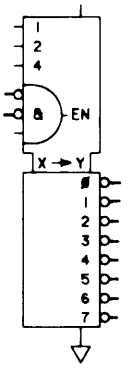
Counter: Binary-weighted registers count on the falling edge of each clock pulse. Active (high) R clears all registers.



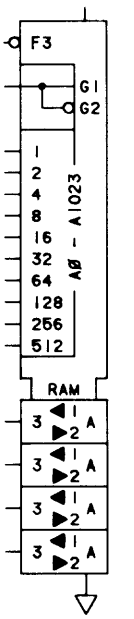
Digital to Analog Converter (DAC): Provides a scaled current output (I_1), the product of V_{REF} and the fractional binary input:

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

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 83522A 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 83522A. If a failure in the 83522A is detected during SELF-TEST, error code E001 will be displayed. Table 8-2 lists other error codes associated with the 83522A 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 problem area.

8-20. OPERATOR-INITIATED TESTS

8-21. The 8350A microprocessor services several operator-initiated tests of the 83522A 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 83522A digital circuitry can be achieved through local programming with the following key entry commands:

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

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

Table 8-2. Error Codes Associated With 83522A

Error Code	Circuit Tested
E001	Addresses 83522A 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.

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, A8†	Address Decoders
SHIFT 55	Interrupt Control	A3	A3U4-38

*Refer to troubleshooting procedure of the appropriate assembly for waveforms and detailed procedures.
†The address decoder for the A8 Sampler is on the A7 Marker Assembly.

By entering the Hex 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.) A hex address entry must be made prior to any of the following:

NOTE

Before addressing an 83522A component, determine whether or not the 8350A microprocessor can READ or WRITE to that particular device. The majority of 83522A digital integrated circuits do NOT have both READ and WRITE capabilities.

- 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 83522A logic components. Available operator initiated self test routines are indexed in Table 8-3.

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 conversions to binary and decimal equivalents.

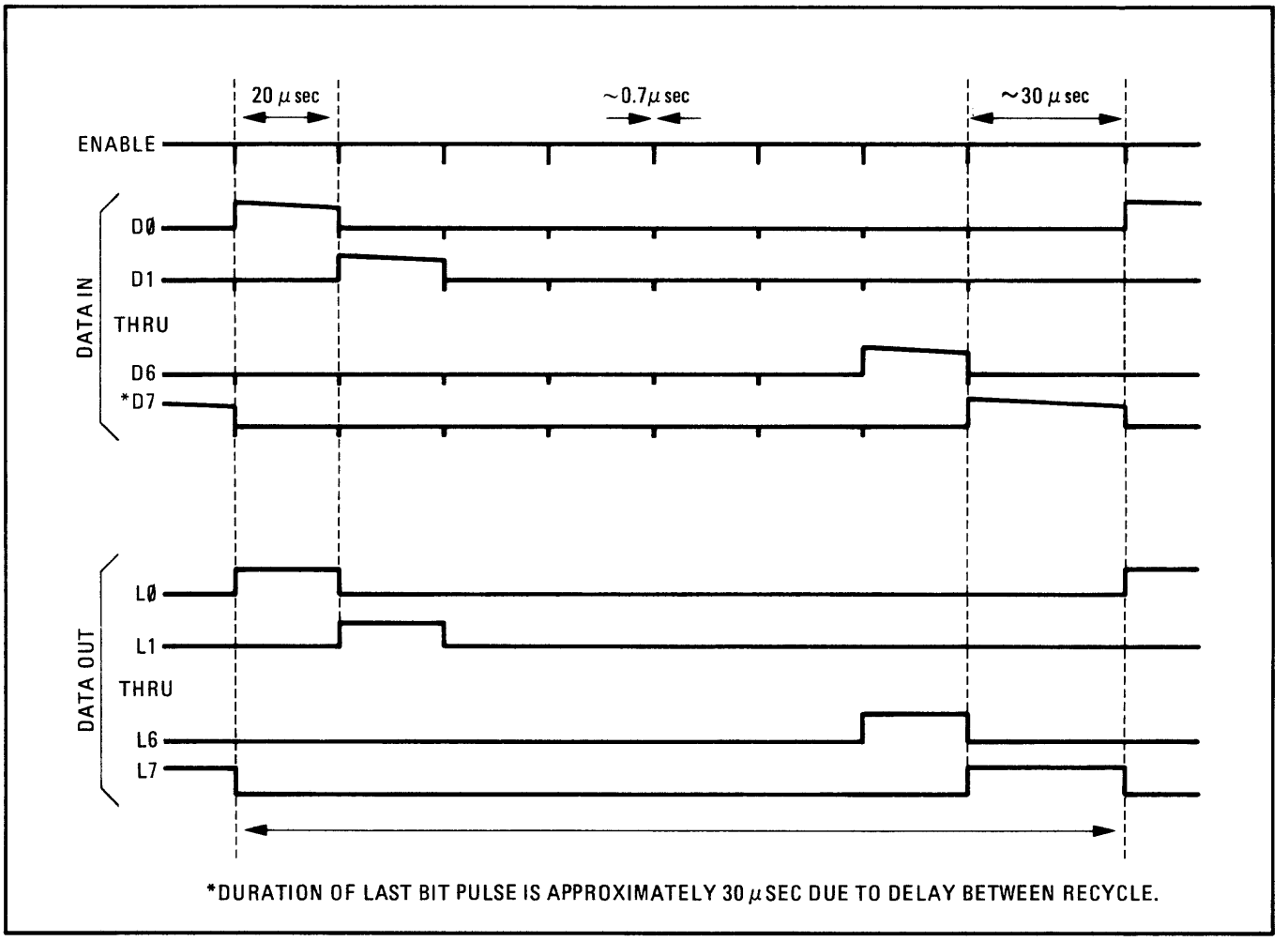


Figure 8-2. Hex Data Rotation Write — Bit Pattern

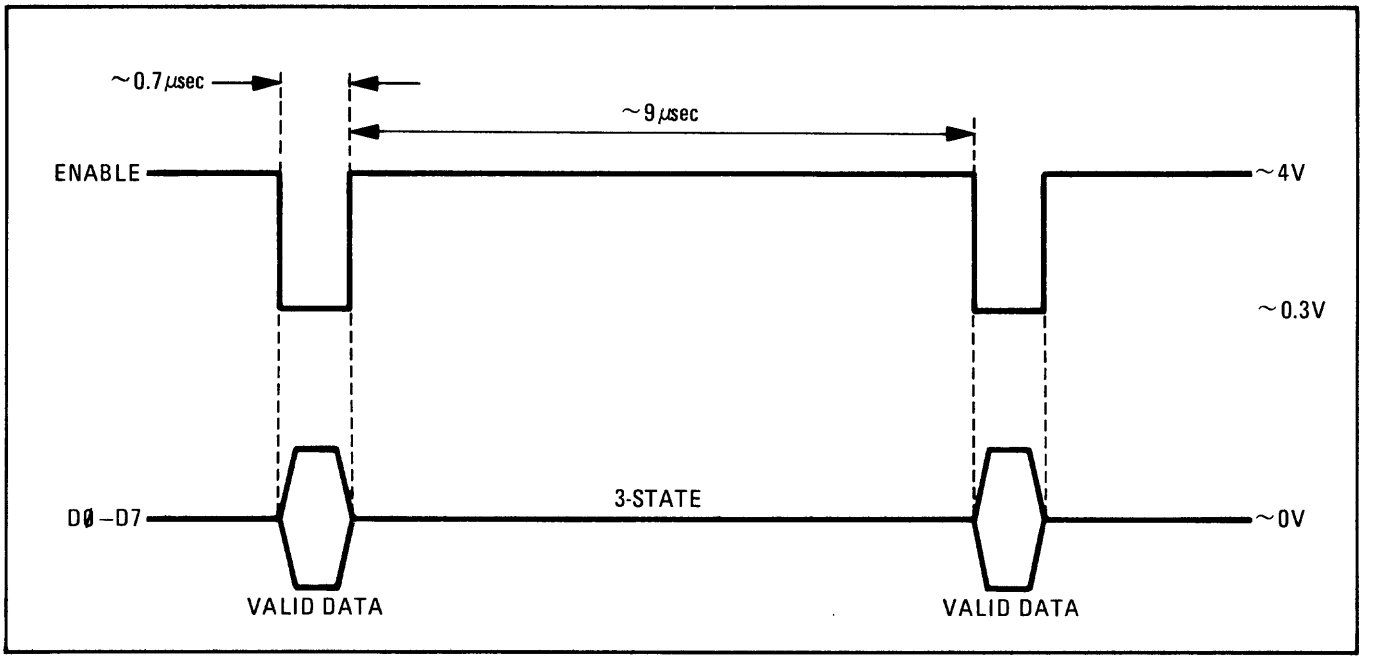


Figure 8-3. Hex Addressed Fast Read — Timing Diagram

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. Figure 8-4 illustrates the DATA ENTRY keyboard with the hexadecimal digits assigned to each pushbutton.

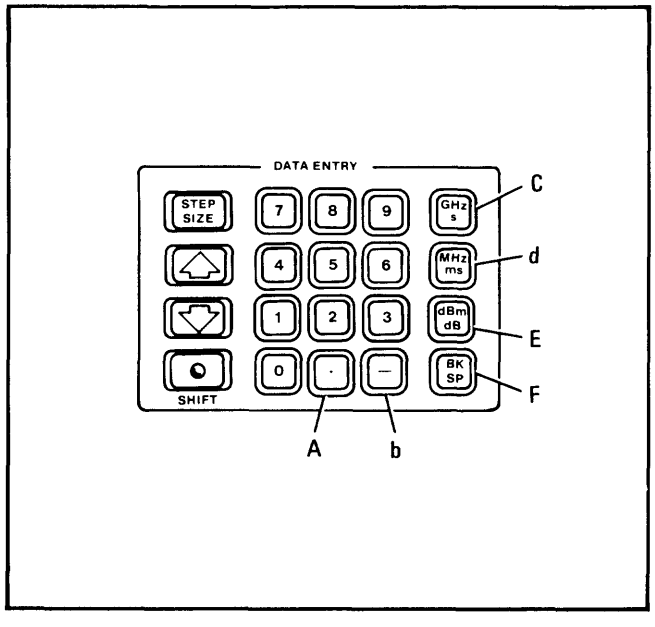


Figure 8-4. Hex Entry Keys

8-27. RECOMMENDED TEST EQUIPMENT

8-28. Test equipment required to maintain the Model 83522A 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.

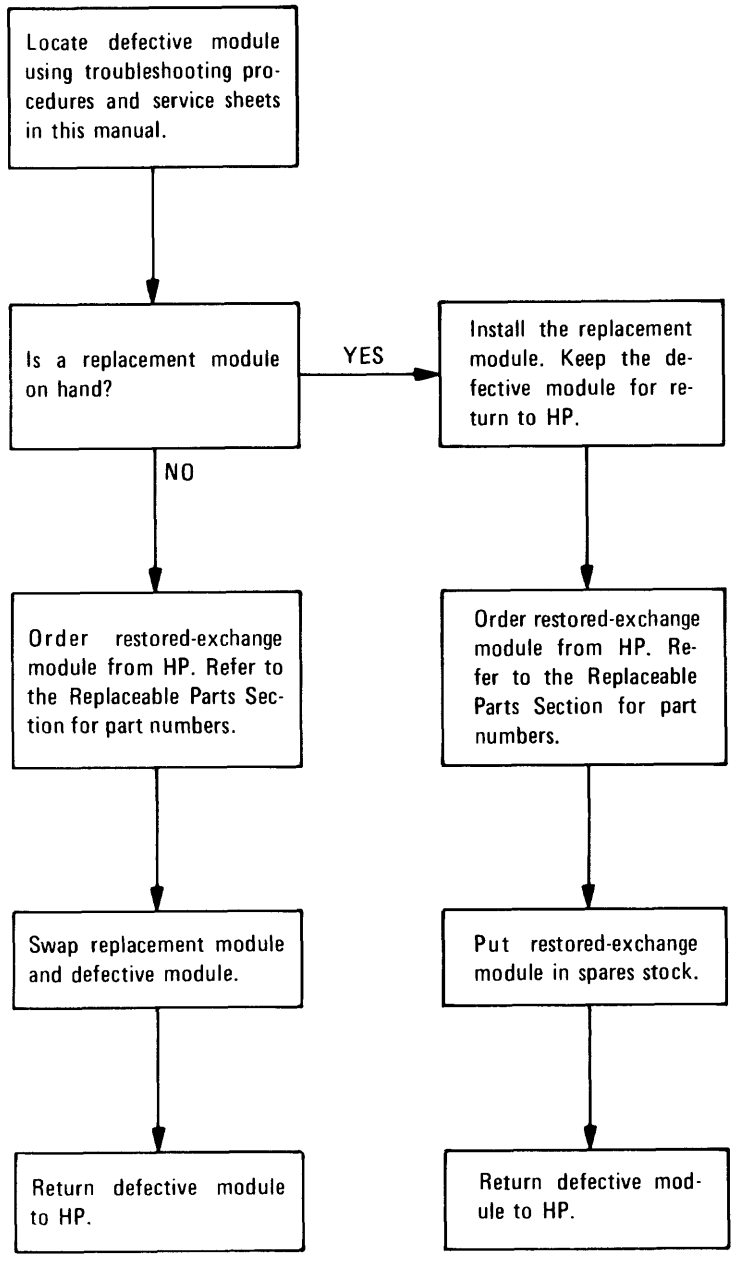
8-33. If you are not going to return the defective module to Hewlett-Packard, or if you are ordering a module for spare parts stock, etc., order a new module using the new module part number listed in Table 6-3.

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

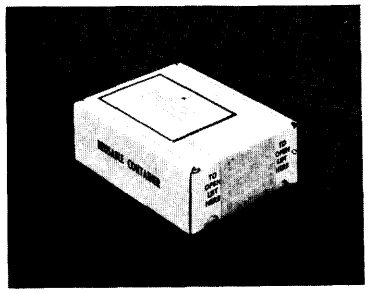
8-36. Each YIG Oscillator requires a unique set of six resistors to be installed in YO Driver A6 for proper YIG coil drive. The value of these resistors is documented on a label attached to the side of the 83522A near the RF section. If A6 is replaced, these six resistors (A6R1, A6R3, A6R38, A6R39, A6R40, 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

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.

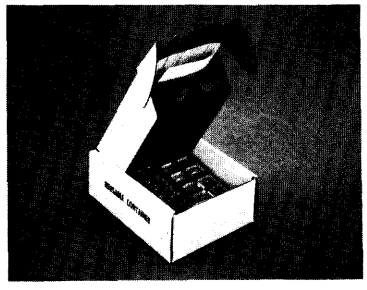
A.



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

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 the interior of the 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.

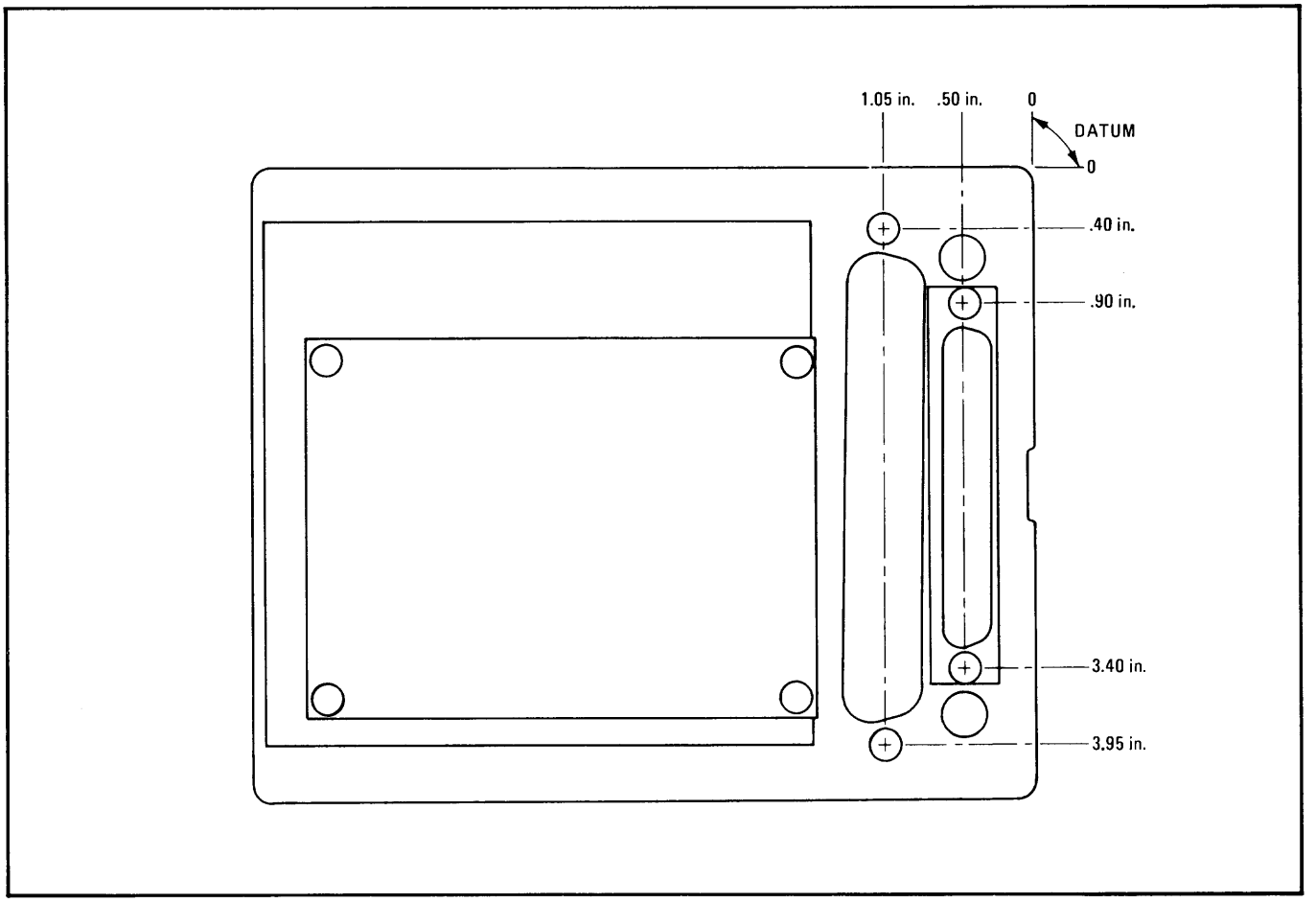


Figure 8-6. Rear Panel Connector Alignment Diagram

83522A RF PLUG-IN SIMPLIFIED BLOCK DIAGRAM DESCRIPTION

The operating principles of the 83522A RF Plug-in are described in two levels. The Functional Block Diagram Description describes major functional areas of the instrument. The Troubleshooting 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 83522A RF Plug-In, used with the 8350A Sweep Oscillator, covers the 0.01 to 2.4 GHz frequency range with +13 dBm of leveled RF power. Internal crystal markers, at 1, 10, or 50 MHz intervals, are available to produce Z-axis intensity markers or 1 dB amplitude markers up to 2.4 GHz (below 1 Ghz for the 1 MHz markers). In addition to internal leveling, external detectors or power meters can be used to level the RF power. Furthermore, the 83522A can sweep power proportional to either frequency or sweep.

The 83522A can be broken down into five functional sections:

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

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

Digital Control/Front Panel

The entire 83522A is digitally controlled by a microprocessor in the Model 8350A. 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 83522A 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 83522A, 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 FREQ CAL, pass through the Front Panel Interface to the appropriate part of the 83522A.

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, used in other multiband RF plug-ins, monitors the tuning voltage (VTUNE) when the RF plug-in is performing a sweep requiring multiple bands. When a tuning voltage corresponding to the end of the band is sensed, these circuits temporarily stop the sweep ramp and interrupt the 8350A microprocessor. The microprocessor then prepares the plug-in for the new band, including new scaling and offset values, and continues the sweep. This portion of the frequency control circits is not used in the 83522A.

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 a 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 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 a PIN modulator and correct the output power level.

Marker Generation

The Marker Generation circuitry produces markers at 1, 10, and 50 MHz intervals for RF frequencies up to 2.4 GHz (below 1 Ghz for 1 MHz markers).

A coupler samples the RF from the frequency RF path. This is combined with the frequency comb of a crystal oscillator to produce "marker birdies" when the RF frequency is an integer multiple of the crystal oscillator frequency. The birdies are then discriminated to produce centered marker pulses of uniform width. These pulses can be routed to the ALC loop to produce amplitude markers, or sent to the 8350A Sweep Oscillator to provide Z-axis intensity markers.

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 0.01 to 2.4 GHz frequency range is covered with a YIG Oscillator (YO) as the tunable source. A fixed 3.8 GHz oscillator is used to mix down the YO output, thus covering the 0.01 to 2.4 GHz range.

A directional coupler with a detector senses the RF power level and sends a voltage to the ALC circuits for internal power leveling. Another coupler samples the output for use in the Marker Generation circuits.

In Option 002 instruments, a programmable step attentuator 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 83522'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, markers, 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 begin the bandswitch in multi-band plug-ins. During bandswitch, the Interrupt Control is programmed to count down time intervals specified by the microprocessor. At the end of these intervals, the L PIIRQ line is again activated to notify the 8350A that the time interval has elapsed.

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. Two special annunciators – MARKER and UNLEVELED – are not digitally controlled, but are driven from separate Mkr/Unlvl circuits which monitor the Marker and ALC assemblies.

The Power Control Interface digitally controls several functional areas. Three of the lines are buffered by the Attenuator Control, which operators the A19 Step Attenuator in instruments equipped with Opt 002. The RF On circuits control the biasing for the A12 YIG Oscillator and A14 Amplifier. When the RF is turned off, the bias to these assemblies is removed, shutting off the oscillator and amplifier.

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 1Vdc 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 FREQ CAL adjustment is used to fine-tune the RF output frequency to correct for drift or error in the frequency of the A16 Cavity Oscillator. 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 full 0 to 10V VTUNE must tune the oscillator from 3.81 to 6.2 GHz.

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 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, this prevents 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, plus the front-panel FREQ CAL. 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 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, 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 sent through 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 +13 and −2 dBm. (Instruments with Option 002 use an RF Step Attenuator to achieve power control down to −72 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 one of the two detectors, and selects one of them for leveling. The sources include DC1 Directional Dectector, the "External" input (external negative detector), and a third position which inverts the polarity of the external input (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 two more component signals. One is the External Cal, an offset voltage from the front panel used to calibrate absolute power when external leveling is used. The 1 dB Marker signal from the A7 assembly is also added, producing a dip in the RF output power when amplitude markers are activated. 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. An additional error voltage is injected at this point to compensate band flatness only. 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. A pulse input to the MOD driver provides pulse modulation. An additional circuit monitors the input to the modulator drivers, 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 coupler. Its input is FREQ TRK V, a voltage exactly proportional to frequency. This signal drives an array of four transistors, and their 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.

MARKER GENERATION

The 83522A features both amplitude and intensity markers at multiples of 1 MHz up to 1.0 GHz, and multiples of 10 or 50 MHz up to 2.0 GHz. They are derived from a crystal, and hence are extremely accurate and stable.

A8 Sampler Assembly

A crystal-stabilized 50 MHz oscillator on the A8 Sampler assembly provides the reference frequency for the markers. This squarewave is divided by five, then divided by ten again, making squarewaves at 50 MHz, 10 MHz, and 1 MHz available. A switch selects one of these outputs to be used, depending on the front panel function selected. The squarewave passes through a comb generator, making a pulse train containing many harmonics at integer multiples of the input frequency. This is then mixed with the RF output sampled by the DC1 Directional Detector, producing many mixing products at the sum and difference frequencies of the RF frequency and each harmonic of the comb generator.

The external marker is produced by mixing the RF output with an externally-produced signal (EXT MKR) below 2.4 GHz in a second mixer. The sum and difference frequencies are then processed just as the harmonic sum and difference frequencies.

The mixing products are passed through a lowpass filter with a programmable cutoff frequency. This filters off the high-frequency mixing products and allows only the low-frequency product to pass. When the RF output frequency is being swept, the resulting string of "birdies" reach peak amplitude when the mixing product frequency approaches zero.

The "birdies" are buffered by an amplifier with a controllable gain. A Gain Shaping circuit monitors the reference power level and adjusts the gain to compensate for varying levels of SAMPLED RF. This maintains uniform "birdie" amplitude as power level changes.

The "birdies" pass through a switch opened by the LPULSE line, disabling the marker circuits when the RF power is pulsed. This prevents the power dropouts from producing false markers. A second switch, actuated by the buffered "birdies," transforms the analog signals into a TTL rectangular wave for processing on the A7 Marker assembly.

A7 Marker Assembly

The A7 Marker assembly receives the TTL "birdies" and processes them to generate marker pulses that are centered where the RF output frequency is exactly equal to a harmonic of the crystal oscillator, producing a mixing "null." A digital circuit detects the time between "birdie" pulses and discriminates this null to produce a marker pulse. This marker pulse produces 1dB markers through the ALC circuits, and sends a pulse to the mainframe to produce Z-axis intensity markers when enabled.

The Pulse circuits are part of the A7 Marker assembly. The Pulse circuits essentially combine three different pulse sources: Square Mod and RF Markers from the 8350A, and Pulse Input from the plug-in rear panel. The output (L PULSE) shuts off the RF, acting on the A17 Modulator/Mixer through the A4 ALC assembly.

RF SECTION

The RF Section includes the microcircuits and their bias boards that produce the actual RF output power. These components include A11 through A19 and DC1.

