Errata

Title & Document Type: **83590A RF Plug-In Operating and Service Manual**

Manual Part Number: **83590-90005**

Revision Date: **February 1982**

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HP References in this Manual

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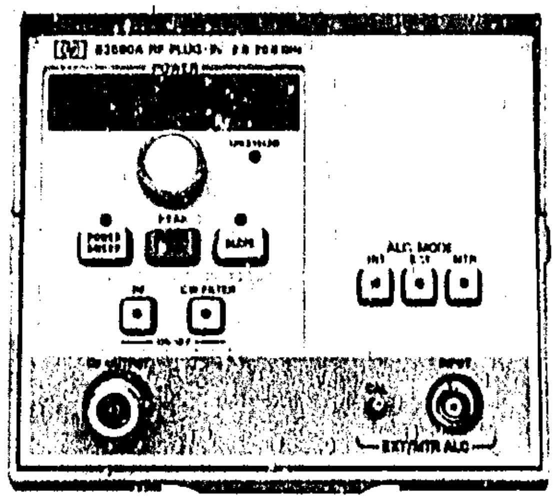
Agilent Technologies

OPERATING AND SERVICE MANUAL

83590A
RF PLUG-IN
2.0 to 20.0 GHz



PRESS PROOF

HEWLETT PACKARD

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

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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.

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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.

83590A
RF PLUG-IN
(Including Options 002, 004, and 005)

SERIAL NUMBERS

This manual applies directly to HP Model 83590A RF Plug-In having serial number prefix 2146A.

With changes described in Section VII this manual also applies to instruments with serial numbers prefixed 2143A.

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

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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.

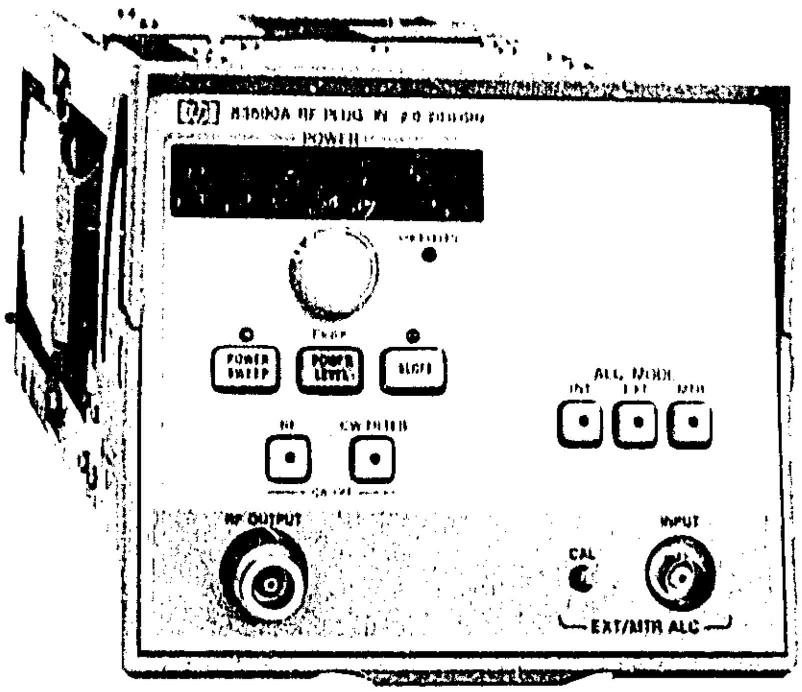


Figure 1-1. Model 83590A RF Plug-in

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 83590A RF Plug-in. Figure 1-1 shows the Model 83590A.

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

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

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

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

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

e. SECTION V, ADJUSTMENTS, presents procedures required to properly adjust and align the Model 83590A 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 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 83590A 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.

Table 1-1. Specifications for Model 83590A Installed in Model 8350A (1 of 3)

FREQUENCY[1]
Range: 2 to 20.0 GHz

Accuracy (25°C ±5°C)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20.0**	**2.0 to 20.0**
CW Mode	±5 MHz	±10 MHz	±10 MHz	———
All Sweep Modes (Sweep time >100 ms)	±20 MHz	±25 MHz	±30 MHz	±50 MHz[2]
Frequency Markers (Sweep time ≥100 ms)	±20 MHz ±.5% of sweep width	±25 MHz ±.5% of sweep width	±30 MHz ±.5% of sweep width	±50 MHz[2] ±.5% of sweep width
Stability				
With 10% Line Voltage Change	±50 kHz	±100 kHz	±150 kHz	±150 kHz
With 10 dB Power Level Change	±200 kHz	±400 kHz	±600 kHz	±600 kHz
With 3:1 Load SWR	±100 kHz	±200 kHz	±300 kHz	±300 kHz
With Time (in a 10 minute period after one hour warmup)	<±100 kHz	<±200 kHz	<±300 kHz	<±300 kHz
Residual FM, Peak (10 Hz to 10 kHz Bandwidth) (CW Mode with CW Filter)	<5 kHz	<7 kHz	<9 kHz	———

POWER OUTPUT

	Frequency Bands (GHz)					
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 18.6**	**13.5 to 20.0**	**2.0 to 18.6**	**2.0 to 20.0**
Maximum Leveled Output Power[2, 3, 4] (25°C)	+10 dBm	+10 dBm	+10 dBm	+8 dBm	+10 dBm	+8 dBm
With Option 002	+8.5 dBm	+8 dBm	+7 dBm	+5 dBm	+7 dBm	+5 dBm
Power Level Accuracy[10] (Internally Leveled)	<±1.3 dB	<±1.3 dB	<±1.4 dB	<±1.4 dB	<±1.5 dB	<±1.5 dB
With Option 002[5] (at 0 dB attenuator step)	<±1.5 dB	<±1.5 dB	<±1.6 dB	<±1.6 dB	<±1.7 dB	<±1.7 dB

Table 1-1. Specifications for Model 83590A Installed in Model 8350A (2 of 3)

POWER OUTPUT (Cont'd)

Minimum Settable Power: −5 dBm

With Option 002: −75 dBm

Attenuator Accuracy (±dB referenced from the 0 dB setting)	**Frequency Range (GHz)**	**Attenuator Setting (dB)**						
		10	**20**	**30**	**40**	**50**	**60**	**70**
	2.0 − 12.4	0.6	0.7	0.9	1.8	2.0	2.2	2.3
	12.4 − 18.0	0.7	0.9	1.2	2.0	2.3	2.5	2.8
	18.0 − 20.0	0.9	1.5	2.5	3.0	3.2	3.3	3.5

Power Variation (at specified Maximum Leveled Power or below)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20**	**2.0 to 20**
Internally Leveled	±0.7 dB	±0.7 dB	±0.8 dB	±0.9 dB
Externally Leveled Negative Crystal Detector[6] (Sweep time >100 ms)	±0.2 dB	±0.2 dB	±0.2 dB	±0.3 dB
Externally Leveled Power Meter[7]	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Residual AM in 100 kHz Bandwidth (in dB below carrier and at specified Maximum Leveled Power)	≥50 dB	≥50 dB	≥50 dB	≥50 dB
Spurious Signals (at specified Maximum Leveled Power)				
Harmonics (in dB below carrier)	>25 dB	>25 dB	>25 dB	>25 dB
Non-Harmonics	>50 dB	>50 dB	>50 dB	>50 dB
Output SWR (Internally Leveled)	<1.9	<1.9	<1.9	<1.9
With Option 002	<2.1	<2.1	<2.1	<2.1

Power Sweep[8]	**Frequency Bands (GHz)**					
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 18.6**	**13.5 to 20.0**	**.01 to 18.6**	**2.0 to 20**
Calibrated Range:[9]	>15 dB	>15 dB	>15 dB	>13 dB	>15 dB	>13 dB
With Option 002:	>13.5 dB	>13 dB	>12 dB	>10 dB	>12 dB	>10 dB

Table 1-1. Specifications for Model 83590A Installed in Model 8350A (3 of 3)

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 8755A/B/C Swept Amplitude Analyzer.
On/Off Ratio: ≥30 dB below specified Maximum Leveled Power.
Symmetry: 40/60
External FM
Maximum Deviations for Modulation Frequencies:

Modulation Frequency	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

GENERAL SPECIFICATIONS [1]
Minimum Sweep Time (over full band): 25 ms
Minimum Sweep Time (over single band): 10 ms
Band Switch Points: Internal band switch points at approximately 7.0 GHz, and 13.5 GHz
RF Output Connector: Type N Female

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

2 For temperatures greater than 25°C, maximum leveled output power typically degrades .1 dB/°C.

3 When RF Output is peaked with PEAK control.

4 0.5 dB lower for Option 004.

5 Attenuator switch points are every 10 dB starting at −5 dBm indicated power.

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

7 Use HP Model 432A/B/C Power Meter. Sweep time typically ≥5 seconds/GHz but not ≤10 seconds.

8 Power Sweep and Slope Compensation total must not exceed the specified Power Sweep calibrated range.

9 With Option 002, in power sweep or slope functions, power can exceed the attenuator step by the amount that the Power Sweep calibrated range exceeds 10 dB (i.e., if the calibrated range is 12 dB, power can exceed the attenuator step by 2 dB).

10 Includes power level variations.

Table 1-2. Supplemental Performance Characteristics for Model 83590A Installed in Model 8350A (1 of 3)

NOTE

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

FREQUENCY CHARACTERISTICS [1]

Accuracy (25°C ±5°C)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20.0**	**2.0 to 20.0**
CW Mode Typically	±2 MHz	±3 MHz	±4 MHz	
Manual Sweep	≤30 MHz	≤30 MHz	≤30 MHz	≤100 MHz
All Sweep Modes (Sweep time 10 ms to 100 ms)	≤±6 MHz	≤±8 MHz	≤±10 MHz	≤±35 MHz
Sweep Mode Linearity [2]	≤±2 MHz	≤±4 MHz	≤±6 MHz	≤±10 MHz
Stability with Temperature	±200 kHz/°C	±400 kHz/°C	±600 kHz/°C	±600 kHz/°C

OUTPUT CHARACTERISTICS [1]

Power Output

Resolution (Displayed): 0.1 dB

Resolution (Power): Typically ±0.01 dB

Stability with Temperature (at specified Maximum Leveled Power): ±0.1 dB/°C

Power Variation (at specified Maximum Leveled Power or below)

Externally leveled with Negative Crystal Detector: [5] ±0.25 dB

Spurious Signals (in dB below carrier and at specified Maximum Leveled Power)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20.0**	**2.0 to 20.0**
Harmonics and Subharmonics	>40 dB	>35 dB	>35 dB	>35 dB
Non Harmonics Typically	>55 dB	>55 dB	>55 dB	>55 dB

Power Sweep [3]

Accuracy (Including Linearity): Typically ±1.5 dB

Resolution (Displayed): 0.1 dB

Slope Compensation [3]

Linearity: Typically <0.2 dB

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

Resolution (Displayed): 0.01 dB/GHz

Table 1-2. Supplemental Performance Characteristics for Model 83590A Installed in Model 8350A (2 of 2)

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
7.0 to 20.0 GHz: Squarewave modulation up to 30 kHz
2.0 to 7.0 GHz:
Rise/Fall Time: Typically 10 ns
Minimum Pulse Width:
Leveled: Typically 1 μs
Unleveled Power level set to +20 dBm: Typically 100 ns

External FM

Frequency Response (DC to 2 MHz): Typically ±3 dB
Sensitivity (Switch selectable)
Typically −20 MHz/V (FM Mode)
Typically −6 MHz/V (Phase-Lock Mode)
Imput Impedance: 2000 Ohms nominal

GENERAL CHARACTERISTICS [1]

Frequency Reference Output: 1 V/GHz ±25 mV (2 to 18 GHz) rear panel BNC output.
Auxiliary Output: Rear panel 2 to 7 GHz fundamental oscillator output, nominally 1 dBm.
Weight: Net 6.0 kg (13.2 lb.); Shipping 9.2 kg (20 lb.)

1 Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0°to 55°C.
2 With respect to the SWEEP OUT voltage.
3 Power Sweep and Slope Compensation must not exceed the specified Power Sweep calibrated range.
4 With Option 002 in power sweep or slope functions, power can exceed attenuator step by the amount that the Power Sweep calibrated range exceeds 10 dB (i.e., if the calibrated range is 12 dB, power can exceed the attenuator step by 2 dB).
5 Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −200 mV at specified maximum leveled power.

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.

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 83590A is an RF Plug-in which has been designed for use with the Model 8350A

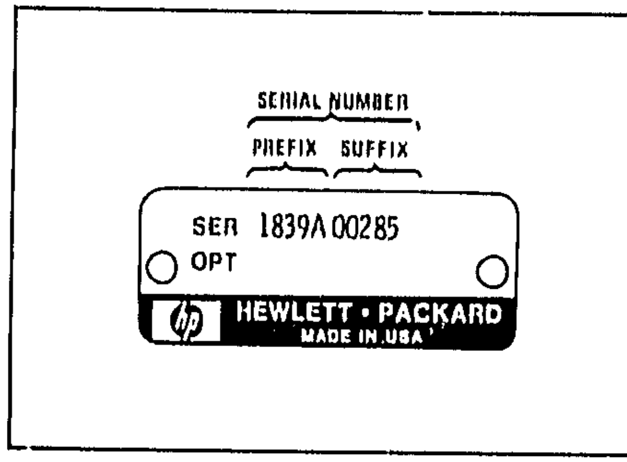


Figure 1-2. Typical Serial Number Plate

Sweep Oscillator. The Model 83590A covers the frequency range of 2 to 20.0 GHz in three bands. A YIG oscillator is used as the tunable RF frequency source of all bands. The YIG oscillator fundamental frequency is used for Band 1 (2.0 to 7.0 GHz). A YIG Tuned Multiplier (YTM) is used to multiply the YIG oscillator frequency for Bands 2 and 3 (6.9 to 13.5 GHz and 13.4 to 20.0 GHz).

1-18. Model 83590A front panel functional controls, pushbuttons, and the Rotary Pulse Generator (RPG), are monitored by the Model 8350A via the RF Plug-in interface circuits. The Model 8350A generates a tuning voltage according to the mode of operation (CW, START/STOP, CF/ΔF). This signal is scaled and offset by the Plug-in to provide a voltage ramp (in swept modes) proportional to the YIG oscillator frequency. The Model 83590A tuning circuits accept the tuning ramp output from the Model 8350A and convert it to a current which drives the YIG oscillator tuning coil.

1-19. The standard Model 83590A offers internally leveled RF output power. Internal (INT), External (EXT), and Power Meter (MTR) leveling are 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 83590A RPG, the Model 8350A data entry controls (keypad and step keys), or through HP-IB control via the Model 8350A.

1-20. A power sweep function allows the RF output power to be swept at least 10 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 83590A RPG or manipulating the Model 8350A data entry controls. The power sweep function and slope compensation may both be selected and modified through HP-IB control via the Model 8350A.

1-21. The RF output may be internally or externally amplitude modulated, or externally frequency modulated. Internal square wave modulation frequency is selectable by a Model 8350A internal jumper to be either 1 kHz or 27.8 kHz (for use with the Model 8755 Swept Amplitude 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 83590A. Refer to Section III, Operation, of this manual for detailed information on the configuration switch.

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

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

1-24. OPTIONS

1-25. Option 002, 70 dB Attenuator

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

1-27. Option 004, Rear Panel RF Output

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

1-29. Option 005, APC-7 ®* RF Output Connector

1-30. Option 005 instruments have an APC-7 RF output connector.

1-31. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-32. To have a complete operating sweep oscillator unit, the Model 83590A 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.

1-33. EQUIPMENT AVAILABLE

1-34. Service Accessories

1-35. A Service Accessory Kit (HP Part Number 08350-60020) is available for servicing the Model 83590A RF Plug-in and the Model 8350A Sweep Oscillator. HP Part Numbers for the individual pieces of the kit are provided in Table 1-3. The accessory kit includes:

- Two 44-pin printed circuit board extenders. These boards have keyed slots which allow them to be used in each of the keyed pc board receptacles in the Model 83590A, and in the Model 8350A as well.
- An RF Plug-in extender cable set that provides all electrical connections when the RF Plug-in is removed from the Sweep Oscillator. The RF Plug-in Interface connector (P2) and the Power Supply Interface connector (P1) are extended by separate cables.
- One Hex Balldriver for use in Model 8350A front panel repairs.
- One 16-pin and one 20-pin I.C. Test Clip for probing integrated circuits.

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

*APC-7® is a registered trademark of the Bunker-Ramo Corporation.

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

1-38. The Model 8350A Sweep Oscillator, with the Model 83590A 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 2 to 18 GHz. The Model 8350A/83590A combination is capable of operation over this full frequency range. The Model 8410B has an Auto-Frequency range mode which gives it the capability of automatically tracking the Model 8350A Sweep Oscillator over octave and multi-octave frequency bands. Two interconnections to the Model 8350A are necessary to ensure that the Model 8410B will phase lock properly. The Model 8410B Source Control Cable (HP 08410-60146) connects the Model 8410B rear panel SOURCE CONTROL connector to the Model 8350A rear panel PROGRAMMING CONNECTOR. Additionally, the Model 83590A 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 83590A RF Plug-in installed is compatible with the Model 8755 Frequency Response Test Set for broadband swept scalar measurements. The Model 8350A provides internal 27.8 kHz square wave amplitude modulation of the RF output, eliminating unnecessary cable connections to the Model 8755 or the use of an external modulator. The Model 8350A can also produce alternate sweeps through use of the ALT n function which works in conjunction with the channel switching circuits in the Model 8755C. This permits Channel 1 on the Model 8755C to respond only to the Model 8350A current state and Channel 2 to the alternate state. A single cable (HP Part Number 8120-3174) connects between the Model 8350A rear panel ALT SWP INTERFACE connector and the Model 8755C front panel ALT SWP INTERFACE connector.

1-41. 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 83590A 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 1-3. 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	1250-07777 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	1400-0979* 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).

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

Instrument	Critical Specifications	Recommended Model	Use*
Sweep Oscillator	No substitute	HP 8350A	P,A,T
Digital Voltmeter (DVM)	Range: −50V to +50V Accuracy: ±0.01% Input Impedance: ≥10M Ohms	HP 3456A	A,T
Oscilloscope	Dual Channel Bandwidth: dc to 100 MHz Vertical Sensitivity: ≤5 mV/DIV Horizontal Sweep Rate: ≤0.1μ S/DIV External Sweep Capability	HP 1740A	P,A,T
Oscilloscope Probe	1:1 General Purpose Probe	HP 10009B	A
Frequency Counter	Frequency Range: 2 to 20.0 GHz Input Impedance: 50 Ohms Resolution: ≤1 MHz	HP 5343A	P,A
Spectrum Analyzer	Frequency Range: 2 to 20.0 GHz Residual FM: <100 Hz	HP 8565A or HP 8566A	P,T

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

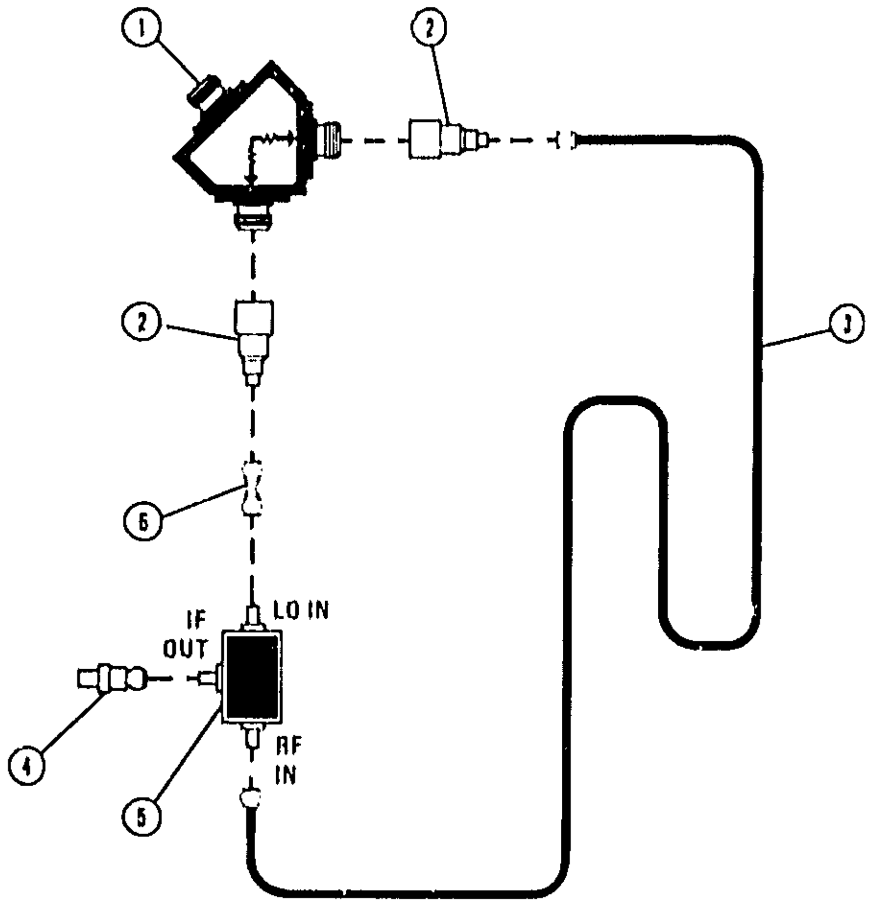
Instrument	Critical Specifications	Recommended Model	Use*
Swept Amplitude Analyzer	Capable of Transmission Measurements Power Resolution: ≤0.25 dB	HP 8755C	A
Display Mainframe	Compatible with 8755C Swept Amplitude Analyzer	HP 180T/TR, 182T/TR	A
Detectors (2)	Compatible with Swept Amplitude Analyzer Frequency Range: 2 to 20.0 GHz Power Range: -20 to +10 dBm	HP 11664B	A
Frequency Meter	Frequency Accuracy: ≤0.17% Calibration Increments: ≤2 MHz Frequency Range: 2.0 to 4.0 GHz, 4.0 to 12.4 GHz 12.4 to 18 GHz	 HP 536A HP 537A HP P532A	 A A A
Function Generator	Frequency Range: 0.1 Hz to 10 MHz Sinewave and squarewave output Output Level: 10Vp-p into 50 Ohms Output Level Flatness: ≤±3% from 10 Hz to 100 kHz ≤±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	Frequency Range: 2 to 20.0 GHz Maximum SWR: ≤1.75	HP 8478B	P,A
Thermistor Sensor	Frequency Range 18 to 20.0 GHz Maximum SWR: ≤2.0	HP K486	P,A
Adaptor	Waveguide to APC 3.5 (f) (for use with HP K486)	HP K281C	A
Power Meter	Power Range: 1 μW to 100 mW	HP 436A	P,A
Power Sensor	Frequency Range 2 to 20.0 GHz	HP 8485A	P,A
Crystal Detector**	Frequency Response: 2 to 20.0 GHz Maximum Input Power: 100 mW	HP 8473C	P,A
Attenuator**	Frequency Range: 2 to 20.0 GHz Maximum Input Power: +20 dBm Attenuation: 20 dB ±1.0 dB 20 dB ±0.8 dB 6 dB ±0.6 dB 3 dB ±0.5 dB	 Weinschel Model M9-20 Weinschel Model M9-10 Weinschel Model M9-6 Weinschel Model M9-3	 P P,A P P

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

Instrument	Critical Specifications	Recommended Model	Use*
Power Splitter**	Frequency Range: 2 to 20.0 GHz Maximum Input Power: ≥+20 dBm	Weinschel Model 1579A	P,A
Directional Coupler	Frequency Range: 2.0 to 18 GHz Nominal Coupling: ≥22 dB Maximum Coupling Variation: ± 1 dB Minimum Directivity: 26 dB	HP 11691D	P
RMS Voltmeter	dB Range: −20 to −70 dBm (0 dBm = 1 mV into 600 ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: ±5% of full scale	HP 3400A	P
Air Line Extension (2 required)	Impedance: 50 Ohms Frequency Range: dc to 18 GHz Reflection Coefficient: 0.018 to 0.001 (times the frequency in GHz)	HP 11567A	P
Step Attenuator	Frequency Range: dc to 18 GHz Incremental Attenuation: 0 to 70 dB in 10 dB steps Calibration Accuracy: ≤±0.1 dB at all steps	HP 8495B Option 890	P
Adjustable Short	Frequency Range: 2 to 18 GHz Impedance: 50 ±1.5 Ohms	Maury Microwave 1953-2	P
DC Power Supply	DC Output: 0 to 6.5Vdc ±0.05 Vdc	HP 6214A	A
50 Ohm Termination	Type N, 50 ±0.5 Ohms	HP 909A	P
Delay Line Discriminator	Refer to Figure 1-3.		P, A
PC Board Extender	44-pin, extends printed circuit boards	HP Part No. 08350-60031	A, T

* P = Performance Test; A = Adjustments; T = Troubleshooting
**For testing at frequencies of ≤18 GHz, the following equipment may be substituted:

ATTENUATORS	POWER SPLITTER	CRYSTAL DETECTOR
20 dB HP 8419B Option 020	HP 11667A	HP 8470B
10 dB HP 8419B Option 010		
6 dB HP 8491B Option 006		
3 dB HP 8491B Option 003		



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

INSTALLATION

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides installation instructions for the Model 83590A 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, of this Operating and Service 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 83590A 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 83590A RF Plug-in has a configuration switch (A3S1) located on the A3 Digital Interface Board. This switch must be preset prior to RF Plug-in operation in the Model 8350A. The configuration switch is an 8-section multiple switch. Each separate switch corresponds to a separate RF plug-in function such as FM sensitivity selection, FM input coupling selection (direct coupled or cross-over), RF power level at power on (maximum or off), and Option 002 Step Attenuator operation. Refer to Section III, Operation, in this manual for a complete description of the configuration switch and instructions on how to set the switches.

2-10. Interconnections

2-11. There are two rear panel interconnections from the Model 83590A 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 for these connectors is provided in Figures 2-1 and 2-2.

2-12. Mating Connectors

2-13. All of the externally mounted connectors on the Model 83590A 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, 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 (15,000 feet).

Table 2-1. Model 83590A Mating Connectors

83590A 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 AUX OUTPUT	Type N (f)	1250-0882	Specialty Connector 25-P117-2
J4 PULSE IN	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J5 1V/GHz	BNC (f)	1250-0256	Specialty Connector 25-P118-1

2-18. Cooling. When the Model 83590A 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 83590A 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 83590A RF Plug-in must be installed in a Model 8350A Sweep Oscillator. To install the Model 83590A 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 83590A to prevent them from being damaged.

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

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

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

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

2-21. STORAGE AND SHIPMENT

2-22. Environment

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

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

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

2-25. Packaging

2-26. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. A complete diagram and listing of packaging materials used for the Model 83590A 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.

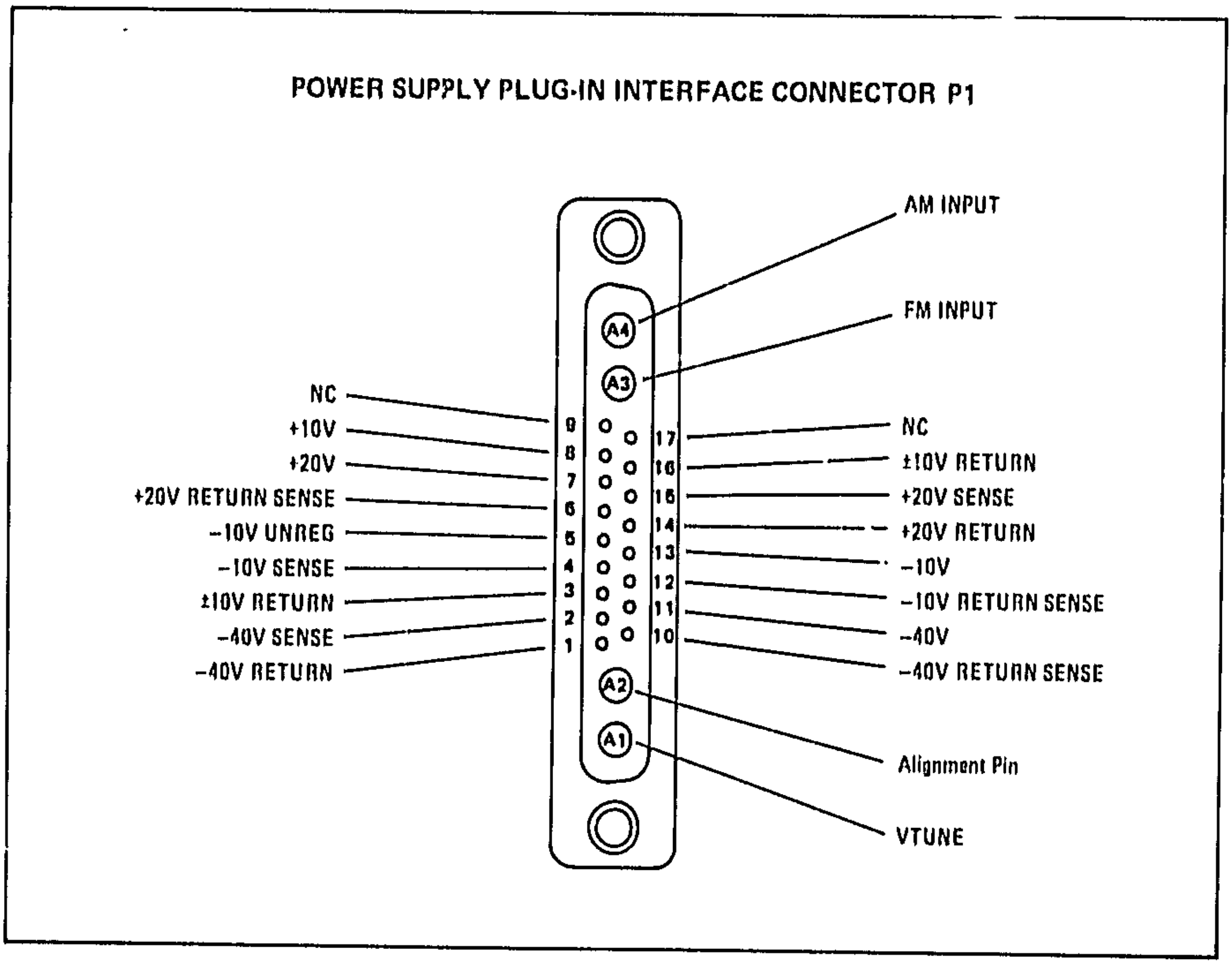


Figure 2-1. Interface Signals on Connector P1

PLUG-IN INTERFACE CONNECTOR P2

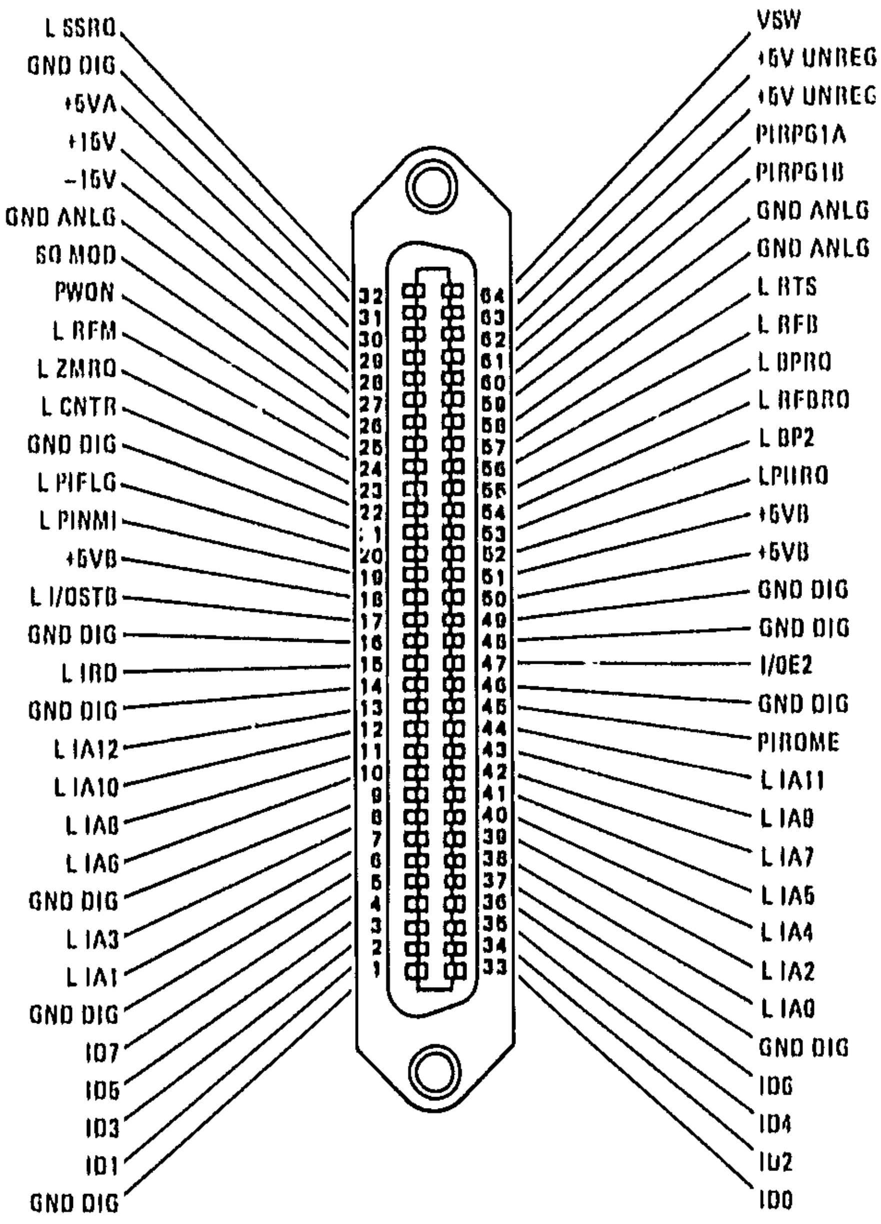
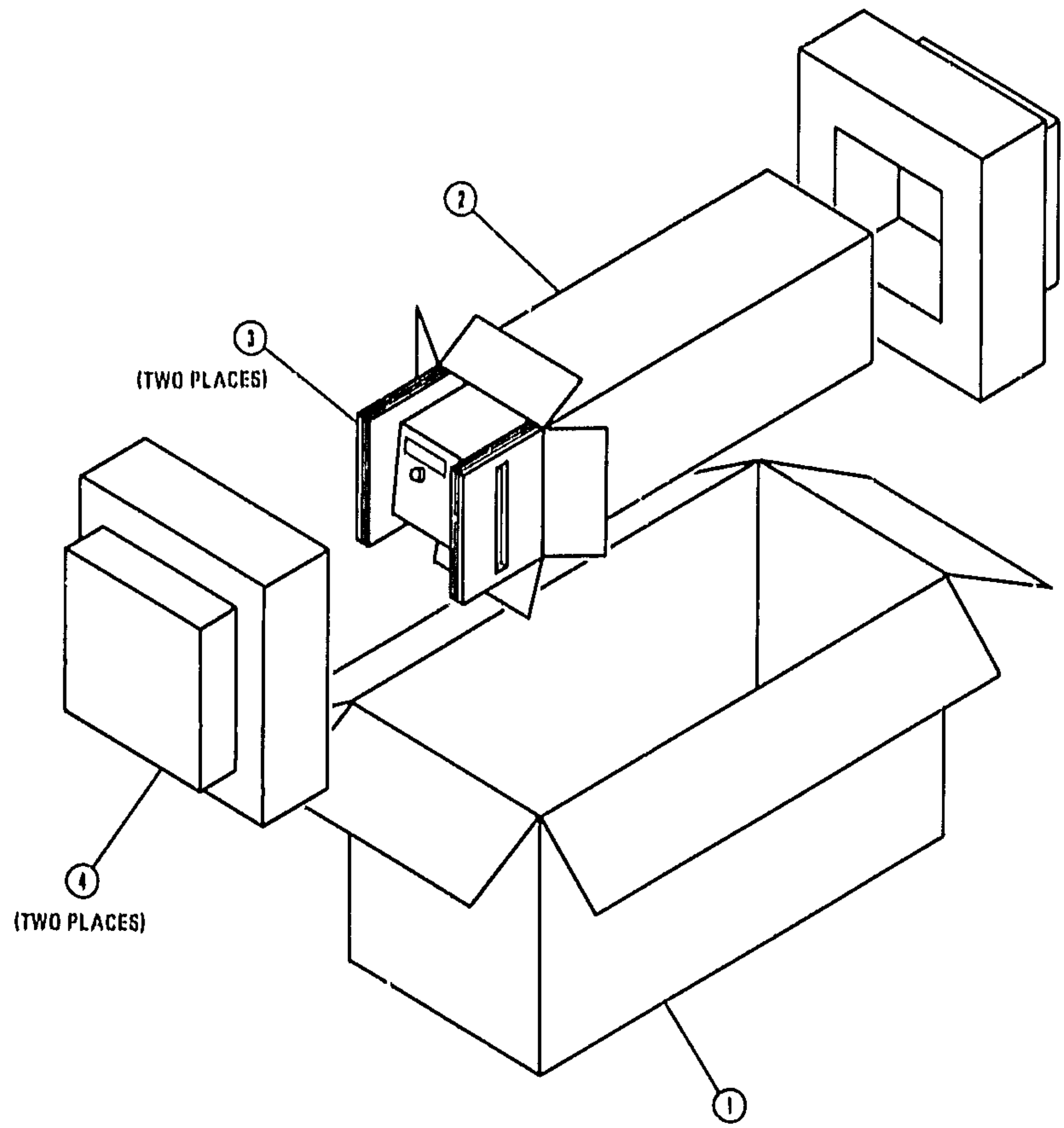


Figure 2-2. Interface Signals on Connector P2



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

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

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section is divided into four major sections. Operating Characteristics explains the bandswitching and frequency resolution characteristics in CW and swept modes. Front and rear panel 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 Bandswitching and Resolution

3-5. The following paragraphs describe the bandswitching and frequency resolution characteristics of the 83590A RF Plug-in.

3-6. The 83590A 2 to 20 GHz RF output is provided in three bands. When sweeping a range of frequencies larger than a single band, the switching between these bands is done automatically. Careful selection of sweep frequencies may avoid problems associated with bandswitching such as harmonics, sweep time, stability, or switching discontinuities. Figure 3-1 illustrates the bandswitching points in the sequential and single band sweep modes.

3-7. Two areas relating to frequency resolution must be considered: these are input resolution and displayed resolution. Input resolution refers to the number of bits (8 bits = 256 points) in the digital to analog converter (DAC) 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.

3-8. Figure 3-2 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.

3-9. The CF DAC has 12 bits, hence 4096 points across any of the Plug-in frequency bands (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).

3-10. Resolution of Center Frequency is enhanced by a summed voltage generated by an 8-bit (256 points) Vernier DAC. Vernier range is set to ±0.05% of bandwidth (including overrange). In multiband Plug-ins, total range of the vernier will vary with each band sweep. Vernier resolution is determined by dividing ±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 the vernier is adjusted through its zero-point, the CF DAC is incremented or decremented by the total value of the vernier (2 points on the CF DAC). At this time the accuracy of the Center Frequency is again entirely dependent on the CF DAC, 0.005% of bandwidth.

3-11. 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 Δ resolution improves with narrower sweep widths. For broad

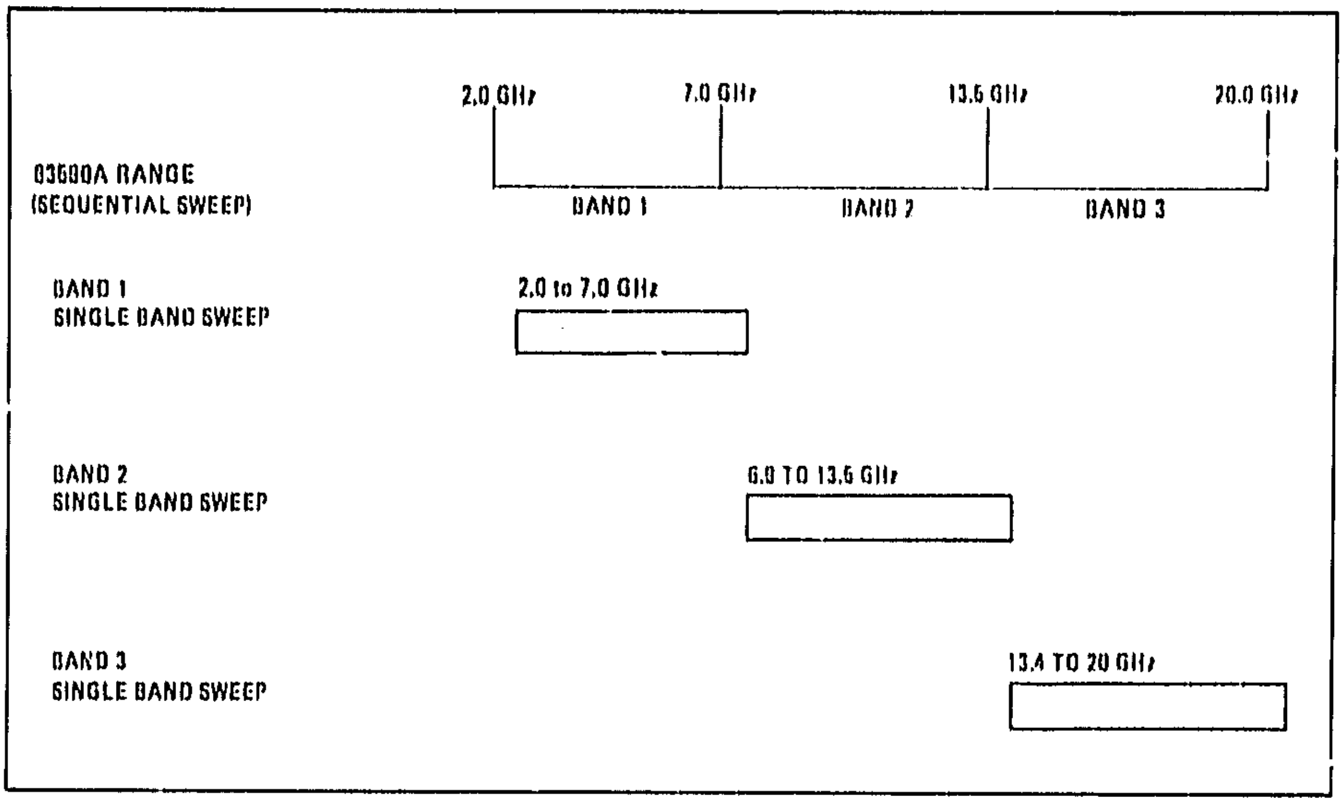


Figure 3-1. Bandswitching in Sequential and Single Band Sweep Modes

sweeps, the resolution is 0.1% of the full band. Greater resolution is provided for sweep widths less than 1/8 of the full band range. At these sweep widths, the resolution is improved to 0.012% of the full band.

3-12. 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 3-3, illustrates the ΔF mode displayed resolution values versus displayed ΔF frequency sweep widths.

3-13. PANEL FEATURES

3-14. Front and rear panel features are described in Figure 3-4 and 3-5, respectively. Numbered callouts on the features described match numbered descriptions below each figure.

3-15. OPERATORS CHECKS

3-16. The Operator's Checks portion (Local and Remote) of the 8350A Sweep Oscillator manual provides a quick evaluation of both 8350A and 83590A main functions. Error codes 50 to 99, displayed on the 8350A FREQUENCY display, are reserved to indicate Plug-in related problems. The 8350A Local Check covers the Sweep Oscillator and RF Plug-in. If the correct indications are not obtained, trouble may be in either of the units. If the RF Plug-in is suspected, follow the troubleshooting information in Section VIII, Service, in this manual, to isolate the problem.

3-17. OPERATING INSTRUCTIONS

3-18. Peaking RF Output Power

3-19. Due to normal "aging" of the 83590A, it may be necessary to peak the RF output power to obtain the specified maximum leveled power. The front panel PEAK function is accessed by pressing SHIFT PEAK. In order to monitor the effect of the Peaking function on the RF Output, the 83590A must be set for an unleveled power condition. This can be accomplished by setting the ALC MODE to External (without an external detector) or increasing the Power setting until the RF output is unleveled. With the Peak function selected and an unleveled RF output, the POWER control should be adjusted to maximize the RF output power over the entire frequency range.

3-20. Internal Leveling

3-21. 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

Table 3-1. Input Resolution

DAC Used	Voltage Resolution	Frequency Resolution			
		Band 1 2.0 to 7.0 GHz	Band 2 7.0 to 13.5 GHz	Band 3 13.5 to 20 GHz	Full Sweep 2 to 20 GHz
CF	2.5 mV	1.17 MHz	1.65 MHz	1.65 MHz	5.08 MHz
Vernier	40 μV	18.25 kHz	25.78 kHz	25.78 kHz	79.38 kHz
ΔF 1-1/8 of band	10 mV	4.67 MHz	6.60 MHz	6.60 MHz	20.30 MHz
ΔF 1/8-1/64 of band	1.25 mV	.584 MHz	.825 MHz	.825 MHz	2.54 MHz
ΔF ≤1/64 of band	0.156 mV	73.0 kHz	103.2 kHz	103.2 kHz	317.2 kHz

the RF output signal. This detected dc voltage is applied to the ALC circuit.

3-22. External Crystal Detector Leveling

3-23. RF output power may also be leveled externally using a power splitter (or external directional coupler) and a negative output 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 output power level. The detector output voltage is compared with an internal reference voltage, and the difference voltage changes the output power level to keep a constant RF output power level. A directional coupler may be used instead of a power splitter to sample the RF signal for the leveling loop. Directional couplers are usually narrow band devices, whereas the power splitter has a flatter frequency response over a wide frequency range. The advantage of a directional coupler is that it does not have as great a coupled loss as the 6 dB loss encountered with the power splitter, therefore, a higher maximum leveled power output may be obtained. Figure 3-6 illustrates a typical crystal detector leveling setup.

3-24. External Power Meter Leveling

3-25. 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 100 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 input signal level. This dc voltage is applied to the 83590A 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.

3-26. External FM

3-27. The 83590A 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 3-9 lists the available configuration switch settings. The configuration switch settings override 8350A Sweep Oscillator non-volatile memory settings at Instrument Preset.

3-28. External Amplitude Modulation

3-29. 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. To get the best pulse modulation performance, the RF output power should be set at +20 dBm. With this power setting, a pulse repetition rate of up to 1 MHz is achievable in the 2 to 7.0 GHz frequency bands. With leveled power in this frequency range, pulse repetition rates may be up to 100 kHz. In the 7.0 to 20.0 GHz frequency bands, RF power may be square-wave modulated at repetition rates up to

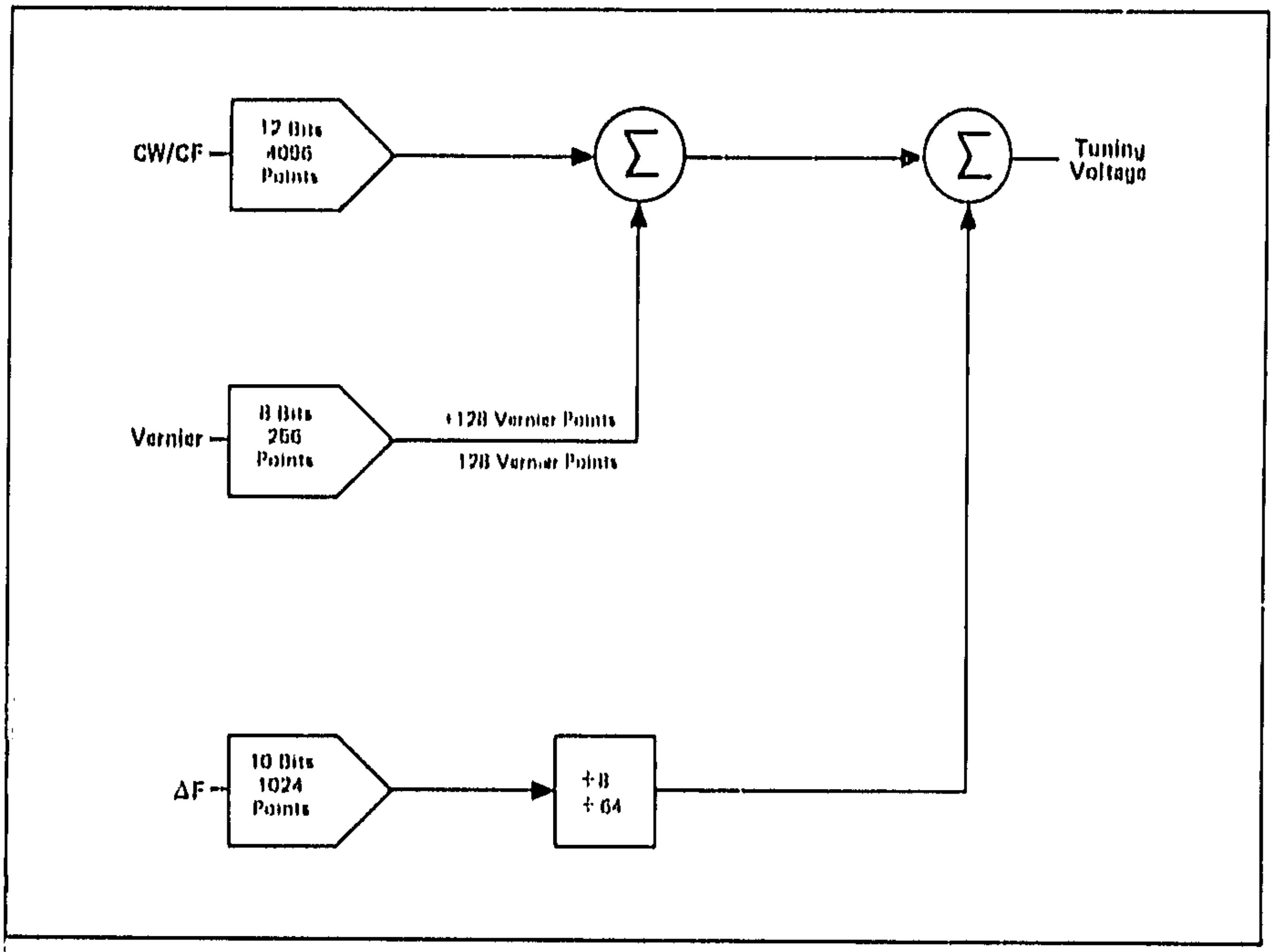


Figure 3-2. Simplified Tuning Voltage Block Diagram

ΔF Display Frequency Width

0 MHz | 124 MHz | 1 GHz | 4.2 GHz | 20.0 GHz

Displayed Resolution	100 kHz	1 MHz	1 MHz	10 MHz
ΔF Display Indication	000.0 MHz	0000. MHz	0000. MHz	00.00 GHz

Figure 3-3. Delta F Sweep Mode Displayed Resolution

30 kHz at any power output 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 the diode clamping action. See the specifications and supplemental characteristics in Section I for more details on the modulation characteristics when using this input.

3-30. Amplitude Modulation (AM INPUT Connector on 8350A). The AM INPUT 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. +2.5 dBm for a Plug-in with calibrated power control from −5 to +10 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 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.

3-31. RF Power Control

3-32. The RF power set at power-up (during Instrument Preset) may be either maximum power (+10 dBm) or RF power OFF as selected by the configuration switch (A3S1). Refer to Figure 3-9 for this setting. Configuration switch settings relating to the specific model Plug-in used and Option 002 Step Attenuator equipped instruments must be set prior to operation. Configuration switch number 7 is set at the factory and should not be changed.

3-33. Option 002 Step Attenuator

3-34. With Option 002 installed, the RF output power may be continuously controlled from +10 dBm to −75 dBm. When the selected POWER setting goes below −5 dBm, the step attenuator increments as required in 10 dB steps to a maximum attenuation of 70 dB. Within the individual 10 dB steps of the attenuator, the ALC loop adjusts the power output to the power level programmed by the front panel POWER control. Pressing SHIFT POWER SWEEP allows control of power within the ALC range without changing attenuator settings. The display in the SHIFT POWER SWEEP mode disregards attenuator settings and only displays the ALC setting. Pressing SHIFT SLOPE allows control of attenuator steps without affecting ALC setting. In this mode the attenuator setting is displayed.

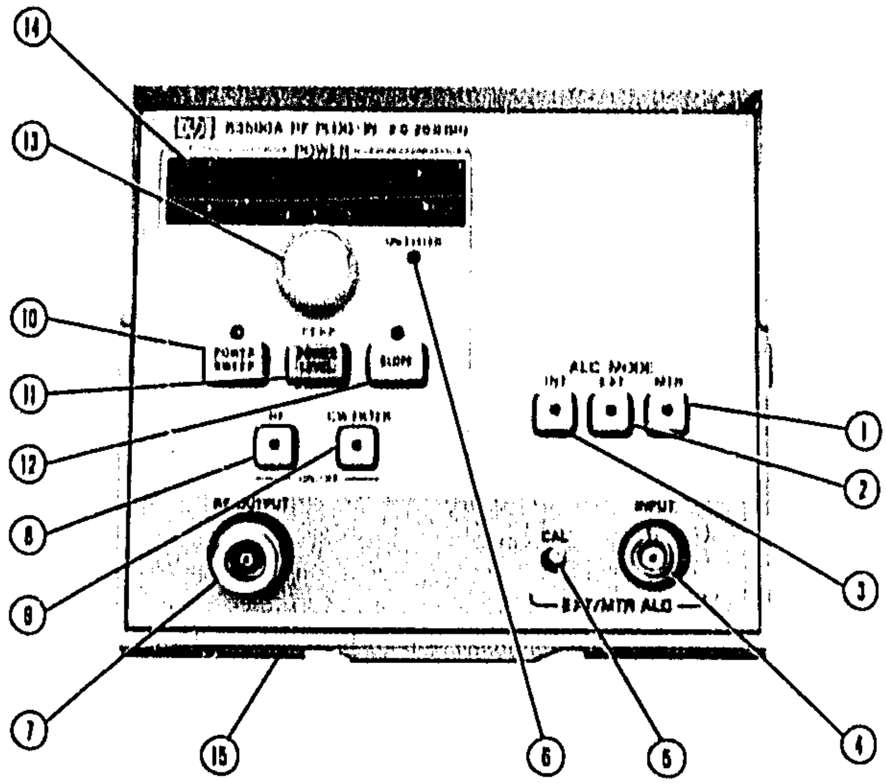
3-35. Alternate Sweep Mode

3-36. If the 83590A changes frequency bands (e.g. Band 1 to Band 3) between each sweep, the minimum sweep time recommended is 100 milliseconds. This allows enough time for the bandswitch operation and settling time for the fundamental oscillator for the next sweep.

3-37. 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 attenuator is prevented from switching faster than 1 step per second to prevent damage to the attenuator relay coils due to overheating.

3-38. Phase-Lock Operation

3-39. The 83590A RF Plug-in RF output (CW) signal may be phase-locked to an external reference oscillator by using an external phase-lock signal applied to the 8350A rear panel FM INPUT connector. The phase-lock function provides a means of obtaining a very stable CW frequency by transferring the frequency stability of the reference oscillator to the 8350A Sweep Oscillator. If the CW frequency starts to drift, the phase difference between the CW frequency and the reference frequency (reference oscillator) is detected, producing a dc voltage. The dc voltage is returned to the FM INPUT as a correction signal which restores the CW frequency to its previous point. Stability of the RF output CW frequency is thus determined by the stability of the reference oscillator. The 83590A CW frequency used for phase-locking may be either the RF output or the fundamental oscillator frequency available at the rear panel AUX OUTPUT. Configuration switch (A3S1) switch position 8 must be set for the source of the CW frequency used for phase-locking (Figure 3-9). The CW filter should be turned off in phase lock operation. Although the front panel RF output can be used for phase-locking, this would require a broadband coupling device and a harmonic mixer capable of producing acceptable harmonic content up to 20 GHz. Therefore, it is preferable to use the rear panel AUX OUTPUT for phase-locking. See Figure 3-8.



FRONT PANEL FEATURES

1. Power meter automatic leveling control selection (HP 432 only).
2. External (crystal detector) automatic leveling control selection (negative crystal output).
3. Internal leveling control selection.
4. Connector (BNC) for power meter or external crystal leveling inputs (rear panel on Option 004).
5. Power level CAL adjust, for setting external (MTR or EXT) ALC.
6. UNLEVELED lamp lights if output power is unleveled.
7. Type-N 50-ohm RF output connector (rear panelon Option 004, APC-7 connector for option 005).
8. RF on-off key. Used for zeroing a power meter or referencing an X-Y recorder.
9. CW FILTER enables an oscillator tune voltage filter when in CW mode.
10. POWER SWEEP allows setting an increase in power per sweep (db/SWP). SHIFT POWER SWEEP allows control of power within the ALC range without changing attenuator settings (display reads ALC settings).
11. POWER LEVEL allows setting of output power for all ALC modes (may be calibrated for external leveling). PEAK allows peaking of RF OUTPUT power (selected when SHIFT POWER LEVEL is pressed.)
12. SLOPE allows setting of the frequency slope compensation in dB/GHz (for lossy devices). SHIFT SLOPE allows control of attenuator steps without affecting ALC setting (display reads attenuator setting).
13. Power control knob for controling power sweep, power level, peak, or slope.
14. Plug-in display provides readout of selected power mode in dBm, dB/GHz, or dB/SWP to a tenth of a dB/dBm.
15. Plug-in latch handle is used to remove, install, and latch the RF Plug-in in the Sweep Oscillator.

Figure 3-4. Front Panel Features

for an example of phase-locking with the rear panel AUX Output.

3-40. OPERATOR'S MAINTENANCE

3-41. Plug-In Error Codes

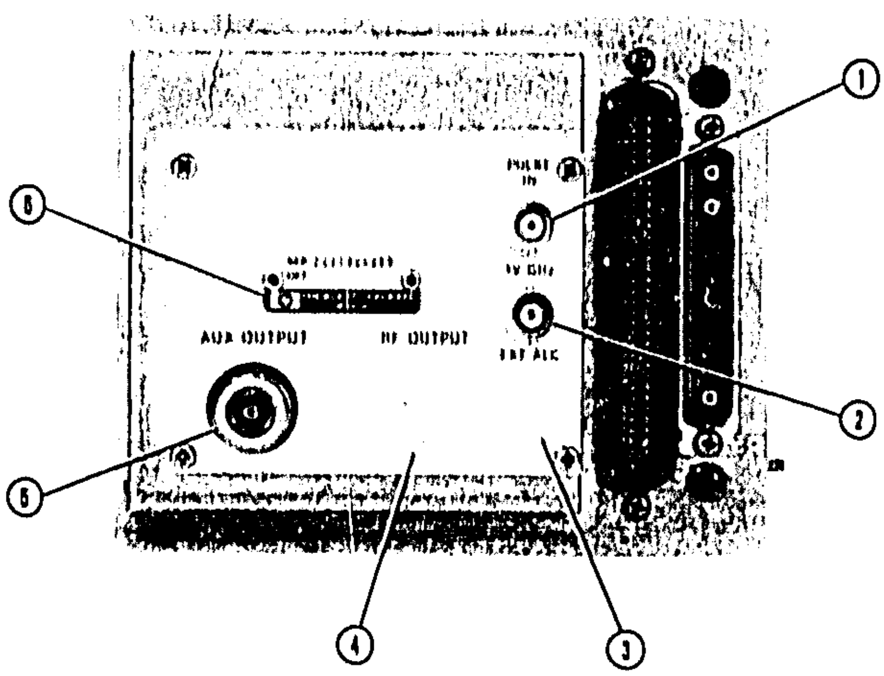
3-42. The 8350A FREQUENCY window will display RF Plug-in error codes (50 to 99) or Sweep Oscillator error codes. Information necessary to interpret Plug-in error codes may be found in Section VIII, Service, in this manual.

3-43. Fuses

3-44. Power circuits for the Model 83590A 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.

3-45. Blue Service Tags

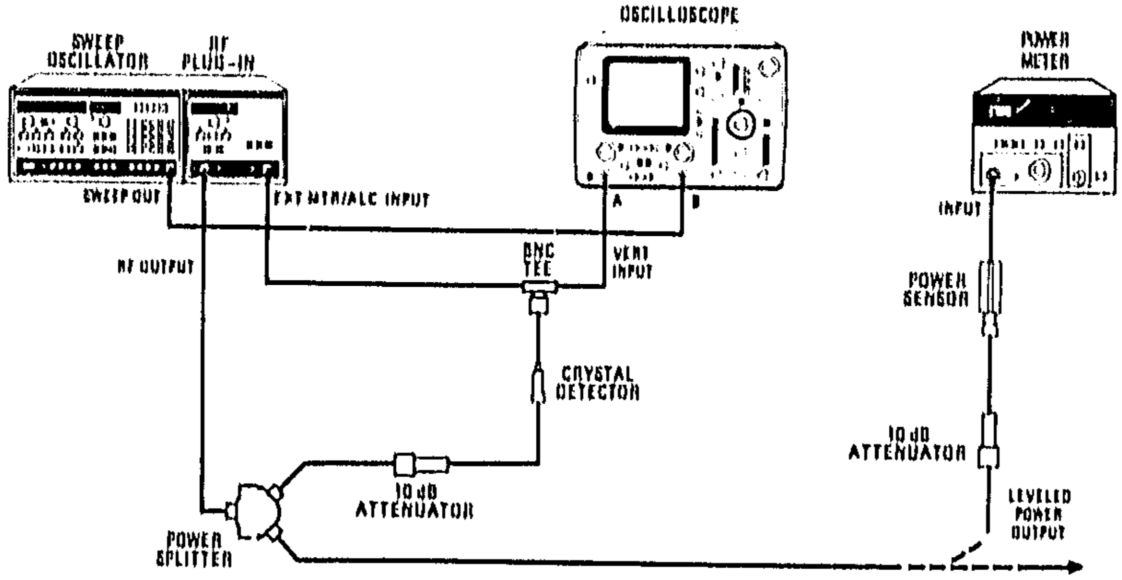
3-46. If the 83590A RF Plug-in requires service, the instrument may be sent to your local HP service organization as described in Section II, Installation, in this manual. Before sending the instrument back, fill out and attach one of the blue service tags. Record any error codes noted on the failure symptoms/special control settings portion of the tag.



REAR PANEL FEATURES

1. PULSE IN connector is used to input external pulse or squarewave modulation.
2. 1V/GHz connector provides a frequency reference output of approximately 1 volt dc per GHz.
3. EXT ALC connector replaces front panel EXT ALC connector on Option 004 Plug-ins.
4. RF OUTPUT connector replaces front panel RF output connector in Option 004 Plug-ins.
5. AUX OUTPUT connector provides 2.0 to 7.0 GHz fundamental oscillator output at approximately 0 dBm.
6. Serial Number Plate has a ten digit serial number (used in any correspondence concerning Plug-in) and Option number if applicable.

Figure 3-5. Rear Panel Features



EXTERNAL CRYSTAL DETECTOR LEVELING

EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83590A
Oscilloscope	HP 1740A
Power Meter	HP 436A
Power Sensor	HP 8485A
Crystal Detector	HP 8473C
Power Splitter	HP 11667A
10 dB Attenuator (2 required)	HP 8491B, Option 010
BNC Tee	HP 1250-0781

PROCEDURE:

NOTE

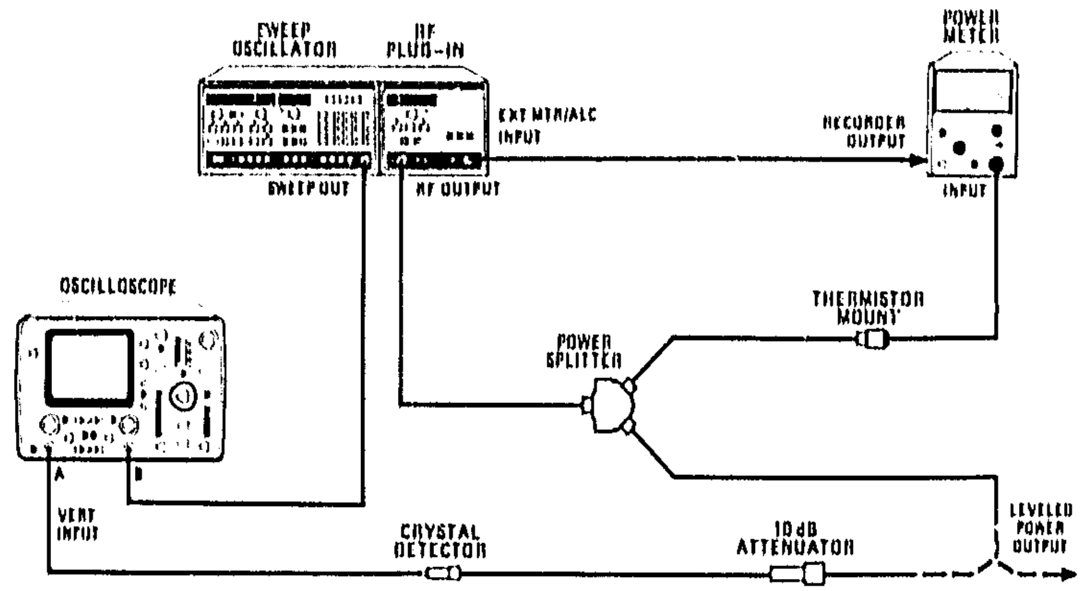
Crystal output signal must be between −10 mVdc and −200 mVdc.

1. Connect equipment as shown in test setup.
2. Switch on 8350A LINE switch. Press INSTR PRESET key. The START and STOP indicators should be on.
3. Set controls as follows:

   83590A:

   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 between power splitter and 10 dB attenuator.

Figure 3-6. External Crystal Detector Leveling



EXTERNAL POWER METER LEVELING

EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83590A
Power Meter	HP 432A
Thermistor Mount	HP 8478A
Oscilloscope	HP 1740A
Crystal Detector	HP 8473C
10 dB Attenuator	HP 8491B, Option 010
Power Splitter	HP 11667A

NOTE

For power meter leveling, sweep rates should be slower than 100 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.

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	100 sec
START/STOP FREQUENCY	As required (<18 GHz for 8478A Thermistor Mount)

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

83590A: Set power to maximum specified.

ALC MODE.. MTR

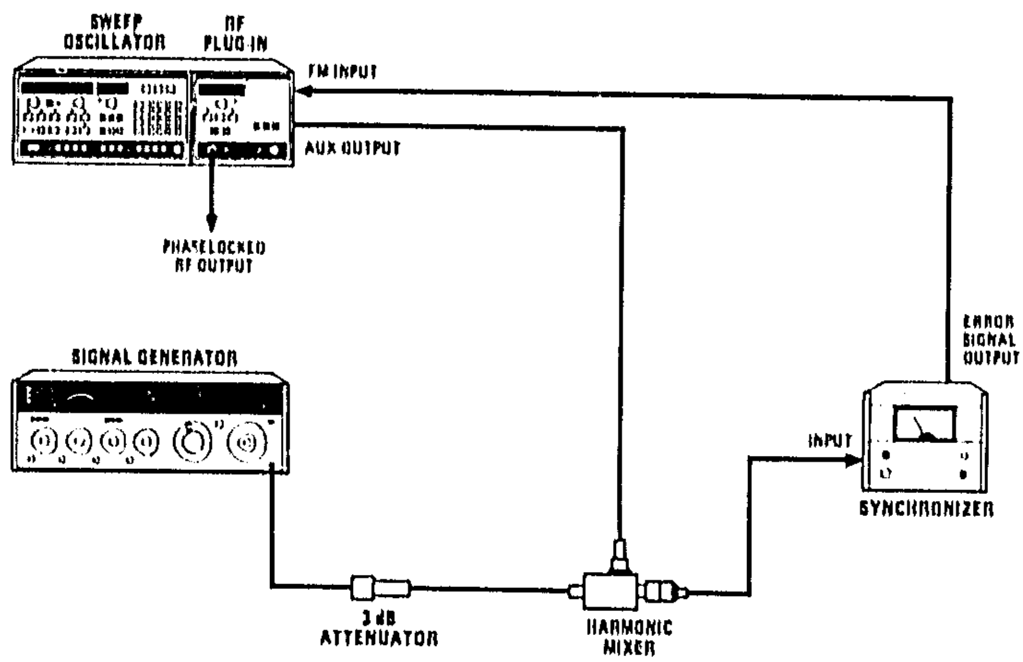
4. Select +10 dBm range on power meter.

5. Adjust 83590A 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 between power splitter and 10 dB attenuator.

Figure 3-7. External Power Meter Leveling (2 of 2)

PHASELOCKING WITH THE REAR PANEL AUX OUTPUT



EQUIPMENT:

Sweep Oscillator.. HP 8350A
RF Plug-in.. HP 83590A
Signal Generator.............................. HP 8640A Option 002
Synchronizer.. HP 8709A
Harmonic Mixer.. HP 934A
3 dB Attenuator.............................. HP 8491B, Option 003

Figure 3-8. Phaselocking with the Rear Panel Output (1 of 2)

PHASELOCKING WITH THE REAR PANEL AUX OUTPUT

PROCEDURE:

1. Set the 83590A Configuration Switch (A3S1) for an FM Sensitivity of −20 MHz/V, Direct Coupled FM, and AUX OUTPUT Phaselock (See Figure 3-9 for specific switch settings).

2. Connect equipment as shown in the test setup. On the 8350A press INSTR PRESET .

3. On the 8350A press CW and enter the desired CW frequency.

4. On the 83590A press CW FILTER to turn off the CW filter (pushbutton LED turned off). Set the 83590A Power Level between 0 and +5 dBm.

5. Set the 8640A for maximum RF output power (>+13 dBm) and both AM and FM Modulation turned off. Set the 8640A to the reference frequency (F_r) determined below.

   F_0 = 83590A RF output frequency
   f_r = Reference frequency (8640A RF output frequency)
   N_1 = Harmonic Number of 83590A Fundamental Oscillator
   N_2 = Lowest integer that results in $F_r \leq$ 1024 MHz

   For F_0<2.0 GHz:

$$F_r = \frac{(F_0 + 3.8\ \text{GHz}) - 20\ \text{MHz}}{N_2}$$

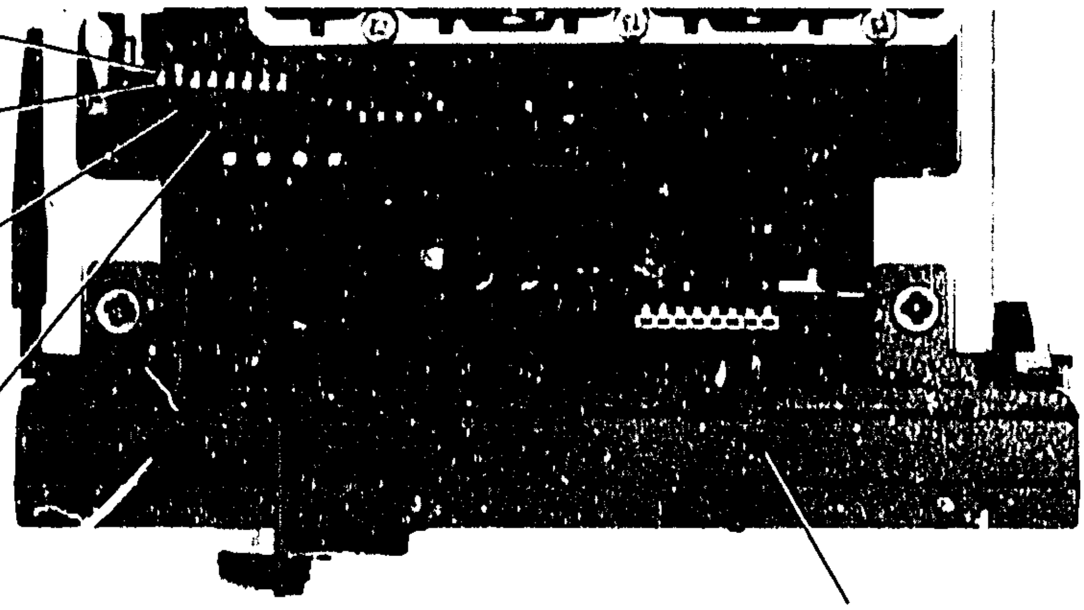
6. Tune the 8640A frequency to turn off the 8709A UNLOCKED light.

7. Slowly adjust the 8640A frequency for zero phase error indication on the 8709A.

8. The 83590A RF output is now phase-locked with the 8640A.

83590A CW Frequency			AUX OUT	N_2
Band 1 (GHz) (N_1=1)	Band 2 (GHz) (N_1=2)	Band 3 (GHz) (N_1=3)		
2.0 to 3.09	——	——	2.0 to 3.09	3
3.09 to 4.12	7.0 to 8.24	——	3.09 to 4.12	4
4.12 to 5.14	8.24 to 10.24	13.5 to 15.42	4.12 to 5.14	5
5.14 to 6.16	10.24 to 12.32	15.42 to 18.48	5.14 to 6.16	6
6.16 to 7.0	12.32 to 13.5	18.48 to 20.0	6.16 to 7.0	7

Figure 3-8. Phaselocking with the Rear Panel Output (2 of 2)



Description	Switch Number							
	1	2	3	4	5	6	7	8
Normal Sweep	0	X	X	X	X	X	X	X
Sequential Sweep Only	1	X	X	X	X	X	X	X
No RF Power 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 (−20 MHz/V)	X	X	X	X	X	1	X	X
Cross-Over Coupled FM	X	X	X	X	X	0	X	X
Step Attenuator Option 002 Installed	X	X	X	X	X	X	1	X
No Step Attenuator	X	X	X	X	X	X	0	X
AUX OUT Phase Lock	X	X	X	X	X	X	X	1
RF OUTPUT Phase Lock	X	X	X	X	X	X	X	0

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	X	X	0	0	0	*	0

Figure 3-9. Configuration Switch

PERFORMANCE CHECK

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the 83590A RF Plug-in/8350A Sweep Oscillator combination with the specifications of the Plug-in used as the performance standards. These specifications may be found in Section I of this manual. Due to the extended frequency range of the 83590A, the performance tests in the 8350A Operating and Service Manual do not apply. None of the tests require access to the interior of the 83590A RF Plug-in.

NOTE

Allow the 83590A RF Plug-in and 8350A Sweep Oscillator to warm up for one hour prior to doing any performance tests.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required to test is listed in the Recommended Test Equipment table in Section I of this manual. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

4-5. OPERATION VERIFICATION

4-6. Operation Verification consists of performing the tests listed in paragraph 4-13 steps 1 to 11 and paragraph 4-14 steps 1 to 13. Operation Verification of the HP-IB functions may be verified by executing the program listed in Section IV of the 8350A Operating and Service Manual. These tests provide reasonable assurance that the Sweep Oscillator and Plug-in are functioning properly and should meet the needs of an incoming inspection (80% verification).

4-7. TEST RECORD

4-8. Table 4-16 provides a tabulated index of the performance tests, their acceptable limits, and a column for recording actual measurements.

4-9. TEST SEQUENCE

4-10. The performance tests should be performed in the order they occur.

4-11. CALIBRATION CYCLE

4-12. The performance tests in this section should be performed at intervals of six months or less for the 83590A.

PERFORMANCE TESTS

Table 4-1. Performance Test

Performance Test	83590A Adjustment	8350A Adjustment
4-13. Frequency Range and Accuracy		
CW Accuracy	5-14, 5-16, 5-17	5-19
Swept Frequency Accuracy	5-15 thru 5-19, 5-23	
Marker Accuracy	5-14 thru 5-19, 5-23	5-20
4-14. Output Amplitude		
Power Variations at Maximum Power	5-25 thru 5-28	
Power Level Accuracy	5-27	
Power Meter Leveling	5-29	
Power Sweep		
4-15. Frequency Stability		5-11
4-16. Residual FM		5-11
4-17. Spurious Signals		
Nonharmonics	5-21	
4-18. Residual AM	5-21, 5-28	5-11
4-20. External FM	5-30	
4-21. AM On/Off Ratio		
Square-wave Symmetry	5-28	

4-13. FREQUENCY RANGE AND ACCURACY TEST

SPECIFICATION:

Frequency Range: 2.0 to 20.0 GHz

Frequency Accuracy:

Bands (GHz)	2.0 to 7.0	7.0 to 13.5	13.5 to 20.0	2.0 to 20.0
CW Mode	±5 MHz	±10 MHz	±15 MHz	
All Sweep Modes	±20 MHz	±25 MHz	±30 MHz	±50 MHz
Frequency Markers	±20 MHz ±0.5% of sweep width	±25 MHz ±0.5% of sweep width	±30 MHz ±0.5% of sweep width	±50 MHz ±0.5% of sweep width

PERFORMANCE TESTS

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

DESCRIPTION:

A frequency counter is used to check frequency range and accuracy in the CW mode. The frequency counter is also used to check swept frequency accuracy and markers in the START/STOP mode.