The A12 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is the frequency-controllable microwave source for the 83522A RF Plug-in. The YO's frequency is determined by the current flowing through large electromagnetic coils inside. 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 YO's 3.81 to 6.2 GHz output is fed to the A17 Modulator/Mixer. Here it is mixed with the fixed 3.8 GHz output of the A16 Cavity Oscillator, yielding the heterodyned output from 0.01 to 2.4 GHz. Power control and leveling is accomplished by modulating the 3.8 GHz input before the mixer, internal to the A17 Modulator/Mixer.

A14 Amplifier boosts the mixed-down low-power output from the A17 assembly. The amplifier also serves to further remove unwanted high-frequency mixing products. The A14A1 Amplifier Bias assembly is directly connected to the microcircuit, has no adjustable or replaceable parts, and is not separately replaceable.

The A15 DC Return allows DC currents to pass to ground, preventing them from affecting other circuits.

DC1 Directional Detector serves a dual purpose. A broadband resistive bridge couples off a portion of the RF energy, rectifies and filters it, and provides a detected output for leveling. Another resistive tap samples the RF power for the Marker Generation circuits.

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).

83522A OVERALL TROUBLESHOOTING

The purpose of this troubleshooting information is to provide an aid in isolating a problem in the 83522A 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 83522A is calibrated and functionally operating.

A failure in the 83522A 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.

- Marker Generation – Typical problems are that markers are generally unstable or not present. Problem may be frequency related. Typically, the trouble is with the A7 or A8 assemblies, or the RF Section. If problem is with amplitude markers only, trouble may be with the A4 ALC 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 first 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 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 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.

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 is 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 Problems. Frequency accuracy problems are most likely related to the front panel FREQ CAL adjustment. Refer to Section III for the FREQ CAL adjustment procedure. The YO DRIVE V on the A6 YO Driver can be checked by comparing the rear panel 1V/GHz output with frequency selected and the actual 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 catagories.

- 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.

Marker Generation

Marker generation problems are generally associated with the A7 Marker or A8 Sampler assemblies. Performance of the Marker and Sampler adjustments is a good troubleshooting aid for unstable or no marker operation. If the marker problem is related to external markers only, perform the External Marker adjustment. If the marker problem is dependent on whether amplitude or intensity markers are selected, the problem is most likely with the A4 ALC for amplitude, and the 8350A, or interface, for intensity markers.

If external markers are operational and internal markers are not available, check the Sampled RF output from DC1 and the 50 MHz oscillator operation on the A8 Sampler.

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. For excessive harmonics or spurious responses, refer to the RF Section service sheet for further troubleshooting.

Table 8-5. 83522A Error Codes

Error Code	Function Tested	Operator Initiated Test	Troubleshooting Hints
E001	8350A/83522A		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.

annunciators are buffered by inverters, and drive current through the LED to ground rather than sinking current from +5V. The outputs of these buffers can be checked during Hex Data Rotation Write.

MKR and UNLEVELED lights are driven by pulse-stretching timers. These are disabled by U9A during retrace. Check that U9, pin 3, is high during retrace (approximately +4Vdc), and low during forward sweep. The UNLEVELED light should be lit when the available power is insufficient for leveling to the desired reference level (typically several dB beyond specified maximum leveled power).

If the L MKR light is not functioning properly, set the 8350A as follows: Start sweep = 30 MHz, Stop sweep = 90 MHz, Time = 500 msec. Select 83522A 1 MHz MARKERS. Connect oscilloscope channel B to the 8350A Sweep Out, and select the A vs B mode for horizontal deflection as a function of the 8350A sweep ramp. Check the input (pin 8) and output (pin 9) of timer U12B. The output of U12 goes high for an initial low pulse at the Trigger input (T), and remains high for a period of approximately 50 milliseconds. Subsequent trigger pulses, occurring within the timing cycle, will not affect the output. However, if the Trigger input remains low for a longer duration than the timing cycle, the output will remain high for the duration of the trigger signal. If no trigger signal is present, check diodes CR4 through CR7, or trace the problem back to the A7 assembly.

If the UNLEVELED light is not functioning properly, select 8350A **RF BLANK** and disengage 83522A RF to turn the power off. In this mode, LUNLVL, J1-12, should be low during forward sweep, and high during retrace. Connect oscilloscope Channel B to 8350A Sweep Out and select the A vs. B mode for horizontal deflection as a function of the 8350A sweep ramp. Check the input (pin 6) and the output (pin 5) of timer U12A. Refer to the previous paragraph for an explanation of U12. If the circuit is functioning properly, trace the problem back to the A4 assembly.

Keyboard

The keyboard matrix is scanned continuously by U6. This LSI device continuously strobes the column lines, senses the row lines for depressed keys, eliminates contact bounce, stores the key code internally, and flags the 8350A to recover the key code. Troubleshooting is difficult because the device is so complicated, but it is worthwhile to check all signals to and from U6, probing directly on the pins of the chip, before replacing it.

Error codes E050 and E051 generally indicate U6-related problems:

- E050 occurs when the microprocessor has received a flag (L PIFLG) from the plug-in (indicating a front panel key was pressed), but cannot recover the keycode (indicating that the key was NOT pressed). Check the FLAG output from A2U6 (accessible at A3P1-42). It should be TTL low, approximately 0 volts. Pressing a front panel pushbutton should result in a very rapid pulse. If the line appears to be locked high, replace A2U6. If it is good, check inverter A3U10F (accessible at A3J1-39) to see if it is locked low.

- E051 occurs when the key code received by the microprocessor cannot be decoded. This indicates a failure in A2U6 or a bad Row Sense line. If the Row Sense lines are good, troubleshoot the keyboard matrix with a continuity checker.

To troubleshoot the plug-in keyboard matrix, initiate the Key Code Test. Enter SHIFT 0 4 . Thereafter, when pressing any plug-in front panel key, the appropriate hexadecimal key code should appear in the mainframe FREQUENCY/TIME display window. The appropriate key codes are given in Table 8-6.

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 2d00 (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 8-14.

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 8-15, 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 8-15. If they are absent, check that the output lines 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 8-16. 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 8-17. If it is present on the A2 assembly, but FREQ TRK V is missing on the A4 and A5 boards, probe the emitter of Q3 for the same waveform offset by approximately 0.6 Vdc.

Analog switches U9B, U9C, and U9D are controlled by latch U8. These switches apply an offset to FREQ TRK V, and turn it off when external leveling is used. These switches 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 and U9D are closed.

The 1V/GHz Amplifier adds one more stage of gain and offset 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 8-18. 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 inputs: **0** **0** and **BKSP** **BKSP** (FF). The RF ON line should toggle from 0 Vdc to −10 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 FREQ CAL and EXT/MTR ALC CAL offsets are generated by A1 potentiometers, with the wipers running between +10 Vdc and −10 Vdc. If the signals are absent, check for the +10V and −10V supplies. If the offset voltages still cannot be produced, replace the defective potentiometer, R3 or R4.

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.

Error Code E053

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 8-22. 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 8-22. If they are incorrect, replace U5.

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 8-22. If they are correct, U5 is functional. Next, check the L PIAE line as shown in Figure 8-22, 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 8-22. 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 Inteface 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 8350 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 8-23. 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 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 activity on each of the buffered address lines (BA0 − BA3).

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, note 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 Hex Data command
2 9 0 0	Address location 2900
M3	Hex Data Read

Watch the display change as 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 8-22 should be observed. Refer to "Other Error Codes" for details on these errors codes and the SHIFT 5 5 Operator Initiated Self Test.

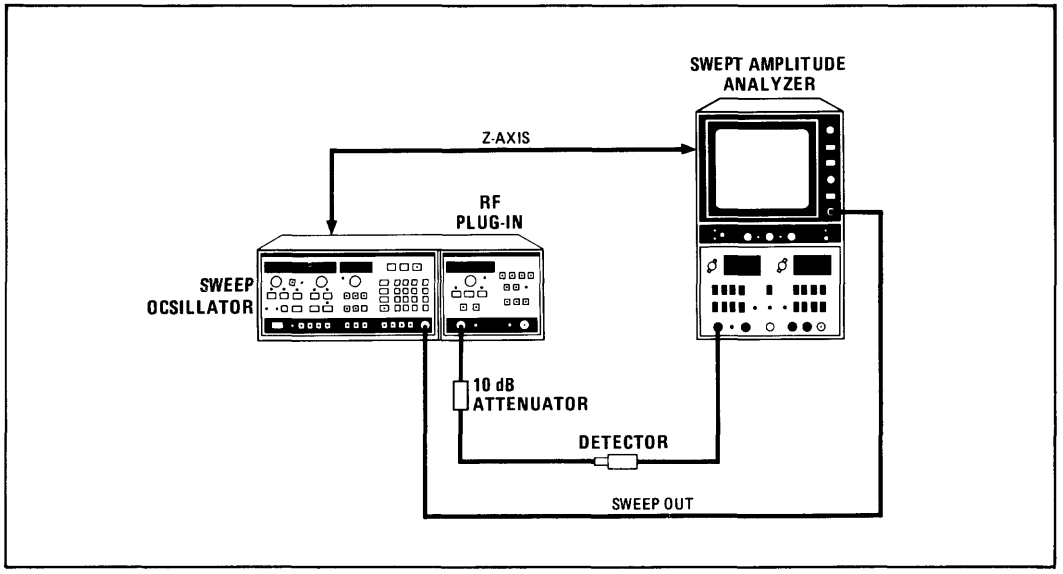


Figure 8-26. Typical ALC Troubleshooting Setup

RPG/Power Display Failure

Check that the POWER display changes when either the RPG is rotated or data is entered via the 8350A keyboard. This verifies that the digital information is reaching the mainframe, is properly processed, and then displayed.

- If the display is flashing rapidly or showing random patterns, refer to A1/A2 Front Panel or A3 Digital Interface troubleshooting. If the RPG causes a change in the measured RF power level, but the POWER display remains the same, refer to A1/A2 troubleshooting. If the RPG produces no response whatsoever, or if the front panel display is blank, refer to A1/A2 troubleshooting, and trace the problem back to the 8350A mainframe.

Unleveled (LED)

If the UNLEVELED light turns on during the sweep, enter a sweep time of 2.4 seconds (i.e. one second per GHz). Observe the SWP light on the 8350A Sweep Oscillator, and determine at which times during the sweep the UNLEVELED light turns on.

- If the UNLEVELED light remains lit during retrace, suspect problems in the front panel annunciator drivers. Refer to A1/A2 troubleshooting.

- If the UNLEVELED light blinks briefly at the beginning of the sweep, the plug-in may be sweeping through 0 Hz and causing an ALC drop-out. Check this by slowly increasing the start frequency. If the UNLEVELED light stops blinking, enter a CW frequency of 50 MHz and enable the 50 MHz crystal marker. Slowly adjust the 83522A front panel FREQ CAL knob until the MKR light stays on. Press INSTR PRESET and observe the UNLEVELED light. A frequency counter may be used to check frequency accuracy at 10 MHz or 50 MHz. If necessary, refer to Section V, Adjustments, in this manual, and perform the Frequency Accuracy calibration procedure.

- 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 Fig. 8-26.

- 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 +13 and −2 dBm, but can't be controlled via the front panel, refer to the Digital Control section under Troubleshooting Diagnosis.

- 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

Set the 83522A to sweep the full range.

- Attempt to level the power externally using the HP 432A Power Meter as shown in Figure 8-27. 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 detector 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. It may be necessary to perform the ALC adjustments in Section V of this manual.

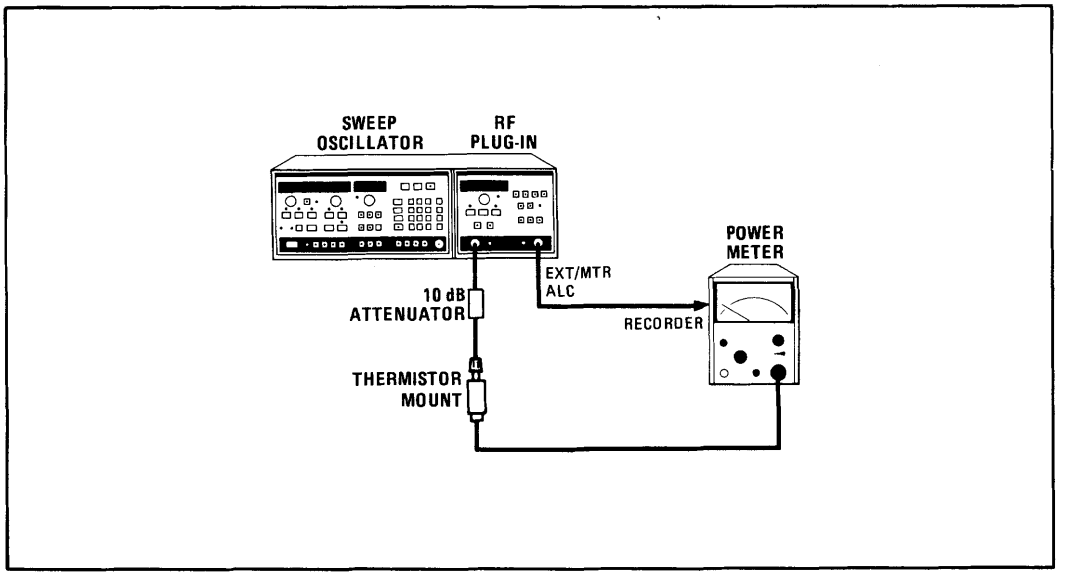


Figure 8-27. Power Meter Leveling Setup

- Check the Detector Selection Switch by entering a CW frequency at the desired frequency or in 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 PIN Mod 0 Driver or the Modulator. If it is below +4 Vdc, suspect the Detectors and Detector Leg.

No Power

NOTE

Turn off line switch before removing or installing any assembly.

NOTE

With the ALC assembly removed from the plug-in, 27.8 kHz square wave modulation is not available in the 83522A.

- To check the RF components, remove the A4 ALC assembly from its socket. This removes all bias from the modulator and should allow maximum power through the RF path. If full power (over +15 dBm) is then detected, the RF amplifier (A14), cavity oscillator (A16), and DC Return (A15), are verified. Suspect primarily the detector. Also inspect the modulator, as well as the A4 PIN Mod 0 Driver and Detector Selection Switch.

- If power is still missing, enable the plug-in markers and check that the MKR light flashes. If it does, then the failure must be limited to the DC1 Directional Detector. If the markers do not work, check the A12 YIG Oscillator, A17 Mod/Mix, A16 Cavity Oscillator, and A14 Amplifier. Refer to RF troubleshooting procedures for details.

- If removing the A4 assembly causes full unleveled RF power to appear, reinstall the board and check A4TP6. If less than +4 Vdc is found, check continuity from A4TP6 to the PIN Mod 0 Driver circuit. If A4TP6 is at +7.5 Vdc, suspect any circuitry between the Detector Selection Switch and A4TP6, particularly the Log Amp.

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) DC1
Detector Leg (D) (E)
Modulator Leg (G) (I)
Mod Driver (K)
Modulator/Mixer A17

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 (Hexadecimal). 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, AM, amplitude markers, 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 the power flatness 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 (−2 dBm displayed) to +10 Vdc (+22 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 +13 dBm.)

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

SHIFT 5 0

The waveform in Figure 8-32 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 CR2. Use the EXT MTR mode to bypass these diodes while troubleshooting.

U3C adds the amplitude markers (L 1DB MKR) and 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 −2 dBm, and +7.0 Vdc for +22 dBm. Amplitude markers produce a 250 mVdc dip when the MKR light is on. An amplitude modulation (AM) signal of 1.0 Vp-p at P1-4 will produce roughly 260 mV p-p at TP1.

Detector/Detector Selection Switch (B) DC1

The DC1 detector is tested simply by checking its output voltages under full leveled power or full unleveled power conditions. The A4 assembly must be installed for troubleshooting as it supplies bias current to the detector.

NOTE

The 27.8 kHz modulation signal required for 8755 compatibility is not available when the A4 assembly is removed from the plug-in.

- If no 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, apply a narrow strip of cellophane tape to the pin-edge connector to isolate the output of the PIN Mod 0 Driver from the modulator (P1-44). Reinstall the A4 board. This removes bias from the modulator, allowing full RF power transmission, while providing detector bias.

If full leveled power (+13 dBm) or full unleveled power (at least +15 dBm) is measured, sweep the full band and check the voltages at the detector inputs against the values shown in Table 8-9. (Use high-impedance 10:1 probes.)

Table 8-9. Detector Voltages

	Full Leveled +13 dBm	Full Unleveled **+20 dBm
A4P1-21	−150 to −200 mV	−300 to −400 mV

If the detector is working and the Detector Selection Switch is suspected, sweep the full band and monitor TP15 for the voltages 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.

NOTE

Remove any tape applied to edge connector pins in the previous procedure.

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 8-33 (above the schematic diagram).

Modulator Leg Ⓖ Ⓘ

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

U3D is a non-inverting unity-gain summing amplifier. Under leveled conditions, both TP4 and TP7 should be nearly 0.0 Vdc. Under any conditions, TP4 and TP7 should be at the same voltage. 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.

- The following procedure can be used to check U3D and U11:

  1. Set power for −2 dBm at any CW frequency.

  2. Press 83522A EXT ALC.

  3. Ground A4TP11.

  4. To check U3D, 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.

  5. 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 8-33 and checking for the waveforms provided in Figure 8-34.

Modulator Driver (K)

The PIN Mod 0 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 TP8 and P1-44 do not vary much over a wide range of modulator attenuations.

The PIN Mod 0 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 establish a bias level for the PIN Mod 0 Driver, TP6 can be forced high (+7.5 Vdc) by pressing 8350A CW and selecting any CW frequency. Select EXT ALC, and enter an RF power level of −2 dBm via front panel controls. Ground A4TP11. Rotate the EXT/MTR ALC CAL knob fully counter-clockwise to set a signal level of approximately +7.5 Vdc at TP6.

Modulator/Mixer A17, A13

The internal modulator for this plug-in is housed in a combination microcircuit package (A17 Modulator/Mixer). Figure 8-28 provides a simplified schematic for this positive-bias shunt-type attenuators. As more current is supplied through the modulator bias pin, the harder the shunt diode turns on, sinking more RF power to ground and allowing less to reach the front panel.

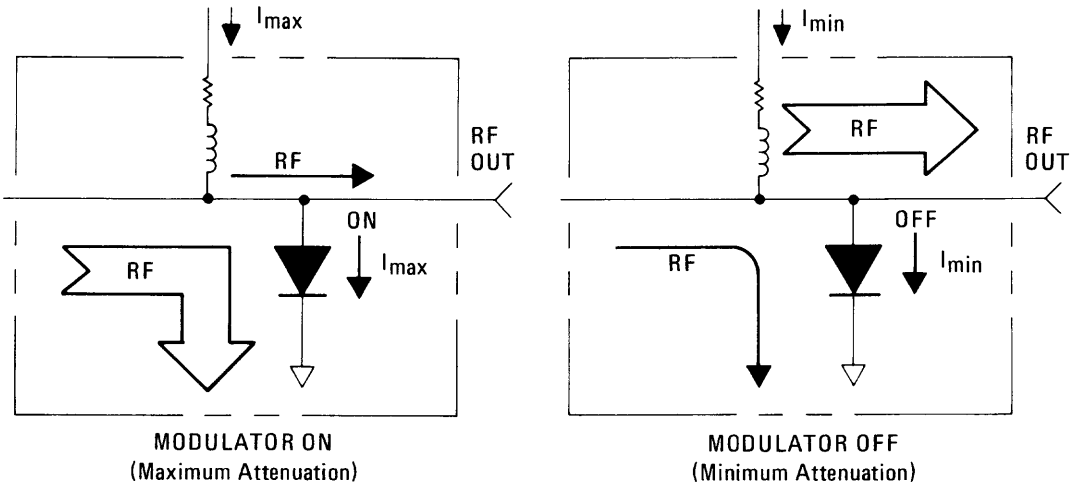


Figure 8-28. Simplified Modulator Schematic

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 all 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 as follows:

  1. Select 83522A EXT ALC. Enter −2 dBm RF power, and select a CW frequency at any point in the band. Ground A4TP11. Rotate the EXT/MTR ALC CAL knob fully clockwise to set TP6 to −0.6 Vdc, essentially removing bias from the modulator. Check TP8 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 (P1−44). If TP8 now measures −10 Vdc, the modulator diode is probably shorted. If the test point still does not achieve −10 Vdc, suspect the blanking circuitry, U9B and Q9.

NOTE

Remove any tape applied to the pin edge connector 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.

  2. If power is low, 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. Measure the RF levels around A17 Mod/Mixer. With no modulation, approximately +13 dBm should be measured at the input of A17, with approximately −10 dBm at the output. If no output is measured, make sure the A16 Cavity Oscillator output is at least +8 dBm.

- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted). Select 83522A EXT ALC. Enter −2 dBm RF power, and select a CW frequency anywhere in the band. Ground A4TP11. Rotate the EXT/MTR ALC CAL knob fully counter-clockwise. The voltage level at TP6 should be +7.5 Vdc. The voltage levels at the output of the PIN Mod 0 Drivers (P1-44) 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 TP8 for approximately +2.0 Vdc. The difference between the test point and the pin-edge connector gives an indication of how much current is flowing to the modulator.

A4

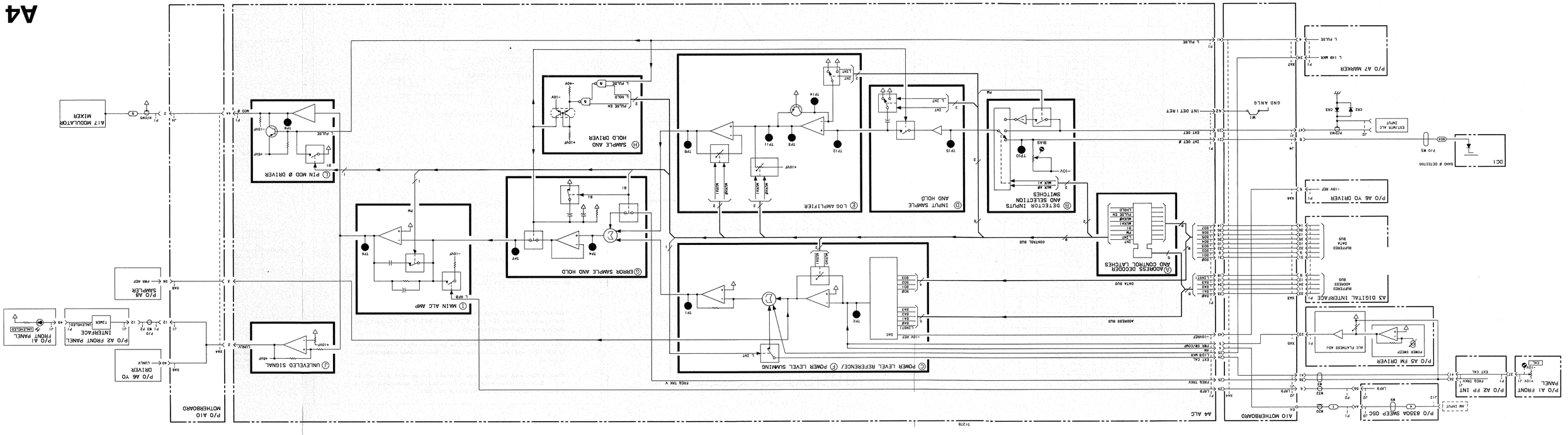


Figure 8-29. A4 ALC Block Diagram

A5 FM DRIVER, CIRCUIT DESCRIPTION

The A5 FM Driver is divided into three major sections: the YIG Main Coil FM Driver, the YIG FM Coil Driver, and the ALC Flatness Adjustments and Power Sweep circuits for the A4 ALC assembly.

The FM input signal from the rear panel of the 8350A Sweep Oscillator provides the input to both the YIG Main Coil and FM Coil Driver circuits. For low frequency FM inputs, the Main Coil Driver scales and buffers the FM signal to produce an output that is summed with the tuning voltage for the YIG main coil on the A6 YO Driver. Thus, the Main Coil Driver output is an extra tuning voltage input to the YIG Oscillator and may be used for phase locking, frequency offsetting, or low frequency FM applications (where up to 75 MHz deviations are required). The FM Coil Driver scales and buffers the FM input signal to produce the current drive for the FM coil in the YIG oscillator for smaller deviation but wideband (up to 10 MHz) FM applications. Relay switches provide the option of selectable sensitivities of −6 or −20 MHz/Volt and/or DC coupling the FM input to the FM Coil Driver circuits. In the DC coupling mode, the main coil driver is shut off and the FM Coil Driver operates over the frequency range of DC to 10 MHz with −20 MHz/Volt sensitivity. The relay switches are controlled by the state of the Configuration Switch on the A3 Digital Interface board.

The ALC Flatness Adjustments circuit is used to flatten output power versus frequency by introducing an error voltage into the ALC reference channel. The Power Sweep circuit is activated by the front panel POWER SWEEP pushbutton and produces a scaled ramp that is summed with the ALC reference voltage causing the output power to increase level versus sweep (the amount of which is selected on the front panel).

YIG Main Coil FM Driver (B)(E)

The YIG Main Coil FM Driver scales and buffers the 8350A rear panel FM input signal for FM frequencies between DC and 700 Hz to produce an output which is summed with the tuning voltage for the YIG main coil on the A6 YO Driver board. Low Frequency Amplifier/Filter and Low Frequency Sensitivity Select circuits make up the YIG Main Coil FM Driver. The FM input signal is filtered by 700 Hz low pass filter R2/C1 and buffered by difference amplifier U7A. The gain of U7A is approximately 1.4. The output of U7A drives the Low Frequency Sensitivity Select/Amplifier circuits. Relay K2 is used to control the overall gain of inverting amplifier U7B by changing the value of the input resistance. Relay K2 is either open or closed (shorting resistor R8) according to the state of control line 6 MHz/V SEL (1 = −6 MHz/Volt, 0 = −20 MHz/Volt sensitivity) The state of control line 6 MHz/V SEL is determined by the position of the Configuration Switch on the A3 Digital Interface board. The overall gain for the main coil driver is approximately 0.239 with −6 MHz/Volt sensitivity selected (K2 open) and 0.807 with −20 MHz/Volt sensitivity selected (K2 closed). The output of U7B (TP3) is summed directly with main coil tuning voltage on the A6 YO Driver board. The YIG main coil driver is shut off with analog switch U3D when the DC coupling mode is selected (on the A3 board Configuration Switch) causing control line L LO FM OFF (Low = Low Frequency FM OFF) to be true.