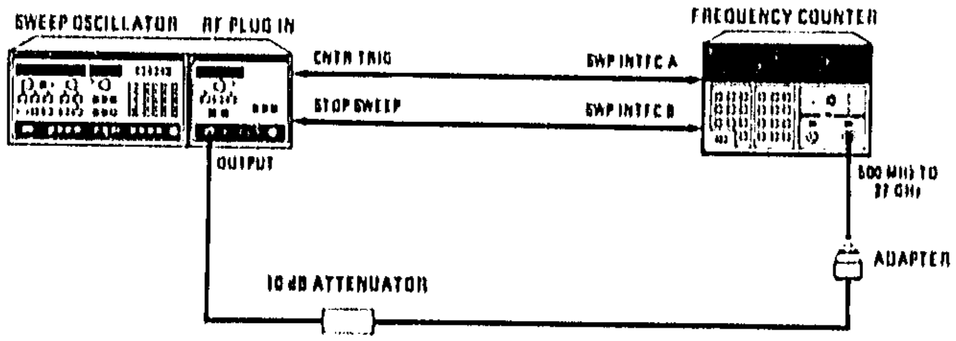


Figure 4-1. Frequency Range and CW Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator.. HP 8350A
Frequency Counter.. HP 5343A
10-dB Attenuator..... .... HP 8491B, Option 010
Adapter, Type-N female to SMA female 1250-1404

PROCEDURE:

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

2. Set controls as follows:

   Frequency Counter

   LINE.. ON
   SAMPLE RATE...................................... minimum (full CCW)
   Range connector...................................... 500 MHz to 27 GHz
   Impedance Switch.. 50Ω
   ACQ TIME (rear panel) .... FAST

3. Press 8350A INSTR PRESET. Note that the Sweep Oscillator display indicates a START frequency of 2 GHz and a STOP frequency of 20 GHz.

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

Frequency Range

4. Press 8350A CW key and enter a CW frequency of 2 GHz. If frequency observed on frequency counter is greater than 2 GHz rotate 8350A CW control counterclockwise until frequency on counter is at or below 2 GHz.

5. Enter a CW frequency of 20.0 GHz. If frequency observed on frequency counter is lower than 20.0 GHz rotate the 8350A CW control clockwise until the frequency counter reading is at or above 20.0 GHz.

CW Frequency Accuracy

6. Check CW frequency accuracy for each CW frequency listed in Table 4-2. Verify the frequency counter indication at the three points on each band is within the accuracy tolerance in Table 4-2. Follow the sequence of frequencies listed for each band from top to bottom to avoid band crossover problems.

Table 4-2. CW Frequency Accuracy

Bands (Accuracy)		
Band 1 (±5 MHz)	Band 2 (±10 MHz)	Band 3 (±15 MHz)
4.0 GHz	10 GHz	17.0 GHz
2.0 GHz	7.1 GHz	14.0 GHz
7.0 GHz	13.5 GHz	20.0 GHz

Swept Frequency Accuracy

7. Press frequency counter RESET , SWP M (Light on), Blue Key , 1KHz . Press 8350A INSTR PRESET and set sweep time to 105 msec.

8. Press the START and STOP frequencies on the 8350A for each band listed in Table 4-3.

9. Press 8350A START , SHIFT , then M2 . Check the frequency counter reading for the START frequency listed in Table 4-3 and record on the test card.

10. Press 8350A STOP , SHIFT , then M2 . Check the frequency counter reading for the STOP frequency listed in Table 4-3 and record on the test card.

11. Repeat steps 9 through 11 for each band listed.

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

Table 4-3. Swept Frequency Accuracy Table

Band	Start	Stop	Tolerance
Full Band	2.0 GHz	20.0 GHz	±50 MHz
Band 1	2.0 GHz	7.0 GHz	±20 MHz
Band 2	7.0 GHz	13.5 GHz	±25 MHz
Band 3	13.5 GHz	20.0 GHz	±30 MHz

Frequency Marker Accuracy

12. Press 8350A **INSTR PRESET** and set sweep time to 105 msec.
13. Set first band's **START** - **STOP** frequencies as listed in Table 4-4.
14. Set the 8350A markers to the frequency listed and verify that the frequency counter readings are within tolerance. Enter marker to be checked, then **SHIFT** **M2** .
15. Set the START and STOP frequencies for each band listed and repeat the previous step with the markers set as listed.

Table 4-4. Frequency Marker Accuracy

Band	Sweep Range		Marker Frequencies					
	Start	Stop	M1	M2	M3	M4	M5	Tolerance
Full Band	2.0 to 20 GHz		3 GHz	6 GHz	10 GHz	14 GHz	18 GHz	±140 MHz
Band 1	2.0 to 7.0 GHz		3.0 GHz	6.0 GHz	———	———	———	±45 MHz
Band 2	7.0 to 13.5 GHz		8.0 GHz	12 GHz	———	———	———	±58 MHz
Band 3	13.5 to 20 GHz		15.0 GHz	18.0 GHz	———	———	———	±63 MHz

4-14. OUTPUT AMPLITUDE TEST

SPECIFICATION:

	Frequency Bands (GHz)					
	2.0 to 7.0	7.0 to 13.5	13.5 to 18.6	13.5 to 20.0	2.0 to 18.6	2.0 to 20.0
Maximum Leveled Output Power[2, 3, 4] (25°C)	+10 dBm	+10 dBm	+10 dBm	+8 dBm	+10 dBm	+8 dBm
With Option 002	+8.5 dBm	+8 dBm	+7 dBm	+5 dBm	+7 dBm	+5 dBm
Power Level Accuracy[10] (Internally Leveled)	<±1.3 dB	<±1.3 dB	<±1.4 dB	<±1.4 dB	<±1.5 dB	<±1.5 dB
With Option 002[5] (at 0 dB attenuator step)	<±1.5 dB	<±1.5 dB	<±1.6 dB	<±1.6 dB	<±1.7 dB	<±1.7 dB

Minimum Settable Power: −5 dBm
With Option 002: −75 dBm

Power Variation (at specified Maximum Leveled Power or below)	Frequency Bands (GHz)			
	2.0 to 7.0	7.0 to 13.5	13.5 to 20	2.0 to 20
Internally Leveled	±0.7 dB	±0.7 dB	±0.8 dB	±0.9 dB
Externally Leveled Negative Crystal Detector[6] (Sweep time >100 ms)	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Externally Leveled Power Meter[7]	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB

DESCRIPTION:

A Power Meter is used to check power level accuracy, maximum leveled output power and power variations.

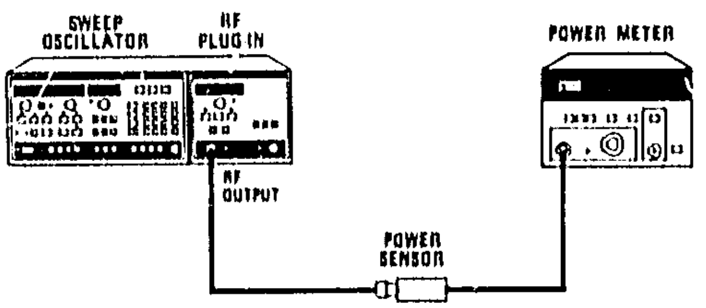


Figure 4-2. Output Amplitude Test Setup (Using HP 436A Power Meter)

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8350A
Power Meter	HP 436A
Power Sensor	HP 8485A
Power Meter	HP 432A
Thermistor Mount	HP 8478B
Thermistor Mount	HP K486A
Crystal Detector	HP 8473C
10 dB Attenuator	Weinschel Model 9-10
Power Splitter	Weinschel Model 1579A
Oscilloscope	HP 1740A
Adapter, Type N male to SMA female	HP 1250-1250
Adapter, Waveguide to SMA female	HP K281C
BNC TEE	HP 1250-0781

PROCEDURE:

1. Connect equipment as shown in Figure 4-2.
2. Press 8350A **INSTR PRESET**, set SWEEP to MAN.

Maximum Leveled Power and Power Variations

3. Set START and STOP frequencies and POWER LEVEL for the first frequency range listed in Table 4-5 (2.0 to 7.0 GHz e. +10 dBm).
4. Slowly tune the 8350A FREQUENCY/TIME control and note the minimum power level in the band. Leave the frequency at this low power point.
5. Adjust 83590A POWER control for a power meter reading equal to the specified maximum leveled output power.
6. Slowly tune the 8350A FREQUENCY/TIME control through the frequency band. Note and record maximum power deviation on test record card.
7. Repeat steps 3 through 6 for the other frequency band settings listed in Table 4-5.

Table 4-5. Frequency and Power Settings

Frequency Range	Maximum Leveled Power		Power Sweep Range	
	(Standard)	(Option 002)	(Standard)	(Option 002)
2.0 to 7.0 GHz	+10 dBm	+8.5 dBm	15 dB/SWP	13.5 dB/SWP
7.0 to 13.5 GHz	+10 dBm	+8 dBm	15 dB/SWP	13 dB/SWP
13.5 to 18.6 GHz	+10 dBm	+7 dBm	15 dB/SWP	12 dB/SWP
13.5 to 20 GHz	+8 dBm	+5 dBm	13 dB/SWP	10 dB/SWP
2.0 to 18.6 GHz	+10 dBm	+7 dBm	15 dB/SWP	12 dB/SWP
2.0 to 20 GHz	+8 dBm	+5 dBm	13 dB/SWP	10 dB/SWP

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

Power Level Accuracy, Range and Power Sweep

8. Set START and STOP frequencies and POWER LEVEL for the first frequency band in Table 4-5 (2.0 to 7.0 GHz at +10 dBm). Engage the 83590A POWER SWEEP, set the dB/SWP level to 16dB/SWP. Disengage POWER SWEEP key.

9. Slowly tune the 8350A FREQUENCY/TIME control through the frequency band and note the maximum power level variations above and below the displayed power level setting. Record these on the test record.

10. Press 83590A POWER LEVEL key. Use the 8350A ⏷ key to step the power down 1 dB.

11. Repeat steps 9 and 10 to check power level accuracy over the full calibrated range (down to −5 dBm).

12. Adjust the FREQUENCY/TIME control for highest frequency and note power meter level. Engage POWER SWEEP and set it for maximum leveled power (UNLEVELED light off). Record power meter level change on test record.

13. Repeat steps 8 through 12 for the frequencies and power levels listed in Table 4-5.

Power Meter Leveling

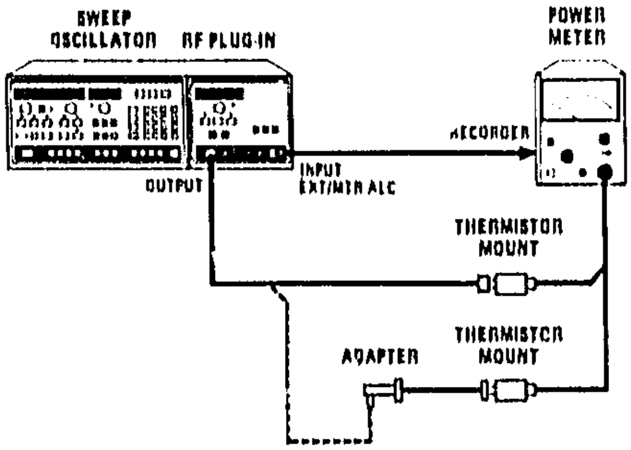


Figure 4-3. Power Meter Leveling Test Setup (Using HP 432A Power Meter)

14. Connect equipment as shown in Figure 4-3 using HP 8478B Thermistor Mount.

15. Press 8350A INSTR PRESET, set STOP frequency to 18 GHz. Set SWEEP TIME to 100 seconds and SWEEP TRIGGER to SINGLE.

16. Adjust ALC EXT/MRT CAL control and power meter range switch for a power meter indication corresponding to the 83590A POWER display.

17. Press SWEEP TRIGGER SINGLE key and note power meter variations.

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

18. When SWP light goes out, press 8350A CW and set a CW frequency of 18 GHz. Note the power meter indication.

19. Change to the K486A Thermistor Mount and adjust the ALC EXT/MTR CAL control for the same power meter indication noted in step 17.

20. Set the Sweep Oscillator for a START/STOP frequency of 18 to 20 GHz and a SWEEP TIME of 10 seconds.

21. Press SWEEP TRIGGER SINGLE key and note power variations. The combined variations from step 16 and 20 should be ≤ ±0.2 dB.

External Crystal Detector Leveling

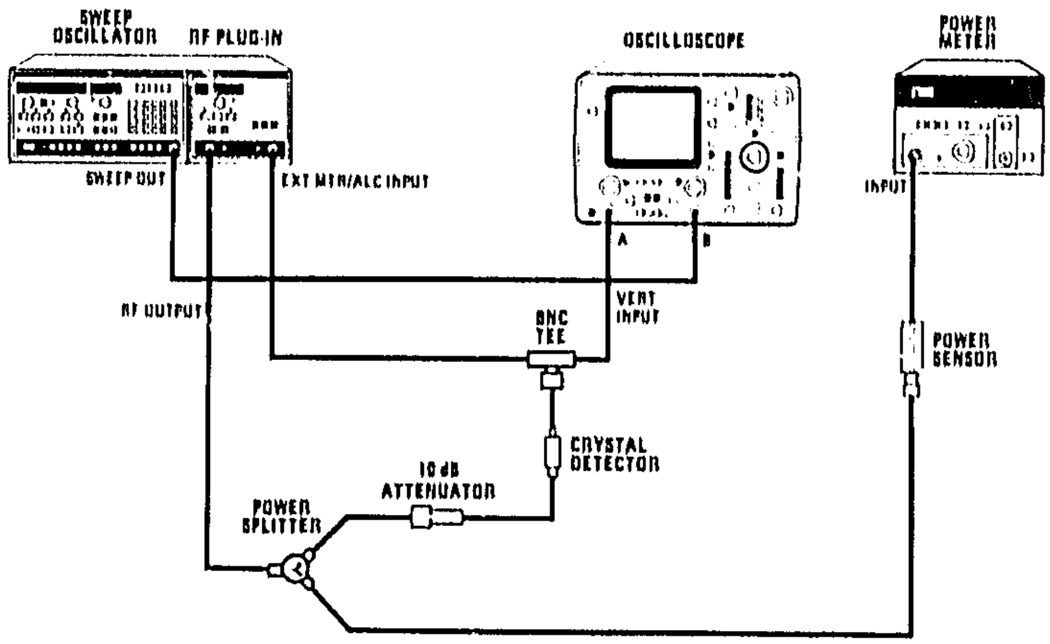


Figure 4-4. Crystal Detector Leveling Test Setup (Using HP 436A Power Meter)

22. Connect equipment as shown in Figure 4-4. Press 8350A INSTR PRESET and set SWEEP TIME to 100 milliseconds. Set the oscilloscope for external sweep mode (A vs B).

23. Press 8350A CW . Adjust the oscilloscope to the center graticule. Adjust the 83590A POWER LEVEL to decrease the power meter indication by 0.4 dB. Note the new trace position on the oscilloscope; the area between the trace and the center graticule represents the leveling tolerance of ±0.2 dB.

24. Press 8350A START .

25. Adjust the oscilloscope trace position so that the lowest point of the trace is on the center graticule. The highest point of the trace should be within the leveled variation limits established in step 22.

PERFORMANCE TESTS

4-15. FREQUENCY STABILITY TEST

SPECIFICATION:

Stability	Frequency Bands (GHz)			
	2.0 to 7.0	7.0 to 13.5	13.5 to 20.0	2.0 to 20.0
With 10% Line Voltage Change	±50 kHz	±100 kHz	±150 kHz	±150 kHz
With 10 dB Power Level Change	±200 kHz	±400 kHz	±600 kHz	±600 kHz
With 3:1 Load SWR	±100 kHz	±200 kHz	±300 kHz	±300 kHz
With Time (in a 10 minute period after one hour warmup)	<±100 kHz	<±200 kHz	<±300 kHz	<±300 kHz

DESCRIPTION:

A frequency counter is used to check frequency change due to line voltage changes, time (10 minutes), output power level changes, and load impedance changes.

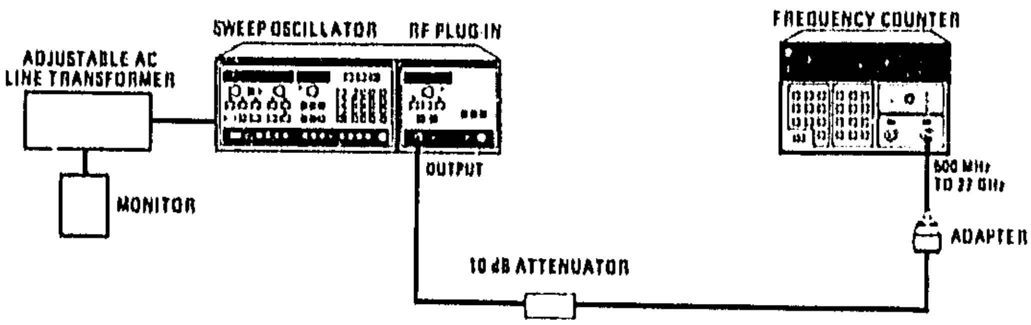


Figure 4-5. Frequency Change with Line Voltage Change

EQUIPMENT:

NOTE

More than one model number is listed for some test equipment. Use only the equipment needed to cover the line voltage used.

Sweep Oscillator.. HP 8350A
Frequency Counter.. HP 5343A
10 dB Attenuator.............................. HP 8491B Option 010
3 dB Attenuator.............................. HP 8491B Option 003
Adapter, Type-N, female to SMA female...................HP 1250–1404

PERFORMANCE TESTS

4-15. FREQUENCY STABILITY TEST (Cont'd)

Adjustable AC Line Transformer and monitor (Select for line voltage needed)
- 100-120 volt .... General Radio W5MTB
- 120 V Monitor .... RCA WV 120B
- 220-240 volt .... General Radio W10HM73
- 240V Monitor .... RCA WV 503A

3 dB Attenuator .... Weinschel Model 9-3
Adjustable Short .... Maury Microwave 1953-2

PROCEDURE:

Frequency Change with Line Voltage Change

1. Connect equipment as shown in Figure 4-5 and set 8350A LINE switch to ON.

2. Set adjustable line transformer using suitable monitor to the line voltage set on the 8350A power module. Press the 8350A **INSTR PRESET** and **CW** key and enter a CW frequency of 6.0 GHz. Rotate frequency counter SAMPLE RATE knob to HOLD, press **SET**, **OFS MHz**, **Blue Key**, then rotate the Frequency Counter SAMPLE RATE knob counter-clockwise back to the normal position.

Table 4-6. High and Low Line Voltage Selection Table

Nominal Line Voltage	100V	115/120V	220V	240V
Low Line Voltage	90V	108V	198V	216V
High Line Voltage	105V	126V	231V	252V

3. Set adjustable line transformer to the low line voltage using suitable monitor which corresponds to the selected nominal voltage in Table 4-6. Check and record on the test card step 3 the difference frequency displayed on counter.

4. Set adjustable line transformer using suitable monitor to the high line voltage using suitable monitor which corresponds to the selected nominal voltage. Check and record on the test record card step 4 the difference frequency displayed on counter.

5. Repeat steps 2 through 4 for the frequencies listed in Table 4-7.

Table 4-7. Frequency Change with Line Voltage Change

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±50 kHz
Band 2	12.0 GHz	±100 kHz
Band 3	18 GHz	±150 kHz

PERFORMANCE TESTS

4-15. FREQUENCY STABILITY TEST (Cont'd)

Frequency Change with Time (10 minutes)

6. Set adjustable line transformer voltage to nominal. Enter POWER LEVEL 1 0 dBm , then CW 6 GHz (wait one minute for frequency counter and Oscillator to settle).

7. Rotate the frequency counter SAMPLE RATE knob to HOLD, press SET , OFS MHZ , Blue Key , then rotate the Frequency Counter SAMPLE RATE knob counter-clockwise back to the normal position. The counter is now indicating frequency change with time. Wait 10 minutes while observing frequency count for maximum frequency change and record this maximum change on the performance test record card step 7.

8. Repeat steps 6 and 7 for the other frequencies shown in Table 4-8.

Table 4-8. Frequency Change with Time

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±100 kHz
Band 2	12.0 GHz	±200 kHz
Band 3	18 GHz	±300 kHz

Frequency Change with 10 dB Power Level Change

9. Enter CW 6 GHz .

10. Rotate the frequency counter SAMPLE RATE knob to HOLD, press SET , OFFSET , Blue Key , then rotate the frequency counter SAMPLE RATE knob counter-clockwise back to the normal position. Enter POWER LEVEL 0 dBm . Verify the frequency change is less than given in Table 4-9.

11. Repeat steps 9 and 10 for the other frequencies given in Table 4-9.

Table 4-9. Frequency Change with Power Level Change

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±200 kHz
Band 2	12.0 GHz	±400 kHz
Band 3	18 GHz	±600 kHz

PERFORMANCE TESTS

4-16. FREQUENCY STABILITY TEST (Cont'd)

Frequency Change With 3:1 Load SWR

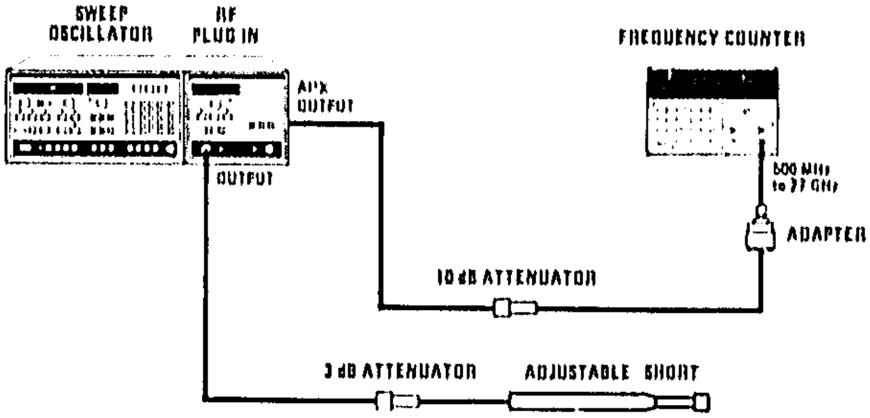


Figure 4-6. Frequency Change with 3:1 Load SWR Test Setup

12. Connect equipment as shown in Figure 4-6. Press the 8350A INSTR PRESET , CW 6 GHz , then POWER LEVEL 1 0 dBm .

13. Since the frequency of the AUX OUTPUT is being counted, a multiplication factor must be entered for bands 2 and 3 only to yield actual RF OUTPUT frequency errors. No factor is needed for band 1. In band 2 press SET , . (decimal point), 2 , and ENTER on counter. In band 3, press SET , . , 3 , and ENTER .

14. On counter rotate the SAMPLE RATE knob clockwise to HOLD, press SET , OFS MHZ , Blue Key , then rotate the SAMPLE RATE knob counter-clockwise to the normal position on the Frequency Counter.

15. Adjust the adjustable short through its range while observing the frequency counter for the greatest plus and minus frequency change. Check that the peak-to-peak frequency change is less than given in Table 4-10.

16. Enter the next CW frequency and repeat steps 14 and 15. To clear the counter multiplication factor, press SET , . and ENTER .

Table 4-10. Frequency Change with 3:1 Load SWR

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±100 kHz
Band 2	12.0 GHz	±200 kHz
Band 3	18 GHz	±300 kHz

PERFORMANCE TESTS

4-10. RESIDUAL FM TEST

SPECIFICATION:

10 Hz to 10 kHz Bandwidth, CW mode with CW Filter
2.0 to 7.0 GHz: <5 kHz (peak)
7.0 to 13.5 GHz: <7kHz (peak)
13.5 to 20 GHz: <9 kHz (peak)

DESCRIPTION:

The CW RF output signal is slope-detected by using the linear portion of a spectrum analyzer resolution bandwidth filter in the zero-span mode.

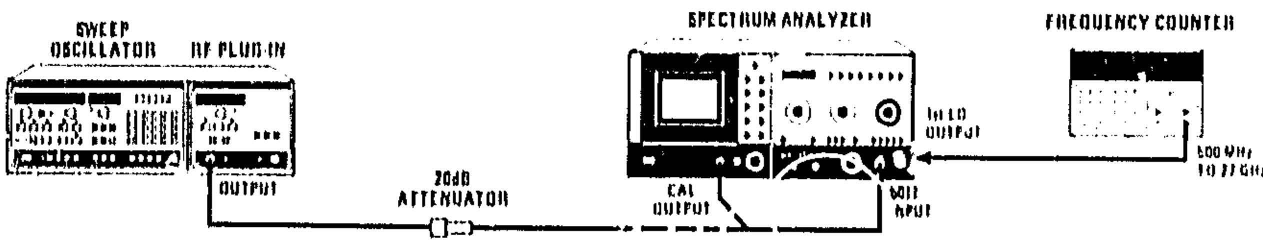


Figure 4-7. Residual FM Test Setup

EQUIPMENT:

Sweep Oscillator.. HP 8350A
Spectrum Analyzer.. HP 8565A
Frequency Counter.. HP 5343A
10 dB Attenuator.. Weinschel Model 9-10

PROCEDURE:

1. Connect equipment as shown in Figure 4-7. Connect the spectrum analyzer CAL OUTPUT to the spectrum analyzer input.

2. Press 8350A **INSTR PRESET** , **CW** . Enter a CW frequency of 6.0 GHz.

NOTE

To minimize drift, allow five minutes warmup before continuing with test.

PERFORMANCE TESTS

4-16. RESIDUAL FM TEST (Cont'd)

3. Set spectrum analyzer controls as follows:

TUNING	0.100 GHz
FREQUENCY SPAN/DIV	.5 MHz
RESOLUTION BW	300 kHz (uncoupled)
INPUT ATTEN	−30 dB
REFERENCE LEVEL	−10 dBm
AMPLITUDE SCALE	LIN
AUTO STABILIZER	ON
SWEEP TIME/DIV	10 msec/DIV
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	fully counterclockwise (OFF)
VIDEO FILTER	.01

4. Adjust spectrum analyzer TUNING to center the 100 MHz CAL OUTPUT signal on the spectrum analyzer display.

5. Adjust spectrum analyzer REFERENCE LEVEL controls to place the peak of the signal trace at the reference level (top) graticule line.

6. Reduce RESOLUTION BW to 100 kHz and FREQUENCY SPAN/DIV to 100 kHz while keeping the signal centered with the FINE TUNING control. The spectrum analyzer display should be as shown in Figure 4-8.

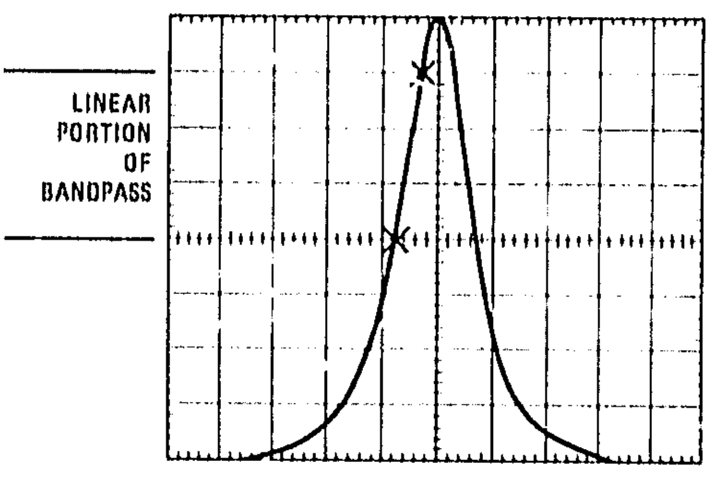


Figure 4-8. Spectrum Analyzer Display for Residual FM

7. Set the FREQUENCY SPAN MODE to ZERO SPAN and adjust the FINE TUNING control counterclockwise to position the CRT trace on the center horizontal graticule. Note the frequency counter indication: ______________ kHz.

8. Adjust the FINE TUNING control clockwise to position the CRT trace on the seventh graticule (one division below the Reference Level). Be sure to stay tuned on the lower frequency side of the signal bandpass. Note the frequency counter indication: ______________ kHz.

PERFORMANCE TESTS

4-16. RESIDUAL FM TEST (Cont'd)

9. The spectrum analyzer demodulation sensitivity per division is calculated as one third of the difference frequency between the frequencies noted in steps 7 and 8. Calculate the demodulation sensitivity: __________ kHz/Div.

10. Connect the 8350A RF OUTPUT signal to the spectrum analyzer.

11. Set spectrum analyzer controls as follows:

    TUNING .... 6.00 GHz
    FREQUENCY SPAN/DIV .... .5 MHz
    AMPLITUDE SCALE .... LIN
    REFERENCE LEVEL .... +10 dBm

12. Adjust spectrum analyzer REFERENCE LEVEL controls to place the peak of the signal trace at the reference level (top) graticule line.

13. Reduce FREQUENCY SPAN/DIV to 0 while keeping the signal centered on the CRT with the FINE TUNING control.

15. Position the trace between the fifth and seventh graticules by turning the FINE TUNING control counterclockwise. STORE a single trace.

16. Note the maximum peak-to-peak deviation in divisions of the CRT trace. The peak deviation is one-half the peak-to-peak deviation. Multiply the peak deviation by the modulation sensitivity calculated in step 8.

    Residual FM (kHz) = (peak-to-peak deviation/2) X (demodulation sensitivity)
    = __________ kHz

17. Verify that residual FM is within tolerance given in Table 4-11.

18. Repeat steps 11 through 17 with spectrum analyzer and RF Plug-in tuned to each frequency listed in Table 4-11.

Table 4-11. Residual FM

Band	CW Frequency	Residual FM
Band 1	6.0 GHz	<8 kHz
Band 2	12.0 GHz	<15 kHz
Band 3	18.0 GHz	<15 kHz

PERFORMANCE TESTS

4-17. SPURIOUS SIGNALS TEST

SPECIFICATIONS:	Frequency Bands (GHz)			
	2.0 to 7.0	7.0 to 13.5	13.5 to 20	2.0 to 20
Harmonics (in dB below carrier)	>25 dB	>25 dB	>25 dB	>25 dB
Non-Harmonics	>50 dB	>50 dB	>50 dB	>50 dB

DESCRIPTION:

RF output signal from Sweep Oscillator is displayed on a spectrum analyzer to verify that harmonic and non-harmonic spurious signals are at or below the specified level.

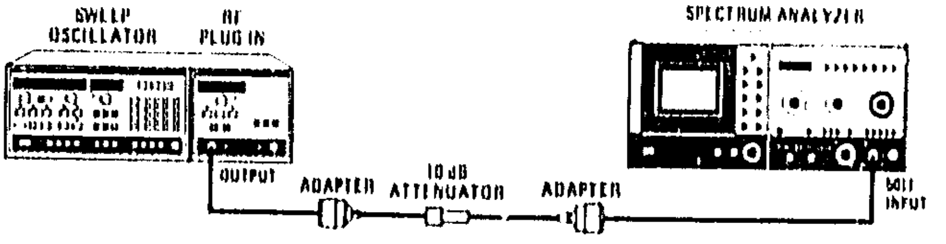


Figure 4-9. Spurious Signals Test Setup

EQUIPMENT:

Sweep Oscillator .... HP 8350A
Spectrum Analyzer .... HP 8565A
10 dB Attenuator .... Weinschel Model 9-10
Adapter, Type N male to SMA female .... HP 1250-1250
Adapter, Type N female to SMA female .... HP 1250-1562

PROCEDURE:

1. Connect equipment as shown in Figure 4-9.
2. Set controls as follows:

8565A:
Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz .... 1.7 to 4.1
INPUT ATTEN .... 10 dB
REF LEVEL dBm .... +10 dBm
FREQUENCY SPAN MODE .... FULL BAND

8350A
Press INSTR PRESET , CW , 2 GHz .

83590A
POWER .... Specified Maximum Leveled Power
CW FILTER .... ON

4-17. SPURIOUS SIGNALS TEST (Cont'd)

NOTE

The spectrum analyzer originates some mixing products that may appear on the display. If a signal is in question, increase the spectrum analyzer input attenuation by 10 dB, note if signal decreases in amplitude by 10 dB, then return the attenuator to the original position. If the signal in question comes from an external source, it will change by 10 dB. If the signal in question originates in the spectrum analyzer, the level will either change by greater or less than 10 dB or may not change at all.

The 8350A CW control when being rotated may generate some noise spikes. These signals should disappear when rotation is stopped.

If a spurious signal is found that appears out of specifications check the fundamental signal amplitude to ensure it is at maximum specified power. Then check spurious level by substituting a known amplitude signal on the spectrum analyzer.

3. Adjust the 8350A CW control through the entire frequency range of the RF Plug-in (2.0 to 20.0 GHz) and check for harmonic and non-harmonic spurious signals. The specifications for harmonic and non-harmonic signals are listed below.

Table 4-12. Spurious Signals Specifications

Frequency Band (83590A)	Harmonics dB below carrier	Nonharmonics dB below carrier
2.0 to 7.0 GHz	>25 dB	>50 dB
7.0 to 13.5 GHz	>25 dB	>50 dB
13.5 to 20 GHz	>25 dB	>50 dB

4-18. OUTPUT SWR TEST (INTERNALLY LEVELED)

SPECIFICATION:

Output SWR: <1.9
Option 002: <2.1

DESCRIPTION:

The RF Output signal is measured using a directional coupler, crystal detector, and oscilloscope. The signal at the oscilloscope contains (1) the incident signal from the oscillator, and (2) the reflected signal. The reflected signal is developed as follows: The incident signal travels down the 20 cm air lines, encounters the open end, and is reflected back to the source. If the reflected signal at the RF OUTPUT connector encounters a perfect 50-ohm source match, no signal is reflected back. However, the greater the mismatch, the greater the reflected signal. This reflected signal either adds to or subtracts from the incident signal. This variation is displayed on the oscilloscope.

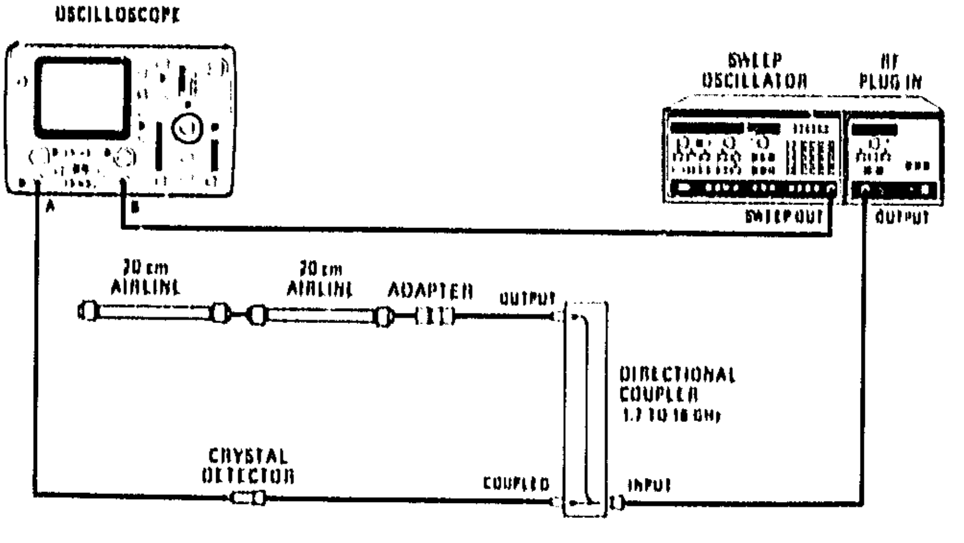


Figure 4-10. Output SWR Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A
Oscilloscope	Any general purpose oscilloscope such as HP 1222A or 1740A
Crystal Detector	HP 8470A Option 012
Directional coupler	HP 11691D
20-cm Air Lines (2 required)	HP 11567A
Adapter APC-7 to Type-N male	HP 11525AC

PERFORMANCE TESTS

4-18. OUTPUT SWR TEST (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-10. Put oscilloscope in A vs. B mode, and adjust horizontal offset and Channel B sensitivity so the trace fills the screen.

2. Press INSTR PRESET, START, 2, GHz, STOP 1 8 GHz on 8350A. Set DISPL BLANKING off and RF BLANKING on.

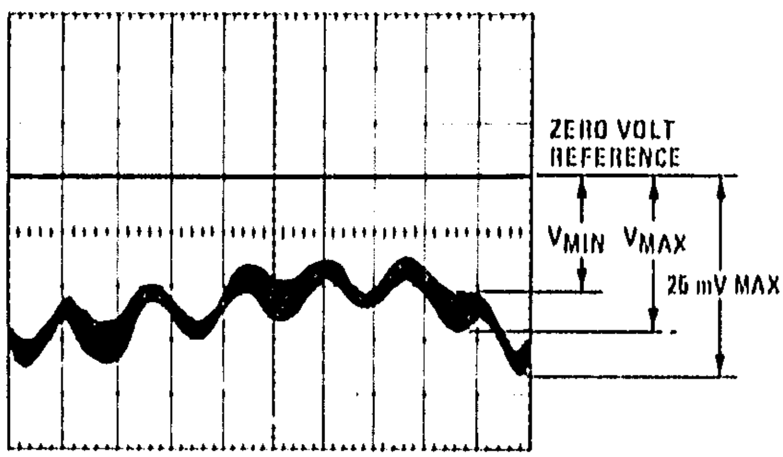


Figure 4-11. Typical Low Frequency Swept SWR Measurement

3. Adjust POWER control on Plug-in for a maximum output power of −25 millivolts peak trace on oscilloscope display in order to keep crystal in square law output range.

4. Select points on trace where V MAX/V MIN appear to have greatest separation and calculate V MAX/V MIN for each point (see Figure 4-11).

5. Convert greatest V MAX/V MIN ratio noted in step 10 into source match SWR using Figure 4-12 on the 0 dB loss line. The SWR should be less than 1.9 (2.1 for Option 002).

PERFORMANCE TESTS

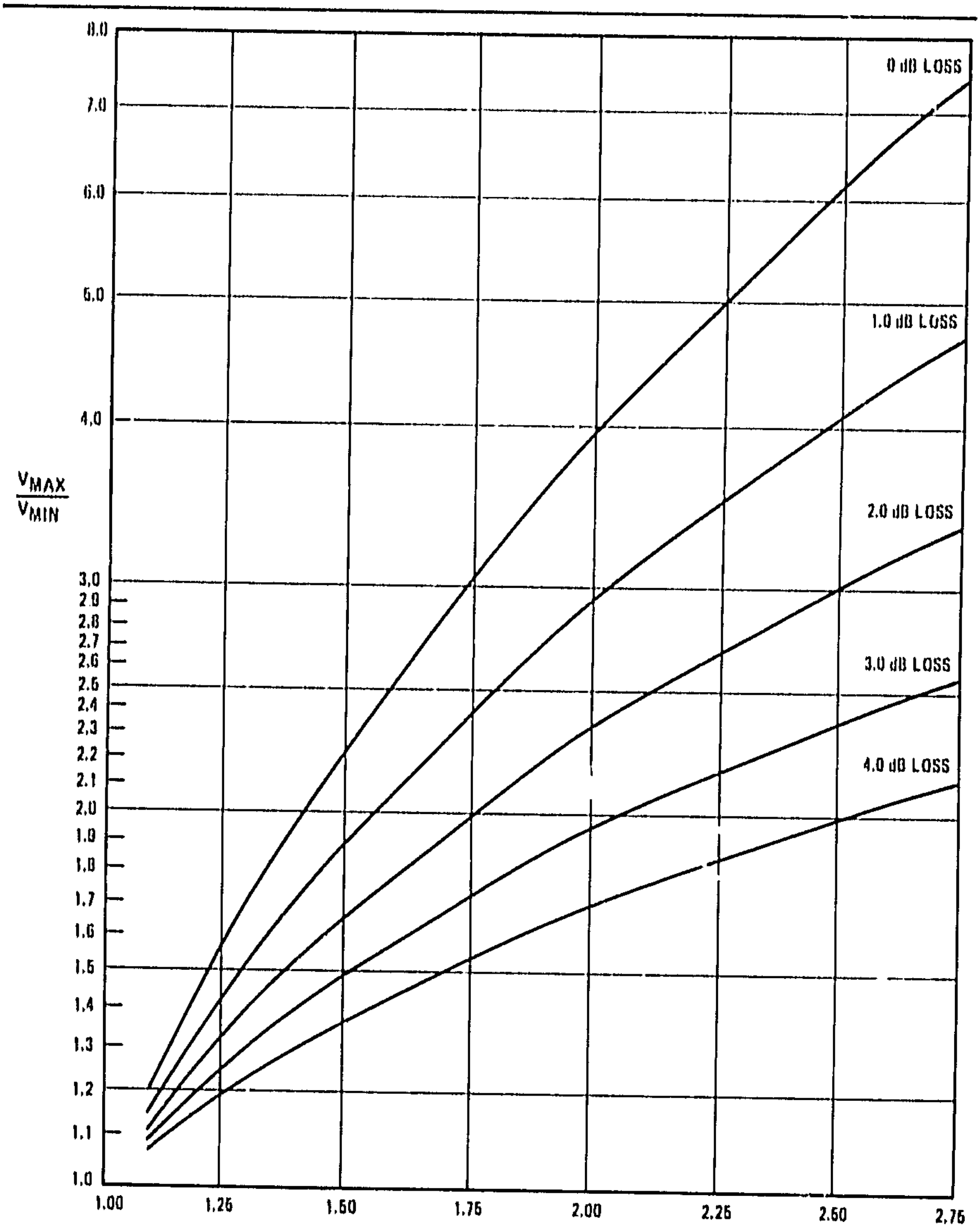


Figure 4-12. Conversion of Oscilloscope Trace to Source Match SWR

PERFORMANCE TESTS

4-19. RESIDUAL AM

SPECIFICATION:

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

DESCRIPTION:

The RF Output signal from the RF Plug-in is amplitude modulated with a square wave from the 8350A. This modulated signal is used to establish a reference on the RMS voltmeter that is 9 dB below actual carrier signal. The 9 dB reduction occurs because of voltmeter response to square wave and square-law response of crystal detector. Modulation is then removed and the magnitude of the Residual AM component is measured with respect to established reference.

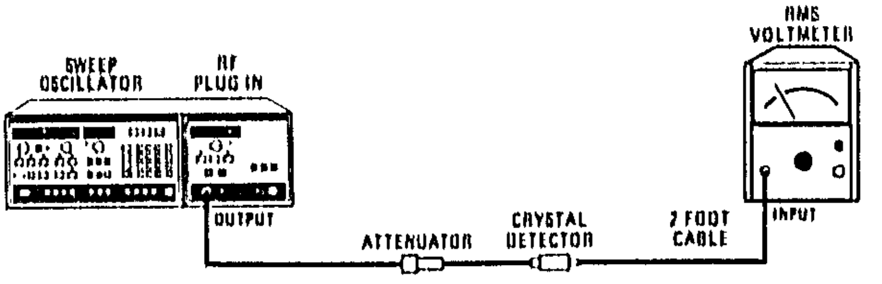


Figure 4-13. Residual AM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A
RMS Voltmeter	HP 3400A
Crystal Detector	HP 8470B Option 012
Attenuator	Refer to PROCEDURE
60 cm (24 in) cable (Limits bandwidth to approximately 100 kHz)	HP 11170B

PROCEDURE:

1. Connect equipment as shown in Figure 4-13 using a 20 dB attenuator.

2. Press **INSTR PRESET**, **CW**, engage **⊔⊓ MOD** (1 kHz or 27.8 kHz), disengage **DISPL BLANK**.

NOTE

A 41 dB decrease in the RMS voltmeter indication corresponds to a 50-dB reduction in signal level. A correction factor of 9 dB is added because of the RMS voltmeter response to a square wave and the square-law response of the crystal detector.

3. Set POWER LEVEL to +10 dBm and CW frequency to 6 GHz.

4. Vary attenuation using 3 dB, 6 dB, and 10 dB attenuators until reading on RMS voltmeter is −28 dB ±3 dB. Note voltmeter reading.

4-19. RESIDUAL AM (Cont'd)

5. Disengage ⊔⊓ MOD . Change RMS voltmeter range switch to obtain an on-scale indication. Calculate the difference between this reading and the indication noted in step 4. Add 9 dB to compensate for square-law inequities, and verify this meets the tolerance in Table 4-13.

6. Engage ⊔⊓ MOD . Repeat steps 4 and 5 for frequencies given in Table 4-13.

Table 4-13. Residual AM

Band	CW Frequency	Residual AM (dB below carrier)
Band 1	6.0 GHz	>50 dB
Band 2	12.0 GHz	>50 dB
Band 3	18.0 GHz	>50 dB

4-20. EXTERNAL FREQUENCY MODULATION TEST

SPECIFICATION:

Modulation Frequency	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

DESCRIPTION:

The RF Output is modulated with an external signal at 100 Hz, 1 MHz, 2 MHz and 10 MHz. The 100 Hz deviation is measured directly on a spectrum analyzer. The deviation at the higher frequencies is found by using a delay line discriminator to observe an increase in the modulation on an oscilloscope until distortion is observed. This frequency change is measured on a frequency counter.

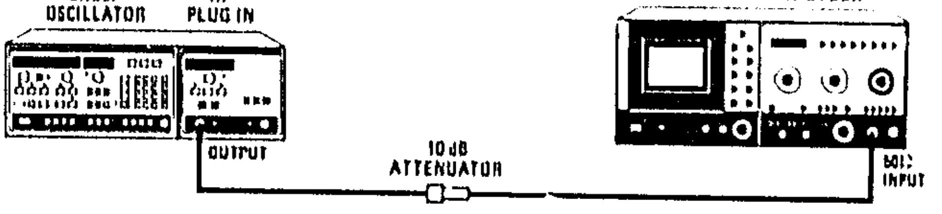


Figure 4-14. 100 Hz External Frequency Modulation Test Setup

4-20. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8350A
Spectrum Analyzer	HP 8565A
Frequency Counter	HP 5343A
Function Generator	HP 3312A
Oscilloscope	Any general purpose oscilloscope such as HP 1222A* or 1740A
0 dB Attenuator	HP 8491B Option 010
Power Splitter	HP 11667A
Delay Line Discriminator	(See Figure 1-3)

* Add a 50Ω load and BNC Tee to each oscilloscope input.

PROCEDURE:

100 Hz Modulation

1. Ensure that modulation sensitivity is set to −20 MHz/volt and modulation coupling to DC (see Figure 3-10 Configuration Switch). Connect equipment as shown in Figure 4-14.

2. Press 8350A **INSTR PRESET** , **CW** and disengage the **DISPL BLANK** key. Disengage RF Plug-in **CW FILTER** key. Center fundamental signal on spectrum analyzer CRT display. Set function generator frequency to 100 Hz sinewave and amplitude to full counterclockwise. Adjust function generator amplitude control slowly clockwise while monitoring display on spectrum analyzer. Deviation from center line should be symmetrical at first then become non-symmetrical as deviation increases.

3. Note point at which deviation becomes non-symmetrical and verify that it is greater than ±12 MHz.

4. Turn 8350A LINE switch to off. Remove RF Plug-in and switch modulation coupling to crossover (see Figure 3-10 Configuration Switch). Install the RF Plug-in and turn the 8350A line switch to ON. Then repeat steps 2 and 3. The highest symmetrical deviation frequency should be greater than ±75 MHz.

>100 Hz FM Modulation

5. Set function generator frequency to 1 MHz. Set both oscilloscope inputs to 50Ω.

6. Set function generator output amplitude to 0.1 volt p-p output. Connect equipment as shown in Figure 4-15 with function generator output not connected. Adjust CW and CW VERNIER for a delay line discriminator output of 0 volts as observed on Channel A of the oscilloscope. Note frequency counter reading.

4-20. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)

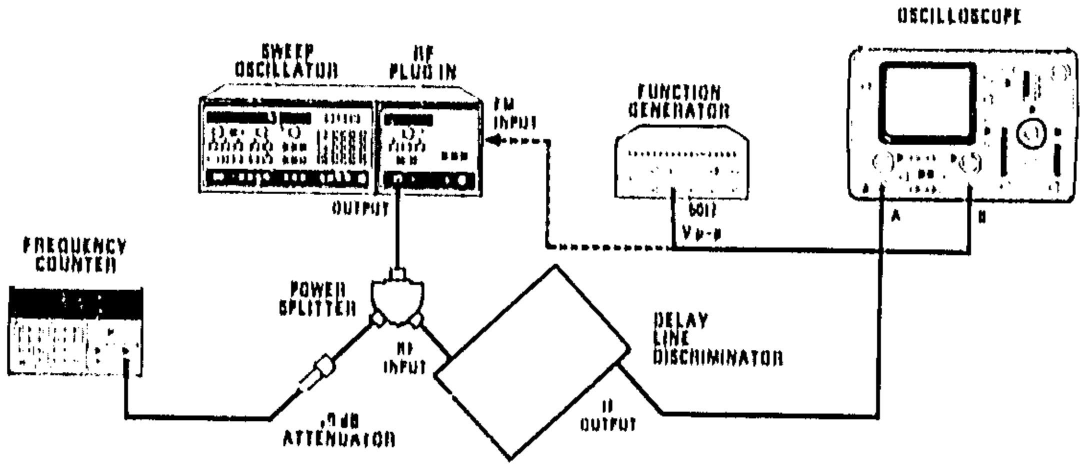


Figure 4-15. >100 Hz Frequency Modulation Test Setup

7. Connect the function generator output to 8350A FM INPUT (rear panel) and adjust Channel A of the oscilloscope for a clear display of the function generator sinewave.

8. Increase the function generator output amplitude until the deviation displayed on Channel A becomes non-symmetrical or distorted. Use Channel B of the oscilloscope to monitor the function generator output. If the output is offset the test is invalid.

9. Mark the peak of the sinewave displayed on Channel A with a grease pencil. Remove the function generator output from FM INPUT and adjust CW/CW VERNIER to the grease pencil mark. Calculate the difference between the present frequency counter reading and the previous reading (step 6). Verify frequency difference is greater than minimum given in Table 4-14 below for the FM frequency range tested.

10. Repeat steps 6 through 9 with the function generator set at 2 MHz and at 10 MHz. Verify the results according to Table 4-14 below.

11. Change mode of Plug-in modulation coupling and repeat steps 6 through 10. Verify the results according to Table 4-14 below.

Table 4-14. External Frequency Modulation

Modulation Frequency	Direct Coupled	Cross-Over Coupled
1 MHz	±7 MHz	±7 MHz
2 MHz	±5 MHz	±5 MHz
10 MHz	±1 MHz	±1 MHz

PERFORMANCE TESTS

4-21. AM ON/OFF RATIO AND SQUARE WAVE SYMMETRY TEST

SPECIFICATION:

On/Off Ratio: ≥30 dB

Symmetry: 40/60

DESCRIPTION:

The AM ON/OFF ratio is checked on the amplitude axis of a video triggered spectrum analyzer display. The symmetry is checked by calculating the on/off time ratio on the frequency axis.

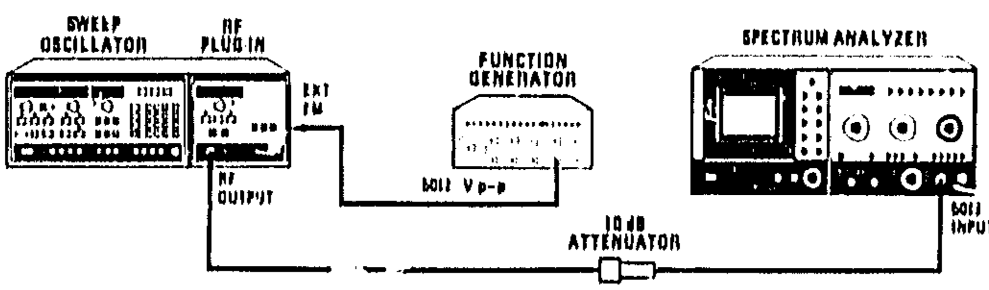


Figure 4-16. AM ON/OFF Ratio and Square Wave Symmetry Test Setup

EQUIPMENT:

Sweep Oscillator .... HP 8350A
10 dB Attenuator .... HP 8491B Option 020
Spectrum Analyzer .... HP 8565A

PROCEDURE:

1. Connect equipment as shown in Figure 4-16. Press 8350A INSTR PRESET CW 4 GHz and engage ⊔⊓ MOD . Set 83590A POWER LEVEL to +10 dBm.

2. Set controls as follows:

   8565A:

   Set all Normal settings (controls marked with green)

   FREQUENCY BAND GHZ .... 3.8 to 8.5 GHz
   INPUT ATTENUATION .... 10 dB
   REFERENCE LEVEL .... 10 dBm
   FREQUENCY SPAN MODE .... ZERO SPAN
   SWEEP TRIGGER .... VIDEO
   RESOLUTION BW .... 3 MHz
   AUTO STABILIZER .... OFF
   SWEEP TIME/DIV .... .1msec for 1 kHz
   .... 5μsec for 27.8 kHz

4-21. AM ON/OFF RATIO AND SQUARE WAVE SYMMETRY TEST (Cont'd)

3. Adjust spectrum analyzer TUNING control to center 4 GHz signal on CRT. Adjust REFERENCE LEVEL to set signal on top trace. Verify that the AM ON/OFF ratio (peak-to-peak signal variation) is greater than 30 dB.

4. Verify that the squarewave symmetry of the observed signal is between 40 and 60 percent.

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002)

SPECIFICATION:

Attenuator Accuracy	Attenuator Setting (dB)						
	10	20	30	40	50	60	70
2.0 to 12.4 GHz	0.6	0.7	0.9	1.8	2.0	2.2	2.3
12.4 to 18 GHz	0.7	0.9	1.2	2.0	2.3	2.5	2.8
18 to 20 GHz	0.9	1.3	2.5	3.0	3.2	3.3	3.5

DESCRIPTION:

The Plug-in RF output is compared to a specially calibrated attenuator and displayed on a spectrum analyzer.

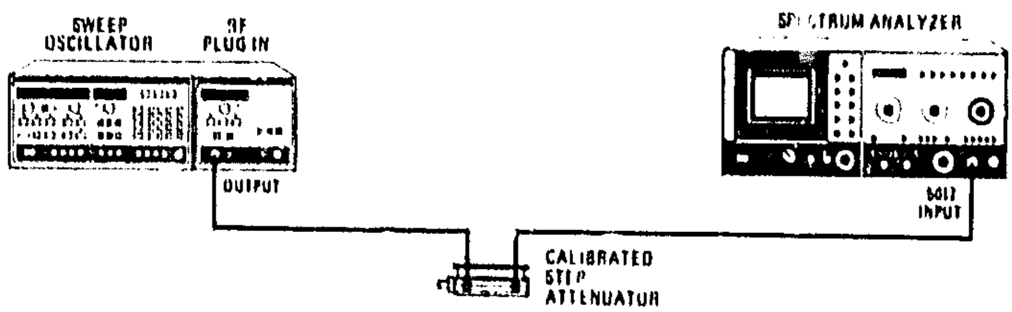


Figure 4-17. Attenuator Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator .... HP 8350A
Step Attenuator .... HP 8495A Opt. 890
Spectrum Analyzer .... HP 8565A

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002) (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-17. Press 8350A INSTR PRESET , CW 4 GHz . Set the 83590A POWER LEVEL to +4 dBm.

2. Set controls as follows:

   Step Attenuator

   ATTENUATION .... 70 dB

   Spectrum Analyzer

   Set all normal settings (controls marked with green)
   INPUT ATTEN .... 10 dB
   REFERENCE LEVEL.. −50 dBm
   RESOLUTION BANDWIDTH....................................... 1 MHz
   FREQUENCY SPAN/DIV.. 5 MHz
   FREQUENCY SPAN MODE.................................. FULL BAND
   VIDEO FILTER.. Adjust as necessary
   FREQUENCY BAND .... 3.8 to 8.5 GHz

3. Press 8350A POWER LEVEL , STEP SIZE , 1 , 0 , and dBm/dB .

4. Note the actual attenuation values on the calibrated step attenuator's (Option 890) calibration report at the frequency and attenuation steps used. Calculate the Reference Attenuation Error for each step as shown below; record this error in the Attenuation Error column of Table 4-15.

   Attenuation Error = (Cal. Ref Atten. − Cal. Step Atten.) − (Ref. Setting − Step Setting)

   For example, with a Reference setting of 70 dB, the calculation for the 30 dB step setting is as follows (Note that the actual attenuation stepped in this example is 38.75 dB (69.55 dB − 30.80 dB)) :

   Example Calibration Report values:

   70 dB setting is actually 69.55 dB
   30 dB setting is actually 30.80 dB

   Attenuation Error = (69.55 dB − 30.80 dB) − (70 dB − 30 dB) = −1.25 dB

5. Adjust spectrum analyzer TUNING control to center notch on Sweep Oscillator output signal. Reduce spectrum analyzer FREQUENCY SPAN/DIV to .2 MHz and recenter TUNING control. Press FREQUENCY SPAN MODE ZERO SPAN key and adjust FINE TUNING to peak signal on spectrum analyzer display. Adjust spectrum analyzer REFERENCE LEVEL VERNIER for a trace at the center graticule line. Press 1 dB/DIV and recenter trace.

6. Press the 8350A ⇓ key and decrease the reference attenuation by 10 dB.

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002) (Cont'd)

7. Record the power level variation from the center graticule (reference) on the spectrum analyzer display (be sure to designate the direction of change: + is above and − is below the reference).

8. Algebraically add the Attenuation Error and Deviation from 0 reference and record the sum in the Attenuator Accuracy column of Table 4-15 below. Repeat steps 6 and 7 for the other attenuation values.

Table 4-15. Step Attenuator Accuracy

Reference Setting =70 dB	Attenuation Error	Deviation from 0 ref	Attenuator Accuracy
70−60	______	______	______
70−50	______	______	______
70−40	______	______	______
70−30	______	______	______
70−20	______	______	______
70−10	______	______	______
70−0	______	______	______

9. Press 8350A CW 1 5 GHz . Repeat the test at 15 GHz.

10. Press 8350A CW 1 8 GHz . Repeat the test at 18 GHz.

Table 4-16. Performance Test Record (1 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-13. Frequency Range and Accuracy					
CW Accuracy					
	4.	Start frequency = 2.0 GHz			2.0 GHz
	5.	Stop frequency = 20 GHz	20 GHz		
2.0 to 7.0 GHz: ±5 MHz	6.	CW frequency = 4 GHz	3.995 GHz		4.005 GHz
		CW frequency = 2.0 GHz	1.995 GHz		2.005 GHz
		CW frequency = 7.0 GHz	6.995 GHz		7.005 GHz
7.0 to 13.5 GHz: ±10 MHz		CW frequency = 10 GHz	9.99 GHz		10.01 GHz
		CW frequency = 7.1 GHz	7.09 GHz		7.11 GHz
		CW frequency = 13.5 GHz	13.49 GHz		13.51 GHz
13.5 to 20 GHz: ±15 MHz		CW frequency = 17.0 GHz	16.985 GHz		17.015 GHz
		CW frequency = 14.0 GHz	13.985 GHz		14.015 GHz
		CW frequency = 20.0 GHz	19.985 GHz		20.015 GHz
Swept Frequency Accuracy					
2.0 to 20 GHz: ±50 MHz	9.	Start frequency = 2.0 GHz	1.95 GHz		2.05 GHz
	10.	Stop frequency = 20 GHz	19.95 GHz		20.05 GHz
2.0 to 7.0 GHz: ±20 MHz	11.	Start frequency = 2.0 GHz	1.98 GHz		2.02 GHz
		Stop frequency = 7.0 GHz	6.98 GHz		7.02 GHz
7.0 to 13.5 GHz: ±25 MHz		Start frequency = 7.0 GHz	6.975 GHz		7.025 GHz
		Stop frequency = 13.5 GHz	13.475 GHz		13.525 GHz
13.5 to 20 GHz: ±30 MHz		Start frequency = 13.5 GHz	13.47 GHz		13.53 GHz
		Stop frequency = 20 GHz	19.97 GHz		20.03 GHz
Marker Accuracy					
2.0 to 20 GHz: ±140 MHz	14.	M1 = 3 GHz	2.86 GHz		3.14 GHz
		M2 = 6 GHz	5.86 GHz		6.14 GHz
		M3 = 10 GHz	9.86 GHz		10.14 GHz
		M4 = 14 GHz	13.86 GHz		14.14 GHz
		M5 = 18 GHz	17.86 GHz		18.14 GHz
2.0 to 7 GHz: ±45 MHz	15.	M1 = 3 GHz	2.955 GHz		3.045 GHz
		M2 = 6 GHz	5.955 GHz		6.045 GHz
7 to 13.5 GHz: ±58 MHz		M1 = 8 GHz	7.942 GHz		8.058 GHz
		M2 = 12 GHz	11.942 GHz		12.058 GHz
13.5 to 20 GHz: ±63 MHz		M1 = 15 GHz	14.937 GHz		15.063 GHz
		M2 = 18 GHz	17.937 GHz		18.063 GHz
4-14. Output Amplitude					
Power Variations at Max. Power:	6.	2.0 to 7.0 GHz @ +10 dBm	+10 dBm		+11.4 dBm

Table 4-16. Performance Test Record (2 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
Power Variations at Max Power: (Cont'd)	7.	7.0 to 13.5 GHz @ +10 dBm	+10 dBm		+11.4 dBm
		13.5 to 18.6 GHz @ +10 dBm	+10 dBm		+11.6 dBm
		13.5 to 20 GHz @ +8 dBm	+8 dBm		+9.6 dBm
		2.0 to 18.6 GHz @ +10 dBm	+10 dBm		+11.8 dBm
		2.0 to 20 GHz @ +8 dBm	+8 dBm		+9.8 dBm
Option 002:	6.	2.0 to 7.0 GHz @ +8.5 dBm	+8.5 dBm		+9.9 dBm
	7.	7.0 to 13.5 GHz @ +8 dBm	+8 dBm		+9.4 dBm
		13.5 to 18.6 GHz @ +7 dBm	+7 dBm		+8.6 dBm
		13.5 to 20 GHz @ +5 dBm	+5 dBm		+6.6 dBm
		2.0 to 18.6 GHz @ +7 dBm	+7 dBm		+8.8 dBm
		2.0 to 20 GHz @ +5 dBm	+5 dBm		+6.8 dBm
Power Level Accuracy 2.0 to 7.0 GHz	9.	Power = +10 dBm	+8.7 dBm		+11.3 dBm
	10.	= +9 dBm	+7.7 dBm		+10.3 dBm
	11.	= +8 dBm	+6.7 dBm		+9.3 dBm
		= +7 dBm	+5.7 dBm		+8.3 dBm
		= +6 dBm	+4.7 dBm		+7.3 dBm
		= +5 dBm	+3.7 dBm		+6.3 dBm
		= +4 dBm	+2.7 dBm		+5.3 dBm
		= +3 dBm	+1.7 dBm		+4.3 dBm
		= +2 dBm	+0.7 dBm		+3.3 dBm
		= +1 dBm	−0.3 dBm		+2.3 dBm
		= 0 dBm	−1.3 dBm		+1.3 dBm
		= −1 dBm	−2.3 dBm		+0.3 dBm
		= −2 dBm	−3.3 dBm		−0.7 dBm
		= −3 dBm	−4.3 dBm		−1.7 dBm
		= −4 dBm	−5.3 dBm		−2.7 dBm
		= −5 dBm	−6.3 dBm		−3.7 dBm
7.0 to 13.5 GHz	9.	Power = +10 dBm	+8.7 dBm		+11.3 dBm
	10.	= +9 dBm	+7.7 dBm		+10.3 dBm
	11.	= +8 dBm	+6.7 dBm		+9.3 dBm
		= +7 dBm	+5.7 dBm		+8.3 dBm
		= +6 dBm	+4.7 dBm		+7.3 dBm
		= +5 dBm	+3.7 dBm		+6.3 dBm
		= +4 dBm	+2.7 dBm		+5.3 dBm
		= +3 dBm	+1.7 dBm		+4.3 dBm
		= +2 dBm	+0.7 dBm		+3.3 dBm
		= +1 dBm	−0.3 dBm		+2.3 dBm
		= 0 dBm	−1.3 dBm		+1.3 dBm
		= −1 dBm	−2.3 dBm		+0.3 dBm
		= −2 dBm	−3.3 dBm		−0.7 dBm
		= −3 dBm	−4.3 dBm		−1.7 dBm
		= −4 dBm	−5.3 dBm		−2.7 dBm
		= −5 dBm	−6.3 dBm		−3.7 dBm
13.5 to 18.6 GHz	9.	Power = +10 dBm	+8.6 dBm		+11.4 dBm
	10.	= +9 dBm	+7.6 dBm		+10.4 dBm

Table 4-16. Performance Test Record (3 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
13.5 to 18.6 GHz (Cont'd)	11.	= +8 dBm	+6.6 dBm		+9.4 dBm
		= +7 dBm	+5.6 dBm		+8.4 dBm
		= +6 dBm	+4.6 dBm		+7.4 dBm
		= +5 dBm	+3.6 dBm		+6.4 dBm
		= +4 dBm	+2.6 dBm		+5.4 dBm
		= +3 dBm	+1.6 dBm		+4.4 dBm
		= +2 dBm	+0.6 dBm		+3.4 dBm
		= +1 dBm	−0.4 dBm		+2.4 dBm
		= 0 dBm	−1.4 dBm		+1.4 dBm
		= −1 dBm	−2.4 dBm		+0.4 dBm
		= −2 dBm	−3.4 dBm		−0.6 dBm
		= −3 dBm	−4.4 dBm		−1.6 dBm
		= −4 dBm	−5.4 dBm		−2.6 dBm
		= −5 dBm	−6.4 dBm		−3.6 dBm
13.5 to 20 GHz	9. 10. 11.	Power = +8 dBm	+6.6 dBm		+9.4 dBm
		= +7 dBm	+5.6 dBm		+8.4 dBm
		= +6 dBm	+4.6 dBm		+7.4 dBm
		= +5 dBm	+3.6 dBm		+6.4 dBm
		= +4 dBm	+2.6 dBm		+5.4 dBm
		= +3 dBm	+1.6 dBm		+4.4 dBm
		= +2 dBm	+0.6 dBm		+3.4 dBm
		= +1 dBm	−0.4 dBm		+2.4 dBm
		= 0 dBm	−1.4 dBm		+1.4 dBm
		= −1 dBm	−2.4 dBm		+0.4 dBm
		= −2 dBm	−3.4 dBm		−0.6 dBm
		= −3 dBm	−4.4 dBm		−1.6 dBm
		= −4 dBm	−5.4 dBm		−2.6 dBm
		= −5 dBm	−6.4 dBm		−3.6 dBm
2.0 to 18.6 GHz	9. 10. 11	Power = +10 dBm	+8.5 dBm		+11.5 dBm
		= +9 dBm	+7.5 dBm		+10.5 dBm
		= +8 dBm	+6.5 dBm		+9.5 dBm
		= +7 dBm	+5.5 dBm		+8.5 dBm
		= +6 dBm	+4.5 dBm		+7.5 dBm
		= +5 dBm	+3.5 dBm		+6.5 dBm
		= +4 dBm	+2.5 dBm		+5.5 dBm
		= +3 dBm	+1.5 dBm		+4.5 dBm
		= +2 dBm	+0.5 dBm		+3.5 dBm
		= +1 dBm	−0.5 dBm		+2.5 dBm
		= 0 dBm	−1.5 dBm		+1.5 dBm
		= −1 dBm	−2.5 dBm		+0.5 dBm
		= −2 dBm	−3.5 dBm		−0.5 dBm
		= −3 dBm	−4.5 dBm		−1.5 dBm
		= −4 dBm	−5.5 dBm		−2.5 dBm
		= −5 dBm	−6.5 dBm		−3.5 dBm
2.0 to 20 GHz	9. 10.	Power = +8 dBm	+6.5 dBm		+9.5 dBm
		= +7 dBm	+5.5 dBm		+8.5 dBm

Table 4-16. Performance Test Record (4 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
2.0 to 20 GHz (Cont'd)	11.	= +6 dBm = +5 dBm = +4 dBm = +3 dBm = +2 dBm = +1 dBm = 0 dBm = −1 dBm = −2 dBm = −3 dBm = −4 dBm = −5 dBm	+4.5 dBm +3.5 dBm +2.5 dBm +1.5 dBm +0.5 dBm −0.5 dBm −1.5 dBm −2.5 dBm −3.5 dBm −4.5 dBm −5.5 dBm −6.5 dBm		+7.5 dBm +6.5 dBm +5.5 dBm +4.5 dBm +3.5 dBm +2.5 dBm +1.5 dBm +0.5 dBm −0.5 dBm −1.5 dBm −2.5 dBm −3.5 dBm
Option 002: 2.0 to 7.0 GHz	9. 10. 11.	Power = +8.5 dBm = +7.5 dBm = +6.5 dBm = +5.5 dBm = +4.5 dBm = +3.5 dBm = +2.5 dBm = +1.5 dBm = +0.5 dBm = −0.5 dBm = −1.5 dBm = −2.5 dBm = −3.5 dBm = −4.5 dBm = −5 dBm	+7 dBm +6 dBm +5 dBm +4 dBm +3 dBm +2 dBm +1 dBm 0 dBm −1 dBm −2 dBm −3 dBm −4 dBm −5 dBm −6 dBm −6.5 dBm		+10 dBm +9 dBm +8 dBm +7 dBm +6 dBm +5 dBm +4 dBm +3 dBm +2 dBm +1 dBm 0 dBm −1 dBm −2 dBm −3 dBm −3.5 dBm
7.0 to 13.5 GHz	9. 10. 11.	Power = +8 dBm = +7 dBm = +6 dBm = +5 dBm = +4 dBm = +3 dBm = +2 dBm = +1 dBm = 0 dBm = −1 dBm = −2 dBm = −3 dBm = −4 dBm = −5 dBm	+6.5 dBm +5.5 dBm +4.5 dBm +3.5 dBm +2.5 dBm +1.5 dBm +0.5 dBm −0.5 dBm −1.5 dBm −2.5 dBm −3.5 dBm −4.5 dBm −5.5 dBm −6.5 dBm		+9.5 dBm +8.5 dBm +7.5 dBm +6.5 dBm +5.5 dBm +4.5 dBm +3.5 dBm +2.5 dBm +1.5 dBm +0.5 dBm −0.5 dBm −1.5 dBm −2.5 dBm −3.5 dBm
13.5 to 18.6 GHz	9. 10. 11.	Power = +7 dBm = +6 dBm = +5 dBm	+5.4 dBm +4.4 dBm +3.4 dBm		+8.6 dBm +7.6 dBm +6.6 dBm

Table 4-16. Performance Test Record (5 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
13.5 to 18.6 (Cont'd)		= +4 dBm	+2.4 dBm		+5.6 dBm
		= +3 dBm	+1.4 dBm		+4.6 dBm
		= +2 dBm	+0.4 dBm		+3.6 dBm
		= +1 dBm	−0.6 dBm		+2.6 dBm
		= 0 dBm	−1.6 dBm		+1.6 dBm
		= −1 dBm	−2.6 dBm		+0.6 dBm
		= −2 dBm	−3.6 dBm		−0.4 dBm
		= −3 dBm	−4.6 dBm		−1.4 dBm
		= −4 dBm	−5.6 dBm		−2.4 dBm
		= −5 dBm	−6.6 dBm		−3.4 dBm
13.5 to 20 GHz	9.	Power = +5 dBm	+3.4 dBm		+6.6 dBm
	10.	= +4 dBm	+2.4 dBm		+5.6 dBm
	11.	= +3 dBm	+1.4 dBm		+4.6 dBm
		= +2 dBm	+0.4 dBm		+3.6 dBm
		= +1 dBm	−0.6 dBm		+2.6 dBm
		= 0 dBm	−1.6 dBm		+1.6 dBm
		= −1 dBm	−2.6 dBm		+0.6 dBm
		= −2 dBm	−3.6 dBm		−0.4 dBm
		= −3 dBm	−4.6 dBm		−1.4 dBm
		= −4 dBm	−5.6 dBm		−2.4 dBm
		= −5 dBm	−6.6 dBm		−3.4 dBm
2.0 to 18.6 GHz	9.	Power = +7 dBm	+5.3 dBm		+8.7 dBm
	10.	= +6 dBm	+4.3 dBm		+7.7 dBm
	11.	= +5 dBm	+3.3 dBm		+6.7 dBm
		= +4 dBm	+2.3 dBm		+5.7 dBm
		= +3 dBm	+1.3 dBm		+4.7 dBm
		= +2 dBm	+0.3 dBm		+3.7 dBm
		= +1 dBm	−0.7 dBm		+2.7 dBm
		= 0 dBm	−1.7 dBm		+1.7 dBm
		= −1 dBm	−2.7 dBm		+0.7 dBm
		= −2 dBm	−3.7 dBm		−0.3 dBm
		= −3 dBm	−4.7 dBm		−1.3 dBm
		= −4 dBm	−5.7 dBm		−2.3 dBm
		= −5 dBm	−6.7 dBm		−3.3 dBm
2.0 to 20 GHz	9.	Power = +5 dBm	+3.3 dBm		+6.7 dBm
	10.	= +4 dBm	+2.3 dBm		+5.7 dBm
	11.	= +3 dBm	+1.3 dBm		+4.7 dBm
		= +2 dBm	+0.3 dBm		+3.7 dBm
		= +1 dBm	−0.7 dBm		+2.7 dBm
		= 0 dBm	−1.7 dBm		+1.7 dBm
		= −1 dBm	−2.7 dBm		+0.7 dBm
		= −2 dBm	−3.7 dBm		−0.3 dBm
		= −3 dBm	−4.7 dBm		−1.3 dBm
		= −4 dBm	−5.7 dBm		−2.3 dBm
		= −5 dBm	−6.7 dBm		−3.3 dBm

Table 4-16. Performance Test Record (6 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
Power Sweep	12.	Power Level = −5 dBm			
2.0 to 7.0 GHz	13.		+10 dBm		
7.0 to 13.5 GHz			+10 dBm		
13.5 to 18.6 GHz			+10 dBm		
13.5 to 20 GHz			+ 8 dBm		
2.0 to 18.6 GHz			+10 dBm		
2.0 to 20 GHz			+ 8 dBm		
Option 002	12.	Power Level = −5 dBm			
2.0 to 7.0 GHz	13.		+8.5 dBm		
7.0 to 13.5 GHz			+8 dBm		
13.5 to 18.6 GHz			+7 dBm		
13.5 to 20 GHz			+5 dBm		
2.0 to 18.6 GHz			+7 dBm		
2.0 to 20 GHz			+5 dBm		
Power Meter Leveled <±0.2 dB	20.				<±0.2 dB
Crystal Det. Leveled <±0.2 dB	24.				<±0.2 dB
4-16. Frequency Stability 10% Line Voltage Change:					
Band 1, 6 GHz: <±50 kHz	3.	Low line frequency change			<±50 kHz
	4.	High line frequency change			<±50 kHz
Band 2, 12 GHz: <±100 kHz	5.	Low line frequency change			<±100 kHz
		High line frequency change			<±100 kHz
Band 3, 18 GHz: <±150 kHz		Low line frequency change			<±150 kHz
		High line frequency change			<±150 kHz
Time (10 minutes):					
Band 1, 6 GHz: ≤±100 kHz	7.	Maximum deviation in 10 minutes			≤±100 kHz
Band 2, 12 GHz: ≤±200 kHz	8.	Maximum deviation in 10 minutes			≤±200 kHz
Band 3, 18 GHz: ≤±300 kHz		Maximum deviation in 10 minutes			≤±300 kHz
10 dB Power Change:					
Band 1, 6 GHz: ≤±200 kHz	10.	Frequency change with power			≤±200 kHz
Band 2, 12 GHz: ≤±400 kHz	11.	Frequency change with power			≤±400 kHz
Band 3, 18 GHz: ≤±600 kHz		Frequency change with power			≤±600 kHz
3:1 Load SWR:					
Band 1, 6 GHz: ≤±100 kHz	15.	3:1 SWR			≤±100 kHz
Band 2, 12 GHz: ≤±200 kHz	16.	3:1 SWR			≤±200 kHz
Band 3, 18 GHz: ≤±300 kHz		3:1 SWR			≤±300 kHz

Table 4-16. Performance Test Record (7 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-16. Residual FM					
2.0 to 7 GHz: <5 kHz	17.	CW frequency = 6 GHz			<5 kHz
7.0 to 13.5 GHz: <7 kHz	18.	CW frequency = 12 GHz			<7 kHz
13.5 to 20 GHz: <9 kHz		CW frequency = 18 GHz			<9 kHz
4-17. Spurious Signals					
Harmonic:					
2.0 to 7 GHz: >−25 dB	3.	Measure relative to carrier	>−25 dB		
7 to 13.5 GHz: >−25 dB			>−25 dB		
13.5 to 20 GHz: >−25 dB			>−25 dB		
Non-harmonic:					
2.0 to 7 GHz: >−50 dB			>−50 dB		
7 to 13.5 GHz: >−50 dB			>−50 dB		
13.5 to 20 GHz: >−50 dB			>−50 dB		
4-18. Output SWR					
Standard: <1.9	5.	Range: 2 to 18 GHz			<1.9
Option 002: <2.1					<2.1
4-19. Residual AM					
6 GHz: ≥−50 dB	5.	Measure relative to carrier			≥−50 dB
12 GHz: ≥−50 dB					≥−50 dB
18 GHz: ≥−50 dB					≥−50 dB
6 GHz: ≥−50 dB	6.	Measure relative to carrier			≥−50 dB
12 GHz: ≥−50 dB					≥−50 dB
18 GHz: ≥−50 dB					≥−50 dB
4-20. External FM					
Direct Coupled:	1.	A3S1: Close switch 5, open 6			
DC to 100 Hz: ≥±12 MHz	3.		≥±12 MHz		
Cross Over Coupled:	4.	A3S1: Close switch 6			
DC to 100 Hz: ≥±75 MHz			≥±75 MHz		
Direct/Cross Over Coupling					
100 Hz to 1 MHz: ≥±7 MHz	9.		≥±7 MHz		
1 to 2 MHz: ≥±5 MHz	10.		≥±5 MHz		
2 to 10 MHz: ≥±1 MHz			≥±1 MHz		
	11.	A3S1: Change switch 6 from previous setting	≥±7 MHz		
			≥±5 MHz		
			≥±1 MHz		
4-21. AM On/Off Ratio Square-Wave Symmetry					
On/Off Ratio:	1.	CW frequency = 4 GHz			
>30 dB below specified maximum leveled power		Power = +10 dBm			
Symmetry of ON/OFF time:	3.		>30 dB		
40/60	4.		40%		60%

Table 4-16. Performance Test Record (8 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-22. Step Attenuator Accuracy (Option 002) (Referenced from 0 dB) 2.0 to 12.4 GHz	1. 2.	CW frequency = 4.0 GHz Power = +4.0 dBm Reference Attenuation = 70 dB			

Attn. Step	Accuracy	Step	Ref. Attn. Step	Attn. Error	+	Deviation from 0 ref.	Lower Limit	Measured Value	Upper Limit
10 dB	≤±0.6 dB	4.	70 − 60		+				≤±0.6 dB
20 dB	≤±0.7 dB	7.	70 − 50		+				≤±0.7dB
30 dB	≤±0.9 dB	8.	70 − 40		+				≤±0.9 dB
40 dB	≤±1.8 dB		70 − 30		+				≤±1.8 dB
50 dB	≤±2.0 dB		70 − 20		+				≤±2.0 dB
60 dB	≤±2.2 dB		70 − 10		+				≤±2.2 dB
70 dB	≤±2.3 dB		70 − 0		+				≤±2.3 dB

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
12.4 to 18 GHz	9.	CW frequency = 15 GHz Power = +4.0 dBm Reference Attenuation = 70 dB			

Attn. Step	Accuracy	Ref. Attn. Step	Attn. Error	+	Deviation from 0 ref.	Lower Limit	Measured Value	Upper Limit
10 dB	≤±0.7 dB	70 − 60		+				≤±0.7 dB
20 dB	≤±0.9 dB	70 − 50		+				≤±0.9 dB
30 dB	≤±1.2 dB	70 − 40		+				≤±1.2 dB
40 dB	≤±2.0 dB	70 − 30		+				≤±2.0 dB
50 dB	≤±2.3 dB	70 − 20		+				≤±2.3 dB
60 dB	≤±2.5 dB	70 − 10		+				≤±2.5 dB
70 dB	≤±2.8 dB	70 − 0		+				≤±2.8 dB

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
10 to 20 GHz	10.	CW frequency = 18 GHz Power = +4.0 dBm Reference Attenuation = 70 dB			

Attn. Step	Accuracy	Ref. Attn. Step	Attn. Error	+	Deviation from 0 ref.	Lower Limit	Measured Value	Upper Limit
10 dB	≤±0.9 dB	70 − 60		+				≤±0.9 dB
20 dB	≤±1.5 dB	70 − 50		+				≤±1.5 dB
30 dB	≤±2.5 dB	70 − 40		+				≤±2.5 dB
40 dB	≤±3.0 dB	70 − 30		+				≤±3.0 dB
50 dB	≤±3.2 dB	70 − 20		+				≤±3.2 dB
60 dB	≤±3.3 dB	70 − 10		+				≤±3.3 dB
70 dB	≤±3.5 dB	70 − 0		+				≤±3.5 dB

ADJUSTMENTS

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 83590A 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. Table 5-2 lists the adjustment included in this section.