YIG FM Coil Driver (D)(F)(H)

The YIG FM Coil Driver scales and buffers the 8350A rear panel FM input for frequencies between DC and 10 MHz to produce an output current that drives the YIG FM coil. The FM Coil Driver is made up of a high pass filter, buffers Q5A and Q5B, video amplifier U10, operational amplifier U19, and unity gain follower U20. The high pass filter is made up of capacitors C2 through C6 and resistors R11 and R12. The filter has a 3 dB cutoff frequency of about 700 Hz. When the FM Driver is configured for the crossover mode as determined by the position of the Configuration Switch on the A3 Digital Interface board, the FM Coil Driver passes FM input signals above 700 Hz and the low pass filter in the Main Coil driver circuits will pass signals below 700 Hz. If the DC coupling mode is selected, the Main Coil driver is shut off and control line L DC COUPLE is true, activating relay K1. This shorts the high pass filter network, and the FM driver is active for frequencies of DC to 10 MHz.

Selectable sensitivities of −6 MHz/Volt and −20 MHz/Volt are available and determined by the state of control line 6 MHz/V SEL (1 = −6 MHz/V, 0 = −20 MHz/V). When 6 MHz/V SEL is high, relay K2 is open and the FM input is scaled by a resistive divider made up of R11 and R12. When 6 MHz/V SEL is low, relay K2 is activated, shorting capacitors C4, C5, C6 and resistor R11. The combination of C2, C3, and R12 still form a high pass filter with a cutoff of 700 Hz. Note that in the DC Coupled mode the sensitivity is always −20 MHz/Volt.

The output of the filter network is limited to about ±3 Vdc with a network made up of VR1, VR2, R14, R15, CR3, and CR4. Q5A and Q5B are connected as emitter followers and buffer the output of the filter network to video amplifier U10. Analog switch U11 is always set to switch position zero. Frequency response shaping to compensate for the roll-off versus frequency of the FM coil is produced by the network made up of C11, C12, C14, R21, R22, R23, R75, and L1 connected across pins 9 and 4 of U10. This network is actually in the emitter of the input differential amplifier of U10 producing greater gain with decreasing impedance. Figure 8-36 shows the approximate response versus frequency of the YIG FM coil and the compensation network. Adjustments R19 (FM OFFSET), R75 (H1), and C14 (LO) adjust the shape of the compensation network response.

The differential output of U10 drives the wideband Output Current Driver, U19 and U20. The voltage difference between the outputs of U10 at pins 6 and 7 is converted to a proportional current which directly drives the YIG FM coil. The overall voltage gain of the Output Current Driver is about 2.0 (between U10 pin 6 and TP6). Resistive divider R30 through R32 sets the FM coil drive scale factor.

Address Decoder (A)

Address Decoder U18 generates two control lines (LEN 4 and LEN 4) by decoding the state of address lines BA0 through BA3 and control line L INST 1. LEN 4 (Low Enable 4) loads data into the Control Latch and LEN 5 (Low Enable 5) loads data into the Power Sweep DAC.

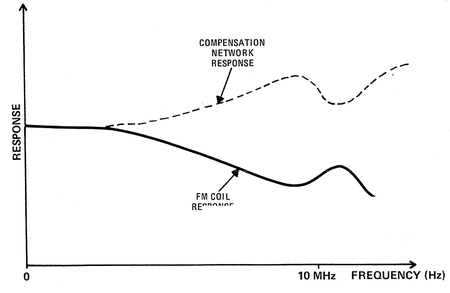


Figure 8-36. Plot of FM Coil Response Versus Modulation Frequency

Control Latches (C)

Control Latch, U16, stores the state of four control lines that are used to set the signal path and amplification factor of the FM input signal. The state of the control lines is determined by the position of switches 5 and 6 of the Configuration Switch on the A3 Digital Interface board. The control lines are loaded into U16 from Data bus lines BD2 through BD5 when the LEN 4 signal from U18 makes a low to high transition.

ALC Flatness Adjustments (I)

The purpose of the ALC Flatness Adjustment circuit is to produce an RF OUTPUT signal that is as flat as possible across the entire frequency band. The input of the ALC flatness circuit is a 0 to 6 Volt ramp (in full sweep) labeled FREQ TRK V (Frequency Tracking Voltage). This ramp is dependent on the frequency START and STOP settings, so it will always be at least a portion of the 0 to 6 Volt range.

The FREQ TRK V ramp is applied to four parallel circuits, each one adjusted to take affect at a different frequency (i.e., voltage threshold of FREQ TRK V) as the sweep progresses from START to STOP. Since the four circuits are identical (Q1, Q2, Q3, Q4), only the Q1 circuit will be discussed. Q1A is connected as a diode, is always conducting, and is in the circuit for temperature compensation of Q1B. The setting of adjustment BP1 (R34) determines at what point on the input ramp Q1B will conduct. When the summing point at the junction of U2C and R33 is at zero Volts or greater, Q1B will conduct. The junction of resistors U1B and U1A form another summing point. U1B applies a positive-going ramp from Q1B to this summing point, and a negative-going ramp comes through U1A from the output of U14C. Slope adjustment SL1 adjusts the amount of negative-going ramp contributed to the summing junction through U1A, and thus determines the resultant contribution of the Q1 circuit to the input of U14A. That is, the resultant signal may be either a positive-going ramp or a negative-going ramp as required to make the RF OUTPUT signal flat over that frequency segment.

The composite correction signal from the four flatness adjustment circuits (Q1 through Q4) are summed at the input of U14A then are applied to the Power Level Reference in the ALC circuit. TP1 shows this composite correction signal. Overall tilt is adjusted by SLP (Slope) adjustment R48.

Power Sweep (H)

When POWER SWEEP mode is selected at the front panel, LEN 4 (Low Enable 4ALC generated by U18, enabling U17 on. This allows power sweep data from

signal path of the YSW voltage sweep signal (0 to +10V), is through the selected gain resistors in U17 to input pin 6 of U14B. The feedback resistor for U14B is also within U17 and is internally connected to the input of the amplifier stage. The output of U14B is summed at the input of U14A with the ALC flatness signal. The output of this entire circuit is then sent to the Power Level Reference in the ALC circuit.

When the plug-in front panel SLOPE key is depressed, data lines BD0 through BD7 redefine the gain of the Power Sweep circuit to compensate the slope of the RF output in dB/GHz.

TROUBLESHOOTING

For troubleshooting purposes, the A5 FM Driver is divided into three groups:

- YIG Main Coil FM Driver and YIG FM Coil Driver circuits.
- FM Configuration Control circuits.
- Power Sweep and ALC Flatness Adjustment circuits.

YIG Main Coil FM Driver and YIG FM Coil Driver Troubleshooting

The most likely indication of a failure in these circuits is unpredictable or no FM operation. A failure in these circuits can also cause excessive residual FM or frequency offset.

Troubleshooting waveforms at various points within the FM driver circuits for FM input frequencies of 100 Hz, 700 Hz, 1 MHz, and 10 MHz are given in Figure 8-42. The waveforms are arranged horizontally by test point and vertically by the FM input frequency. Figure 8-41 shows the test setup required to obtain the waveforms.

NOTE

Before altering the switch settings on A3S1, note the present configuration. Return the switches to their original status after troubleshooting.

A4

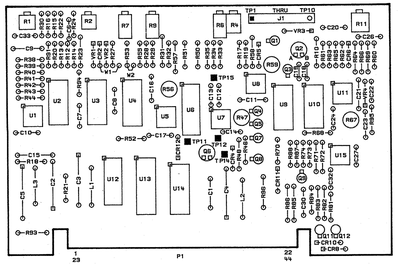


Figure 8-30. A4 ALC, Component Locations

NOTES

1. THE FOLLOWING KEY ENTRIES PROVIDE FRONT PANEL ACCESS FOR A DATA WRITE/READ OPERATION TO/FROM THE ADDRESSED LOCATION:

FUNCTION	KEY ENTRY
*Hex Address Entry	SHIFT 0 0 (enter hex address)
Hex Data WRITE	M2 (enter data: two hex digits)
Hex Data READ	M3
Hex Data Rotation Write	M4
Hex Addressed Fast Read	M5

*TO ADDRESS A DIFFERENT LOCATION, PRESS M1 AND ENTER THE NEW ADDRESS, OR USE THE INCREMENT KEYS ◆▶ ◀◆ TO STEP TO THE NEW ADDRESS.
TO PREVENT THE MICROPROCESSOR FROM SERVICING THE RETRACE INTERRUPT, PRESS 8350A CW.

Table 8-10. Leveling Control Lines

Data Bus		Leveling Mode
Mux A1	Mux A0	
H	H	INT 0
H	L	INT 1
L	H	EXT DET
L	L	POWER METER

A4P1

PIN	SIGNAL	I/O	TO/FROM	BLOCK
1	EXT DET RET	IN	A10J1-43	M
23	EXT DET	IN	A10J1-47	B
2	L UNLVL	OUT	A6P1-40	J
			A10J1-12	
24	EXT CAL	IN	A10J1-41	F
3	PWR REF	OUT	A8P1-26	C
25	L1dBMKR	IN	A7P1-24	F
4	AM	IN	P1-A4	F
26	FREQTRKV	IN	A10J1-36	G
5	PWRSW/COMP	IN	A5P1-23	C
27	+5V	IN	A3P1-6,7	M
6			NOT USED	
28	−15V	IN	P2-28	M
7	+10V	IN	P1-8	M
29	L RFB	IN	P2-56	I
8	GND DIG			M
30	GND DIG			M
9	BD1	IN	A3P1-8	AC
31	BD0	IN	A3P1-31	AC
10	BD3	IN	A3P1-10	AC
32	BD2	IN	A3P1-32	AC
11	BA1	IN	A3P1-11	AC
33	BA0	IN	A3P1-33	AC
12	BA3	IN	A3P1-12	AC
34	BA2	IN	A3P1-34	AC
13	BD5	IN	A3P1-13	A
35	BD4	IN	A3P1-35	A
14	BD7	IN	A3P1-14	A
36	BD6	IN	A3P1-36	A
15	GND ANLG			M
37	GND ANLG			M
16			NOT USED	
38	+15V	IN	P2-29	M
17	−10V	IN	P1-13	M
39	−40V	IN	P1-11	M
18	L INST1	IN	A3P1-8	AC
40	DET REF	OUT	NC	C
19	MOD 1	OUT	NOT USED	
41	L PULSE	IN	A7P1-4	H L
20	INT DET 1	IN	NOT USED	B
42	INT DET RET	IN	NOT USED	M
21	INT DET Ø	IN	J4-5	B
43	−10V REF	IN	A6P1-5	C
22	MOD DRIVE	OUT	NC	K
44	MOD Ø	OUT	A10J4-2	L

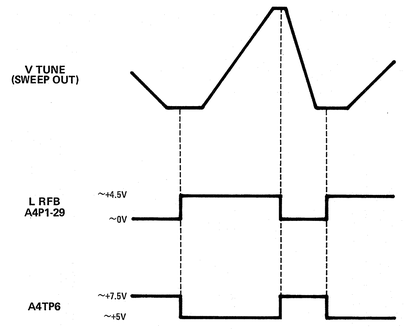


Figure 8-31. Retrace Blanking Waveform

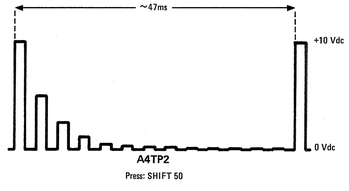
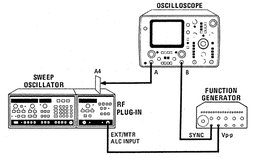


Figure 8-32. ALC DAC Test Waveform



Open Loop Procedure Test Setup

EQUIPMENT:

Function Generator	HP 3312A
Oscilloscope	HP 1740A

PROCEDURE:

1. Press 8350A INSTR PRESET.
2. Press 83525A EXT ALC.
3. Adjust Function Generator output for a 50 mV p−p sine wave at 500 Hz. Adjust the OFFSET knob for −25 mVdc.
4. Connect Function Generator output to EXT/MTR ALC connector.
5. Set oscilloscope DISPLAY to A and TRIGGER COMP to B. Check for the waveforms shown in Figure 8-34.

NOTE

The HP 3312 OFFSET knob may have to be adjusted slightly to produce the waveforms given in Figure 8-34. If the EXT/MTR ALC input goes positive, the Log Amp will saturate.

Adjustment of the EXT/MTR ALC CAL knob will affect the waveforms at TP4, TP7, and TP6. Adjust the CAL knob until these waveforms are obtained.

Slight differences may be noted between the waveforms shown in Figure 8-34 and those obtained on individual ALC assemblies. This is due to the many adjustments on the A4 assembly.

Figure 8-33. Open Loop Procedure

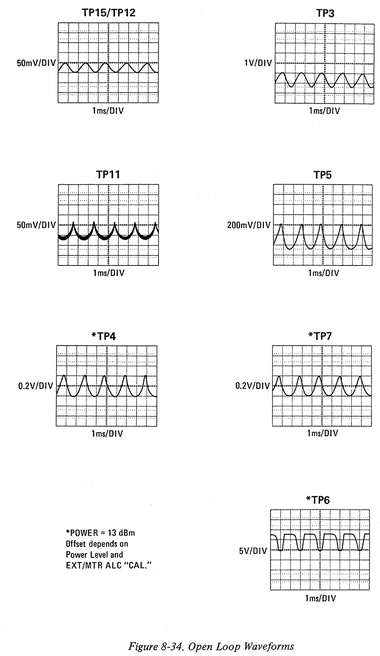


Figure 8-34. Open Loop Waveforms

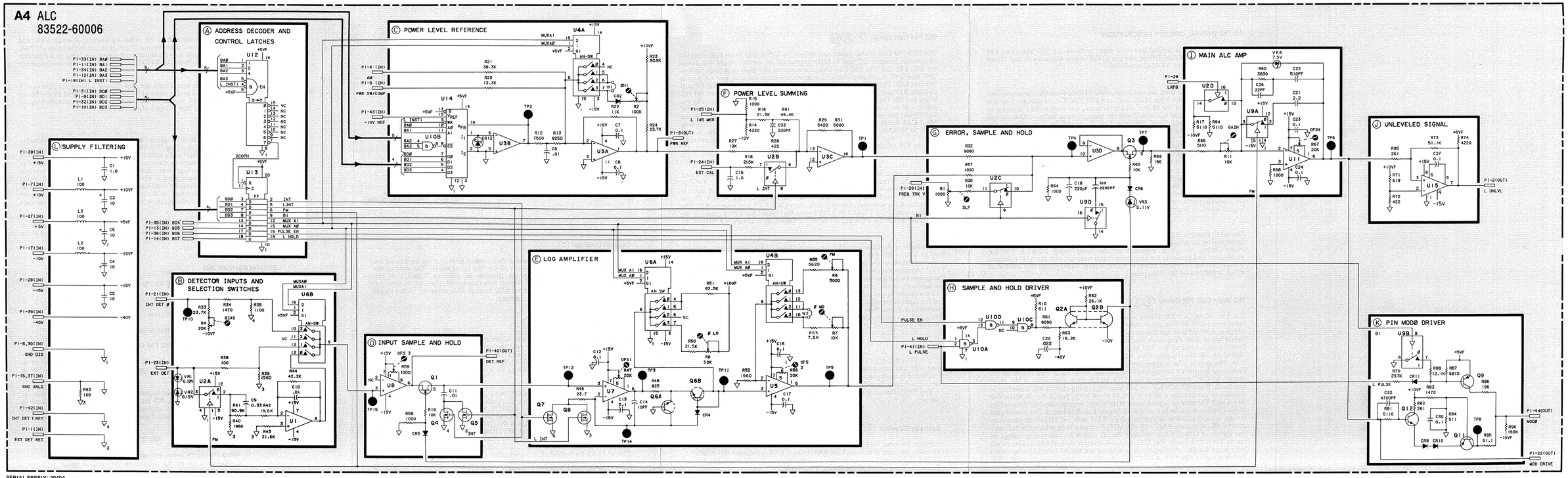


Figure 8-35. A4 ALC, Schematic Diagram

Prior to performing the test procedure, preset the A3S1 Configuration switch sections 5 and 6 to the closed (0) position. Several of the troubleshooting waveforms require different switch settings. A description of each switch setting follows.

- For **−6 MHz/V Sensitivity** − set A3S1 section 5 to the open (1) position.
- For **−20 MHz/V Sensitivity** − set A3S1 section 5 to the closed (0) position.
- For **DC Coupled mode** − set A3S1 section 6 to the open (1) position.
- For **Cross-Over Coupled mode** − set A3S1 section 6 to the closed (0) position.

NOTE

The 8350A front panel INSTR PRESET pushbutton must be pressed after each switch position change in order for the selection mode to take effect.

1. Adjust the function generator frequency and amplitude controls to obtain one of the waveforms in the first column (TP11) of Figure 8-42.
2. Verify the remaining waveforms in the corresponding row.

FM Configuration Control Circuits Troubleshooting

The FM configuration control circuits include the Address Decoder, Control Latches, relays K1 and K2, and analog switches U3D and U11. Incorrect or no operation in a specific configuration mode is the most likely result of a failure in these circuits.The troubleshooting procedure for these circuits uses several of the 8350A Sweep Oscillator operator initiated self tests. Separate tests for each section of the configuration control circuits are provided in the following paragraphs.

Address Decoder. Check proper Address Decoder operation by performing a Minor Address Decoder Self Test.

On the 8350A, enter:

SHIFT 5 4	Minor Address Decoder Test

Check the Address Decoder outputs LEN 4 and LEN 5 as shown in Figure 8-37.

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.

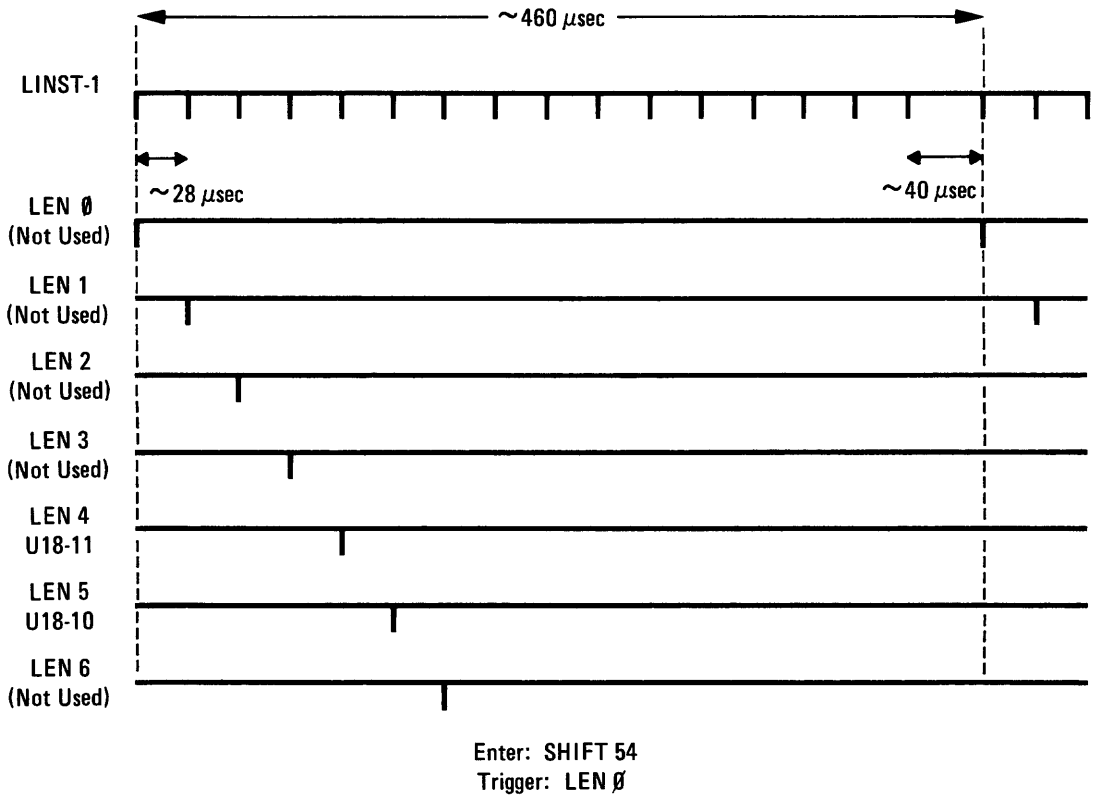


Figure 8-37. A5 Address Decoder Timing Waveforms

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 8-41. Adjust the function generator for a 500 Hz 1 V peak-to-peak sine wave 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 8-41. Adjust the function generator for a 500 Hz 1V peak-to-peak sine wave output.

On the 8350A, enter:

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

Analog switch U3D should be closed. Verify that there is 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 8-38.

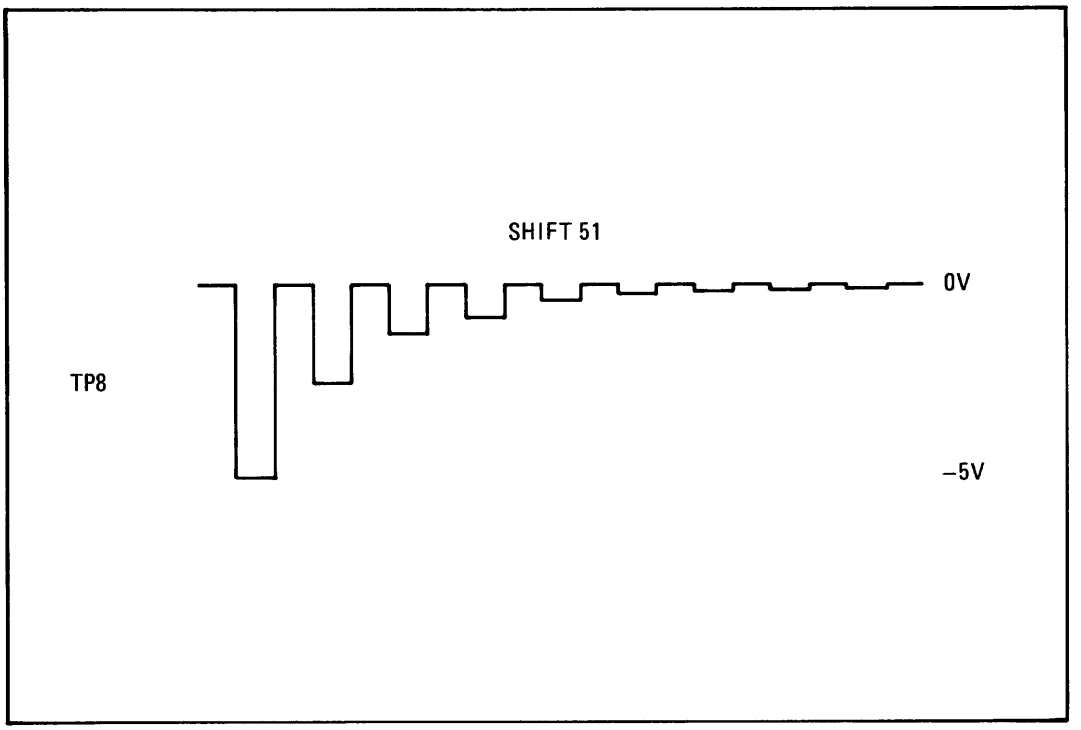


Figure 8-38. Power Sweep DAC Self Test Waveform

A5

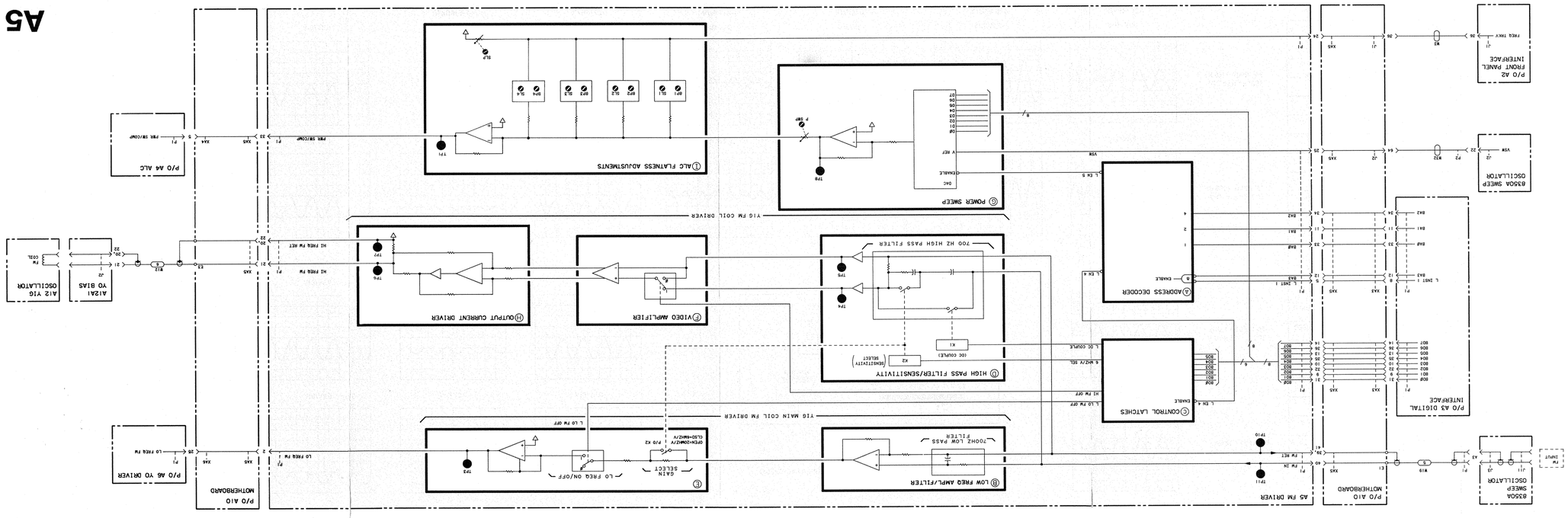


Figure 8-39. A5 FM Driver, Block Diagram

A6 YO DRIVER/A9 REFERENCE RESISTOR, CIRCUIT DESCRIPTION

NOTE

All reference designators refer to the A6 assembly unless otherwise noted.