NOTE

Allow the 83590A 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-metallic adjustment tool whenever possible.

5-5. EQUIPMENT REQUIRED

5-6. The equipment required for the adjustment procedures is listed in Section I of this manual. If the test equipment recommended is not available, other equipment may be used if its performance meets the critical specifications listed in the table. The specified equipment required for each adjustment is referenced in each procedure.

5-7. FACTORY-SELECTED COMPONENTS

5-8. Table 5-3 contains a list of factory-selected components that includes 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 5-4.

5-9. RELATED ADJUSTMENTS

5-10. Interactive adjustments are noted in the adjustment procedures. Table 5-5 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.

5-11. ADJUSTMENT PROCEDURES

5-12. Adjustment procedures are given in the proper sequence to allow for interrelated adjustments.

Table 5-1 Adjustable Components (1 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A2R1	GAIN	5-24	Sets gain of frequency reference in Bands 1, 2, and 3 (1V/GHz).
A2R4	OFFSET	5-24	Sets offset of frequency reference in Bands 1, 2, and 3 (1 V/GHz).
A3S1	Configuration Switch	5-13	Selects Plug-in code, power-up power level, FM sensitivity, FM modulation coupling, step attenuator Option Code, normal or sequential sweep option, and phase-lock operation.
A4R3	1 HI	5-25	Sets power calibration at the high end of the power range (+10 dBm) in Band 1.
A4R5	1 LO	5-25	Sets power calibration at the low end of the power range (−5 dBm) in Bands 1, 2, and 3.
A4R8	1 MD	5-25	Sets power calibration at the middle of the power range (+7 dBm) in Bands 1, 2, and 3.
A4R9	PM	5-27	Sets power meter leveling calibration.
A4R11	GAIN	5-28	Sets gain of U11 Main ALC Amplifier.
A4R47	OFS 1	5-25	Adjusts for zero offset through U7-Q6 Log Amplifier circuit.
A4R56	OFS 2	5-25	Adjusts for zero offset through U5 Log Amplifier circuit.
A4R59	OFS 3	5-25	Adjusts for zero offset through U8-Q1 Sample and Hold circuit.
A4R67	OFS 4	5-25	Adjusts for zero offset through U11 Main ALC Amplifier.
A5C14	LO	5-30	Adjusts low frequency for best frequency response flatness through U10.
A5R18	FM OFFSET	5-30	Adjusts shape of U10 Video Amplifier compensation network response.
A5R19	FM	5-30	Sets DC offset of U10 Video Amplifier.
A5R34	BP 1	5-26	Breakpoint that works with SL1 (Slope 1) for ALC flatness.
A5R36	BP 2	5-26	Breakpoint that works with SL2 (Slope 2) for ALC flatness.
A5R38	BP 3	5-26	Breakpoint that works with SL3 (Slope 3) for ALC flatness.
A5R40	BP 4	5-26	Breakpoint that works with SL4 (Slope 4) for ALC flatness.
A5R41	SL 1	5-26	Slope adjustment for best ALC flatness.
A5R42	SL 2	5-26	Slope adjustment for best ALC flatness.

Table 5-1. Adjustable Components (2 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A5R43	SL 3	5-26	Slope adjustment for best ALC flatness.
A5R44	SL 4	5-26	Slope adjustment for best ALC flatness.
A5R48	SLP	5-26	Sets overall slope of internal leveling ALC.
A5R50	PWSP	5-29	Sets range for power sweep.
A5R75	HI	5-30	Works in conjunction with C14 to set frequency response flatness of FM Coil.
A6R12	C	5-20, 5-21	Adjusts YTM SRD bias to peak power in all bands at low power settings.
A6R16	TV GAIN	5-15	Sets the gain of U6 Tune Voltage buffer amplifier.
A6R21	DAC CAL	5-15	Adjusts the gain of U5 Variable Gain Amplifier during all single band sweeps.
A6R24	B3	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 3 during sequential sweeps.
A6R26	B2	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 2 during sequential sweeps.
A6R28	B1	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 1 during sequential sweeps.
A6R34	-10V OFFSET	5-15	Offsets the -10 volt reference voltage to U15.
A6R37	SP	5-15	Offsets input voltage to U24A forward sweep bandswitch amplifier.
A6R63	3HL	5-20, 5-21	Adjusts balance of SRD Bias circuit.
A6R68	2H	5-20, 5-21	Adjusts YTM SRD bias at high power, high frequency end of Band 2.
A6R69	3H	5-20, 5-21	Adjusts YTM SRD bias at high power, high frequency end of Band 3.
A6R73	2L	5-20, 5-21	Adjusts YTM SRD bias at high power, low frequency end of Band 2.
A6R74	3L	5-20, 5-21	Adjusts YTM SRD bias at high power, low frequency end of Band 3.
A6R78	T	5-20, 5-21	Adjusts YTM SRD bias at an intermediate power level for Bands 2 and 3.
A7R10	SGL HI	5-22	Adjusts offset of YTM delay compensation signal at the high end of single band sweeps.

Table 5-1. Adjustable Components (3 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A7R12	SGL LO	5-22	Adjusts offset of YTM delay compensation signal at the low end of single band sweeps.
A7R18	Z	5-16	Adjusts offset of U20 delay compensation amplifier to minimize the difference between CW and ΔF ±0 with YTM delay compensation circuits.
A7R19	GAIN	5-16	Adjusts the Scaled Voltage Tune DAC input signal to U21 YTM Summing Amplifier.
A7R22	ZRO	5-16	Adjusts supply correction voltage to U21 YTM Summing Amplifier.
A7R24	OFS	5-16	Adjusts Offset DAC input signal to U21 YTM Summing Amplifier.
A7R42	SEQ HI	5-22	Adjusts offset of YTM delay compensation signal at high end of sequential band sweeps.
A7R43	SEQ LO	5-22	Adjusts offset of YTM delay compensation signal at low end of sequential band sweeps.
A7R45	SEQ TC	5-22	Adjusts gain of YTM delay compensation signal in sequential band sweeps.
A7R46	SGL TC	5-22	Adjusts gain of YTM delay compensation signal in single band sweeps.
A7R51	BI OFS	5-20	Adjusts offset of U21 Summing Amplifier in single band sweeps.
A7R55	RTC COMP	5-22	Adjusts the pulse width of YTM retrace compensation signal.
A7S1	OFFSET	5-20	Adjusts low end of band YTM to YO tracking at slow sweep speeds.
A7S2	GAIN	5-20	Adjusts high end of band YTM to YO tracking at slow sweep speeds.
A8R10	HI	5-19	Adjusts YO delay compensation at high frequency end of band.
A8R12	LO	5-19	Adjusts YO delay compensation at low frequency end of band.
A8R13	Z	5-16, 5-19	Adjusts offset to minimize the difference between CW and ΔF ±0 with YO delay compensation circuits.
A8R19	GAIN	5-16	Adjusts Scaled Voltage Tune DAC input signal to U20 Summing Amplifier.
A8R22	ZRO	5-16	Adjusts supply correction voltage to U20 Summing Amplifier.

Table 5-1. Adjustable Components (4 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A8R24	OFS	5-16	Adjusts Offset DAC input signal to U20 Summing Amplifier.
A8R44	10V	5-14	Sets 10 volt reference voltage source.
A8R55	RTC COMP	5-18	Adjusts the pulse width of the YO retrace compensation signal.
A8S1	OFFSET	5-17	Adjusts the low end of band YO frequency accuracy.
A8S2	GAIN	5-17	Adjusts the high end of band YO frequency accuracy.
A13A1R4		none	Factory adjusted.
A14A1R11		none	Factory adjusted.
A14A1R13		none	Factory adjusted.
A14A1R14		none	Factory adjusted.
A14A1R15		none	Factory adjusted.
A14A1R16		none	Factory adjusted.
A14A1R18		none	Factory adjusted.

Table 5-2. Adjustments

Paragraph	Adjustments	Paragraph	Adjustments
5-13	Configuration Switch A3S1	5-22	YTM Delay Compensation
5-14	-10 Volt Reference On A8 YO Driver	5-23	Band Overlap Adjustment
5-15	Sweep Control Adjustments	5-24	Frequency Reference 1V/GHz Output
5-16	YO and YTM DAC Calibration	5-25	ALC Adjustments
5-17	Preliminary Frequency Accuracy	5-26	ALC Internally Leveled Flatness Adjustment
5-18	YO Retrace Compensation	5-27	Power Meter Leveling Calibration
5-19	YO Delay Compensation	5-28	ALC Gain Adjustment
5-20	Slow Speed YTM to YO Tracking	5-29	Power Sweep
5-21	SRD Bias	5-30	FM Driver Adjustments

Table 5-3. Factory Selected Components

Reference Designator	Adjustment Paragraph	Allowable Range of Values	Basis of Selection
A5R31	5-30	200 to 300 Ohms	Selects scaling of current drive of YO FM coil near 100 kHz.
A7R34	none		Selected at factory to correct for frequency nonlinearity in YTM.
A7R35-39	none		
A7R66-71	none		
A8R36	none		Selected at factory to correct for frequency nonlinearity in the YO.
A8R37-39	none		
A13A1R1	none		Selected at factory to optimize YO bandwidth, power, and harmonics.
A13A1R2	none		

Table 5-4. 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 5-5. Related Adjustments

Assembly Changed or Repaired	Related Assemblies (in order of Adjustments)	Perform the Following Paragraph Number
A1/A2 Front Panel	A2	5-24
A3 Digital Interface	A3	5-13
A4 ALC	A4, A5	5-25 thru 5-28
A5 FM	A4, A5	5-25 thru 5-30
A6 Sweep Control	A6, A8, A7	5-15 thru 5-23
A7 YTM Driver	A6, A8, A7	5-15 thru 5-23
A8 YO Driver	A6, A8, A7	5-15 thru 5-23
A12 Switched YIG Tuned Multiplier	A6, A8, A7, A2	5-15 thru 5-20, 5,23, 5-24
A13 2.0 – 7.0 GHz Oscillator	A6, A8, A7, A2, A5	5-15 thru 5-20, 5-23, 5-24, 5-30
A14 Power Amplifier	A4, A5	5-25 thru 5-28
A16 Modulator/Coupler	A4, A5	5-25 thru 5-28
AT1 Isolator	A4, A5	5-25 thru 5-28
DC2 Directional Coupler	A4, A5	5-25 thru 5-28

ADJUSTMENTS

5-13. CONFIGURATION SWITCH A3S1

REFERENCE:

Performance Test: None.
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

All adjustment procedures assume that A3S1 is set to the factory setting unless otherwise specified in the test. 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.
3. Press INSTR PRESET to set the instrument into the operating mode selected by the configuration switch.

NOTE

INSTR PRESET must be pressed after the configuration switch positions are modified in order to set the instrument immediately to the desired operating mode set by the configuration switch.

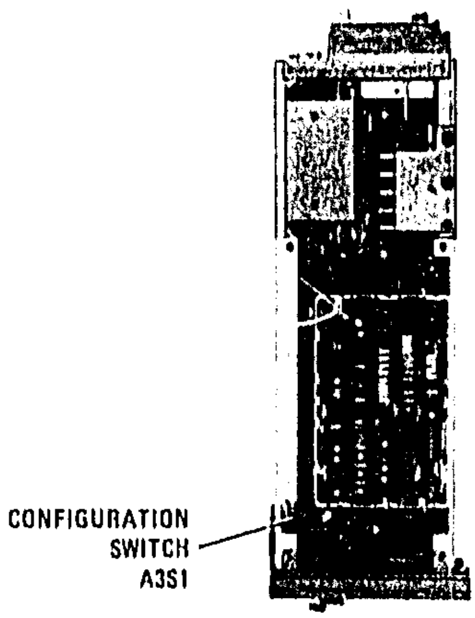


Figure 5-1. Configuration Switch A3S1 Location

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

Description	Switch Number							
	1	2	3	4	5	6	7	8
Plug-In: 83590A	x	x	x	x	x	x	x	x
Normal Sweep	0	x	x	x	x	x	x	x
Sequential Sweep Only	1	x	x	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 Modulation (−20 MHz/V)	x	x	x	x	x	1	x	x
Cross-Over Coupled FM Modulation	x	x	x	x	x	0	x	x
Step Attenuator Option	x	x	x	x	x	x	1	x
No Step Attenuator Option	x	x	x	x	x	x	0	x
AUX OUT Phase Lock	x	x	x	x	x	x	x	1
RF OUTPUT Phase Lock	x	x	x	x	x	x	x	0

NOTE

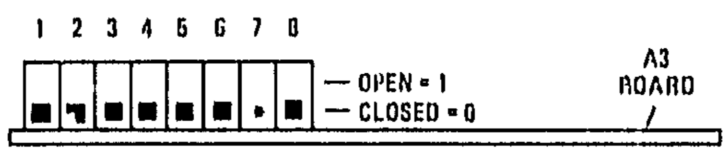
1 = Switch Open = High
0 = Switch Closed = Low (Ground)
x = Don't Care
•With the configuration switch set for an Instrument Preset condition of "RF Power OFF", bias is removed from A13 YIG Oscillator. In addition, the 8350A microprocessor issues a blanking pulse to the Plug-In. L RFB (Low = RF Blank) 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 microcircuit 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.

A3S1 Factory Settings

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

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

A3S1



■ = DEPRESSED SWITCH POSITION

ADJUSTMENTS

5-14. −10 VOLT REFERENCE ON A8 YO DRIVER

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

The −10 volt reference voltage source on the A8 YO Driver board is used as a reference voltage for the DACs on the A4 ALC, A6 Sweep Control, the A7 YTM Driver, and the A8 YO Driver boards. The −10 volt reference output voltage is set by the A8R44 −10V adjustment while monitoring A8TP12.

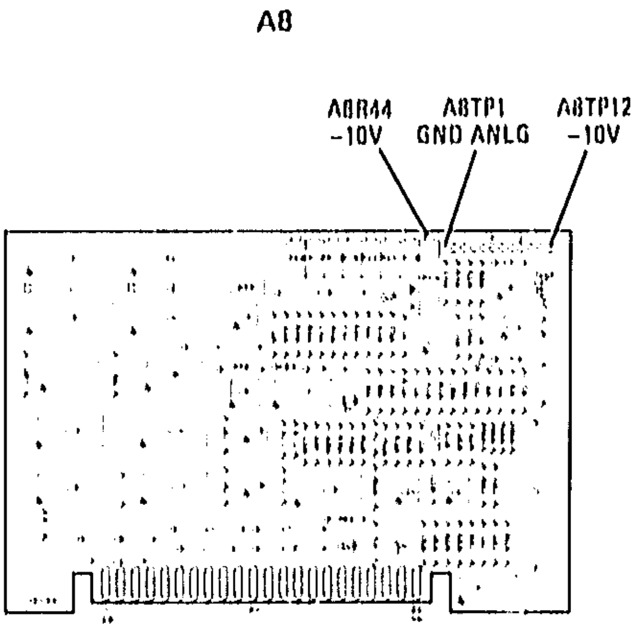


Figure 5-2. −10V Reference Adjustment Location

EQUIPMENT:

Digital Voltmeter .... HP 3456A
Sweep Oscillator .... HP 8350A

PROCEDURE:

1. Connect the DVM to A8TP12 (−10V) with reference to A8TP1 (GND ANLG).
2. Adjust A8R44 −10V for a DVM reading of −10 ± 0.001 Vdc. Refer to Figure 5-2 for −10 volt reference adjustment location.

ADJUSTMENTS

5-15. SWEEP CONTROL ADJUSTMENTS

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6

DESCRIPTION:

With the tuning voltage (VTUNE) set to +10V (CW frequency of 20 GHz), the TV Buffer is set for unity gain, and the DAC CAL adjustment is set to equalize the Bandswitch Comparator DAC and TV Buffer inputs to the Variable Gain Amplifier (DAC CAL is set for 0V at A6TP4). The −10V OFFSET adjustment is then set to offset the Variable Gain Amplifier output by −10V. The gain of the Variable Gain Amplifier is then calibrated at the low end of each frequency band. The 83590A is then swept across its full frequency range and the Switch Point adjust A6R37 (SP) is adjusted to set the bandwitch points.

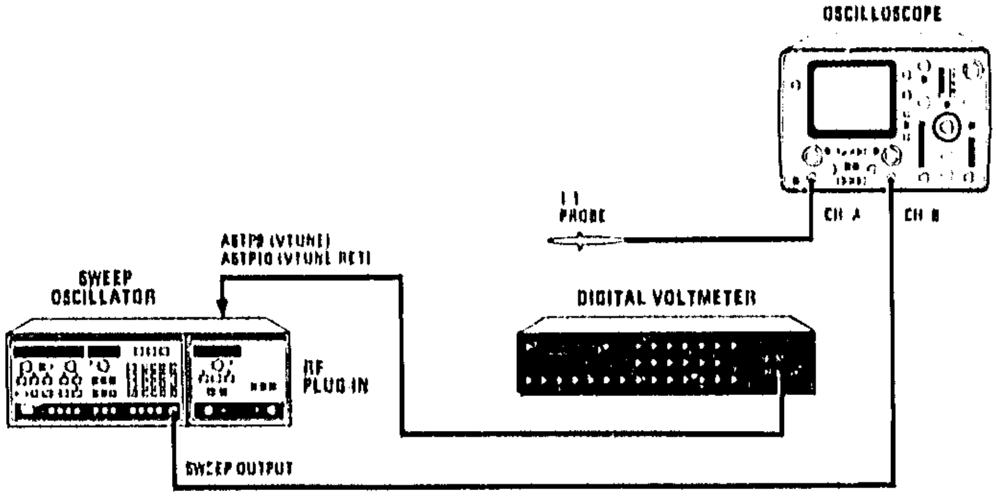


Figure 5-3. Sweep Control Adjustments Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3456A
Oscilloscope	HP 1740A
1:1 Probe	HP 10008B
Sweep Oscillator	HP 8350A

ADJUSTMENTS

5-15. SWEEP CONTROL ADJUSTMENTS (Cont'd)

PROCEDURE:

1. Ensure that A3S1 switch position 1 is in the OPEN (up) position. Refer to Adjustment Paragraph 5-13 for instructions on setting A3S1.

2. Set up the equipment as shown in Figure 5-3 with the DVM connected to A6TP9 (VTUNE) and with the reference probe connected to A6TP10 (VTUNE RET). Do not connect the Oscilloscope probe yet. Allow the instrument to warm up for 1 hour.

3. On the 8350A, press INSTR PRESET 2 0 GHz VERNIER .

4. Adjust the 8350A FREQ VERNIER for a DVM reading of 10 ± 0.001 Vdc.

NOTE

The following voltage measurement procedures on the A6 Sweep Control board are made with the DVM reference probe connected to A6TP1 (which is electrically the same as motherboard ground).

5. Connect the DVM to A6TP5 and adjust A6R16 (TV GAIN) for a DVM reading of −10 ± 0.001 Vdc. Refer to Figure 5-4 for sweep control adjustment locations.

6. Connect the DVM to A6TP4 and adjust A6R21 (DAC CAL) for a DVM reading of 0 ± 0.001 Vdc.

7. Connect the DVM to A6TP8 (BVTUNE) and adjust A6R34 for a DVM reading of −10 ±0.001 Vdc.

8. On the 8350A, press CW 1 3 . 5 GHz .

9. Connect the DVM to A6TP5 and adjust the 8350A FREQ VERNIER control for a DVM reading of −6.38889 ± 0.00005 Vdc.

10. Connect the DVM to A6TP8 and adjust A6R24 (B3) for a DVM reading of 0 ± 0.001 Vdc.

11. On the 8350A, press CW 7 GHz .

12. Connect the DVM to A6TP5 and adjust the 8350A FREQ VERNIER control for a DVM reading of −2.77778 ± 0.00005 Vdc.

13. Connect the DVM to A6TP8 and adjust A6R26 (B2) for a DVM reading of 0.001 Vdc.

14. On the 8350A, press CW 2 . 0 GHz .

15. Connect the DVM to A6TP5 and adjust the 8350A FREQ VERNIER control for a DVM reading of 0±0.00005 Vdc.

ADJUSTMENTS

5-15. SWEEP CONTROL ADJUSTMENTS (Cont'd)

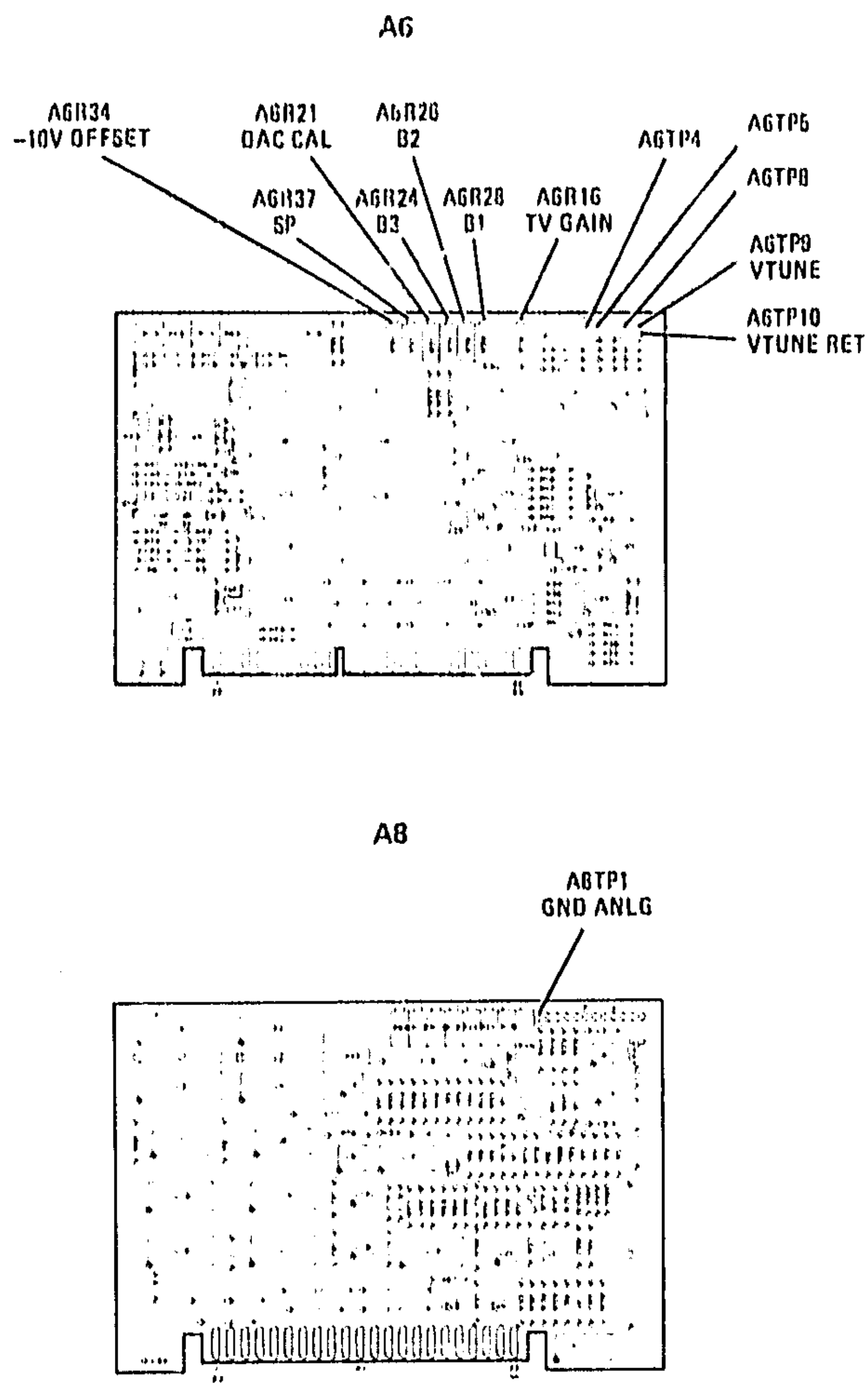


Figure 5-4. Sweep Control Adjustment Locations

ADJUSTMENTS

5-15. SWEEP CONTROL ADJUSTMENTS (Cont'd)

16. Connect the DVM to A6TP8 and adjust A6R28 (B1) for a DVM reading of 0 ± 0.001 Vdc.

17. On the 8350A, press **INSTR PRESET**.

18. Connect the Oscilloscope probe to A6TP8. Set the Oscilloscope settings as follows:

Mode	A vs B
Vertical Sensitivity	0.5 V/DIV
Coupling	DC

19. Adjust the oscilloscope vertical position control to set the top of the first full 0 to −10 volt sweep ramp on the centerline as shown in Figure 5-5.

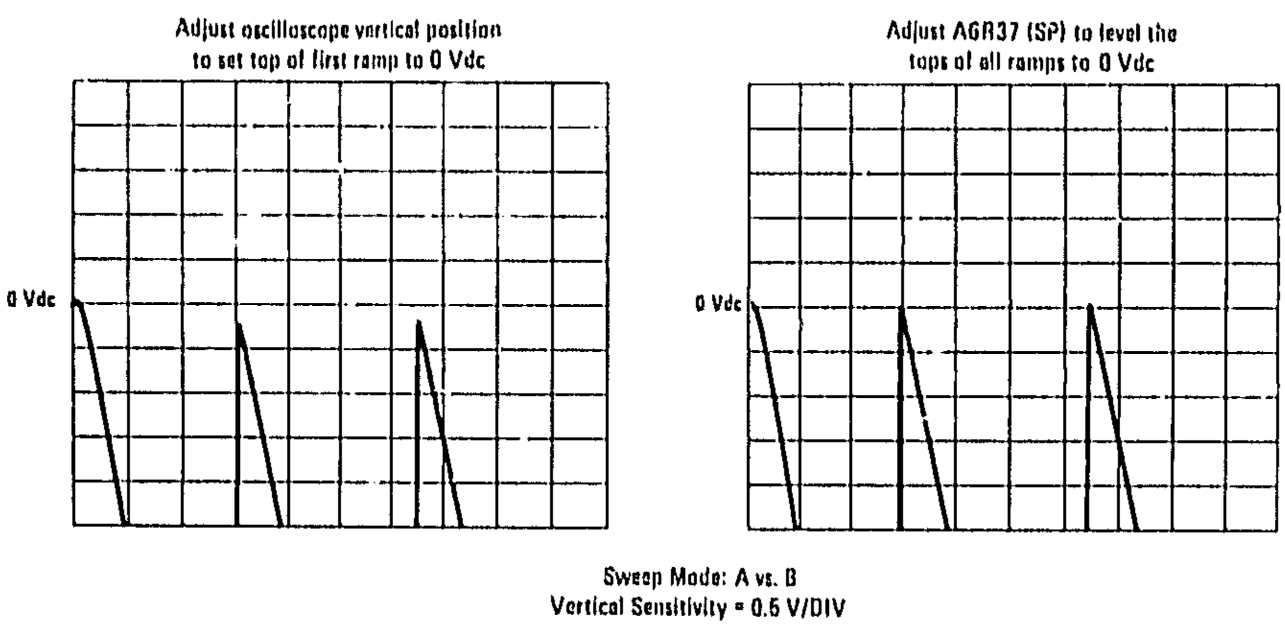


Figure 5-5. Sweep Control Adjustment Waveforms

20. Adjust A6R37 (SP) to bring the tops of the remaining 0 to −10 volt sweep ramps to the center graticule as shown in Figure 5-5.

21. If A3S1 switch position 1 was modified in step 1 of this procedure, reset it to the closed (down) position as described in Adjustment Paragraph 5-13 before continuing with the adjustment procedures.

ADJUSTMENTS

5-16. YO AND YTM DAC CALIBRATION

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A7 and A8

DESCRIPTION:

The 8350A is set for a CW frequency of 20 GHz and then fine-tuned for a tuning voltage (VTUNE) of +10V. The Hex Data Write feature of the 8350A is used to load each DAC with either all ones or all zeros. The A8 YO Driver is adjusted first. With both the Scaled Voltage Tune and Offset DACs loaded with all zeros, the YO Collector output is monitored and the +20V Tracking Amplifier ZRO adjustment is set. Each DAC is then loaded with all ones and the respective Offset or Gain adjustment is set. The A7 YTM Driver is adjusted the same way. The 8350A is then set into the Swept CW mode and the Delay Compensation circuits on both A7 and A8 are adjusted for a 0V output.

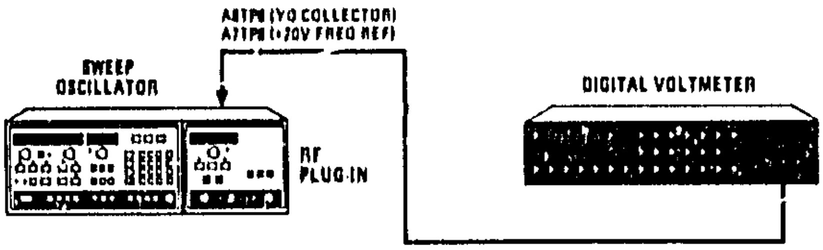


Figure 5-6. YO and YTM DAC Calibration Test Setup

EQUIPMENT:

Digital Voltmeter .... HP 3456A
Sweep Oscillator .... HP 8350A

PROCEDURE:

1. Connect the equipment as shown in Figure 5-6 with the DVM connected to A6TP9 (VTUNE) and the reference probe connected to A6TP10 (VTUNE RET). Refer to Figure 5-7 for test point and adjustment locations. Allow the RF Plug-in to warm up for 1 hour.

2. On the 8350A, press **INSTR PRESET** **CW** **2** **0** **GHz** .

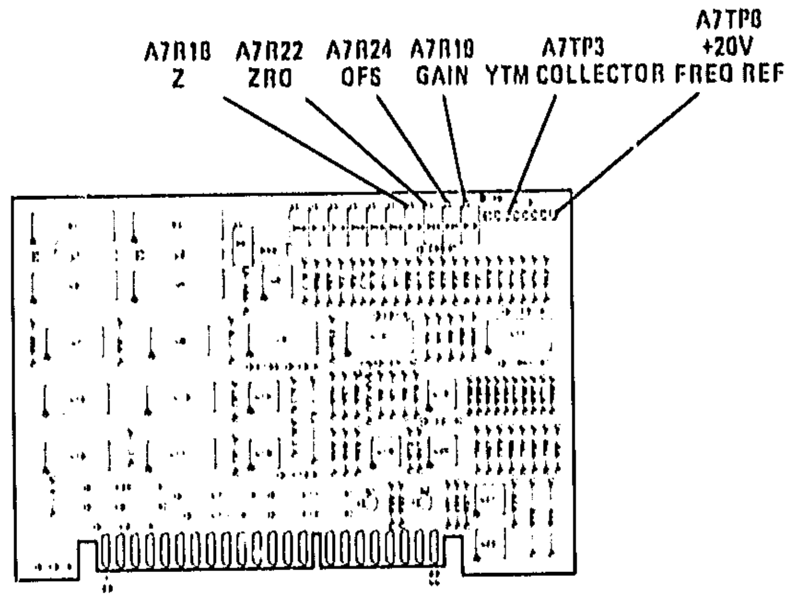
3. Adjust the 8350A FREQ VERNIER for a DVM reading of 10 ±0.001 Vdc.

4. Float the ground on the DVM. Connect the DVM to A8TP6 (YO COLLECTOR) with the reference probe connected to A7TP8 (+20V FREQ REF).

ADJUSTMENTS

5-16. YO AND YTM DAC CALIBRATION (Cont'd)

A7



A8

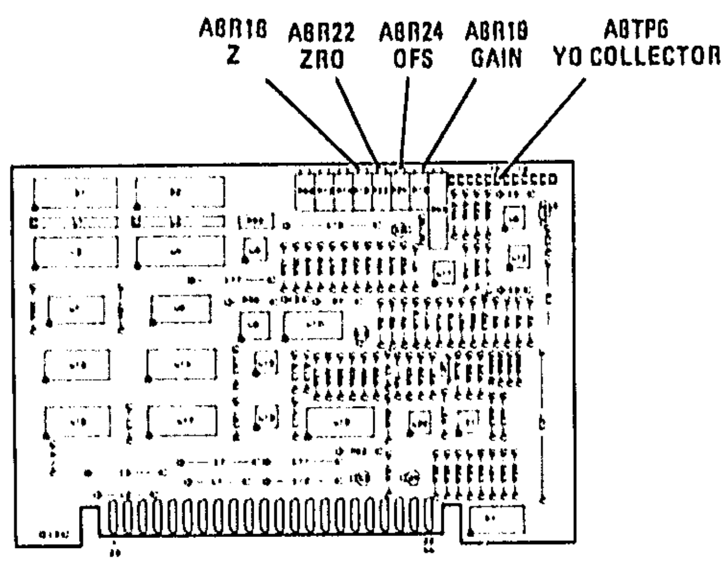


Figure 5-7. YO and YTM DAC Calibration Adjustment Locations

ADJUSTMENTS

5-16. YO AND YTM DAC CALIBRATION (Cont'd)

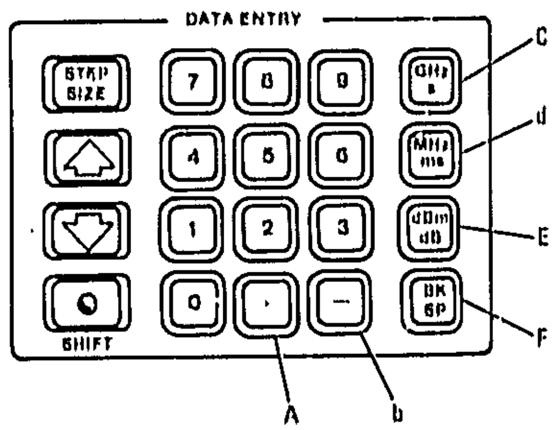


Figure 5-8. Front Panel Hexadecimal Entry Keys

5. Use the Hex Data Write feature to write all zeros to both DACs on the A8 YO Driver:

SHIFT 0 0	Enters hex data command
2 GHz 8 0	Address location 2C80
M2	Hex Data Write
0 0	Enter hex data 00
↑ 0 0	Increment address to 2C81 and write 00
↑ 0 0	Increment address to 2C82 and write 00
↑ 0 0	Increment address to 2C83 and write 00

6. Adjust A8R22 (ZRO) for a DVM reading of −7.000 ±0.001 Vdc.

7. Use the Hex Data Write feature to write zeros to the Scaled Voltage Tune DAC and ones to the Offset DAC as follows:

↓ ↓ ↓	Decrement address to 2C80
0 BKSP	Enter hex data 0F
↑ 0 F	Increment address to 2C81 and write 0F
↑ 0 F	Increment address to 2C82 and write 0F
↑ 0 F	Increment address to 2C83 and write 0F

8. Adjust A8R24 (OFS) for a DVM reading of −20.000 ± 0.001 Vdc.

9. Use the Hex Data Write feature to write ones to the Scaled Voltage Tune DAC and zeros to the Offset DAC as follows:

↓ ↓ ↓	Decrement address to 2C80
F 0	Enter hex data F0
↑ F 0	Increment address to 2C81 and write F0
↑ F 0	Increment address to 2C82 and write F0
↑ F 0	Increment address to 2C83 and write F0

5-16. YO AND YTM DAC CALIBRATION (Cont'd)

10. Adjust A8R19 (GAIN) for a DVM reading of −26.500 ± 0.001 Vdc.

11. Use the Hex Data Write feature to write all zeros to both DACs on the A7 YTM Driver as follows:

⇧ ⇧ ⇧ ⇧ ⇧	Increment address to 2C88
0 0	Enter hex data 00
⇧ 0 0	Increment address to 2C89 and write 00
⇧ 0 0	Increment address to 2C8A and write 00
⇧ 0 0	Increment address to 2C8B and write 00

12. Connect the DVM to A7TP3 (YTM COLLECTOR) with the reference probe still at A7TP8 (+20V FREQ REF). Adjust A7R22 (ZRO) for a DVM reading of −3.000 ± 0.001 Vdc.

13. Use the Hex Data Write feature to write zeros to the Scaled Voltage Tune DAC and ones to the Offset DAC as follows:

⇩ ⇩ ⇩	Decrement address to 2C88
0 BKSP	Enter hex data 0F
⇧ 0 F	Increment address to 2C89 and write 0F
⇧ 0 F	Increment address to 2C8A and write 0F
⇧ 0 F	Increment address to 2C8B and write 0F

14. Adjust A7R24 (OFS) for a DVM reading of −19.500 ± 0.001 Vdc.

15. Use the Hex Data Write feature to write ones to the Scaled Voltage Tune DAC and zeros to the Offset DAC as follows:

⇩ ⇩ ⇩	Decrement address to 2C88
BKSP 0	Enter hex data F0
⇧ F 0	Increment address to 2C89 and write F0
⇧ F 0	Increment address to 2C8A and write F0
⇧ F 0	Increment address to 2C8B and write F0

16. Adjust A7R19 (GAIN) for a DVM reading of −9.500 ± 0.001 Vdc.

17. On the 8350A, press INSTR PRESET SHIFT CW .

18. Connect the DVM to A7TP4 with reference to A8TP1 (GND ANLG).

19. Adjust A7R18 (Z) for a DVM reading of 0.000 ± 0.001 Vdc.

20. Connect the DVM to A8TP9 with reference to A8TP1 (GND ANLG).

21. Adjust A8R18 (Z) for a DVM reading of 0.000 ± 0.001 Vdc.

ADJUSTMENTS

5-17. FREQUENCY ACCURACY

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

The 83590A CW frequency is set first to the low end and then to the high end of Band 2. Special calibration modes are used for this procedure (SHIFT 90 for the low end of Band 2 and SHIFT 91 for the high end of Band 2). When the output frequency matches the front panel frequency display, the calibration switches on A8 are set for the appropriate correction factor. A8S1 calibrates the lower portion of the band and A8S2 calibrates the high section of the band.

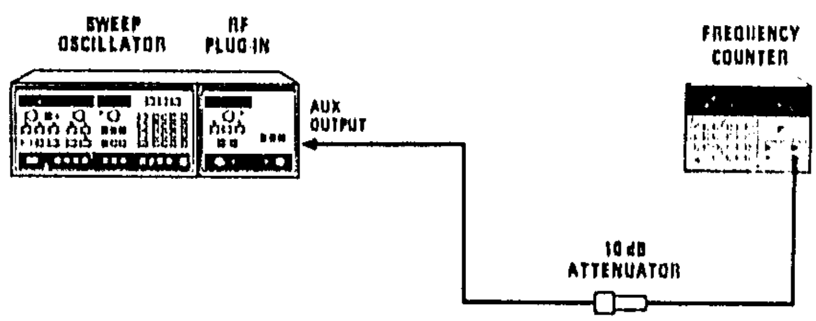


Figure 5-9. Frequency Accuracy Test Setup

EQUIPMENT:

Frequency Counter .... HP 5343A
10 dB Attenuator .... HP 8491B Option 010
Sweep Oscillator.. HP 8350A

PROCEDURE:

1. Connect the equipment as shown in Figure 5-9 with the Frequency Counter connected to the 83590A rear panel AUX OUTPUT connector through the 10 dB attenuator. Allow the equipment to warm up for 1 hour.

ADJUSTMENTS

5-17. FREQUENCY ACCURACY (Cont'd)

2. On the 8350A, press INSTR PRESET CW 6 . 9 GHz SAVE 1 .
3. On the 8350A, press CW 1 3 . 5 GHz SAVE 2 .
4. On the 5343A, press SET . 2 ENTER . This sets the Frequency Counter in a mode which displays twice the input frequency. This step is necessary to compensate for the frequency of the rear panel AUX OUTPUT, which is the YO fundamental frequency, approximately half of the 8350A displayed frequency in Band 2.

Low End Frequency Calibration

5. On the 8350A, press RECALL 1 . The 8350A FREQUENCY display should show 6.900 GHz.
6. On the 8350A, press SHIFT 9 0 to select the low end frequency calibration mode.
7. Adjust the 83590A POWER control if necessary to display 6.900 ± 0.003 GHz on the Frequency Counter.
8. Set switch A8S1 for the hexadecimal value displayed in the 83590A POWER display. Refer to Figure 5-10 for the location of the frequency calibration switches. Refer to Figure 5-11 for an illustration of the calibration switch configuration.
9. On the 8350A, press RECALL 1 . Verify that the Frequency Counter reads 6.900 ± 0.010 GHz.

High End Frequency Calibration

10. On the 8350A, press RECALL 2 . The 8350A FREQUENCY display should show 13.500 GHz.
11. On the 8350A, press SHIFT 9 1 to select the high end frequency calibration mode.
12. Adjust the 83590A POWER control if necessary to display 13.500 ± 0.003 GHz on the Frequency Counter.
13. Set switch A8S2 for the value displayed in the 83590A POWER display in the same manner as that described in step 8.
14. On the 8350A, press RECALL 2 . Verify that the Frequency Counter reads 13.500 ± 0.010 GHz.
15. On the 8350A, press RECALL 1 . Manually adjust the 8350A CW FREQUENCY control across band 2 (6.9 to 13.5 GHz) and check for Frequency Counter readings which correspond to the displayed 8350A FREQUENCY display reading (± 10 MHz). If necessary repeat steps 5 through 14.

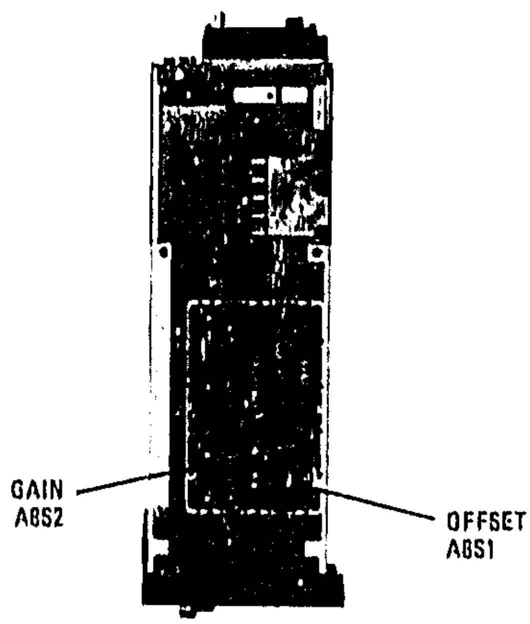


Figure 5-10. Frequency Calibration Adjustment Location

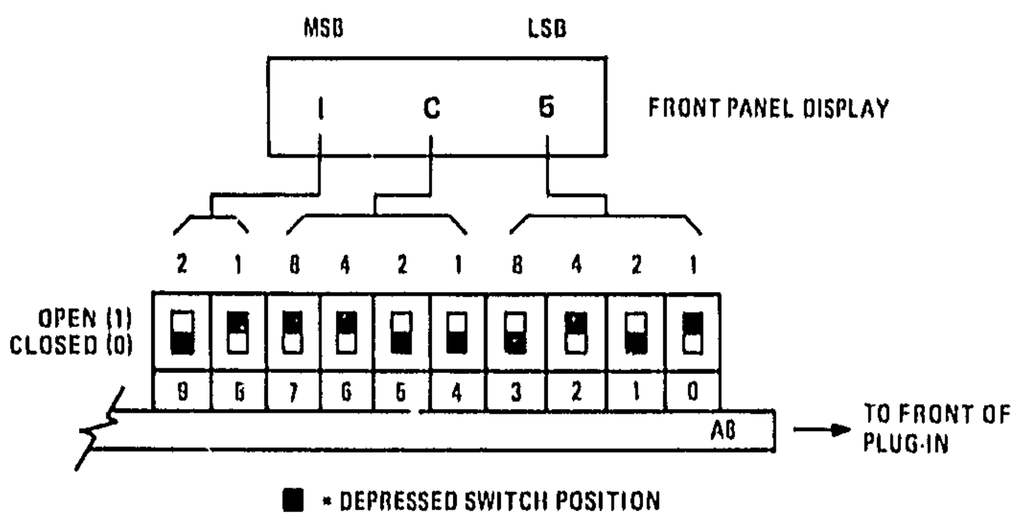


Figure 5-11. A8S1 and A8S2 Frequency Calibration Switch Configuration

ADJUSTMENTS

5-18. YO RETRACE COMPENSATION

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

During sweep retrace and each bandswitch, the YO frequency is forced to the required beginning frequency of the next band by the retrace compensation circuit. This circuit is adjusted to maximize the YO frequency settling time before sweeping the next band. An external frequency meter is set to the YO frequency for the start of the next band. The width of the frequency meter pip corresponds to how long the YO has settled at the correct start frequency.

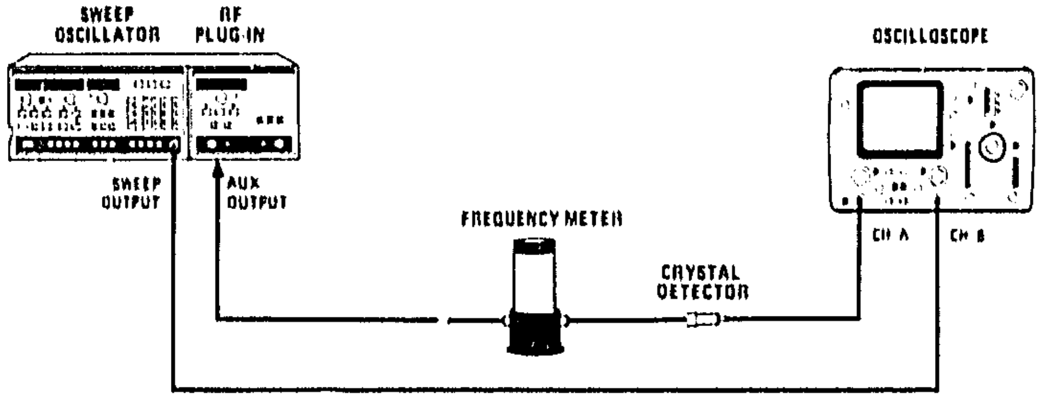


Figure 5-12. YO Retrace Compensation Test Setup

EQUIPMENT:

Oscilloscope	HP 1740A
Crystal Detector	HP 8470B
Frequency Meter (3.7 to 12.4 GHz)	HP 537A
Frequency Meter (0.96 to 4.2 GHz)	HP 536A
Sweep Oscillator	HP 8350A

ADJUSTMENTS

5-18. YO RETRACE COMPENSATION (Cont d)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

1. Connect the equipment as shown in Figure 5-12 with the oscilloscope connected through the detector and 536A Frequency Meter to the 83590A rear panel AUX OUTPUT. On the 8350A, press INSTR PRESET ; set the RF Blanking on. Allow the equipment to warm up for 1 hour.

2. Set the oscilloscope controls as follows:

Channel B	DC
Channel B Sensitivity	2 Volts/Div.
Horiz. Sweep	5 mSEC/Div.
Delayed Sweep	0.5 mSEC/Div.
Display	CHOP
Trigger	B
Sweep Mode	MAIN

3. Adjust the vertical sensitivity of Channel A on the oscilloscope to bring the trace to center screen.

4. Set the 536A Frequency Meter to 3.5 GHz.

5. Use the delayed sweep vernier to set the delayed part of the trace on the bandswitch point between Band 1 and Band 2 as shown in Figure 5-13.

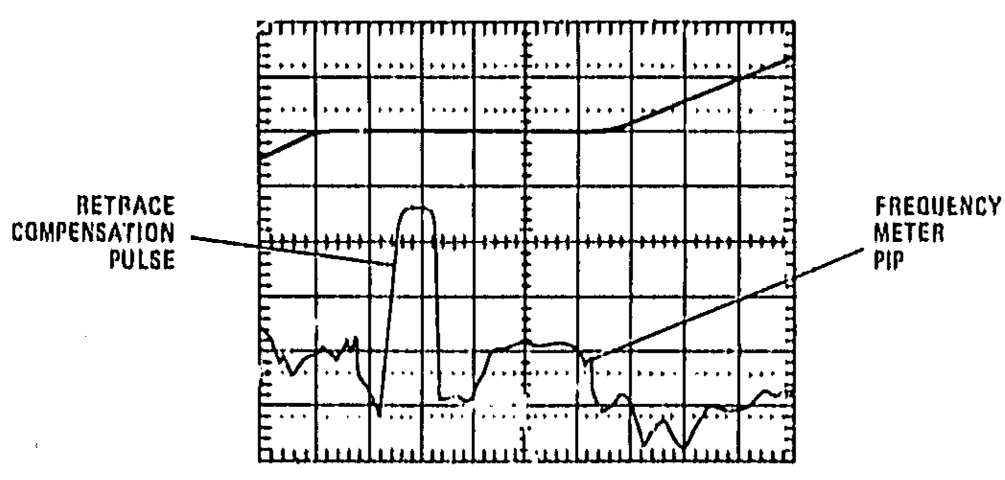


Figure 5-13. YO Retrace Compensation Pulse

ADJUSTMENTS

5-18. YO RETRACE COMPENSATION (Cont'd)

6. On the oscilloscope, go to delayed sweep and fine-adjust the Frequency Meter to set the frequency pip near center screen.

7. Start with A8R55 (RTC COMP) fully clockwise and adjust it for the widest and flattest pip while moving the Frequency Meter to track the bandswitch frequency. A well adjusted retrace compensation pulse is shown in Figure 5-13.

A8

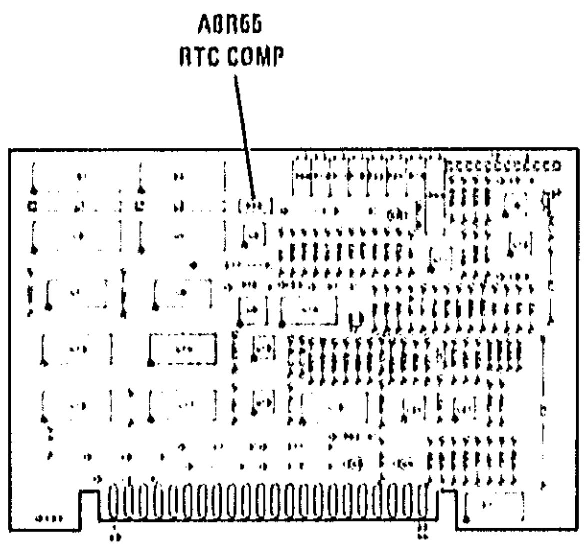


Figure 5-14. YO Retrace Compensation Adjustment Location

8. Select main sweep on the oscilloscope and adjust the delayed sweep vernier to move the delayed portion of the sweep to the bandswitch point between Band 2 and Band 3.

9. Replace the 536A Frequency Meter with the 537A and set it to 4.49 GHz.

10. On the oscilloscope, go to delayed sweep and fine adjust the wavemeter to set the frequency pip near center screen. If the previous Band 1 to Band 2 adjustment was made properly, this bandswitch point will look the same. If it does not, repeat steps 4 through 10 for the best compromise.

ADJUSTMENTS

5-19. YO DELAY COMPENSATION

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

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

Delay compensation adjustments are made while observing the shift between marker pips at a sweep time of 10 milliseconds (worst case for single-band sweeps). At sweep times greater than 100 msec, delay should not exceed ±15 MHz (the difference between CW and Swept Frequency accuracies).

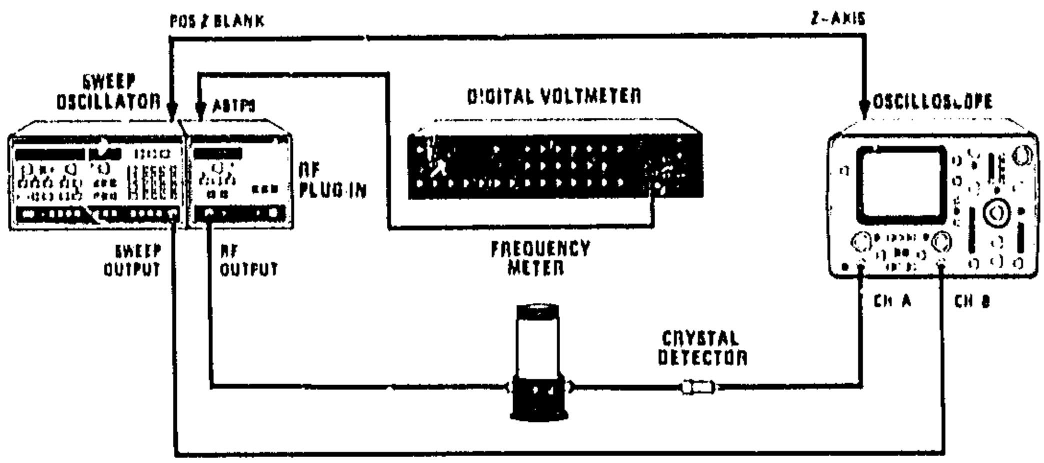


Figure 5-15. YO Delay Compensation Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3456A
Oscilloscope	HP 1740A
Frequency Meter (3.7 to 12.4 GHz)	HP 537A
Frequency Meter (12.4 to 18 GHz)	HP P532A
Crystal Detector	HP 8470B
Sweep Oscillator	HP 8350A

5-19. YO DELAY COMPENSATION (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

1. Connect the equipment as shown in Figure 5-15 with the 537A Frequency Meter. On the 8350A, press INSTR PRESET and allow the equipment to warm up for 1 hour.

2. Set the oscilloscope for A versus B sweep mode to obtain a display of amplitude versus frequency.

3. On the 8350A, press CW .

4. Measure and note the DC voltage at A8TP9.

5. On the 8350A, press CF ΔF 0 MHz .

6. Adjust A8R18 (Z) for a DVM reading equal to the reading noted in step 4. Remove the DVM test leads.

7. On the 8350A, enter the front panel data as follows:

   INSTR PRESET
   START 6 . 9 GHz
   STOP 1 3 . 5 GHz
   SWEEP TIME 1 0 ms
   M1 7 . 2 GHz
   AMPTD MKR
   RF BLANK
   SAVE 2

8. On the 8350A, press SWEEP TIME 2 0 0 ms SAVE 1 .

9. On the 8350A, press M2 1 3 . 2 GHz SAVE 3 .

10. On the 8350A, press SWEEP TIME 1 0 ms SAVE 4 .

11. On the 8350A, press RECALL 1 .

12. Expand the oscilloscope trace at the marker by centering the marker on the oscilloscope then setting the oscilloscope for a magnified horizontal trace. Set the 537A Frequency Meter so that the peak of the pip is on the leading edge of the 7.2 GHz marker.

13. On the 8350A, press RECALL 2 .

14. Adjust A8R12 (LO) so that the peak of the 537A Frequency Meter pip is on the leading edge of the marker.

ADJUSTMENTS

5-19. YO DELAY COMPENSATION (Cont'd)

15. Verify that the delay is accurate by manually adjusting the sweep time from 10 ms to 200 ms. Reset A8R12 (LO) as necessary for the best compromise in overall delay setting (minimum delay per change in sweep time). The position of the 537A Frequency Meter pip should typically stay within ± 15 MHz as read on the Frequency Meter across the 10 ms to 200 ms range.

16. On the 8350A, press **RECALL** **3** .

17. Replace the 537A Frequency Meter with the P532A and set it so that the peak of the pip is coincident with the leading edge of the 13.2 GHz marker.

18. On the 8350A, press **RECALL** **4** .

19. Adjust A8R10 (HI) so that the peak of the Frequency Meter is coincident with the leading edge of the marker.

20. Verify that the delay is accurate by manually adjusting the sweep time from 10 ms to 200 ms. Reset A8R10 (HI) as necessary for the best compromise in overall delay setting (minimum delay per change in sweep time). The position of the Frequency Meter pip should typically stay within ±15 MHz as read on the P532A Frequency Meter across the 10 ms to 200 ms sweep speed range.

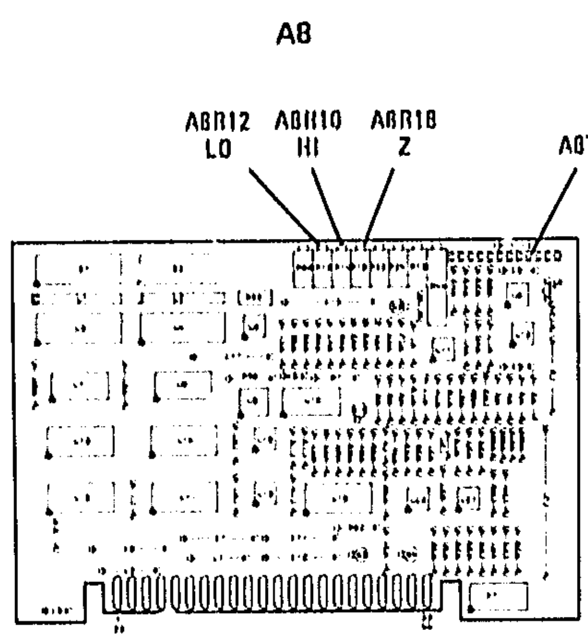


Figure 5-16. YO Delay Compensation Adjustment Location

ADJUSTMENTS

5-20. SLOW SPEED YTM TO YO TRACKING

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6 and A7

DESCRIPTION:

The 83590A is set to sweep Bands 2 and 3 (7 to 20 GHz), and the ALC loop is opened by selecting the External ALC mode. The SRD Bias for the Switched YTM is preset and requires further adjustment according to Paragraph 5-21. Special calibration modes are selected (SHIFT 92 for the beginning of Band 2 and SHIFT 93 for the rest of the sweep). The output power is peaked for each calibration mode, and the appropriate correction factor is entered with the calibration switches. A7S1 calibrates the lower part of Band 2 and A7S2 calibrates the higher frequencies.

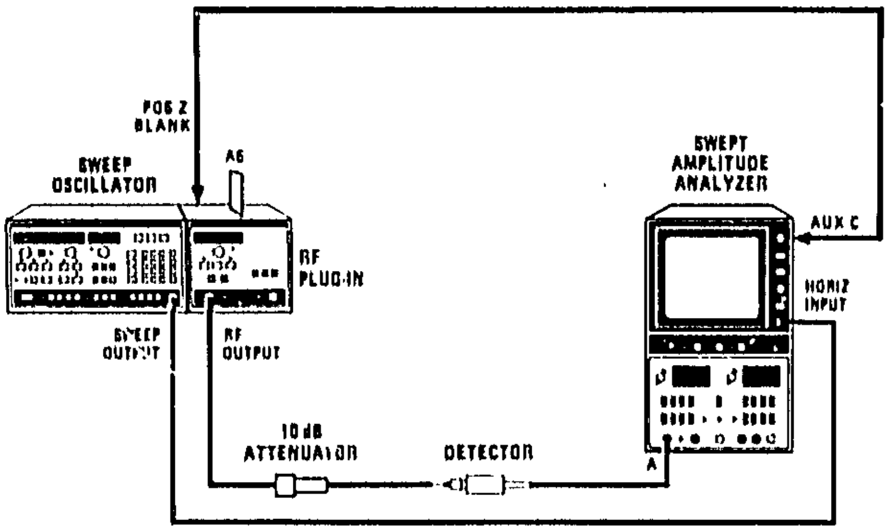


Figure 5-17. Slow Speed YTM and YO Tracking Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664B
10 dB Attenuator	Weinschel Model M9-10
Sweep Oscillator	HP 8350A
Extender Board	HP 08350-60031

ADJUSTMENTS

5-20. SLOW SPEED YTM TO YO TRACKING (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

NOTE

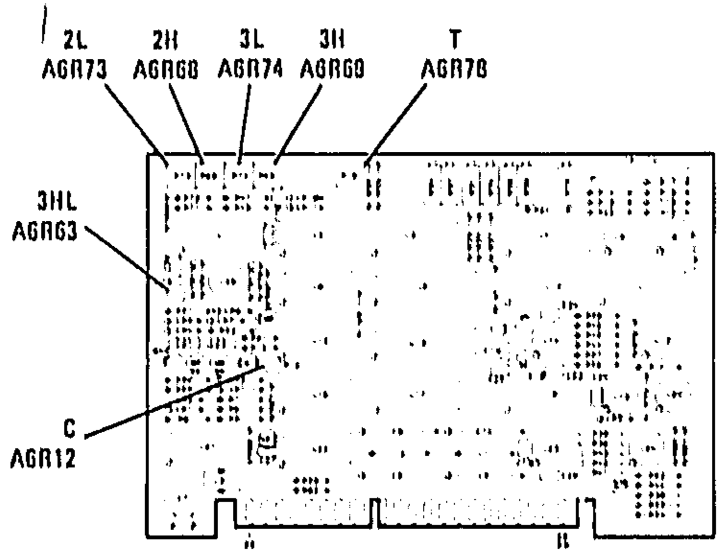
During this adjustment, a localized drop in power may occur. This drop in power is due to the YTM being overdriven and is called squegging. If squegging occurs in Band 2, adjust A6R66 and R73 to eliminate the squegging and to maximize power across the band. If squegging occurs in Band 3, adjust A6R69 and R74.

1. Connect the equipment as shown in Figure 5-17 with the 83590A A6 Sweep Control Board on an extender. Allow the equipment to warm up for 1 hour.
2. On the 8350A press INSTR PRESET START 7 GHz SWEEP TIME 2 0 0 ms ⊔⊓ MOD. On the 83590A, press EXT ALC MODE. The unleveled lamp should be lit.
3. Preset A6R63 (3HL) to midrange. Refer to Figure 5-18 for adjustment locations.
4. Preset A6R78 (T) and A6R12 (C) 1/4 turn from the full counter-clockwise position.
5. Select 1 dB/Division display resolution on the 8755C and center the display.
6. On the 8350A, press SHIFT 9 2 to enable the YTM OFFSET DAC subroutine. Using the 83590A POWER control, peak the power within the first graticule of the display.
7. Enter the number displayed on the 83590A POWER display into A7S1 as shown in Figure 5-20. Refer to Figure 5-19 for the switch location.
8. On the 8350A, press SHIFT 9 3 to enable the YTM GAIN DAC subroutine. Using the 83590A POWER control, peak the power within the last graticule of the display.
9. Enter the number displayed on the 83590A POWER display into A7S2 as shown in Figure 5-20. Refer to Figure 5-19 for the switch location.
10. On the 8350A, press INSTR PRESET so that the new calibration data will be entered from the current switch settings.
11. On the 8350A, press STOP 7 GHz. On the 83590A, press EXT ALC MODE.
12. Adjust A7R51 (B1 OFS) to maximize the Band 1 displayed trace minimum power points.

ADJUSTMENTS

5-20. SLOW SPEED YTM TO YO TRACKING (Cont'd)

A6



A7

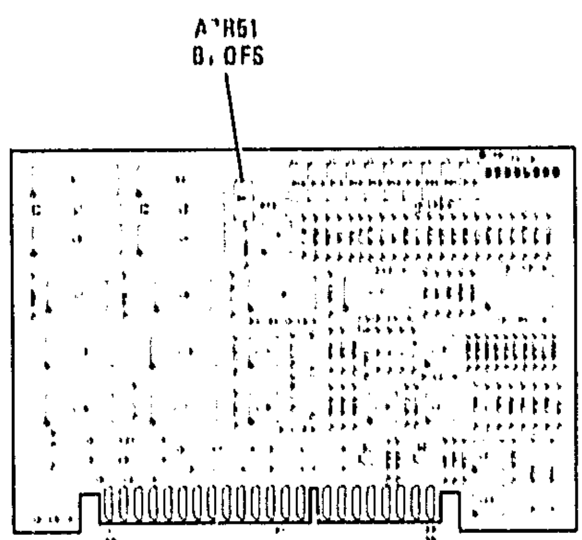


Figure 5-18. Slow Speed YTM to YO Tracking Adjustment Locations

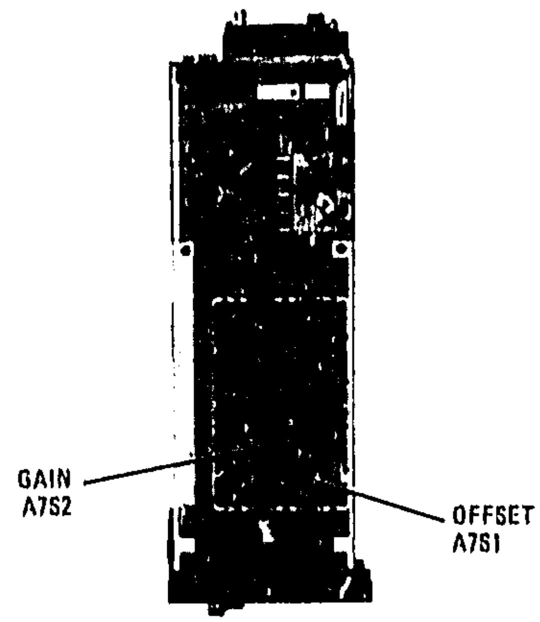


Figure 5-19. YTM to YO Tracking Calibration Switch Location

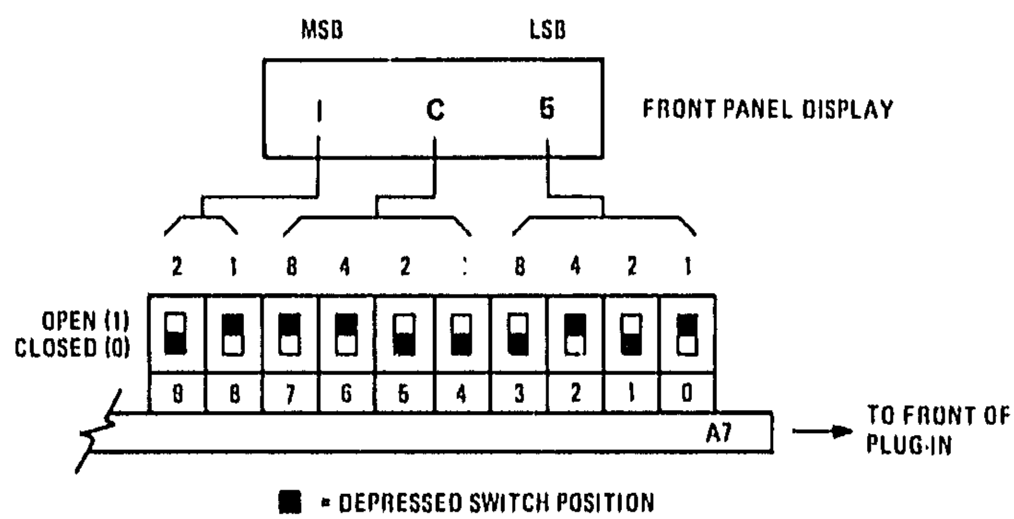


Figure 5-20. YTM to YO Tracking Calibration Switch Configuration

5-21. SRD BIAS

REFERENCE:

Performance Test: Paragraphs 4-17, 4-19
Service Sheet: A4 and A6

DESCRIPTION:

The High Power SRD Bias is set by peaking the 8755C displayed trace with A6R68 (2H) and A6R73 (2L) in Band 2, and A6R69 (3H) and A6R74 (3L) in Band 3.

The Low and Mid Power SRD Bias is adjusted by inserting a voltage source through a 1 kOhm current-limiting resistor into the MOD 1 signal path in place of the A4 ALC board output. With the 83590A at maximum RF output power level, the voltage is increased (from a starting point of 0.6 Vdc to a maximum of 5.0 Vdc) to set the RF output to a point just above the noise level of the 8755C. At this point, A6R63 (3HL) is adjusted until minimum slope is obtained on an Oscilloscope display, and A6R12 (C) is adjusted to peak the power in Bands 2 and 3. The voltage from the Power Supply is decreased until the display on the 8755C reaches a point halfway between full RF out and the previous point. A6R78 (T) is adjusted to optimize the power at this intermediate point. The Power Supply is then removed.

The YTM fundamental feedthrough is suppressed while Bands 2 and 3 are swept. A ratio measurement is taken to determine system error and is subtracted from the ratio of a filtered RF path (fundamental feedthrough only) and an unfiltered RF path. A6R78 (T) is then adjusted until the harmonics specification is met.

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detectors (2)	HP 11664B
6 dB Attenuator	Weinschel Model M9-6
10 dB Attenuator	Weinschel Model M9-10
20 dB Attenuator	Weinschel Model M9-20
Directional Coupler	HP 0955-0125
Power Supply	HP 6214A
Low Pass filter (6.8 GHz)	HP 11684A
Storage Normalizer	HP 8750A
Oscilloscope	HP 1740A
Extender Board	HP 08350-60031
Sweep Oscillator	HP 8350A
1 kOhm Resistor	HP 0757-0280

PROCEDURE:

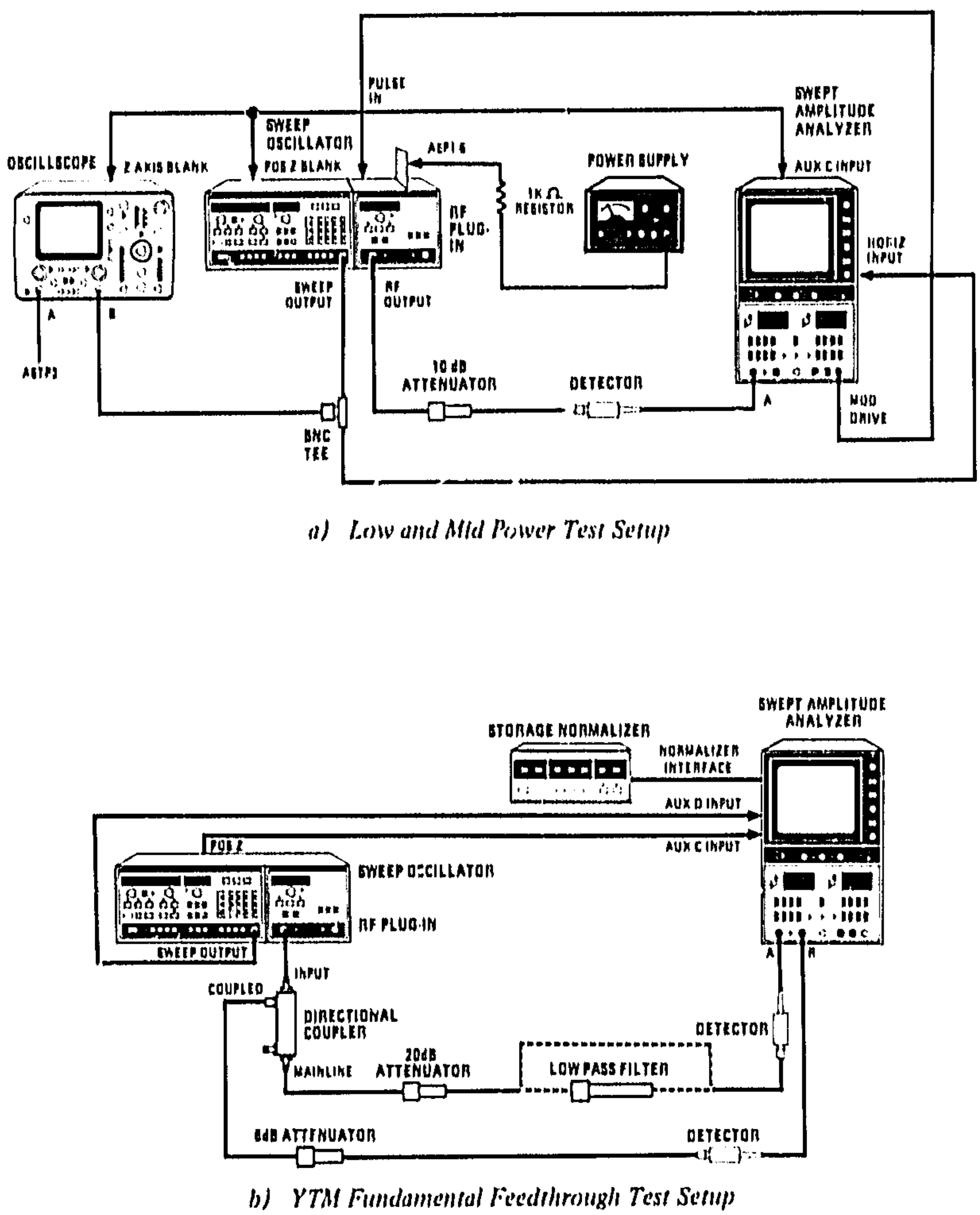
NOTE

Turn the 8350A LINE power OFF when removing or installing PC boards.

NOTE

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

SRD Bias (Cont'd)



a) Low and Mid Power Test Setup

b) YTM Fundamental Feedthrough Test Setup

Figure 5-21. SRD Bias Adjustment Test Setups

ADJUSTMENTS

SRD Bias (Cont'd)

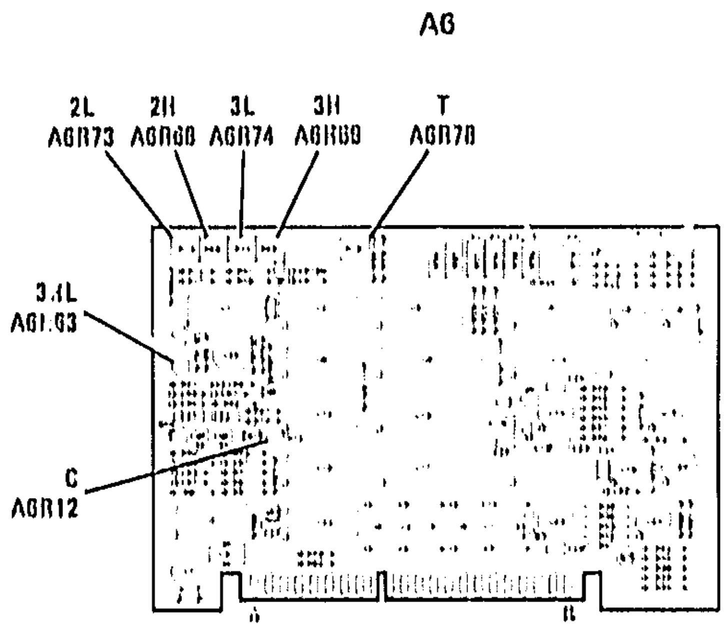


Figure 5-22. SRD Bias Adjustment Location

High Power SRD Bias

1. Connect the equipment as shown in Figure 5-17 with the 83590A A6 Sweep Control board on an extender. With the LINE power OFF, remove the 83590A A4 ALC board. Connect the 8755C MODULATOR DRIVE output to the 83590A rear-panel PULSE IN connector.

2. Allow the equipment to warm up for one hour.

3. On the 8350A press INSTR PRESET START 7 GHz SWEEP TIME 2 0 0 ms .

4. Set the 8755C display resolution for 5 dB/DIV and center the display.

5. Adjust A6R73 (2L) and A6R68 (2H) until Band 2 is at maximum power across the band. A6R73 adjusts the low frequency end of Band 2 and A6R68 adjusts the high end.