GENERAL

The A6 YO Driver assembly converts the tuning voltage from the 8350A mainframe into a drive current. The A9 Ref Resistor assembly provides the current driver to control the frequency of the YIG Oscillator (YO). (The A6 y also initiates band-switch sequence in multi-band plug-ins.)

ying Digital-to-Analog Converters (DACs) scale and offset the buffered /oltage to the frequency end-points of the plug-in. A summing amplifier lay compensation, low frequency external FM, and the FREQ CAL ottset trom the front panel. The resultant waveform at TP14 is then converted to a current-drive for the YO's Main Coil. Sweep control circuitry interrupts the microprocessor at the end of each sweep. (Band-switch circuitry is disabled in the 83522A.)

Tuning Voltage Buffer Amplifier (B)

U10 receives the tuning voltage from the 8350A mainframe and buffers it for use on the rest of the board. The circuit is arranged as a differential amplifier, with the tuning signal appearing at the inverting input and the cable shield at the non-inverting terminal. This provides good common mode rejection to eliminate noise picked up on the cable. The waveform at TP4 is an inverted ramp, ranging from 0 to −10V for sweeping the full frequency range of the plug-in. See Figure 8-50.

Scaled Voltage Tune DAC (D)
Offset DAC (F)

U9 is a 12-bit multiplying DAC, which scales the tuning voltage according to the binary pattern loaded at its inputs. Inverting amplifier U15 and emitter-follower Q3 are included in the feedback path to provide the current gain needed to drive later stages. CR1 prevents transients from damaging the DAC during turn-on. C1, along with the DAC's internal feedback resistor, determine the bandwidth of the circuit. The waveform at TP1 is a scaled ramp, with a maximum range of 0 to +10Vdc. See Figure 8-50.

U19 is a 12-bit multiplying DAC which scales a stable −10V REF voltage according to the binary pattern loaded at its inputs. Inverting amplifier U14 works with the DAC's internal feedback resistor to provide a programmable offset voltage between 0 and +10Vdc at TP2. See Figure 8-50. CR2 protects the DAC from turn-on transients. C11 and the DAC's internal feedback resistor determine the bandwidth of the circuit.

SCVTUNE and OFFSET DACs function together to determine the frequency of the YIG oscillator. The Offset DAC determines the start frequency while the Scaling DAC sets the gain of U16 so that SCVTUNE determines the high end frequency. For full-band sweeps, the entire 0 to −10 Volt VTUNE is scaled and offset to sweep the YO from 3.81 to 6.2 GHz. The YO output is ten heterodyned with 3.8 GHz from the Fixed Cavity Oscillator for a full-band range of 0.01 to 2.4 GHz.

Input Data Latches (C)

Four octal latches store various signals including the digital data for the Scaling (D) and Offset (F) DACs, and the control signals for the Sweep Control/Interrupt Logic circuit (E). Each latch is clocked by a separate line from the Address Decoder to store the byte of data appearing on the Data Bus.

U8 stores the 8 least significant bits (S0 through S7) for the Scaling DAC (U9). The remaining four bits (S8 through S11) come from half of U13. Similarly, the least significant bits (O0 through O7) for the Offset DAC come from U18, with the remaining four (O8 through O11) coming from the other half of U13. The 8350A microprocessor multiplexes the two numbers so that they can be loaded in three bytes.

U22 is a control latch which stores commands from the 8350A for the control lines used on the A6 YO Driver assembly. (Several of these signals are associated with band-switching circuitry used in multi-band plug-ins and therefore are not used in this application.) The command byte is latched into U22 when LEN3 pulses low. Refer to the Summing Amplifier, YO Coil Current Source, and Sweep Control/Interrupt Logic sections for detailed descriptions of these control lines.

LRFBRQ is not used in the 83522A.

+20V Tracking Amplifier (G)

Inverting amplifier U11 monitors the +20V line (TP13/15) used to supply current to the YIG Oscillator. If the +20V supply becomes loaded down or drifts, the YO Main Coil current and, consequently, the frequency will try to change. However, U11 senses any drift in the +20V FREQ REF line, and provides a correction signal so that the resultant YO DRIVE Voltage (TP14) is compensated for the drift.

Summing Amplifier (I)

U16 provides the summing point for the scaled tuning and offset voltages, and provides a drive voltage (YO DRIVE V) for the Current Driver. Several correction signals are summed at this junction:

SC V TUNE provides the scaled ramp portion of the YO DRIVE Voltage. R11, 'G', fine-tunes the range of the scaling DAC (D).

OFFSET adjusts the YO DRIVE Voltage so that the YO Coil is driven between the proper end points, as determined by the front panel controls. R30, 'OFS', fine-tunes the range of the Offset DAC (F).

SUPPLY VOLTAGE CORRECTION provides a compensation signal, from the +20V Tracking Amplifier, to offset changes in the reference supply.

DLY COMP, from the A7 Marker assembly, is added to correct for lags in the response time of the YIG Oscillator. This compensation is derived from SC V TUNE (D).

FREQ CAL (from the A1/A2 Front Panel) is summed in through U26. (The BAND 0 line from U22 (C) is held high in the 83522A.) This offset corrects for errors in the Fixed Cavity and YIG Oscillator frequencies.

LO FREQ FM sums low frequency components of external FM signals onto the drive voltage when crossover coupling of the FM signal is selected. (Configuration switch A3S1 provides this adjustment. Refer to the A3 Service Sheet for further details.) Due to the response time limitations of the YIG Oscillator's main coil, only frequencies below 700 Hz are passed from the A5 FM Driver assembly to the A6 YO assembly.

−10V REF and R25 'ZRO' adjust for gain and offset inaccuracies between U11 (G) and summing amplifier U16.

−10V Reference (J)

U23 contains a low-noise 6.95V zener diode to provide a stable voltage reference for the rest of the plug-in. The package includes an internal heater to control its temperature and improve its stability. R19 and C7 filter the reference voltage to the non-inverting terminal of differential amplifier U20. R21, '−10', adjusts the overall gain for exactly −10V at TP3. C8 limits the high-frequency gain of the system to reduce noise. R24 provides the bias current for the zener diode from the −10V REF output. R23, with filtering capacitor C9, increases the current drive capability of the −10V REF.

Sweep Control/Interrupt Logic (E)

NOTE

Most of the signals discussed in this section are illustrated in Figure 8-50.

Band-switch circuitry is disabled in the 83522A. The L BSE line from U22 is held high by microprocessor control, thereby grounding the input to comparator U5. This effectively disables U5, U21A, and U17A.

In the 83522A, the SS HOLD line is also deactivated by microprocessor control, disabling U12A and U12B. However, L SSRQ (Low=Stop Sweep Request) and L BPRQ (Low=Blanking Pulse Request) are wire-ored signals and may appear active at the output, via several other sources.

End of Sweep Interrupt circuitry interrupts the microprocessor at the beginning and end of each sweep. Each time LRTS (Low=Retrace Strobe) changes from high to low, or low to high, U21C pulses high. (Pin 9 of U21C is prevented from tracking pin 10 by C16. Consequently, the output of EXOR U21C will pulse high everytime LRTS changes states.) Each pulse from U21C clocks flip-flop U17B. The noninverting output of U17B pulls LSIRQ low and requests microprocessor attention. LRTS is read through U7 to determine whether the forward sweep is beginning (LRTS=High) or ending (LRTS=Low). U17B is then reset by a control line from U22 and the microprocessor services the interrupt.

LRFBRQ is not used in the 83522A. It is activated only during bandswitching in multi-band plug-ins.

Frequency Cal Switches/Output Data Buffers (H)

DIP switches S1 and S2, with their corresponding data bus buffers, are used to digitally calibrate the low and high end frequencies. The data on these switches is read by the microprocessor during power-up and INSTR PRESET and used to calculate the settings for the Scale (D)and Offset (F) DACs. S1, with pull-up resistor package U1, is read through U3 when enabled by LEN4. S1 determines the value of the Offset DAC and calibrates the low end frequency. S2, with pull-up resistor package U2, is read through U4 when enabled by LEN5. This establishes the Scale DAC values, and calibrates the high end frequency. The ninth bits from S1 and S2 are read through U7.

S1 and S2 switch positions encode binary numbers to set up the Offset and Scaling DACs. Refer to the Frequency Accuracy adjustment procedure in Section V for instructions. Figure 8-51 illustrates the switch configurations.

The microprocessor reads U7 outputs each time it receives a retrace initiated interrupt to determine what action is required. LUNLVL, from the A4 ALC assembly, is read through U7. When the 8350A is under HP-IB control, the microprocessor alerts the controller to unleveled power conditions.

Supply Filtering (N)

Power supply circuitry provides eight different voltages for the A6 YO Driver and other assemblies. U27 provides a regulated +15V supply for the DACs. The other supplies use capacitive or LC filtering to reduce supply noise.

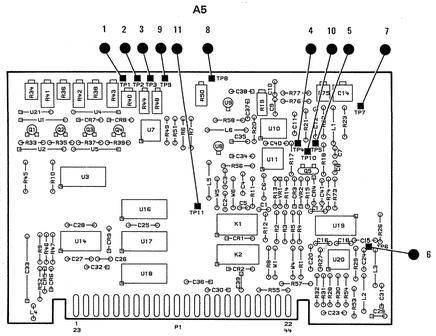
YO Coil Current Source (K)
YO Coil Current Driver A9 (M)

The YIG Coil Current Driver works with Reference Resistor A9R1 and YO Coil Driver A9Q1 to drive a current proportional to the drive voltage through the YIG's main tuning coil.

U24, Q1, Q2, and A9Q1 comprise a voltage-to-current converter and current driver for the YO's main coil. The non-inverting input of U24 receives the YO DRIVE Voltage signal. The inverting input of U24 monitors the voltage drop across reference resistor A9R1, which is directly proportional to the coil current. If the drive current is not tracking the drive voltage, U24 will produce an error voltage to correct the difference. Emitter-follower Q1 and common-emitter-stage Q2 provide the current gain needed to drive A9Q1. Q1 and Q2 emitter currents are also drawn through A9R1, and therefore, sensed by U24. VR1 and CR6 protect the current drive transistors by limiting voltage spikes due to sudden changes in the coil current. R42 helps to dampen ringing caused by the parasitic capacitance and the inductance of the YO coil.

When 8350A CW and 83522A CW FILTER are selected, LCW goes low, energizing relay K1. C14 filters out noise in the YIG coil current, reducing the residual FM noise in the CW mode.

CR7, CR3, CR4, and their associated factory-select resistors provide a three break-point compensation network to correct for non-linearities in the YO characteristics.


A5
1
2
3
9
11
8
4
10
5
7
6
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
TP15
TP16
TP17
TP18
TP19
TP20
TP21
TP22
TP23
TP24
TP25
TP26
TP27
TP28
TP29
TP30
TP31
TP32
TP33
TP34
TP35
TP36
TP37
TP38
TP39
TP40

NOTE

The values of the factory-select resistors are stamped on a label, attached to the RF casting. Matching resistor sets are supplied with replacement YOs and must be installed on the A6 YO assembly. The new label, indicating the replacement resistor values, should be attached to the RF casting.

If the A6 YO Driver Assembly is replaced, the shaping resistors from the defective board must be reinstalled in the new assembly.

NOTE

If the YO needs little or no compensation, some of the factory-select resistors may be omitted.

+5V Regulator A9 (L)

A9Q3 is a +5Vdc regulator mounted in a single package. It receives the +5V UNREG line (slightly more than 5V) from the mainframe, and regulates it for use in the plug-in RF components, A7 Marker, and A8 Sampler assemblies.

A6 YO DRIVER/A9 REFERENCE RESISTOR TROUBLESHOOTING

NOTE

All reference designators refer to the A6 assembly, unless otherwise noted.

The A6 YO Driver and A9 Reference Resistor assemblies are primarily responsible for controlling the RF output frequency. A failure in these assemblies usually results in large frequency errors that are independent of sweep time. (Frequency errors that change with sweep time are usually related to delay compensation. Refer to Service Sheet A7.) Frequency errors on the order of 500 MHz or less may be due to improper calibration. The problem may be relieved by performing the Frequency Accuracy adjustment in Section V.

General

Check that all power supply voltages are present. +20V (on the A6 assembly) and −40V (on the A12A1 assembly) supply the YO. Ensure that cable plugs are correctly seated over the correct jacks throughout the plug-in. With the line power off, remove and reseat the A6 assembly to assure good motherboard contact.

NOTE

Unless specifically stated otherwise, the troubleshooting waveforms and voltages described below occur when the plug-in is sweeping across its full range (INSTR PRESET conditions).

Sweep Circuitry

A failure in the sweep circuitry may cause the YIG to sweep between improper frequency endpoints, or, not sweep at all. If the YO Drive Voltage is missing, the instrument may toggle between two or more CW frequencies.

1. Check the YO DRIVE V (TP14) for the waveform shown in Figure 8-46. If this waveform is correct, then the Sweep and Interrupt circuits are working properly, and troubleshooting should continue with the YO Current Driver section below.

   a. If YO DRIVE V is incorrect, check BVTUNE (TP4) for the waveform shown in Figure 8-50. If it is missing or of the wrong amplitude, trace the problem back through the inputs of U10 (both should be close to 0 Vdc) to the sweep ramp output of the 8350A.

   b. If the waveform at TP14 appeared to be level-shifted, check −10 VREF (TP3) for −10 Vdc ±1 mV. Then, with the plug-in sweeping its entire range, check OFFSET (TP2) for approximately +9 Volts. If this signal is incorrect, select a CW frequency of 2.4 GHz and press SHIFT 5 2 . Check TP2 for a +0.4 to +9.2 Volt pulse. If this fails, check address decoding and the DAC latches using the Digital Control troubleshooting procedure described below.

2. If BVTUNE is correct, check SCVTUNE (TP1) against the waveform shown in Figure 8-50. 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 8-53. 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 8-48. 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 8-46). 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. 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 P1-23 (L SSRQ) for approximately +4.5 Volts. Since the band-switch 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 RTS is low, check that U5 pin 3 is at 0 Volts. If it is not, check the L BSE line for approximately +4.5 Volts. Then troubleshoot U26.

   b. If U26 is good, ensure that U17A pin 5 is not held high. If it is good, other lines are probably pulling L SSRQ low. Refer to the 8350A Operating and Service Manual for more troubleshooting information to determine the problem.

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

   a. L RTS should appear as illustrated in Figure 8-50 with a low pulse occuring 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. LSIRQ should pulse low briefly for end-of-sweep interrupts as illustrated in Figure 8-50. 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 LINST2 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.

2. If LINST2 is functional, check each of the LENn lines (U25) for the pulses shown in Figure 8-52. 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, note the present configuration. Return the switches to their original status after troubleshooting. If this is not done, the frequency endpoints 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 entries:

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 2.4 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 8-53.

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 the voltage is missing. Remove A7, A8, 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	BLOCK
1	BASE	IN	A6P1-22	M
7	+5V REG	OUT	A9P1-7	L
2	COLLECTOR	OUT	A6P1-41	M
8	NC			
3	+20V	IN	P1-7	M
9	NC			
4	EMITTER/COIL	OUT	A6P1-20	M
10	NC			
5	+20V FREQ REF	OUT	A6P1-21	M
11	+20V	IN	P1-7	M
6	GND ANLG		P2-27,58,59	L
12	+5V UNREG	IN	P2-62,63	L

A9

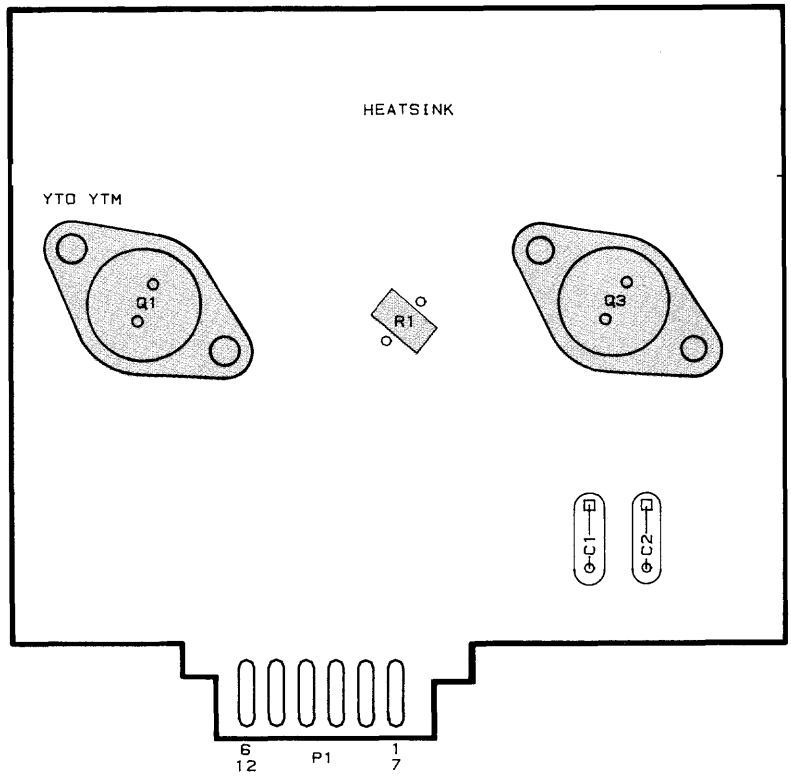


Figure 8-44. A9 Reference Resistor, Component Locations

Figure 8-48. Delay Compensation (A6TP6)

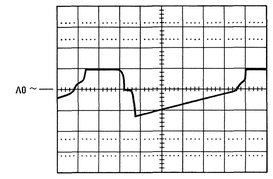


Figure 8-47. YO DRIVE Voltage (A6TP4)

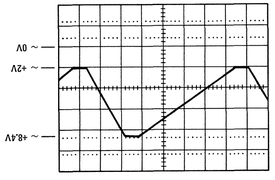


Figure 8-46. Emitter/Coil Voltage (A6TP12)

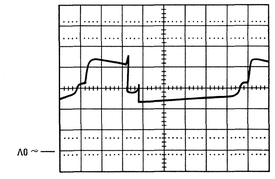
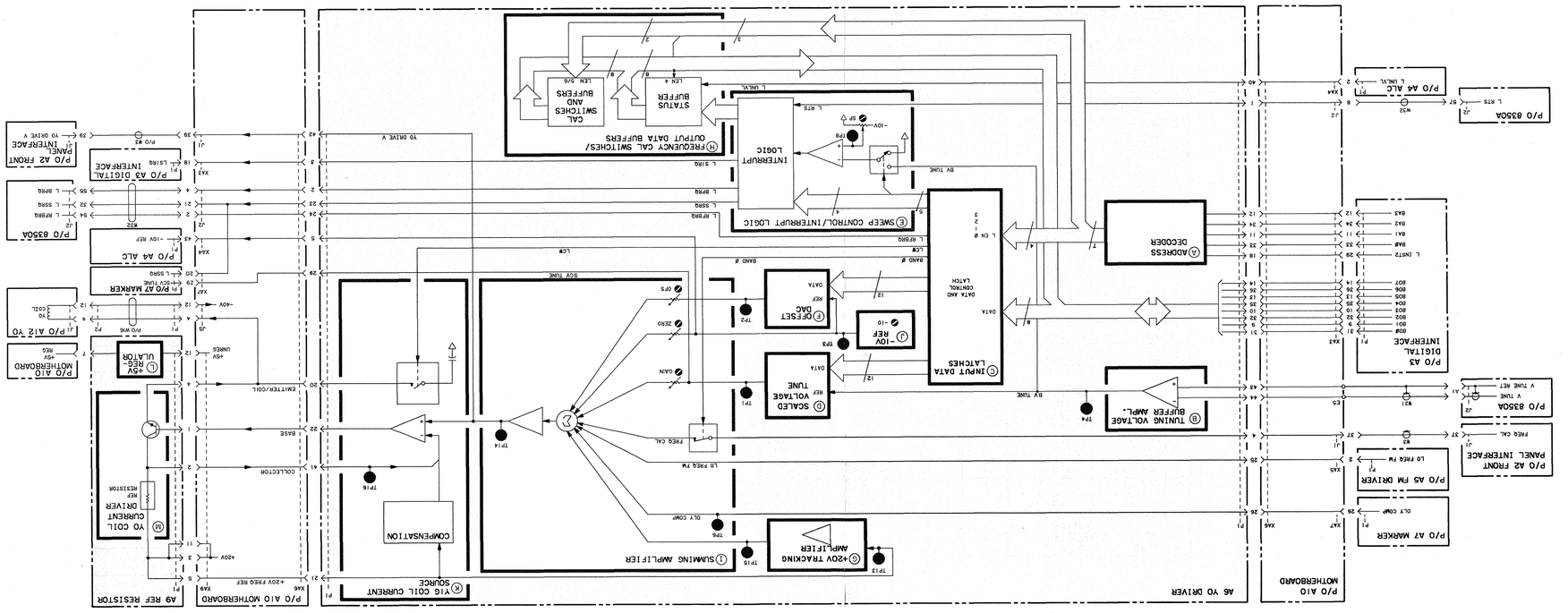


Figure 8-45. A6 YO Driver, Block Diagram



A7 MARKER ASSEMBLY, CIRCUIT DESCRIPTION

The A7 Marker and A8 Sampler Assemblies combine to provide crystal referenced frequency markers at 10 MHz or 50 MHz intervals over the frequency range of 0.01 to 2.4 GHz and 1 MHz intervals in the 0.01 to 1 GHz range in the 8352A.

In addition to the internal crystal referenced markers, markers may be generated whenever the sweep oscillator output frequency is the same as that of an external signal source applied to the External Marker input on the plug-in rear panel. This feature is useful for obtaining markers which are not an integral multiple of 1, 10, or 50 MHz.

Two types of markers are available. Intensity markers of a CRT trace are available through the intensity modulation outputs on the rear panel of the 8350A Sweep Oscillator. Amplitude markers of approximately 1 dB are available on the plug-in RF Output. In addition, when either intensity or amplitude markers are selected, an LED marker indicator on the plug-in front panel is turned on by any marker occurrence.

Marker mode as well as marker frequency is selectable by either a front panel pushbutton or through HP-IB control.

The A7 Marker assembly also provides the following functions:

- The RF Switch Driver controls PIN diode RF switches in multiband plug-ins. This circuit is not used in the 83522A.
- The Oscillator Bias Shaping Control shapes and controls the negative bias signal to the A12 YIG Oscillator. A high (0V) on L RFON (L=RF ON) turns off the A12 YIG Oscillator as controlled by the front panel RF ON/OFF pushbutton.
- The Delay Compensation circuits compensate the A12 YIG Oscillator for swept frequency inaccuracy caused by delay in the oscillator tuning coil at fast sweep times.

Marker Circuits.

The A7 Marker circuits accept the BIRDIE signal from the A8 Sampler. This BIRDIE signal consists of a square wave beat frequency which is the result of a portion of the RF Output signal being mixed with an internal comb or external marker reference frequency. The beat frequency is converted to a square wave by the A8 Sampler Squarer circuit so that the fast rising edge of the BIRDIE signal can accurately trigger the marker timer circuits on the A7 Marker board. The marker circuits include a programmable pulse width discriminator which compares the time period of the input BIRDIE pulses to a minimum time period reference. This reference time period is varied by the Marker Threshold circuit depending upon which front panel MARKER FREQUENCY is selected. If the time period of the BIRDIE pulses is greater than the reference time period, a valid marker will be output. Markers will be disabled by the Pulse Modulation Logic whenever the RF Output is turned off, such as when RF modulation is used. If Intensity Markers are selected, L ZMKR (L=INTENSITY MARKER REQUEST) is sent to the 8350A Sweep Oscillator to be processed for the POS Z BLANK and NEG Z BLANK rear panel BNC outputs. If Amplitude Markers are selected, L DBMKR (L=1 dB MARKER MARKER REQUEST) will signal the A4 ALC board to modify the power level of the RF Output to cause a dip of approximately 1 dB at the marker occurrence.

Address Decoder (A)

The A7 Marker and A8 Sampler use address locations 2C01H, 2C02H, and 2C03H. U14 is a 3-to-8 address decoder which produces 3 active low control signals when an address associated with the Sampler or Marker assemblies is present on the plug-in address bus. These signals are used to latch control information from the data bus into latches U9 and U13 on the Marker assembly and into U10 on the A8 Sampler.

Marker/RF Switch Control (B)

When L EN3 goes low, control information from the data bus is latched through U9 to control the Marker Threshold adjustment circuits and marker type. The RF switches are not installed in the 83522A, therefore, the switch control lines are not used.

Marker On (E)

The incoming BIRDIE signal from the A8 Sampler Squarer circuit is inverted by U4D and then applied to the ON interval comparator U1B and delay network R1, C1. When the input BIRDIE pulse train goes from high to low at TP3, it causes U1B to trigger and U1A pin 1 to go high. Delay network R1, C1 keeps the signal at U1A pin 2 from going high until the signal on U1A pin 1 goes high, allowing for the propagation delay in U1B. This condition is sustained until either the input signal goes high again causing U1A pin 2 to go low or timer U1B times out causing U1A pin 1 to go low. In the first condition, nothing happens. In the second condition, U1A triggers causing U1A pin 4 to go low resulting in a marker being generated and the front panel marker LED being turned on. Therefore, the Marker On timer U1A outputs a pulse whenever the BIRDIE pulse periods are longer than the reference time period set by U1B.

The type of marker generated depends on the digital control lines AMKR (H=Amplitude Marker) and ZMKR (H=Intensity Marker) enabling U4B and U5D, respectively. A high signal on U4B pin 4 (AMKR) enables U4B pin 6 to go low driving inverter U12A pin 1 high. This causes U2B pin 7 to go low and signals the A4 ALC board to generate an amplitude marker. Similarly, a high on U5D pin 12 (ZMKR) enables U5D and causes an intensity marker to be generated by the 8350A Sweep Oscillator. Markers may be prevented from occurring by a low signal on the clear input of U1A pin 3. Whenever a valid marker is generated, U1A pin 4 pulls L MKRLED (L=Marker LED on) low and the front panel MKR LED is turned on once for each marker occurrence.

U15A is a marker stretcher circuit. If the sweep oscillator RF output is shut off by a low L PULSE signal from the Pulse Modulation Logic during the time in which a marker is being generated, U15A triggers and causes the marker to continue, even when U1A pin 3 has gone low and driven the Marker On output at U1A pin 4 low. This stretching of several microseconds keeps the marker signal from being shut off prematurely by short modulation pulses such as those encountered when the 8350A is used in conjunction with an 8755C Swept Amplitude Analyzer. The sweep speed may be slowed when modulation is used to improve marker consistency and avoid "beating" between marker and modulation pulses.

Marker Threshold (C)

The Marker Threshold is adjusted by R7, R6 and R5 which are selected by U2D, U2C, and U2A via the digital control lines for 1, 10, and 50 MHz marker frequencies, respectively. R5 also adjusts the marker threshold when external markers are selected. These adjustments vary the charging current for the timing capacitors in marker timers U1B and U8A simultaneously, thus varying the reference pulse width out of U1B and U8A.

Marker Off (F)

The Marker Off circuit turns off a previously generated Marker On signal when the BIRDIE low period is shorter than the reference time period pulses or when the sweep oscillator RF output has been turned off by the Pulse Modulation Logic circuit. The Marker On pulse width could otherwise cause a marker to be output after the sweep oscillator frequency has swept above the comb frequency or the external input frequency. U8A serves as the threshold detector by firing whenever the BIRDIE input goes low. This low signal is also applied to U8B pin 9 and enables U8B. When U8A pin 13 triggers, it causes U8B pin 10 to go high. If the BIRDIE signal does not return high before U8A times out, no output is generated by U8B. This would happen if the BIRDIE low period is longer than the reference time period. If the BIRDIE signal returns high sooner than the reference time period of U8A, this allows U8B pin 10 to return low, and a Marker Off pulse is generated at U8B pin 5. Either this signal or the L PULSE signal causes U12C pin 10 to go low and turns off the marker timer U1A.

Pulse Modulation Logic (D)

The Pulse Modulation Logic circuit provides the L PULSE output that is primarily used to amplitude modulate the RF output. When L PULSE is low, the RF Output is effectively turned off. The actual modulation drive current is provided by the A4 ALC Assembly. The L PULSE output is also provided to the Marker On circuit where it is used to control a marker stretcher circuit. The Pulse Modulation Logic circuit provides a low L PULSE signal if any one of the RF Marker (L RFM), Internal Squarewave Modulation (SQ MOD), or External Squarewave Modulation (PULSE IN) signals are present. The resistor diode network on U5C pin 10 translates the (PULSE IN) 8755 Modulation Drive to TTL levels but does not affect TTL inputs.

Delay Compensation Control (G)

U13 latches the Delay Compensation control lines to the appropriate circuits as controlled by the L EN1 line from Address Decoder U14. Buffered data lines BD1 through BD6 are used as the control inputs to the various delay compensation circuits.

Delay Compensation (I)

The delay compensation block circuitry is used to compensate the A12 YIG Oscillator for the inherent inaccuracy caused by delay in the magnets at fast sweeps. The input signal is SC VTUNE, a scaled ramp from the A6 YO Driver, the slope of which is proportional to the change in frequency. SC VTUNE is sent to two separate signal processors; 1) a Voltage Follower/Subtractor whose output is equal to zero at start of sweep and at the band switch point. The amplitude is proportional to sweep width, and 2) a Differentiator whose output is proportional to the rate of frequency change while sweeping. These two signals are then multiplied in the Analog Multiplier U7. The multiplier signal is summed with the bandswitch compensation (corrects for errors at bandswitching points) in multi-band plug-ins. This bandswitch compensation signal is not enabled in the 83522A. If the sweep oscillator is in a swept mode, U11A enables the delay compensation which is summed into the main coil driver voltage on the A6 YO Driver.

During retrace, analog switch U11B closes. In this condition, U10 together with R39, R41, R42, and R43 form a subtractor circuit. Both inputs are the input signal so they cancel in the operational amplifier and the resulting output is 0V, regardless of the input level. With U11B closed, C17 charges to one half the value of the input signal (R41 and R42 form a voltage divider). U11B opens again during the sweep which leaves only C17 in the feedback path of U10. Since there is no discharge path with U11B and U11C open, C17 remains charged to the i 1 just before U11B was opened. U10 now operates as a voltage follower, with the output level shifted by the voltage across C17. Therefore, the output of U10 has one half the slope of the input signal and returns to 0V whenever U11B is closed during retrace. The output of U10 is scaled by the HI adjust potentiometer and is applied, with an offset from the LO adjust potentiometer, to inverting amplifier U3B. The output generated at TP5 is one input to the analog multiplier.

If the sweep is stopped momentarily, such as when an external counter is used, L SSRQ is pulled low by the 8350A mainframe. L SLSMPL enables gate U5A and allows the L SSRQ line to control analog switch U11C. When U5A is enabled by a low on the L SLSMPL control line, and L SSRQ goes low, U11C closes and slowly recharges C17 through R40. Thus, when L SSRQ is pulled, the output of U10 will begin to go to zero volts, but may or may not reach zero volts depending on the length of time L SSRQ was pulled. This is done when in CF ΔF mode where ΔF equals zero. When L SSRQ goes high again and the sweep continues, U11C opens and U10 resumes its voltage follower operation.

SC VTUNE is also applied to Differentiator C15 and U3D. The output is amplified and inverted by U3C and is applied at TP4 to the second input of the analog multiplier. The output at TP6 is connected to U7 pin 7 to provide feedback for an operational amplifier internal to U7. The Z adjust at U7 pin 6 allows nulling of the offset voltage appearing at DLY COMP. This is done when in CF ΔF mode where ΔF equals zero. The YIG Oscillator does not always naturally settle to the proper start frequency after retracing. For fast, repetitive sweeps, the frequency during the first part of the band will be higher than it should be, unless it is corrected. CR9, C22, R63, and R64 correct for this condition by charging C22 to the output voltage of the differentiator during retrace and then allowing it to discharge through R63 and R64 into summing amplifier U3A. Q3 disables this function during sequential or alternate sweeps by shunting R63 and R64 to ground.

U11D is momentarily closed during bandswitching in multi-band plug-ins. It is held open at all times in the 83522A.

The output of U3A is then sent to the A6 YO Driver where it is summed into the main coil driver voltage. Since the delay compensation is unnecessary during CW operation, analog switch U11A disables
DLY COMP output to ground.

RF Switch Driver (H)

The RF switches are not intalled in the 83522A and, therefore, the switch driver circuits are not used.

Oscillator Bias Shaping Control (J)

U6A, U6B, and Q1 shape and control the negative bias signal to the A12 YIG oscillator. A frequency related YO DRIVE Voltage is applied to U6B. By adjusting the network of variable resistors R20, R21, R26, and R27, the YIG Oscillator bias can be controlled for optimum operation. A high state on the L RFON line allows the oscillator bias to be removed when it is desired to turn off the oscillator. Q1 serves as a high current output stage to provide adequate bias current for the YIG Oscillator.

Table 8-11. Marker Assembly Address Decoding

Address (Hexadecimal)	Components Addressed	Read or Write	Description
2C01	A7U13	Write	Addresses data latch to provide Delay Compensation control.
2C02	A8U10	Write	Addresses data latch on the A8 Sampler to provide digital control.
2C03	A7U9	Write	Addresses data latch for Marker/RF Switch control.

A7 MARKER ASSEMBLY, TROUBLESHOOTING

Component failures on the A7 Marker Assembly may be classified as either Digital Control, Marker, Delay Compensation, Oscillator Bias, or Pulse Modulation Logic failures. Digital circuitry in blocks A and B control the Markers and Delay Compensation circuits. Failures in these circuits may cause failure symptoms in the various functions performed by the A7 assembly. Therefore, the troubleshooting guide verifies these blocks first.

Digital Control

All data bus and control lines may be effectively checked by making use of the Hex Data programming and Operator Initiated checks available through software.

To verify Address Decoder U14, press 8350A CW . Then enter SHIFT 5 4. In this mode, the 8350A microprocessor continuously strobes the plug-in

A6

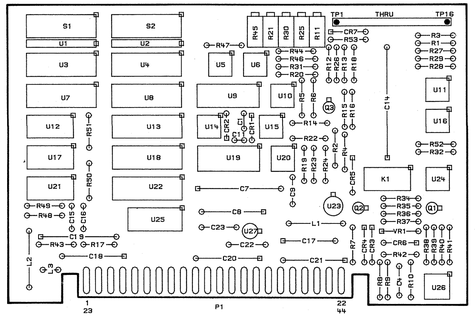


Figure 8-49. A6 YO Driver, Component Locations

A6P1

PIN	SIGNAL	I/O	TO/FROM	BLOCK
1 23	L RTS L SSRQ	IN	P2-57 NOT USED	E H
2 24	L BPRQ L RFBRQ		NOT USED NOT USED	
3 25	L SIRQ LO FREQ FM	OUT IN	A3P1-18 A5P1-2	E I
4 26	FREQ CAL DLY COMP	IN IN	A10J1-37 A7P1-26	I I
5 27	–10V REF +5V	OUT IN	A4P1-43 A3P1-6,7	J L
6 28	–40V –15V	IN IN	P1-11 P2-28	L L
7 29	+10V SCVTUNE	IN OUT	P1-8 A7P1-29	L D
8 30	GND DIG GND DIG			L L
9 31	BD1 BDØ	I/O I/O	A3P1-9 A3P1-31	CH CH
10 32	BD3 BD2	I/O I/O	A3P1-10 A3P1-32	CH CH
11 33	BA1 BAØ	IN IN	A3P1-11 A3P1-33	A A
12 34	BA3 BA2	IN IN	A3P1-12 A3P1-34	A A
13 35	BD5 BD4	I/O I/O	A3P1-13 A3P1-35	CH CH
14 36	BD7 BD6	I/O I/O	A3P1-14 A3P1-36	CH CH
15 37	PWON GND ANLG	IN	P2-25	C L
16 38	+20V +15V	IN IN	P1-7 P2-29	L L
17 39	–10V –40V	IN IN	P1-13 P1-11	L L
18 40	L INST2 L UNLVL	IN IN	A3P1-29 A4P1-2	A H
19 41	GND ANLG COLLECTOR		A9P1-2	L K
20 42	EMITTER/COIL YO DRIVE V	OUT	A9P1-4 A7P1-5 A10J1-39	K I
21 43	+20V FREQ REF VTUNE RET	IN OUT	A9P1-5 P1-A1	K B
22 44	BASE VTUNE	OUT IN	A9P1-1 P1-A1	K B

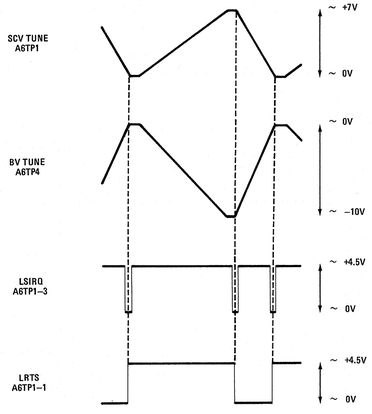
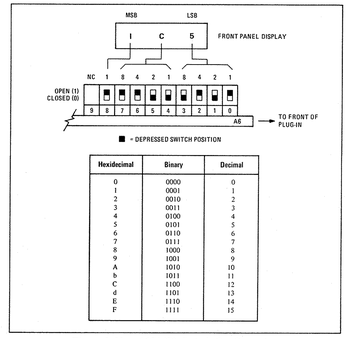


Figure 8-50. Sweep Control and Interrupt Logic Waveforms



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

Figure 8-51. A6SI/S2 Switch Configuration

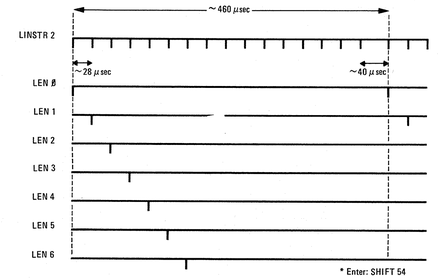
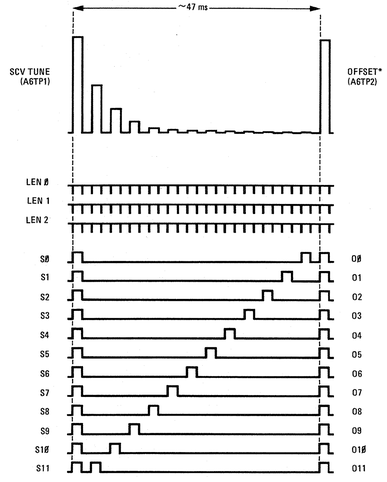


*Figure 8-52. A6 Decoder Timing Diagrams**



*Waveform at TP2 will have slightly rounded edges due to larger feedback capacitor.

Figure 8-53. DAC Test

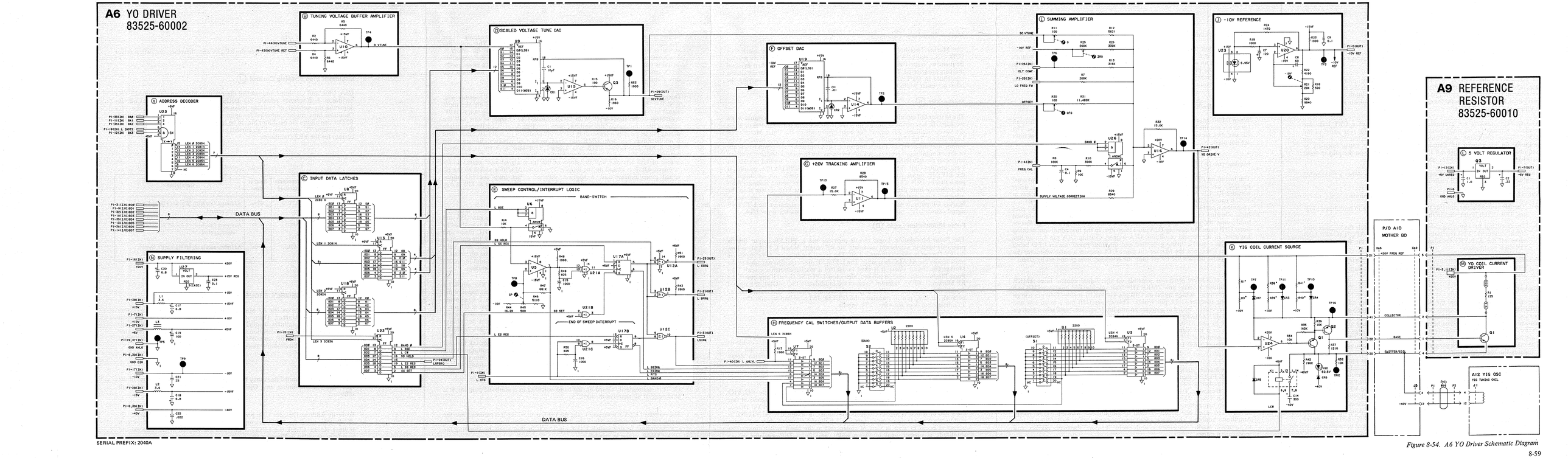


Figure 8-54. A6 YO Driver Schematic Diagram

NOTES

1. THE FOLLOWING KEY ENTRIES PROVIDE FRONT PANEL ACCESS FOR A DATA WRITE/READ OPERATION TO/FROM THE ADDRESSED LOCATION:

FUNCTION	KEY ENTRY
*Hex Address Entry	SHIFT 0 0 (enter hex address)
Hex Data WRITE	M2 (enter data: two hex digits)
Hex Data READ	M3
Hex Data Rotation Write	M4
Hex Addressed Fast Read	M5

*TO ADDRESS A DIFFERENT LOCATION, PRESS M1 AND ENTER THE NEW ADDRESS, OR USE THE INCREMENT KEYS ◄► ▼► TO STEP TO THE NEW ADDRESS.

TO PREVENT THE MICROPROCESSOR FROM SERVICING THE RETRACE INTERRUPT, PRESS 8350A CW .

Verify operation of U9, Marker/RF Switch Control, by making the following key entry:

Press 8350A INSTR PRESET CW

SHIFT 0 0	Hex Data mode
2 GHz s 0 3	Address location 2C03 (U9)
M2	Hex Data Write
5 5	Enters byte with alternate high/low states

Check the outputs of U9 for the alternating high/low pattern. To obtain the complement of each of the U9 outputs, press . . (AA). This will expose any locked latch registers.

To verify operation of U13, Delay Compensation Control, make the following key entries:

M1 2 GHz s 0 1	Address location 2C01 (U13)
M2	Hex Data Write
5 5	Enters byte with alternate high/low states

Check the outputs of U13 for the alternating high/low pattern. To obtain the complements of each of the U13 outputs, press . . . Check the outputs of U13 again.

Markers

To troubleshoot A7 for marker failure symptoms, start by using an oscilloscope to check Test Points 1, 2, and 3.

Press 8350A:

INSTR PRESET
CF 1 GHz s
ΔF 1 MHz ms
TIME 1 0 MHz ms

Press 83522A:

AMPTD MRK

Engage the 1 MHz frequency marker and check TP1. The signal should represent a TTL pulse approximately 2 cm wide. See Figure 8-57. Likewise, the pulse at TP1 should be 4 cm wide for 10 MHz Markers, and 6 cm wide for 50 MHz Markers. If these pulses appear to be incorrect, check that analog switch U2A,C,D is switching properly. If it is, check the output pulse widths of the monostable multivibrators against the data given in Table 8-12.

Check TP3 for the Birdie signal illustrated in Figure 8-57. (The birdie can be centered on the screen with the front panel FREQ CAL knob.) If the waveform is incorrect, refer to A8 troubleshooting.

Check TP2 for the waveform shown in Figure 8-57. These Marker OFF pulses should surround the Marker ON pulses at TP1. If these are incorrect, check the outputs of the monostable multivibrators against the data in Table 8-12.

Table 8-12. Approximate Monostable Multivibrator Pulse Times

U1B	8 to 10 μsec
U8A	1 to 10 μsec
U8B	75 nsec
U15A	88 μsec

Delay Compensation

Before troubleshooting the A7 assembly for delay compensation failures, refer to the A6 Service Sheet and verify the YO Drive Voltage at A6TP14. If this signal is correct, begin troubleshooting the A7 assembly by checking the waveforms at TP 4, 5, and 6. Press 8350A INSTR PRESET .

Test point 4 shows the compensation for the abrupt change in tuning current at the start of a sweep (Figure 8-58). The amplitude of this signal decreases as sweep time increases. Test point 5 shows the compensation for current lag in the YO with respect to sweep voltage (8-58). Test point 6 shows the sum of TP 4 and 5 signals (Figure 8-58). These checks should isolate the problem to one of the following circuits: Voltage Follower Subtractor, Differentiator, Analog Multiplier, or Delay Compensation Enable/Bandswitch Compensation.

Oscillator Bias Shaping Control

Check TP7 with a voltmeter while switching the plug-in RF power switch on and off. With the RF on, TP7 should be approximately −9.8 Vdc. With the RF off, TP7 should be approximately 0 Vdc.

Pulse Modulation Logic

Enable 8350A ⌐¬ MOD and check pin 13 of U12D for the proper square wave signal: 27.8 or 1 kHz.

RF Switchdriver

RF switches are not installed in the 83522A and, therefore, the switch driver circuits are not used.

A7

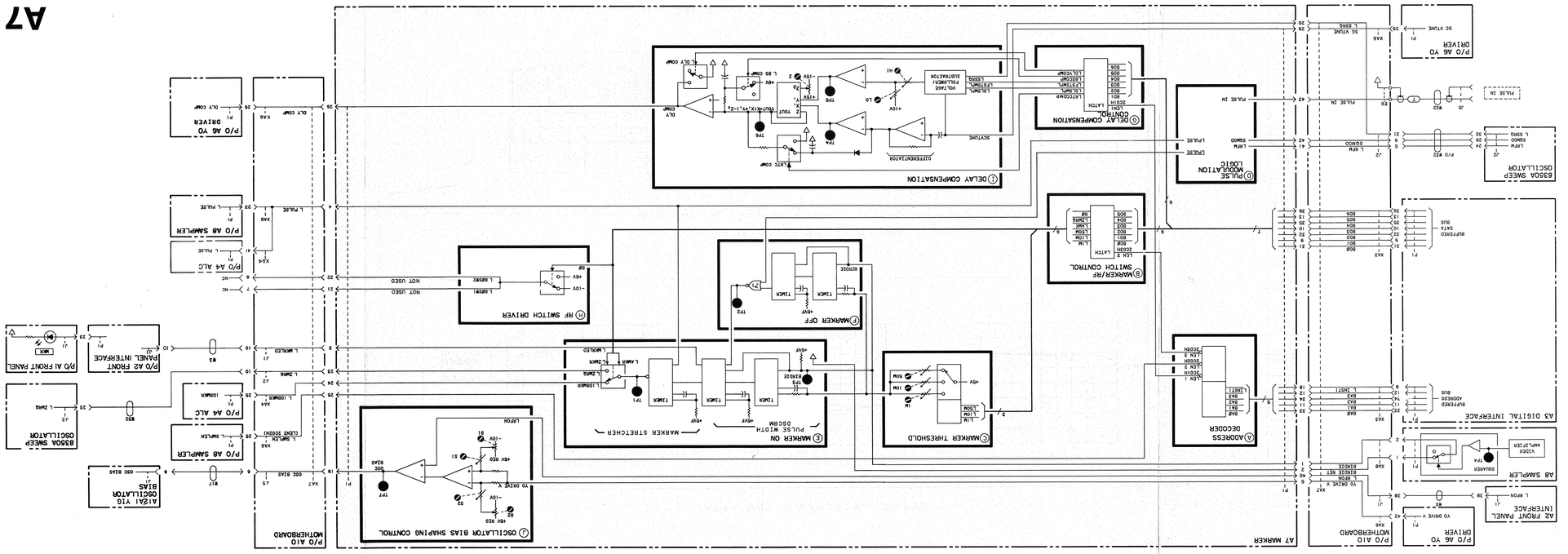


Figure 8-55. A7 Marker, Block Diagram

A8 SAMPLER, CIRCUIT DESCRIPTION

The A8 Sampler accepts an RF signal from the DC1 Directional Coupler/ Detector AUXiliary output port which is mixed in one of two mixers with the rear panel EXT MKR input or the comb generator output signal. The comb generator output consists of a selected 1 MHz, 10 MHz, or 50 MHz frequency multiples source. The mixer used supresses all output signals except the lower sideband which is then used as a birdie signal. The birdie is then sent to the programmable low pass filter to ensure that only the lowest frequency birdie is used. This birdie is then the result of a single Comb Generator harmonic which is closest in frequency to the input RF signal. The birdie is amplified in the variable gain video amplifier so that a constant level, regardless of input RF frequency and power level, can be sent to the Squarer. The Squarer converts the birdie signal to a TTL level compatible signal which is then used to generate a marker on the A7 Marker board.

Digital Control (A)

The L SMPL EN input from the Address Decoder on the A7 Marker assembly clocks data into data latch U10. These latched data lines provide digital control of the sampler board. Resistor array U12 provides pullups to ensure that the high level on the control lines is near +5V.

50 MHz Oscillator (C)

The frequency determining network of the 50 MHz Oscillator is formed by crystal Y1, resonant tank circuit C1 and L1, and capacitors C3 and C4. C4 is used to fine tune the center frequency of the oscillator to 50 MHz. Resistor R1 is used in conjunction with L1 and C1 to ensure oscillations at 50 MHz. U11B provides a buffer stage for the oscillator. R3 and R4 provide the necessary pulldown for the outputs of ECL devices U11A and U11B.

Frequency Divider Circuits (F)

Integrated circuits U6 and U9 are ECL bi-quinary dividers, having both divide-by-two and divide-by-five circuits built in. The output of the 50 MHz Oscillator is applied at the input of the divide-by-five portion of U9. When U9 is selected by a low on the digital control line through CR3, it produces one-fifth of the input frequency, or 10 MHz at U9 pin 4. This 10 MHz signal is applied simultaneously to the divide-by-five input of U6 and to the gate U7B. Both divider circuits are used in U6. The output of the divide-by-five is fed back to the input of the divide-by-two, resulting in a divide-by-ten circuit. The result is an output of 1 MHz at U6 pin 15 when both U6 and U9 are enabled by lows on their respective control lines. Selection of the desired frequency is done through the use of the digital control lines on the divider circuits U6 and U9 as well as gates U7A, U7B, and U7C.