6. Adjust A6R74 (3L) and A6R69 (3H) until Band 3 is at maximum power across the band. A6R74 adjusts the low frequency end of Band 3 and A6R69 adjusts the high end.

7. Repeat steps 5 and 6 in order to obtain optimum power across the display.

8. Check the YO to YTM tracking to ensure it has not changed (refer to paragraph 5-20). If retracking is necessary, adjust A6R68, R69, R73, and R74 as necessary to eliminate any squegging that may have occurred.

SRD Bias (Cont'd)

Low and Mid Power SRD Bias

9. Set up the equipment as shown in Figure 5-21a, with a 1 kOhm resistor connected to A6P1-6 (reference to ground). Remove the 83590A A4 ALC board. Connect the 8755C Swept Amplitude Analyzer MODULATOR DRIVE output to the 83590A rear-panel PULSE IN connector.
10. Allow the equipment to warm up for one hour.
11. On the 8350A, press INSTR PRESET START 7 GHz SWEEP TIME 2 0 0 ms.
12. Set the 8755C display resolution for 10 dB/DIV and adjust the display to the top graticule. On the 1740A Oscilloscope, select A vs B, set Channel 1 to .5 V/DIV, set Channel 2 to 1 V/DIV, and DC-couple Channels 1 and 2.
13. On the 8755C, select the R DISPLAY and note the position of the trace. This is the noise floor of the 8755C. Return to the A DISPLAY.
14. Set the Power Supply voltage at .6 Vdc and increase the voltage until the lowest point of the 8755C display is 10 dB above the noise floor (do not exceed 5 Vdc).
15. Monitor A6TP3 with the Oscilloscope and adjust A6R63 until minimum slope (flat display) is obtained.
16. Monitor the 8755C display and adjust A6R12 until optimum power is obtained for Bands 2 and 3.
17. Reduce the Power Supply voltage until the power displayed on the 8755C rises to a level approximately halfway between maximum power output (0 volts from the Power Supply) and the previous point.
18. Adjust A6R78 to optimize the power in Bands 2 and 3 at this intermediate power level.

YTM Fundamental Feedthrough

19. Set up the equipment as shown in Figure 5-21b without the Low Pass Filter, and with the 83590A A4 ALC board installed.
20. Allow the equipment to warm up for one hour.
21. On the 8350A, press INSTR PRESET START 8 GHz SWEEP TIME 2 0 0 ms ⊓ MOD.
22. On the 8755C, select A/R DISPLAY and 5 dB/DIV. Center the display.
23. On the 8750A, press SELECT CH 1 and DISPLAY STORE INPUT. The display now shows the system error between Channel A and Channel R.
24. Press REFERENCE MEMORY STORE and then DISPLAY INPUT −MEM. The trace on the 8755C should be flat, showing that system errors have been removed. Note the position of the trace and the REFERENCE LEVEL. This will be used as a reference in step 27.

SRD Bias (Cont'd)

25. Install the Low Pass Filter at the location shown in Figure 5-21b.

26. Adjust the REFERENCE LEVEL so that the entire trace is on the display. The YTM fundamental feedthrough is now displayed on the 8755C.

28. Determine how many dB the trace is below the reference position established in step 24. If necessary, adjust A6R78 (T) until the trace is greater than 25 dB below the reference.

28. Follow the performance test in paragraph 4-14 to ensure that power specifications are met. If specifications are not met, repeat the adjustments in paragraphs 5-20 and 5-21.

5-22. YTM DELAY COMPENSATION

REFERENCE:

Performance Test: Paragraph 4-14
Service Sheet: A7

DESCRIPTION:

The YTM Delay Compensation circuit is adjusted to optimize YTM to YO tracking over varying sweep rates. Adjustments are provided for sequential sweeps (multiband) and single band sweeps.

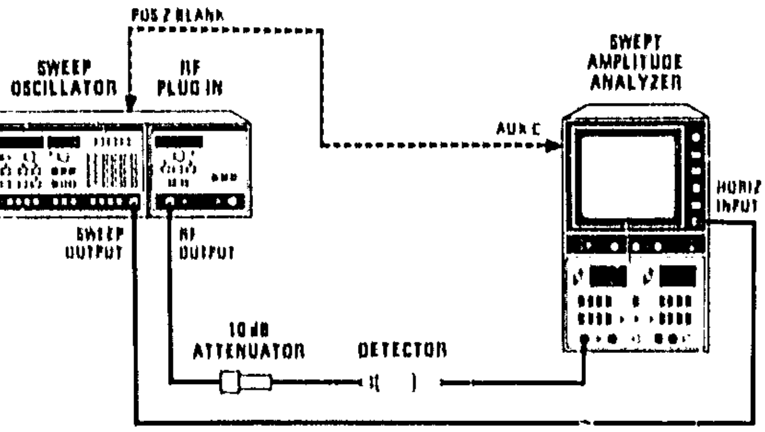


Figure 5-23. YTM Delay Compensation Adjustment Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664B
10 dB Attenuator	Weinschel Model M9-10
Sweep Oscillator	HP 8350A

ADJUSTMENTS

5-22. YTM DELAY COMPENSATION (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set postion. Refer to Table 5-6.

1. Connect the equipment as shown in Figure 5-23. Do not connect the BNC cable between the 8350A rear panel POS Z BLANK and the 182T AUX C connector yet. Preset A7R45 (SEQ TC) fully counter-clockwise. Refer to Figure 5-24 for adjustment locations. Allow the equipment to warm up for 1 hour.

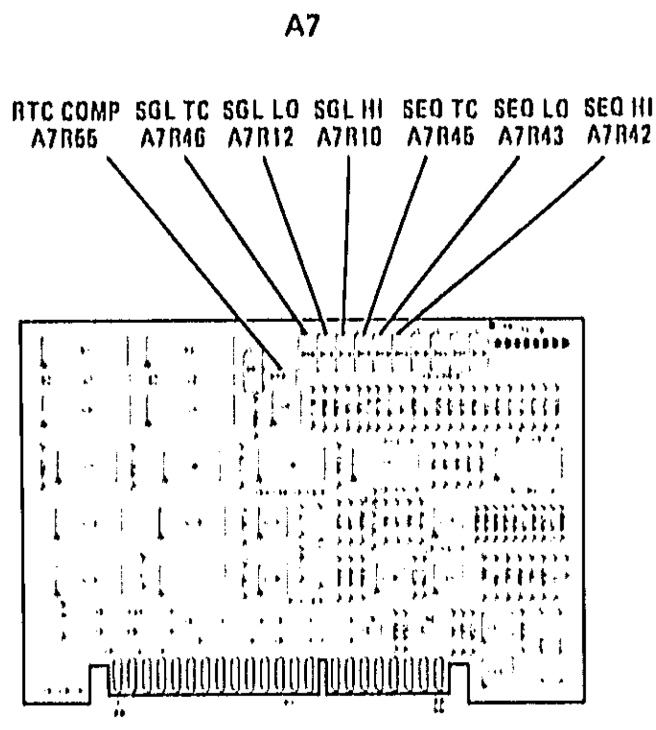


Figure 5-24. YTM Delay Compensation Adjustment Locations

2. On the 8350A and 83590A press INSTR PRESET ⎍ MOD EXT ALC MODE SAVE 1 SWEEP TIME 0 . 5 s SAVE 2 .

3. Press RECALL 1 . Adjust A7R45 (SEQ TC) for the highest power with the best defined (brightest) bandswitch point between Band 2 and Band 3.

ADJUSTMENTS

5-22. YTM DELAY COMPENSATION (Cont'd)

4. Connect a BNC cable from the 8350A rear panel POS Z BLANK connector to the 182T rear panel AUX C connector.

5. Adjust A7R43 (SEQ LO) for maximum power at the beginning of Band 2.

6. Adjust A7R42 (SEQ HI) for maximum power at the end of Band 3.

7. On the 8350A, iterate between RECALL 1 and RECALL 2 while readjusting A7R42 (SEQ HI) and A7R43 (SEQ LO) as necessary to minimize the power level changes.

8. On the 8350A, press START 7 . 1 GHz SWEEP TIME 3 0 ms .

9. Adjust A7R55 (RTC COMP) for maximum power in Band 2.

10. Vary the 8350A START FREQUENCY control from 2 GHz to 20 GHz to check for power variations. Readjust A7R42 (SEQ HI), A7R43 (SEQ LO), and A7R55 (RTC COMP) as necessary to minimize any droop in power (particularly near 20 GHz). The worst case droop should not exceed 0.5 dB as the START frequency is varied. If this step cannot be met, repeat the Slow Speed YTM to YO Tracking Adjustments.

11. On the 8350A and 83590A, press INSTR PRESET ⊓ MOD EXT ALC MODE .

12. Repeatedly press SINGLE SWEEP TRIGGER while watching the displayed power level. Readjust A7R42 (SEQ HI) and A7R43 (SEQ LO) as necessary to minimize the power level difference between a 30 ms single sweep and a 30 ms INT sweep.

13. On the 8350A and 83590A, press INSTR PRESET ⊓ MOD START 6 . 9 GHz STOP 1 3 . 5 GHz EXT ALC MODE .

14. Preset A7R46 (SGL TC) fully counter-clockwise.

15. While continuously changing the SWEEP TIME control for a sweep speed from 10 ms to 100 ms, adjust A7R12 (SGL LO) to maximize the power at the low end of Band 2. In the same manner, adjust A7R10 (SGL HI) to maximize the power at the high end of Band 2. Then adjust A7R46 (SGL TC) to maximize the power at the very start of the band.

16. On the 8350A, press START 1 3 . 4 GHz STOP 2 0 GHz . Vary the sweep speed as in step 15 and note any drop in power. If the change is greater than 0.5 dB, make slight adjustments to A7R10 (SGL HI) and A7R12 (SGL LO). If it is necessary to adjust A7R10 (SGL HI) and A7R12 (SGL LO), repeat step 15 and 16 until the power variation while adjusting sweep time is less than 0.5 dB.

ADJUSTMENTS

5-23. BAND OVERLAP

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6

DESCRIPTION:

The 83590A is set to sweep across each bandswitch point. A frequency meter is set to the bandswitch frequency and the gain of the Variable Gain Amplifier on the A6 Sweep Control assembly is adjusted for a smooth frequency transition between bands.

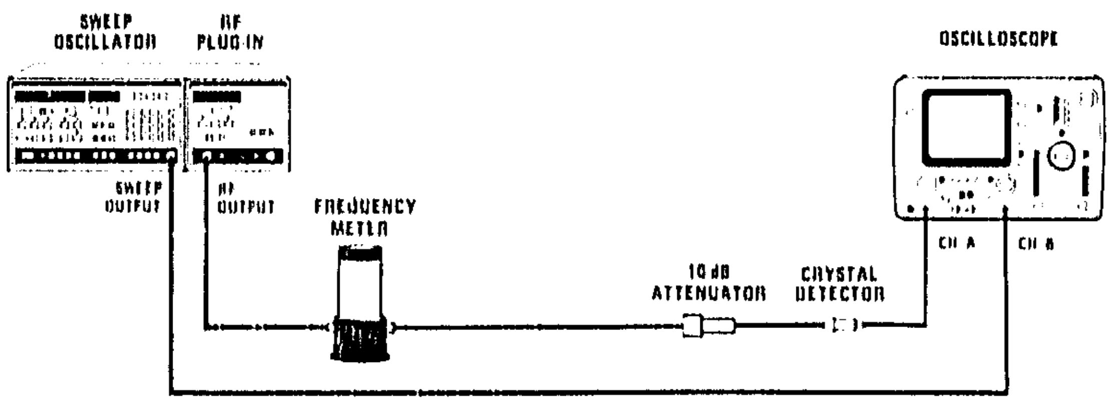


Figure 5-25. Band Overlap Adjustment Test Setup

EQUIPMENT:

Oscilloscope	HP 1740A
Frequency Meter (3.7–12.4 GHz)	HP 537A
Frequency Meter (12.4–18 GHz)	HP P532A
10 dB Attenuator	HP 8491B Option 010
Crystal Detector	HP 8470B
Sweep Oscillator	HP 8350A

PROCEDURE:

NOTE

This procedure requires that A3S1 be set to the factory-set position. Refer to Table 5-6.

1. Connect the equipment as shown in Figure 5-25 with the 537A Frequency Meter in the test setup. Allow the equipment to warm up for 1 hour.
2. On the 8350A, press INSTR PRESET CF 7 GHz ΔF 1 5 0 MHz.

5-23. BAND OVERLAP (Cont'd)

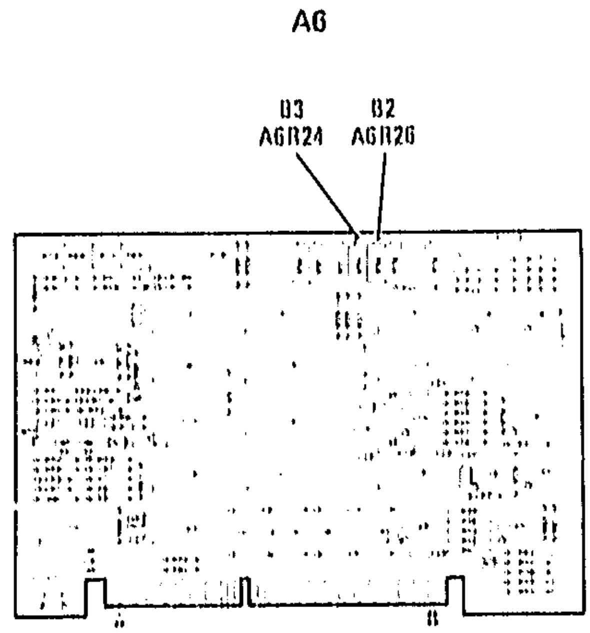


Figure 5-26. Band Overlap Adjustment Locations

3. Set the oscilloscope for A versus B display mode to display amplitude versus frequency. Center the display on screen.
4. Set the 537A Frequency Meter to 7.0 GHz.
5. Center the bandswitch point on the display using the 8350A FREQUENCY control.
6. Adjust the Frequency Meter to put the left half of the pip on the left side of the switch point.
7. Adjust A6R26 (B2) to bring the right side pip over to the switch point so that the right half of this pip mates with the left half of the other as shown in Figure 5-27. Refer to Figure 5-26 for the adjustment location. The pip should be undisturbed as it moves through the bandswitch point.
8. Replace the 537A Frequency Meter with the P532A and set it to 13.5 GHz.
9. On the 8350A, press CF 1 3 . 5 GHz .
10. Repeat steps 5 through 7 but, this time, adjust A6R24 (B3) in step 7.

ADJUSTMENTS

5-23. BAND OVERLAP (Cont'd)

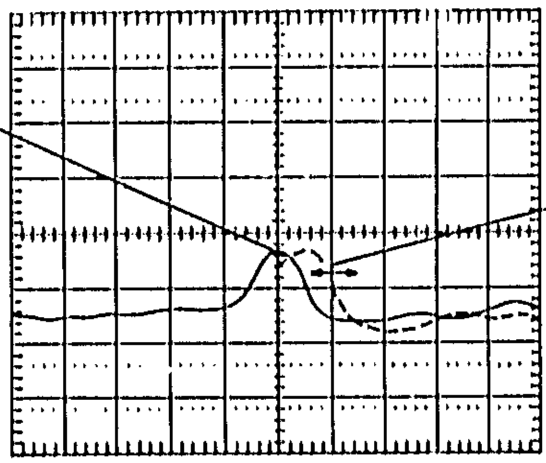


Figure 5-27. Band Overlap Adjustment Waveform

5-24. FREQUENCY REFERENCE 1V/GHz OUTPUT

REFERENCE:

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

DESCRIPTION:

The frequency reference rear panel output is adjusted for 1 Volt per GHz output. Example: 2 GHz = 2 Volts; 3 GHz = 3 Volts, etc.

EQUIPMENT:

Digital Voltmeter. . . . . HP 3456A
Sweep Oscillator . . . . HP 8350A

PROCEDURE:

NOTE

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

1. Connect the equipment with the DVM connected to the rear panel 1V/GHz Frequency Reference connector, J4. Allow the equipment to warm up for 1 hour.

2. Adjust A2R4 (OFFSET) to the center of its mechanical range. Refer to Figure 5-28 for the adjustment location.

3. On the 8350A, press CW 8 GHz .

4. Adjust A2R4 (OFFSET) for a DVM reading of 8.000 ±0.005 Vdc.

ADJUSTMENTS

5-24. FREQUENCY REFERENCE 1V/GHz OUTPUT (Cont'd)

5. On the 8350A, press CW 1 5 GHz .

6. Adjust A2R1 (GAIN) for a DVM reading of 15.000 ±0.005 Vdc.

7. Repeat steps 2 through 6 until there is no change.

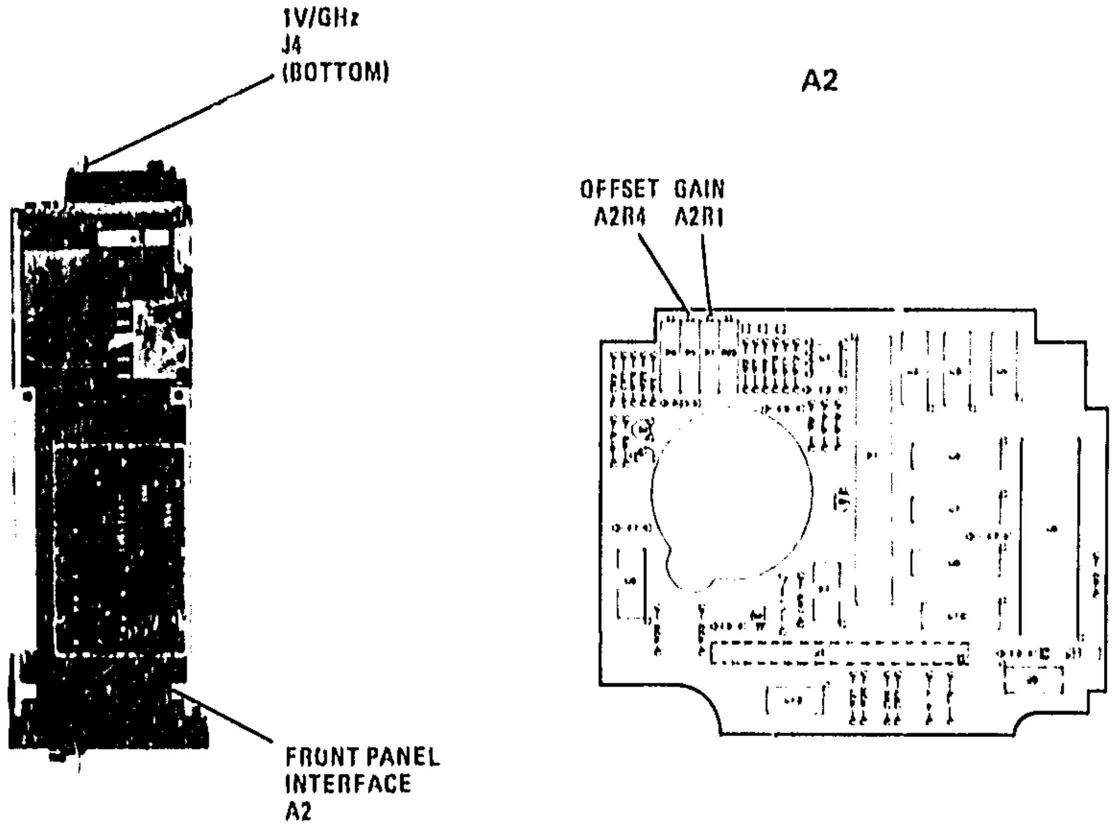


Figure 5-28. Frequency Reference Adjustment Locations

ADJUSTMENTS

5-25. ALC ADJUSTMENT

NOTE

Complete adjustment of the levelling loop requires several procedures to be performed in the order prescribed from paragraphs 5-25 through 5-28. Deviation from this routine may cause improper levelling 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.

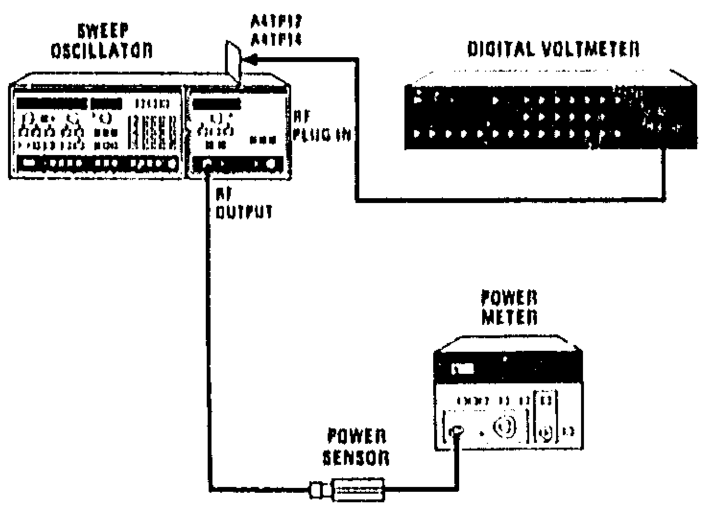


Figure 5-29. ALC Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3456A
Power Meter	HP 436A
Thermistor Mount	HP 8485A
Extender Board	HP 08350-60031
Sweep Oscillator	HP 8350A

ADJUSTMENTS

5-25. 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 that 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. Sweep the full range of the Plug-in at any leveled power. Preset the following adjustments as indicated:

A4R47 (OFS 1)	Midrange
A4R56 (OFS 2)	Midrange
A4R59 (OFS 3)	Midrange
A4R67 (OFS 4)	Midrange
A4R11 (GAIN)	Midrange
A4R3 (1 HI)	Fully CW

2. Float the ground on the Digital Voltmeter and measure the voltage between A4TP12 and A4TP14. Refer to Figure 5-30 for adjustment locations. Adjust A4R47 (OFS 1) for 0.000 ±0.001 Vdc.

A4

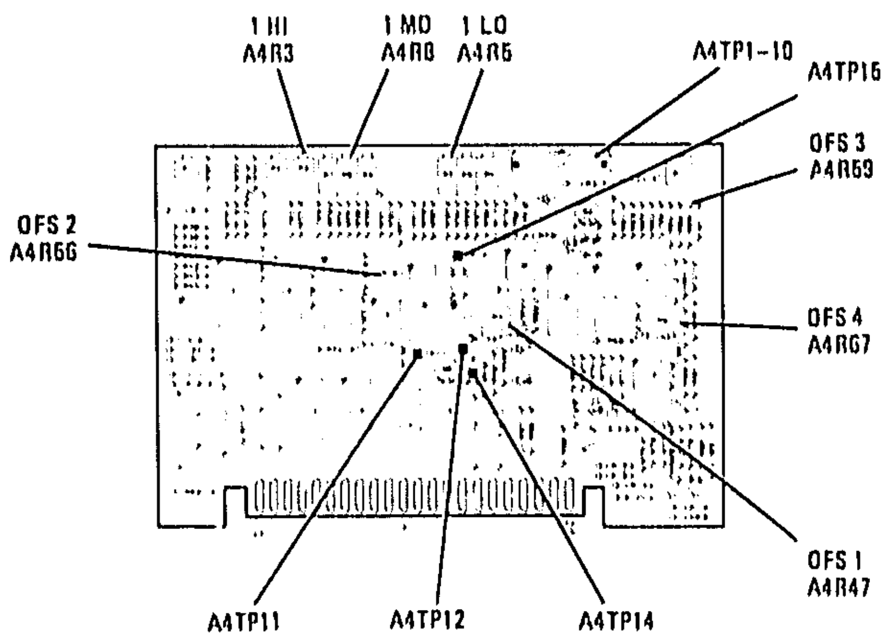


Figure 5-30. ALC Adjustment Locations

ADJUSTMENTS

5-25. ALC ADJUSTMENT (Cont'd)

3. Attach a jumper from A4TP11 to ground. Connect the DVM to A4TP11 and A4TP5 and adjust A4R56 (OFS 2) for a DVM reading of 0.000 ±0.001 Vdc. Remove the jumper.

4. Connect the DVM between A4TP12 and A4TP15 (floating ground). Adjust A4R59 (OFS 3) for a DVM reading of 0.000 ±0.001 Vdc.

5. On the 8350A, press CW and ensure that the power is leveled (83590A UNLEVELED light off). Connect the DVM to P1 pin 15/37 (analog ground) and A4TP7 and adjust A4R67 (OFS 4) for a DVM reading of 0.000 ±0.001 Vdc.

6. Turn instrument Line power OFF. Remove A4 assembly from the extender board and reinsert A4 directly into the instrument. Turn ON Line power to instrument. Connect Power Meter sensor to RF OUTPUT.

7. On the 8350A press CW 2 . 0 GHz . Set POWER for Plug-in front panel reading of −3 dBm. Adjust A4R5 "1 LO" for an RF OUTPUT power of −3 dBm ±0.1 dB.

8. Set POWER for Plug-in front panel reading of +7 dBm. Adjust A4R8 "1 MD" for an RF OUTPUT power of +7 dBm ±0.1 dB.

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

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

11. Reinstall the A5 FM board assembly.

ADJUSTMENTS

5-26. ALC INTERNAL LEVELED FLATNESS

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-25 through 5-28. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: 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.

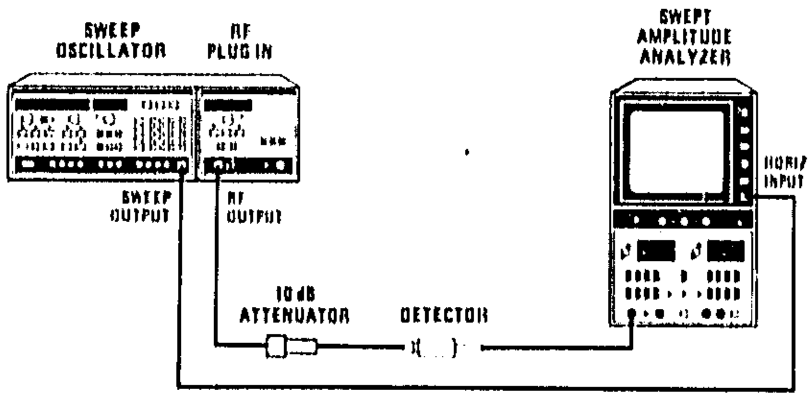


Figure 5-31. Internal Leveling Adjustment Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664B
10 dB Attenuator	Weinschel Model M9−10
Sweep Oscillator	HP 8350A

PROCEDURE:

NOTE

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

ADJUSTMENTS

5-26. ALC INTERNAL LEVELED FLATNESS (Cont'd)

1. Connect equipment as shown in Figure 5-31 with the 8755C monitoring the RF output through the 10 dB attenuator. On the 8350A, press INSTR PRESET ⎍ MOD . Allow the equipment to warm up for 1 hour.

NOTE

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

2. Adjust all breakpoint potentiometers fully clockwise to effectively remove the circuit from the leveling loop (A5R34 (BP1), A5R36 (BP2), A5R38 (BP3), and A5R40 (BP4)). Refer to Figure 5-32 for adjustment locations.

A5

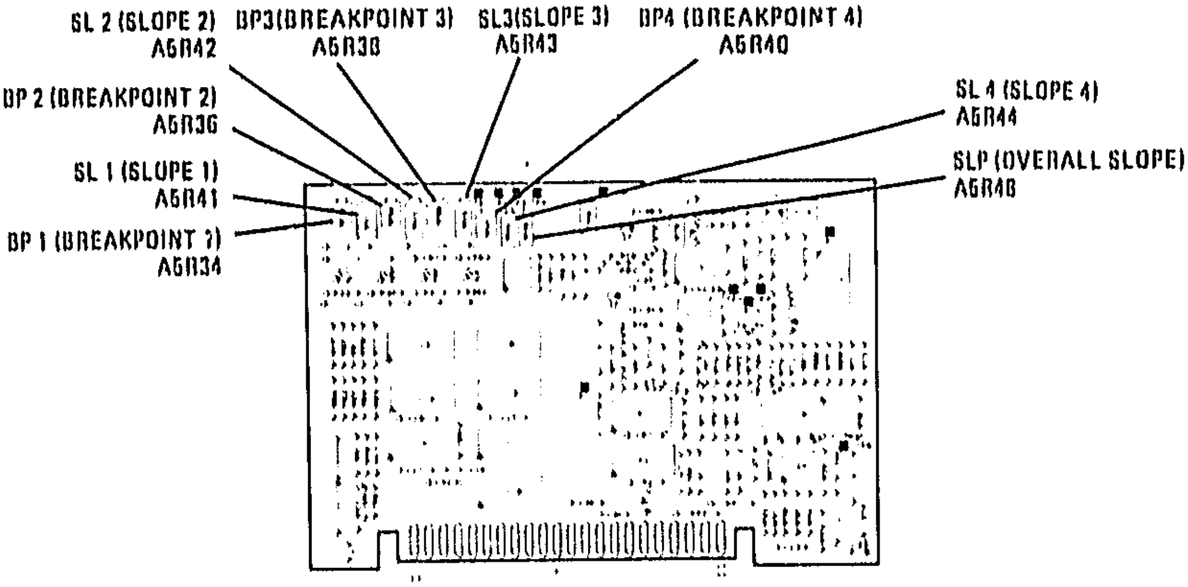


Figure 5-32. Internal Leveling Adjustment Locations

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

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

ADJUSTMENTS

5-27. 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 paragraphs 5-25 through 5-28. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: 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.

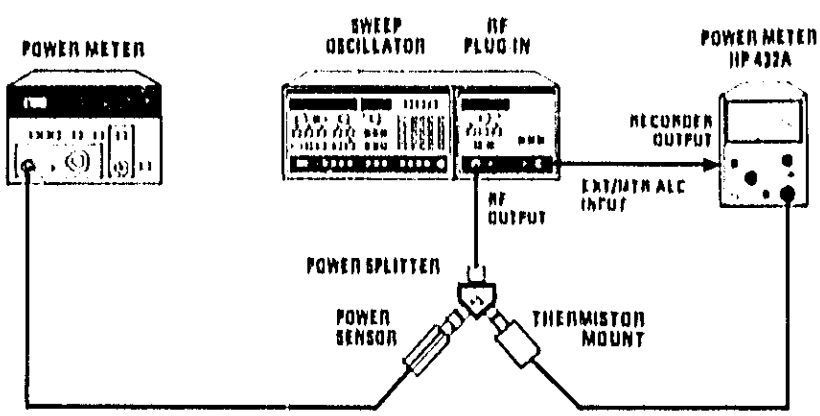


Figure 5-33. Power Meter Leveling Calibration

EQUIPMENT:

Power Meters .... HP 432A and HP 436A
Thermistor Mount .... HP 8478A
Power Sensor .... HP 8485A
Power Splitter .... HP 11667A
Sweep Oscillator .... HP 8350A

5-27. POWER METER LEVELING CALIBRATION (Cont'd)

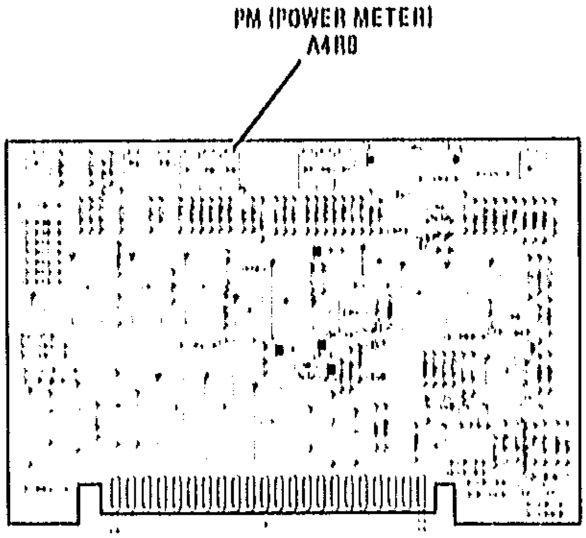


Figure 5-34. Power Meter Adjustment Location

PROCEDURE:

1. Connect equipment as shown in Figure 5-33. On the 8350A, press INSTR PRESET CW and select a frequency at midband. Set the RF power level to −2 dBm, as indicated on the 83590A POWER display. Allow the equipment to warm up for 1 hour.

2. Select the 0 dB range on the HP 432A Power Meter. Both meters should read approximately −8 dBm. Note the insertion loss through the Power Splitter (typically 6 dB).

3. On the 83590A, press MTR and adjust the EXT CAL control to reset the 432A to the same power measured in step 1.

4. Increase the 83590A power level until the 432A Power Meter reaches full scale deflection (83590A RF output equals approximately +6 dBm). Adjust A4R9 (PM) until the 436A Power Meter indication is equal to the 83590A POWER display minus the power splitter insertion loss noted in step 1 (approximately 6 dB). Refer to Figure 5-34 for the adjustment location.

5. Alternately set the 83590A POWER to −2 dBm (and adjust the 83590A EXT CAL control) and then set the 83590A POWER to +6 dBm (and adjust A4R9 (PM) control) to obtain best compromise (where further adjustment of each is unnecessary).

ADJUSTMENTS

5-28. ALC GAIN ADJUSTMENT

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-25 to 5-28. Deviation from this rountine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: Paragraphs 4-14, 4-19 and 4-21
Service Sheet: A4

DESCRIPTION:

A4R11 (GAIN) in the input leg of A4U11 adjusts the gain of the Main ALC Amplifier on the A4 assembly. A4R11 (GAIN) is adjusted for maximum possible gain without producing oscillations.

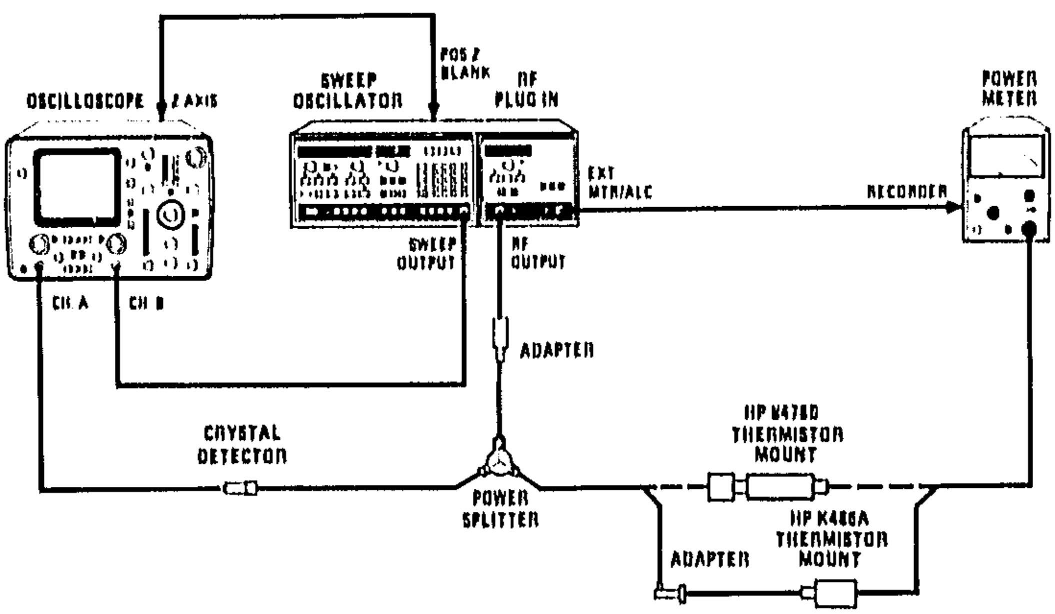


Figure 5-35. ALC Gain Adjustment Test Setup

EQUIPMENT:

Sweep Oscillator .... HP 8350A
Oscilloscope .... HP 1740A
Crystal Detector .... HP 8473C
Power Meter .... HP 432A
Thermistor Mount (0.01 to 18 GHz) .... HP 8478B
Thermistor Mount (18 to 26.5 GHz) .... HP K486A
Waveguide to APC 3.5(f) Adapter (18 to 26.5 GHz) .... HP K281C
Power Splitter .... Weinschel Model 1579A
Type N(m) to SMA(f) Adapter .... HP 1250-1250

ADJUSTMENTS

5-28. ALC GAIN ADJUSTMENT (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position.

1. Connect the equipment as shown in Figure 5-35 with the 8478B Thermistor Mount connected to the Power Splitter. Preset A4R11 (GAIN) fully counterclockwise. Refer to Figure 5-36 for the adjustment location. Allow the equipment to warm up for 1 hour.

A4

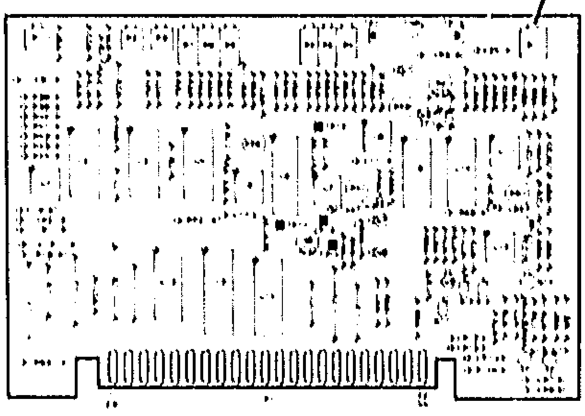


Figure 5-36. ALC Gain Adjustment Location

2. On the 8350A, press **INSTR PRESET** **STOP** **1** **8** **.** **0** **GHz** **SWEEP TIME** **1** **0** **0** **s** .

3. On the Oscilloscope, select A versus B mode to display a plot of amplitude versus frequency. Set the Channel A Vertical Sensitivity for 0.01 volts/division and ac coupling. Set the Channel B Vertical Sensitivity for 1 volt/division and dc coupling. Adjust the horizontal position and vertical position controls for a stable display at mid screen.

4. On the 8350A, press **CW** .

5. Set the Power Meter RANGE switch to +5 dBm. Note the Power Meter needle position.

6. On the 83590A, press **MTR** **ALC MODE** .

ADJUSTMENTS

5-28. ALC GAIN ADJUSTMENT (Cont'd)

7. If necessary, adjust the output power with the 83590A front panel EXT CAL 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 which causes the 83590A output power to be near the low end of its power range (approximately −5 dBm).
8. On the 8350A, press START .
9. Observe the trace dot as it sweeps across the CRT. Adjust A4R11 (GAIN) clockwise, increasing the gain of the ALC loop, until the trace dot begins to oscillate. Then reduce the gain slightly to eliminate the oscillations so that a sharp trace dot is obtained.
10. Set the 83590A to maximum leveled RF output power by returning the Power Meter range switch to the +5 dB position. Observe the trace through the entire sweep to ensure that no oscillations occur. If oscillations do occur, reduce the gain slightly by turning A4R11 (GAIN) counterclockwise.
11. On the 8350A, press INSTR PRESET STOP 1 8 . 0 GHz to set the 83590A to internal leveling.
12. Adjust the Oscilloscope Channel A vertical sensitivity to obtain the internally leveled sweep trace at center screen. If oscillations are present, further reduce the loop gain by adjusting A4R11 (GAIN) counterclockwise.
13. Reduce the 83590A RF output power by rotating the 83590A POWER control until the 83590A POWER display reads −5 dBm. Observe a full sweep. If oscillations occur, reduce the gain further by adjusting A4R11 (GAIN) counterclockwise.
14. Reconnect the equipment with the K486A Thermistor Mount and the Adapter connected to the Power Splitter as shown in Figure 5-35.
15. On the 8350A, press INSTR PRESET START 1 7 . 5 GHz STOP 2 0 GHz SWEEP TIME 1 0 0 s .
16. On the Oscilloscope, adjust the horizontal position and vertical position controls for a stable display at mid screen.
17. On the 8350A, press CW .
18. Set the Power Meter RANGE switch to +5 dBm. Note the Power Meter needle position.
19. On the 83590A, press MTR ALC MODE .
20. If necessary, adjust the output power with the 83590A front panel EXT CAL control to position the Power Meter needle to the same reading noted in step 16. Then, decrease the Power Meter range switch by three 5 dB steps to −10 dB. This attenuates the output power by 15 dB which causes the 83590A output power to be near the low end of its power range (approximately −5 dBm).
21. On the 8350A, press START .
22. Observe the trace dot as it sweeps across the CRT. If oscillations occur, reduce the gain by adjusting A4R11 (GAIN) counterclockwise.

ADJUSTMENTS

5-28. ALC GAIN ADJUSTMENT (Cont'd)

23. Set the 83590A to maximum leveled RF output power by returning the Power Meter range switch to the +5 dB position. Observe the trace through the entire sweep to ensure that no oscillations occur with the 83590A at maximum power. If oscillations do occur, further reduce the gain slightly by turning A4R11 (GAIN) counterclockwise.

24. On the 8350A, press **INSTR PRESET** **START** 1 7 . 5 **GHz** to set the 83590A to internal leveling.

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

26. Reduce the 83590A RF output power by rotating the 83590A POWER control until the 83590A POWER display reads −5 dBm. Observe a full sweep. If oscillations occur, reduce the gain further by adjusting A4R11 (GAIN) counterclockwise.

5-29. POWER SWEEP

REFERENCE:

Performance Test: 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.

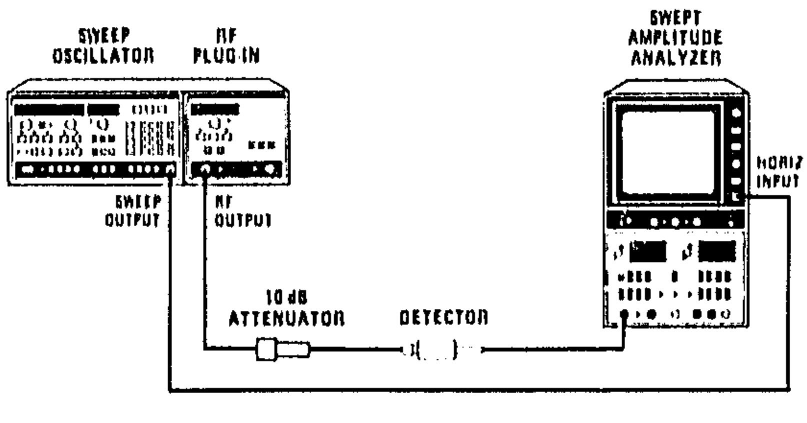


Figure 5-37. Power Sweep Test Setup

EQUIPMENT:

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

ADJUSTMENTS

5-29. POWER SWEEP (Cont'd)

PROCEDURE:

NOTE

ALC gain adjustments (paragraph 5-27) must be checked before power sweep adjustment is made.

NOTE

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

1. Connect equipment as shown in Figure 5-37. On the 8350A, press INSTR PRESET ⊔⊓ MOD . Allow the equipment to warm up for 1 hour.
2. On the 8350A, press SHIFT CW .
3. On the 83590A, press POWER LEVEL . Then, on the 8350A, press 0 dBm .
4. On the 83590A, press POWER SWEEP . Then, on the 8350A, press 1 0 dB .
5. While observing the 8755C display of the RF output, adjust A5R50 (PWSP) for a power level change across the display of 10 dB (10dB/sweep). Refer to Figure 5-38 for the adjustment location.

A5

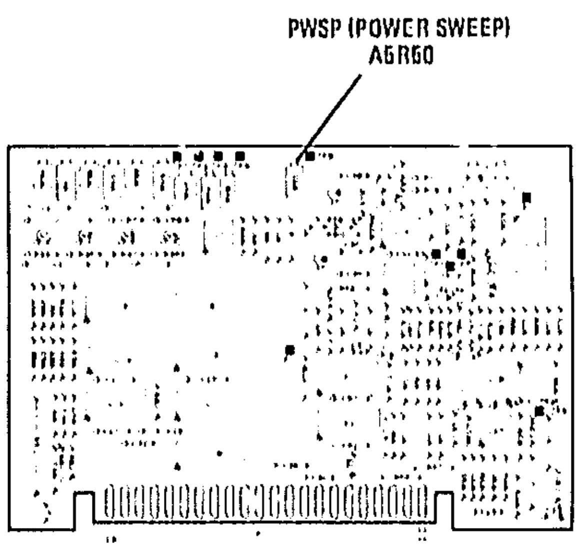


Figure 5-38. Power Sweep Adjustment Location

ADJUSTMENTS

5-30. FM DRIVER

REFERENCE:

Performance Test: Paragraph 4-20
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 supplemental characteristic of ±3 dB FM flatness is checked between DC and 2 MHz.

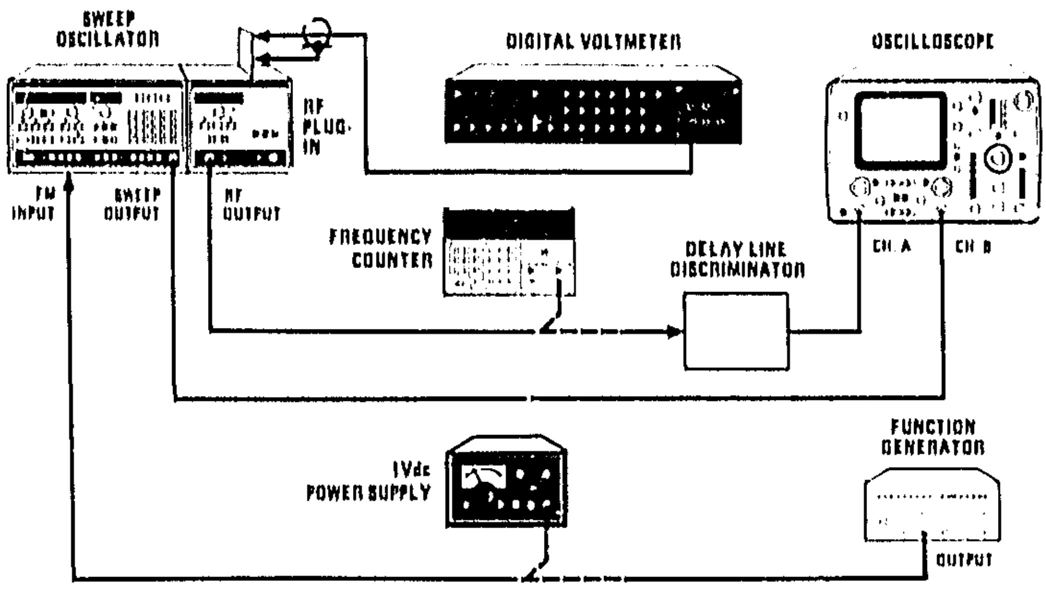


Figure 5-39. Test Setup for FM Driver Adjustments

EQUIPMENT:

Digital Voltmeter (DVM)	HP 3456A
Oscilloscope	HP 1740A
Function Generator	HP 3312A
Delay Line Discriminator	See Figure 1-3
Frequency Counter	HP 5343A
DC Power Supply	HP 6213A
Sweep Oscillator	HP 8350A

ADJUSTMENTS

5-30. FM DRIVER (Cont'd)

PROCEDURE:

NOTE

Turn AC power OFF when removing or installing PC boards.

NOTE

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

FM Offset

1. Connect the equipment as shown in Figure 5-39. Connect the Frequency Counter to the 83590A RF OUTPUT connector. Do not connect the Power Supply or Function Generator to the 8350A rear panel FM INPUT connector yet. Allow the equipment to warm up for 1 hour.

2. Connect the DVM between A5 pin 21 and A5TP7 (HIGH FREQ FM RET). Refer to Figure 5-40 for adjustment procedure locations. Adjust A5R19 (FM OFFSET) for a DVM reading of 0.000 ±0.001 Vdc.

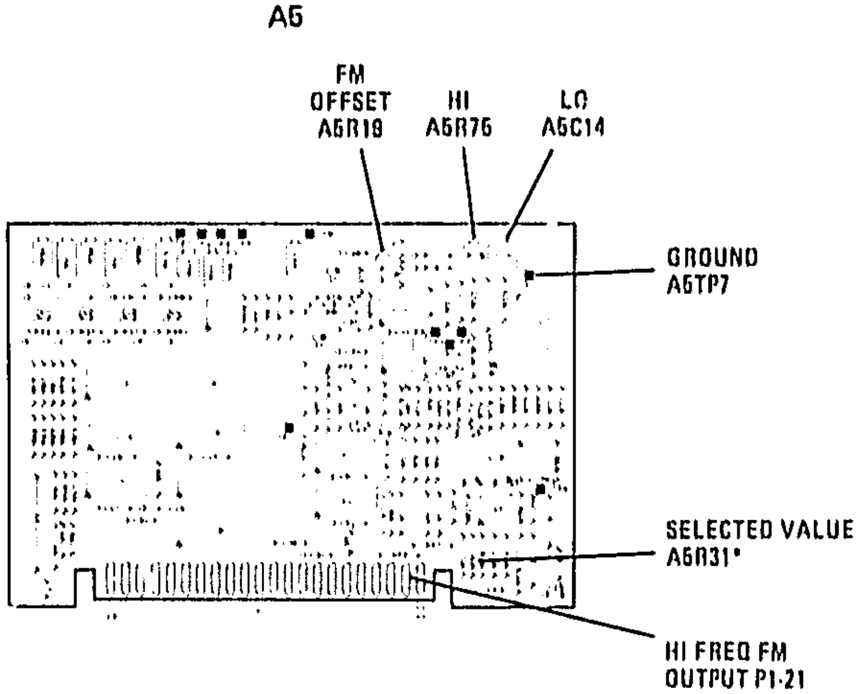


Figure 5-40. Location of A5 FM Driver Adjustments

ADJUSTMENTS

5-30. FM DRIVER (Cont'd)

3. Disconnect the DVM and set the equipment controls as follows:

8350A SWEEP OSCILLATOR

CW FREQUENCY .... 3 GHz
FREQUENCY Sweep Mode .... Press **SHIFT** **CW** (swept CW)
CW VERNIER .... ON
SWEEP TRIGGER .... INT
RF BLANK .... OFF

83590A RF PLUG IN

POWER LEVEL .... +10 dBm
CW FILTER .... OFF
ALC MODE .... INT

Configuration switch A3S1 on Digital Interface board (Table 5-6) set as follows:

Switch Position	1	2	3	4	5	6	7	8
Position	0	X	X	0	0	0	*	0

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

NOTE

The A3S1 switch positions select the 83590A 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 (10 MHz)
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 .... 0.02 (CAL)
CHANNEL B INPUT .... DC
CHANNEL B V/DIV 1

ADJUSTMENTS

5-30. FM DRIVER (Cont'd)

Frequency Response

4. Connect the Frequency Counter to the 83590A RF OUTPUT. Connect a +1 Vdc power supply to the 8350A rear panel FM INPUT. A shift in frequency of approximately −20 MHz should occur on the Frequency Counter when +1 Vdc is applied. (This shows correct FM modulation sensitivity.) Connect the Delay Line Discriminator to the 83590A RF OUTPUT and connect the Function Generator to the 8350A rear panel FM INPUT connector.

5. Adjust the 8350A CW FREQUENCY and CW VERNIER for a waveform at the center of the oscilloscope CRT. Adjust the oscilloscope Channel A CAL control for a trace 4 divisions high centered on the CRT.

6. Manually sweep the Function Generator frequency from DC to 100 kHz. Select resistor A5R31 so that the amplitude of the CRT waveforms at Function Generator frequencies of 100 Hz and 100 kHz are the same ±0.2 divisions on the CRT. Refer to Figure 5-40 for A5R31 location. Refer to Table 5-3 for the allowable range of values for A5R31.

7. Manually sweep the Function Generator frequency from DC to 10 MHz. Adjust A5C14 (LO) and A5R75 (HI) controls to obtain the most constant overall response from DC to 10 MHz. Repeat this step several times.

8. Check that the ±3 dB FM flatness supplemental characteristic is met between DC and 2 MHz as follows. Manually sweep the Function Generator frequency between DC and 2 MHz. On the oscilloscope, note the maximum and minimum response points as shown in Figure 5-41. Maximum point (+3dB) can be up to 5.6 divisions, and minimum point (−3 dB) can be down to 2.8 divisions.

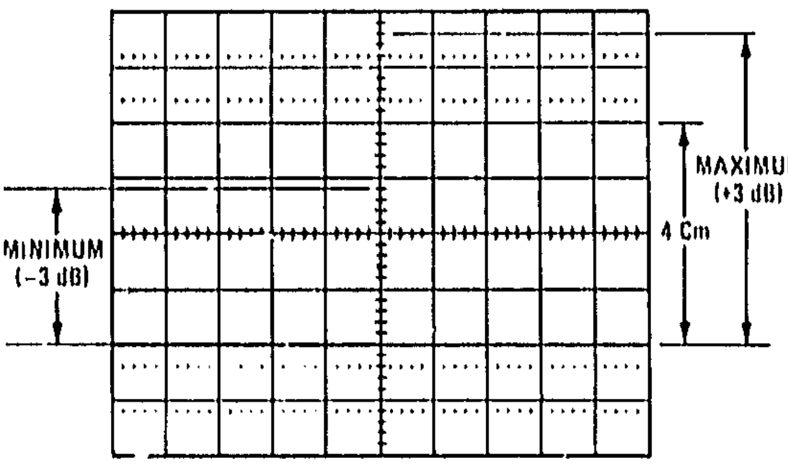


Figure 5-41. FM Flatness Tolerance, DC to 2 MHz

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

10. Reset the A3S1 Configuration Switch as indicated in Table 5-6.

PARTS LIST

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

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

6-3. EXCHANGE ASSEMBLIES

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

6-5. ABBREVIATIONS

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

6-7. REPLACEABLE PARTS LIST

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

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

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

c. Miscellaneous parts.

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

a. The Hewlett-Packard part number.

b. Part number check digit (CD).

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

d. The description of the part.

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

f. The manufacturer's number for the part.

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

NOTE

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

6-11. ILLUSTRATIONS

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

6-13. ORDERING INFORMATION

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

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

6-16. SPARE PARTS KIT

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

Table 6-1. Exchange Parts

Reference Designation	New Part Number	Rebuilt-Exchange Part Number	Description
A12	5086-7341	5086-6341	Switched YTM
A13	5086-7335	5086-6335	YO 2.0 to 7.0 GHz
A14	5086-7342	5086-6342	Power Amp. 2.0 to 7.0 GHz

NOTE

For module exchange procedure, see Section VIII.

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		
0004G	UNITRODE COMPUTER PRODUCTS CORP	METHUEN MA	
01121	ALLEN-BRADLEY CO	MILWAUKEE WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75222
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 ELEC CO SEMICONDUCTOR DIV	CONCORD NH	03301
17856	SILICONIX INC	SANTA CLARA CA	95054
18324	SIGNETICS CORP	SUNNYVALE CA	94086
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
24355	ANALOG DEVICES INC	NORWOOD MA	02062
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
25098	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
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC CT	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON CA	92634

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

REFERENCE DESIGNATIONS

A	Assembly
AT	Attenuator, Isolator, Limiter, Termination
C	Capacitor
CR	Diode, Diode Thyristor, Step Recovery Diode (SCR), Varactor
DC	Directional Coupler
DS	Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Audible or Visible)
E	Miscellaneous Electrical Part
F	Fuse
FL	Filter
H	Hardware
J	Electrical Connector (Stationary Portion), Jack
K	Relay
L	Coil, Inductor
MP	Miscellaneous Mechanical Part
P	Electrical Connector (Movable Portion), Plug
Q	Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R	Resistor
S	Switch
T	Transformer
TP	Test Point
U	Integrated Circuit, Microcircuit
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
AMP	Amperage
AMPL	Amplifier
ANLG	Analog
ASSY	Assembly
ASTBL	Astable
ATTEN	Attenuation, Attenuator
AWG	American Wire Gage

B

BD	Board, Bundle
BE	Baume, Beryllium
BFR	Before, Buffer
BLK	Black, Blank, Block
BNC	Type of Connector
BSC	Basic
BVR	Reverse Breakdown Voltage

C

C	Capacitance, Capacitor, Center Tapped, Centistoke, Ceramic, Cermet, Circular Mil Foot, Closed Cup, Cold, Compression
CBL	Cable
CER	Ceramic
CH	Center Hole
CHAM	Chamfer
CHAN	Channel
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

D

D	Deep, Depletion, Depth, Diameter, Direct Current
D/A	Digital-to-Analog
DAP	Diallyl Phthalate
DB	Decibel, Double Break
DC	Direct Current, Double Contact
DBL	Double
DCDR	Decoder
DEG	Degree
DIA	Diameter
DIFF	Differential
DIP	Dual In-Line Package
DO	Package Type Designation
DRVR	Driver

E

E	Enamel (Insulation, Enhancement, Extension)
E-MODE	Enhancement Mode
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
FM	Flange, Male Connection, Foam, Frequency Modulation
FT	Current Gain Bandwidth Product (Transition Frequency); Feet, Foot
FXD	Fixed

G

GEN	General, Generator
GL	Glass
GP	General Purpose, Group

H

H	Henry, Hermaphrodite, High, Hole Diameter, Hot, Hub Inside Diameter, Hydrogen
HD	Hand, Hard, Head, Heavy Duty
HEX	Hexadecimal, Hexagon, Hexagonal

I

IC	Collector Current, Integrated Circuit
ID	Identification, Inside Diameter

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

Abbreviation	Meaning
IF	Forward Current, Intermediate Frequency
IMPD	Impedance
IN	Inch, Indium
INP	Input
INT	Integral, Intensity, Internal
INTL	Internal, International
INV	Invert, Inverter
J	
JFET	Effect Transistor
K	
K	Kilo, Potassium
KB	Knob
L	
LED	Light Emitting Diode
LG	Length, Long
LIN	Linear, Linear Taper, Linearity
LK	Link, Lock
LKG	Leakage, Locking
LKWR	Lockwasher
LS	Loudspeaker, Low Power Schottky, Series Inductance
LUM	Luminous
M	
M	Male, Maximum, Mega, Mil, Milli, Mode, Momentary, Mounting Hole Centers, Mounting Hole Diameter
MA	Milliampere
MACH	Machined
MAX	Maximum
MCD	Millicandela
MICPROC	Microprocessor
MISC	Miscellaneous
MLD	Mold, Molded
MM	Magnetized Material (Restricted Articles Code); Millimeter
MOD	Model, Modified, Modular, Modulated, Modulator
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
MTG	Mounting
MTR	Meter
MULTIPLXR	Multiplexer
MUW	Music Wire
MW	Milliwatt
N	
N-CHAN	N-Channel
N-CHAN	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
OXD	Oxide
P	
PC	Picocoulomb, Piece, Printed Circuit
PCB	Printed Circuit Board
PD	Pad, Palladium, Pitch Diameter, Power Dissipation
PKG	Package
PL	Phase Lock, Plain, Plate, Plug
PLSTC	Plastic
PNP	Positive Negative Positive (Transistor)
POLYE	Polyester
POS	Position, Positive
POZI	Pozidriv Recess
PRCN	Precision
PRP	Purple, Purpose
PT	Part, Pint, Platinum, Point, Pulse Time
PVC	Polyvinyl Chloride
PW	Power Wirewound, Pulse Width
Q	
QUAD	Set of Four
R	
RES	Research, Resistance, Resistor, Resolution
RET	Retaining
RF	Radio Frequency
RGLTR	Regulator
RKR	Rocker
RND	Round
RPG	Rotary Pulse Generator
RR	Rear
RVT	Rivet, Riveted
S	
SCR	Screw, Scrub, Silicon Controlled Rectifier
SGL	Single
SHFT	Shaft
SI	Silicon, Square Inch
SIG	Signal, Significant
SIP	Single In-Line Package
SKT	Skirt, Socket
SLDR	Solder
SM	Samarium, Seam, Small, Square Meter, Sub Modular, Subminiature
SMB	Subminiature, B Type (Snap-On Connector)
SQ	Square
STL	Steel
SZ	Size
T	
TA	Ambient Temperature, Tantalum
TC	Thermoplastic
THD	Thread, Threaded
THK	Thick
TO	Package Type Designation, Troy Ounce
TPL	Triple
TRIG	Trigger, Triggerable, Triggering, Trigonometry
TRMR	Trimmer
TRN	Turn, Turns
TTL	Tan Translucent, Transistor Transistor Logic
U	
UNCT	Undercut
UF	Microfarad
V	
V	Vanadium, Variable, Violet, Volt, Voltage
VA	Volt Ampere
VDC	Volts, Direct Current
VID	Video
W	
W	Watt, Wattage, White, Wide, Width, Wire
WB	Wide Band
WD	Width, Wood
X	
XSTR	Transistor
Y	
YTM	YIG Tuned Multiplier
Z	
ZNR	Zener

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	83590-60008	7	1	BOARD ASSEMBLY-FRONT PANEL (DOES NOT INCLUDE A1RPG1 ROTARY PULSE GENERATOR)	28480	83590-60008
A1C1	0160-4084	8	20	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	0	1	CAPACITOR-FXD 220UF ±20% 10VDC TA	28480	0180-0552
A1DS1				NOT ASSIGNED		
A1DS2	1990-0487	7	2	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1DS3	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A1DS4	1990-0670	0	5	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4160
A1DS5	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4160
A1DS6	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A1DS7-A1DS13				NOT ASSIGNED		
A1DS14	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4160
A1DS15	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4160
A1DS16	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4160
A1DS17	1990-0699	3	3	LED-LIGHT BAR MODULE LUM-INT=2MCD	28480	HLMP-2350
A1DS18	1990-0699	3		LED-LIGHT BAR MODULE LUM-INT=2MCD	28480	HLMP-2350
A1DS19	1990-0699	3		LED-LIGHT BAR MODULE LUM-INT=2MCD	28480	HLMP-2350
A1J1	1251-4827	1	2	CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A1MP1				NOT ASSIGNED		
A1MP2	2950-0006	3	1	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A1MP3				NOT ASSIGNED		
A1MP4	2190-0067	4	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
A1MP5-A1MP7	0380-1333	0	3	SPACER-SPECIALTY .480-IN-LG .175-IN-OD	00000	ORDER BY DESCRIPTION
A1R1				NOT ASSIGNED		
A1R2	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0±100	24546	C4-1/8-T0-316R-F
A1R3				NOT ASSIGNED		
A1R4	2100-3766	7		RESISTOR-VAR CONTROL CP 10K 10% LIN	28480	2100-3766
A1R5				NOT ASSIGNED		
A1R6	0698-8820	7	1	RESISTOR 4.64 1% .125W F TC=0±100	28480	0698-8820
A1R7	0757-0398	4	4	RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A1R8	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A1R9	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A1RPG1	5060-9444	7	1	ROTARY PULSE GENERATOR	28480	5060-9444
A1S1	5060-9436	7	8	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S6-A1S11				NOT ASSIGNED		
A1S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1U1	1810-0124	0	1	NETWORK-RES 16-DIP200.0 OHM X 8	28480	1810-0124
A1U2	1990-0738	1	1	DISPLAY-NUM-SEG 8-CHAR .162-H RED	28480	1990-0738
A1U3	1810-0403	7	1	NETWORK-RESISTOR R1-R15 330 OHM ±2%	01121	316A331
A1XDS17	1200-0901	7	3	SOCKET-STRP 8-CONT SIP DIP-SLDR	28480	1200-0901
A1XDS18	1200-0901	7		SOCKET-STRP 8-CONT SIP DIP-SLDR	28480	1200-0901
A1XDS19	1200-0901	7		SOCKET-STRP 8-CONT SIP DIP-SLDR	28480	1200-0901
A1XU2	1251-5828	5	1	CONNECTOR 15-PIN M POST TYPE	28480	1251-5828
A2	83590-60067	8		BOARD ASSEMBLY-SUB PANEL	28480	83590-60067
A2C1	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A2C2	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A2C3	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A2C4				NOT ASSIGNED		
A2C5	0160-0174	9	4	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A2C6	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A2C7	0160-3879	7	26	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A2C8	0160-3875	3		CAPACITOR-FXD 22PF 5% 200VDC CER 0±30	28480	0160-3875
A2CR1	1901-0033	2	20	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR4				NOT ASSIGNED		
A2CR5				NOT ASSIGNED		
A2CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2J1	1251-4827	1		CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A2J2				NOT ASSIGNED		

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
A2J3	1200-0508	0	1	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0508
A2K1	0490-0916	8	3	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A2L1	9100-1618	1	1	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
A2MP2	0380-0773	0		SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A2MP3	0380-0773	0		SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A2MP4	0380-0773	0		SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A2P1	1251-8401	2	1	CONNECTOR 26-PIN F POST TYPE	28480	1251-8401
A2Q1	1854-0474	4	2	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N6661
A2Q2	1853-0318	1	1	TRANSISTOR DUAL PNP PD=600MW	28480	1853-0318
A2Q3	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N6661
A2Q4	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A2R1	2100-3056	8	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A2R2	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0±100	24546	C4-1/8-T0-2152-F
A2R3	0698-3266	7	1	RESISTOR 11.5K 1% .125W F TC=0±100	24546	C4-1/8-T0-1152-F
A2R4	2100-3109	2	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3006P-1-202
A2R5	0757-0465	6	8	RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A2R6	2100-3054	6	2	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A2R7	0757-0440	7	3	RESISTOR 7.5K 1% .125W F TC=0±100	24546	C4-1/8-T0-7501-F
A2R8	0698-3451	0	1	RESISTOR 133K 1% .125W F TC=0±100	24546	C4-1/8-T0-1333-F
A2R9	0757-0280	3	17	RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A2R10	0757-0442	9	30	RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A2R11	0757-0123	3	2	RESISTOR 34.8K 1% .125W F TC=0±100	28480	0757-0123
A2R12	0698-3153	9	3	RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-T0-3831-F
A2R13	0698-3431	6	1	RESISTOR 23.7 1% .125W F TC=0±100	03888	PME55-1/8-T0-23R7-F
A2R14	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A2R15	0698-3156	2	4	RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A2R16				NOT ASSIGNED		
A2R17	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A2R18	0757-0289	2	3	RESISTOR 13.3K 1% .125W F TC=0±100	19701	MF4C1/8-T0-1332-F
A2R19				NOT ASSIGNED		
A2R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A2R21	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A2R22	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A2R23	2100-3054	6		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A2R24	0698-7260	7	8	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
A2R26	0698-7229	6		RESISTOR 511 1% .05W F TC=0±100	24546	C3-1/8-T0-511R-G
A2TP1	0360-0535	0	10	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2U1	1826-0092	3	3	IC OP AMP GP DUAL TO-99 PKG	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	4	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	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A2U9	1826-0417	6	5	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A2U10	1858-0069	1		TRANSISTOR ARRAY 18-PIN PLSTC DIP	13606	ULN-2803A
A2U11	1810-0280	3	1	NETWORK-RES 8-SIP10.0K OHM X 5	01121	208A103
A2U12	1826-0205	0	1	IC TIMER TTL	18324	NE556A
A2W2	8150-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8150-0005
A3	83590-60007	8		BOARD ASSEMBLY-DIG NT	28480	83590-60007
A3C1	0160-0127	2	8	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	0180-0600	7	1	CAPACITOR-FXD 47UF ±20% 20VDC TA	28480	0180-0600
A3J1	1251-4827	1		CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A3MP1	5040-6852	3	1	EXTRACTOR, ORANGE	28480	5040-6852
A3MP2	5000-9046	8	1	EXTRACTOR PIN .031 BOARD	28480	5000-9046
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		RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-T0-3831-F
A3R3	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-T0-3831-F
A3R4	0698-7212	9	4	RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A3S1	3101-2243	6	1	SWITCH-RKR DIP RKR ASSY 8-1A .05A 30VDC	28480	3101-2243
A3U1	83590-80001	2	1	IC-NMOS 32K EPROM PROGRAMMED	28480	83590-80001
A3U2	83590-80002	3	1	IC-NMOS 32K EPROM PROGRAMMED	28480	83590-80002
A3U3	1820-0189	0	3	IC TIMER TTL MONO/ASTBL	01295	NE555P
A3U4	1820-2??	2	1	IC NMOS	04713	MC68A21P
A3U5	1820-2006	0	1	IC TIMER NMOS	00033	UPD8253D

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
A3U6	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3U7	1820-1197	9	3	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
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-DIP1000.0 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-DIP1000.0 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-DIP1000.0 OHM X 8	11236	761-3-R100
A4	83590-60081	2		BOARD ASSEMBLY ALC	28480	83590-60081
A4C1	0160-0127	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		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	0160-3871	0	1	CAPACITOR-FXD .33UF +-20% 50VDC CER	28480	0160-3871
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	4	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	0160-0572	1	3	CAPACITOR-FXD 2200PF +-20% 100VDC CER	28480	0160-0572
A4C19				NOT ASSIGNED		
A4C20	0160-0574	3	4	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	0160-0046	7	2	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0046
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				NOT ASSIGNED		
A4C27	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4C28				NOT ASSIGNED		
A4C29	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A4C30 - A4C34				NOT ASSIGNED		
A4C35	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C36	0160-3878	6	13	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C37				NOT ASSIGNED		
A4CR1				NOT ASSIGNED		
A4CR2				NOT ASSIGNED		
A4CR3	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A4CR4	1901-0535	9	13	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A4CR6	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A4CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A4CR8				NOT ASSIGNED		
A4CR9	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A4CR10				NOT ASSIGNED		
A4CR11				NOT ASSIGNED		
A4CR12	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR13	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR14	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR15	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A4CR16				NOT ASSIGNED		
A4J1	1258-0124	7	11	SHUNT-PROGRAMMABLE 1 DBL PIN SET	28480	1258-0124
A4J2	1258-0124	7		SHUNT-PROGRAMMABLE 1 DBL PIN SET	28480	1258-0124
A4L1	9140-0210	1	3	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L2	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L3	9140-0210	1		INDUCTOR RF-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
A4MP3	1251-4032	0	4	CONNECTOR-SGL CONT SKT .021-IN BSC-SZ	28480	1251-4032
A4Q1	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A4Q2	1854-0285	7	2	TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0285
A4Q3	1855-0414	4	1	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A4Q4				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
A4Q5				NOT ASSIGNED		
A4Q6	1854-0285	7		TRANSISTOR DUAL NPN PD=400MW	28480	1854-0285
A4Q7	1855-0423	5	6	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q8	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q9				NOT ASSIGNED		
A4Q10	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A4Q11				NOT ASSIGNED		
A4Q12				NOT ASSIGNED		
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
A4Q16	1855-0[illegible]	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q17				NOT ASSIGNED		
A4R1				NOT ASSIGNED		
A4R2				NOT ASSIGNED		
A4R3	2100-2516	2	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A4R4				NOT ASSIGNED		
A4R5	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A4R6				NOT ASSIGNED		
A4R7				NOT ASSIGNED		
A4R8	2100-0570	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A4R9	2100-3749	6	4	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	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A4R12	0698-7257	2	2	RESISTOR 2.8K 1% .05W F TC=0±100	24546	C3-1/8-T0-2801-G
A4R13	0698-7258	3	1	RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3-1/8-T0-8251-G
A4R14				NOT ASSIGNED		
A4R15				NOT ASSIGNED		
A4R16				NOT ASSIGNED		
A4R17	0698-7253	8	2	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-G
A4R18	0698-7268	5	1	RESISTOR 21.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-2152-G
A4R19	0698-7260	7		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	2	RESISTOR 11K 1% .05W F TC=0±100	24546	C3-1/8-T0-1102-G
A4R23	0757-0464	5	1	RESISTOR 90.9K 1% .125W F TC=0±100	24546	C4-1/8-T0-9092-F
A4R24	0698-7269	6	2	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	5	1	RESISTOR 422 1% .05W F TC=0±100	24546	C3-1/8-T0-422R-G
A4R29	0698-8846	3	1	RESISTOR 5.42K .5% .125W F TC=0±50	24546	NC55-1/8-T2-5421-D
A4R30				NOT ASSIGNED		
A4R31	0837-0119	7	1	THERMISTOR ROD 5K OHM TC=+.7%/C DEG	28480	0837-0119
A4R32	0698-7259	4	3	RESISTOR 9.09K 1% .05W F TC=0±100	24546	C3-1/8-T0-9091-G
A4R33				NOT ASSIGNED		
A4R34				NOT ASSIGNED		
A4R35				NOT ASSIGNED		
A4R36	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A4R37	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A4R38	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A4R39	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A4R40	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A4R41	0698-7283	4	1	RESISTOR 90.9K 1% .05W F TC=0±100	24546	C3-1/8-T0-9092-G
A4R42	0698-7267	4	1	RESISTOR 19.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-1962-G
A4R43	0698-7272	1	1	RESISTOR 31.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-3162-G
A4R44	0698-7275	4	1	RESISTOR 42.2K 1% .05W F TC=0±100	24546	C3-1/8-T0-4222-G
A4R45				NOT ASSIGNED		
A4R46	0698-7197	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	3	RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A4R49*	0698-8816	8	2	RESISTOR 78K 1% .05W F TC=0±100	28480	0698-8816
A4R50				NOT ASSIGNED		
A4R51	0698-7282	3	1	RESISTOR 82.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-8252-G
A4R52	0698-7248	2	1	RESISTOR 3.48K 1% .05W F TC=0±100	24546	C3-1/8-T0-3481-G
A4R53				NOT ASSIGNED		
A4R54	0698-7259	4		RESISTOR 9.09K 1% .05W F TC=0±100	24546	C3-1/8-T0-9091-G
A4R55	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A4R56	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R57	0757-0280	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				NOT ASSIGNED		
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

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
A4R66	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A4R67	2100-3030	8		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R68	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1001-G
A4R69	0698-3440	7	5	RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-196R-F
A4R70				NOT ASSIGNED		
A4R71	0698-0085	0	2	RESISTOR 2.61K 1% .125W F TC=0±100	24546	C4-1/8-T0-2611-F
A4R72	0757-0278	9	9	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-G
A4R74	0698-7251	6	1	RESISTOR 4.22K 1% .05W F TC=0±100	24546	C3-1/8-T0-4221-G
A4R75	0698-7247	0	1	RESISTOR 2.87K 1% .05W F TC=0±100	24546	C3-1/8-T0-2871-G
A4R76	0757-0399	8		RESISTOR 82.5 1% .125W F TC=0±100	24546	C4-1/8-T0-82R5-F
A4R77	0757-0274	5	3	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-G
A4R79	0757-0394	0	4	RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A4R80	0698-3440	7		RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-196R-F
A4R81 - A4R88				NOT ASSIGNED		
A4R89	0698-7244	7	2	RESISTOR 2.15K 1% .05W F TC=0±100	24546	C3-1/8-T0-2151-G
A4R90	0698-7261	8		RESISTOR 11K 1% .05W F TC=0±100	24546	C3-1/8-T0-1102-G
A4R91				NOT ASSIGNED		
A4R92				NOT ASSIGNED		
A4R93	0698-7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-T0-100R-G
A4R94	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-G
A4R95	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0±100	24546	C3-1/8-T0-261R-G
A4R96				NOT ASSIGNED		
A4R97	0698-3157	3	4	RESISTOR 19.6K 1% .125W F TC=0±100	24546	C4-1/8-T0-1962-F
A4R98	0837-0085	5	1	THERMISTOR ROD 550-OHM TC=+.7%/C-DEG	28480	0837-0085
A4R99	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A4R100	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0±100	24546	C4-1/8-T0-681R-F
A4TP1 - A4TP10				PINS ON J1		
A4TP11	0360-0535	0		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	3	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A4U2	1826-0417	6		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	OP11EY
A4U4	1826-0610	1	2	ANLG MULTIPLXR 4-CHAN-CERDIP	28480	1826-0610
A4U5	1826-0319	7	3	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	04713	LF356G
A4U6	1826-0610	1		ANLG MULTIPLXR 4-CHAN-CERDIP	28480	1826-0610
A4U7	1826-0447	2		IC OP AMP WB TO-99 PKG	27014	LF357H
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		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		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	5	IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A4U15	1826-0026	3	3	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-7 PD=.4W TC=-.074%	28480	1902-3070
A4VR5	1902-3070	5		DIODE-ZNR 4.22V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3070
A4W1	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A4W2	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A4W3	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A5	83592-60008	6		BOARD ASSEMBLY-FM	28480	83592-60008
A5C1	0160-0575	4	4	CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A5C2	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A5C3	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C4	0160-0945	2		CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
A5C5	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A5C6	0160-2247	1	1	CAPACITOR-FXD 3.9PF ±.25PF 500VDC CER	28480	0160-2247
A5C7	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C8	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C9	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C10	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C11	0140-0198	5	1	CAPACITOR-FXD 200PF ±5% 300VDC MICA	72136	DM15F201J0300WV1CR
A5C12	0160-2199	2	1	CAPACITOR-FXD 30PF ±5% 300VDC MICA	28480	0160-2199
A5C13				NOT ASSIGNED		
A5C14	0121-0446	6	1	CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0446
A5C15	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C16	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C17	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879

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
A5C18	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C19				NOT ASSIGNED		
A5C20	0160-2240	3	2	CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2240
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	1	CAPACITOR-FXD 100UF ±10% 10VDC TA	56289	150D107X9010R2
A5C34	0180-0474	4	6	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	0160-2240	3		CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2240
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-SM SIG 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	9100-1626	0	1	INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1626
A5L2	9100-1619	7	4	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L3	9100-1619	7		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L4	08503-80001	0	4	COIL TOROID	28480	08503-80001
A5L5	9100-1619	7		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L6	9100-1619	7		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	1854-0620	0	4	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0620
A5Q2	1854-0620	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0620
A5Q3	1854-0620	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0620
A5Q4	1854-0620	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0620
A5Q5	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A5R1	0698-0083	8	9	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R2	0698-3154	0	5	RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R3	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R4	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R5	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R6	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A5R7	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A5R8	0698-3158	4	2	RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R9	0698-6360	6	6	RESISTOR 10K 1% .125W F TC=0±25	28480	0698-6360
A5R10	0699-0124	0	1	RESISTOR 10.2K 1% .125W F TC=0±25	28480	0699-0124
A5R11	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0±100	24546	C4-1/8-T0-4641-F
A5R12	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R13	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-T0-383R-F
A5R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A5R15	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A5R16				NOT ASSIGNED		
A5R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R19	2100-3749	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A5R20	0757-0458	7	3	RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A5R21	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0±100	24546	C4-1/8-T0-1782-F
A5R22	0698-6360	6		RESISTOR 10K 1% .125W F TC=0±25	28480	0698-6360
A5R23	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0±100	24546	C4-1/8-T0-2871-F
A5R24				NOT ASSIGNED		

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
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	0757-0287	0	2	RESISTOR 16.2 1% .125W F TC=0±100	19701	MF4C1/8-T0-16R2-F
A5R29	0757-0287	0		RESISTOR 16.2 1% .125W F TC=0±100	19701	MF4C1/8-T0-16R2-F
A5R30	0757-0388	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A5R31*	0757-0401	0	4	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A5R32	0757-0403	2	3	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	4	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	4	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	2100-3760	8	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	28480	2100-3760
A5R49	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-G
A5R50	2100-3740	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3740
A5R51	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R52	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A5R53	0757-0346	2	6	RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R54	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R55	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R56	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R57	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R58	0757-0346	2		RESISTOR 10 1% .125W F TC=0±100	24546	C4-1/8-T0-10R0-F
A5R59	0698-6360	6		RESISTOR 10K 1% .125W F TC=0±25	28480	0698-6360
A5R60	0698-6360	6		RESISTOR 10K 1% .125W F TC=0±25	28480	0698-6360
A5R61	0698-6360	6		RESISTOR 10K 1% .125W F TC=0±25	28480	0698-6360
A5R62	0698-6[illegible]	6		RESISTOR 10K 1% .125W F TC=0±25	28480	0698-6360
A5R63	0757-0467	8	1	RESISTOR 121K 1% .125W F TC=0±100	24546	C4-1/8-T0-1213-F
A5R64	0698-6363	9	2	RESISTOR 40K 1% .125W F TC=0±25	28480	0698-6363
A5R65	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0±100	19701	MF4C1/8-T0-1332-F
A5R66	0698-6363	9		RESISTOR 40K 1% .125W F TC=0±25	28480	0698-6363
A5R67	0698-3447	4	7	RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A5R68	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A5R69	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A5R70	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A5R71	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A5R72	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
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	2100-2632	1	2	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
A5R78	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R79	0757-0403	2		RESISTOR 121 1% .125W F TC=0±100	24546	C4-1/8-T0-121R-F
A5R80	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0±100	24546	C4-1/8-T0-4640-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	3	IC SWITCH ANLG QUAD 16 DIP-C PKG	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	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A5U7	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A5U8	1826-0349	3	1	IC V RGLTR TO-39	07263	UA78M08HL
A5U9	1826-0558	8	1	IC 337 V RGLTR TO-39	27014	LM337H
A5U10	1826-0546	2	1	IC WIDEBAND AMPL VID TO-100 PKG	18324	NE592K
A5U11	1826-0476	7	2	IC SWITCH ANLG 8 DIP-P PKG	01295	TL601CP

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
A6U12	1826-0416	6		IC SWITCH ANLG QUAD 16 DIP-C PKG	27014	LF13333D
A6U13	1826-0416	6		IC SWITCH ANLG QUAD 16 DIP-C PKG	27014	LF13333D
A6U14	1826-0567	6	1	IC OP AMP GP QUAD 14 DIP-C PKG	27014	LM348J
A6U15				NOT ASSIGNED		
A6U16	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A6U17	1826-0699	6	1	IC CONV 8-B D/A 16 DIP-C PKG	24355	AD7524AD
A6U18	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U19	1826-0700	0	1	IC OP AMP WB 14-DIP-C PKG	34371	HA1-5105-5
A6U20	1810-0224	0	1	NETWORK-RES 8-SIP33.0K OHM X 4	01121	208B333
A6U21	1810-0368	1	1	NETWORK-RES 8-SIP220.0 OHM X 6	01121	208A221
A6VR1	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A6VR2	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A6W1	8150-0005	0	7	WIRE 22AWG W PVC 1X22 80C	28480	8150-0005
A6W2				NOT ASSIGNED		
A6W3				NOT ASSIGNED		
A6W4	8150-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8150-0005
A6W5	8150-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8150-0005
A6W6	8150-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8150-0005
A6W7	8150-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8150-0005
A8	83590-60084	3		BOARD ASSEMBLY-SWEEP CONTROL	28480	83590-60084
A8C1 - A8C4				NOT ASSIGNED		
A8C5	0180-0116	1	8	CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A8C6	0180-0116	1		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A8C7	0180-2815	1	3	CAPACITOR-FXD 100UF ±20% 10VDC TA	28480	0180-2815
A8C8				NOT ASSIGNED		
A8C9	0180-0228	6	5	CAPACITOR-FXD 22UF ±10% 15VDC TA	56289	150D226X9015B2
A8C10	0180-0228	6		CAPACITOR-FXD 22UF ±10% 15VDC TA	56289	150D226X9015B2
A8C11				NOT ASSIGNED		
A8C12				NOT ASSIGNED		
A8C13				NOT ASSIGNED		
A8C14	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C15	0160-0573	2		CAPACITOR-FXD 4700PF ±20% 100VDC CER	28480	0160-0573
A8C16	0160-3878	1		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C17	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C18				NOT ASSIGNED		
A8C19	0160-0576	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0576
A8C20	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C21	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C22	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C23	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C24	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
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	0160-0576	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0576
A8C28	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A8CR1	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR4	1901-0050	3	8	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR8				NOT ASSIGNED		
A8CR9				NOT ASSIGNED		
A8CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A8CR13	1901-0033	2		DIODE-GP 180V 200MA DO-7	28480	1901-0033
A8L1	9140-0137	1	5	INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A8L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A8L3	08503-80001	0		COIL-TOROID	28480	08503-80001
A8MP1	5040-6849	8	1	EXTRACTOR, P.C. BOARD BLUE	28480	5040-6849
A8MP2	5000-9043	6		PIN P.C. BOARD EXTRACTOR	28480	5000-9043
A8Q1	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A8Q2	1854-0477	7	3	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A8Q3	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A8Q4	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8Q5	1853-0405	9	1	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A8Q6	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A8Q7	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A8Q8	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	04713	SS0333
A8Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A8Q10	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A

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
A6R1				NOT ASSIGNED		
A6R2				NOT ASSIGNED		
A6R3				NOT ASSIGNED		
A6R4				NOT ASSIGNED		
A6R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A6R6	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0±100	24546	C4-1/8-T0-1471-F
A6R7	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-T0-383R-F
A6R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A6R9	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R10	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0±100	24546	C4-1/8-T0-1962-F
A6R11				NOT ASSIGNED		
A6R12	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	32997	3329H-1-103
A6R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A6R15	0698-8460	0	8	RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R16	2100-3766	6	1	RESISTOR-TRMR 20 10% C SIDE-ADJ 17-TRN	28480	2100-3766
A6R17	0698-8460	0		RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R18	0698-8460	0		RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R19	0698-8460	0		RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R20	0699-0642	7	1	RESISTOR 10K 1% 1W F TC=0±5	28480	0699-0642
A6R21	2100-3767	8	3	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3767
A6R22	0699-0831	5	1	RESISTOR 9.95K 1% 1W F TC=0±5	28480	0699-0831
A6R23	0699-0033	9	2	RESISTOR 27.362K 1% 1W F TC=0±5	28480	0699-0033
A6R24	2100-3732	7	3	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R25	0699-0033	9		RESISTOR 27.362K 1% 1W F TC=0±5	28480	0699-0033
A6R26	2100-3732	7		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R27	0699-0034	4	1	RESISTOR 36.650K 1% 1W F TC=0±5	28480	0699-0034
A6R28	2100-3732	7	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R29				NOT ASSIGNED		
A6R30				NOT ASSIGNED		
A6R31	0698-8460	0		RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R32	0698-8460	0		RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R33	0698-8460	0		RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R34	2100-3765	4	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3765
A6R35	0698-8460	0		RESISTOR 6.98K 1% 1W F TC=0±4	28480	0698-8460
A6R36	0698-8827	4	5	RESISTOR 1M 1% .125W F TC=0±100	28480	0698-8827
A6R37	2100-3760	9	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3760
A6R38	0698-8827	4		RESISTOR 1M 1% .125W F TC=0±100	28480	0698-8827
A6R39	0699-0164	5	1	RESISTOR 7.2K 1% .125W F TC=0±25	28480	0699-0164
A6R40	0698-8867	8	1	RESISTOR 7.36K .25% .125W F TC=0±50	28480	0698-8867
A6R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R42	0698-3260	9	4	RESISTOR 464K 1% .125W F TC=0±100	28480	0698-3260
A6R43	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0±100	24546	C4-1/8-T0-2371-F
A6R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A6R45	0698-3260	9		RESISTOR 464K 1% .125W F TC=0±100	28480	0698-3260
A6R46	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0±100	24546	C4-1/8-T0-2371-F
A6R47	0757-0421	4		RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A6R48	0757-0421	4		RESISTOR 825 1% .125W F TC=0±100	24546	C4-1/8-T0-825R-F
A6R49	0698-3447	4		RESISTOR 422 1% .125W F TC=0±100	24546	C4-1/8-T0-422R-F
A6R50	0698-3440	7		RESISTOR 196 1% .125W F TC=0±100	24546	C4-1/8-T0-196R-F
A6R51	0698-3445	2		RESISTOR 348 1% .125W F TC=0±100	24546	C4-1/8-T0-348R-F
A6R52	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A6R53	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A6R54	0698-3453	2	3	RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A6R55	0698-8827	4		RESISTOR 1M 1% .125W F TC=0±100	28480	0698-8827
A6R56	0698-3160	5	3	RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A6R57	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0±100	24546	C4-1/8-T0-2373-F
A6R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A6R59	0698-7236	7		RESISTOR 1K 1% .05W F TC=0±100	24546	C4-1/8-T0-1001-F
A6R60	0698-7277	7		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C4-1/8-T0-5112-F
A6R61	0698-7277	7		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C4-1/8-T0-5112-F
A6R62	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-G
A6R63	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	32997	3329H-1-203
A6R64	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A6R65				NOT ASSIGNED		
A6R66	0698-7272	1		RESISTOR 31.6K 1% .05W F TC=0±100	24546	C3-1/8-T0-3162-G
A6R67	0698-7253	8		RESISTOR 6.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-6110-G
A6R68	2100-2516	3		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R69	2100-2516	3		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R70				NOT ASSIGNED		
A6R71	0698-7237	8		RESISTOR 1.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1101-G
A6R72	0698-7242	5		RESISTOR 1.78K 1% .05W F TC=0±100	24546	C3-1/8-T0-1780-G
A6R73	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-202
A6R74	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-202
A6R75				NOT ASSIGNED		
A6R76	0698-7283	4		RESISTOR 90.9K 1% .125W F TC=0±100	24546	C3-1/8-T0-9092-G
A6R77	0698-7286	6		RESISTOR 110K 1% .05W F TC=0±100	24546	C3-1/8-T0-1103-G
A6R78	2100-2892	6		RESISTOR-TRMR 1M 20% C SIDE-ADJ 1-TRN	32997	3329W-1-105
A6R79	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A6R80	0698-3157	8		RESISTOR 3.48K 1% .05W F TC=0±100	24546	C4-1/8-T0-3481-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
A6R1	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-G
A6R2	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-G
A6TP1	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP2	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP3	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP4	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP5	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP6	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP7	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP8	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP9	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP10	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6U1	1826-0720	4	5	IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-0210
A6U2	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A6U3	1820-1108	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A6U4	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-0210
A6U5	1826-0471	2	10	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U6	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U7				NOT ASSIGNED		
A6U8	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U9	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U10	1826-0417	8		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A6U11	1826-0417	8		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A6U12	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U13	1820-2024	3	5	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U14	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U16	1820-1240	1	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A6U17	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U18	1826-0767	2		IC CONV 12-B D/A 18-DIP-C PKG	24355	AD7542BD
A6U19	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U20	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U21	1820-1202	7		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A6U22	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A6U23	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U24	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A6U25				NOT ASSIGNED		
A6U26	1826-0155	5		IC OP AMP GPCL TO-99	3L585	CA3080
A6VR1	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A6W1	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A6W2				NOT ASSIGNED		
A6W3	8159-0005	0		WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A6W4				NOT ASSIGNED		
A7	83590-60088	4		BD ASSY-YTM DRIVER (DOES NOT INCLUDE 20-PIN HEADER P2 OR FACTORY SELECT RESISTORS R34* THROUGH R38* AND R66* THROUGH R71*)	28480	83590-60088
A7C1	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A7C2	0160-3877	5	2	CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A7C3	0160-0162	6	1	CAPACITOR-FXD .022UF ±10% 200VDC POLYE	28480	0160-0162
A7C4	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A7C5	0160-3877	5		CAPACITOR-FXD 100PF ±20% 200VDC CER	28480	0160-3877
A7C6	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A7C7	0180-0116	1		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A7C8	0180-0116	1		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A7C9	0180-2816	5		CAPACITOR-FXD 100UF ±20% 10VDC TA	28480	0180-2816
A7C10	0180-0116	1		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A7C11	0180-0228	6		CAPACITOR-FXD 22UF ±10% 15VDC TA	56289	150D226X9015B2
A7C12	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A7C13	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A7C14	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A7C15	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A7C16	0160-0576	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0576
A7C17	0180-2731	0		CAPACITOR-FXD 2.2UF ±10% 20VDC TA	28480	0180-2731
A7C18	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A7C19	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A7C20	0180-0228	6		CAPACITOR-FXD 22UF ±10% 15VDC TA	56289	150D226X9015B2
A7C21	0180-2704	5	1	CAPACITOR-FXD 3.3UF ±20% 35VDC TA	06751	MDB 525-335-20/0042
A7CR1	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A7CR2	1901-0539	3	2	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A7CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A7CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033

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
A7CR9	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A7J1	1200-0626	3	1	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0626
A7L1	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .20DX.45LG Q=60	28480	9140-0137
A7L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .20DX.45LG Q=60	28480	9140-0137
A7L3	08503-80001	9		COIL TOROID	28480	08503-80001
A7MP1	5040-6844	3	1	EXTRACTOR BOARD	28480	5040-6844
A7MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A7MP3	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A7MP4	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A7P1				NOT ASSIGNED		
A7P2	1251-7204	4	1	HEADER 20 PIN	28480	1251-7204
A7Q1	1853-0044	2	4	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A7Q2	1853-0044	2		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A7R1	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A7R2	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A7R3	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A7R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R5	0698-3449	6		RESISTOR 28.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2872-F
A7R6	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A7R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A7R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R10	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R11	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A7R12	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R13	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A7R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R15	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A7R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R17	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A7R18	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R19	2100-3732	7		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A7R20	0699-0796	2	1	RESISTOR 2.05K 1% 1W F TC=0+-4	28480	0699-0796
A7R21	0699-0406	1	4	RESISTOR 8.64K 1% 1W F TC=0+-4	28480	0699-0406
A7R22	2100-3749	8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A7R23	0699-0800	9	1	RESISTOR 49.9K 1% 1W F TC=0+-4	28480	0699-0800
A7R24	2100-3757	8		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A7R25	0699-0801	0	1	RESISTOR 9.041K 1% 1W F TC=0+-4	28480	0699-0801
A7R26	0698-8960	5	1	RESISTOR 750K 1% .125W F TC=0+-100	28480	0698-8960
A7R27	0698-8489	4	4	RESISTOR 16K 1% 1W F TC=0+-4	28480	0698-8489
A7R28	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A7R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R30	0757-0470	3	3	RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1623-F
A7R31	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R32	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A7R33	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A7R34*				FACTORY SELECTED, NOT REPLACEABLE		
A7R35*				FACTORY SELECTED, NOT REPLACEABLE		
A7R36*				FACTORY SELECTED, NOT REPLACEABLE		
A7R37*				FACTORY SELECTED, NOT REPLACEABLE		
A7R38*				FACTORY SELECTED, NOT REPLACEABLE		
A7R39*				FACTORY SELECTED, NOT REPLACEABLE		
A7R40	0698-8489	4		RESISTOR 16K 1% 1W F TC=0+-100	28480	0698-8489
A7R41	0699-0406	1		RESISTOR 8.64K 1% 1W F TC=0+-4	28480	0699-0406
A7R42	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R43	2100-3760	9		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-203
A7R44	0811-1037	5	2	RESISTOR 316 1% 3W PW TC=0+-20	28480	0811-1037
A7R45	2100-3763	2	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 17-TRN	28480	2100-3763
A7R46	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R47	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A7R48	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A7R49	0698-8721	3	1	RESISTOR 10K 1% .125W F TC=0+-25	28480	0698-8721
A7R50	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A7R51	2100-0570	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A7R52	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A7R53	0698-3160	8		RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A7R54	0698-8958	2	2	RESISTOR 511K 1% .125W F TC=0+-100	28480	0698-8958
A7R55	2100-2517	4	2	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	30983	ET50X503
A7R56	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R57	0757-0290	5	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A7R58	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R59	0811-1037	5		RESISTOR 316 1% 3W PW TC=0+-20	28480	0811-1037
A7R60	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A7R61	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A7R62	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R63	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-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
A7R64	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R65	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R66*				FACTORY SELECTED NOT REPLACEABLE		
A7R67*				FACTORY SELECTED NOT REPLACEABLE		
A7R68*				FACTORY SELECTED NOT REPLACEABLE		
A7R69*				FACTORY SELECTED NOT REPLACEABLE		
A7R70*				FACTORY SELECTED NOT REPLACEABLE		
A7R71*				FACTORY SELECTED NOT REPLACEABLE		
A7R72	0698-8960	3	1	RESISTOR 619K 1% .125W F TC=0±100	28480	0698-8960
A7R73	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R74	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0±100	24546	C4-1/8-T0-619R-F
A7S1	3101-0471	8	4	SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A7S2	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A7TP1	1251-5618	0	12	CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP2	1251-5618	0		CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP3	1251-5618	0		CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP4	1251-5618	0		CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP5	1251-5618	0		CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP6	1251-5618	0		CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP7	1251-5618	0		CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP8	1251-5618	0		CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A7TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7U1	1810-0277	3	4	NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A7U2	1810-0277	3		NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A7U3	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A7U4	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A7U5	1826-0180	0		IC TIMER TTL MONO/ASTBL	01295	NE555P
A7U6				NOT ASSIGNED		
A7U7	1820-1858	8	2	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A7U8	1820-1144	6	2	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A7U9	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A7U10	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A7U11	1826-0763	3	2	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	04713	MC34004BL
A7U12	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A7U13	1826-0757	7		IC CONV 12-B D/A 16-DIP-C PKG	24355	AD7542BD
A7U14	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U16	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A7U17	1826-0757	7		IC CONV 12-B D/A 16-DIP-C PKG	24355	AD7542BD
A7U18	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U19	1826-0261	6		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A7U20	1826-0768	8	2	IC MULTIPLIER ANLG TO-100 PKG	28480	1826-0768
A7U21	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U22	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7VR1	1902-0187	1	3	DIODE-ZNR 8.25V 5% DO-15 PD=1W TC=+.062%	28480	1902-0187
A8	83592-60002	3		BOARD ASSEMBLY-YO DRIVER (DOES NOT INCLUDE 8-PIN HEADER P2 OR FACTORY-SELECT RESISTORS R36* THROUGH R39* AND R58* THROUGH R60*)	28480	83592-60002
A8C1	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C2	0160-4389	6	2	CAPACITOR-FXD 100PF ±5PF 200VDC CER	51642	200-200-NPO-101J
A8C3	0160-0161	4	1	CAPACITOR-FXD .01UF ±10% 200VDC POLYE	28480	0160-0161
A8C4	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C5	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	51642	200-200-NPO-101J
A8C6	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A8C7	0180-0116	1		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A8C8	0180-0116	1		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A8C9	0180-2815	1		CAPACITOR-FXD 10UF ±20% 10VDC TA	28480	0180-2815
A8C10	0180-0116	1		CAPACITOR-FXD 6.8UF ±10% 35VDC TA	56289	150D685X9035B2
A8C11	0180-0228	6		CAPACITOR-FXD 22UF ±10% 15VDC TA	56289	150D226X9015B2
A8C12	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A8C13	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C14	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A8C15	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C16	0180-3070	2	1	CAPACITOR-FXD 20UF ±10% 50VDC TA	28480	0180-3070
A8C17	0180-2206	4	1	CAPACITOR-FXD 60UF ±10% 6VDC TA	56289	150D606X9006B2
A8C18	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C19	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C20	0180-2731	0		CAPACITOR-FXD 2.2UF ±10% 20VDC TA	28480	0180-2731
A8C21	0180-2188	9	1	CAPACITOR-FXD 200UF ±20% 30VDC TA	06001	69F455G7
A8CR1	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR2	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A8CR3				NOT ASSIGNED		
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

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
A8CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8J1	1200-0485	6	1	SOCKET-IC 8-CONT DIP SLDR	28480	1200-0485
A8K1	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A8L1	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A8L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A8L3	08503-80001	9		COIL-TOROID	28480	08503-80001
A8MP1	5040-6846	6	1	P.C. BOARD EXTRACTOR	28480	5040-6846
A8MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A8MP5	1200-0173	5	4	INSULATOR-XSTR DAP-GL	28480	1200-0173
A8MP6	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A8P2	1251-7203	3	1	HEADER 8 PIN	28480	1251-7203
A8Q1	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A8Q2	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A8Q3	1853-0044	2		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A8Q4	1853-0044	2		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A8R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R2	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A8R3	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A8R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R5	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0±100	24546	C4-1/8-T0-7502-F
A8R6	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A8R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A8R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R10	2100-0570	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A8R11	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0±100	24546	C4-1/8-T0-4641-F
A8R12	2100-3762	1	1	RESISTOR-TRMR 500K 10% C SIDE-ADJ 17-TRN	28480	2100-3762
A8R13	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0±100	24546	C4-1/8-T0-6192-F
A8R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R15	0698-3452	1	1	RESISTOR 147K 1% .125W F TC=0±100	24546	C4-1/8-T0-1473-F
A8R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R17	0698-3456	6		RESISTOR 287K 1% .125W F TC=0±100	28480	0698-3456
A8R18	2100-3750	9		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A8R19	2100-3757	6		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A8R20	0699-0797	3	1	RESISTOR 7.68K 1% 1W F TC=0±4	28480	0699-0797
A8R21	0698-8406	1		RESISTOR 8.54K 1% 1W F TC=0±4	28480	0698-8406
A8R22	2100-0546	4		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-102
A8R23	0699-0799	5	1	RESISTOR 21.1K 1% 1W F TC=0±4	28480	0699-0799
A8R24	2100-3758	7	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	28480	2100-3758
A8R25	0699-0798	4	1	RESISTOR 11.475K 1% 1W F TC=0±4	28480	0699-0798
A8R26	0757-0470	3		RESISTOR 162K 1% .125W F TC=0±100	24546	C4-1/8-T0-1623-F
A8R27	0698-8489	4		RESISTOR 15K 1% 1W F TC=0±4	28480	0698-8489
A8R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R30	0757-0470	3		RESISTOR 162K 1% .125W F TC=0±100	24546	C4-1/8-T0-1623-F
A8R31	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R32	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0±100	24546	C4-1/8-T0-1211-F
A8R33	0698-3453	2		RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A8R36*				FACTORY SELECTED NOT REPLACEABLE		
A8R37*				FACTORY SELECTED NOT REPLACEABLE		
A8R38*				FACTORY SELECTED NOT REPLACEABLE		
A8R39*				FACTORY SELECTED NOT REPLACEABLE		
A8R40	0698-8489	4		RESISTOR 15K 1% 1W F TC=0±4	28480	0698-8489
A8R41	0698-8406	1		RESISTOR 8.54K 1% 1W F TC=0±4	28480	0698-8406
A8R42	0698-8472	6	1	RESISTOR 2.653K 1% 1W F TC=0±5	28480	0698-8472
A8R43	0698-8409	4	1	RESISTOR 19.68K 1% 1W F TC=0±4	28480	0698-8409
A8R44	2100-3161	6	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A8R45	0699-0518	6	1	RESISTOR 11.480K 1% 1W F TC=0±4	28480	0699-0518
A8R46	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A8R47	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A8R48	0757-0416	7		RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A8R49	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A8R50	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A8R51	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A8R52	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0±100	28480	0757-0180
A8R53	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-2612-F
A8R54	0698-8958	7		RESISTOR 511K 1% .125W F TC=0±100	28480	0698-8958
A8R55	2100-2517	4		RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	30983	ET50X503
A8R56	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0±100	24546	C4-1/8-T0-5111-F
A8R57	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A8R58	0698-3457	5	1	RESISTOR 316K 1% .125W F TC=0±100	28480	0698-3457
A8R59	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R60	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A8R61	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A8R62	0698-3455	4	1	RESISTOR 261K 1% .125W F TC=0±100	24546	C4-1/8-T0-2613-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
A8R63	0698-3162	8	1	RESISTOR 46.4K 1% .125W F TC=0±100	24546	C4-1/8-T0-4642-F
A8R64	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A8R65	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-1472-F
A8R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R67	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0±100	19701	MF4C1/8-T0-6191-F
A8R68*				FACTORY SELECTED NOT REPLACEABLE		
A8R69*				FACTORY SELECTED NOT REPLACEABLE		
A8S1	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A8S2	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A8TP1	1251-5026	2	12	CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP2	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP3	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP4	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP5	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP6	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP7	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP8	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP9	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP10	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP11	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8TP12	1251-5026	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5026
A8U1	1810-0277	3		NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A8U2	1810-0277	3		NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A8U3	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A8U4	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A8U5	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U6	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	IH501CP
A8U7	1820-1858	8		IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A8U8	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A8U9	1826-0180	0		IC TIMER TTL MONO/ASTBL	01295	NE555P
A8U10	1826-0753	3		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	04713	MC34004BL
A8U11	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U12	1826-0768	8		IC MULTIPLIER ANLG TO-100 PKG	28480	1826-0768
A8U13	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A8U14	1826-0762	2		IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A8U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U16	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A8U17	1826-0762	2		IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A8U18	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U19	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A8U20	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U21	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8VR1	1902-0197	1		DIODE-ZNR 8.25V 5% DO-15 PD=1W TC=+.082%	28480	1902-0197
A8VR2	1902-0826	0	3	DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829
A8VR3	1902-0826	0		DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829
A8VR4	1902-0826	0		DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829
A8VR5	1902-3070	5	1	DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1902-3070
A9	83525-60010	2		BOARD ASSEMBLY-TRANSISTOR HEAT SINK	28480	83525-60010
				INCLUDES PC BOARD, C1, AND C2 ONLY		
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	3	INSULATOR-XSTR ALUMINUM	28480	1200-0043
A9E2	1200-0043	8		INSULATOR-XSTR ALUMINUM	28480	1200-0043
A9E3	1200-0043	8		INSULATOR-XSTR ALUMINUM	28480	1200-0043
A9E4	83525-20034	6	1	BACKING PAD	28480	83525-20034
A9MP1	83525-20036	8	1	HEAT SINK	28480	83525-20036
A9MP2	2360-0115	4	6	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
A9MP6	2360-0115			SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A9MP7	2360-0115			SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A9Q1	1854-0080	8	2	TRANSISTOR NPN SI TO-3 PD=100W FT=3MHZ	28480	1854-0080
A9Q2	1854-0080	8		TRANSISTOR NPN SI TO-3 PD=100W FT=3MHZ	28480	1854-0080
A9Q3	1820-0430	1	1	IC 309 V RGLTR TO-3	07263	LM309K
A10	83595-60085	9		BOARD ASSEMBLY-MOTHER	28480	83595-60085
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

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
A10J1	1251-6026	3	1	CONNECTOR 60-PIN M POST TYPE	28480	1251-6026
A10J2	1251-6062	7	1	CONNECTOR 20-PIN M POST TYPE	28480	1251-6062
A10J3	1251-3108	6	1	CONNECTOR 4-PIN M POST TYPE	28480	1251-3108
A10J4	1200-0607	0	6	SOCKET-IC 16-CONT DIP SLDR	28480	1200-0607
A10J5	1200-0607	0		SOCKET-IC 16-CONT DIP SLDR	28480	1200-0607
A10J8	1250-0257	1	2	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A10MP1	1251-1115	4	5	POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A10MP2	1251-1115	4		POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A10MP3	1251-1115	4		POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A10MP4	1251-1115	4		POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A10MP5	1251-1115	4		POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A10R1	0698-8812	7	1	RESISTOR 1 1% .125W F TC=0+-100	28480	0698-8812
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
A12	5086-7341	3	1	SWITCHED YIG TUNED MULTIPLIER	28480	5086-7341
A12	5086-6341	1		EXCHANGE 5086-7341 YTM	28480	5086-6341
A12A1				BD ASSY SWITCHED YTM HEATER P/O A12 AND NOT SEPARATELY REPLACEABLE		
A12A1C1	0160-2055	9	2	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12A1C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12A1C3	0180-0049	0	1	CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A12A1CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A12A1E1	1251-3172	7	21	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1E2	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1E3	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1E4	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1J1	1200-0607	0		SOCKET-IC 16-CONT DIP SLDR	28480	1200-0607
A12A1MP1	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A12A1MP2	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A12A1Q1	1853-0038	4	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A12A1R1	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A12A1R2	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A12A1R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A12A1R4	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A12A1R5	0683-1555	0	1	RESISTOR 1.5M 5% .25W FC TC=-800/+1100	01121	CB1555
A12A1R6	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A12A1R7	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A12A1TP1	1251-0600	0	10	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1U1	1826-0261	8		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A12A1VR1	1902-0178	6	1	DIODE-ZNR 47.5V 5% DO-15 PD=1W TC=+.061%	28480	1902-0178
A13	5086-7336	8	1	OSCILLATOR 2.0 - 7.0 GHZ	28480	5086-7336
A13E1	5001-1550	5	1	INSULATOR	28480	5001-1550
A13	5086-6336	3		EXCHANGE 5086-7336 OSCILLATOR	28480	5086-6336
A13A1				BD ASSY OSCILLATOR BIAS P/O A13 AND NOT SEPARATELY REPLACEABLE		
A13A1C1	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A13A1C2	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A13A1CR1	1901-0033			DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A13A1E1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A13A1E2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A13A1E3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A13A1E4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A13A1E5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A13A1E6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A13A1J1	1200-0607	0		SOCKET-IC 16-CONT DIP SLDR	28480	1200-0607
A13A1J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A13A1MP1	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172

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
A13A1R1				FACTORY SELECTED NOT REPLACABLE		
A13A1R2				FACTORY SELECTED NOT REPLACABLE		
A13A1R3	0757-0278	0		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A13A1R4	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A13A1VR1	1902-0579	3	2	DIODE-ZNR 5.11V 5% DO-15 PD=1W TC=-.009%	28480	1902-0579
A13A1VR2	1902-0575	3		DIODE-ZNR 5.11V 5% DO-15 PD=1W TC=-.009%	28480	1902-0579
A13A1VR3	1902-0107	1		DIODE-ZNR 82.6V 5% DO-15 PD=1W TC=+.082%	28480	1902-0107
A14	5086-7342	4	1	POWER AMPLIFIER	28480	5086-7342
A14	5086-6342	2		EXCHANGE 5086-7342 AMPLIFIER	28480	5086-6342
A14A1			1	BD ASSY-AMP BIAS PART OF A14 AND NOT SEPARATELY REPLACABLE		
A14A1C1	0180-0174	0		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0180-0174
A14A1C2	0180-1704	5	4	CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A14A1C3	0180-1704	5		CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A14A1C4	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A14A1C5	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A14A1C6	0180-1704	5		CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A14A1C7	0180-1704	5		CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A14A1C8	0180-0174	0		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0180-0174
A14A1E1	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E2	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E3	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E4	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E5	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E6	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E7	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E8	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E9	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E10	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E11	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E12	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1J1	1200-0607	0		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0607
A14A1MP1	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A14A1MP2	0380-0322	5	8	SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP3	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP4	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP5	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP6	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP7	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP8	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1MP9	0380-0322	5		SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A14A1Q1	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A14A1Q2	1853-0213	1	1	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A14A1R1	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A14A1R2	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A14A1R3	0698-3441	8	3	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14A1R4	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14A1R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A14A1R6	0757-0198	7	1	RESISTOR 100 1% .5W F TC=0+-100	28480	0757-0198
A14A1R7	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A14A1R8	0757-0400	9	2	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A14A1R9	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A14A1R10	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A14A1R11				FACTORY ADJUSTED NOT REPLACABLE		
A14A1R12				NOT ASSIGNED		
A14A1R13				FACTORY ADJUSTED NOT REPLACABLE		
A14A1R14				FACTORY ADJUSTED NOT REPLACABLE		
A14A1R15				FACTORY ADJUSTED NOT REPLACABLE		
A14A1R16				FACTORY ADJUSTED NOT REPLACABLE		
A14A1R17				NOT ASSIGNED		
A14A1R18				FACTORY ADJUSTED NOT REPLACABLE		
A14A1R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14A1R20				NOT ASSIGNED		
A14A1R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14A1R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14A1R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14A1R24	0757-[illegible]	1		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14A1R25				NOT ASSIGNED		
A14A1R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14A1R27	0757-0417	8		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A14A1R28	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A14A1R29				NOT ASSIGNED		
A14A1R30	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A14A1R31	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-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
A14A1VR	1902-0951	1	2	DIODE-ZNR 8.19V 5% DO-15 PD=1W TC=+.072%	28480	1902-0951
A14A1VR2	1902-0028	8	1	DIODE-ZNR 12.1V 5% DO-15 PD=1W TC=+.064%	28480	1902-0028
A15				NOT ASSIGNED		
A16	5086-7182	4	1	MODULATOR/COUPLER	28480	5086-7182
A16A1	83590-60012	3	1	BOARD ASSEMBLY MOD/COUPLER	28480	83590-60012
A16A1CR1	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A16A1J1	1250-0843	8		CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0843
A16A1J2	1250-0843	8		CONNECTOR-RF SM-SNP M PC 50-OHM	28480	1250-0843
A16A1J3	1251-2313	8		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A16A1MP1	0380-0843	5	4	STANDOFF-RIVET-ON .125-IN-LG 4-40 THD	28480	0380-0843
A16A1MP2	0380-0843	5		STANDOFF-RIVET-ON .125-IN-LG 4-40 THD	28480	0380-0843
A16A1MP3	0380-0843	5		STANDOFF-RIVET-ON .125-IN-LG 4-40 THD	28480	0380-0843
A16A1MP4	0380-0843	5		STANDOFF-RIVET-ON .125-IN-LG 4-40 THD	28480	0380-0843
A17				NOT ASSIGNED		
A18				NOT ASSIGNED		
				MISCELLANEOUS PARTS		
AT1	0960-0638	6	1	ISOLATOR-2.0-7.0 GHZ	28480	0960-0638
CR1	86290-60046	5	1	LBHCD DETECTOR	28480	86290-60046
CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
DC2	0955-0148	2	1	DIRECTIONAL COUPLER 1.7 - 20.0 GHZ	28480	0955-0148
E1	5040-0346	7	2	INSULATOR CONNECTOR	28480	5040-0346
E2	5040-0346	7		INSULATOR CONNECTOR	28480	5040-0346
J1	86290-60005	7	2	CONNECTOR ASSEMBLY TYPE-N	28480	86290-60005
J2	1250-0118	3	3	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J3	86290-60005	7		CONNECTOR ASSEMBLY TYPE-N	28480	86290-60005
J4	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J5	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
MP1	0370-3023	8	1	KNOB-3/4 JACK .25-IN-ID	28480	0370-3023
MP2	83525-00005	0	1	COVER PC	28480	83525-00005
MP3	4040-1686	1	1	WINDOW DISPLAY	28480	4040-1686
MP4	83590-00001	4	1	FRONT PANEL-DRESS	28480	83590-00001
MP5	5041-0285	6	5	KEY CAP-LITE	28480	5041-0285
MP6	5040-8873	2	2	KEY CAP-JADE GRAY	28480	5040-8873
MP7	5041-1926	4	1	KEY CAP-SLOPE	28480	5041-1926
MP8	5041-1924	2	1	KEY CAP-POWER LEVEL	28480	5041-1924
MP9	5041-1925	3	1	KEY CAP-POWER SWEEP	28480	5041-1925
MP10	0050-2032	8	1	CASTING-AL FRAME (RR)	28480	0050-2032
MP11	0050-2067	0	1	CASTING-AL OSCILLATOR BRACKET	28480	0050-2067
MP12	0050-2069	2	1	CASTING-AL HEAT SINK RF	28480	0050-2069
MP13	0050-2068	1	1	CASTING-AL HEAT SINK	28480	0050-2068
MP14	83525-20038	0	1	SHIELD-REAR	28480	83525-20038
MP15	1400-1095	5	1	CLIP-FASTENER .400 X .300 X .090 HL BE	28480	1400-1095
MP16	83525-20037	9	1	SHIELD-FRONT	28480	83525-20037
MP17	83592-20016	5	1	SIDERAIL UPPER RIGHT	28480	83592-20016
MP18	83525-20039	1	1	CASTING FRONT	28480	83525-20039
MP19	0510-1148	2	1	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
MP20	83592-20017	6	1	SIDERAIL UPPER LEFT	28480	83592-20017
MP21	83592-00008	3	1	SHIELD-ISOLATOR	28480	83592-00008
MP22	0050-2066	9	1	CASTING-AL HEAT SINK RF	28480	0050-2066
MP23	83592-00006	1	1	BRACKET-ISOLATOR	28480	83592-00006
MP24				NOT ASSIGNED		
MP25	83525-00010	0	1	GUARD	28480	83525-00010
MP26	1460-1881	8	1	WIREFORM MUW BLK OXD	28480	1460-1881
MP27				NOT ASSIGNED		
MP28	83525-10033	6	1	LATCH-SCREW	28480	83525-20033
MP29	83525-20040	4	1	LATCH	28480	83525-20040
MP30	83592-00009	4	1	BRACKET-COUPLER	28480	83592-00009
MP31	83592-20018	7	1	SIDERAIL-LOWER LEFT	28480	83592-20018
MP32	83592-20015	4	1	SIDERAIL-LOWER RIGHT	28480	83592-20015
MP33	83592-00012	0	1	WIRE HOLDER	28480	83592-00012
MP34				NOT ASSIGNED		
MP35	83592-00003	8	1	PANEL-REAR	28480	83592-00003
MP36				NOT ASSIGNED		
MP37				NOT ASSIGNED		
MP38	6960-0002	4	1	PLUG-HOLE DOME-HD FOR .5-D HOLE STL	28480	6960-0002
MP39	6960-0003	5	1	PLUG-HOLE DOME-HD FOR .75-D HOLE STL	28480	6960-0003
MP40	83590-00007	0	1	BRACKET-MODULATOR/COUPLER	28480	83590-00007
R1	0811-3673	9	2	RESISTOR-MATCHED SET WIREWOUND CHASSIS	28480	0811-3673
R2	0811-3673	9		RESISTOR-MATCHED SET WIREWOUND CHASSIS	28480	0811-3673

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

Table 6-3. Replaceable Parts

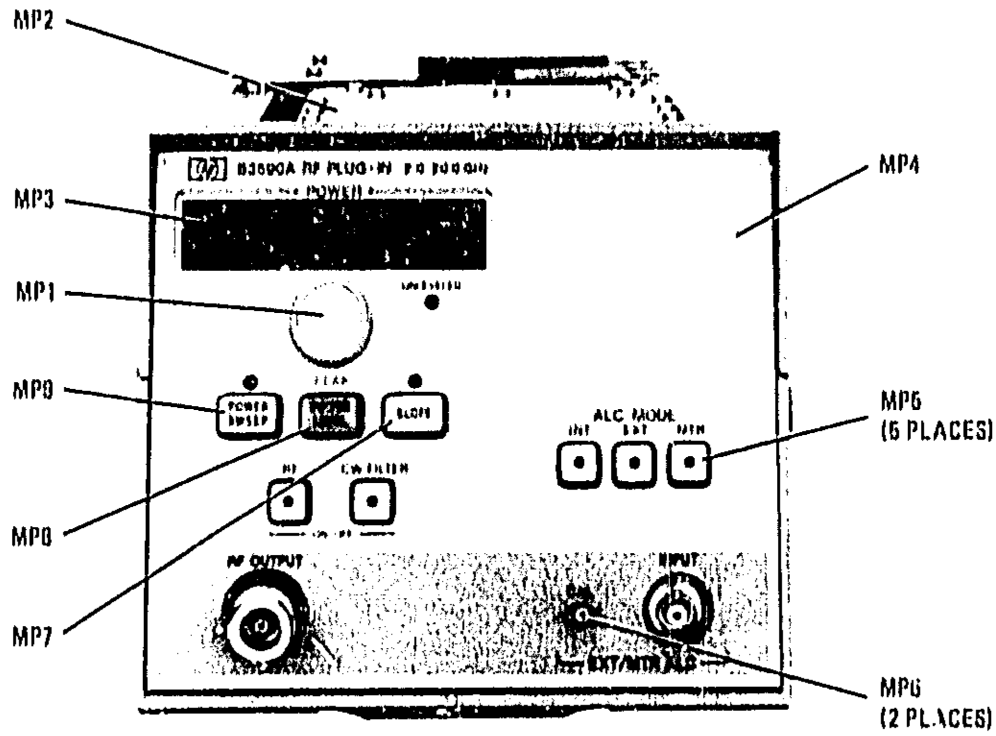
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W1	83592-20046	0	1	CBL-RF COUPLER/OUTPUT	28480	83592-20046
W2	83592-60021	8	1	CABLE COAX EXT/MTR ALC	28480	83592-60021
W3	83592-60026	0	1	CABLE ASSY RIBBON FRONT PANEL	28480	83592-60026
W4	83592-60018	1	1	CABLE ASSY RIBBON RF SECTION	28480	83592-60018
W5	83592-60017	0	1	CABLE COAX PULSE IN	28480	83592-60017
W6	83590-60013	4	1	CABLE COAX RED PULSE MOD	28480	83590-60013
W7	83525-60020	3	1	CABLE COAX ORANGE VTUNE	28480	83525-60020
W8	83592-60012	5	1	CABLE COAX GRAY DETECTOR	28480	83592-60012
W9	83592-60016	8	1	CABLE COAX BLUE FM	28480	83592-60016
W10				NOT ASSIGNED		
W11	83592-60020	6	1	CABLE COAX GREEN FM IN	28480	83592-60020
W12	83592-60011	4	1	CABLE COAX BROWN AM IN	28480	835[illegible]0011
W13	83590-60014	5	1	CABLE COAX YELLOW MOD 1	28480	83[illegible]14
W14	83590-60016	7	1	CABLE COAX RIBBON RF SECTION	28480	8[illegible]60016
W15	83592-20047	2	1	CABLE RF DC2/YTM	28480	83592-20047
W16	83592-20039	2	1	CABLE-RF ATT/YTM	28480	83592-20039
W17	83592-20038	1	1	CABLE-RF PWR AMPL/ATT	28480	83592-20038
W18				NOT ASSIGNED		
W19				NOT ASSIGNED		
W20	83590-20022	1	1	CABLE-RF SEMI-RIGID A16/A14	28480	83590-20022
W21				NOT ASSIGNED		
W22				NOT ASSIGNED		
W23				NOT ASSIGNED		
W24				NOT ASSIGNED		
W25	83590-20020	9	1	CABLE RF SEMI-RIGID A1[illegible]/A16	28480	83590-20020
W26	83590-20021	0	1	CABLE RF SEMI-RIGID A16/J3 AUX OUTPUT	28480	83590-20021
W27				NOT ASSIGNED		
W28	83525-60024	8	1	CABLE ASSEMBLY POWER SUPPLY	28480	83525-60024
W29	83525-60056	6	1	CABLE ASSEMBLY RIBBON-REAR CONN	28480	83525-60056
				OPTION 002		
A19	5086-7371	9	1	ATTENUATOR, PROGRAMMABLE, 70 DB (OPT 002 ONLY)	28480	5086-7371
A19MP1	83592-00010	7	1	BRACKET-ATTENUATOR	28480	83592-00010
W8	83592-60023	8	1	CABLE-COAX DETECTOR GRAY (DELETE STD W8)	28480	83592-60023
W15	83592-20048	2	1	CABLE-RF DC2/YTM (DELETE STD W15)	28480	83592-20048
W30	83592-20050	7	1	CABLE-RF A19/RF OUTPUT	28480	83592-20050
W31	83592-20029	0	1	CABLE-RF DC2/A19	28480	83592-20029
				OPTION 004		
MP1	6960-0106	9	1	PLUG-HOLE .625D HOLE (DELETE MP38)	28480	6960-0106
MP2	6960-0107	0	1	PLUG-HOLE FOR .750 HOLE (DELETE MP39)	28480	6960-0107
W2	83592-60024	9	1	CABLE-COAX EXT/MTR ALC(OPT 004)(DELETE STD W2)	28480	83592-60024
W8	83592-60023	8	1	CABLE-COAX DETECTOR GRAY (DELETE STD W8)	28480	83592-60023
W15	83592-20048	3	1	CABLE-RF DC2/YTM (DELETE STD W15)	28480	83592-20048
W32	83592-20062	9	1	CABLE-RF DC2/REAR PANEL RF OUTPUT	28480	83592-20062
				OPTION 005		
J1	83592-60027	2	1	CONNECTOR ASSEMBLY, APC-7 (DELETE STD J1)	28480	83592-60027
				OPTION 002 AND 004		
A19	5086-7371	9	1	ATTENUATOR, PROGRAMMABLE, 70DB	28480	5086-7371
A19MP1	83592-00010	7	1	BRACKET-ATTENUATOR	28480	83592-00010
MP1	6960-0106	9	1	PLUG-HOLE .625D HOLE (DELETE MP38)	28480	6960-0106
MP2	6960-0107	0	1	PLUG-HOLE FOR .750 HOLE (DELETE MP39)	28480	6960-0107
W2	83592-60024	9	1	CABLE COAX EXT/MTR ALC (DELETE STD W2)	28480	83592-60024
W8	83592-60023	8	1	CABLE COAX DETECTOR GRAY (DELETE STD W8)	28480	83592-60023
W15	83592-20048	3	1	CABLE-RF DC2/YTM (DELETE STD W15)	28480	83592-20048
W31	83592-20029	0	1	CABLE-RF DC2/A19	28480	83592-20029
W33	83592-20051	8	1	CABLE-RF A19/REAR PANEL RF OUTPUT	28480	83592-20051
				OPTION 002 AND 005		
A19	5086-7371	9	1	ATTENUATOR, PROGRAMMABLE, 70 DB	28480	5086-7371
A19MP1	83592-00010	7	1	BRACKET ATTENUATOR	28480	83592-00010
J1	83592-60027	2	1	CONNECTOR ASSEMBLY, APC-7 (DELETE STD J1)	28480	83592-60027
W8	83592-60023	8	1	CABLE COAX DETECTOR GRAY (DELETE STD W8)	28480	83592-60023
W15	83592-20048	3	1	CABLE-RF DC2/YTM (DELETE STD W15)	28480	83592-20048
W30	83592-20050	7	1	CABLE-RF A19/RF OUTPUT	28480	83592-20050
W31	83592-20029	0	1	CABLE-RF DC2/A19	28480	83592-20029
				OPTION 004 AND 005		
J1	83592-60027	2	1	CONNECTOR ASSEMBLY, APC-7 (DELETE STD J1)	28480	83592-60027
W2	83592-60024	9	1	CABLE-COAX EXT/MTR ALC(OPT 004)(DELETE STD W2)	28480	83592-60024
W8	83592-60023		1	CABLE-COAX DETECTOR GRAY (DELETE STD W8)	28480	83592-60023

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
W18	83592-20048	3	1	CABLE-RF DC2/YIM (DELETE STD W18)	28480	83592-20048
W32	83592-20062	0	1	CABLE-RF DC2/REAR PANEL RF OUTPUT	28480	83592-20062
				OPTION 002 AND 004 AND 005		
A18	5086-7371	0	1	ATTENUATOR, PROGRAMMABLE, 7000	28480	5086-7371
A18MP1	83592-00010	7	1	BRACKET-ATTENUATOR	28480	83592-00010
J1	83592-60027	2	1	CONNECTOR ASSEMBLY, APC 7 (DELETE STD J1)	28480	83592-60027
W2	83592-60024	0	1	CABLE-COAX EXT/MTR ALC (DELETE STD W2)	28480	83592-60024
W8	83592-60023	8	1	CABLE-COAX DETECTOR ARRAY (DELETE STD W8)	28480	83592-60023
W18	83592-20048	3	1	CABLE-RF DC2/YIM (DELETE STD W18)	28480	83592-20048
W31	83592-20020	0	1	CABLE-RF DC2/A18	28480	83592-20020
W33	83592-20061	8	1	CABLE-RF A18/REAR PANEL RF OUTPUT	28480	83592-20061
				ATTACHING HARDWARE		
				NOTE SEE FIGURE 6-3 FOR ATTACHING HARDWARE LOCATIONS		
1	0520-0128	6	4	SCREW-MACH 2-56 .125-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
2	0520-0127	6	6	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	0520-0166	3	2	SCREW-MACH 2-56 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
4	0624-0281	3	28	SCREW-TPG 4-20 .5-IN-LG PAN-HD-POZI STL	28480	0624-0281
5	2200-0101	0	5	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
6	2200-0103	2	10	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	2200-0105	4	6	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	2200-0107	6	6	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
9	2200-0113	4	8	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
10	2200-0164	5	2	SCREW-MACH 4-40 .188-IN-LG UNCT 82 DEG	00000	ORDER BY DESCRIPTION
11	2360-0115	4	23	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
12	2360-0117	6	3	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
13	2360-0118	8	2	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
14	2360-0129	0	4	SCREW-MACH 6-32 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
15	2360-0182	5	3	SCREW-MACH 6-32 .312-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
16	2360-0197	2	5	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
17	2360-0333	8	16	SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
18	2360-0334	9	8	SCREW-MACH 6-32 .312-IN-LG	28480	2360-0334
19	2510-0081	5	2	SCREW-MACH 8-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
20	2260-0009	3	6	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
21	2420-0001	5	5	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
22	2950-0001	8	4	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
23	2950-0132	6	2	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
24	2950-0177	9	1	NUT-HEX-DBL-CHAM 1/4-36-THD .06-IN-THK	28480	2950-0177
25	1250-1142	5	1	WASHER-LK INTL T 1/2 IN .26-IN-ID	28480	1250-1142
26	2190-0004	9	2	WASHER-LK INTL T NO. 4 .115-IN-ID	28480	2190-0004
27	2190-0014	1	6	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
28	2190-0016	3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
29	2190-0104	0	2	WASHER-LK INTL T 7/16 IN .439-IN-ID	28480	2190-0104
30	0360-0355	2	1	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR	28480	0360-0355
31	0360-1190	5	1	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-SCR	28480	0360-1190
32	0360-1632	0	2	TERMINAL-SLDR LUG LK-MTG FOR-#3/8-SCR	28480	0360-1632

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



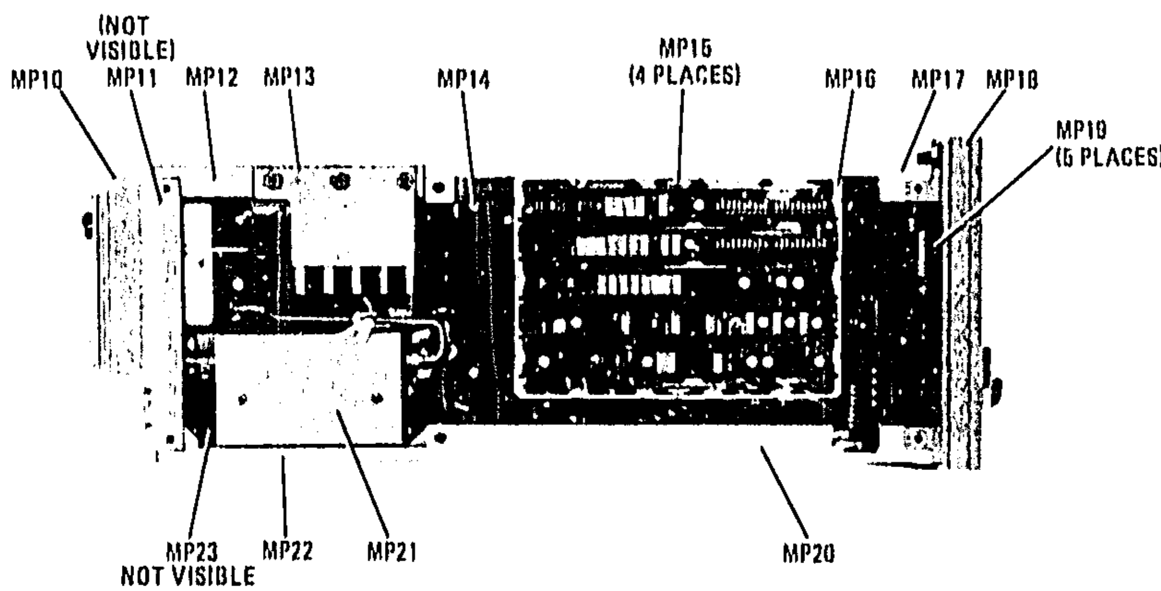
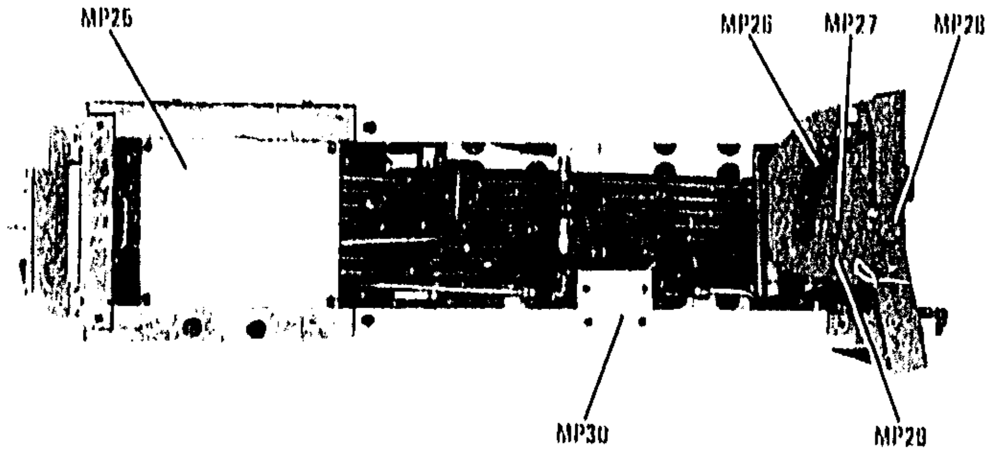


Figure 6-1. Mechanical Parts (1 of 3)



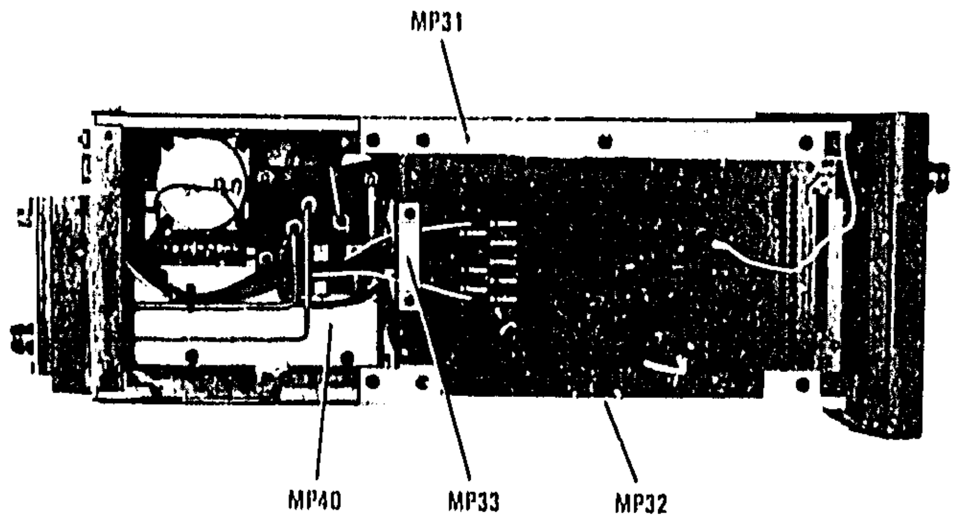


Figure 6-1. Mechanical Parts (2 of 3)

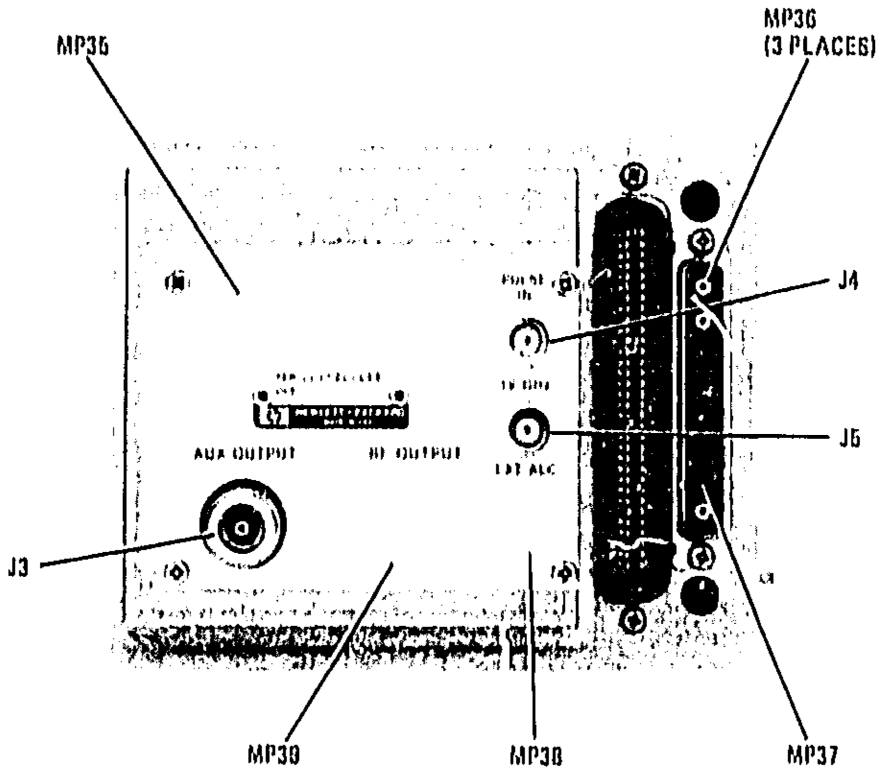


Figure 6-1. Mechanical Parts (3 of 3)

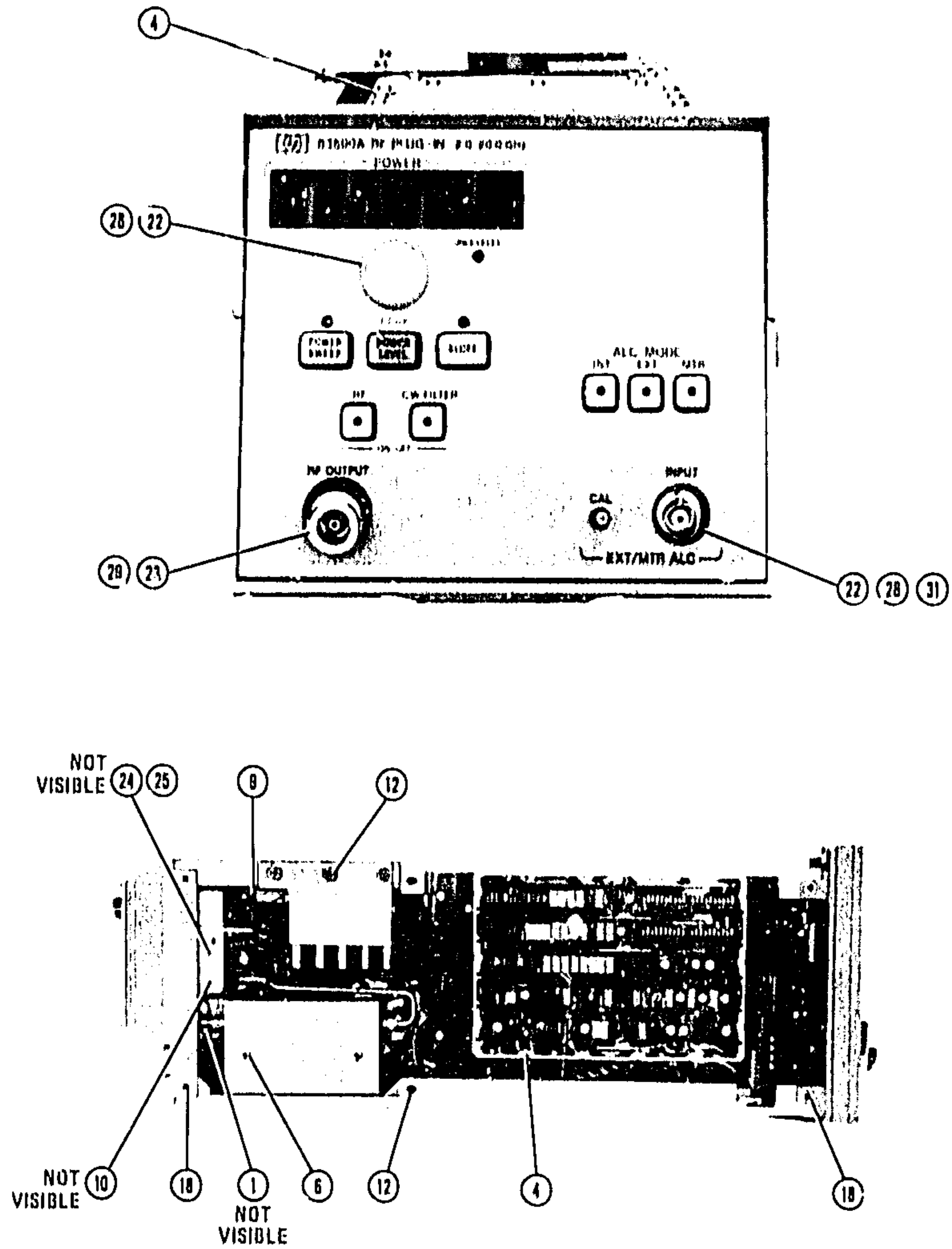


Figure 6-2. Attaching Hardware (1 of 3)

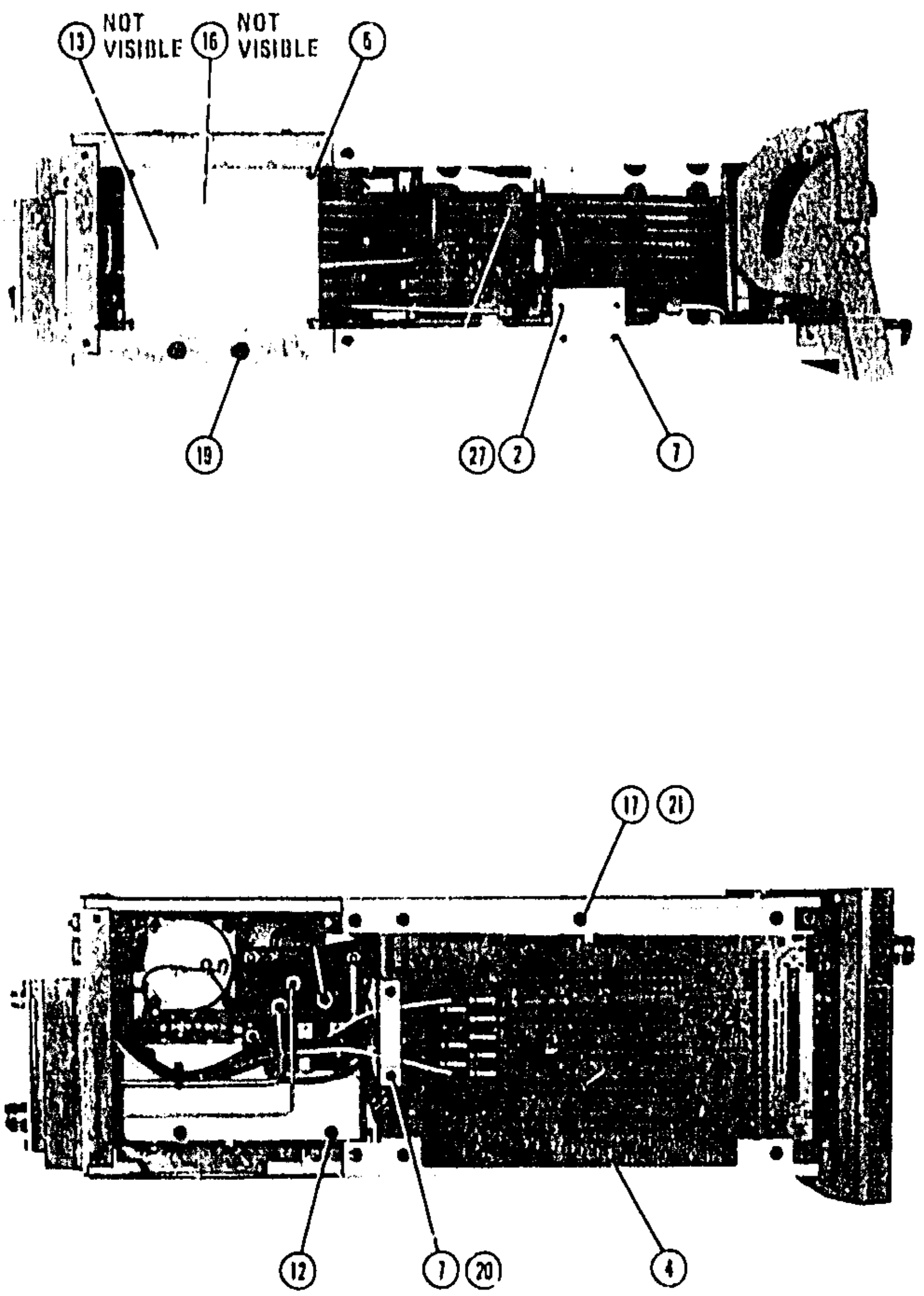


Figure 6-2. Attaching Hardware (2 of 3)

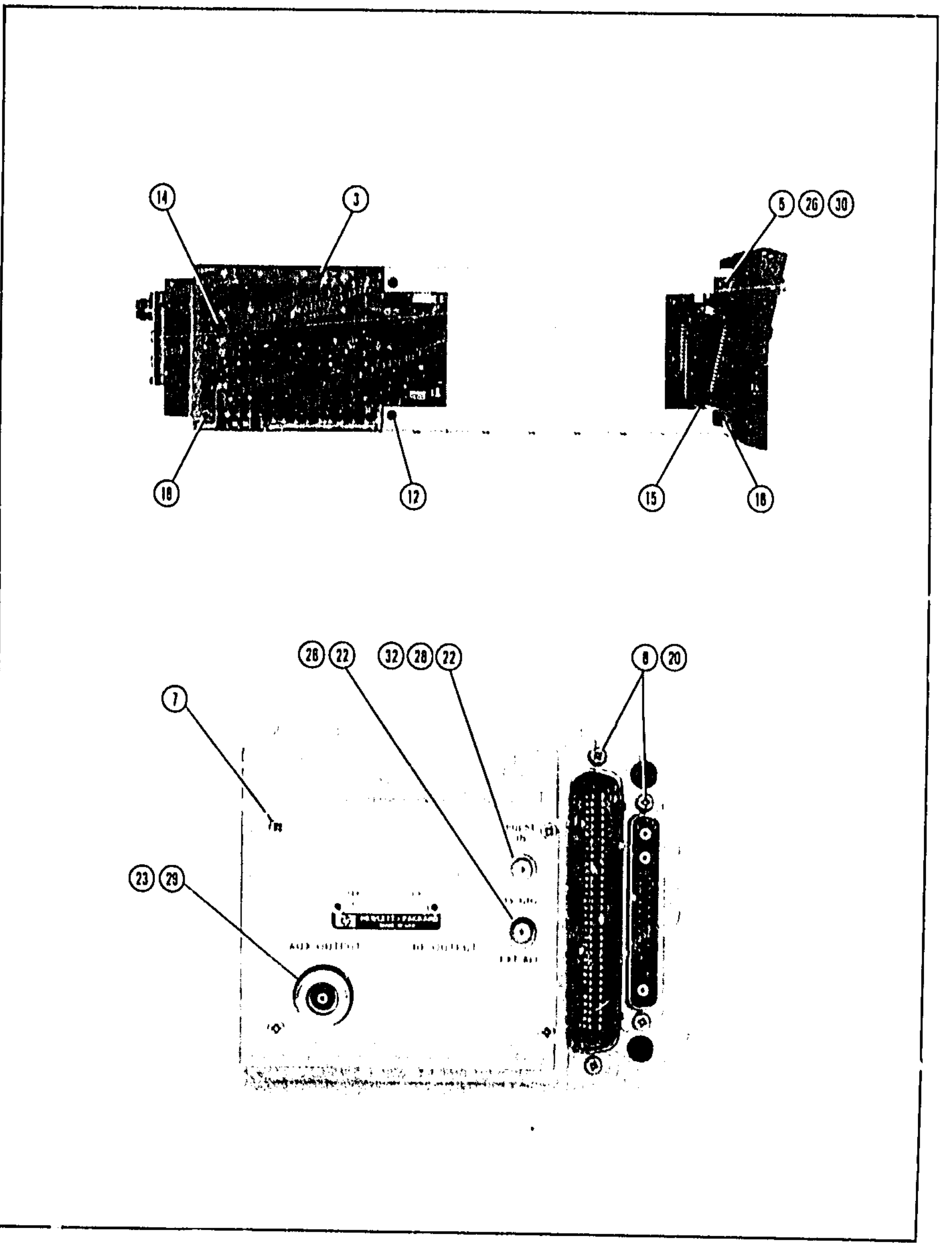
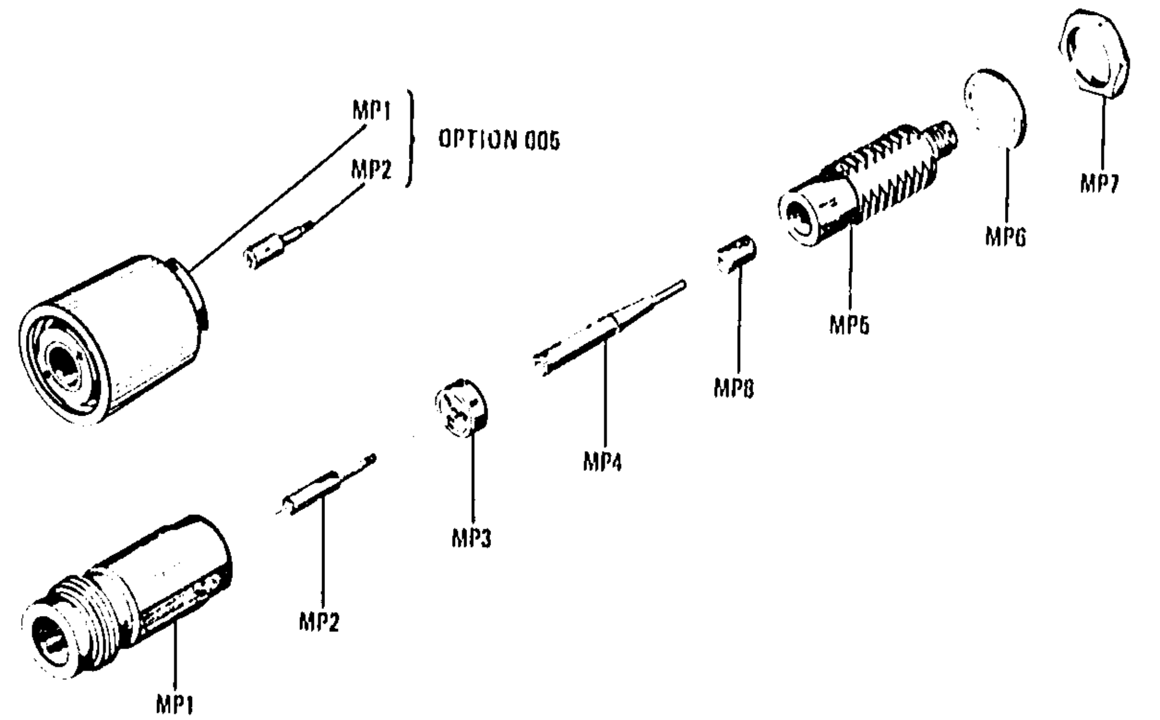


Figure 6-2. Attaching Hardware (3 of 3)



Reference Designation	HP Part Number	Description	Mfr. Code	Mfr. Part Number
J1	86290-60005	Connector Assy (Type N) (RF OUTPUT) Same as J3 (AUX OUT)	28480	86290-60005
J1	83592-60027	Connector Assy (APC-7) (Option 005)	28480	83592-60027
J1MP1	1250-0914	Body: RF Connector (Type N)	02660	131-150
J1MP1	1250-0909	Body: RF Connector (APC-7) (Option 005)	28480	1250-0909
J1MP2	1250-0915	Contact: RF Connector (Type N)	02660	131-149
J1MP2	1250-0816	Contact: RF Connector (APC-7) (Option 005)	28480	1250-0816
J1MP3	5040-0306	Insulator	28480	5040-0306
J1MP4	08555-20093	Center Conductor	28480	08555-20093
J1MP5	08555-20094	Body: Bulkhead	28480	08555-20094
J1MP6	2190-0104	Washer - Lock 0.439" ID	00000	OBD
J1MP7	2950-0132	Nut - Hex 7/16 - 28	00000	OBD
J1MP8	08761-2027	Insulator	28480	08761-2027

Figure 6-3. RF Output Connector, Exploded View

BACK DATING MANUAL CHANGES

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 numbers prefixed lower than the ones indicated on the title page) may be slightly different in design or appearance. The purpose of this section of the manual is to document these differences.

7-3. 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 numbers prefixed higher than the ones indicated on the title page) are documented in a yellow Manual Changes supplement.

7-4. To adapt this manual to an earlier instrument, refer to Table 7-1 and make the manual backdating changes listed opposite your instrument serial number or serial number prefix.

7-5. For additional important information about serial number coverage, refer to INSTRUMENTS COVERED BY THE MANUAL in Section I.

Table 7-1. Manual Backdating Changes by Serial Number Prefix

Serial Prefix	Make Manual Change
2143A	A

7-6. MANUAL CHANGE INSTRUCTIONS

CHANGE A

Page 6-7, Table 6-3:
Change A4 HP and Mfr. Part Number to 83590-60053, CD 2.
Change A4CR4 to HP Part Number 1901-1098 CD 1, DIODE-SWITCHING 1N4150 50V 200MA 4NS, Mfr. Code 0004G, Mfr. Part Number 1N4150.

Page 6-8, Table 6-3:
Change A4R49* to A4R49 (fixed value).

Page 8-47, Figure 8-34:
Change the A4 ALC Part Number in the top left-hand corner of the A4 schematic to 83590-60053.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2143A.
Replace block **E** LOG AMPLIFIER with *Figure 7-1, P/O A4 ALC Schematic Diagram (CHANGE A)* from this Manual.

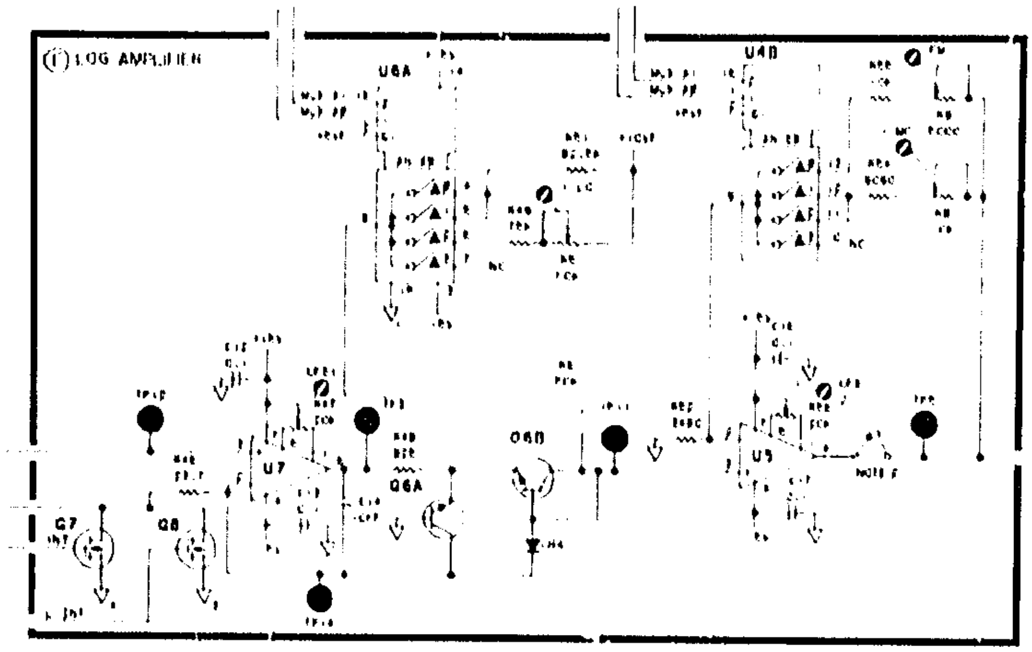


Figure 7-1. P/O A4 ALC Schematic Diagram (CHANGE A)

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TITLE: 03590A
Manual Changes
(including #27, 28, & 32)

PART NUMBER: 03590-90005

MICROFICHE: 03590-90006

PRINT DATE: 2/82

UPDATE: 2/89

PRINTED IN THE U.S.A.