For 50 MHz markers, U9 and U6 are disabled by a logic high on their reset inputs (pin 9), and the 50 MHz Oscillator output is gated through NOR gates U7A and U7C.

For 10 MHz markers, U6 is disabled, and the 10 MHz output from U9 is gated through U7B and U7C; the U7A output is kept low by a logic high on the L 50 MHz logic line.

For 1 MHz markers, the 1 MHz output from U6 is gated through U7C and the U7A and U7B outputs are kept low by logic highs on their inputs.

Resistors R6, R8, R11, R12, and R27 provide the necessary pulldown for the outputs of the ECL logic. Diodes CR2 and CR5 in the digital control lines and resistors R5, R7, R9, and R10 provide the necessary interface between the TTL digital control and the ECL logic.

Comb Generator (H)

The 1, 10, or 50 MHz square wave at TP2 is applied to the inverting and non-inverting inputs of U11C and U11D, respectively. This causes the differential voltage across the Comb Generator diode CR8 to be twice the normal ECL logic voltage swing or about 1.6V. The output of CR8 is coupled through C14 to the Internal Mixer diode CR7. This output signal is a spectrum of frequencies at multiples of the input frequency to the comb generator (1, 10, or 50 MHz).

U11C pin 9 provides an input bias level for all parts of U11. This bias is applied through R64 on the Comb Generator and R2 on the 50 MHz Oscillator.

RF Power Divider (B)

The RF Power Divider divides and shapes a portion of the sweeper output signal and sends it to the Internal and External Mixer circuits. The signal input at J1 may range from about −25 dBm to about −10 dBm. The output signal to the two mixers will be slightly below this level, depending upon input frequency.

Internal Mixer (E)

Internal Mixer Diode CR7 mixes a portion of the sweeper output signal with the frequency comb produced by the comb generator circuit. The circuit including Q2A and Q2B produces an output of only the difference frequency of the two inputs. The sum frequency is attenuated by the circuit's high impedence and parasitic capacitances. Therefore, as the sweep oscillator output frequency approaches that of one of the Comb Generator harmonics, a difference frequency appears at the internal mixer output through R28. This frequency decreases to zero Hz when the sweep oscillator output frequency is identical to that of the Comb Generator harmonic and then increases in frequency as the sweep oscillator output frequency moves higher. The resulting waveform is referred to as a birdie. Bias for CR7 is provided by the constant current stage Q5. The Q5 current output is adjusted by R29, R30, and R31 for 1, 10, and 50 MHz marker frequencies respectively.

External Mixer (D)

The External Mixer operates in a similar manner as the Internal Mixer with the exception that it uses an externally provided signal rather than the Comb Generator signal. A similar output birdie is obtained. CR6 mixer diode bias is maintained by R17. Q4A and Q4B provide a high impedence follower identical to Q2A and Q2B. The External Mixer is selected by applying 0V at the gate of FET switch Q3. The internal 50 MHz crystal oscillator and the Frequency Divider Circuits are disabled when the external marker mode is selected.

Programmable Low Pass Filter (G)

Birdies from either the Internal and External Mixers are applied to emitter follower Q1. This stage provides a low impedance source for the Low Pass Filter circuits. Multiplexer U4B selects one of the following filters: approximately 300 kHz LPF, approximately 4 MHz LPF, or the filter bypass line. The Low Pass Filters insure that the birdie is a result of only one comb frequency at a time.

Video Amplifier (J)

U3 and U1 amplify the birdie signal from the output of the Low Pass Filter from a level of a few millivolts to a level of about one volt. Because the level of the incoming birdie signal can change as a function of the marker frequency and the RF OUTPUT level, a means to control the gain of the video amplifier is necessary. This is accomplished by varying the bias current into U3 pin 7 and U1 pin 7. The bias current for U3 pin 7 adjusts the gain to compensate for instrument RF OUTPUT power level changes. The bias current into U1 pin 7 adjusts the gain to compensate for variations in the amplitude of the birdie signal when different marker frequencies are selected. This current is adjusted by R53, R54, R55, and R67 when 1 MHz, 10 MHZ, 50 MHz, and EXTernal marker frequencies are selected, respectively. Multiplexer U5 selects the appropriate adjustment as well as switching in an additional shaping capacitor when 1 MHz markers are selected. This capacitor helps to further low pass filter the 1 MHz birdie signal. U5 also provides control lines to select the proper bias for the internal mixing diode CR7 and to select the External Mixer when required.

Gain Shaping (I)

The Gain Shaping circuit alters the gain of Video Amplifier U3 so that as the sweep oscillator RF output level changes, the amplitude of the birdie signal remains relatively constant. The power reference signal from the ALC board is amplified in U8A and is applied to U8B along with an offset voltage from R65. With low power output, the power reference voltage is only slightly negative. At this level, CR11 clamps the voltage at the output of U8B to about +0.6V. As the RF OUTPUT power level is increased, this voltage decreases and causes the current into U3 pin 7 to decrease, reducing the Video Amplifier gain. This keeps the amplitude of the birdie signal at TP4 relatively constant regardless of RF power output variations.

Squarer (K)

The Squarer circuit provides TTL compatible signals for the rest of the marker circuits located on the A7 Marker assembly. U2 is a voltage comparator which compares the incoming birdie to an approximately −0.1V reference established by resistor divider R58 and R59. Resistor R60 provides some hysteresis for the stage. The effect of these resistors is to improve the noise immunity of the circuit. U4A is an analog switch which provides drive for the TTL circuitry and serves as a transition point for the two different ground returns on the A7 and A8 boards. This is important because the high gain on the A8 Sampler assembly would be particularly susceptable to pick-up from the fast rise time digital signals on the A7 Marker assembly.

The Squarer circuit can be disabled either by a low signal on the digital control line to U2 pin 6 or by a low signal on the LPULSE line to U2 pin 5. The LPULSE line disables the Squarer output any time the sweep oscillator RF output is absent due to pulse type modulation. Hence, the Squarer circuit only outputs a signal when the sweep oscillator output is present and the marker operation has been selected.

A8 SAMPLER, TROUBLESHOOTING

A8 Sampler component failures affect the plug-in crystal markers. On the front panel of the 8350A, select a start frequency of 10 MHz and a stop frequency of 2.4 GHz. Select 83522A 50 MHz markers (amplitude or intensity). Monitor A7TP3 and check for birdie pulses as noted in Figure 8-57 (A7 Service Sheet). If birdie pulses are present then the A8 Sampler assembly is operational and a problem exists on the A7 Marker Assembly. Refer to the troubleshooting procedure for the A7 Marker Assembly. If there are no birdie pulses then a problem exists on the A8 Sampler Assembly.

NOTE

Some distortion of the actual waveforms may occur due to probe capacitance.

Monitor A8TP1. With the selection of any internal marker, the 50 MHz output of the crystal oscillator should appear as illustrated in the lower right corner of the A8 Schematic Diagram. If the 50 MHz signal is not present, check control signal OSC EN U10 pin 2. When internal markers are selected, OSC EN will be a logical one. If OSC EN does not go high with internal markers selected, ensure that CR1 is not shorted. Also ensure that data latch U10 is operational.

To troubleshoot U10 utilize the Hex Data Rotation Write self test. To utilize the test, perform the following keystrokes on the 8350A Sweep Oscillator Mainframe:

INSTR PRESET	Initiates Instrument Preset
SHIFT 0 0	Initiates hex address mode
2 GHz s 0 2	Addresses data latch A8U10
M4	Initiates HEX DATA ROTATION WRITE

Monitor the I/O operation of U10. Check for waveforms in Figure 8-2 at the beginning of this Service Section.

If the output of crystal Y1 is present at A8TP1 and U10 is operational, check A8TP2 for the waveforms given in the lower right corner of the A8 Schematic Diagram. If no signal appears at A8TP2 for any selection of internal markers, check U7C. If the signal does not appear for 1 MHz markers, check divider U6. If a signal does not appear for either the 1MHz or 10 MHz markers, check U9. If a signal does not appear for 10 MHz markers, check CR5 and U7B. If a signal does not appear for 50 MHz markers, check CR2 and U7A.

If A8TP2 is valid and there are no internal markers, check the output of U11C and U11D. Their outputs should be a 1, 10, or 50 MHz signal, depending upon which marker is selected. Their outputs will be 180° out of phase.

If the comb generator circuitry is operational, verify that the RF output signal from directional detector DC1 is getting to the A8 assembly. Remove W6 from the J1 connector on the assembly. Select a CW frequency setting anywhere in the band. With an external power meter, measure the level of the signal at W6. The signal level should be approximately 25 dB below the level indicated on the front panel of the 83522A. If there is no signal present, or the amplitude is more than 25 dB down from the RF output, a problem exists in either the directional detector DC1, cables W8 or W6, or the connector between them. Trace the signal path to determine the failed component.

If the signal from the directional detector is valid, check Internal Mixer (E) and Programmable Low Pass Filter Circuitry (G) by monitoring A8TP3 with an oscilloscope. Set the 8350A Start/Stop sweep for 10 MHz to 2.4 GHz with a Sweep Time of 100 msec. Select 83522A 1MHz amplitude markers and set the output power to +13 dBm. Vary potentiometer R29 (1M). The envelope height should vary. Select 10 MHz markers and vary potentiometer R30 (10 MHz). The envelope height should vary. Select 50 MHz markers and vary potentiometer R31 (50 MHz). The envelope height should vary. If no effect is observed at A8TP3 for all three selected marker frequencies, suspect the internal mixer Q1 or analog switch U5. If only one of the selected marker frequencies displays improper operation then a failed component exists in Programmable Low Pass Filter (G) or possibly U5.

If A8TP3 output appears correct, check the waveform at A8TP4 for each marker position. Both waveforms appear in the lower right corner of the A8 Schematic Diagram. If the pulse amplitude is not approximately 1 volt, attempt to adjust the corresponding IF gain control. If the adjustments do not have any effect, check U5.

Reduce the RF output level from +13 to 0 dBm. The pulse amplitude should remain the same. If the amplitude varies, check the Gain Shaping Circuit (I).

If the pulses at A8TP4 appear correct, check the output of U2 pin 7 for amplified pulses. If no output is seen from U2 check that control lines L PULSE and SQ EN are both enabled.

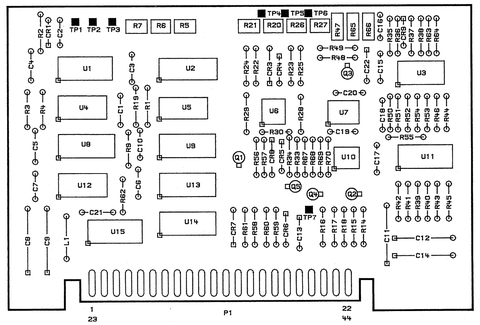


Figure 8-56. A7 Marker, Component Locations

A7P1

PIN	SIGNAL	I/O	TO/FROM	BLOCK
1 23	BIRDIE L ZMRQ	IN OUT	A8P1-1 P2-23	E E
2 24	BIRDIE RET L IDBMKR	OUT OUT	A8P1-2 A4P1-25	E E
3 25	L MKRLED L SMPL EN	OUT OUT	A2J1-10 A8P1-25	E A
4 26	L PULSE DLY COMP	OUT OUT	A8P1-23 A6P1-26	D I
5 27	YO DRIVE V +5V	IN IN	A6P1-42 A3P1-6,7	J K
6 28	−40V −15V	IN IN	P1-11 P2-28	NOT USED K
7 29	+10V SC VTUNE	IN IN	P1-8 A6P1-29	K I
8 30	GND DIG GND DIG			K K
9 31	BD1 BD0	IN IN	A3P1-9 A3P1-31	B,G B
10 32	BD3 BD2	IN IN	A3P1-10 A3P1-32	B,G B,G
11 33	BA1 BA0	IN IN	A3P1-11 A3P1-33	A A
12 34	BA3 BA2	IN IN	A3P1-12 A3P1-34	A A
13 35	BD5 BD4	IN IN	A3P1-13 A3P1-35	B,G B,G
14 36	BD7 BD6	IN IN	A3P1-14 A3P1-36	B,G G
15 37	GND ANLG GND ANLG			K K
16 38	+20V +15V	IN IN	P1-7 P2-29	NOT USED K
17 39	−10V −40V	IN IN	P1-13 P1-11	K NOT USED
18 40	L INST 1 L RFON	IN IN	A3P1-8 A2J1-38	A J
19 41	OSC BIAS L RFM	OUT IN	A12A1J1-6 P2-24	J D
20 42	L SSRQ SQ MOD	IN IN	A6P1-23 P2-26	I D
21 43	L BØSW1 PULSE IN	IN	NOT USED J5(BNC)	D
22 44	L BØSW2 +5V REG	IN	NOT USED A9P1-7	K

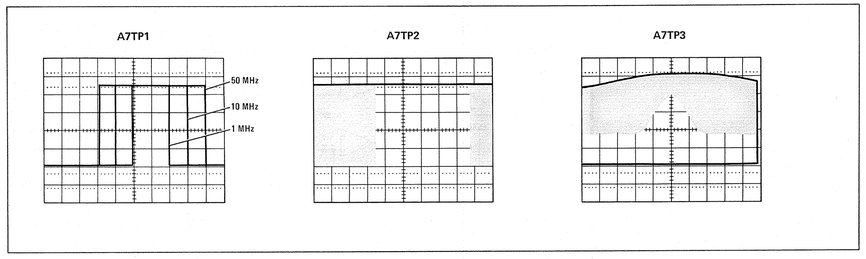


Figure 8-57. A7 Marker, Test Points 1 thru 3

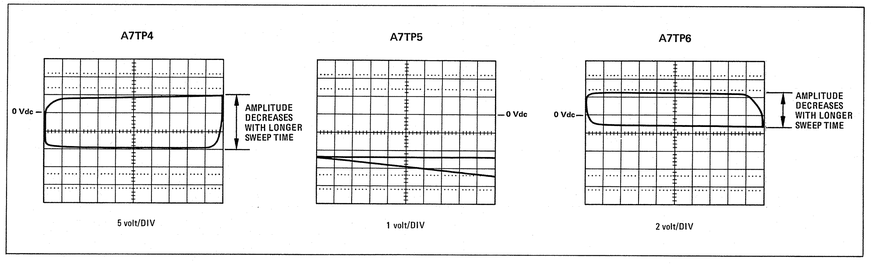


Figure 8-58. A7 Delay Compensation, Test Points 4 thru 6

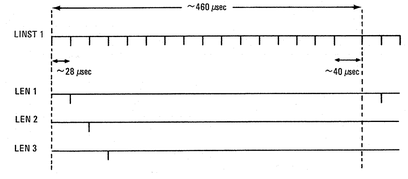


Figure 8-59. A7 Address Decoder Timing Diagram

NOTES

1. THE FOLLOWING KEY ENTRIES PROVIDE FRONT PANEL ACCESS FOR A DATA WRITE/READ OPERATION TO/FROM THE ADDRESSED LOCATION:

FUNCTION	KEY ENTRY
*Hex Address Entry	SHIFT 0 0 (enter hex address)
Hex Data WRITE	M2 (enter data: two hex digits)
Hex Data READ	M3
Hex Data Rotation Write	M4
Hex Addressed Fast Read	M5

*TO ADDRESS A DIFFERENT LOCATION, PRESS M1 AND ENTER THE NEW ADDRESS, OR USE THE INCREMENT KEYS ◄► TO STEP TO THE NEW ADDRESS.

TO PREVENT THE MICROPROCESSOR FROM SERVICING THE RETRACE INTERRUPT, PRESS 8350A CW .

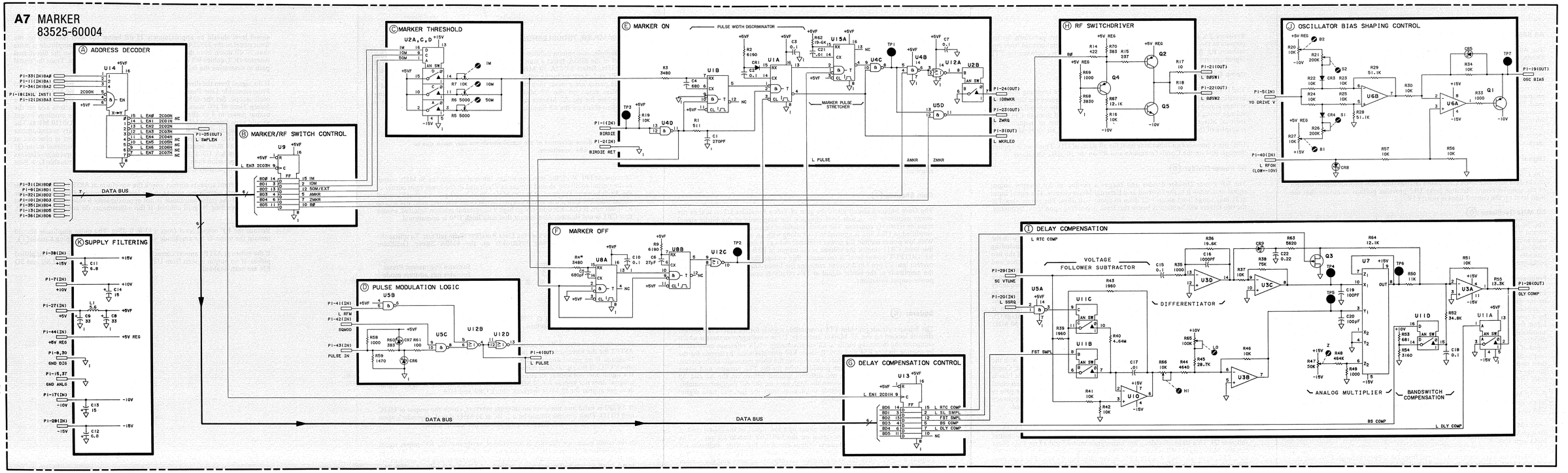
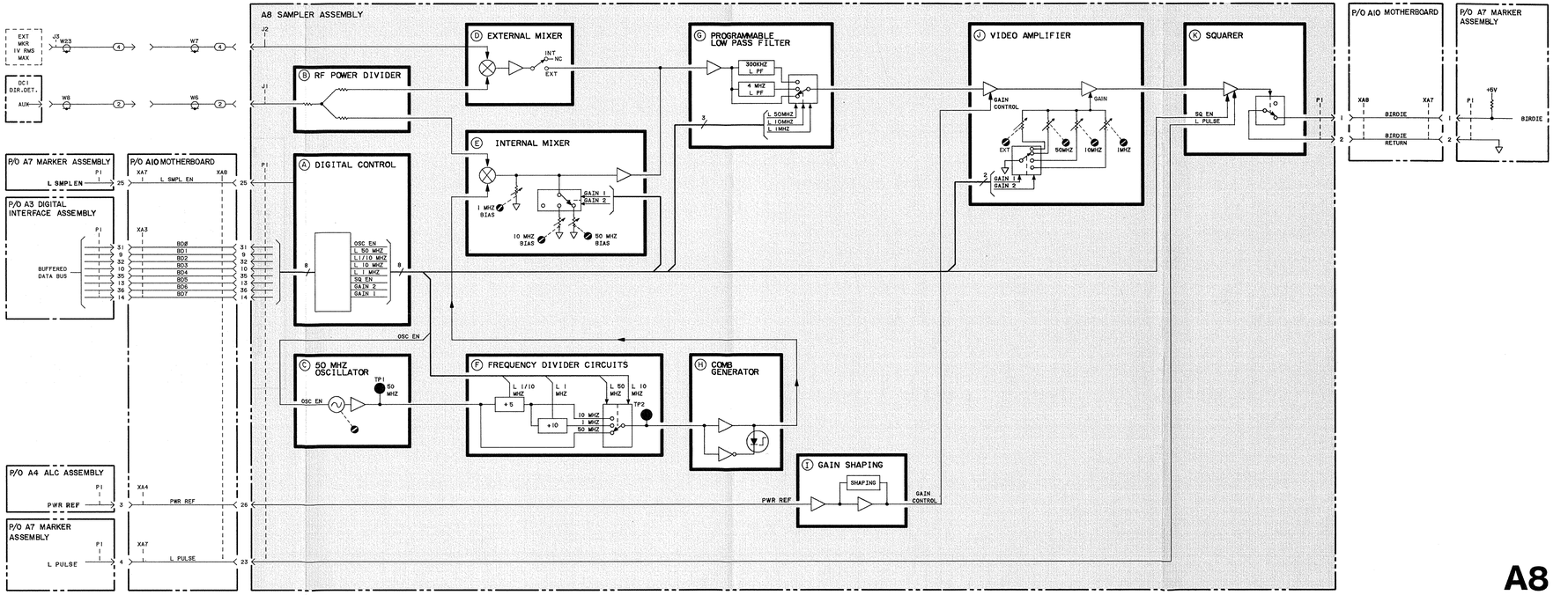


Figure 8-60. A7 Marker, Schematic Diagram



A8

Figure 8-61. A8 Sampler Assembly, Block Diagram

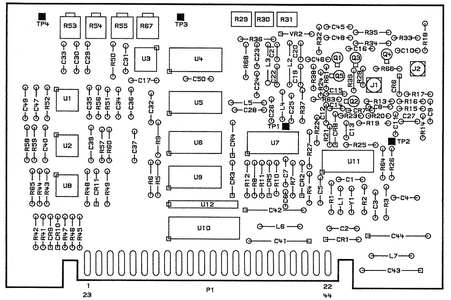
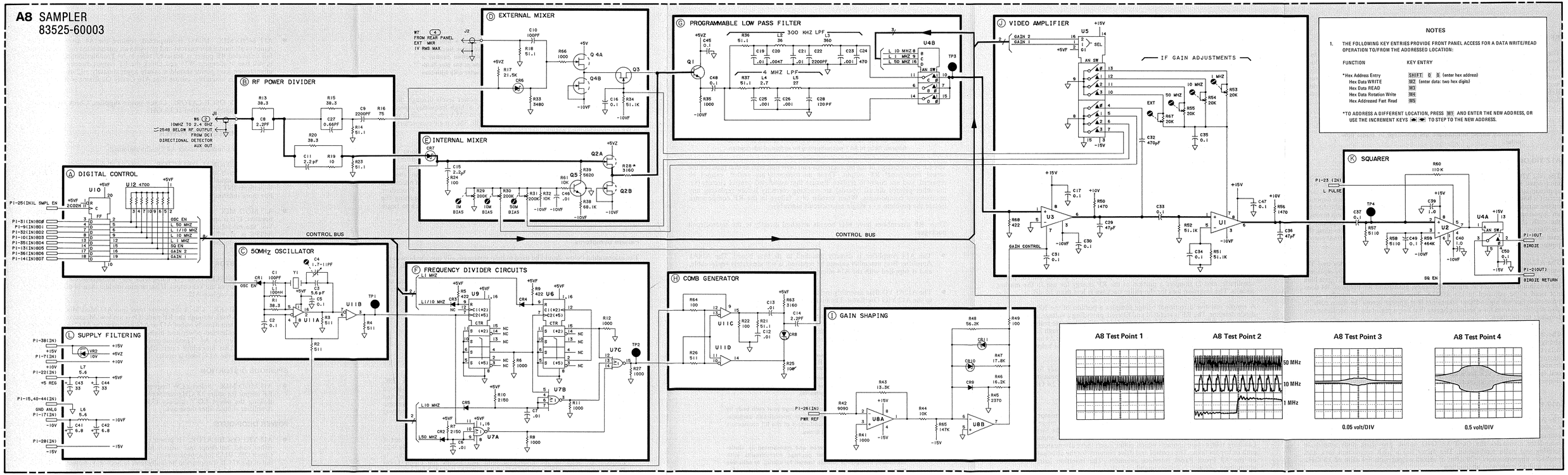


Figure 8-62. A8 Sampler, Component Locations

A9P1

PIN	SIGNAL	I/O	TO/FROM	BLOCK
1 23	BIRDIE L PULSE	OUT IN	A7P1-1 A7P1-4	K K
2 24	BIRDIE RET NC	OUT	A7P1-2	K
3 25	NC L SMPL EN	IN	A7P1-25	A
4 26	NC PWR REF	IN	A4P1-3	I
5 27	NC +5V	IN	A3P1-6,7	NOT USED
6 28	–40V –15V	IN IN	P1-11 P2-28	NOT USED L
7 29	+10V NC	IN	P1-8	L
8 30	GND DIG GND DIG			NOT USED NOT USED
9 31	BD1 BD0	IN IN	A3P1-9 A3P1-31	A A
10 32	BD3 BD2	IN IN	A3P1-10 A3P1-32	A A
11 33	BA1 BA0	IN IN	A3P1-11 A3P1-33	NOT USED NOT USED
12 34	BA3 BA2	IN IN	A3P1-12 A3P1-34	NOT USED NOT USED
13 35	BD5 BD4	IN IN	A3P1-13 A3P1-35	A A
14 36	BD7 BD6	IN IN	A3P1-14 A3P1-36	A A
15 37	GND ANLG GND ANLG			L NOT USED
16 38	+20V +15V	IN IN	P1-7 P2-29	NOT USED L
17 39	–10V –40V	IN IN	P1-13 P1-11	L NOT USED
18 40	L INST1 GND ANLG	IN	A3P1-8	NOT USED L
19 41	NC GND ANLG			L
20 42	NC GND ANLG			L
21 43	NC GND ANLG			L
22 44	+5V REG GND ANLG	IN	A9P1-7	L L



SERIAL PREFIX: 2040A

Figure 8-63. A8 Sampler, Schematic Diagram

RF SECTION, CIRCUIT DESCRIPTION

The RF Section includes the high-frequency microcircuits, with their bias boards, that produce the actual RF output power. These components include A12, A14 through A17, A19, and DC1. All other plug-in assemblies function essentially to control these RF components. The connections between microcircuits and other assemblies are provided on the Overall Block Diagram. Refer to the Overall Block Diagram circuit description for a more general, functional description.