The product related to this manual is no longer in production at the Hewlett-Packard Corporation. The manual is maintained on a microfiche master at Direct Marketing Division. As a service to our customers we are providing a hardcopy print of the microfiche. The print is produced at Direct Marketing Division using a TAMCRAN 1000-F Autoprint Microfiche Printing System. In addition, we are providing a duplicate of the microfiche to provide maximum flexibility for our customers.

MANUAL CHANGES SUPPLEMENT

HP 83590A RF Plug-in

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 order the latest edition of this supplement. Copies are available through any HP office. When ordering copies, quote the supplement part number from the bottom of this page, or the model number and print date from the title page of the manual.

MANUAL IDENTIFICATION

Manual Part Number: 83590-90005
Date Printed: February 1982

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.

TO USE THIS SUPPLEMENT: Make all changes applicable to the serial prefix or number of your instrument as indicated in the following reference table.

Note that there may be more than one Title Page and/or Parts Cross-Reference Table included in this supplement. The last change(s) applicable to your instrument will contain the most current information for these specific pages.

■ – NEW ITEM, CHANGED ITEM

HP Part Number 83590-91033 (For HP Internal Use Only)
Part of HP Part Number 83590-90033
Microfiche Part Number 83590-90034

1 FEBRUARY 1988

Printed in U.S.A.

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■ – NEW ITEM

HP 83590A

Serial Prefix or Number	Make Manual Changes
2216A	1
2217A	1, 2
2221A	1 – 3
2233A	1 – 4
2234A	1 – 5
2249A	1 – 6
2252A	1 – 7
2306A	1 – 8
2313A	1 – 9
2315A	1 – 10
2338A	2 – 11

Serial Prefix or Number	Make Manual Changes
2410A	2 – 7, 9 – 12
2411A	2, 3, 5, 9 – 14
2412A	2, 3, 5, 9, 11 – 15
2413A	2, 3, 5, 9, 11 – 16
2428A	2, 3, 5, 9, 11 – 17
2451A	2, 3, 5, 9, 11 – 18
2502A	2, 3, 5, 9, 11 – 19
2507A	2, 3, 5, 9, 11 – 20
2519A	2, 3, 5, 9, 11, 13 – 21
2543A	2, 3, 5, 9, 11, 13 – 22
2602A	2, 3, 5, 9, 13 – 23
2619A	2, 3, 5, 9, 13 – 24
2645A	2, 3, 5, 9, 13 – 25
2718A	2, 3, 5, 9, 13-16, 18-26
2726A	2, 3, 5, 9, 13-16, 18-27
■ 2809A	2, 3, 5, 9, 13-16, 18-24, 26, 28

■ –NEW ITEM

Numbered Changes Index (1 of 2)

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2216A	1	A2	83590-60060	Replaceable Parts Service
2217A	2	N/A	N/A	Replaceable Parts
2221A	3	A1, A16	N/A	Replaceable Parts
2233A	4	A4	N/A	Replaceable Parts
2234A	5	A16	5086-7395	Replaceable Parts
2249A	6	A4	N/A	Replaceable Parts Service
2252A	7	A4	N/A	Replaceable Parts Service
2306A	8	A6	N/A	Replaceable Parts Service
2313A	9	N/A	N/A	General Information
2315A	10	A3	83590-60073	Replaceable Parts Service
2338A	11	A2	83590-60072	Replaceable Parts Service
2410A	12	A6	83590-60091	Replaceable Parts Service
2411A	13 and 14	N/A A4	N/A 83590-60077	General Information Operation Performance Tests Adjustments Replaceable Parts Service
2412A	15	A3	83525-60080	Replaceable Parts Service
2413A	16	A2 and A7	N/A 83595-60068	Replaceable Parts Service
2428A	17	A3	N/A	Replaceable Parts
2451A	18	A7	N/A	Replaceable Parts Service
2502A	19	A10	83595-60078	Replaceable Parts Service

■ –NEW ITEM

Numbered Changes Index (2 of 2)

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2507A	20	A14	83592-60113	Replaceable Parts Service
2519A	21	A6	83590-60106	Replaceable Parts Service
2543A	22	Mechanical Parts	N/A	Replaceable Parts
2602A	23	A2	83590-60122	General Information Installation Operation Adjustments Replaceable Parts Service
2619A	24	A8	83595-60070	Adjustments Replaceable Parts Service
2645A	25	A4	83590-60098	Replaceable Parts Service
2718A	26	A3	N/A	None
2726A	27	A4	N/A	Replaceable Parts
■ 2809A	28	A4	83590-60135	Performance Tests Replaceable Parts Service

MANUAL IDENTIFICATION

HP Model Number: HP 83590A
Manual Part Number: 83590-90005
Date Printed: February 1982

UPDATES through CHANGE 27

Incorporate all UPDATES first, then make all changes appropriate for your instrument (see the preceding Serial Prefix reference table).

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 83590A
Date Printed: February 1982
Part Number: 83590-90005

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 LISTED IN THIS DOCUMENT.

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 first and then all appropriate serial number related CHANGES indicated in the following tables.

▶ = NEW ITEM

NOVEMBER 12, 1987

HEWLETT PACKARD

Printed in U.S.A.

▶ = NEW ITEM

HP 83590A

Serial Prefix or Number	Make Manual Changes
2216A	1
2217A	1, 2
2221A	1 – 3
2233A	1 – 4
2234A	1 – 5
2249A	1 – 6
2252A	1 – 7
2306A	1 – 8
2313A	1 – 9
2315A	1 – 10
2338A	2 – 11

Serial Prefix or Number	Make Manual Changes
2410A	2 – 7, 9 – 12
2411A	2, 3, 5, 9 – 14
2412A	2, 3, 5, 9, 11 – 15
2413A	2, 3, 5, 9, 11 – 16
2428A	2, 3, 5, 9, 11 – 17
2451A	2, 3, 5, 9, 11 – 18
2502A	2, 3, 5, 9, 11 – 19
2507A	2, 3, 5, 9, 11 – 20
2519A	2, 3, 5, 9, 11, 13 – 21
2543A	2, 3, 5, 9, 11, 13 – 22
2602A	2, 3, 5, 9, 13 – 23
2619A	2, 3, 5, 9, 13 – 24
▶ 2645A	2, 3, 5, 9, 13 – 25

▶ – NEW ITEM

Numbered Changes Index

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2216A	1	A2	83590-60060	Replaceable Parts Service
2217A	2	N/A	N/A	Replaceable Parts
2221A	3	A1, A16	N/A	Replaceable Parts
2233A	4	A4	N/A	Replaceable Parts
2234A	5	A16	5086-7395	Replaceable Parts
2249A	6	A4	N/A	Replaceable Parts Service
2252A	7	A4	N/A	Replaceable Parts Service
2306A	8	A6	N/A	Replaceable Parts Service
2313A	9	N/A	N/A	General Information
2315A	10	A3	83590-60073	Replaceable Parts Service
2338A	11	A2	83590-60072	Replaceable Parts Service
2410A	12	A6	83590-60091	Replaceable Parts Service
2411A	13 and 14	N/A A4	N/A 83590-60077	General Information Operation Performance Tests Adjustments Replaceable Parts Service
2412A	15	A3	83525-60080	Replaceable Parts Service
2413A	16	A2 and A7	N/A 83595-60068	Replaceable Parts Service
2428A	17	A3	N/A	Replaceable Parts

▶ – NEW ITEM

Numbered Changes Index

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2451A	18	A7	N/A	Replaceable Parts Service
2502A	19	A10	83595-60078	Replaceable Parts Service
2507A	20	A14	83592-60113	Replaceable Parts Service
2519A	21	A6	83590-60106	Replaceable Parts Service
2543A	22	Mechanical Parts	N/A	Replaceable Parts
2602A	23	A2	83590-60122	General Information Installation Operation Adjustments Replaceable Parts Service
2619A	24	A8	83595-60070	Adjustments Replaceable Parts Service
▶ 2645A	25	A4	83590-60098	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

Title Page:
Delete Option 005.

Page 1-1:
After paragraph 1-8 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 83590A

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 1-2, Table 1-1:
Delete all references to Stability with Time (in a 10-minute period after one-hour warmup).

Page 1-5, Table 1-2:
Add STABILITY WITH TIME (in a 10-minute period after one hour warmup at the same frequency setting):

2.0 to 7.0: < ± 100 kHz
7.0 to 13.5: < ± 200 kHz
13.5 to 20.0: < ± 300 kHz
2.0 to 20.0: < ± 300 kHz

Page 1-6, Table 1-2:
Change the PULSE IN characteristics as follows:

Pulse In (2.0 to 20.0 GHz)
TTL compatible: Logic high = RF on, Logic low = RF off
Squarewave modulation up to 30 kHz (absolute error for 8755 compatibility up to 2 dB, typically 1 dB)
Rise/Fall Time:
Unleveled: Rise Time 5 µs
Fall Time 5µs
Leveled: Rise Time 7 µs
Settling Time 7 µs
Fall Time 5 µs

Page 1-8:
Delete Paragraphs 1-29 and 1-30.

UPDATES (Cont'd)

Page 4-2, Section 4-13:
Change the specification for CW Mode (13.5 to 20.0) to ±10 MHz.

Page 4-10, Paragraph 4-15, SPECIFICATION:
Delete all references to Stability with Time (in a 10-minute period after one hour warmup).

Page 4-12, Paragraph 4-15:
Delete Frequency Change with Time (10 minutes).
Delete steps 6 through 8.
Delete Table 4-8.

Page 4-16, Table 4-11:
Change Residual FM tolerances to: 5 kHz, 7 kHz, 9 kHz.

Page 4-30, Table 4-16, Section 4-13:
Change 13.5 to 20 GHz Accuracy to ±10 MHz.
Change lower and upper limits at 17.0 GHz to 16.99, 17.010.
Change lower and upper limits at 14.0 GHz to 13.99, 14.010.
Change lower and upper limits at 20.0 GHz to 19.99 20.010.

Page 4-35, Table 4-16, Section 4-15:
Delete all references to time (10 minutes) specifications.

Page 5-21, Paragraph 5-17:
Add [INSTR PRESET] before [RECALL] in step 9.
Add [INSTR PRESSET] before [RECALL] in step 14.
After step 15, add the following:
16. On the 83540A/B press [INSTR PRESET] [CW] [5] [0] [MHz]. While observing the frequency counter display, adjust the 83590A FREQ CAL control for 50 MHz.

Page 5-29, Paragraph 5-20:
Replace Paragraph 5-20 on pages 5-29 through 5-32 with 5-20, **SLOW SWEEP SYTM TO YO TRACKING (UPDATES)** contained in this document.

Page 5-33, Paragraph 5-21:
Replace Paragraph 5-21 on pages 5-33 through 5-37 with 5-21, **SRD BIAS (UPDATES)** contained in this document.

Page 5-51, Paragraph 5-28.
Replace Paragraph 5-28 on pages 5-51 through 5-54 with 5-28, **ALC GAIN ADJUSTMENT (UPDATES)** contained in this document.

UPDATES (Cont'd)

Page 6-2, Paragraph 6-17:

Add the following after paragraph 6-17:

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	Switched YTM	Yes	Yes
A13	YO 2.3 - 6.7 GHz	Yes	Yes
A14	2 - 7 GHz Power Amp	Yes	Yes
A16	Mod/Coupler	Yes	No

Page 6-2, Table 6-1:

Change A12 New Part Number to 83592-60065, Rebuilt Part Number to 83592-60066, Description to Switched YTM Kit.

Change A13 New Part Number to 83590-60066, Rebuilt Part Number to 83590-60067, Description to YO 2.0 to 7.0 GHz Kit.

Add A19, New Part Number 83592-60123, Rebuilt Part Number 83592-60124, Description 70dB ATTENUATOR (OPT. 002).

Page 6-5, Table 6-3:

Change A1RPG1 to HP and Mfr. Part Number 0960-0683, CD 3 (recommended replacement).

Change A2J1 to HP and Mfr. Part Number 1251-5926, CD 3 (recommended replacement).

Page 6-6, Table 6-3:

Change A2R1 to: 2100-3103, CD 5, RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN, 04568, 889PR10K.

Change A2U9 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).

Change A3 to HP and Mfr. Part Number 83525-60080, CD 6, DIGITAL INTERFACE ASSEMBLY (does not include A3U1 and A3U2).

Change A3J1 to HP and Mfr. Part Number 1251-5926, CD 3 (recommended replacement).

Change A3U1 and A3U2 to A3U1/A3U2 (not separately replaceable), HP and Mfr. Part Number 83590-60074, CD 7, EPROM Replacement Kit (recommended replacement).

Change A3U5 to HP and Mfr. Part Number 1820-3093, CD 8 (recommended replacement).

Page 6-7, Table 6-3:

Add A3XU1 and A3XU2, HP and Mfr. Part Number 1200-054., CD 1, SOCKET-IC 24-CONT DIP-SLDR (recommended addition).

UPDATES (Cont'd)

Page 6-9, Table 6-3:
Change A4U1 to HP and Mfr. Part Number 1826-1058.
Change A4U2 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A4U9 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A4VR4 to Part Number 1902-0111, CD 9, DIODE-ZNR 1N753A 6.2V 5% DO-7 PD=.4W (recommended replacement).

Page 6-14, Table 6-3:
Change A6U10 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A6U11 to HP and Mfr. Part Number 1826-1186 (recommended replacement).

Page 6-16, Table 6-3:
Change A7U19 to HP and Mfr. Part Number 1826-1349, CD 5 (recommended replacement).

Page 6-19, Table 6-3:
Change A12 to HP and Mfr. Part Number 83592-60065, CD 8, SWITCHED YIG TUNED MULTIPLIER KIT.
Change A12 to HP and Mfr. Part Number 83592-60066, CD 9, EXCHANGE 83592-60065 SWITCHED YTM KIT.
Change A13 to HP and Mfr. Part Number 83590-60066, CD 7, OSCILLATOR 2.0-7.0 GHz KIT.
Change A13 to HP and Mfr. Part Number 83590-60067, CD 8, EXCHANGE 83590-60066 OSC. KIT.
Delete A13A1C2 (recommended deletion).

Page 6-21, Table 6-3:
Change A16 to HP and Mfr. Part Number 5086-7395, CD 7 (recommended replacement).
Change J1 to HP and Mfr. Part Number 5061-5304, CD 2, CONNECTOR ASSY TYPE-N APC-7 DC BLOCK (recommended replacement).
Change J3 to HP and Mfr. Part Number 5061-5386, CD 0 (recommended replacement).
Delete MP6, KEY CAP-JADE GRAY.
Add E3, HP and Mfr. Part Number0960-0055, CD 1, CONNECTOR AND WIRE: RF SHORT.
Change MP3 to HP and Mfr. Part Number 83522-20028, CD 5.

Page 6-22, Table 6-3:
Change W13 to HP Part Number 83592-20014, CD 7.
Under Option 002, Option 004, and Option 002 and 004, change both HP and Mfr. Number of W8 to 83592-60012, CD 5.
Under OPT. 002 change the following item:
A19 HP and Mfr. Part Number 83592-60123, CD 9, EXCHANGE ATTENUATOR 70 dB (OPT. 002 ONLY).
Under OPT. 004change the following items:
MP1 to HP and Mfr. Part Number 83592-20062, CD 1.
W32 to HP and Mfr. Part Number 83590-20024, CD 3.
Under OPT. 002 and 004 change the following items:
A19 to HP and Mfr. Part Number 83592-60123, CD 9.
MP2 to HP and Mfr. Part Number 83592-20063, CD 2.
W33 to HP and Mfr. Part Number 83590-20025, CD 4.
Since OPT. 005 is no longer available, delete all references to OPT. 005 and combinations with other options. Specifically, delete titles and parts references associated with OPTION 005, OPTION 002 and 005, OPTION 004 and 005, and OPTION 002, 004, and 005.

Page 6-24, Figure 6-1:
Delete MP 6.

Page 8-31, Figure 8-18 (A1/A2 Schematic):
Change A2R1 to 10K.

Page 8-57, Figure 8-44:
Change the designation of the resistor between U19 and U20 to R32.

UPDATES (Cont'd)

Page 8-69, Figure 8-17:
In Block E DELAY COMPENSATION change the value of R17 to 287K.

Page 8-73, Figure 8-73:
Delete A13A1C2 from the component locations diagram (recommended deletion).

Page 8-75, Figure 8-76:
Delete A13A1C2 (recommended deletion).
On the male connector to the left of J2, draw a connecting line from the center conductor to the outer conductor (a short) and label E3.

5-20. SLOW SWEEP SYTM TO YO TRACKING (UPDATES)

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6 and A7

DESCRIPTION:

To obtain optimum output power, the Switched Yittrium-Iron-Garnet tuned multiplier (SYTM) passband peaking should track the output of the Yittrium-Iron-Garnet Oscillator (YO). The 83590A is set to sweep Bands 2 and 3 (7 to 20 GHz), and the Automatic Leveling Control (ALC) loop is opened by selecting the External (EXT) ALC MODE. The Step Recovery Diode (SRD) Bias for the SYTM is preset and will be adjusted in Paragraph 5-21. Special calibration modes are used for this procedure (SHIFT 92 for OFFSET and SHIFT 93 for GAIN of the frequency sweep). The output power is peaked for each calibration mode, and the appropriate calibration constant is entered into the calibration switches. A7S1 stores the OFFSET constant, and A7S2 stores the GAIN constant.

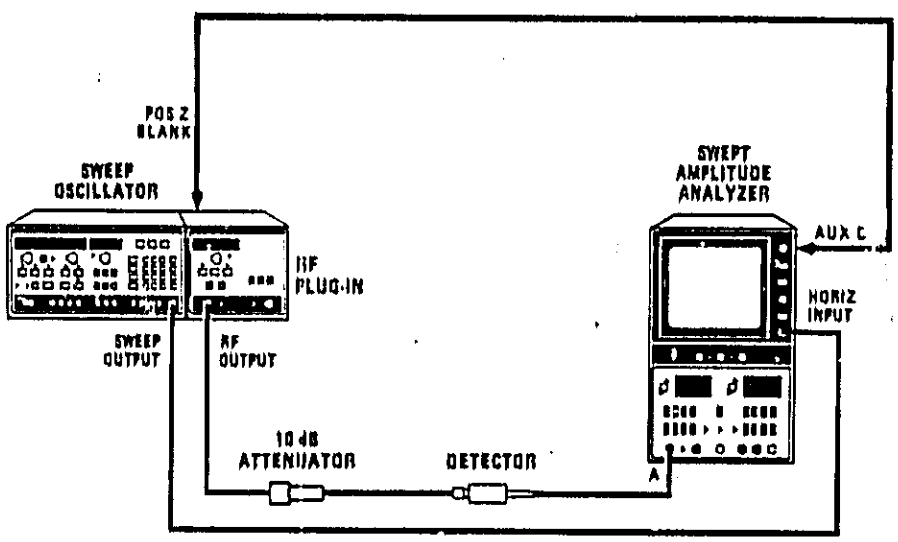


Figure 5-17. Slow Sweep SYTM to YO Tracking Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664B
10 dB Attenuator	Weinschel Model M9-10
Sweep Oscillator	HP 8350A/B

5-20. SLOW SWEEP SYTM TO YO TRACKING (UPDATES) (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

NOTE

During this adjustment, a localized drop in power may occur. This drop in power is due to the SRD being over biased and is called squegging. If squegging occurs in Band 2, adjust A6R68 and R73 to eliminate the squegging and to maximize power across the band. If squegging occurs in Band 3, adjust A6R69 and R74.

1. Connect the equipment as shown in Figure 5-17. Allow the equipment to warm up for one hour.
2. On the 8350A/B, press **[INSTR PRESET] [START] [7] [GHz] [SWEEP TIME] [2] [0] [0] [ms] [⊔⊓ MOD]**. On the 83590A press **[EXT ALC MODE]**. The unleveled lamp light should be lit.
3. Preset A6R78 (T) one quarter turn from full clockwise position.
4. Select 5 dB/DIV display resolution on the 8755C and center the display.
5. On the 8350A/B, press **[SHIFT] [9] [2]** to enable the SYTM OFFSET DAC sub-routine. Using the 83590A POWER control, peak the power in the beginning of Band 2.
6. On the 8350A/B, press **[SHIFT] [9] [3]** to enable the SYTM GAIN DAC sub-routine. Using the 83590A POWER control, peak the power at the end of Band 3. Maximum peaking occurs when the power at the high end of Band 3 has been optimized without the power in other bands dropping out.
7. Iterate between steps 5 and 6. SHIFT 92/93 are interactive so the adjustments must be alternated until the best compromise is found.
8. Press **[SHIFT] [9] [2]**. Set A7S1 to the Hex-code on the plug-in display. Press **[SHIFT] [9] [3]**. Set A7S2 to the Hex-code on the plug-in display.
9. Press **[INSTR PRESET]** on the 8350A/B so that the new calibration data will be entered from the current switch settings.
10. On the 8350A/B, press **[STOP] [7] [GHz] [⊔⊓ MOD] [SWEEP TIME] [4] [0] [0] [ms]**. On the 83590A, press **[EXT ALC MODE]**.
11. Adjust A7R51 (B1 OFS) to maximize the minimum power points of the Band 1 displayed trace.

5-21. SRD BIAS (UPDATES)

REFERENCE:

Performance Test: Paragraphs 4-17, 4-19
Service Sheet A4 and A6

DESCRIPTION:

The High Power SRD Bias is set by peaking the 8755C displayed trace with A6R68 (2H) and A6R73 (2L) in Band 2, A6R69 (3H) and A6R74 (3L) in Band 3.

The Low and Mid Power SRD Bias is adjusted by inserting a voltage through a 511 ohm current-limiting resistor to directly bias the Modulator/Splitter. With the 83590A at maximum RF output, the power supply voltage is increased (minimum voltage 0.5 Vdc, maximum voltage 5.0 Vdc) to set the RF output power just above the 8755C noise floor. Then A6R63 (3HL) is adjusted until minimum slope is obtained on the oscilloscope display. The voltage from the power supply is decreased until the lowest part of the trace, on the 8755C display, is 10 dB above the noise floor. Then A6R12 (C) is adjusted to peak the power in Bands 2 and 3. The power supply is then removed.

The 8750A is used to normalize system errors so an accurate measurement of the SYTM fundamental feedthrough can be made. A low pass filter is then inserted before the detected 8755C input. A comparison between the normalized and low pass inputs are made to determine the SYTM fundamental feedthrough.

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detectors (2)	HP 11664A
6 dB Attenuator	HP Weinschel Model M9-6
10 dB Attenuator	HP Weinschel Model M9-10
20 dB Attenuator	HP Weinschel Model M9-20
Directional Coupler	HP 0955-0125
Power Supply	HP 6214A
Low Pass Filter (6.8 GHz)	HP 11684A
Storage Normalizer	HP 8750A
Oscilloscope	HP 1740A
Extender Board	HP 08350-60031
Sweep Oscillator	HP 8350A/B
511 ohm Resistor	HP 0757-0416

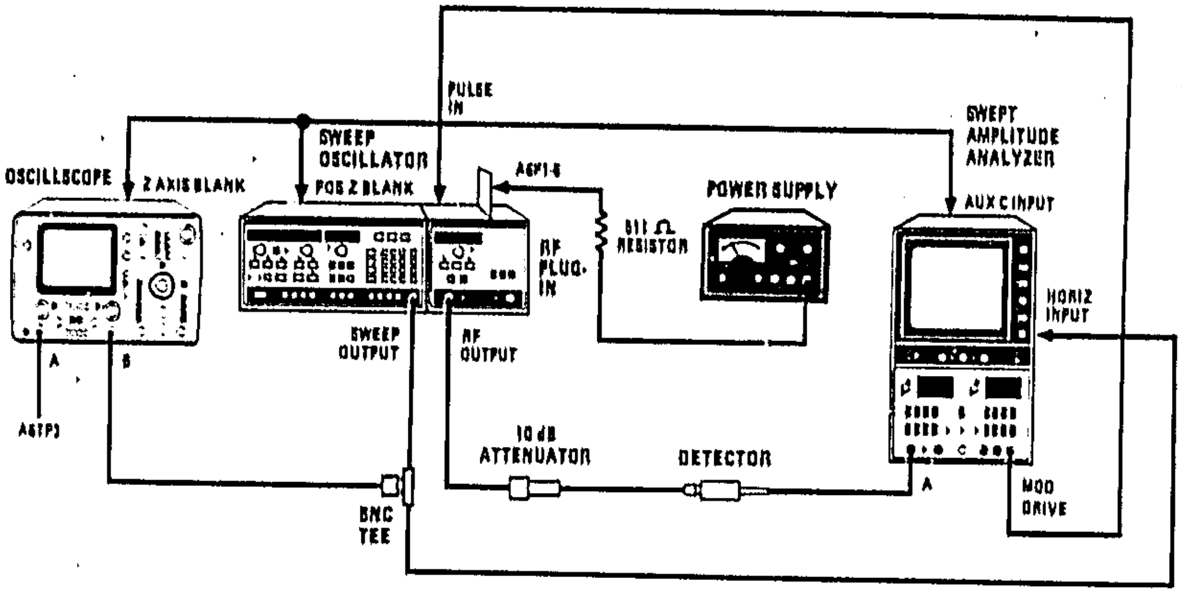
PROCEDURE:

NOTE

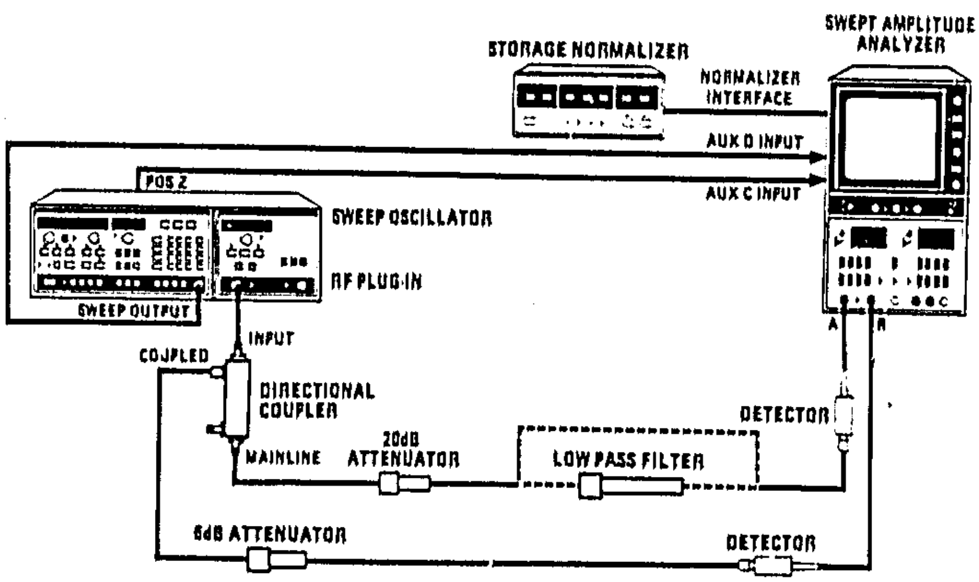
Turn the 8350A/B LINE power OFF when removing or installing PC boards.

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

5-21. SRD BIAS (UPDATES) (Cont'd)



a) Low and Mid Power Test Setup



b) YTM Fundamental Feedthrough Test Setup

Figure 5-21. SRD Bias Adjustment Test Setups

5-21. SRD BIAS (UPDATES) (Cont'd)

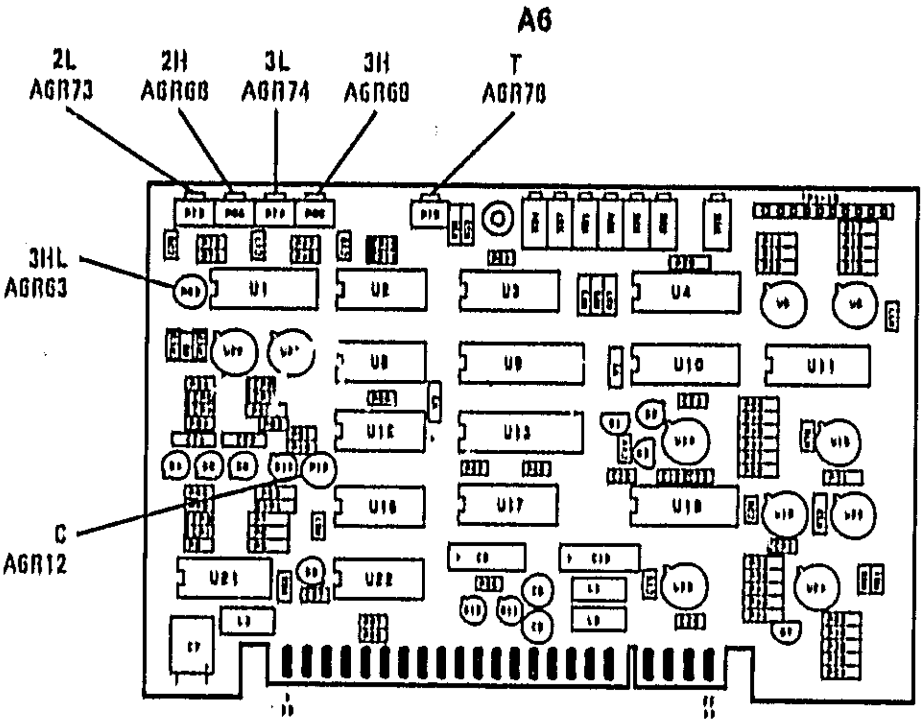


Figure 5-22. SRD Bias Adjustment Locations

High Power SRD Bias

1. Connect the equipment as shown in Figure 5-21a with the 83590A A6 Sweep Control board on an extender. Do not connect the power supply. With the LINE power OFF, remove the 83590A A4 ALC board. Connect the 8755C MODULATOR DRIVE output to the 83590A rear panel PULSE IN connector.
2. Allow the equipment to warm up for one hour.
3. On the 8350A/B press **[INSTR PRESET] [START] [6] [.] [9] [GHz] [STOP] [1] [3] [.] [5] [GHz] [SWEEP TIME] [4] [0] [0] [ms]**. On the 83590A select the **[EXT ALC MODE]**.
4. Set the 8755C display resolution for 5 dB/DIV and center the display.
5. Set up a zero volt reference on the ocilloscope.

NOTE

BEFORE beginning each adjustment, preset the potentiometer to the point where one side of the trace on the oscilloscope display is below zero volts. Adjustment locations labeled 2L and 3L set the left side of the displayed trace. Adjustment locations labeled 2H and 3H set the right side of the displayed trace. DO NOT preset more than one potentiometer at a time.

6. Observe the 8755C display, adjust A6R73 (2L) to peak the power at the low end of Band 2 without the power squegging. Then adjust A6R78 (2H) to peak the rest of the band. Iterate between (2L) and (2H) to peak the power across the band without any squegging.
7. On the 8350A/B press **[START] [1] [3] [.] [4] [GHz] [STOP] [2] [0] [GHz]**. Adjust A6R74 (3L) for the low end of Band 3 and A6R69 (3H) for the rest of the band to peak the power without squegging.

5-21. SRD BIAS (UPDATES) (Cont'd)

8. Check the SYTM to YO tracking to ensure it has not changed (refer to Paragraph 5-20). If retracking is necessary, repeat the steps above to eliminate any squegging that may have occurred.

Low and Mid Power SRD Bias

CAUTION

The voltage connected to A6P1-6 is to bias the Modulator/Splitter directly. If A6P1-7 (+10Vdc supply) is shorted to A6P1-6, the Modulator/Splitter will be damaged.

9. Set up the equipment as shown in Figure 5-21a, with a 511 ohm resistor connected to A6P1-6 (reference to ground). Remove the 83590A A4 ALC board. Connect the 8755C Swept Amplitude Analyzer MODULATOR DRIVE output to the 83590A rear-panel PULSE IN connector.
10. Allow the equipment to warm up for one hour.
11. On the 8350A/B, press **[INSTR PRESET] [SWEEP TIME] [2] [0] [0] [ms] [START] [7] [GHZ]**. Set the power on the 83590A to 20dB.
12. Set the 8755C display resolution for 10 dB/DIV and adjust the display to the top graticule. On the 1740A Oscilloscope, select A vs B, set Channel A to .5 B/DIV, set Channel B to 1 V/DIV, and DC-couple Channels A and B.
13. Set the 6214A voltage to .5 Vdc. Increase the voltage until the highest power point is 10 dB above the noise floor **(DO NOT EXCEED 5 Vdc)**.
14. Monitor A6TP3 with the oscilloscope and adjust A6R63 until minimum slope (flat display) is obtained.
15. Decrease the 6214A voltage until the power at the lowest point between 6.9 and 20 GHz is 10 dB above the noise floor.
16. Set A6R12 (C) to a centered position and then adjust to peak the power between 6.9 and 20 GHz. Using the voltage source, keep the RF power at or near 10dB above the noise floor, then repeak A6R12 (C). If the power of the sweep drops at any frequency, maximum peaking has been exceeded.
17. Repeat step 14 to verify baseline flatness, readjust A6R63 as needed.

Threshold

NOTE

For this adjustment to be accurate, the attenuator must be in the 0.0dB step. (Opt 002 only)

18. On the 8350A/B press **[INSTR PRESET]**. Set the power level on the 83590A to −5dB.
19. Observe the 8755C with a 1dB/DIV reference. Preset A6R78 (T) clockwise then adjust A6R78 (T) counter-clockwise until squegging and/or oscillations are eliminated.
20. Observe the 8755C trace, increase power slowly to maximum specified power out. If squegging or oscillations reoccur, readjust A6R78 (T) in small increments. If excessive adjustment of A6R78 (T) is required, the SRD bias may be misadjusted.

5-21. SRD BIAS (UPDATES) (Cont'd)

SYTM Fundamental Feedthrough

21. Set up the equipment as shown in Figure 5-21b without the Low Pass Filter, and with the 83590A A4 ALC board installed.
22. Allow the equipment to warm up for one hour.
23. On the 8350A/B, press **[INSTR PRESET] [START] [8] [GHz] [SWEEP TIME] [2] [0] [0] [ms] [⊔⊓MOD]**.
24. On the 8755C, select A/R DISPLAY and 5 dB/DIV. Center the display.
25. On the 8750A, press **[SELECT CH 1]**, and **[DISPLAY STORE INPUT]**. The display now shows the system error between Channel A and Channel R.
26. Press **[REFERENCE MEMORY STORE]** and then **[DISPLAY INPUT-MEM]**. The trace on the 8755C should be flat, showing that system errors have been removed. Note the position of the trace and the REFERENCE LEVEL. This will be used as a reference in step 27.
27. Install the Low Pass Filter at the location shown in Figure 5-21b.
28. Adjust the REFERENCE LEVEL so that the entire trace is on the display. The SYTM fundamental feedthrough is now displayed on the 8755C.
29. Determine how many dB the trace is below the reference position established in step 24. If the trace is less than 25dB below the reference between 8 GHz and 20 GHz, repeat paragraph 5-21.

5-28. ALC GAIN ADJUSTMENT (UPDATES)

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-25 through 5-28. 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

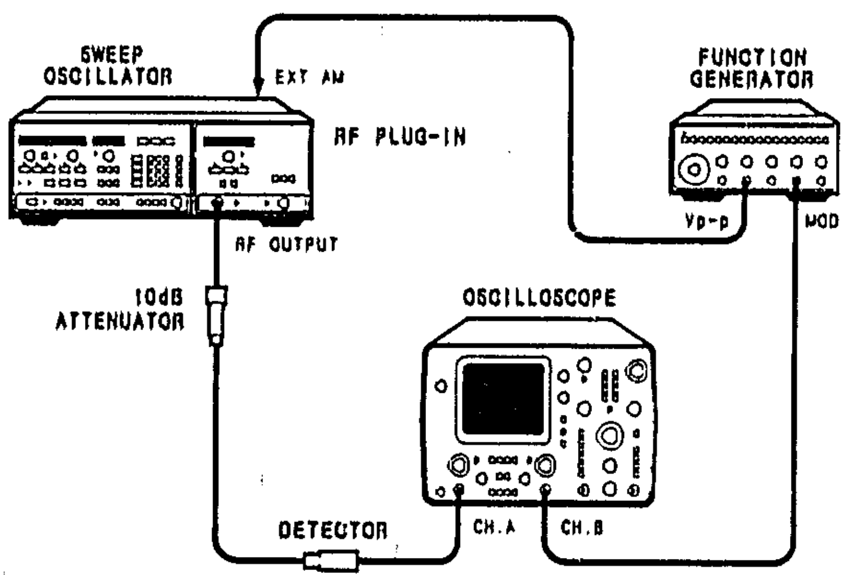


Figure 5-35. ALC Gain Adjustment Test Setup

5-28. ALC GAIN ADJUSTMENT (UPDATES) (Cont'd)

NOTE

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

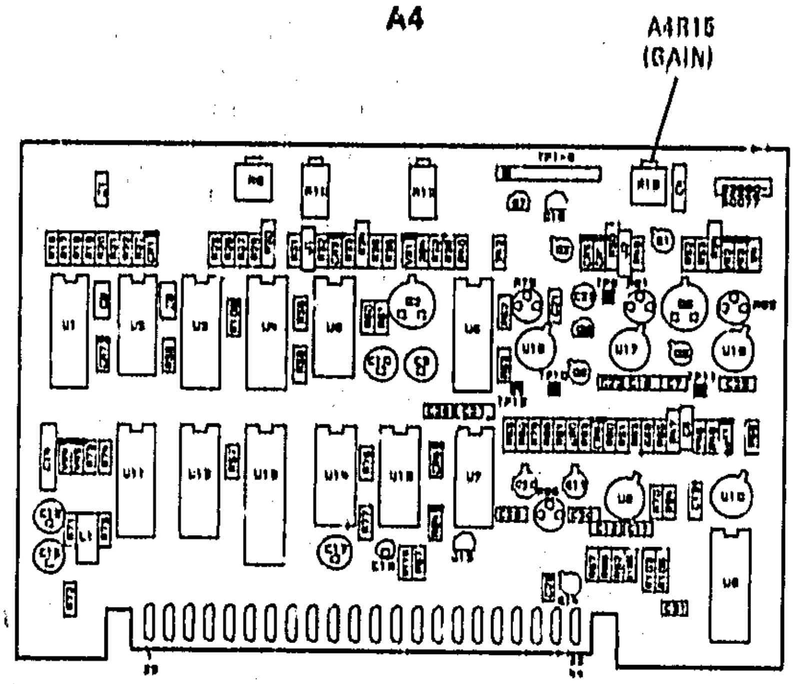


Figure 5-36. ALC Gain Adjustment Location

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 .... 2 GHz
STOP .... 20 GHz
SWEEP MODE .... MANUAL

83590A 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

5-28. 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 5-35.

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 5-36a)

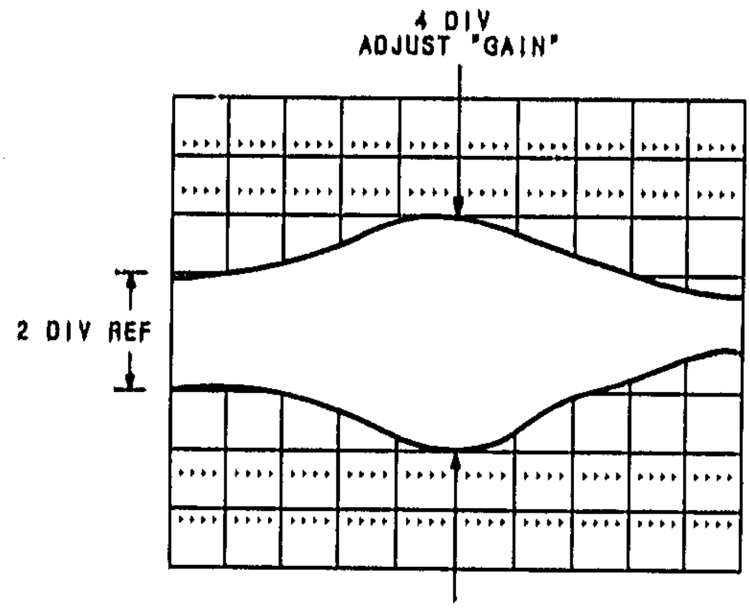


Figure 5-36a. ALC Gain Adjusted Correctly (Worst Case)

CHANGE 1

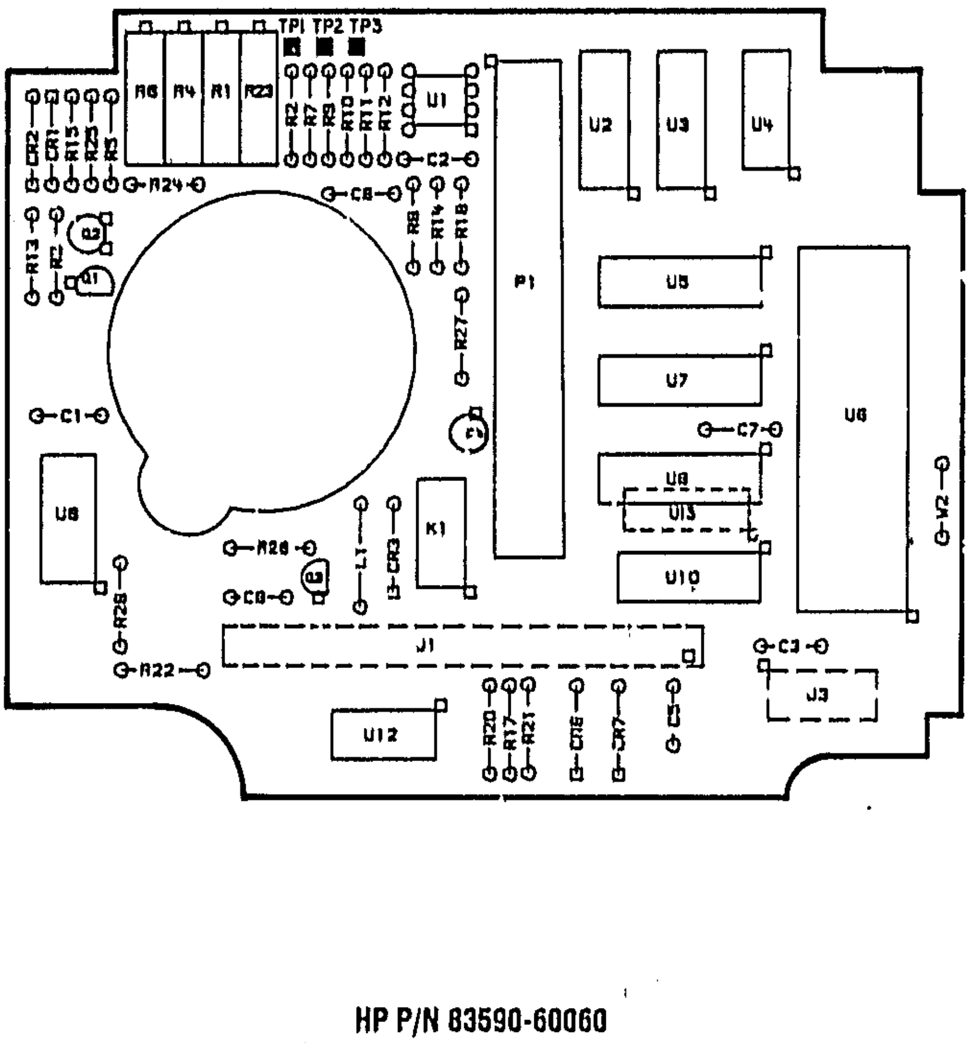
This change documents a new Front Panel Interface.

Page 6-5, Table 6-3:
Change A2 to HP and Mfr. Part Number 83590-60060, CD 1.

Page 6-6, Table 6-3:
Change A2Q4 to 1854-0477, CD 7, Qty 1, TRANSISTOR NPN SI CHIP FT=1.3 GHZ, 02037, SMCS1005.
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 1% .05W F TC=0±100, 03292, C3-1/8-TO-51R1-F.
Delete A2U11.
Add A2U13, 1820-1199, CD 1, Qty 1, IC INV TTL LS HEX 1-INP, 01698, SN74LS04N.

Page 8-31, Figure 8-12:
Replace the FRONT Component Locations diagram with *A2 Front Panel Interface, Component Locations (CHANGE 1)* from this document.

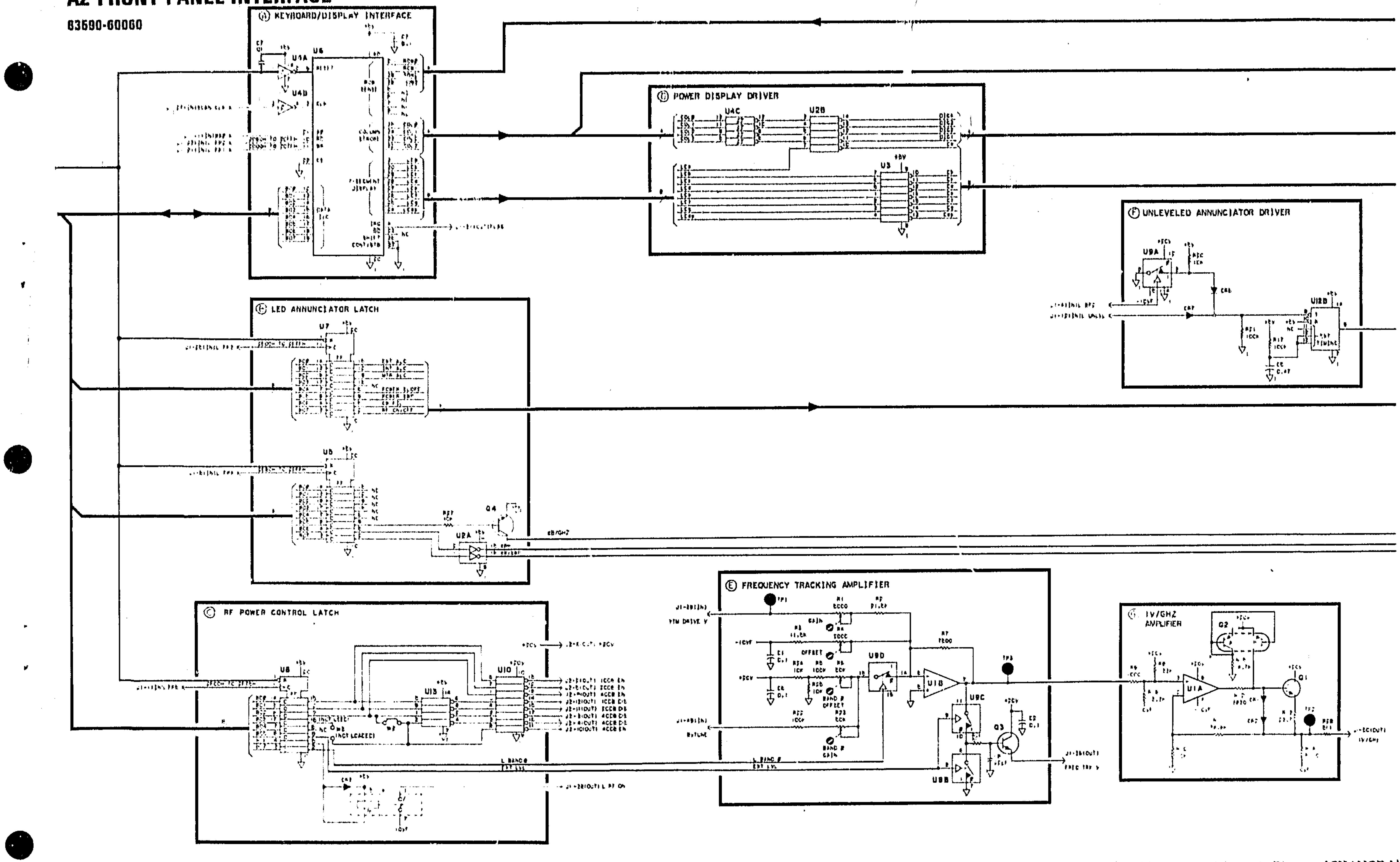
Page 8-31, Figure 8-18:
Change the A2 FRONT PANEL INTERFACE part number in the top left-hand corner of the A2 schematic to 83590-60060.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2216A.
Replace blocks A through G with the partial schematic *P/O A2 Front Panel Interface, Schematic Diagram (CHANGE 1)* from this document.



A2 Front Panel Interface, Component Locations (CHANGE 1)

A2 FRONT PANEL INTERFACE

83590-60060

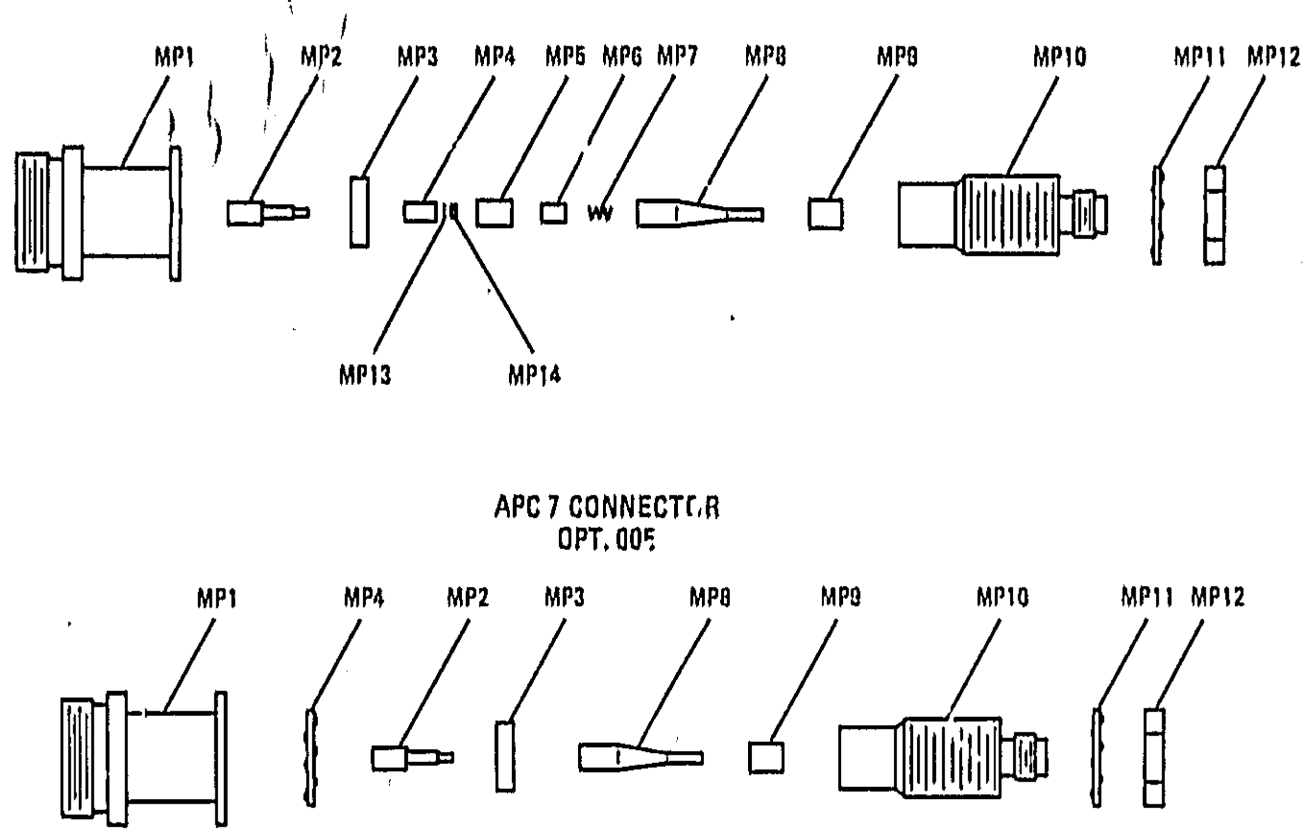


P/O A2 Front Panel Interface, Schematic Diagram (CHANGE 1)

CHANGE 2

This change documents a new RF output connector.

Page 6-30, Figure 6-3:
Replace Figure 6-3 with *Figure 6-3. RF Output Connector (CHANGE 2)* from this document.



Reference Designator	HP Part Number	Description	Mfr. Code	Mfr. Part Number
J1	5061-5304	CONNECTOR ASSY (TYPE N) (RF OUT)	28480	5061-5304
J1	83592-60027	CONNECTOR ASSY (APC-7) (OPT. 005)	28480	83592-60027
J1MP1	5021-0141	TRMNATOR HYBRD	28480	5021-0141
J1MP2	1250-0816	CONT-RF CONN	05879	131-1054
J1MP3	5040-8856	INSULATOR	28480	5040-8856
J1MP3	5040-0306	INSULATOR (OPT. 005)	28480	5040-0306
J1MP4	5021-3559	CAP MT CTR	28480	5021-3559
J1MP5	5021-3558	CTR COND GUIDE SL	28480	5021-3558
J1MP6	8160-0393	RFI PLUG	28480	8160-0393
J1MP7	1460-1960	SPRING-CPRSM	00359	1460-1960
J1MP8	5021-3561	CTR COND CONT MT	28480	5021-3561
J1MP8	08555-20093	CONTACT JACK (OPT. 005)	28480	0855-20093
J1MP9	08761-2027	INSULATOR	28480	08761-2027
J1MP10	5021-3560	CONN BODY BLKHD	28480	5021-3560
J1MP10	08555-20094	BODY BULKHEAD	28480	0855-20094
J1MP11	2190-0104	WSHR-LK .439ID	000	OBD
J1MP12	2950-0132	NUT-HEX 7/16-28	000	OBD
J1MP13	0470-0562	COND EPOXY	28480	0470-0562
J1MP14	0160-5448	CAPACITOR	28480	0160-5448

Figure 6-3. RF Output Connector (CHANGE 2)

CHANGE 3

This change documents a new connector on A16 Modulator/Coupler.

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

Page 6-21, Table 6-3:
Change A16A1J3 to HP and Mfr. Part Number 1251-3172, CD 7, CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ-RND.
Delete MP6, KEY CAP-JADE GRAY.

CHANGE 4

This change increases the compensation effect of the 1 HI adjustment in Band 1.

Page 6-8, Table 6-3:

Change A4R23 to HP Part Number 0698-3162, CD 0, RESISTOR 46.4K 1% .125W F TC=0±100, Mfr. Part Number C4-1/8-TO-4642-F.

Change A4R24 to HP Part Number 0698-7262, CD 9, RESISTOR 12.1K 1% .05W F TC=0±100, Mfr. Part Number C3-1/8-TO-1212-F.

Page 8-47, Figure 8-34:

In Block **C POWER LEVEL REFERENCE**, change the value of R23 to 46.4K and change the value of R24 to 12.1K.

Change the SERIAL PREFIX number in the lower left-hand corner of the page to 2233A.

CHANGE 5

This change incorporates an Improved Modulator/Coupler.

Page 6-21, Table 6-3:
Change A16 HP and Mfr. Part Number to 5086-7395, CD 7.

CHANGE 6

This change modifies the A4 ALC Board to minimize squarewave overshoot.

Page 6-8, Table 6-3:

Change A4R11 to HP Part Number 2100-2521, CD 0, RESISTOR-TRMR 2K 10% Mfr. Code 32997, Mfr. Part Number 3329W-1-202.

Page 6-9:

Change A4R66 to HP Part Number 0698-3132, CD 4, RESISTOR 261 1%, Mfr. Part Number C4-1/8-TO-2610-F.
Change A4R71 to A4R71*, FACTORY SELECTED - NOT REPLACEABLE.
Change A4R80 to A4R80*, FACTORY SELECTED-NOT REPLACEABLE.
Change A4R97 to A4R97*, FACTORY SELECTED-NOT REPLACEABLE.

Page 8-47, Figure 8-34:

Change the SERIAL PREFIX number in the bottom left-hand corner to 2249A.
In Block I **MAIN ALC AMP** change the value of R66 to 261 and change the value of R11 to 2000.
In Block J **UNLEVELED SIGNAL** change the value of R71 to 2870.
In Block K **PIN MOD 1 DRIVER** change R80 to R80*, value 511; and change R97 to R97*, value 30.0K.

CHANGE 7

This change adds further improvements to the A4 ALC Board to compensate for modulator variations.

Page 6-7, Table 6-3:
- Change A4C35 to HP Part Number 0160-0574, CD 3, CAPACITOR .022μF.
- Delete A4CR13.
- Add A4MP4, HP Part Number 1251-1277, CD 9, Qty 3, TERMINAL POST.

Page 6-8, Table 6-3:
- Change A4R11 to HP Part Number 2100-2489, CD 9, RESISTOR-TRMR 5K.

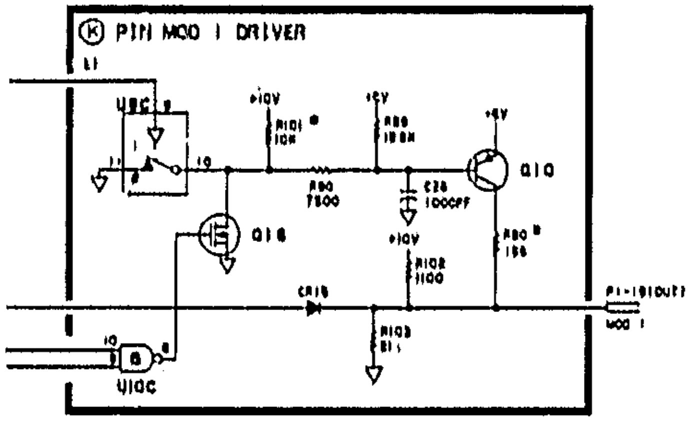
Page 6-9, Table 6-3:
- Change A4R66 to HP Part Number 0757-0416, CD 7, RESISTOR 511.
- Change A4R71 to A4R71*, FACTORY SELECTED-NOT REPLACEABLE.
- Change A4R89 to HP Part Number 0698-7267, CD 4, RESISTOR 19.6K.
- Change A4R90 to HP Part Number 0698-7257, CD 2, RESISTOR 7.5K.
- Delete A4R97.
- Add A4R101*, FACTORY SELECTED-NOT REPLACEABLE.
- Add A4R102, HP Part Number 0757-0424, CD 7, RESISTOR 1.1K 1% .125W F TC=0±100.
- Add A4R103, HP Part Number 0757-0394, CD 0, RESISTOR 51.1 1% .125W F TC=0±100.

Page 6-13, Table 6-3:
- Change A6R53 to HP Part Number 0698-3429, CD 2, RESISTOR 19.6.

Page 8-47, Figure 8-29 (A4 Component Locations):
- Delete R97.
- Move R98 to a location directly above and parallel to CR15.
- Move R78 to a location directly below Q15 and Q16 and parallel to R98.
- Delete CR13 and in its place insert R103.
- Add R101, mounted on the far side of the board. R101 is located diagonally between the top of R77 and the top of R90.
- Add R102, mounted on the far side of the board. R102 is located diagonally between the bottom of R80 and a feedthrough pad below Q10 (where the top of R78 was formerly connected).

Page 8-47, Figure 8-34 (A4 Schematic):
- In Block H SAMPLE AND HOLD DRIVER change the value of C35 to .022μF.
- In Block I MAIN ALC AMP:
  - Change the value of R66 back to 511.
  - Change the value of R11 to 5000.
- In Block J UNLEVELED SIGNAL change R71 to R71* and change the nominal value back to 2610.
- Replace Block K PIN MOD I DRIVER with *P/O Figure 8-34, A4 ALC Schematic Diagram (CHANGE 7)* from this document.

Page 8-57, Figure 8-49 (A6 Sweep Control Schematic):
- In Block J PULSE MODULATION, change the value of R53 to 19.6.



P/O A4 ALC Schematic Diagram (CHANGE 7)

CHANGE 8

This change modifies the A6 Sweep Control Assembly for improved modulator compatibility.

Page 6-12, Table 6-3:
Add A6MP3, HP Part Number 0360-0124, CD 3, CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND.
Change A6R51 to 0698-7225, CD 4, RESISTOR 348 1% .05W F TC=0±100, 28480, 0698-7225.

Page 6-14, Table 6-3:
Add A6R83, 0698-7242, CD 5, RESISTOR 1.78K 1% .05W F TC=0±100, 24546, C3-1/8-TO-1780-G.
Add A6R84, 0698-7238, CD 9, RESISTOR 1.21K 1% .05W F TC=0±100, 24546, C3-1/8-TO-1210-G.

Page 8-57, Figure 8-44:
Add *Figure 8-44A. A6 Component Mounting Diagram (CHANGE 8)* from this document.

Page 8-57, Figure 8-49:
Replace Block J PULSE MODULATION with *P/O Figure 8-49. A6 Sweep Control Schematic (CHANGE 8)* from this document.

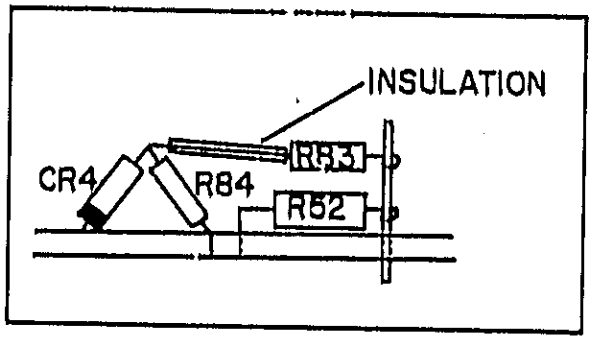


Figure 8-44A. A6 Component Mounting Diagram (CHANGE 8)

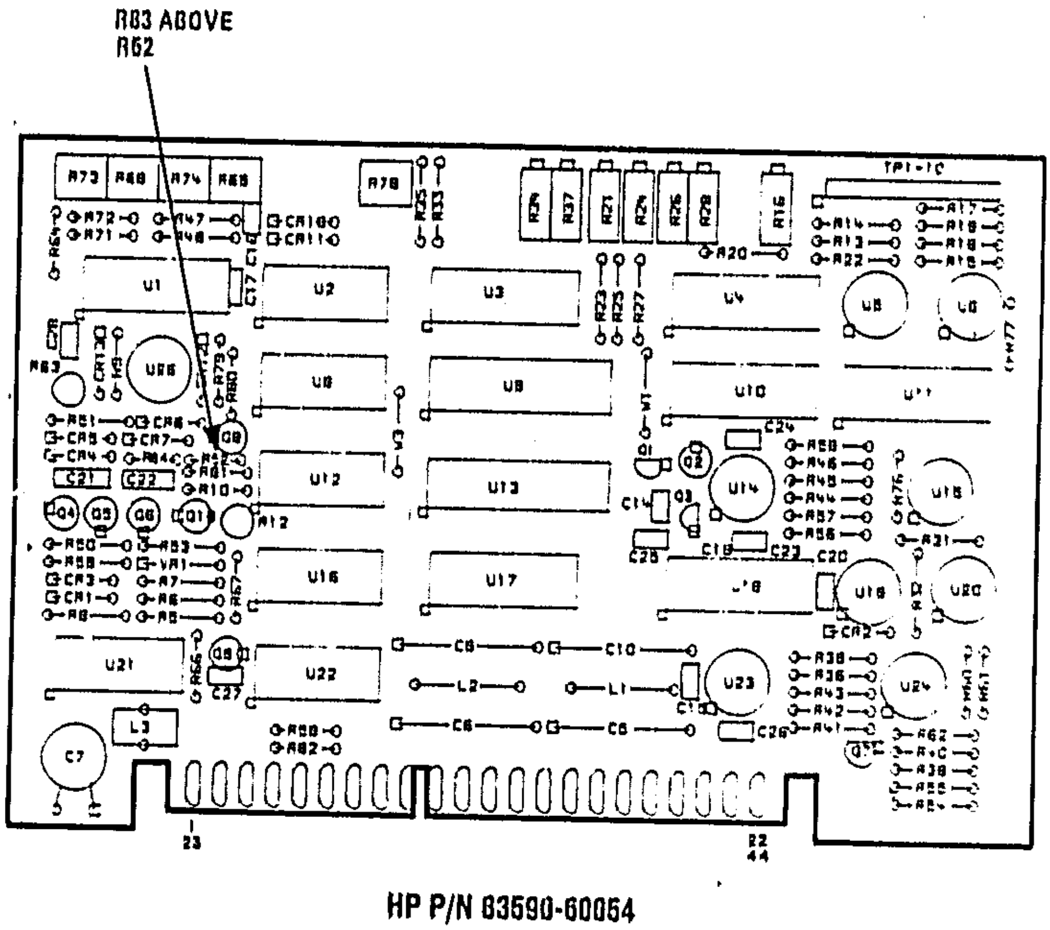
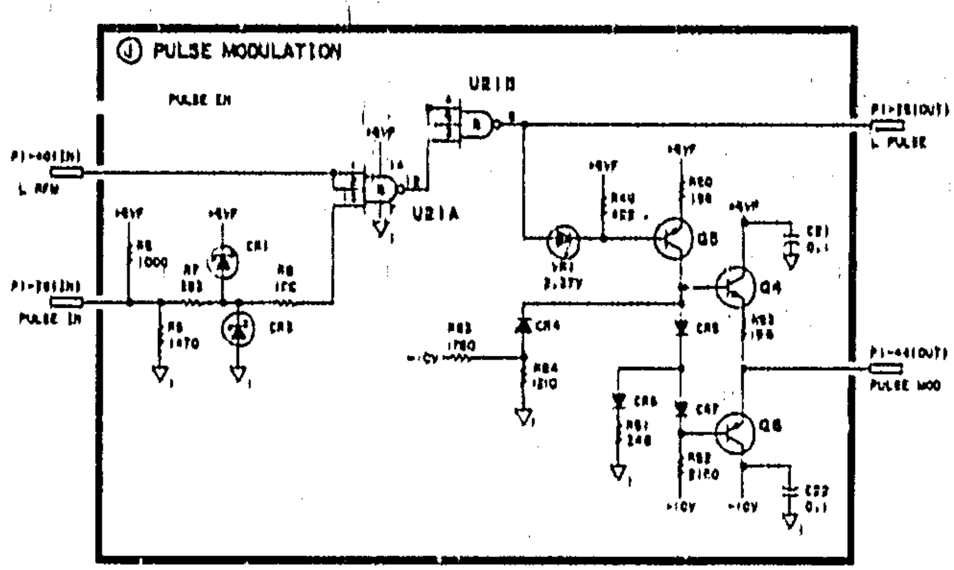


Figure 8-44. A6 Sweep Control Component Locations (CHANGE 8)



P/O Figure 8-49. A6 Sweep Control Schematic (CHANGE 8)

CHANGE 9

This change improves the output power specifications.

Page 1-2, Table 1-1, **POWER OUTPUT:**
Change the specifications as follows:

Maximum Leveled Output Power:					
2.0 to 7.0 GHz +10 dBm	**7.0 to 13.5 GHz** +10 dBm	**13.5 to 18.6 GHz** +10 dBm	**13.5 to 20.0 GHz** +10 dBm	**2.0 to 18.6 GHz** +10 dBm	**2.0 to 20 GHz** +10 dBm
With Option 002					
+8.5 dBm	+8 dBm	+8 dBm	+7 dBm	+7 dBm	+7 dBm

Note that the maximum leveled output power for the standard instrument is now +10 dBm across the entire frequency band.

CHANGE 10

This change updates the A3 Digital Interface Board with revised firmware (Revision 4).

Page 6-6, Table 6-3:

Change A3 Digital Interface Board to HP Mfr. Part Number 83590-60073, CD 6.
Change A3U1 to 83590-80003, CD 4, Qty 1, EPROM Lw.
Change A3U2 to 83590-80004, CD 5, Qty 1, EPROM Hi.

Page 8-35, Figure 8-23:

Change the A3 DIGITAL INTERFACE part number in the top left-hand corner of the schematic to 83590-60073.
Change the SERIAL PREFIX in the bottom left-hand corner of the schematic to 2315A.

CHANGE 11
(Supersedes CHANGE 1)

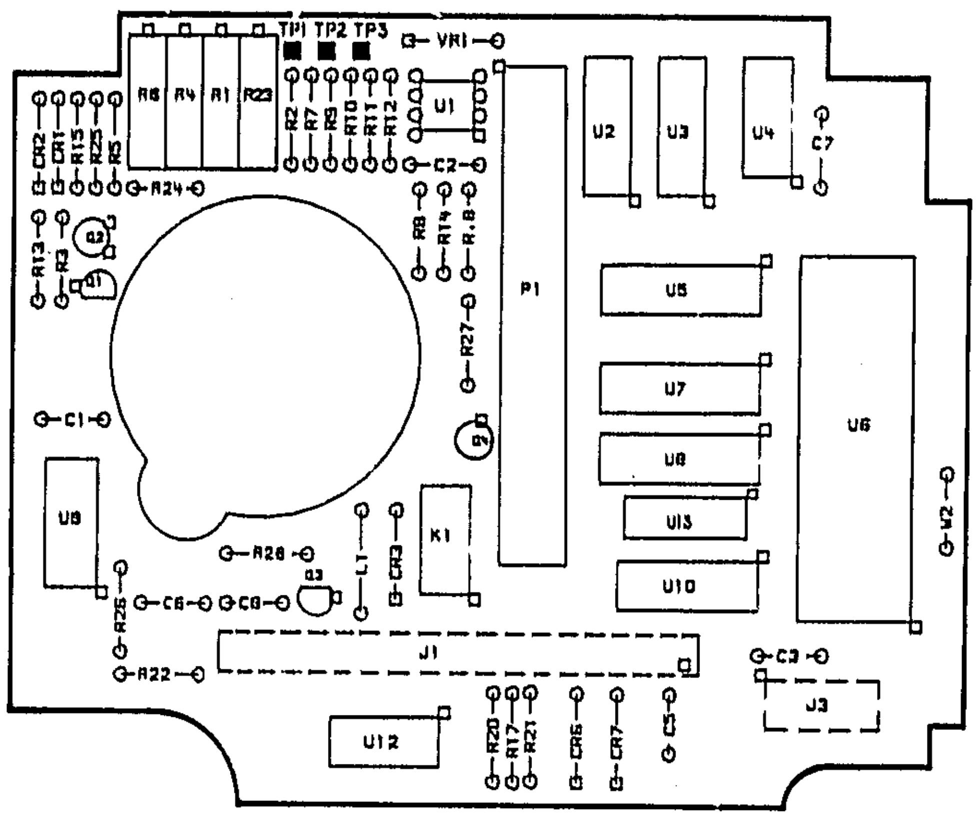
This change incorporates a new A2 Sub Panel Board.

Page 6-5, Table 6-3:
Change the A2 Board Assembly Sub Panel part number to 83590-60072, CD 5.

Page 6-6, Table 6-3:
Add A2VR1, 1902-0041, CD 4, DIODE-ZNR 5.11V 5% DO-35 PD=.4W.

Page 8-31, Figure 8-12:
Replace the Component Locations Diagram with the *A2 Front Panel Interface, Component Locations (CHANGE 11)* from this document. Note that U13 is now mounted on the front of the board.

Page 8-31, Figure 8-18:
Change the A2 FRONT PANEL INTERFACE part number in the top left-hand corner of the A2 Schematic to 83590-60072.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2338A.
In Block G (1V/GHz Amplifier) add VR1 across R12, anode connected pin 1 of U1A.



HP P/N 83590-60072

A2 Front Panel Interface, Component Locations (CHANGE 11)

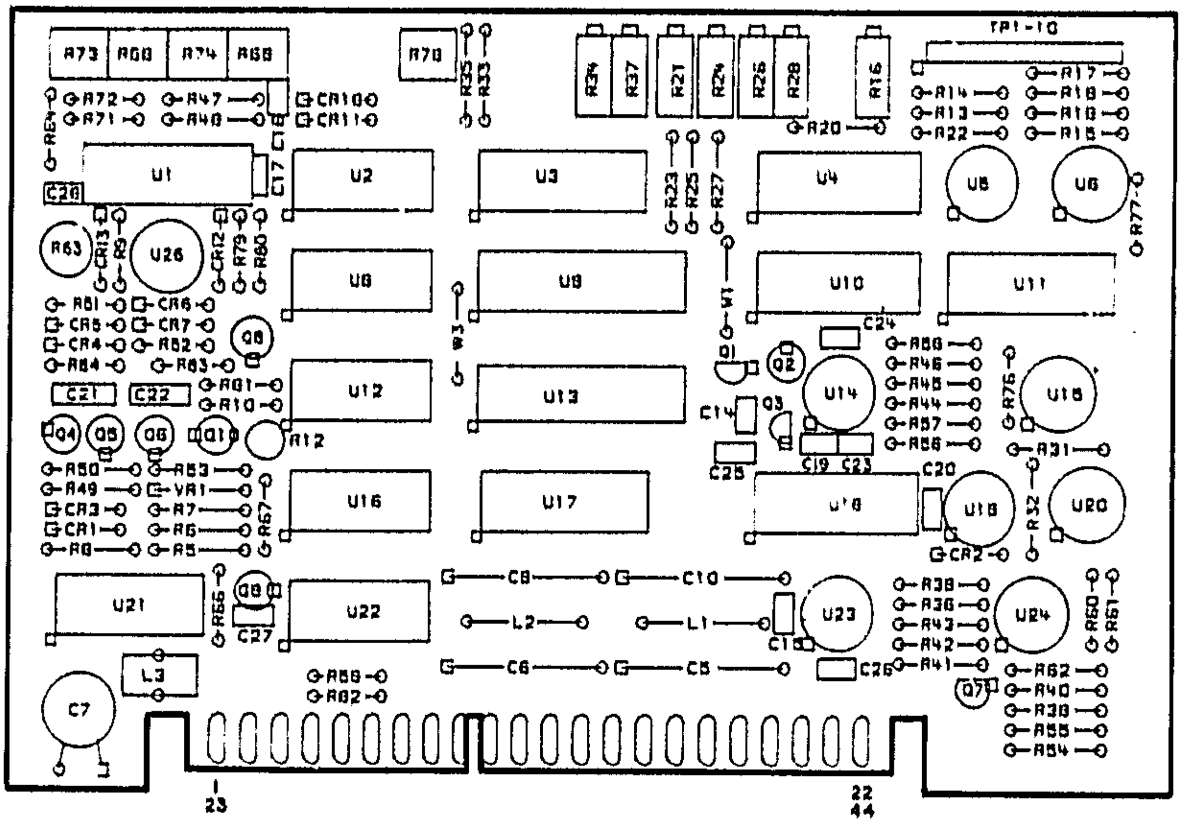
CHANGE 12
(Supersedes CHANGE 8)

This change incorporates a new A6 Sweep Control Board.

Page 6-12, Table 6-3:
Change the A6 Sweep Control Assembly HP and Mfr. Number to: 83590-60091, CD 8.

Page 8-57, Figure 8-44 (A6 Component Locations):
Replace Figure 8-44 with Figure 8-44 (CHANGE 12) in this change sheet.

Page 8-57, Figure 8-49 (A6 Schematic):
Change the A6 SWEEP CONTROL part number in the top left-hand corner of the A6 Schematic to 83590-60091.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2410A.



HP P/N 83593-60091

Figure 8-44. A6 Sweep Control Component Locations (CHANGE 12)

CHANGE 13

Change not applicable.

CHANGE 14
(Supersedes CHANGES 4, 6, and 7)

This change introduces a new ALC board. It is now possible to power meter level the plug-in with the HP 436A and HP 438A as well as the HP 432A.

Page 1-4, Table 1-1, Note 9:
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 100 seconds for full sweep, typically greater than or equal to 5 seconds per GHz but not less than 10 seconds."

Page 1-9, 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 1-11, Table 1-4:
Across from the first listed "Power Meter" under **Critical Specifications** delete: "(No substitute when used for external power meter leveling)." Under **Recommended Model** add: "HP 436A," "HP 438A."
Across from the first listed "Thermistor Sensor" under **Recommended Model** delete: "HP 8478B" and replace with: "Unit compatible with power meter being used."
Across from the second listed "Thermistor Sensor" under **Recommended Model** delete: "HP K486" and replace with: "Unit compatible with power meter being used."

Page 3-3, Paragraph 3-25:
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 3-6, Figure 3-4, Number 1:
Delete: "(HP 432 only)."

Page 3-9, 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.**" and add: "**When using an HP 436A power meter, enable RANGE HOLD to lock power meter in one range.**"
Under PROCEDURE, number 5, delete all reference to "HP 432A."

Page 4-2, Table 4-1:
Across from "Squarewave Symmetry" under **83590A Adjustment** add "5-27."

Page 4-8, Power Meter Leveling:
Insert "13a. External leveling is shown using the HP 432A, HP 8478B, and HP K486A. However, the HP 432A/B/C, 436A, 438A meters and compatible sensors may also be used."

Page 5-2, Table 5-1:
Change A4R3 to A4R8.
Change A4R5 to A4R12.
Change A4R8 to A4R10.
Delete the line beginning with A4R9.
Change A4R11 to A4R15. Under **Description**, change U11 to U9.
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.

CHANGE 14 (Cont'd)

Page 5-6, Table 5-2:
Across from 5-27 under "Adjustments," delete "Power Meter Leveling Calibration" and replace with "Squarewave Symmetry Adjustment (CHANGE 14)."

Page 5-44, 5-29, ALC Adjustment:
Replace pages 5-44 through 5-46 with the 5-28, **ALC ADJUSTMENT (CHANGE 14)** procedure in this document.

Page 5-49, **POWER METER LEVELING CALIBRATION:**
Delete pages 5-49 and 5-50 and replace with 5-27, **SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 14)** procedure in this document.

Pages 5-51 to 5-54: **ALC GAIN ADJUSTMENT:**
Replace all reference to A4R11 with A4R15.

Page 5-51, DESCRIPTION:
Change A4U11 to A4U9.

Page 5-51, EQUIPMENT:
Across from "Power Meter," add: "436A, and 438A."
Across from both Thermistor Mounts delete: "HP 8478A" and "HP K486," and replace with "Unit compatible with power meter being used."

Page 5-54, Paragraph 5-36:
Add the following steps:

"27. With the Model 83590A set to −5 dBm, press **[INSTR PRESET] [CW]**. Set the oscilloscope to a 10 us sweep time. If the GAIN control (A4R15) has been over adjusted, the shape of the squarewave on the oscilloscope will be distorted."

"28. Back off on A4R15 and observe the squarewave. If the shape of the squarewave improves, back off until there is no more change. If there is no change, in the shape of squarewave as A4R15 is adjusted, return it to its initial position."

Page 6-7, Table 6-3:
Replace the parts list for the A4 Assembly with **A4 Replaceable Parts (CHANGE 14)** from this document.

Page 8-19, **A4 ALC Assembly:**
Add the following paragraph at the end of the A4 ALC assembly description:
"when used in the ALC MODE **[MTR]**, the A4 ALC 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 8-35, **A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION:**
Replace pages 8-35 to 8-46 with the **A4 ALC CIRCUIT DESCRIPTION (CHANGE 14)** from this document.

Page 8-47, Figure 8-28:
Replace Figure 8-28 with *Figure 8-28. A4 ALC Block Diagram (CHANGE 14)* from this document. Note this is a fold-out page.

Page 8-47, Figure 8-29:
Replace Figure 8-29, with *Figure 8-29. A4 ALC Component Locations (CHANGE 14)* from this document.

CHANGE 14 (Contd)

Page 8-47, Table 8-12:
Replace Table 8-12 with *Table 8-12. Leveling Control Lines (CHANGE 14)* from this document.

Page 8-47, A4P1 Pin-out Table:
Replace the A4P1 Pin-out Table with *A4P1 Pin-out Table (CHANGE 14)* from this document.

Page 8-47, Figure 8-32:
Under **NOTE**, change the middle paragraph to read: "**Adjustment of the EXT/MTR ALC CAL screw will affect the waveforms at TP6 and TP5. Adjust the CAL screw until the correct waveforms are obtained.**"

Page 8-47, Figure 8-33:
Replace Figure 8-33 with *Figure 8-33. Open Loop Waveforms (CHANGE 14)* from this document.

Page 8-47, Figure 8-34:
Replace Figure 8-34 with *Figure 8-34. A4 ALC Schematic Diagram (CHANGE 14)* from this document. Note this is a fold-out page.

5-25. ALC ADJUSTMENT (CHANGE 14)

NOTE

Complete adjustment of the ALC leveling loop requires procedures to be performed in the order prescribed, from Paragraph 5-25 through 5-28. 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.

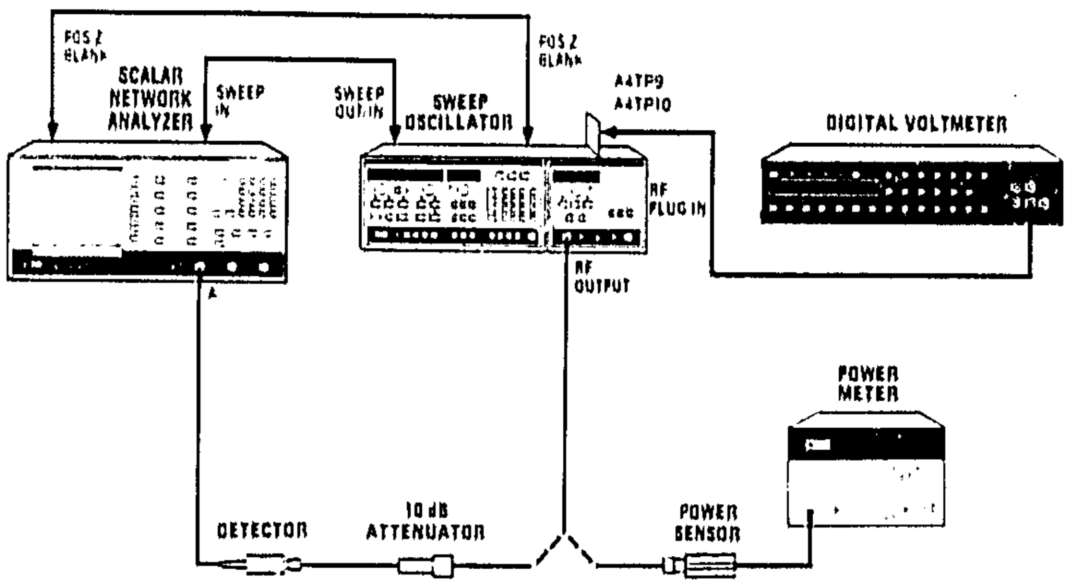


Figure 5-29. ALC Adjustment Test Setup

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

5-25. ALC ADJUSTMENT PROCEDURE (CHANGE 14) (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 that the 8350A/B Sweep Oscillator 27.8 kHz squarewave modulation is selected.

1. Remove the A5 FM Driver 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
   A4R8 (1 HI) .... Fully CW

A4

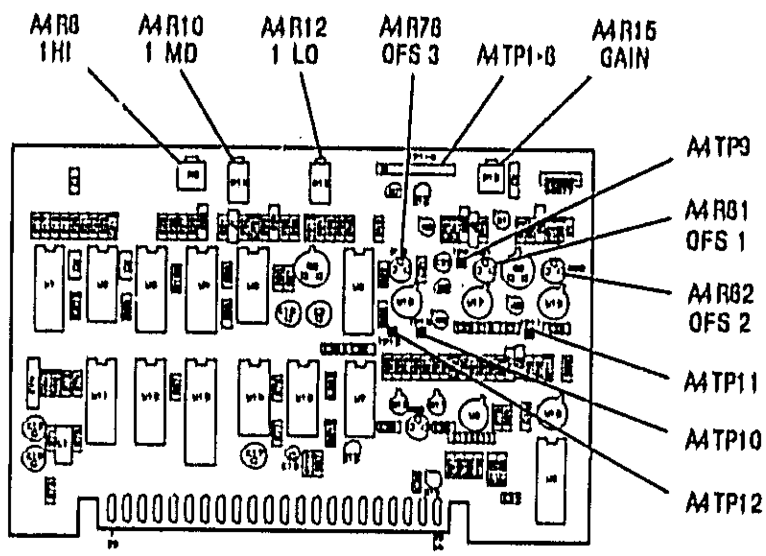


Figure 5-30. ALC Adjustment Locations (CHANGE 4)

5-25. ALC ADJUSTMENT PROCEDURE (CHANGE 14) (Cont'd)

2. Float the ground on the Digital Voltmeter and measure the voltage between A4TP9 and A4TP10. Refer to Figure 5-30 for adjustment locations. Adjust A4R81 (OFS 1) for 0.000 ± 0.001 Vdc.
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. 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] [2] [.] [0] [GHz s]**. Connect the Power Meter sensor to the HP 83590A RF OUTPUT.
6. Set the HP 83590A for a POWER reading of −5 dBm. Adjust A4R12 (1 LO) for an RF output power at the HP 83590A connector of −5 ± 0.1 dBm.
7. Set the HP 83590A for a POWER reading of +7 dBm. Adjust A4R10 (1 MD) for an RF output power at the HP 83590A connector of +7 ± 0.1 dBm.
8. Iterate steps 7 and 8 until both low and midpower ranges are calibrated and no readjustment is necessary.
9. Set the HP 83590A for a front panel POWER reading of +10 dBm. Adjust A4R8 (1 HI) for an RF output power at the HP 83590A connector of +10 ± 0.1 dBm.
10. Reinstall the A5 FM board assembly.

5-27. SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 14)

NOTE

Complete adjustment of the ALC leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-25 to 5-28. Deviation from this routine may cause improper leveling and/or power variation problems.

Turn AC power OFF when removing or installing PC boards.

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

REFERENCE:

Performance Tests: Paragraph 4-21
Service Sheet: A4

DESCRIPTION:

C23 (SYM 1) and R99 (SYM 2) minimize overshoot of the squarewave. R92 adjusts the duty cycle of the squarewave.

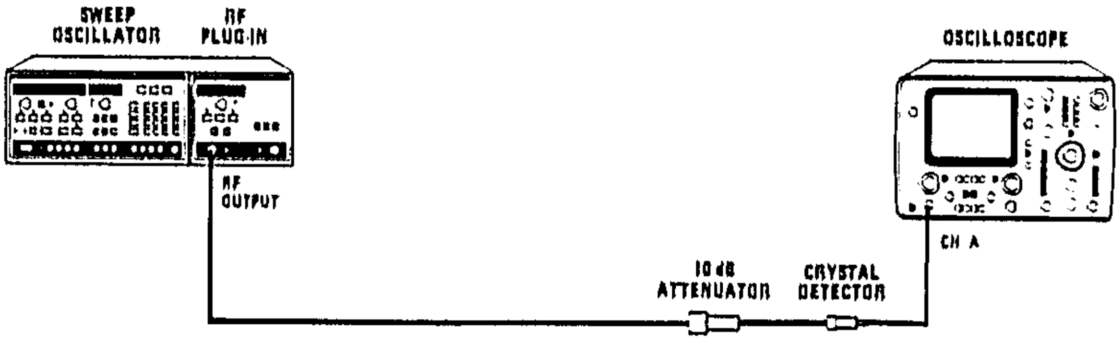


Figure 5-33. Squarewave Symmetry Adjustment Setup

EQUIPMENT:

Sweep Oscillator .... HP 8350A/B
Oscilloscope .... HP 1740A
Diode Detector .... HP 8473C
Attenuator .... HP 8491B-010

5-27. SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 14) (Cont'd)

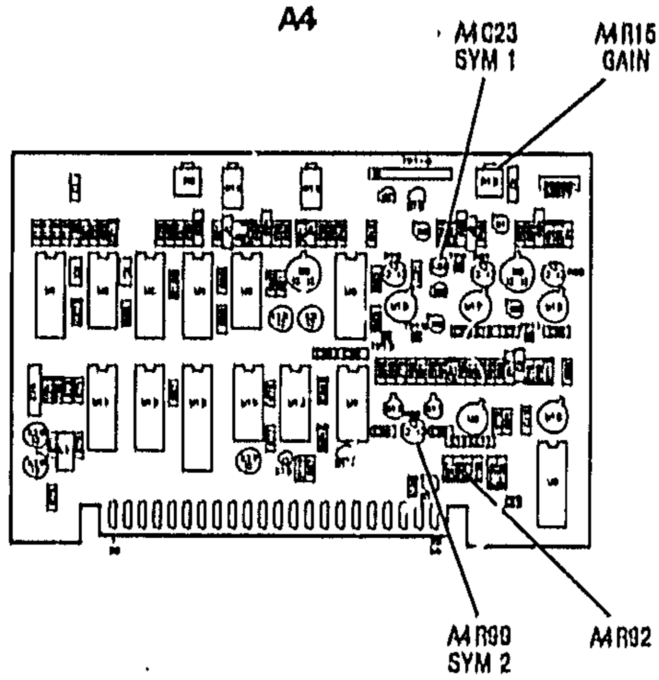


Figure 5-34a. Squarewave Symmetry Adjustment Locations

PROCEDURE:

1. Connect the equipment as shown in Figure 5-33, with A4 on an extender board. On the HP 8350A/B, press **[INSTR PRESET] [CW] [⊔⊓ MOD]**. Set the RF power level to 0 dBm and allow the equipment to warm up for one hour.

NOTE

Insure that you do not overdrive the detector as this will distort the squarewave.

2. On the oscilloscope, select MAIN SWEEP with a 10µs/DIV time. Set Channel A to .005V/DIV and Channel B to 1V/DIV.

3. Press **[CW] [3] [GHz s]**. Alternately adjust C23 (SYM 1) and R99 (SYM 2) for the waveform shown in Figure 5-34b.

4. Press **[CW] [10] [GHz s]**. Check that the squarewave resembles that shown in Figure 5-34b. If not, adjust C23 and R99 for best squarewave while alternately checking the squarewave at 3 GHz.

5. Repeat step 4 for 15 and 20 GHz. Optimize the shape of the squarewave over the entire range of the plug-in. Naturally there will be slight variations at each end of the plug-in's range.

6. With the A4 board on an extender, there may be a slight "pip" on the detected signal. This will disappear when the board is mounted in the plug-in.

7. If you are unable to obtain the correct waveshape, you may need to adjust the value of R92. Replace R92 with a potentiometer having a mid range value the same as that of R92. Vary its resistance until 50% duty cycle is obtained. Remove the potentiometer and measure its value. Replace with a fixed resistor closest to the measured value.

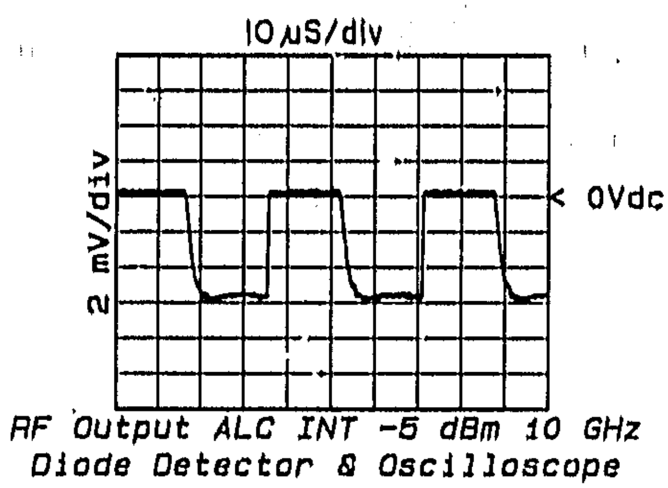


Figure 5-34b. Optimum Squarewave (CHANGE 14)

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Model 83590A Parts List (CHANGE 14) (1 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4	83590-60077	2	1	BD AY - ALC	28480	83590-60077
A4C1	0160-3879	7	4	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C3	0180-2617	1	1	CAPACITOR-FXD 6.8 UF ±10% 35VDC TA	25088	D6R8GS1B35K
A4C4	0160-0945	2	1	CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
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		CAPCITOR-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	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A4C22	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A4C23	0121-0448	8	1	CAPACITOR-V TRMR-CER 2.5-5PF 63V PC-MTG	28480	0121-0448
A4C25	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C26	0160-3879	7	1	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C28	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
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
A4C31	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4CR1	1901-1098	1	6	DIODE SWITCHING 1N5150 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
A4CR8	1901-0535	9		DIODE - SM SIG SCHOTTKY	28480	1901-0535
A4CR9	1901-0535	9		DIODE - SM SIG SCHOTTKY	28480	1901-0535
A4CR11	1901-1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098

Model 83590A Parts List (CHANGE 14) (2 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4J1	1250--0124	7	2	PIN--PROGRAMING DUMPER .30 CONTACT	91506	0136--475G1
A4J2	1250--0124	7		PIN--PROGRAMING DUMPER .30 CONTACT	91506	0136--475G1
A4L1	9140--0210	1	1	INDUCTOR RF--CH--MLD 100UH 5% 166DX 385LG	28480	9140--0210
A4MP2	5040--6040	1	1	BOARD EXTR YELLOW	28480	5040--6040
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--2679	8	1	LBL-IN 83590 .14-IN-WD .4-IN-LG	28480	7121--2679
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--0306	9	2	TRANSISTOR J--FET 2N4392 N--CHAN D--MODE	04713	2N4392
A4Q6	1855--0306	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
A4Q13	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q14	1853--0451	5	1	TRANSISTOR PNP 2N3799 SI TO--18 PD=360MW	01295	2N3799
A4Q16	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4R8	2100--2515	2	1	RESISTOR--TRMR 200K 10% C SIDE--ADJ 1--TRN	30983	ET50W204
A4R10	2100--0670	6	1	RESISTOR--TRMR 10K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--103
A4R12	2100--3753	2	1	RESISTOR--TRMR 200K 10% C SIDE--ADJ 17--TRN	28480	2100--3753
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
A4R20	0698--7250	3	1	RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3--1/8--T0--8251--F
A4R21	0698--7261	8	2	RESISTOR 11K 1% .05W F TC=0±100	24546	C3--1/8--T0--1102--F
A4R22	0698--7262	9	1	RESISTOR 12.1K 1% .05W F TC=0±100	24546	C3--1/8--T0--1212--F
A4R23	0698--7276	5	1	RESISTOR 46.4K 1% .05W F TC=0±100	24546	C3--1/8--T0--4642--F
A4R25	0698--7261	8		RESISTOR 11K 1% .05W F TC=0±100	24546	C3--1/8--T0--1102--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	1	RESISTOR 5.62K 1% .05W F TC=0±100	24546	C3--1/8--T0--5621--F
A4R30	0837--0119	7		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	0699--7240	2	2	RESISTOR 3.40K 1% .05W F TC=0±100	24546	C3--1/8--T0--3401--F

Model 83590A Parts List (CHANGE 14) (3 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
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	5	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
A4R40*	0698--7288	9	1	RESISTOR 147K 1% .05W F TC=0+-100	24546	C3--1/8--T0--1473--F
A4R41	0698--7284	5	1	RESISTOR 100K 1% .05W F TC=0+-100	24546	C3--1/8--T0--1003--F
A4R42	0698--7256	1	3	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	C3--1/8--T0--6811--F
A4R46	0698--7234	5	2	RESISTOR 825 1% .05W F TC=0+-100	24546	C3--1/8--T0--825R--F
A4R47	0837--0005	6	1	THERMISTOR ROD 680--OHM TC=-.7%/C--DEG	28480	0837--0005
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--T0--51R1--F
A4R50	0757--0399	5	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4--1/8--T0--82R5--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--T0--511R--F
A4R53	0698--7232	3	2	RESISTOR 681 1% .05W F TC=0+-100	24546	C3--1/8--T0--681R--F
A4R54	0698--3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4--1/8--T0--2871--F
A4R56	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3--1/8--T0--1002--F
A4R57	0698--7248	2		RESISTOR 3.40K 1% .05W F TC=0+-100	24546	C3--1/8--T0--3401--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--T0--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--T0--196R--F
A4R62	0698--7212	9	3	RESISTOR 100 1% .05W F TC=0+-100	24546	C3--1/8--T0--100R--F
A4R63	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3--1/8--T0--1961--F
A4R64	0698--7256	1		RESISTOR 6.81K 1% .05W F TC=0+-100	24546	C3--1/8--T0--6811--F
A4R68	0698--7222	1	1	RESISTOR 261 1% .05W F TC=0+-100	24546	C3--1/8--T0--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--7266	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--T0--100R--F
A4R73	0698--7212	9		RESISTOR 100 1% .05W F TC=0+-100	24546	C3--1/8--T0--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--7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3--1/8--T0--51R1--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

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

Model 83590A Parts List (CHANGE 14) (4 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
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 ± 10024546	24546	C3-1/8-TO-681R-F
A4R85	0698-7260	7		RESISTOR 10K 1% .05W F TC=0 ± 10024546	24546	C3-1/8-TO-1002-F
A4R87	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1961-F
A4R88	0698-7264	1	2	RESISTOR 14.7K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1472-F
A4R89	0698-7263	0		RESISTOR 13.3K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1332-F
A4R90	0698-7264	1		RESISTOR 14.7K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1472-F
A4R91	0698-7240	3	1	RESISTOR 1.47K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1471-F
A4R92	0698-7270	9	1	RESISTOR 26.1K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-2612-F
A4R93	0698-7260	7		RESISTOR 10K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1002-F
A4R94	0698-7242	5	1	RESISTOR 1.78K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1781-F
A4R96	0698-7251	6	1	RESISTOR 4.22K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-4221-F
A4R97	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1962-F
A4R98	0698-7257	2	1	RESISTOR 7.5K 1% .05W F TC=0 ± 100	28480	0698-7257
A4R99	2100-1738	9	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	820R10K
A4R103	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0 ± 100	24546	C4-1/8-TO-1101-F
A4R105	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-51R1-F
A4R106	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0 ± 100	24546	C4-1/8-TO-196R-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-TO-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
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	00000	ORDER BY DESCRIPTION
A4U1	1826-1186	8	3	IC SWITCH ANLG QUAD 16-DIP-C PKG		
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	1826-1186	8		IC SWITCH ANLG QUAD 16-DIP-C PKG		
A4U9	1826-0319	7	2	IC OP AMP WB TO-99 PKG	A3500	AD3591
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	SN7RLS138
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	1826-0621	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

Model 83590A Parts List (CHANGE 14) (5 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4U10	1826-0319	7		IC OP AMP WB TO-99 PKG	A3510	AD3591
A4VR1	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4VR2	1902-0111	9	1	DIODE-ZNR 1N753A 6.2V 5% DO-7 PD=.4W	28480	1902-0111
A4VR3	1902-3070	5	1	DIODE-ZNR 4 22V 5% DO-35 PD=.4W	28480	1902-3070
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
A4W1	0159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	0159-0005

A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION (CHANGE 14)

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 8-24 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 8-24.

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 8-12. U6 decodes these control lines to select the proper detector input for the desired operating mode.

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 +1V 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.

A4 (ALC), CIRCUIT DESCRIPTION (CHANGE 14) (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 either L PULSE or SQ MOD 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 or SQ MOD input. When the system is used with the HP 8756A Scalar Network Analyzer, the SQ MOD 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). A time delay set by R64 and C26 causes an approximate 5 μsec delay, enabling the RF signal to come to full power before releasing HOLD and thus preventing overshoot. The sample level is maintained during the OFF pulse, thus preventing saturation of the Log and Main ALC amplifiers.

The SQ MOD input is also connected to the PIN MOD 1 Driver (Block N) for RF modulation when the Model 8350A/B internal squarewave modulation is used.

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 whick buffers the detector input. R78 compensates for the offset voltage of the operational amplifier. Q6 and C21 perform the sample and hold function. C23 is used to reduce error due to the gate to source capacitance of Q6.

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 14) (Cont'd)

U6A decodes MUX A0B and MUX A1B (Table 8-12) 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 and R10 adjust the gain of U18, and calibrate midrange power levels for their respective bands.

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 resistors R7 and R8 reduce 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 5 volt ramp proportional to the YTM DRIVE Voltage. R1 (SLP) adjusts the overall slope of Band 0.

Under leveled power conditions, the voltage at U2D pin 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 14) (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.

L RFB goes low during bandswitching to blank the RF power, thus preventing the loop from saturating. When Model 8350A/B RF BLANK is selected, L RFB goes low during retrace and U1D closes, pulling current through C4, forcing TP5 high and turning on the PIN modulators.

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.

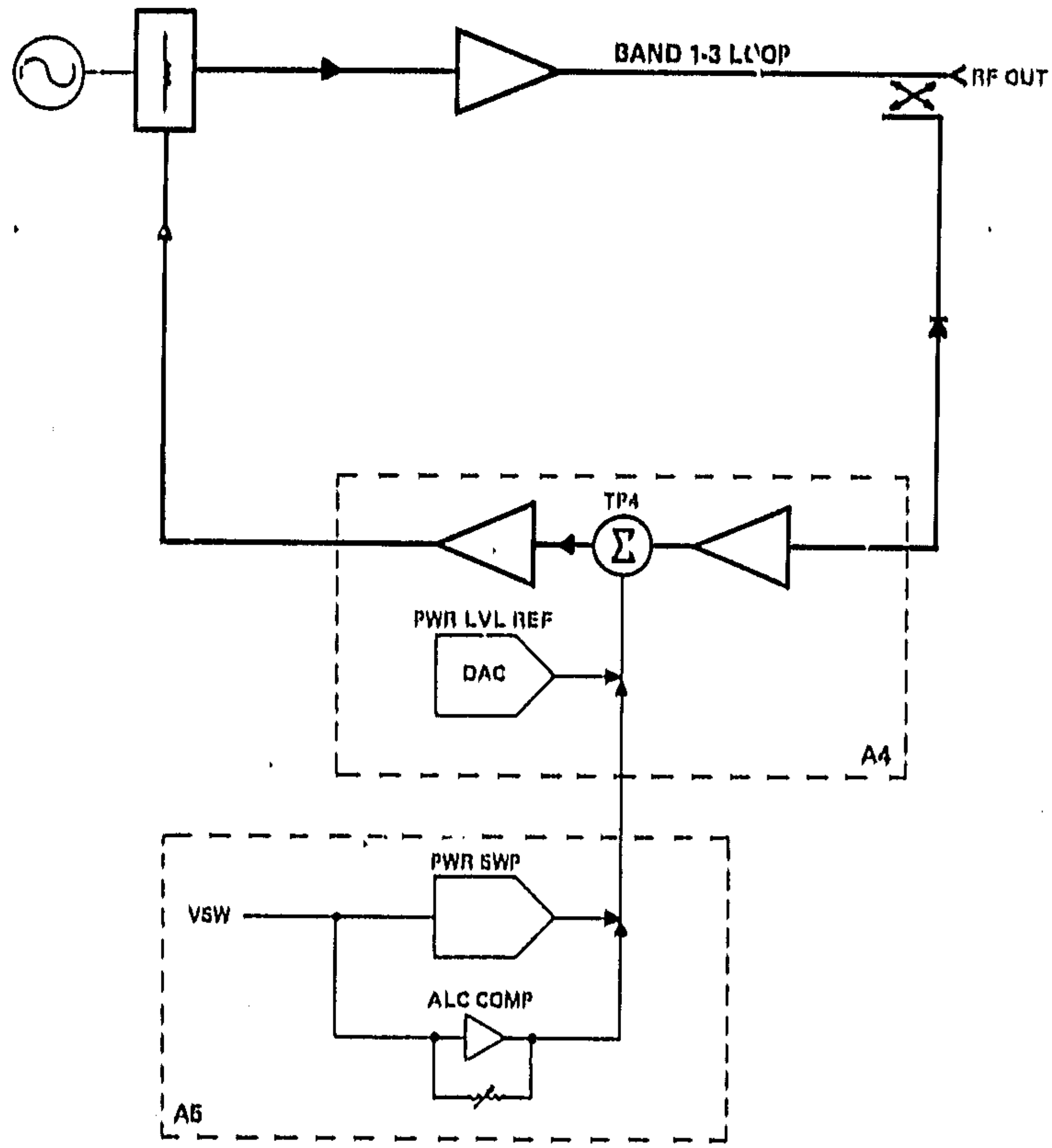
Collector current in common-base transistor Q1 is exponentially related to the base-emitter voltage. The PIN modulator is driven exponentially to maintain constant loop gain.

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

PIN Mod 1 Driver N

R105 compensates for the loss of modulator sensitivity with increasing bias current. Q13 and Q14 act to fully turn the modulator on when either SQ MOD or RF blanking is selected.

R92 is factory selected to match the modulator for best square wave modulation symmetry.



NOTE

DARKER LINES REPRESENT THE BAND 0 AND BAND 1-3 LEVELING LOOPS. LIGHTER LINES REPRESENT CIRCUITRY WHICH CONTRIBUTES TO, BUT IS NOT CONTAINED WITHIN, EITHER LOOP.

Figure 8-24. Simplified ALC Block Diagram (CHANGE 14)

A4 ALC TROUBLESHOOTING (CHANGE 14) (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 83590A 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 causes 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 (Single Band)
NO POWER (All Bands)
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 8-25 configures a typical test setup. Initiate all tests with the **[INSTR PRESET]** condition.

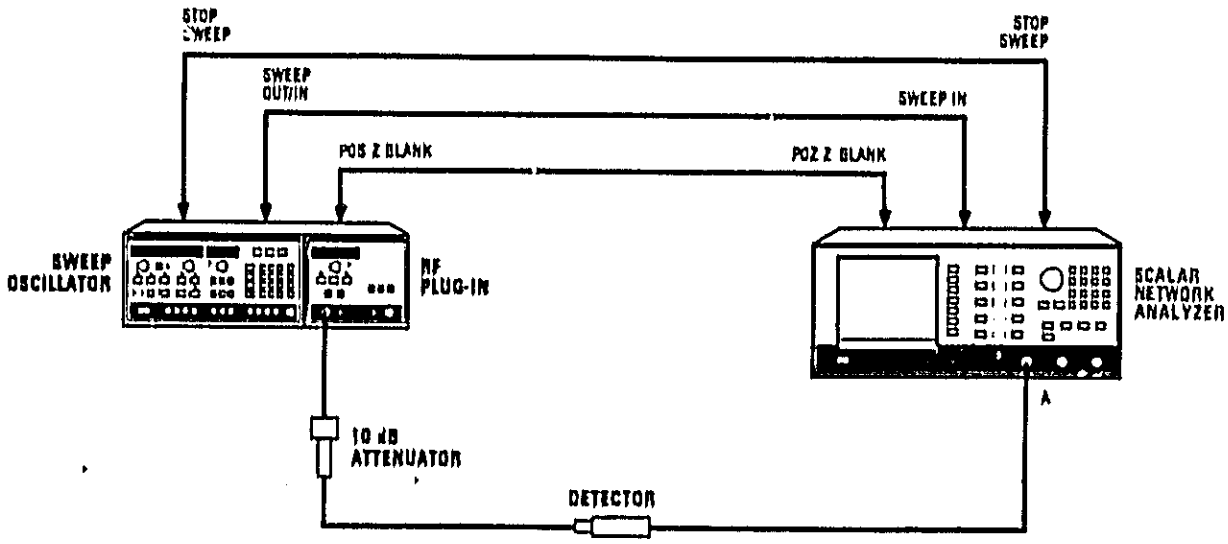


Figure 8-25. Typical ALC Troubleshooting Setup

A4 ALC TROUBLESHOOTING (CHANGE 14) (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 20 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 is on during the entire forward sweep, suspect components common to all bands.

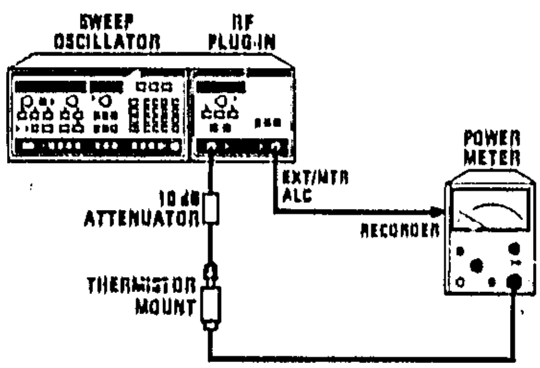


Figure 8-26. Power Meter Leveling Setup

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

- If the UNLEVELED light flashes on briefly three times during the sweep (at 7 and 13.5 seconds into the trace), the problem occurs at the bandswitch points. Check for the RF blanking (L RFB) pulses during bandswitch at A4P1-29, as shown in Figure 8-30. If the signal is missing, trace the problem back through the Model 8350A/B, to the blanking request (L RFBRQ) line on the RF Plug-In A6 assembly. If L RFB is present, but A4TP5 does not clamp at greater than or equal to +4 Vdc during blanking, suspect A4U2D or A4U9.
- 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 Dropouts)

Monitor the RF output with the HP 8756A as shown in Figure 8-25. Optimize the output power with the front panel PEAK control.

- 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 +10 and −5 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.

FULL UNLEVELED POWER (One or More Bands)

If power is unleveled in one Band only, select a sweep width within the unleveled band(s). If power is unleveled in all bands, continue to sweep the plug-in's full range.

- Attempt to level the power externally using the HP 432A/B/C, 436A, or 438A Power Meter as shown in Figure 8-26. Select **MTR** leveling, and enter a 100 second 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.
- 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 8-12). 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 Modulator. If it is below −2 Vdc, suspect the Detectors and Detector Leg.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

NO POWER (Single Band Only)

If no power is detected in one band, but there is leveled power in another band, suspect the components of the RF path appropriate to the faulty band within the ALC loop.

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 (at least +12 dBm from 2 to 20 GHz) is then detected in all bands, the RF Amplifier (A14), the DC Return (A15), the Isolator (AT1), and the YTM (A12) are verified. Suspect primarily the appropriate detector. Also inspect the modulator, as well as the A4 Mod Driver and Detector Selection Switch.
- If the RF signal for all bands is missing, check the A6 SRD and PIN Diode Bias circuit.

NO POWER (All Bands)

NOTE

Turn off line power before removing or installing any assembly.

- If no power is detected in any band, remove the A4 ALC assembly. This removes all bias from the modulator, and should allow full RF power to be transmitted. If there is still no power, check the rear panel AUX OUTPUT for approximately 0 dBm to verify that the A13 YIG Oscillator is providing an RF output. Refer to RF Troubleshooting for details.
- If removing the A4 assembly causes 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. It the situation improves, suspect a failure on the A5 assembly.

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

A4 ALC TROUBLESHOOTING (CHANGE 14) (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, CR1
DETECTOR LEG E F G
MODULATOR LEG I L
MOD DRIVER N
MODULATOR A13
SAMPLE AND HOLD E K

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 e] [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., B1 is held high by selecting a CW frequency in Bands 1 through 3; 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, detector compensation, and power sweep signals.

The detector 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 U11 establishess the absolute power level. The −10V REF from the A6 assembly is scaled to yield from 0 Vdc (−5 dBm displayed) to the +10 Vdc (+20 dBm displayed) at TP2. (This breaks down to a voltage step of 0.40 Vdc per 1.0 dB of power over the dynamic range, or 6.00 Vdc at +10 dBm.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

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

[SHIFT] [5] [0]

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

- If the waveform at TP2 is not correct, check for −10V REF, and trace any problem back to the 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 CR1. Use the EXT MTR mode to bypass this diode while troubleshooting.

U2C adds the front panel amplitude adjustment (EXT CAL) used with external leveling. The following levels should be seen at TP1 with A5 removed and INT leveling selected: +0.3 Vdc for −5 dBm, and +7.0 Vdc for +20 dBm. An amplitude modulation (AM) signal of 1.0 V p-p at P1-4 will produce roughly 260 mV p-p at TP1. (Note that U3A and CR1 in the feedback path around U2A change the gain depending on the band and the desired power level. This may result in a 1.0 Vdc difference between bands at +20 dBm.)

DETECTOR CR1 / DETECTOR SELECTION SWITCH B

The detector CR1 is tested simply by checking the output voltage under full leveled power or full unleveled power conditions.

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 in the suspected band, 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 P1-19 to isolate the output of the modulator driver from the modulators. Reinstall the A4 board. This removes bias from the modulator, allowing full RF power transmission, while providing detector bias.

- If full leveled power (+10 dBm from 2 to 20 GHz) or full unleveled power (at least +2 dB higher than leveled) is measured, sweep only the band in question and check the voltages at the detector input against the values shown in Table 8-11. (Use high-impedance 10:1 probes.)

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

Table 8-11. Detector Voltages

	Full Leveled +10 dBm	Full Unleveled +20 dBm
Bands 1-3 (A4P1-20)	−100 to −120 mV	−200 to −600 mV

- If the detector is working and the Detector Selection Switch is suspected, sweep only in the faulty 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 8-32.

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 −5 dBm at any CW frequency.
3. Press Model 83590A **[EXT]** ALC.

A4 ALC TROUBLESHOOTING (CHANGE 14) (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. (When sweeping across a bandswitch point, RF blanking pulses will saturate TP5 at +5 Vdc regardless of input.)

6. Remove jumper from A4TP11 to ground.

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

MODULATOR DRIVER N

The voltage-to-current conversion and current gain needed to drive the modulators 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 modulator, shunting more RF energy to ground and allowing less to pass through. Since the modulator is essentially current-controlled, the voltages measured at TP6, P1-19, 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 stages, TP5 can be forced high (+5 Vdc). Using a jumper, ground A4TP11. Press Model 8350A/B **[CW]** and select a CW frequency in the appropriate band. Select **[EXT]** ALC, and enter an RF power level of −5 dBm via front panel controls. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. Verify a signal level of approximately +5 Vdc at TP5. Remove jumper from A4TP11 to ground.

R92 is adjusted for 50% duty cycle of the square wave.

- Set the HP 8350A/B to CW, SQ MOD on. Connect the RF output to a crystal detector and oscilloscope. While observing the square wave, adjust R92 for 50% duty cycle.

MODULATOR

The internal modulator for this plug-in is housed in a combination microcircuit package, A16 Modulator/Coupler. Figure 8-27 provides a simplified schematic for this positive-bias, shunt-type attenuator. As more current is supplied through the modulator bias pin, the shunt diode turns on harder, sinking more RF power to ground and allowing less to reach the front panel.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

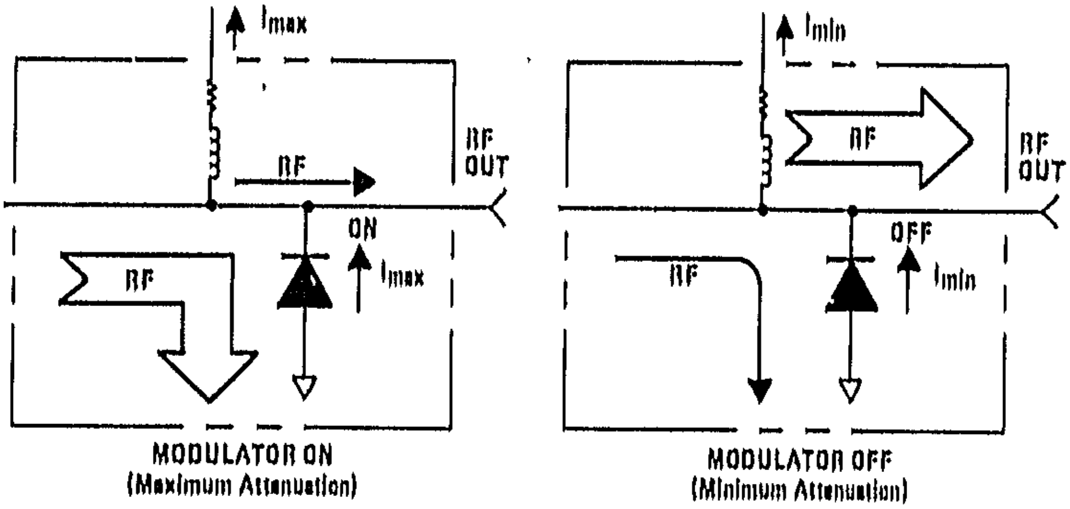


Figure 8-27. Simplified Modulator Schematic

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

NOTE

Turn off line power before removing or installing any assembly.

- If low or no RF power is observed, remove 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 Model 83590A **[EXT]** ALC. Attach a jumper from A4TP11 to ground. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully clockwise. This should result in −7 Vdc at TP5, essentially removing bias from the modulator. Measure the voltage across R49. It should be 0V. If this is not the case, isolate each modulator from its drive circuitry by applying a piece of cellophane tape to the pin edge connection: P1-19. 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 U8C and Q14. Remove jumper from A4TP11 to ground.

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 in all bands, check the RF level at the rear panel AUX OUTPUT connector. Refer to the RF Schematic Diagram at the end of Section VIII for the proper levels. Check the RF levels around the Power Amplifier A14 with no modulation. A14 should output approximately +26 dBm with about +13 dBm at the input.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

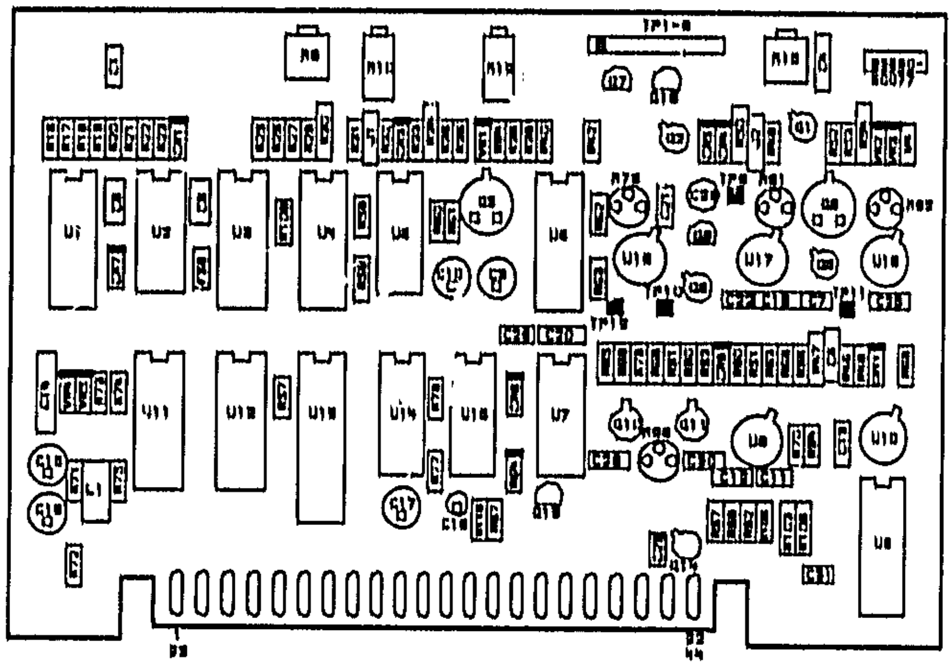
- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted). Select Model 83590A **[EXT]** ALC. Attach a jumper from A4TP11 to ground. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. The voltage level at TP5 should be +5 Vdc. Concurrently, the voltage level at the output of the Mod Driver, P1-19, should be approximately +0.6 Vdc to +0.8 Vdc.

  1. If the voltages are significantly higher than this, the modulator diode is probably open.
  2. Check TP6 for approximately +2.0 Vdc. The difference between the test point and the corresponding pin-edge connector gives an indication of how much current is flowing to the modulator.

SAMPLE AND HOLD E K

There are adjustments to improve the shape of the squarewave. C23 in block E and R99 in block K are used to eliminate offset in the Input Sample and Hold, and Error Sample and Hold circuits respectively. They act to effectively cancel charge passed through the gate to source capacitance of the FET. Refer to Paragraph 5-27 for the proper adjustment procedures.

A4



HP P/N 83590-60077

Figure 8-29. A4 ALC Component Locations (CHANGE 14)

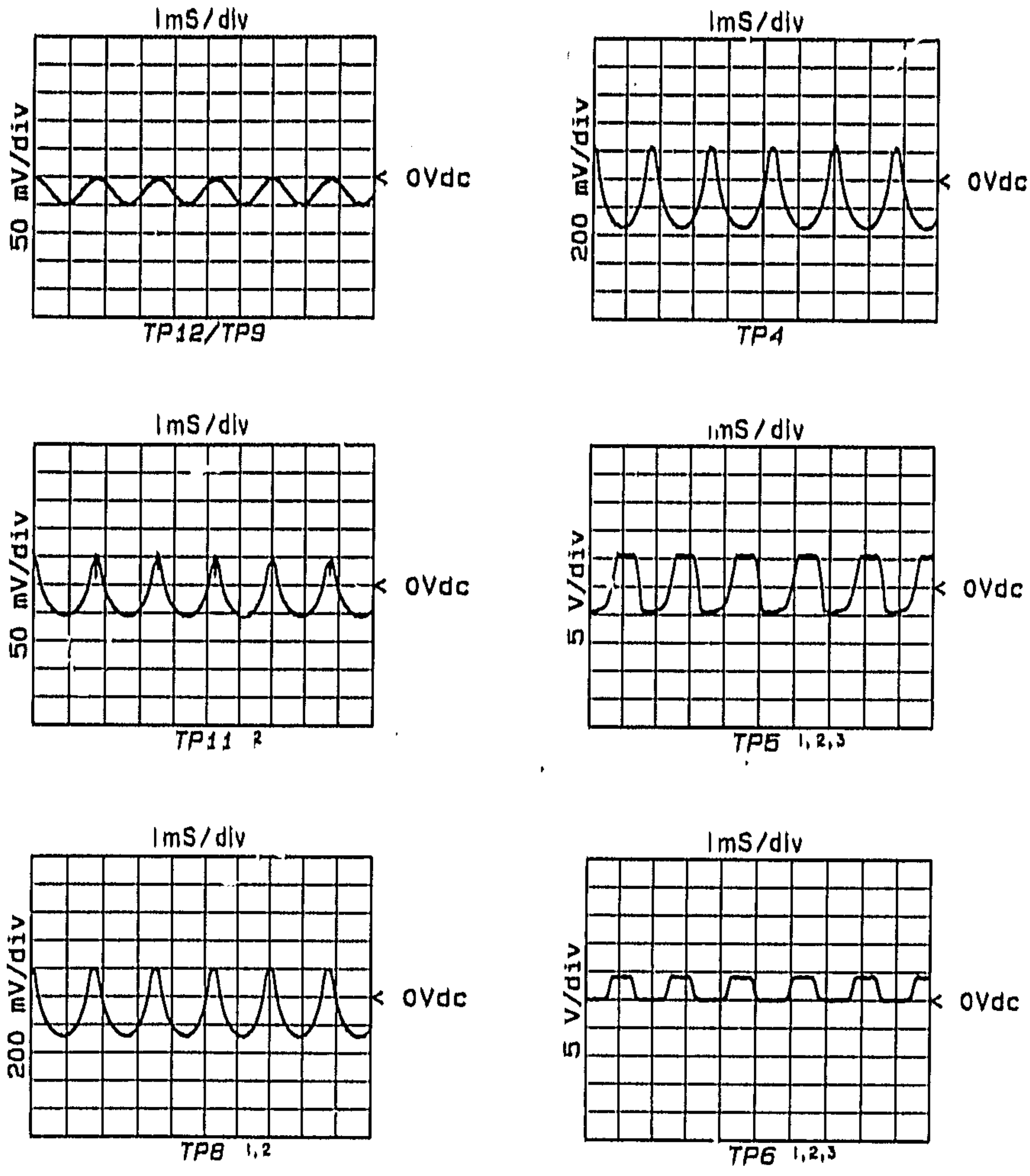
Table 8-12. Leveling Control Lines (CHANGE 14)

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

A401 Pin-out Table (CHANGE 14)

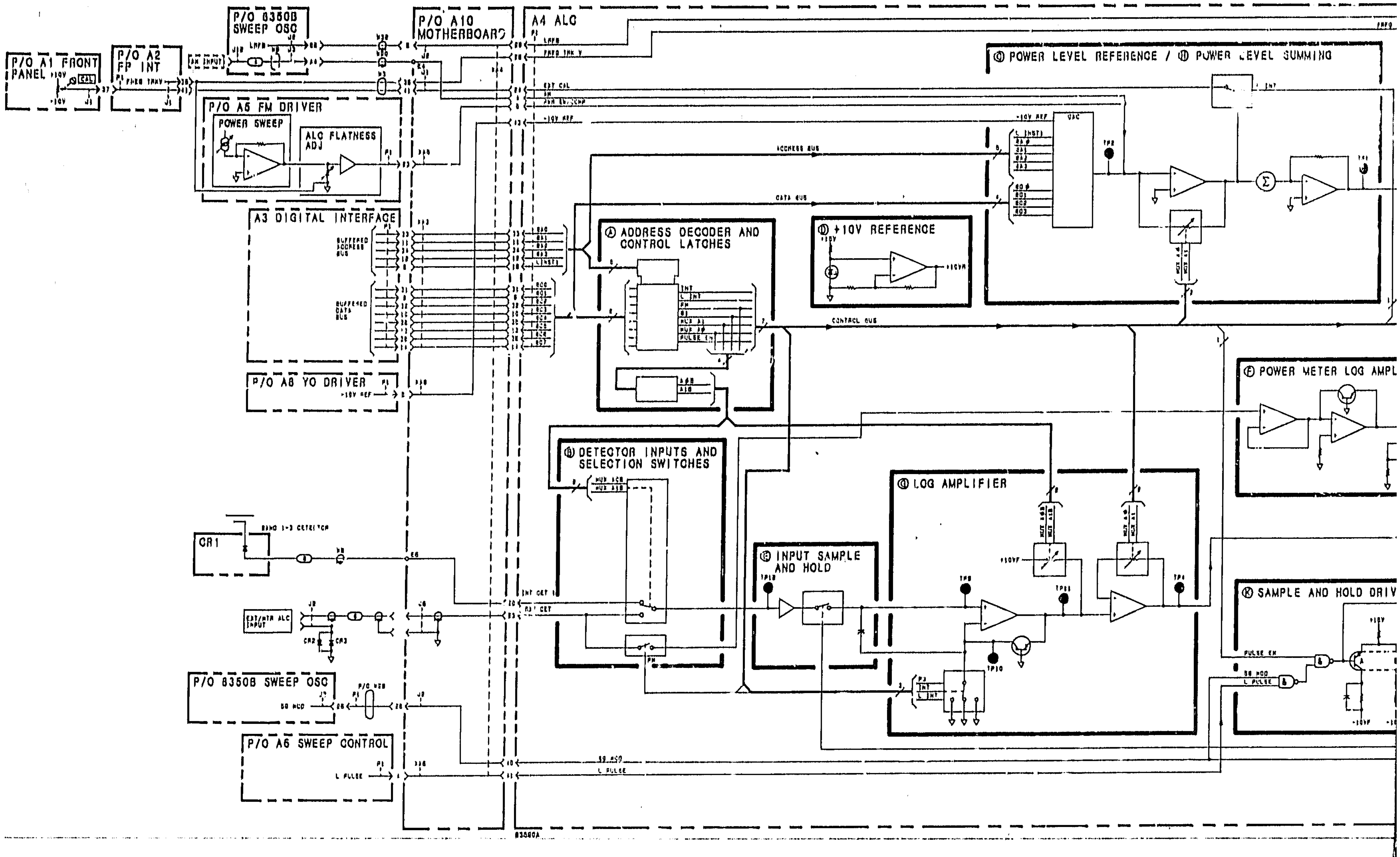
A4P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1	EXT DET RET	IN	J2	P
23	EXT DET	IN	J2	B
2	L UNLVL	OUT	A6P1-40, A10J1-12	M
24	EXT CAL	IN	A10J1-41	H
3	PWR REF	OUT	NOT USED	C
25			NOT USED	
4	AM	IN	P1-A4	C
26			NOT USED	
5	PWR SW/COMP	IN	A5P1-23	C
27	+5V	IN	A3P1-6,7	P
6			NOT USED	
28	−15V	IN	P2-28	P
7	+10V	IN	P1-8	P
29	L RFB	IN	P2-56	L, N
8	GND DIG			P
30	GND DIG			P
9	BD1	IN	A3P1-9	A, C
31	BD0	IN	A3P1-31	A, C
10	BD3	IN	A3P1-10	A, C
32	BD2	IN	A3P1-32	A, C
11	BA1	IN	A3P1-11	A, C
33	BA[illegible]	IN	A3P1-33	A, C
12	BA[illegible]	IN	A3P1-12	A, C
34	BA2	IN	A3P1-34	A, C
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			P
37	GND ANLG			P
16			NOT USED	
38	+15V	IN	P2-20	P
17	−10V	IN	P1-13	P
39	−40V	IN	P1-11	P
18	L INST1	IN	A3P1-8	A, C
40	SQ MOD	IN	P2-26	K, N
19	MOD 1	OUT	A10E1	N
41	L PULSE	IN	A6P1-25	K
20	INT DET	IN	CR1	B
42	INT DET RET	IN	CR1	
21			NOT USED	
43	−10V REF	IN	A8P1-3	C
22	MO[illegible] DRIVE	OUT	NOT USED	L
44			NOT USED	



1. Power: 10 dBm. Offset depends on power level and **EXT/MTR ALC "CAL"**.
2. CW mode.
3. Adjust **EXT/MTR ALC "CAL"** to obtain waveshape.

Figure 8-33. Open Loop Waveforms (CHANGE 14)



P/O A1 FRONT PANEL
P/O A2 FP INT
P/O 8350B SWEEP OSC
P/O A10 MOTHERBOARD
A4 ALC
P/O A5 FM DRIVER
POWER SWEEP
ALC FLATNESS ADJ
A3 DIGITAL INTERFACE
P/O A8 YO DRIVER
CR1
P/O 8350B SWEEP OSC
P/O A6 SWEEP CONTROL
Ⓒ POWER LEVEL REFERENCE / Ⓗ POWER LEVEL SUMMING
ADDRESS BUS
DATA BUS
Ⓐ ADDRESS DECODER AND CONTROL LATCHES
Ⓓ +10V REFERENCE
CONTROL BUS
Ⓕ POWER METER LOG AMPL
Ⓑ DETECTOR INPUTS AND SELECTION SWITCHES
Ⓖ LOG AMPLIFIER
Ⓔ INPUT SAMPLE AND HOLD
Ⓚ SAMPLE AND HOLD DRIV

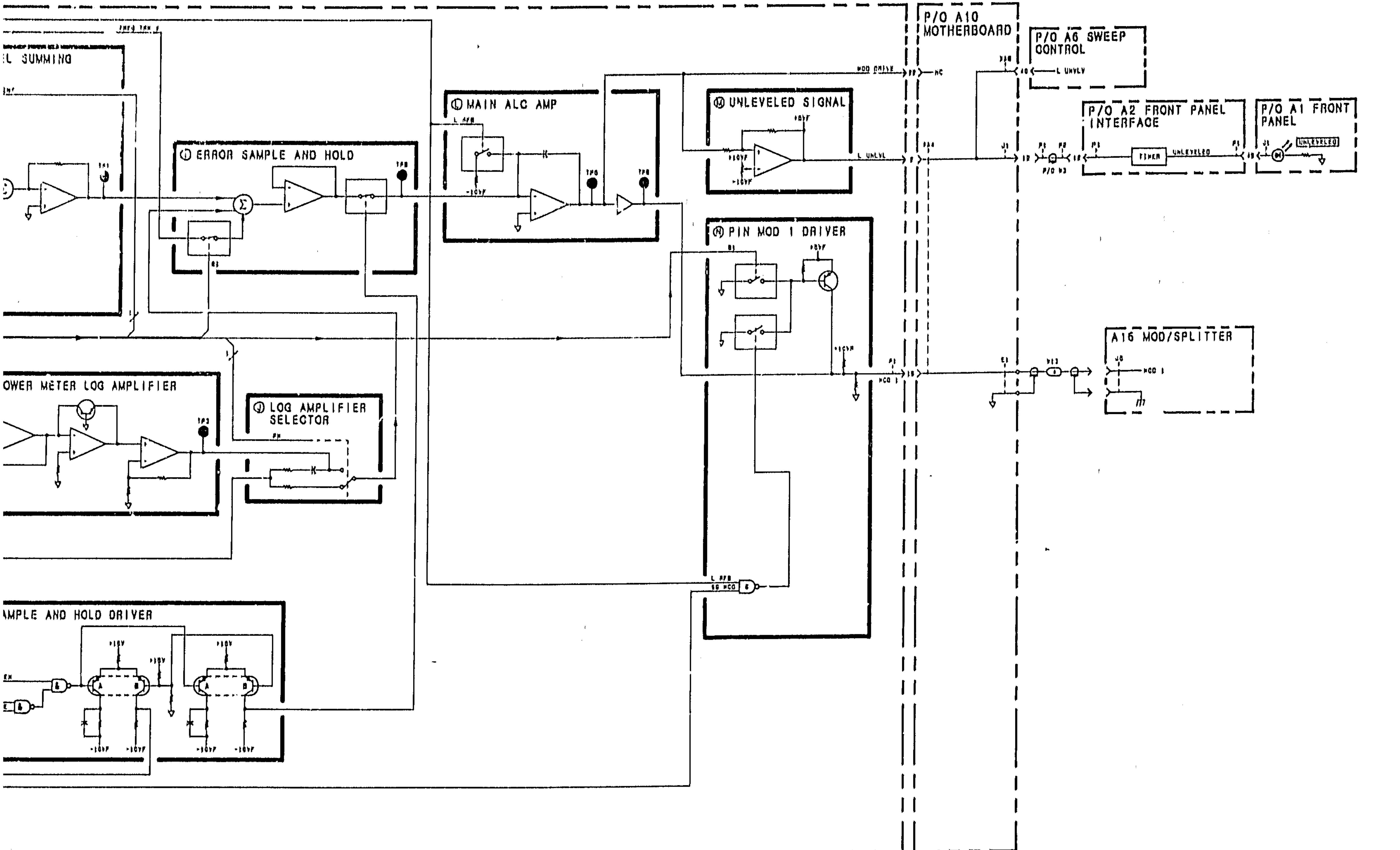
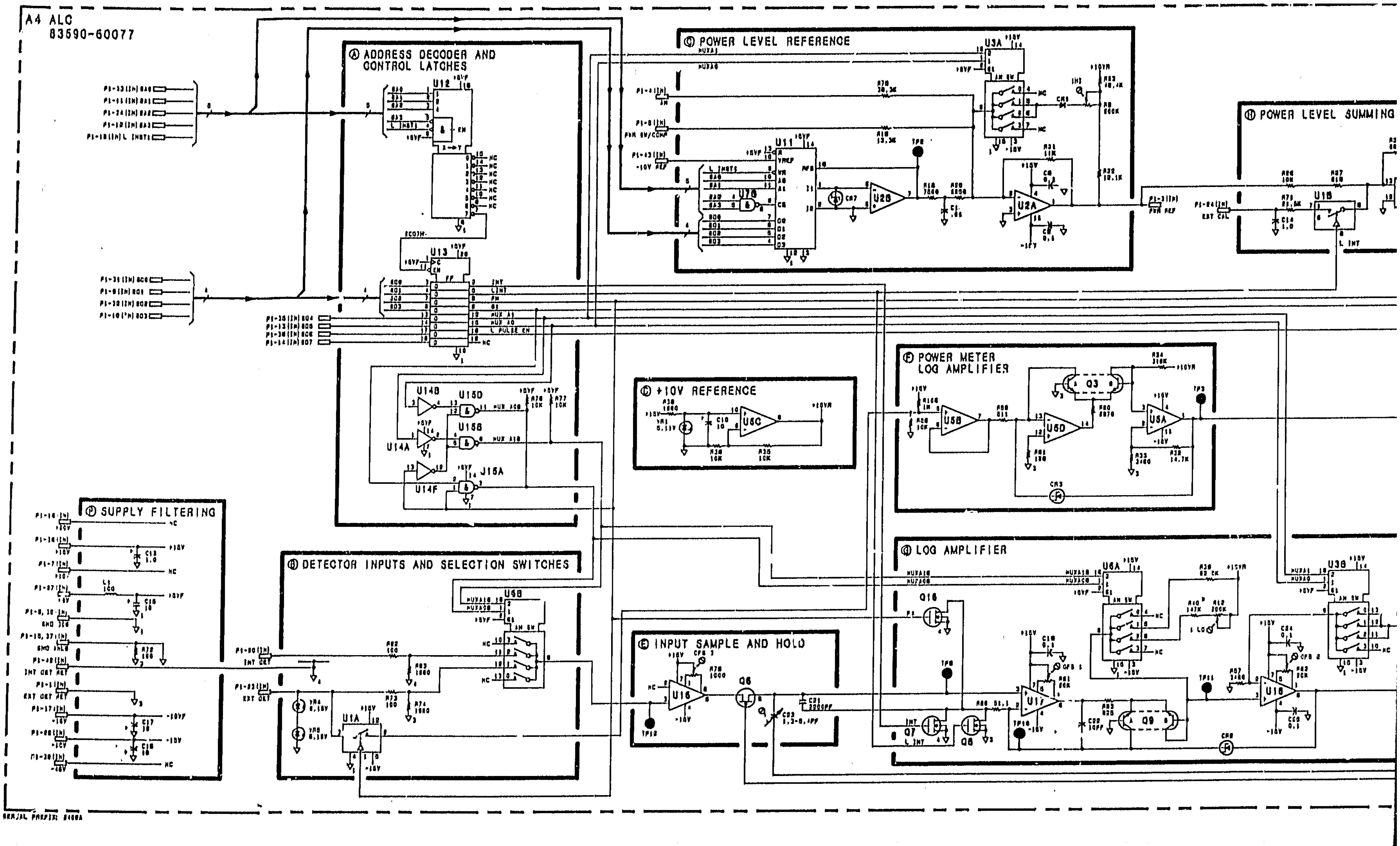


Figure 8-26. A4 ALC Block Diagram (CHANGE 14)


A4 ALC
83590-60077
(A) ADDRESS DECODER AND CONTROL LATCHES
(B) DETECTOR INPUTS AND SELECTION SWITCHES
(C) POWER LEVEL REFERENCE
(D) +10V REFERENCE
(E) INPUT SAMPLE AND HOLD
(F) POWER METER LOG AMPLIFIER
(G) LOG AMPLIFIER
(H) POWER LEVEL SUMMING
(P) SUPPLY FILTERING

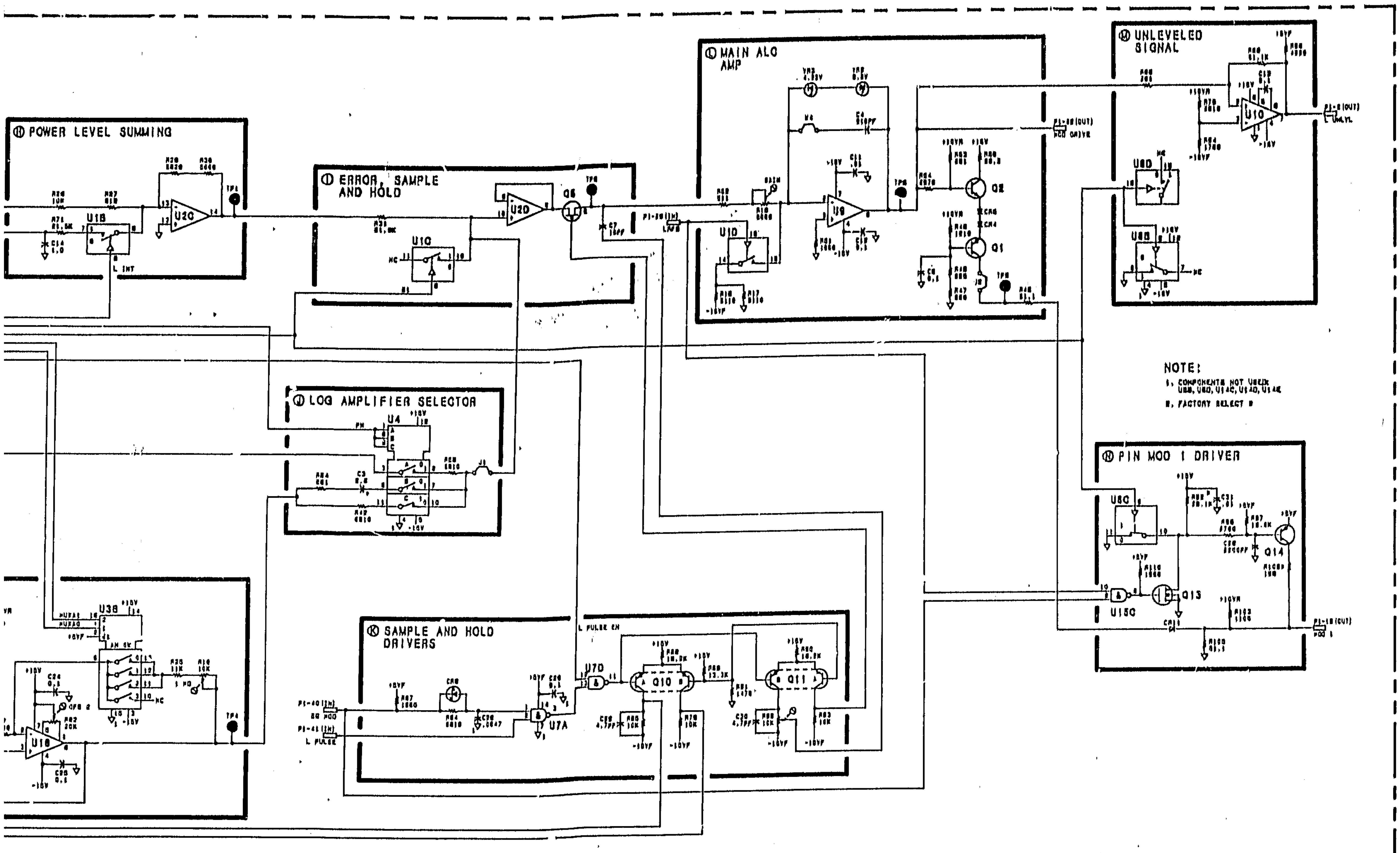


Figure 8-34 A4 ALC Schematic Diagram(CHANGE 14)

CHANGE 15
(Supersedes CHANGE 10)

This change installs Revision 6 firmware.

Page 6-6, Table 6-3:
Change A3 to HP and Mfr. Part Number 83525-60080 CD 6, DIGITAL INTERFACE ASSEMBLY (does not include A3U1 and A3U2).
Change A3U1 to HP and Mfr. Part Number 83590-80006 CD 7.
Change A3U2 to HP and Mfr. Part Number 83590-80007 CD 8.

Page 8-35, Figure 8-23:
Change A3 DIGITAL INTERFACE part number in the top left-hand corner of the schematic to 83525-60080.
Change the SERIAL PREFIX in the bottom left-hand corner of the schematic to 2412A.

CHANGE 16

This change incorporates modifications to the A2 Sub Panel Board and A7 YTM Driver Board.

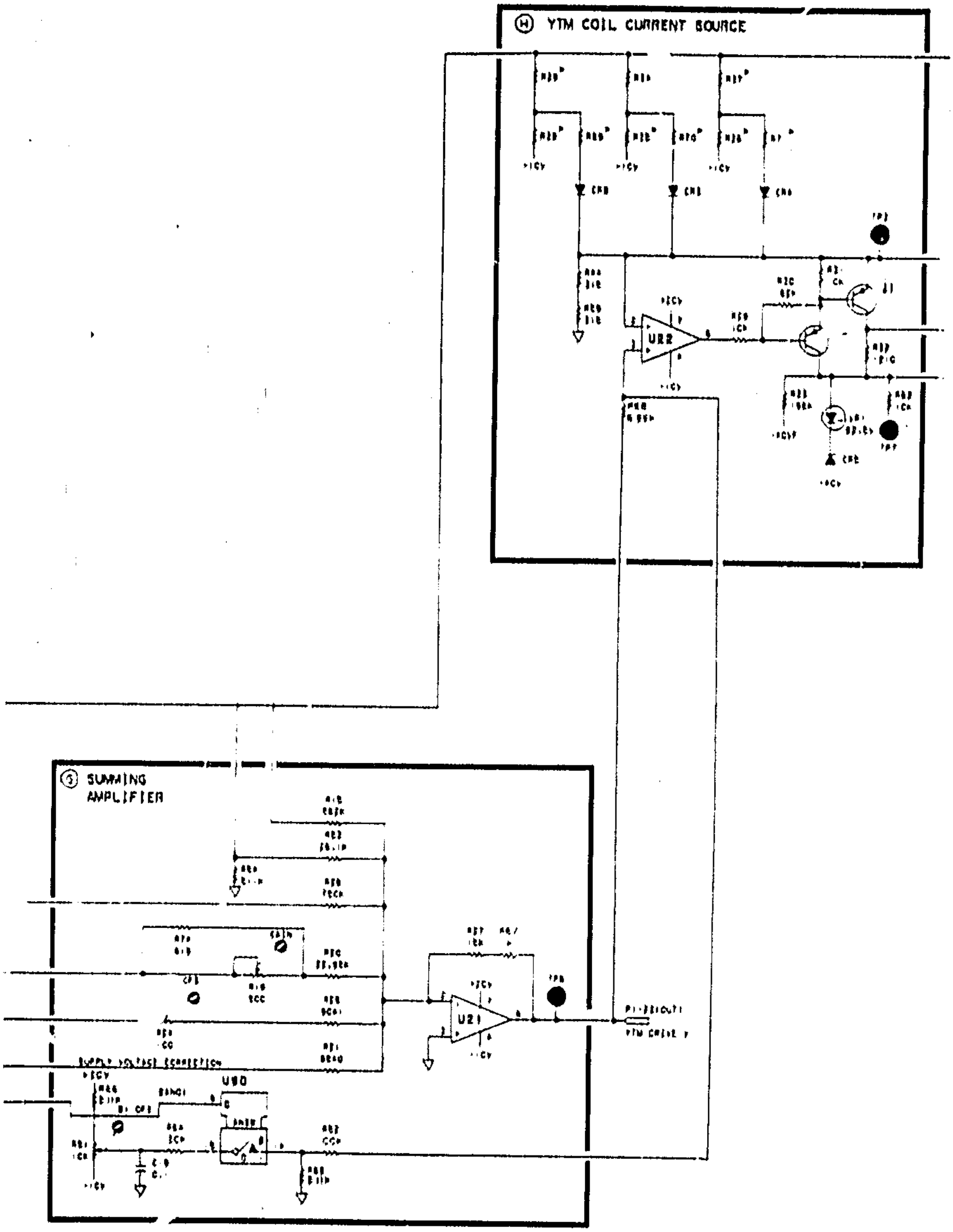
Page 6-6, Table 6-3:
Change A2R1 to HP Part Number 2100-3103, CD *.

Page 6-14, Table 6-3:
Change the A7 YTM Driver assembly HP and Mfr. Part Number to 83595-60068, CD 4.

Page 6-15, Table 6-3:
Change A7R52 to: 0698-6358, CD 2, RESISTOR 100K .1% .125W F TC=0±25, 28480, 0698-6358.
Change A7R64 to: 0698-6977, CD 1, RESISTOR 30K .1% .125W F TC=0±25, 28480, 0698-6977.
Change A7R65 to: 0757-0438, CD 3, RESISTOR 5.11K .1% .125W F TC=0±100, 28480, 0757-0438.
Change A7R66 to: 0757-0438, CD 3, RESISTOR 5.11K .1% .125W F TC=0±100, 28480, 0757-0438.
Change A5R67 to: 0698-6362, CD 8, RESISTOR 1K .1% .125W F TC=0±25, 28480, 0698-6362.
Change A7R68 to: 0698-8469, CD 0, RESISTOR 6.99K .1% .1W F TC=0±4, 28480, 0698-8469.
Delete A7CR6.

Page 8-63, Figure 8-52 (A7 Component Locations):
Delete R68.
Change R66 to R68.
Change CR6 to R66.

Page 8-63, Figure 8-60 (A7 Schematic):
Replace the function blocks G SUMMING AMPLIFIER and H YTM COIL CURRENT SOURCE with *P/O A7 YTM DRIVER SCHEMATIC DIAGRAM (CHANGE 16)* in this document.
Change the part number in the top left-hand corner of the schematic to: 83595-60068.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2413A.



P/O A7 YTM Driver Schematic Diagram (CHANGE 16)

CHANGE 17
(Supersedes Part Numbers in CHANGE 16)

This change installs Revision 7 firmware.

Page 6-6, Table 6-3:
Change A3U1 to HP and Mfr. Part Number 83590-80010, CD 3.
Change A3U2 to HP and Mfr. Part Number 83590-80011, CD 4.

CHANGE 18

This change documents the increase in range of the sequential-band delay compensation adjustments.

Page 6-15, Table 6-3:
Change A7R42 to HP and Mfr. Part Number 2100-0544, CD 3, RES-TRMR 100K 10%.
Change A7R43 to HP and Mfr. Part Number 2100-3611, CD 1, RES-TRMR 50K 10%.

Page 8-63, Figure 8-60:
In block E DELAY COMPENSATION change the following items:
A7R42 to 100K
A7R43 to 50K

CHANGE 19

This change documents a revision to the Motherboard Assembly and Power Supply Cables.

Page 6-18, Table 6-3:
Change A10 to HP and Mfr. Part Number 83595-60078, CD 6.

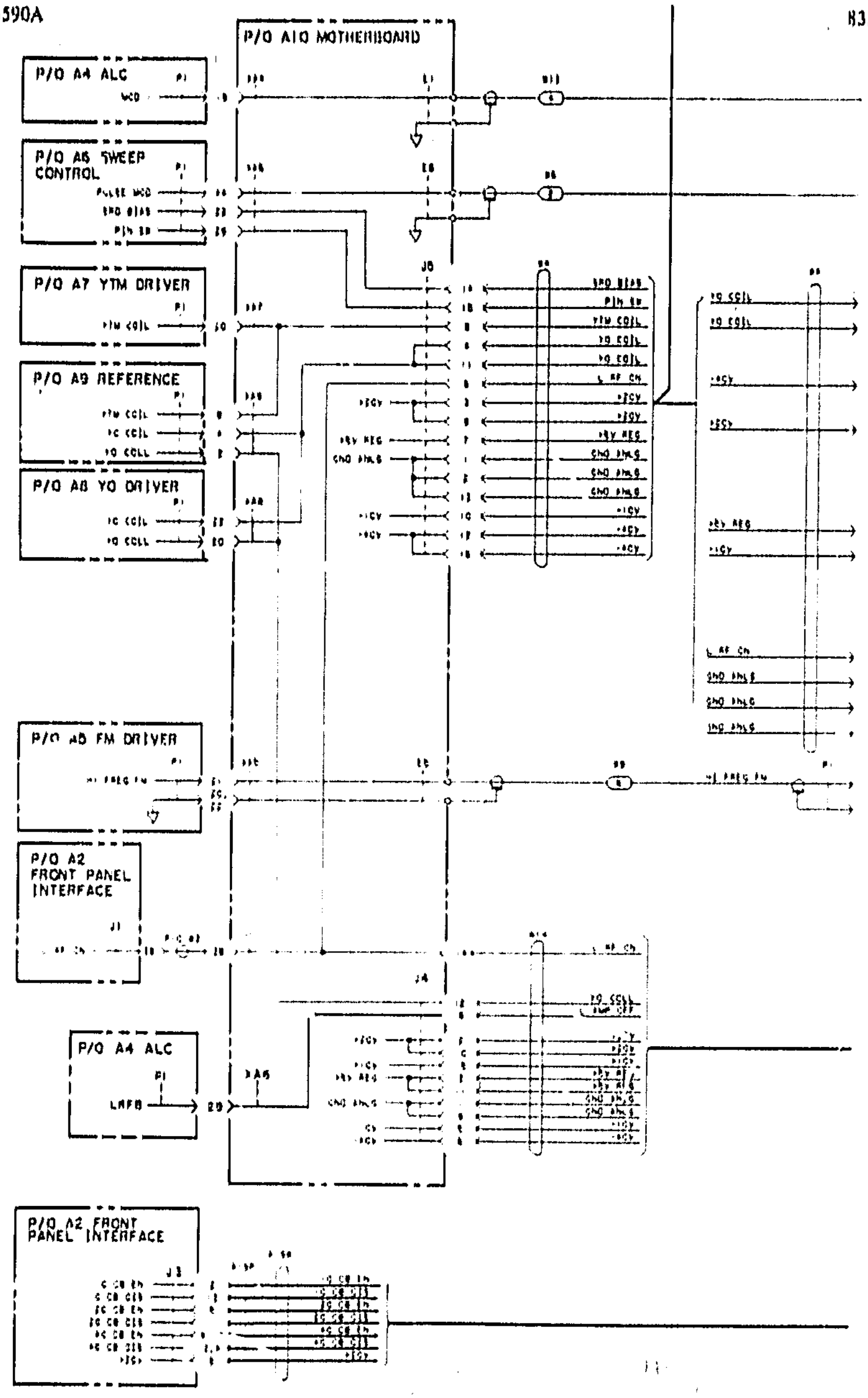
Page 6-19, Table 6-3:
Change A10J2 to HP and Mfr. Part Number 1251-6952, CD 7.
Change A10J3 to HP and Mfr. Part Number 1251-6343, CD 0.

Page 6-22, Table 6-3:
Change W28 to HP and Mfr. Part Number 83525-60066, CD 8.

Page 8-75, Figure 8-76. RF Schematic Diagram:
Replace left part of Figure 8-76 with *P/O Figure 8-76. RF Schematic Diagram (CHANGE 19)* in this document.

Page 8-76, Figure 8-79. A10 Motherboard Component Locations:
Replace Figure 8-79 with *Figure 8-79. A10 Motherboard Component Locations (CHANGE 19)* in this document.

Page 8-81, Table 8-15. 83590A Motherboard Wiring List (5 of 5):
Replace Table 8-15 with *Table 8-15. 83590A Motherboard Wiring List (5 of 5) (CHANGE 19)* in this document.