NOTE

Assembly circuit descriptions are discussed in signal flow order.

A12 YIG Oscillator

The A12 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is the solid-state tunable microwave source. Its output frequency ranges from 3.81 to 6.2 GHz, with approximately +12 to +14 dBm of output power. The oscillator's resonant tank circuit is basically a small YIG sphere with a resonant frequency which depends on the surrounding magnetic field strength. The magnetic field is established by an opposing pair of electromagnetic "main coils." Changing the current through the coils changes the magnetic field strength, and hence the frequency of oscillation. The sphere is lightly coupled to a bi-polar transistor, providing the gain necessary to sustain oscillation. A FET amplifier provides the final output power gain.

The A12A1 YO Bias assembly supplies the biasing for the oscillator and YO amplifier. This board is matched to the YO, and cannot be separately replaced. There is a single adjustment (R4) on the assembly, optimizing the FET gate bias for minimum harmonics in higher frequency, multiband RF plug-ins. R4 does not need to be adjusted in the 83522A. The bias assembly provides zener protection against high-voltage transients that appear across the main coils. It also supplies current for a resistive heater that helps maintain the oscillator at a constant temperature.

The dynamic response of the YO (i.e. how fast frequency changes for a fast change in coil current) is somewhat limited, due to the inductive and magnetic delays of the electromagnet coils and poles. Delay compensation circuits help during a sweep, but frequency modulation is limited to low modulation frequencies. To allow high-frequency modulation, a smaller, faster, air-core FM coil is added to the YO. Its magnetic field adds to the main coil's field, yet frequency changes are far quicker.

A17 Modulator/Mixer

The A17 Modulator/Mixer mixes a fixed 3.8 GHz signal with the swept 3.81 to 6.2 GHZ YO output, producing the 0.01 to 2.4 GHz RF output. The swept YO output acts as the Local Oscillator signal for the mixer. The internal PIN diode modulator attenuates the fixed 3.8 GHz input, providing both amplitude leveling and pulse modulation. The mixer has a high conversion loss, and produces approximately −20 dBm of mixed output with +9 dBm of 3.8 GHz input and no modulator attenuation.

A16 Cavity Oscillator

The A16 Cavity Oscillator provides a fixed 3.8 GHz RF output at approximately +9 dBm which is mixed down by the swept YO output, yielding the heterodyned low-frequency output. This source is extremely stable in both frequency and amplitude. The +20V and −10V lines provide power for the A16 assembly. Two large, separately-replaceable capacitors help filter these supplies to reduce residual FM noise.

A14 Amplifier

The A14 Amplifier provides approximately 40 dB of gain from 0.01 to 2.4 GHz. The amplifier gain drops sharply at higher frequencies, providing a lowpass nature which rejects the unwanted mixing products.

The A14A1 Amplifier Bias assembly provides the various bias currents for the A14 amplifier. It is matched and attached to the microcircuit at the factory, has no adjustments or replaceable parts, and cannot be replaced separately as an assembly. The +20V and L RFON lines provide the power. When the RF is "off," the bias is removed, shutting off the amplifier completely.

A15 DC Return

The A15 DC Return is simply a shunt RF choke. The shunt inductor allows DC currents to flow to ground while passing on the RF power with less than 0.6 dB of insertion loss.

DC1 Directional Detector

The DC1 Directional Detector serves two purposes: 1) detects the RF power amplitude; and 2) samples a portion of the RF energy for use in the marker circuits. The insertion loss for the entire package is less than 3.5 dB.

A simple resistive directional bridge samples a portion of the RF energy to a diode detector. The RF is rectified and filtered, providing a voltage, proportional to the peak RF amplitude, which is used for leveling. A single resistor (A10R1) biases the detector diode through feed-through E1. Feed-through E2 carries the detected signal, but also carries a second bias current from the A4 assembly for a second, temperature compensating diode. An internal resistor helps protect the static sensitive diodes.

A simple resistive tap samples a portion of the RF frequency for use in the marker generation circuits. The SAMPLED RF output is approximately 25 dB below the front panel output power, and ranges from 0.01 to 2.4 GHz.

A19 Step Attenuator (Option 002 Only)

On RF plug-ins equipped with Option 002, the A19 Step Attenuator provides up to 70 dB of attenuation in 10 dB steps. Combined with the range of the ALC loop, this yields a leveled power range of +13 to −72 dBm. The Step Attenuator consists of three fixed attenuators, with 10, 20, and 40 dB of attenuation each. Latching relays close contacts which either insert these attenuators into the RF path or bypass them. The control and drive circuitry for the attenuator is located on the A2 Front Panel Interface assembly. The insertion loss, with 0 dB attenuation selected, is approximately 0.5 dB.

RF OUTPUT Connector

On Standard or Option 002 instruments, the RF output is directed to a female type N "RF OUTPUT" connector at the front panel. On plug-ins with Option 004 (with or without Option 002), the output is directed to the rear panel RF OUTPUT connector.

RF PATH TROUBLESHOOTING

NOTE

Many RF path failure symptoms are closely related to A4 ALC failures. Refer to A4 Troubleshooting for additional information.

The RF Path consists of the microcircuits and their bias boards that produce the actual front-panel RF output. These microcircuits are sealed, cannot be repaired, and are costly to replace. Ensure that associated control circuits (i.e. the other printed circuit boards) are working correctly before replacing any microcircuit components. When certain of a failure in the RF components, isolate the problem to a single microcircuit assembly.

Three RF assemblies have bias boards attached directly to the microcircuit packages:

- The A14 Amplifier is directly attached to its bias board. The A14A1 Amplifier Bias assembly cannot be repaired, is not separately replaceable, and is supplied with the A14 microcircuit.

- The A12A1 YO Bias assembly includes two factory select resistors matched to the A12 YIG Oscillator. The bias board is part of the A12 assembly and cannot be separately replaced. If a bias board component (e.g. protection diode or variable resistor) has been externally damaged, it is acceptable (and economical) to replace that individual component. However, a bias board failure often indicates a failure inside the microcircuit and may require that the entire assembly be replaced.

WARNING

Many microcircuits are extremely sensistive to static electric discharges (more so when the microcircuits are removed from their bias boards or control circuits).

Before handling a microcircuit, discharge your own body by touching the instrument chassis or microcircuit package. Avoid touching the center conductors of the RF connectors and bias feed-throughs at all times.

Microcircuits should be stored and transported in static-protective packaging. Never package microcircuits with styrofoam, cellophane (unless treated for static), or adhesive tape.

Do not attempt to test any microcircuits, at a bias feed-through or the RF connectors, with an ohmmeter. Resistance measurements are rarely useful, and will often destroy a working microcircuit. Measure DC voltages at the bias feed-throughs with a high-impedance DC voltmeter only with bias or control connections intact.

The following troubleshooting procedure traces power levels through the RF path. RF measurements should be made with a high-frequency spectrum analyzer or an RF power meter. A type-N (female)-to-SMA adapter, along with a short, flexible RF cable terminated at both ends with SMA male connectors, will make troubleshooting easier.

Opening RF connections within the ALC loop will cause the loop to be unleveled, producing abnormally high power levels (up to +20 dBm) and harmonic distortion. The ALC loop includes all connections between the A17 Mod/Mix and DC1 Directional Detector. (Figure 8-25, within the A4 Troubleshooting section, provides a graphic definition of the loop.) If necessary, the modulators may be externally biased using the Open Loop Procedure described in the A4 Troubleshooting Section. If possible, avoid opening the ALC loop to make RF measurements. In any case, it is a good idea to begin troubleshooting just outside the ALC loop.

Failure Symptoms

The information below should be used to help systematically troubleshoot to the individual RF assembly. Based on the failure symptom, the components most likely to have failed are listed, with the most probable failure cited first. Hints for ensuring that the RF Path is actually responsible for the failure are also given. For troubleshooting information related to a specific assembly, refer to **Microcircuit Verification By Assembly** below.

NOTE

All references to test points, pin connections, etc., can be located on the RF Schematic, Figure 8-66.

NO RF POWER

- A12 YIG OSCILLATOR. Check power supplies and bias levels. OSC BIAS (TP "ON") should be at −10 Vdc, with some shaping. TP "G" should be approximately −2 Vdc. Check TP "M" for the waveform entitled EMITTER/COIL, Figure 8-48, within the A6 Service Sheet. This waveform represents the current across the main coil. Check the RF output directly at the YO for approximately +14 dBm at several frequencies.

- A14 AMPLIFIER. Check power supplies. Check the power directly out of A14. This will open the ALC loop. Expect to measure approximately +20 dBm unleveled RF output with high harmonic distortion. If this is undesirable, refer to A4 troubleshooting and follow the Open Loop Procedure to externally level the RF while opening the ALC loop.

- A17 MOD/MIX. If A17 is suspected, remove the A4 assembly. This removes all modulator current and provides an unrestricted path for RF. If full unleveled RF power is achieved, refer to A4 Troubleshooting. If power is still bad, disconnect W25 and check the RF output directly out of the mixer (open loop power should measure approximately −12 dBm). Before replacing this assembly, ensure that A16 Cavity Oscillator is functioning properly.

- A16 CAVITY OSCILLATOR. Check power supplies. Check RF output for approximately +9 dBm at 3.8 GHz.

MAXIMUM RF UNLEVELED POWER

- Refer to this symptom under A4 Troubleshooting.

- DC1 DIRECTIONAL DETECTOR. Select a CW frequency anywhere in the band. Verify maximum unleveled RF output power. Check INT DET 0 output to be equal to or more negative than −0.2 Vdc. (It may be necessary to perform INT DET 0 BIAS adjustment. Refer to Section V, Adjustments.) For more information refer to A4 Troubleshooting.

- A17 MOD/MIX. Check modulator bias line MOD 0. It should be slightly negative. If it is approximately +4 Vdc while A4TP6 is approximately +7.5 Vdc, the modulator diode is probably open. If MOD 0 is at 0.0 Vdc, but A4TP6 is at +7.5 Vdc, troubleshoot the A4 PIN Mod 0 Driver and connections to the modulator.

HARMONIC DISTORTION

- A12 YIG OSCILLATOR. If harmonics are unnacceptable, check the spectral purity of the YO output. If harmonics are less than 14 dB below the fundamental, replace A12.

- A14 AMPLIFIER. Check the power level into A17 Mod/Mix, and trace the problem back through the RF path if it is too low. Measuring power or spectral content directly out of A17 or A14 will open the ALC loop, causing maximum unleveled power and high harmonic distortion even without a failure. Refer to A4 Troubleshooting and perform the Open Loop Procedure. This procedure externally biases the modulator to level RF power while the ALC loop is open.

SPURIOUS DISTORTION

- A17 MOD/MIX. Select a CW frequency anywhere in the band and check RF output for spurs 3.8 GHz removed from the carrier. The mixer may be leaking the swept LO frequency (3.81 − 6.2 GHz). However, the A14 Amplifier should filter these out.

POWER DROP-OUTS

- A12 YIG OSCILLATOR. If power is present and leveled across part of either band, but drops out entirely for the rest of the band, suspect A12. Check OSC BIAS for approximately −10 Vdc. Check the RF power directly out of the YO. If it appears to be faulty refer to Section V, Adjustments, and perform the A7 Oscillator Bias adjustments.

POWER HOLES

- Check all RF connections in the proper loop(s). Narrow-band power dips or "holes" are usually the result of loose or faulty RF connections. Tighten all internal RF connectors. Secure the front-panel RF connection. Inspect the front-panel RF connector for damage or wear, and clean or replace parts as necessary. Section VI, Replaceable Parts, provides an exploded view of the RF connector.

Microcircuit Verification By Assembly

The information below is organized by microcircuit assembly in RF signal flow order. It provides troubleshooting tips to isolate a particular microcircuit failure. This information is intended as a guide. Any suspected failure should be thoroughly researched before replacements are made.

The general approach to troubleshooting is:

1. Make sure that all power supply voltages are present. If not, trace the problem back through the 83522A 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

A16 CAVITY OSCILLATOR

The output of this assembly should measure approximately +9 dBm RF power at 3.8 GHz.

A17 MODULATOR/MIXER

Ensure that A16 is functioning. Control line MOD 0 should be near +0.7 Vdc. If not, remove the modulation control wire and check for approximately +5 Vdc. If this is not the case, troubleshoot A4. To verify the MOD/MIXER, remove the A4 assembly. Monitor the RF output directly from A17. In this open loop condition the power should measure approximately −12 dBm. (Expect high harmonic distortion.)

A14 AMPLIFIER

Check for power input as described under A17, above. Verify RF output at approximately +20 dBm unleveled with high harmonic distortion. When trying to isolate harmonic sources, refer to A4 Troubleshooting and follow the Open Loop Procedure. This procedure externally biases the modulators to level the RF power under open loop conditions.

A15 DC RETURN

An A15 failure is extremely unlikely. However, this component can be tested OUT OF CIRCUIT with an ohmmeter. Verify DC short to ground.

DC1 DIRECTIONAL DETECTOR

Check for approximately +15 dBm of leveled output power. Ensure that power is nominally +13 dBm and check the detector output, E2, for approximately −0.2 Vdc or more negative. If temperature drift is suspected, check that the INT DET 0 BIAS adjustment (A4R4) has an effect on the detected output level. If it does not, replace DC1.

A19 STEP ATTENUATOR (Option 002 Only)

Check the output of DC2 for approximately +13 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.

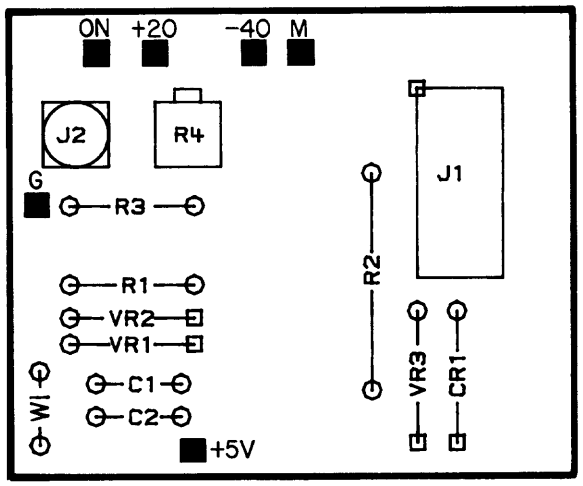


Figure 8-64. A12A1 YO Bias, Component Locations

RF SCHEMATIC DIAGRAM

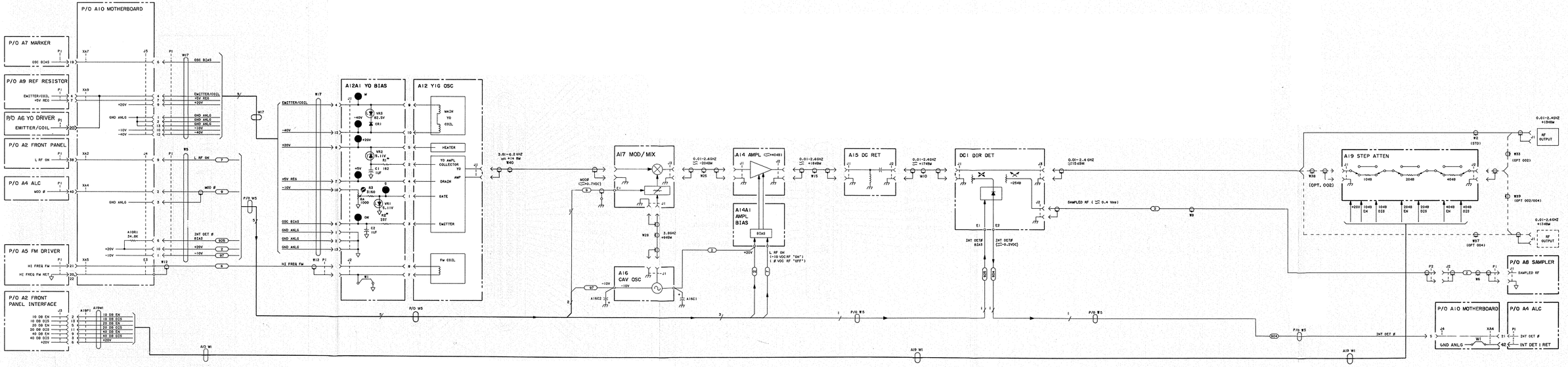


Figure 8-65. RF Schematic Diagram

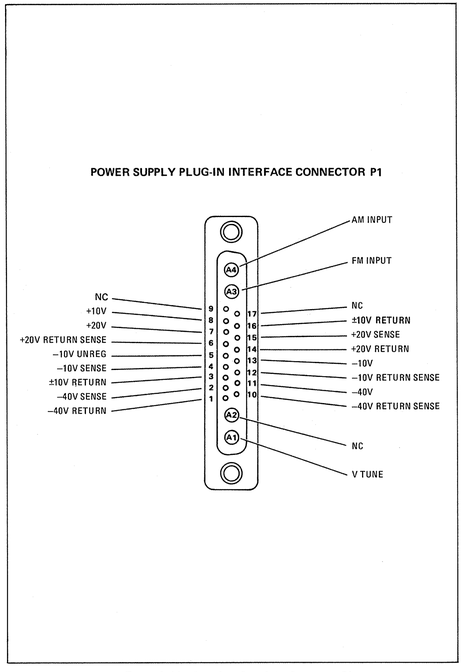


Figure 8-66. Interface Signals in Connector P1

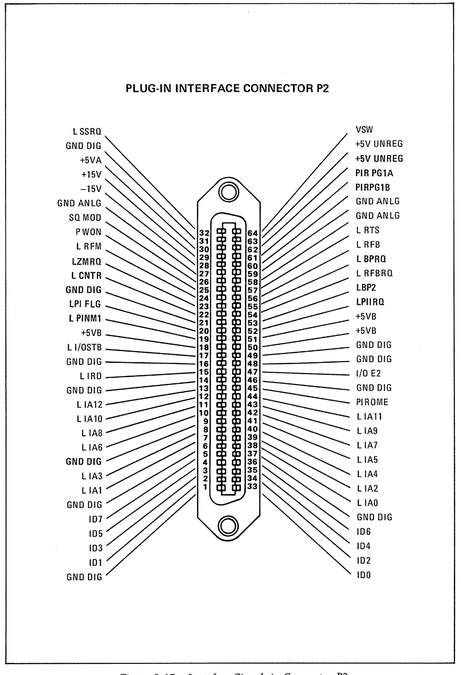


Figure 8-67. Interface Signals in Connector P2

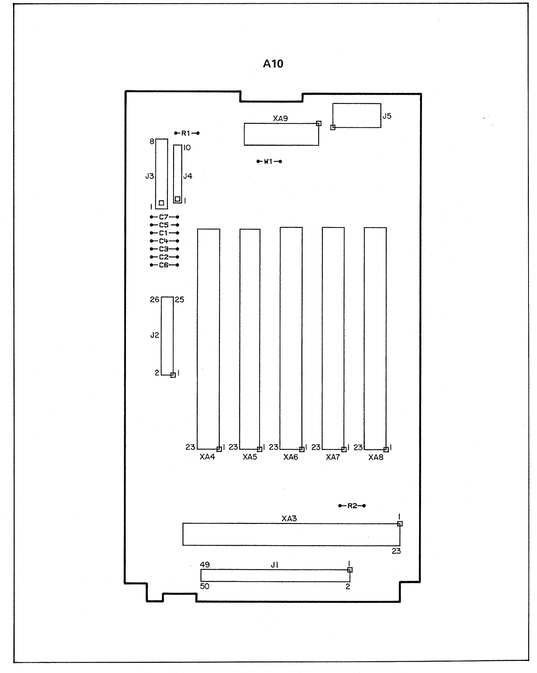


Figure 8-68. A10 Motherboard, Component Locations

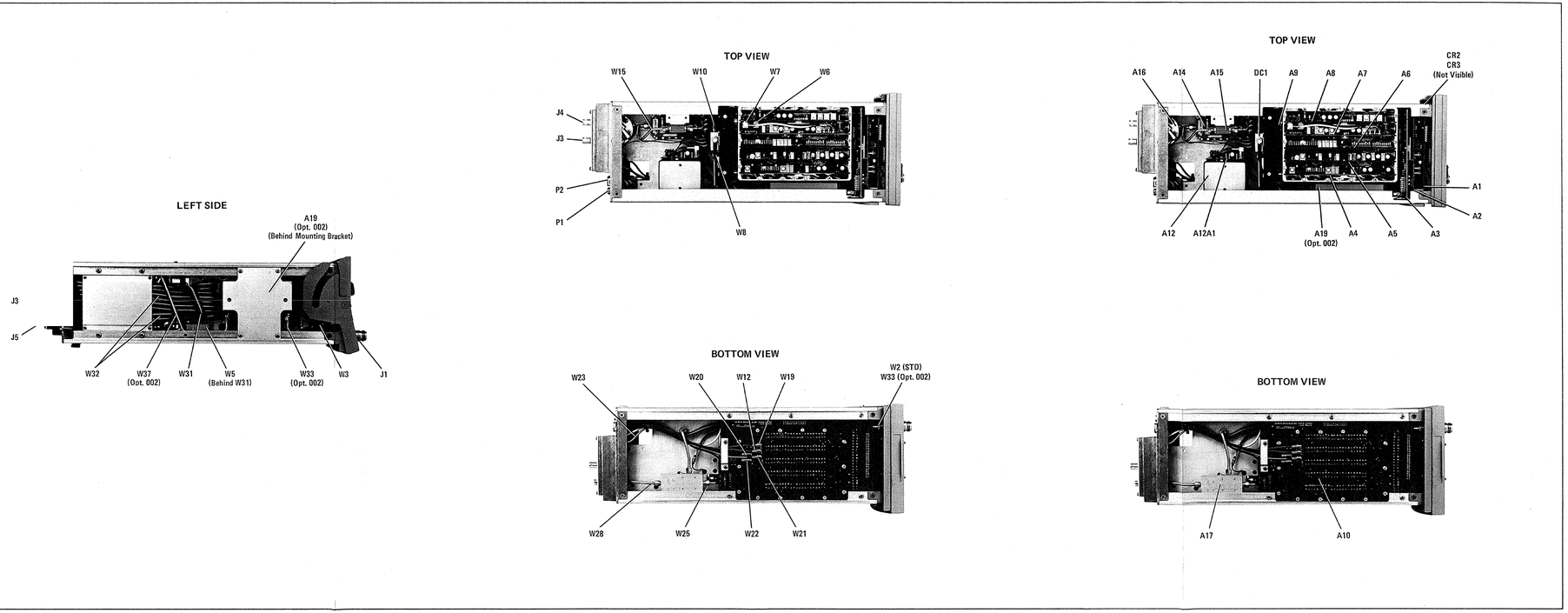


Figure 8-69. Major Assemblies Locations

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-in Interface P2	Dig Interface A3P1	Dig Interface A3J1	ALC A4P1	FM A5P1	YO A6P1	Marker A7P1	Sampler A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	RF Wiring Harness A10J4	RF Ribbon Cable A10J5	Miscellaneous
AM	P1-A4	Amplitude Modulation	A4-C[1]				4											E4-C[1]
BASE	A6P1-22	YO Current Drive Control							22			1						
L BØSW1	A7P1-21	RF Switch; −10V=Band Ø (Not Used)								21*						7		
L BØSW2	A7P1-22	RF Switch; −10V=Band Ø (Not Used)								22*						8		
BAØ	A3P1-33	Buffered Addr Ø			33		33	33	33	33	33*		11					
BA1	A3P1-11	Buffered Addr 1			11		11	11	11	11	11*							
BA2	A3P1-34	Buffered Addr 2			34		34	34	34	34	34*							
BA3	A3P1-12	Buffered Addr 3			12		12	12	12	12	12*							
BDØ	A3P1-31	Buffered Data Ø			31		31	31	31	31	31		5					
BD1	A3P1-9	Buffered Data 1			9		9	9	9	9	9		3					
BD2	A3P1-32	Buffered Data 2			32		32	32	32	32	32		7					
BD3	A3P1-10	Buffered Data 3			10		10	10	10	10	10		9					
BD4	A3P1-35	Buffered Data 4			35		35	35	35	35	35		15					
BD5	A3P1-13	Buffered Data 5			13		13	13	13	13	13		13					
BD6	A3P1-36	Buffered Data 6			36		36	36	36	36	36		19					
BD7	A3P1-14	Buffered Data 7			14		14	14	14	14*	14		17					
BIRDIE	A8P1-1	Marker Birdie								1	1							
BIRDIE RET	A8P1-2	Marker Birdie Return								2	2							
L BPRQ	A6P1-2	L=Blanking Pulse Request							2*					4				
L CNTR	P2-22	L=Counter Trigger (Not Used)		22														
COLLECTOR	A9P1-2	Ref Resistor Sense							41			2						
DET REF	A4P1-40	Detected Power Reference (Not Used)					40											
DLY COMP	A7P1-26	YO Delay Compensation							26	26								
EMITTER/COIL	A9P1-4	YO Coil Current							20			4					4	
EXT CAL	A10J1-41	External Leveling Power Cal					24						41					
EXT DET	A10J1-47	External Leveling Input					23						47					
EXT DET RET	A10J1-43	External Leveling Return					1						43					
FLAG	A10J1-31	Front Panel Flag			42								31					
FM IN	P1-A3	Frequency Modulation Input	A3-C[1]					40										E1-C[1]
FM IN RET	P1-A3	Frequency Modulation Return	A3-S[2]					39,41										E1-S[2]

[1] Coaxial Cable - Center conductor
[2] Coaxial Cable - Shield
* Not used on this assembly

Table 8-13. 83522A Motherboard Wiring List (1 of 5)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-in Interface P2	Dig Interface A3P1	Dig Interface A3J1	ALC A4P1	FM A5P1	YO A6P1	Marker A7P1	Sampler A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	RF Wiring Harness A10J4	RF Ribbon Cable A10J5	Miscellaneous
L FP1	A3P1-15	L=F.P. Display Write			15								21					
L FP2	A3P1-37	L=F.P. Keyboard Read			37								23					
L FP3	A3P1-16	L=F.P. Annunciator Write			16								25					
L FP4	A3P1-26	L=F.P. Annunciator Write			26								6					
L FP5	A3P1-30	L=F.P. RF Control			30								1					
FREQ CAL	A10J1-37	Band Ø Freq Cal							4				37					
FREQ TRK V	A10J1-36	Frequency Tracking Voltage					26	24					36					
HI FREQ FM	A5P1-21	YO FM Coil Drive						21										E3-C[1]
HI FREQ FM RET	A5P1-20,22	YO FM Coil Return						20,22										E3-S[2]
L IAØ	P2-38	Instr Bus - Inv Addr Ø		38		12												
L IA1	P2-7	Instr Bus - Inv Addr 1		7		13												
L IA2	P2-39	Instr Bus - Inv Addr 2		39		14												
L IA3	P2-8	Instr Bus - Inv Addr 3		8		15												
L IA4	P2-40	Instr Bus - Inv Addr 4		40		16												
L IA5	P2-41	Instr Bus - Inv Addr 5		41		18												
L IA6	P2-10	Instr Bus - Inv Addr 6		10		19												
L IA7	P2-42	Instr Bus - Inv Addr 7		42		20												
L IA8	P2-11	Instr Bus - Inv Addr 8		11		21												
L IA9	P2-43	Instr Bus - Inv Addr 9		43		22												
L IA10	P2-12	Instr Bus - Inv Addr 10		12		23												
L IA11	P2-44	Instr Bus - Inv Addr 11		44		24												
L IA12	P2-13	Instr Bus - Inv Addr 12		13		25												
IDØ	P2-33	Instr Bus - Data Ø		33		2												
ID1	P2-2	Instr Bus - Data 1		2		3												
ID2	P2-34	Instr Bus - Data 2		34		4												
ID3	P2-3	Instr Bus - Data 3		3		5												
ID4	P2-35	Instr Bus - Data 4		35		6												
ID5	P2-4	Instr Bus - Data 5		4		7												
ID6	P2-36	Instr Bus - Data 6		36		8												
ID7	P2-5	Instr Bus - Data 7		5		9												

[1] Coaxial Cable - Center conductor

[2] Coaxial Cable - Shield

* Not used on this assembly

Table 8-13. 83522A Motherboard Wiring List (2 of 5)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-in Interface P2	Dig Interface		ALC A4P1	FM A5P1	YO A6P1	Marker A7P1	Sampler A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	RF Wiring Harness A10J4	RF Ribbon Cable A10J5	Miscellaneous
					A3P1	A3J1												
L INST1	A3P1-8	L=Plug-in Control			8		18	5		18	18*							
L INST2	A3P1-29	L=Plug-in Control			29				18									
INT DET Ø	A10J4-5	Band Ø RF Detector					21									5		
INT DET Ø BIAS	A10R1	Band Ø Detector Bias														6		R1
INT DET 1 RET	CR1	Band 1 RF Detector (Not Used)					20*											E2-C[1]
INT DET RET	CR1	Band 1 RF Detector Return (Not Used)					42*											E2-S[2]
I/O E2	P2-47	Plug-in I/O Enable		47		30												
L I/OSTB	P2-17	Inv I/O Strobe		17		33												
L IRD	P2-15	L=Instr Bus Read		15		29												
LO FREQ FM	A5P1-2	Low Freq FM (Main Call)						2	25									
L MKRLED	A7P1-3	L=Marker LED								3			10					
MOD Ø	A4P1-44	Band Ø RF Modulation					44									2		
MOD 1	A4P1-19	Band 1 RF Modulation (Not Used)					19*										15	
MOD DRIVE	A4P1-22	Modulator Drive (Not Used)					22											
OSC BIAS	A7P1-19	YIG Oscillator Bias								19							6	
L PIFLG	A3J1-39	L=Plug-in Flag		20		39												
L PIIRQ	A3J1-40	L=Plug-in Interrupt Request		52		40												
L PINMI	(NC)	L=Plug-in Non-Maskable Interrupt		19														
PIROME	P2-45	Plug-in ROM Enable		45		26												
PIRPGA	A10J1-35	Plug-in RPG A		60									35	14				
PIRPGB	A10J1-34	Plug-in RPG B		61									34	16				
PULSE IN	J5(BNC)	External Pulse Input								43								E6-C[1]
L PULSE	A7P1-4	L=Pulse Mod					41			4	23						16	
PWON	P2-25	Power On		25	22				15				29	7				
PWR REF	A4P1-3	Power Level Reference					3				26							
PWR SW/COMP	A5P1-23	Power Sweep, Level Compensation					5	23										
L RFB	P2-56	L=RF Blanking		56			29							6				
L RFBRQ	A6P1-24	L=RF Blanking Request		54					24*					2				
L RFM	P2-24	L=RF Marker		24						41				5				
L RFON	A10J1-38	−10V=RF On, 0V=RF Off								40			38			9		
L RTS	P2-57	L=Retrace Strobe		57					1				4	8				

[1] Coaxial Cable - Center Conductor

[2] Coaxial Cable - Shield

* Not used on this assembly

Table 8-13. 83522A Motherboard Wiring List (3 of 5)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-in Interface P2	Dig Interface A3P1	Dig Interface A3J1	ALC A4P1	FM A5P1	YO A6P1	Marker A7P1	Sampler A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	RF Wiring Harness A10J4	RF Ribbon Cable A10J5	Miscellaneous
SCAN CLK	A3P1-38	F.P. Scan Clock			38								27					
SC VTUNE	A6P1-29	Scaled Tune Voltage							29	29								
L SIRQ	A6P1-3	L=Sweep Interrupt Request			18				3									
L SMPLEN	A7P1-25	L=Sampler Latch Enable								25	25							
SQMOD	P2-26	Square Modulation (27.8/1.0 kHz)		26						42				9				
L SSRQ	A6P1-23	L=Stop Sweep Request		32					23*	20				21				
L UNLVL	A4P1-2	L=Unleveled					2		40				12					
VSW	P2-64	Sweep Voltage		64				25						22				
VTUNE	P1-A1	Tune Voltage	A1-C[1]						44									E5-C[1]
VTUNE RET	P1-A1	Tune Voltage Return	A1-S[2]						43									E5-S[2]
YO DRIVE V	A6P1-42	YO Drive Voltage							42	5			39					
L ZMRQ	A7P1-23	L=Intensity Marker Request		23						23				3				
L 1DBMKR	A7P1-24	L=1dB Amplitude Marker					25			24								
1V/GHZ	A10J1-50	1V per GHz Output											50	23				J4(BNC)
−10V REF	A6P1-5	−10V Reference Voltage					43		5									
+20V FREQ REF	A9P1-5	+20V Frequency Reference Sense							21			5						

[1] Coaxial Cable - Center Conductor

[2] Coaxial Cable - Shield

* Not used on this assembly

Table 8-13. 83522A Motherboard Wiring List (4 of 5)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-in Interface P2	Dig Interface A3P1	Dig Interface A3J1	ALC A4P1	FM A5P1	YO A6P1	Marker A7P1	Sampler A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	RF Wiring Harness A10J4	RF Ribbon Cable A10J5	Miscellaneous
+20V +20V RET +20V RET SENSE +20V SENSE	P1-7 P1-14 P1-6 P1-15	+20V Regulated +20V Return +20V Return Sense +20V Sense	7 14 6 15				16*	16*	16	16*	16*	3,11	42		3 6	10	9	C7,R1
+15V	P2-29	+15V Regulated		29			38	38	38	38	38			15				C6
+10V +10/−10V RET	P1-8 P1-3, 16	+10V Regulated +/−10V Return	8 3				7	7	7	7	7		46		2		5,11	C5
+5V +5VA +5VB	A3P1-6,7 P2-30 P2-18,50,51	+5V Internal for RF Plug-in +5V for 8350A +5V for RF Plug-in		30 18,50,51	6,7	 35, 36, 38	27	27	27	27	27*		2					
+5V REG +5V UNREG	A9P1-7 P2-62, 63	+5V Regulated +5V Unregulated		62, 63						44	22	7 12		18,20			7	C4
−10V −10V RET SENSE −10V SENSE −10V UNREG	P1-13 P1-12 P1-4 P1-5	−10V Regulated −10V Return Sense −10V Sense −10V Unregulated	13 12 4 5				17	17	17	17	17		40		5	1	10	C3
−15V	P2-28	−15V Regulated		28			28	28	28	28	28			13				C2
−40V −40V RET −40V RET SENSE −40V SENSE	P1-11 P1-1 P1-10 P1-2	−40V Regulated −40V Return −40V Return Sense −40V Sense	11 1 10 2				6*, 39		6, 39	6*, 39*	6*, 39*				7		12	C1
GND ANLG	P2-27,58,59	Analog Ground					15, 37	15*,37	19, 37	15, 37	15,37* 40,41,42, 43,44	6	48	10,11,12	8	3, 4	1, 2, 13	C1-C7,R2,W1 E1-S[2], E5-S[2]
GND DIG	P2-1, 6, 14, 16,21,31,37, 46, 48, 49	Digital Ground		1, 6, 14, 16, 21, 31, 37, 46, 48, 49	4, 5	1,10,11, 17,27,28, 31,32,34, 41	8, 30	8, 30	8, 30	8, 30	8*, 30*		8					R2

[1] Coaxial Cable - Center Conductor

[2] Coaxial Cable - Shield

* Not used on this assembly

Table 8-13. 83522A Motherboard Wiring List (5 of 5)

Table 8-14. HP 83522A Cable List (Sheet 1 of 2)

Cable	Description	Connections
W1	Not Assigned	
W2	Cable Assembly, Rigid, RF OUTPUT	DC–Directional Coupler J1–Front Panel RF OUTPUT (Type N)
W3	Cable Assembly, Ribbon, Front Panel	A10J1–Motherboard A2J1–Front Panel
W4	Not Assigned	
W5	Wire Assembly, RF Section	A10J4 Motherboard A14A1, A16, A17, DC1 (RF Section)
W6	Cable Assembly, Coax, Red	W8P1–Shield Cage A8J1–Sampler Board (Sampled RF)
W7	Cable Assembly, Coax, Yellow	W23P1–Shield Cage A8J2–Sampler Board (EXT MKR)
W8	Cable Assembly, Coax, Red	DC1–Dir. Detector (Sampled RF) W6J1–Shield Cage
W9	Not Assigned	
W10	Cable Assembly, Rigid, RF	A15–DC Return DC1–Directional Detector
W11	Not Assigned	
W12	Cable Assembly, Coax, Blue	A10E3–Motherboard A12A1J2–YO (FM Coil)
W13	Not Assigned	
W14	Not Assigned	
W15	Cable Assembly, Rigid, RF	A14–Amplifier (0.01 to 2.4 GHz) A15–DC Return
W16	Not Assigned	
W17	Cable Assembly, Ribbon, RF Section	A10J5–Motherboard A12A1J1–YO
W18	Not Assigned	
W19	Cable Assembly, Coax, Green, FM IN	P1-A3–Rear Panel Interface A10E1–Motherboard
W20	Cable Assembly, Coax, Brown, AM	P1-A4–Rear Panel Interface A10E4–Motherboard

Table 8-14. HP 83522A Cable List (Sheet 2 of 2)

Cable	Description	Connections
W21	Cable Assembly, Coax, Orange, VTUNE	P1-A1–Rear Panel Interface A10E5–Motherboard
W22	Cable Assembly, Coax, Violet, PULSE IN	J5–Rear Panel BNC (PULSE IN) A10E6–Motherboard
W23	Cable Assembly, Coax, Yellow, EXT MKR	J3–Rear Panel BNC (EXT MKR) W7J1–Shield Cage
W24	Not Assigned	
W25	Cable Assembly, Rigid, RF	A17–Modulator/Mixer A14–Amplifier (0.01 to 2.4 GHz)
W26	Not Assigned	
W27	Not Assigned	
W28	Cable Assembly, Rigid, RF	A16–Cavity Oscillator A17–Modulator/Mixer
W29	Not Assigned	
W30	Not Assigned	
W31	Cable Assembly, Power Supply	P1–Rear Panel Interface A10J3–Motherboard
W32	Cable Assembly, Ribbon	P2–Rear Panel Interface A3J1–Digital Interface Board A10J2–Motherboard J4–Rear Panel BNC (1V/GHz Output)
W33	Cable Assembly, Rigid, RF (Opt. 002)	A19–RF Step Attenuator J1–Front Panel RF OUTPUT (Type N)
W34	Not Assigned	
W35	Not Assigned	
W36	Not Assigned	
W37	Cable Assembly, Rigid, RF (Opt. 004)	DC1–Directional Detector J1–Rear Panel RF OUTPUT (Type N)
W38	Cable Assembly, Rigid, RF (Opt. 002)	DC1–Directional Detector A19–Step Attenuator
W39	Cable Assembly, Rigid, RF (Opt. 002, 004)	A19–Step Attenuator J1–Rear Panel RF OUTPUT (Type N)
W40	Cable Assembly, Rigid, RF	A12–YO A17–Modulator/Mixer

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E Electronic Instruments & Measurement Systems
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IMPORTANT:These symbols designate general product line capability.They do not insure sales or support availability for all products within a line, at all locations.Contact your local sales office for information regarding locations where HP support is available for specific products.

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Tel: (61) 40-11-12
Telex: 531639F
A,C,E,P*

Hewlett-Packard France
9, rue Baudin
26000 **VALENCE**
Tel: (75) 42 76 16

Hewlett-Packard France
Carolor
ZAC de Bois Briand
57640 **VIGY** (Metz)
Tel: (8) 771 20 22
C

Hewlett-Packard France
Parc d'activité des Prés
1, rue Papin
59658 **VILLENEUVE D'ASCQ** Cedex
Tel: (20) 47 78 78
Telex: 160124F
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GABON

Sho Gabon
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LIBREVILLE
Tel: 721 484
Telex: 5230

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Geschäftsstelle
Keithstrasse 2-4
D-1000 **BERLIN** 30
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Hewlett-Packard GmbH
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D-7030 **BÖBLINGEN**
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Telex: 7265 743 hep
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Berliner Strasse III
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Telex: 589 070 hprad
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Hewlett-Packard GmbH
Geschäftsstelle
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Telex: 822858 hepdad
A,C,E

Hewlett-Packard GmbH
Vertriebszentrum Mitte
Hewlett-Packard-Strasse
D-6380 **BAD HOMBURG**
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Hewlett-Packard GmbH
Vertriebszentrum Nord
Kapstadtring 5
D-2000 **HAMBURG** 60
Tel: (040) 63804-1
Telex: 021 63 032 hphh d
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Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 **HANNOVER** 61
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Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 **MANNHEIM**
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A,C,E

Hewlett-Packard GmbH
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Messerschmittstrasse 7
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Telex: 0712816 HP ULM-D
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Hewlett-Packard GmbH
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Hewlett-Packard GmbH
Vertriebszentrum Süd
Eschenstrasse 5
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A,C,E

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Greece
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Kostas Karaynnis S.A.
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ATHENS 133
Tel: 32 30 303, 32 37 371
Telex: 215962 RKAR GR
A,C*,CM,E

Impexin
Intelect Div.
209 Mesogion
11525 **ATHENS**
Tel: 6474481/2
Telex: 216286
P

Haril Company
38, Mihalakopoulou
ATHENS 612
Tel: 7236071
Telex: 218767
M*

Hellamco
P.O. Box 87528
18507 **PIRAEUS**
Tel: 4827049
Telex: 241441
A

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GUATEMALA CITY
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Telex: 66678 HEWPA HX
Cable: HEWPACK Hong Kong
E,C,P

CET Ltd.
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64-66 Gloulester Road
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Tel: (5) 200922
Telex: 85148 CET HX
CM

Schmidt & Co. (Hong Kong) Ltd.
18th Floor, Great Eagle Centre
23 Harbour Road
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A,M

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Hewlett-Packard Iceland
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Computer products are sold through Blue Star Ltd.All computer repairs and maintenance service is done through Computer Maintenance Corp.

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Sabri Complex 2nd Floor
24 Residency Rd.
BANGALORE 560 025
Tel: 55660, 578881
Telex: 0845-430
Cable: BLUESTAR
A,C*,CM,E

Blue Star Ltd.
Band Box House
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BOMBAY 400 025
Tel: 4933101, 4933222
Telex: 011-71051
Cable: BLUESTAR
A,M

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
BOMBAY 400 025
Tel: 422-6155, 422-6556
Telex: 011-71193 BSSS IN
Cable: FROSTBLUE
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Blue Star Ltd.
Kalyan, 19 Vishwas Colony
Alkapuri, **BORODA,** 390 005
Tel: 65235, 65236
Cable: BLUE STAR
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Blue Star Ltd.
7 Hare Street
CALCUTTA 700 001
Tel: 230131, 230132
Telex: 021-7655
Cable: BLUESTAR
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Blue Star Ltd.
133 Kodambakkam High Road
MADRAS 600 034
Tel: 472056, 470238
Telex: 041-379
Cable: BLUESTAR
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Blue Star Ltd.
13 Community Center
New Friends Colony
NEW DELHI 110 065
Tel: 633773, 634473
Telex: 031-61120
Cable: BLUEFROST
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Blue Star Ltd.
15/16 C Wellesley Rd.
PUNE 411 011
Tel: 22775
Cable: BLUE STAR
A

Blue Star Ltd.
2-2-47/1108 Bolarum Rd.
SECUNDERABAD 500 003
Tel: 72057, 72058
Telex: 0155645
Cable: BLUEFROST
A,E

Blue Star Ltd.
T.C. 7/603 Poornima
Maruthunkuzhi
TRIVANDRUM 695 013
Tel: 65799, 65820
Telex: 0884-259
Cable: BLUESTAR
E

Computer Maintenance Corporation Ltd.
115, Sarojini Devi Road
SECUNDERABAD 500 003
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Telex: 031-2960
C**

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BERCA Indonesia P.T.
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Jl. Abdul Muis 62
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Telex: 46748 BERSAL IA
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BERCA Indonesia P.T.
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JAKARTA-PUSAT
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Telex: 46748 BERSAL IA
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Jalan Kutai 24
SURABAYA
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Telex: 31146 BERSAL SB
Cable: BERSAL-SURABAYA
A*,E,M,P

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Hewlett-Packard Trading S.A.
Service Operation
Al Mansoor City 9B/3/7
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Telex: 212-455 HEPAIRAQ IK
C

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Hewlett-Packard Ireland Ltd.
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Cardiac Services Ltd.
Kilmore Road
Artane
DUBLIN 5
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M

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Arranged alphabetically by country

ISRAEL
Eldan Electronic Instrument Ltd.
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16, Ohaliav St.
JERUSALEM 94467
Tel: 533 221, 553 242
Telex: 25231 AB/PAKRD IL
A,M

Computation and Measurement Systems (CMS) Ltd.
11 Masad Street
67060
TEL-AVIV
Tel: 388 388
Telex: 33569 Motil IL
C,CM,E,P

ITALY
Hewlett-Packard Italiana S.p.A
Traversa 99C
Via Giulio Petroni, 19
I-70124 **BARI**
Tel: (080) 41-07-44
C,M

Hewlett-Packard Italiana S.p.A.
Via Emilia, 51/C
I-40011 **BOLOGNA** Anzola Dell'Emilia
Tel: (051) 731061
Telex: 511630
C,E,M

Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43G/C
I-95126 **CATANIA**
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Telex: 970291
C

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio 9
I-20063 **CERNUSCO SUL NAVIGLIO**
(Milano)
Tel: (02) 4459041
Telex: 334632
A,C,CM,E,M,P

Hewlett-Packard Italiana S.p.A.
Via C. Colombo 49
I-20090 **TREZZANO SUL NAVIGLIO**
(Milano)
Tel: (02) 4459041
Telex: 322116
C

Hewlett-Packard Italiana S.p.A.
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I-80131 **NAPOLI**
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A**,C,E,M

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 **GENOVA PEGLI**
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Telex: 215238
C,E

Hewlett-Packard Italiana S.p.A.
Via Pelizzo 15
I-35128 **PADOVA**
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Hewlett-Packard Italiana S.p.A.
Viale C. Pavese 340
I-00144 **ROMA EUR**
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Telex: 610514
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Hewlett-Packard Italiana S.p.A.
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Hewlett-Packard Italiana S.p.A.
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I-10144 **TORINO**
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Telex: 221079
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S.I.T.E.L.
Societe Ivoirienne de Telecommunications
Bd. Giscard d'Estaing
Carrefour Marcory
Zone 4.A.
Boite postale 2580
ABIDJAN 01
Tel: 353600
Telex: 43175
E

S.I.T.I.
Immeuble "Le General"
Av. du General de Gaulle
01 BP 161
ABIDJAN 01
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C,P

JAPAN
Yokogawa-Hewlett-Packard Ltd.
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C,CM,E

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei Bldg. 6F
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Yokogawa-Hewlett-Packard Ltd.
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Yokogawa-Hewlett-Packard Ltd.
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C,CM,E

Yokogawa-Hewlett-Packard Ltd.
Asahi Shinbun Daiichi Seimei Bldg.
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KUMAMOTO, 860
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C,E

Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
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KYOTO, 600
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Yokogawa-Hewlett-Packard Ltd.
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Telex: 22247 MATIN KT
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LIBERIA
Unichemicals Inc.
P.O. Box 4509
MONROVIA
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E

MADAGASCAR
Technique et Precision
12, rue de Nice
P.O. Box 1227
101 **ANTANANARIVO**
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Telex: 22255
P

LUXEMBOURG
Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
B-1200 **BRUSSELS**
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Telex: 23-494 paloben bru
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Kuching, **SARAWAK**
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Telex: 70904 PROMAL MA
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MRIEHEL
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Telex: 1649
E,M,P

MAURITIUS
Blanche Birger Co. Ltd.
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P

MEXICO
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Francisco J. Allan #30
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P

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P

SALES & SUPPORT OFFICES
Arranged alphabetically by country

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P

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16020 **MEXICO D.F.**
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Hewlett-Packard De Mexico (Polanco)
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Colonia Granada 11560
MEXICO D.F.
Tel: 254-4433
P

Hewlett-Packard De Mexico, S.A. de C.V.
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409 Ote. 4th Piso
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Municipio de Garza Garciá
66220 **MONTERREY,** Nuevo León
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Telex: 038 410
P

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E

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Telex: 23 739
P

Sema-Maroc
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Telex: 13 216 HEPA NL
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NL 2900AA **CAPELLE A/D IJSSEL**
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C,E

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NL 5600 CH **EINDHOVEN**
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A,C,E,M,P

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C,CM,E,P

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AUCKLAND
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Telex: 60605
A,M

Northrop Instruments & Systems Ltd.
110 Mandeville St.
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CHRISTCHURCH
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Telex: 4203
A,M

Northrop Instruments & Systems Ltd.
Sturdee House
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Telex: NZ 3380
A,M

NIGERIA
Elmeco Nigeria Ltd.
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LAGOS
E

NORTHERN IRELAND
See United Kingdom

NORWAY
Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 **FYLLINGSDALEN** (Bergen)
Tel: 0047/5/16 55 40
Telex: 76621 hpnas n
C,E,M

Hewlett-Packard Norge A/S
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P.O. Box 34
N-1345 **OSTERÅS**
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OMAN
Khimjil Ramdas
P.O. Box 19
MUSCAT/SULTANATE OF OMAN
Tel: 745601
Telex: 5289 BROKER MB MUSCAT
P

Suhail & Saud Bahwan
P.O.Box 169
MUSCAT/SULTANATE OF OMAN
Tel: 734201
Telex: 5274 BAHWAN MB
E

Imtac LLC
P.O. Box 8676
MUTRAH/SULTANATE OF OMAN
Tel: 601695
Telex: 5741 Tawoos On
A,C,M

PAKISTAN
Mushko & Company Ltd.
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Cable: FEMUS Islamabad
A,E,M,P*

Mushko & Company Ltd.
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Abdullah Haroon Road
KARACHI 0302
Tel: 524131, 524132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi
A,E,M,P*

PANAMA
Electronico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 64-2700
Telex: 3483 ELECTRON PG
A,CM,E,M,P

PERU
Cía Electro Médica S.A.
Los Flamencos 145, Ofc. 301/2
San Isidro
Casilla 1030
LIMA 1
Tel: 41-4325, 41-3705
Telex: Pub. Booth 25306 PEC PISIDR
CM,E,M,P

SAMS
Arenida Republica de Panama 3534
San Isidro, LIMA
Tel: 419928/417108
Telex: 20450 PE LIBERTAD
A,C,P

PHILIPPINES
The Online Advanced Systems Corp.
2nd Floor, Electra House
115-117 Esteban Street
Legaspi Village, Makati
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Tel: 815-38-10 (up to 16)
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A,C,E,M,P

PORTUGAL
Mundinter Intercambio
Mundial de Comércio S.A.R.L.
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LISBON
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Telex: 16691 munter p
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Telex: 13316 SABASA
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Telectra-Empresa Técnica de Equipmentos Eléctricos S.A.R.L.
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Hewlett-Packard Division
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