P/O figure 8-76. RF Schematic Diagram (CHANGE 19)

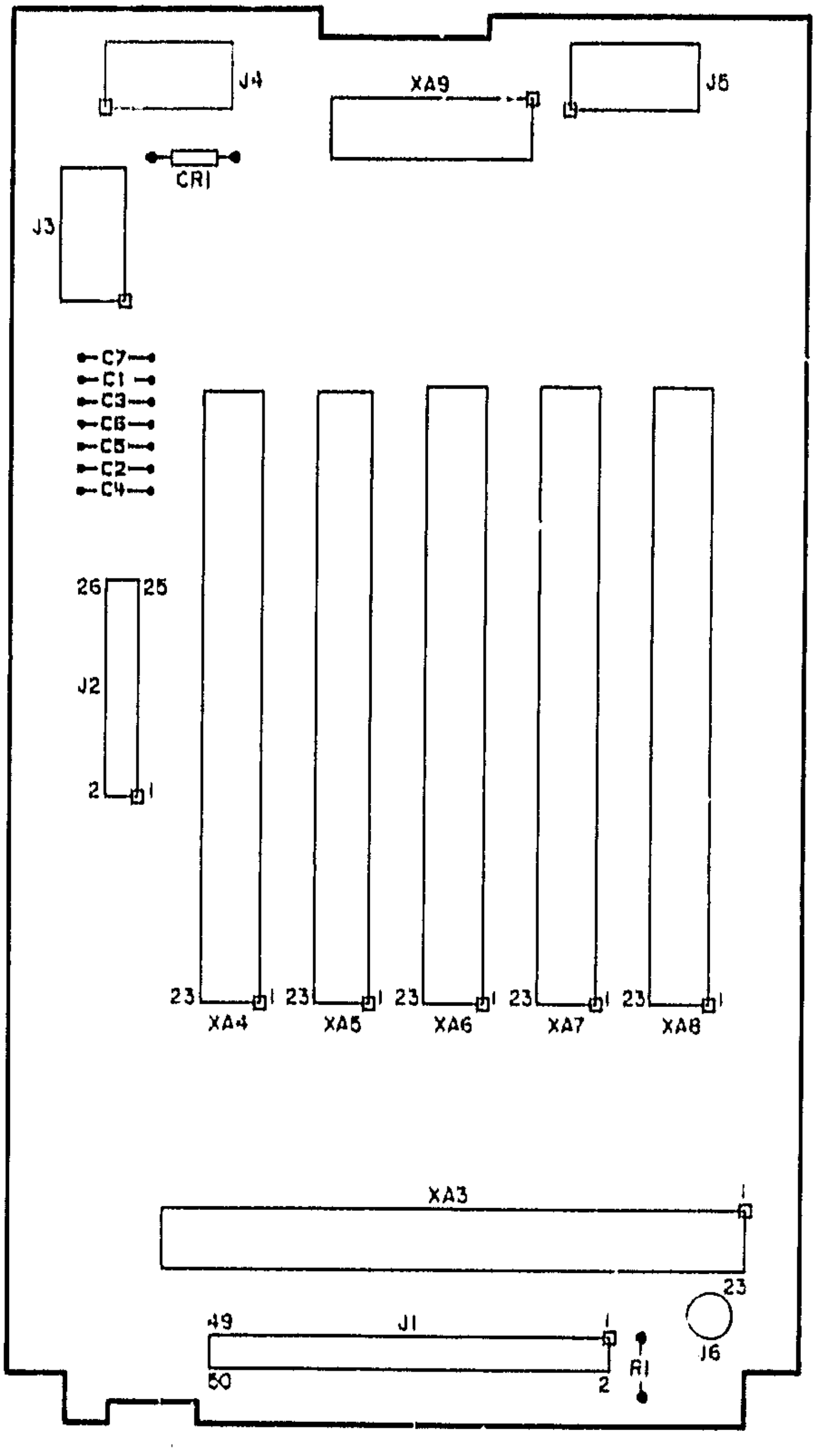


Figure 8-79. A10 Motherboard, Component Locations (CHANGE 19)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-In Interface P2	Dig Intfc A3P1	Dig Intfc A3J1	ALC A4P1	FM A5P1	Sweep Control A6P1	YTM A7P1	YO A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-In Interface A10J2	Power Supply Interface A10J3	YO/YTM Ribbon Cable A10J5	RF Ribbon Cable A10J4	Miscellaneous
+20V	P1-7	+20V Regulated	7				16	16		16	16	3,11	42		7	3,9	2,10	C7
+20V RET	P1-14	+20V Return	14												14			
+20V RET SENSE	P1-6	+20V Return Sense	6												6			
+20V SENSE	P1-15	+20V Sense	15												15			
+15V	P2-29	+15V Regulated		29			38	38	38	38	38			15				C6
+10V	P1-8	+10V Regulated	8				7	7	7	7	7		46		8		15	C5
+/−10V RET	P1-3, 16	+/−10V Return	3, 16												3,6			
+5V	A3P1-6,7	+5V Internal for RF Plug-In			6,7		27	27	27	27	27		2					
+5VA	P2-30	+5V for 8350A		30														
+5VB	P2-18,60,61	+5V for RF Plug-In		18,60,61		35,36,38												
+5V REG	A9P1-7	+5V Regulated										7				7	3,11	
+5V UNRFG	P2-63	+5V Unregulated		63								12		18,20				C4
−10V	P1-13	−10V Regulated	13				17	17	17	17	17		40		13	10	5	C3
−10V RET SENSE	P1-12	−10V Return Sense	12												12			
−10V SENSE	P1-4	−10V Sense	4												4			
−10V UNREG	P1-5	−10V Unregulated	5												5			
−15V	P2-28	−15V Regulated		28			28	28	28	28	28			13				C2
−40V	P1-11	−40V Regulated	11				6,39			6,39	6,39				11	12,16	6	C1
−40V RET	P1-1	−40V Return	1												1			
−40V RET SENSE	P1-10	−40V Return Sense	10												10			
−40V SENSE	P1-2	−40V Sense	2												2			
GND ANLG	W28P1-8 P2-27,68,69	Analog Ground					15,37	15,37	37,41 43	15,18, 24,26, 28 37	15,18, 24,26, 28,37	6	48	10,11, 12,24	10,12,14 16,1,3,6	1,2 13	1,9	C1-C7, R1
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		8,30	8,30	8,30	8,30	8,30		8					R1
GND SENSE	W28P1-4	Analog Ground Sense													4			

[1] Coaxial Cable
[2] Shielded Cable
* Not used on this assembly

Table 8-15. 83590A Motherboard Wiring List (5 of 5) (CHANGE 19)

CHANGE 20

This change documents a replacement kit and an exchange replacement kit for the Power Amplifier Assembly.

Page 6-2, Table 6-1:
Change A14 New Part Number to 83592-60113, Rebuilt Part Number to 83592-60114, Description to Power Amp, 2.3 to 7.0 GHz Kit.

Page 6-20, Table 6-3:
Change A14 to HP and Mfr. Part Number 83592-60113, CD 7, POWER AMPLIFIER KIT.
Change A14 to HP and Mfr. Part Number 83592-60114, CD 8, EXCHANGE POWER AMPLIFIER KIT.

Page 6-20, Table 6-3:
Change A14A1C4 to HP part number 0180-0228, 22ufd 15V CD 5.
Add A14A1C9 HP part number 0160-4084, .1ufd 50V CD 8.
Add A14A1CR1 and A14A1CR2 HP part number 1901-0033, 180V 2A CD 2.
Change A14A1J1 to HP part number 1200-0482 CD 5.
Change A14A1MP1 to HP part 5021-5320 CD 8.
Change A14A1MP3 to HP part number 1251-3172 CD 4.
Change A14A1MP5 to HP part number 1200-0173 CD 5.
Add A14A1Q3 HP part number 1854-0477 CD 7.
Add A14A1Q4 HP part number 1853-0281 CD9.

Page 6-21, Table 6-3:
Add A14A1R32 HP part number 0698-7253 5.11K 1% .05W CD 0.
Add A14A1R33 HP part number 0698-7284 100K 1% .05W CD 5.
Add A14A1R34 HP part number 0698-7270 26.1K 1% .05W CD 9.
Add A14A1R35 HP part number 0698-7243 1.96K 1% .05W CD 6.
Add A14A1R36 HP part number 0698-7234 825 1% .05W CD 5.
Add A14A1R37 HP part number 0698-7257 7.5K 1% .05W CD 2.
Add A14A1R38 HP part number 0698-3438 147 1% .12W CD 3.
Add A14A1R39 HP part number 0698-7284 100K 1% .05W CD 5.
Add A14A1R40 HP part number 0698-3440 196 1% .12W CD 7.
Add A14A1U2 HP part number 1826-1058 CD 3.

Page 8-74, Figure 8-74:
Replace Figure 8-74 with *Figure 8-74. A14A1 Power Amplifier Bias, Component Locations* (CHANGE 20).

Page 8-75, Figure 8-76:
Replace blocks A14A1 and A14 with *P/O Figure 8-76. RF Schematic Diagram* (CHANGE 20).
Change Serial Prefix on bottom left corner to 2507A.

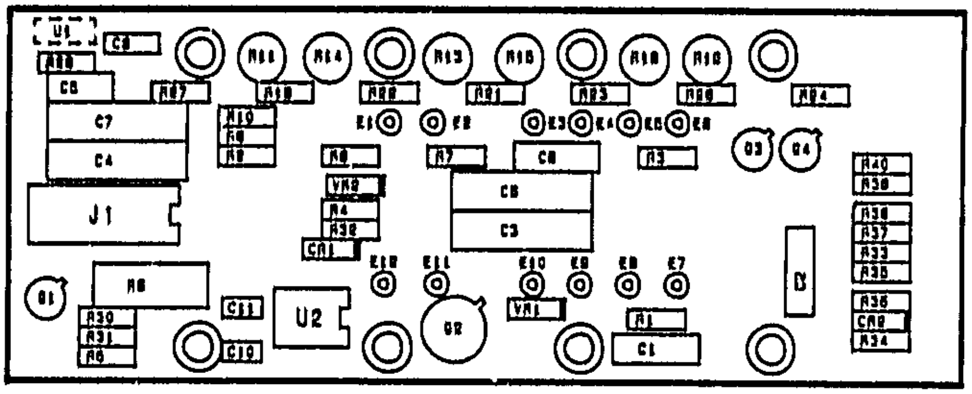
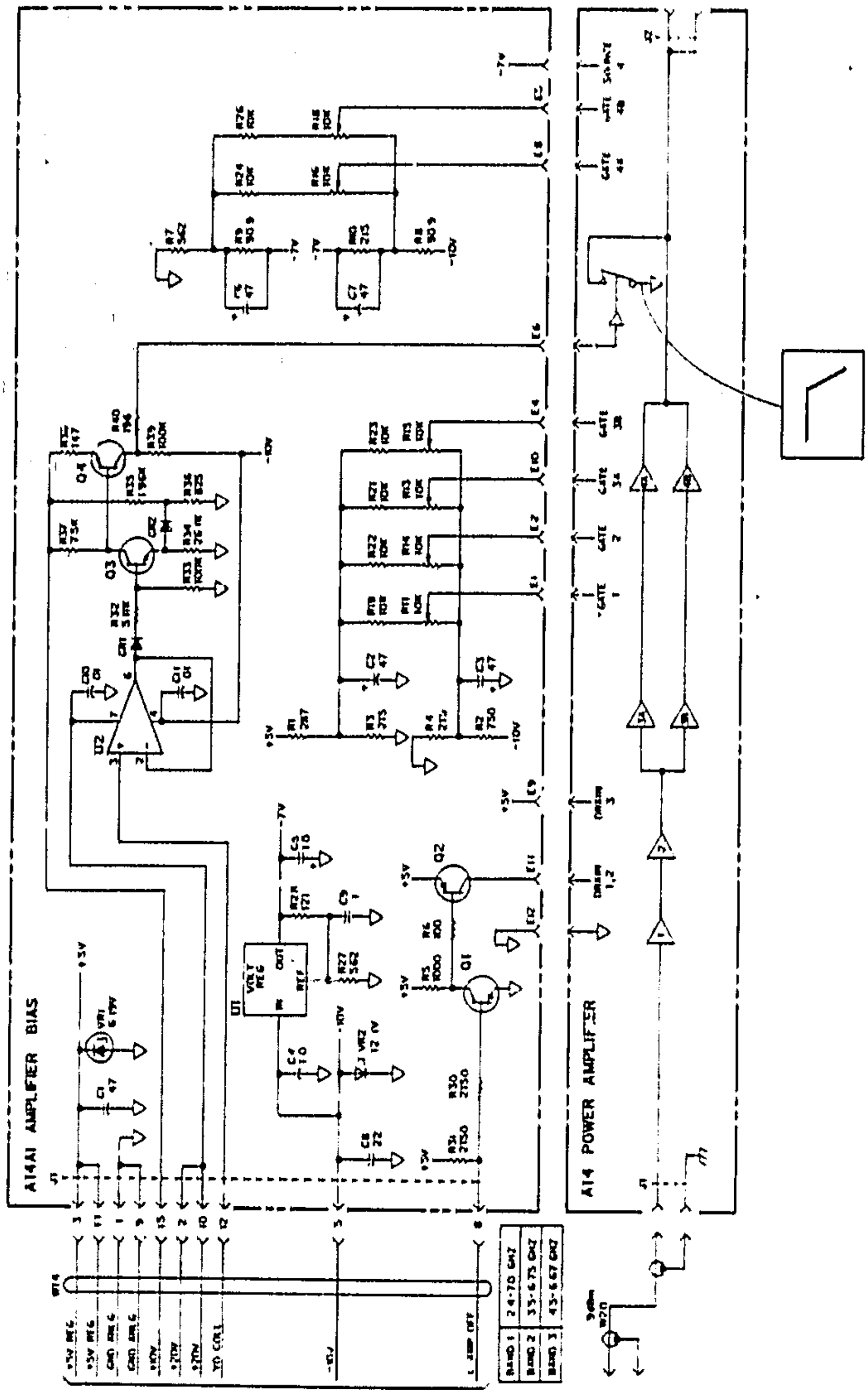


Figure 8-74. A14A1 Power Amplifier Bias, Component Locations (CHANGE 20)



P/O Figure 8-76. RF Schematic Diagram (CHANGE 20)

CHANGE 21

This change documents a modified A6 Sweep Control Assembly. (Supersedes Change 12)

Page 6-12, Table 6-3:
Replace All the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 21) (1 of 3)* in this document.

Page 6-13, Table 6-3:
Replace All the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 21) (2 of 3)* in this document.

Page 6-14, Table 6-3:
Replace All the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 21) (3 of 3)* in this document.

Page 8-57, Figure 8-44. A6 Sweep Control Component Locations:
Replace Figure 8-44 with *Figure 8-44. A6 Sweep Control Component Locations (CHANGE 21)* in this document.

Page 8-57, Figure 8-49. A6 Sweep Control Schematic Diagram:
Replace Figure 8-49 with *Figure 8-49. A6 Sweep Control Schematic Diagram (CHANGE 21)* supplied in this document.

P/O Table 6-3. Replaceable Parts (CHANGE 21) (1 of 3)

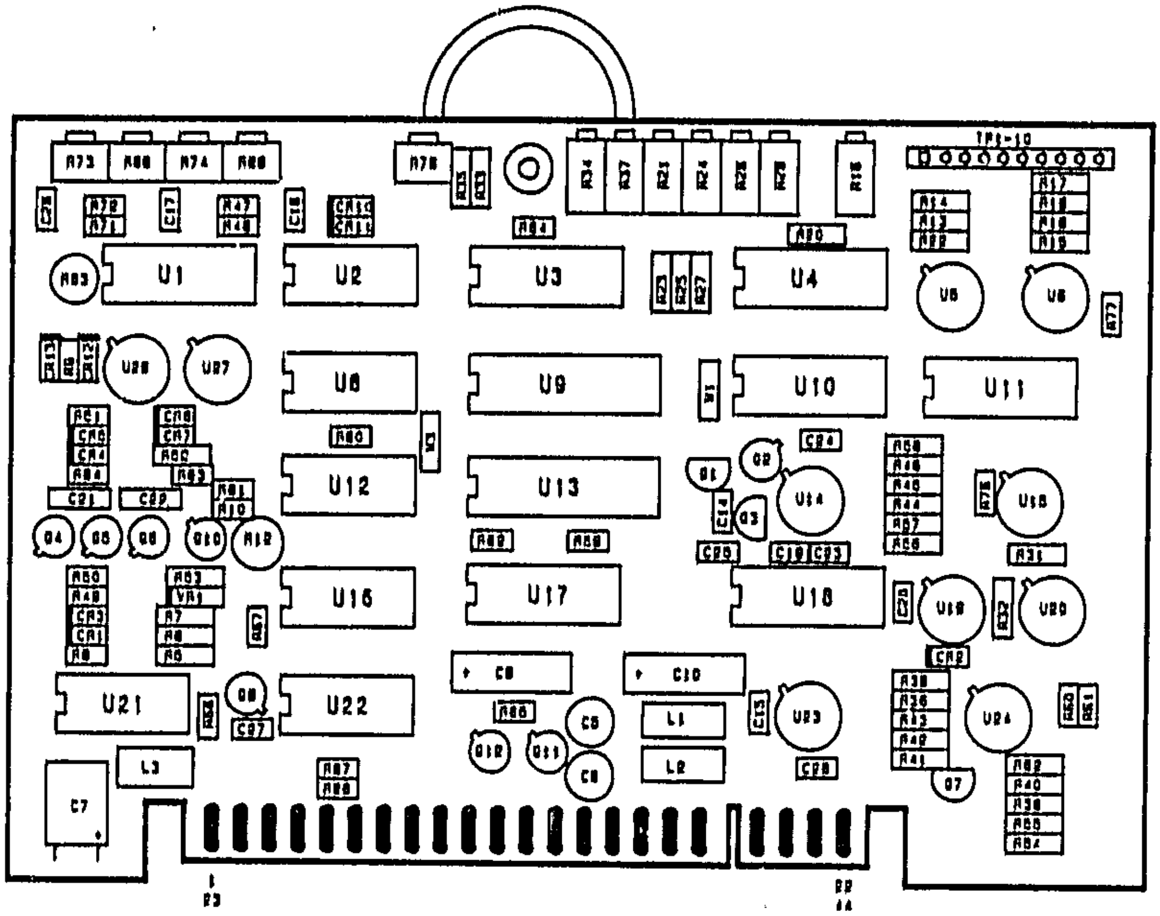
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	83590-60106	6	1	BOARD ASSEMBLY-SWEEP CONTROL	28480	
A6C1-A6C4				NOT ASSIGNED		
A6C5	0180-2617	1	2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C6	0180-2617	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C7	0180-2815	1	1	CAPACITOR-FXD 100UF+-20% 10VDC TA	28480	0180-2815
A6C8				NOT ASSIGNED		
A6C9	0180-0228	6	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A6C10	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A6C11				NOT ASSIGNED		
A6C12				NOT ASSIGNED		
A6C13				NOT ASSIGNED		
A6C14	0160-3878	6	6	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C15	0160-0573	2	1	CAPACITOR-FXD 4700PF +-20% 100VDC CER	28480	0160-0573
A6C16	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C17	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C18				NOT ASSIGNED		
A6C19	0160-0576	4	2	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0576
A6C20	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C21	0160-4084	8	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C22	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C23	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C25	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C26	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C27	0160-0576	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0576
A6C28	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A6CR1	1901-0535	9	3	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR4	1901-0050	3	7	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR8				NOT ASSIGNED		
A6CR9				NOT ASSIGNED		
A6CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR13	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6L1	9140-0137	1	2	INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L3	08503-80001	8	1	COIL-TOROID	28480	08503-80001
A6MP1	5040-6848	8	1	EXTRACTOR P.C. BOARD BLUE	28480	5040-6848
A6MP2	5000-9043	6	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A6MP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6Q1	1855-0423	6	3	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q2	1854-0477	7	2	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q3	1855-0423	6		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q4	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q5	1853-0405	8	2	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q6	1853-0405	8		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q7	1855-0423	6		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q8	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q10	1853-0281	8	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6Q11	1854-0009	9	2	TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0009
A6Q12	1854-0009	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0009
A6R1				NOT ASSIGNED		
A6R2				NOT ASSIGNED		
A6R3				NOT ASSIGNED		
A6R4				NOT ASSIGNED		
A6R5	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R6	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R7	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R8	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R9	0698-7260	7	6	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R10	0698-7267	4	1	RESISTOR 19.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1962-F
A6R11	0698-7283	4	2	RESISTOR 90.9K 1% .05W F TC=0+-100	24546	C3-1/8-T0-9092-F
A6R12	2100-1738	9	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K

P/O Table 6-3. Replaceable Parts (CHANGE 21) (2 of 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R13	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R15	0698-8469	0	8	RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R16	2100-3756	5	1	RESISTOR-TRMR 20 10% C SIDE-ADJ 17-TRN	28480	2100-3756
A6R17	0698-8469	0		RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R18	0698-8469	0		RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R19	0698-8469	0		RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R20	0699-0642	7	1	RESISTOR 10K .1% .1W F TC=0+-5	28480	0699-0642
A6R21	2100-3757	6	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A6R22	0699-0031	8	1	RESISTOR 9.95K .1% .1W F TC=0+-5	28480	0699-0031
A6R23	0699-0033	9	2	RESISTOR 27.362K .1% .1W F TC=0+-5	28480	0699-0033
A6R24	2100-3732	7	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R25	0699-0033	9		RESISTOR 27.362K .1% .1W F TC=0+-5	28480	0699-0033
A6R26	2100-3732	7		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R27	0699-0034	0	1	RESISTOR 35.650K .1% .1W F TC=0+-5	28480	0699-0034
A6R28	2100-3732	7	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R29				NOT ASSIGNED		
A6R30				NOT ASSIGNED		
A6R31	0698-8469	0		RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R32	0698-8469	0		RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R33	0698-8469	0		RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R34	2100-3755	4	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3755
A6R35	0698-8469	0		RESISTOR 6.98K .1% .1W F TC=0+-4	28480	0698-8469
A6R36	0698-8827	4	3	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R37	2100-3750	9	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A6R38	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R39	0699-0154	5	1	RESISTOR 7.2K .1% .125W F TC=0+-25	28480	0699-0154
A6R40	0698-6067	8	1	RESISTOR 7.35K .25% .125W F TC=0+-50	28480	0698-6067
A6R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R42	0698-3260	9	2	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R43	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R45	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R46	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R47	0757-0421	4	2	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A6R48	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A6R49	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R50	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R51	0698-7212	9	1	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A6R52	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R53	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A6R54	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A6R55	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R56	0698-3159	5	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A6R57	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2373-F
A6R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R59	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A6R60	0698-7277	6	2	RESISTOR 51.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5112-F
A6R61	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5112-F
A6R62	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A6R63	2100-2030	6	1	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A6R64	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R65				NOT ASSIGNED		
A6R66	0698-7272	1	1	RESISTOR 31.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3162-F
A6R67	0698-7253	8	1	RESISTOR 5.11K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5111-F
A6R68	2100-2516	3	2	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R69	2100-2516	3		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R70				NOT ASSIGNED		
A6R71	0698-7237	8	1	RESISTOR 1.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1101-F
A6R72	0698-7242	5	2	RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-F
A6R73	2100-2521	0	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R74	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R75				NOT ASSIGNED		
A6R76	0698-7283	4		RESISTOR 90.9K 1% .05W F TC=0+-100	24546	C3-1/8-T0-9092-F
A6R77	0698-7285	6	1	RESISTOR 110K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1103-F
A6R78	2100-2692	6	1	RESISTOR-TRMR 1M 20% C SIDE-ADJ 1-TRN	30983	ET50X105
A6R79	0699-7243	7	1	RESISTOR 1.96K 1% .05W F TC=0+-100	28480	0699-7243
A6R80*	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A6R81	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R82	0698-7243	6	1	RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-F
A6R83	0698-7242	5		RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-F
A6R84	0698-7238	9	1	RESISTOR 1.21K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1211-F
A6R85	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R86	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R87	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6TP1	1251-4672	4	10	CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP2	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP3	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP4	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672

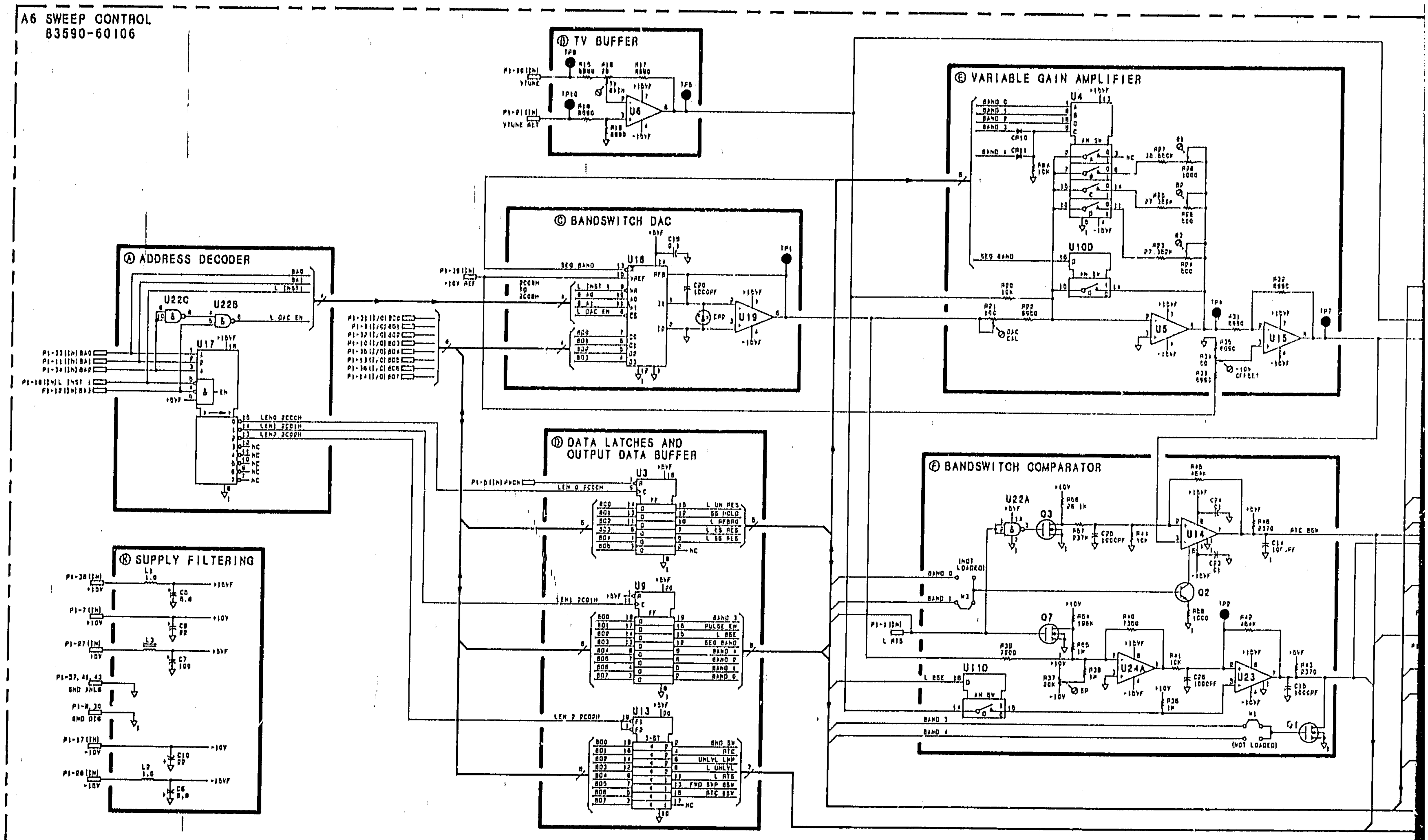
P/O Table 6-3. Replaceable Parts (CHANGE 21) (3 of 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6TP5	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP6	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP7	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP8	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP9	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP10	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6U1	1826-0720	4	2	IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U2	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A6U3	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A6U4	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U5	1826-0471	2	5	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U6	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U7				NOT ASSIGNED		
A6U8	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U9	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U10	1826-1188	8	2	ANALOG SWITCH 4 SPST 16 -CERDIP	28480	1826-1188
A6U11	1826-1188	8		ANALOG SWITCH 4 SPST 16 -CERDIP	28480	1826-1188
A6U12	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U13	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U14	1826-0026	3	2	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U16	1820-1248	9	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS09N
A6U17	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U18	1826-0752	2	1	IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542GD
A6U19	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U20	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U21	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A6U22	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A6U23	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U24	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A6U25				NOT ASSIGNED		
A6U26	1826-0185	5	1	IC OP AMP SPCL TO-99 PKG	3L585	CA3060
A6U27	1826-0915	9	1	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-C PKG	01295	TL071ACJG (PER HP DWG)
A6VR1	1902-3002	3	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A6W1	8159-0005	0	2	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W2				NOT ASSIGNED		
A6W3				NOT ASSIGNED		
A6W4	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005



HP P/N 83590-60106

Figure 8-44. A6 Sweep Control Component Locations (CHANGE 21)



SERIAL PREFIX: 2519A

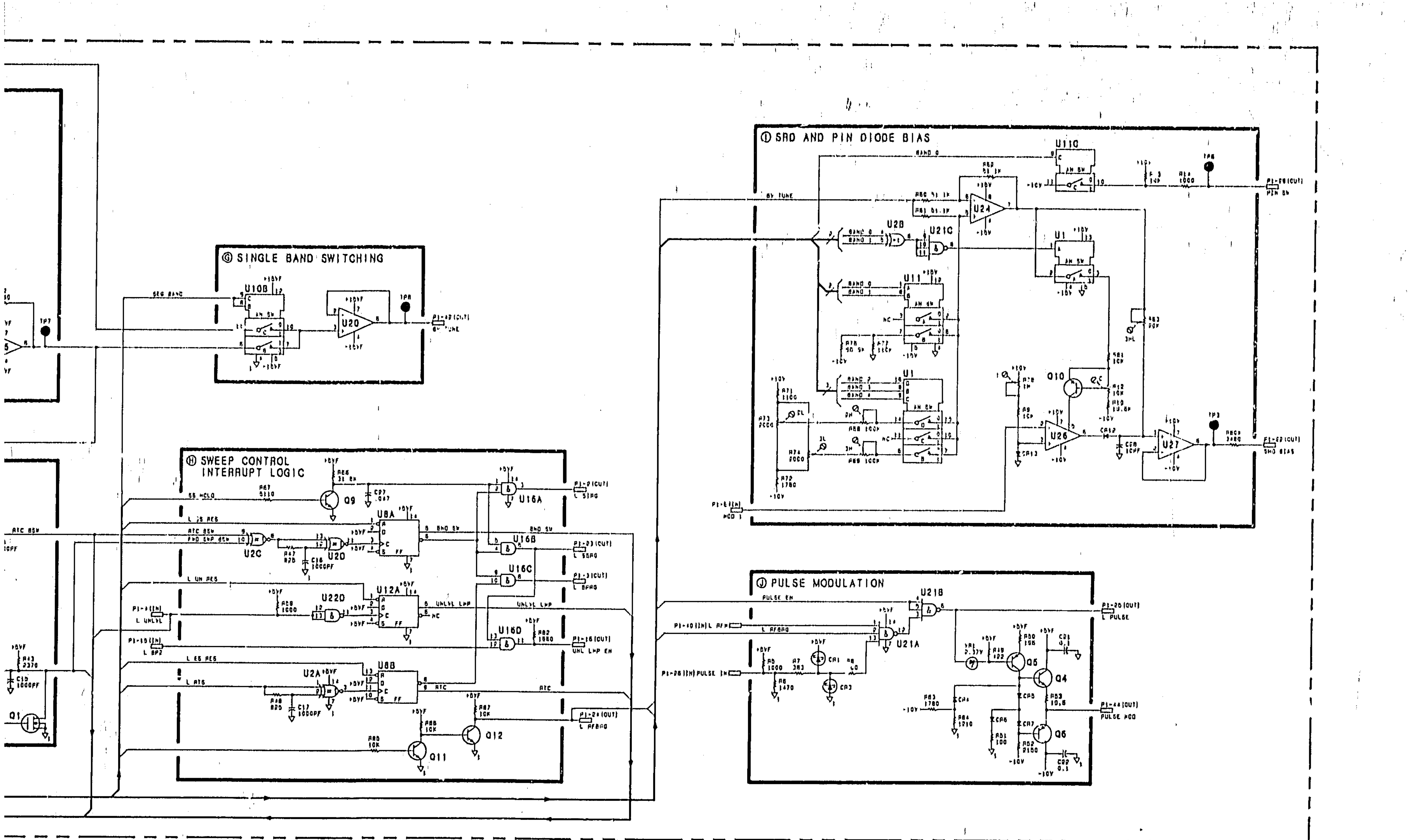


Figure 8-49. A6 Sweep Control, Schematic Diagram(CHANGE 21).

CHANGE 22

This change documents a new Front Panel casting and dress panel.

Page 6-21, Table 6-3:
Change MP4, FRONT PANEL-DRESS to HP Part Number 83590-00008, CD 1.
Change MP18, CASTING-FRONT to HP Part Number 83545-20081, CD 7.
Change MP19, RETAINER-PUSH ON to HP Part Number 0510-1267, CD 6.
Change MP 28, LATCH-SCREW to HP Part Number 83525-20059, CD 0.

▶ CHANGE 23
(Supersedes CHANGE 11)

This change documents a selectable FREQUENCY REFERENCE output.

Throughout the manual there are references to the 1.0 V/GHz rear panel output. Change all references to include 0.5 V/GHz. What follows are some specific areas to change.

Page 1-6, Table 1-2, (Supplemental Performance Characteristics):
Under **GENERAL CHARACTERISTICS:**
Change **Frequency Reference Output** to, selectable, 1.0 V/GHz ± 25 mV (0.01 to 18 GHz) or 0.5 V/GHz ± 25 mV (0.01 to 26.5 GHz) rear panel BNC output.

Page 1-8, paragraph 1-22:
Change to read as follows:
A rear panel 1.0 V/GHz (0.5 V/GHz) signal corresponds to the RF output frequency up to 18 GHz (26.5 GHz). This output voltage is selectable and may be used as a reference for pretuning external equipment. The HP 8410B/8411A network analyzer utilizes the 1.0 V/GHz output for phase-locking. The HP 83554A/55A/56A millimeter-wave source module uses the 0.5 V/GHz as its frequency reference for millimeter frequency applications.

Page 3-12:
After page 3-12 add page 3-13/3-14, *Figure 3-10, Frequency Reference Selection Switch* provided in this document.

Page 5-43, paragraph 5-24, **FREQUENCY REFERENCE 1V/GHz OUTPUT:**
Add the following:

NOTE

The frequency reference selection switch must be set to the 1.0 V/GHz position before performing this adjustment. Refer to Figure 3-10.

Page 6-5, Table 6-3:
Change A2 to HP and Mfr. Part Number 83590-60122, CD 6.
Add A2C9 HP and Mfr. Part Number 0160-4808, CD 4, CAPACITOR-FXD CER 470 pF 100 WV.

Page 6-6, Table 6-3:
Change to the following:

Reference Designation	HP Part Number	CD	Description
A2R8	0757-0463	4	RESISTOR-FXD 82.5K 1% .125W
A2R9	0698-7251	6	RESISTOR-FXD 4.22K 1% .05W
A2R10	0698-6320	8	RESISTOR-FXD 5K 0.1% .125W
A2R11	0698-6630	3	RESISTOR-FXD 20K 0.1% .125W
A2R18	0698-3159	5	RESISTOR-FXD 26.1K 1% .125W

Add the following:

Reference Designation	HP Part Number	CD	Description
A2R27	0698-7260	7	RESISTOR-FXD 10K 1% .05W
A2R29	0698-5437	6	RESISTOR-FXD 12K 0.1% .125W
A2S1	3101-2751	1	SWITCH ROCKER 2 POSITION DIP 1A
A2VR1	1902-0041	4	DIODE-ZNR 5.11V 5% DO-35 PD=.4W

Delete A2R28.

CHANGE 23 (Cont'd)

Page 6-21, Table 6-3:
Change MP35 to HP and Mfr. Part Number 83592-00028, CD 7.

Page 8-25, paragraph titled **1V/GHz Frequency Tracking Amplifier A2: E 1V/GHz Amplifier A2: G;**
Add the following: When A2S1 is closed 0.5 V/GHz frequency reference output is selected. U1A is now scaled to provide 0.5 V per GHz up to 26.5 GHz.

Page 8-31, Figure 8-12:
Replace the Components Location Diagram with *Figure 8-12, A2 Front Panel Interface, Components Locations (CHANGE 23)* provided in this document.

Page 8-31, Figure 8-18:
Replace Figure 8-18 with *Figure 8-18, A1 Front Panel/A2 Front Panel Interface, Schematic Diagram (CHANGE 23)* provided in this document.

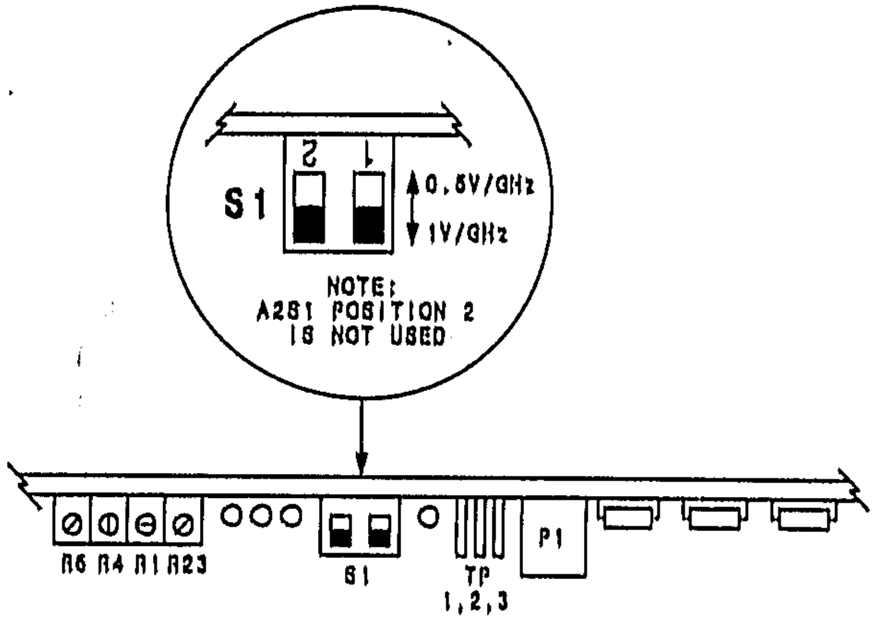


Figure 3-10. A2 Frequency Reference Selection Switch (CHANGE 23)

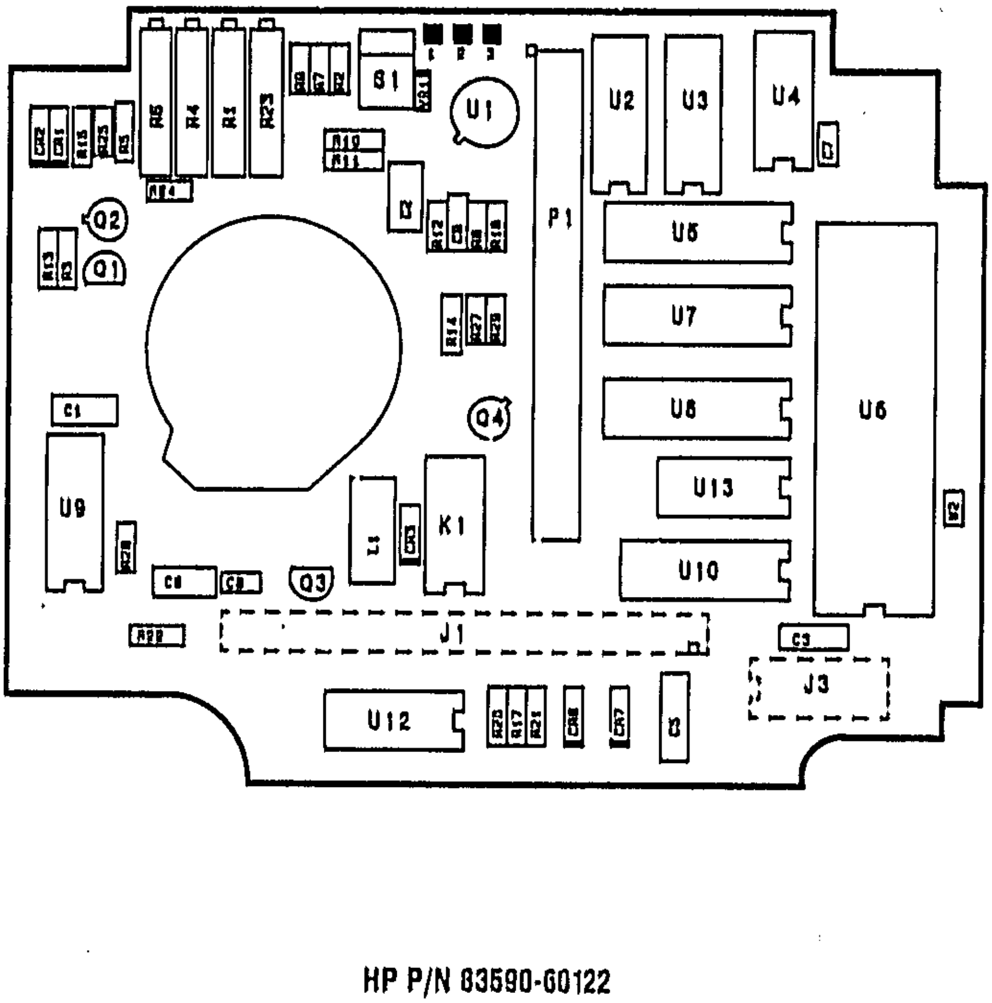
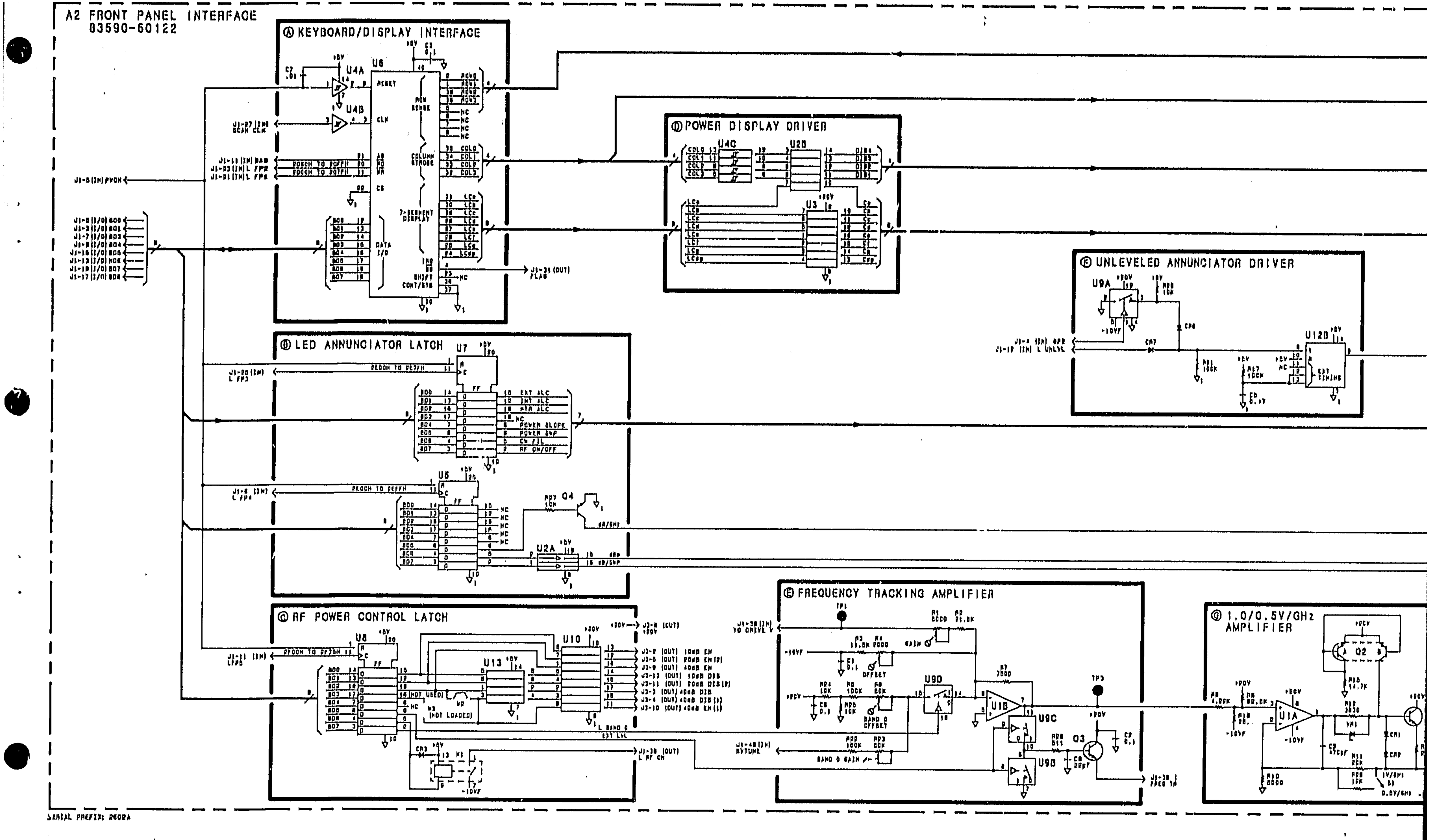
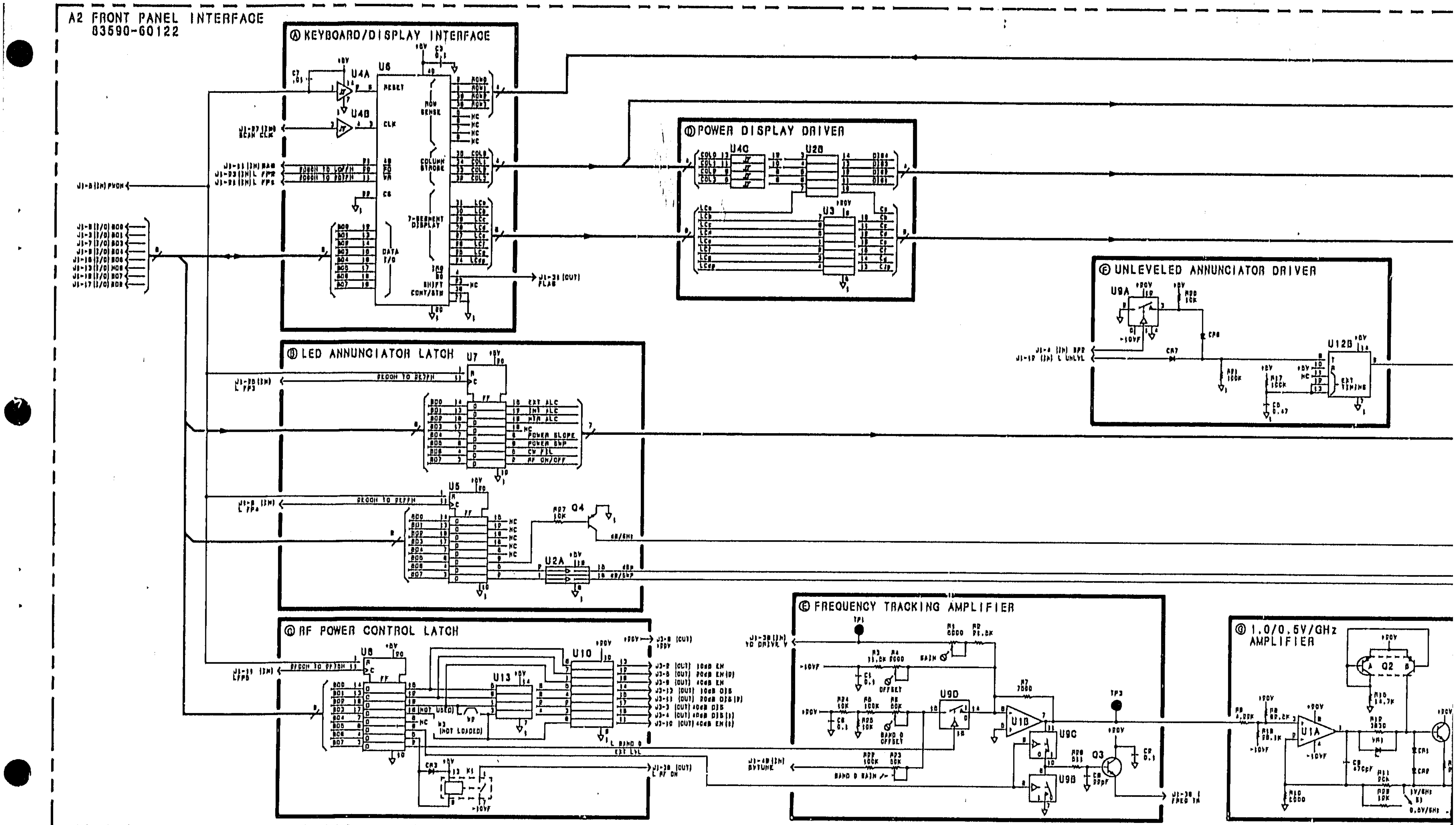


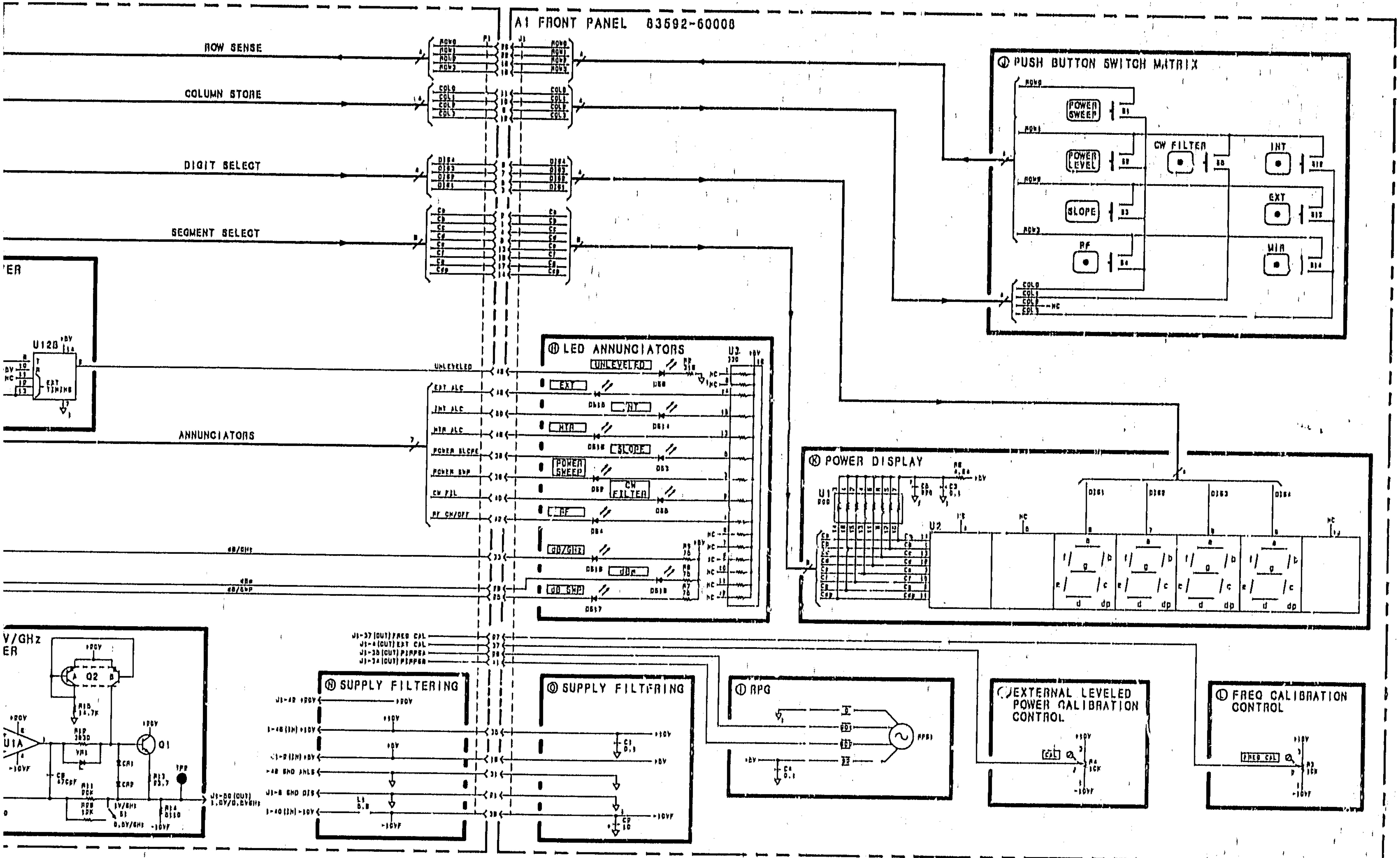
Figure 8-12. A2 Front Panel Interface, Component Locations (CHANGE 23)



SERIAL PREFIX: 2602A



SERIAL PREFIX: 2602A



83590A Figure 8-18. A1 Front Panel/A2 Front Panel Interface, Schematic Diagram (CHANGE 23)

CHANGE 24

This change documents a new YO Driver Board Assembly.

On the pages listed below, replace the figures with the new figures given.

Adjustments

Page 5-11, *Figure 5-2. −10V Reference Adjustment Location.*
Page 5-14, *Figure 5-4. Sweep Control Adjustment Location.*
Page 5-17, *Figure 5-7. YO and YTM DAC Calibration Adjustment Location.*
Page 5-25, *Figure 5-14. YO Retrace Compensation Adjustment Location.*
Page 5-28, *Figure 5-16. YO Delay Compensation Adjustment Location.*

Service

Page 8-69, *Figure 8-63. A8 YO Driver, Component Locations.*

Page 8-69, *Figure 8-71. A8 YO Driver, Schematic Diagram:*
Replace Block I YIG COIL CURRENT SOURCE with the partial schematic *P/O A8 YO Driver, Schematic Diagram (CHANGE 30)* from this document.

Page 6-16, Table 6-3:
Change the A8 Part No. to 83595-60070, CD 8, 83595-60070.
Add A8C22, 0160-3879, CD 7, CAPACITOR .01UF +20% 100VDC CER, 02010, SR201C103MAA.
Add A8C23, 0160-3879, CD 7, CAPACITOR .01UF +20% 100VDC CER, 02010, SR201C103MAA.
Add A8C24, 0160-3878, CD 6, CAPACITOR .001UF +20% 100VDC CER, 02010, SR201C102MAA.
Add A8C25, 0160-4801, CD 7, CAPACITOR 100 PF +5% 100VDC CER, 02010, SA101A101JAA.

Page 6-17, Table 6-3:
Add A8CR9, 1901-0033, CD 2, DIODE-GEN PRP 180V 200MA DO-35, 00046, NDP692.

Page 6-18, Table 6-3:
Add A8R70, 0698-7220, CD 9, RESISTOR 215 1% .05W FTC=+100, 00746, CRB20.
Add A8R71, 0698-7220, CD 9, RESISTOR 215 1% .05W FTC=+100, 00746, CRB20.

Page 8-69, Figure 8-71 in the upper left hand corner:
Change the Part No. 83592-60002 to 83595-60070.

Page 8-69, Figure 8-71 in the lower left hand corner:
Change the Serial Prefix 2620A.

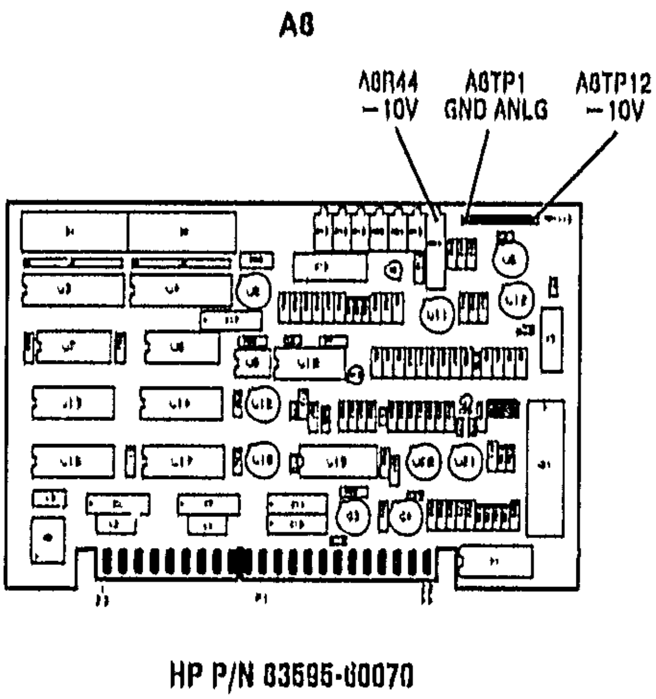


Figure 5-2. −10V Reference Adjustment Location (CHANGE 24)

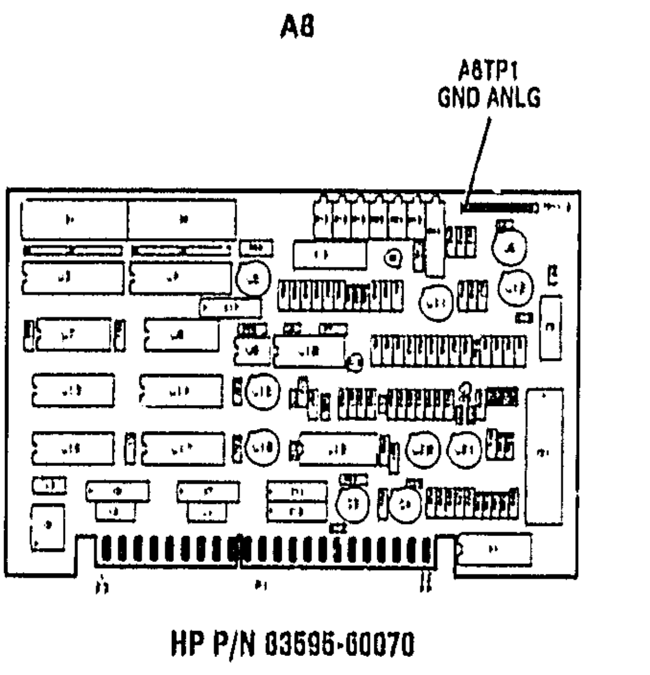


Figure 5-4. Sweep Control Adjustment Locations (CHANGE 24)

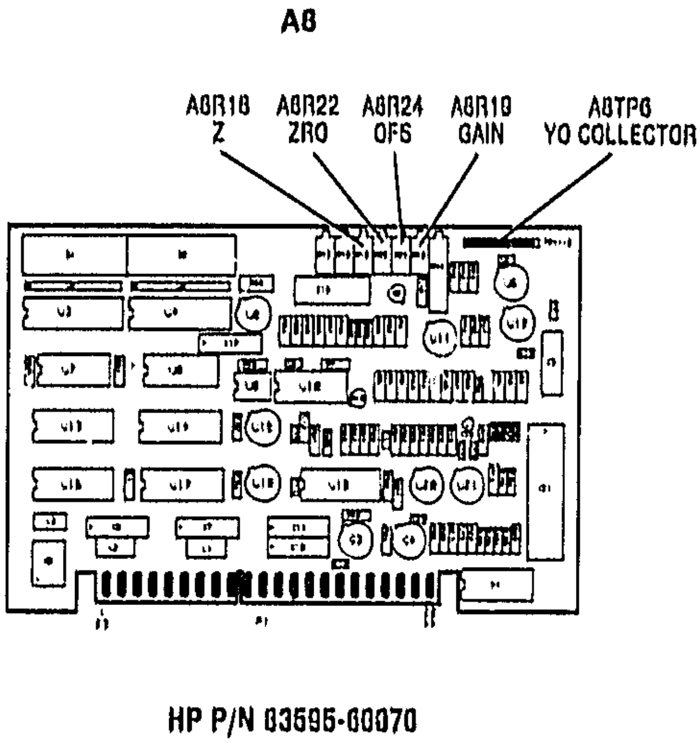


Figure 5-7. YO and YTM DAC Calibration Adjustment Locations (CHANGE 24)

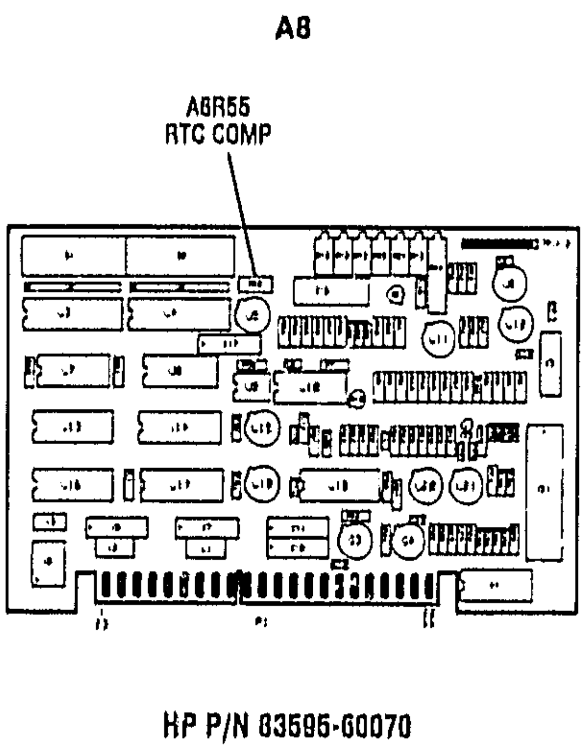
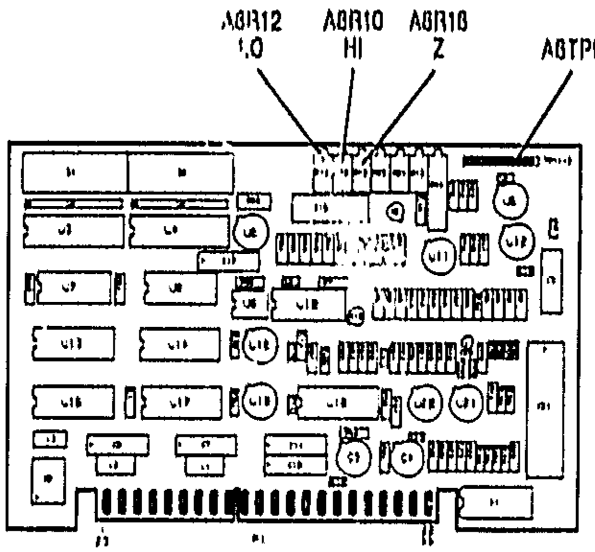


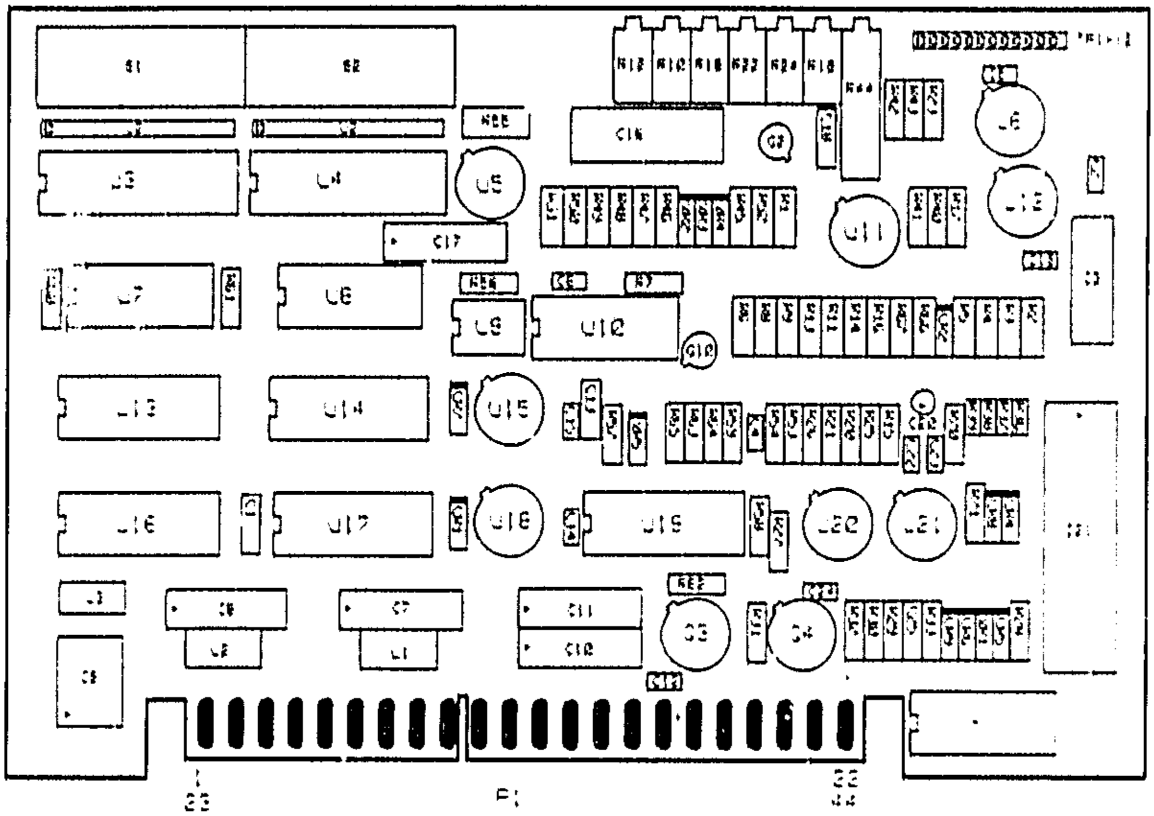
Figure 5-14. YO Retrace Compensation Adjustment Location (CHANGE 24)

A8



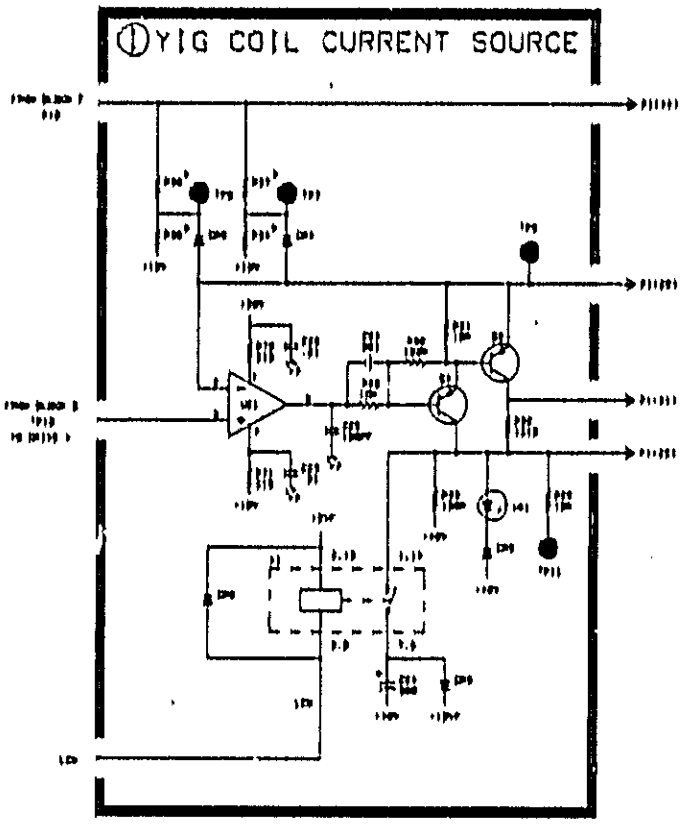
HP P/N 83595-60070

Figure 5-16. YO Delay Compensation Adjustment Location (CHANGE 24)



HP P/N 83595-60070

Figure 8-63. A8 YO Driver, Component Locations (CHANGE 24)



HP P/N 83595-60070

P/O Figure 8-71. A8 YO Driver, Schematic Diagram (CHANGE 24)

▶ CHANGE 25

This change documents the addition of a jumper to the A4 ALC assembly, it does not change any electrical functions of the ALC. Change 14 in this document is assumed to be incorporated prior to making the changes written in this change (Change 25).

Section VI, Replaceable Parts:

Change A4 ALC assembly to HP and Mfr. Part Number 83590-60098, CD 5.

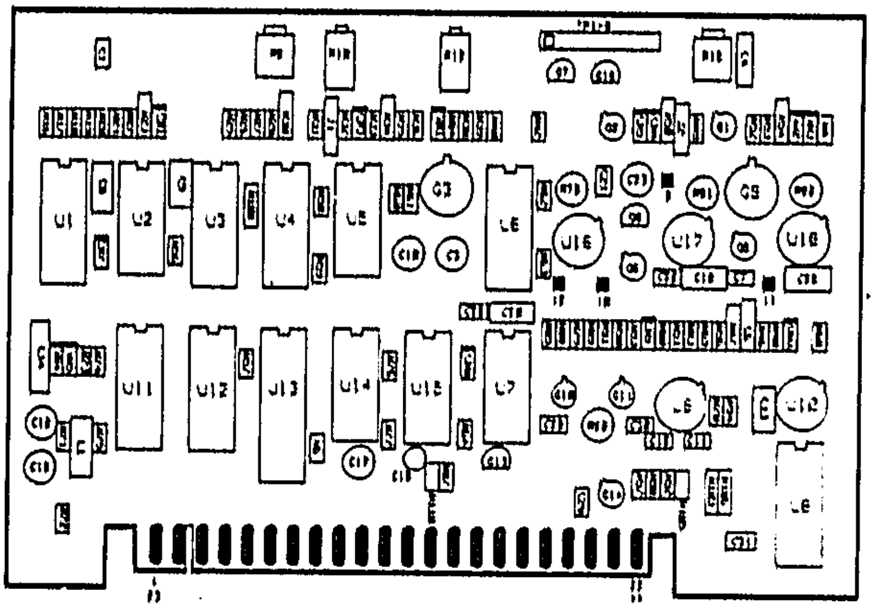
Add A4W6, HP and Mfr. Part Number 8159-0005, CD 0, RESISTOR-ZERO OHMS 22 AWG LEAD DIA.

Page 8-47, Figure 8-29:

Replace the Components Location Diagram with *Figure 8-29, A4 ALC, Component Locations (CHANGE 25)* provided in this document.

Page 8-47, Figure 8-34:

Add A4W6 in series with the input to U15C pin 9 located in block N, PIN MOD 1 DRIVER.



HP P/N 83590-60090

Figure 8-29. A4 ALC Component Locations (CHANGE 25)

ADDENDUM

MANUAL CHANGES

NOTE

This ADDENDUM contains important information of the kind normally contained in the attached MANUAL CHANGES supplement but received too late to be included. Use the ADDENDUM to correct your manual in the same way you use the MANUAL CHANGES supplement.

MANUAL IDENTIFICATION

HP Number: HP 83590A
Date Printed: Feb. 1982
Part Number: 83590-90005

▶ = NEW ITEM

Serial Prefix or Number	Make Manual Changes
2718A	2, 3, 5, 9, 13-16, 18-26
▶ 2726A	2, 3, 5, 9, 13-16, 18-27

Addendum Date: June 1, 1987
For Manual Changes Dated: November 12, 1986

HEWLETT PACKARD

Printed in U.S.A.

▶ – NEW ITEM

NUMBERED CHANGES INDEX

Serial Prefix No.	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2718A	26	A3	N/A	None
▶ 2726A	27	A4 83592-60077 83592-60132	N/A	Replaceable Parts

CHANGE 26

This change documents a serial prefix change only.

▶ CHANGE 27

Page 6-8, Table 6-3:
Change A4R64 to 1.96K ohms HP part number 0698-7256, CD 1.

Page 6-9, Table 6-3:
Change A4U7 to HP part number 1820-1425, CD 6.

Page 8-47, Figure 8-34 (Block K):
Change A4R64 to 1.96K ohms.

NOTE: A4R64 and A4U7 are interactive components, therefore, they both must be changed at the same time.

MANUAL IDENTIFICATION

HP Model Number: HP 83590A
Manual Part Number: 83590-90005
Date Printed: February 1982

CHANGE 28

Change 28 documents serial number prefix 2809A.

This change documents a new A4 assembly.

INSTRUCTIONS

Replace — Replace the existing manual page(s) with the page(s) provided in this change. These page(s) supersede the existing page(s) in the manual, provided that the serial number prefix of your instrument is the same or higher than the one indicated on this page. To keep your documentation applicable to all versions of instruments, place the superseded page(s) in the MANUAL BACKDATING section of your manual.

Replace the following pages:

Title Page
5-1 through 5-6
5-45 through 5-52
6-7 through 6-10
8-37 through 8-47

HP 83590A
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBERS

This manual applies directly to HP 83590A RF plug-in having serial number prefix 2146A.

For instruments with serial prefix 2143A and below, refer to Section 7, Manual Backdating

For additional information about serial numbers, refer to INSTURMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: 1 FEBRUARY 1988

Change	Documents Prefix		Change	Documents Prefix		Change	Documents Prefix
1	2216A		17	2428A			
2	2217A		18	2451A			
3	2221A		19	2502A			
4	2233A		20	2507A			
5	2234A		21	2519A			
6	2249A		22	2543A			
7	2252A		23	2602A			
8	2306A		24	2619A			
9	2319A		25	2645A			
10	2315A		26	2718A			
11	2338A		27	2726A			
12	2410A		28	2809A			
13	2411A						
14	2411A						
15	2412A						
16	2413A						

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MANUAL PART NO. 83590-90005
Microfiche Part Number 83590-90006

Printed: FEBRUARY 1982

HEWLETT PACKARD

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.

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

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 83590A 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. Table 5-2 lists the adjustment included in this section.

NOTE

Allow the 83590A 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-metallic adjustment tool whenever possible.

5-5. EQUIPMENT REQUIRED

5-6. The equipment required for the adjustment procedures is listed in Section I of this manual. If the test equipment recommended is not available, other equipment may be used if its performance meets the critical specifications listed in the table. The specified equipment required for each adjustment is referenced in each procedure.

5-7. FACTORY-SELECTED COMPONENTS

5-8. Table 5-3 contains a list of factory-selected components that includes 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 5-4.

5-9. RELATED ADJUSTMENTS

5-10. Interactive adjustments are noted in the adjustment procedures. Table 5-5 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.

5-11. ADJUSTMENT PROCEDURES

5-12. Adjustment procedures are given in the proper sequence to allow for interrelated adjustments.

Table 5-1. Adjustable Components (1 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A2R1	GAIN	5-24	Sets gain of frequency reference in Bands 1, 2, and 3 (1 V/GHz).
A2R4	OFFSET	5-24	Sets offset of frequency reference in Bands 1, 2, and 3 (1 V/GHz).
A3S1	Configuration Switch	5-13	Selects Plug-in code, power-up power level, FM sensitivity, FM modulation coupling, step attenuator Option Code, normal or sequential sweep option, and phase-lock operation.
A4R6	I LO	5-26	Sets power calibration at the low end of the power range (−5 dBm).
A4R49	I HI	5-26	Sets power calibration at the high end of the power range (+10 dBm).
A4R54	I MD	5-26	Sets power calibration at the middle of the power range (0 dBm).
A4R59	SYM	5-25	Sets best square wave symmetry.
A5C14	LO	5-30	Adjusts low frequency for best frequency response flatness through U10.
A5R18	FM OFFSET	5-30	Adjusts shape of U10 Video Amplifier compensation network response.
A5R19	FM	5-30	Sets DC offset of U10 Video Amplifier.
A5R34	BP 1	5-26	Breakpoint that works with SL1 (Slope 1) for ALC flatness.
A5R36	BP 2	5-26	Breakpoint that works with SL2 (Slope 2) for ALC flatness.
A5R38	BP 3	5-26	Breakpoint that works with SL3 (Slope 3) for ALC flatness.
A5R40	BP 4	5-26	Breakpoint that works with SL4 (Slope 4) for ALC flatness.
A5R41	SL 1	5-26	Slope adjustment for best ALC flatness.
A5R42	SL 2	5-26	Slope adjustment for best ALC flatness.

Table 5-1. Adjustable Components (2 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A5R43	SL 3	5-28	Slope adjustment for best ALC flatness.
A5R44	SL 4	5-28	Slope adjustment for best ALC flatness.
A5R48	SLP	5-23	Sets overall slope of internal leveling ALC.
A5R50	PWSP	5-29	Sets range for power sweep.
A5R75	HI	5-30	Works in conjunction with C14 to set frequency response flatness of FM Coil.
A6R12	C	5-20, 5-21	Adjusts YTM SRD bias to peak power in all bands at low power settings.
A6R16	TV GAIN	5-15	Sets the gain of U6 Tune Voltage buffer amplifier.
A6R21	DAC CAL	5-15	Adjusts the gain of U5 Variable Gain Amplifier during all single band sweeps.
A6R24	B[illegible]	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 3 during sequential sweeps.
A6R26	B2	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 2 during sequential sweeps.
A6R28	B1	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 1 during sequential sweeps.
A6R34	−10V OFFSET	5-1[illegible]	Offsets the −10 volt reference voltage to U15.
A6R37	SP	5-15	Offsets input voltage to U24A forward sweep bandswitch amplifier.
A6R63	3HL	5-20, 5-21	Adjusts balance of SRD Bias circuit.
A6R68	2H	5-20, 5-21	Adjusts YTM SRD bias at high power, high frequency end of Band 2.
A6R69	3H	5-20, 5-21	Adjusts YTM SRD bias at high power, high frequency end of Band 3.
A6R73	2L	5-20, 5-21	Adjusts YTM SRD bias at high power, low frequency end of Band 2.
A6R74	3L	5-20, 5-21	Adjusts YTM SRD bias at high power, low frequency end of Band 3.
A6R78	T	5-20, 5-21	Adjusts YTM SRD bias at an intermediate power level for Bands 2 and 3.
A7R10	SGL HI	5-22	Adjusts offset of YTM delay compensation signal at the high end of single band sweeps.

Table 5-1. Adjustable Components (3 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A7R12	SGL LO	5-22	Adjusts offset of YTM delay compensation signal at the low end of single band sweeps.
A7R18	Z	5-16	Adjusts offset of U20 delay compensation amplifier to minimize the difference between CW and ΔF ±0 with YTM delay compensation circuits.
A7R19	GAIN	5-16	Adjusts the Scaled Voltage Tune DAC input signal to U21 YTM Summing Amplifier.
A7R22	ZRO	5-16	Adjusts supply correction voltage to U21 YTM Summing Amplifier.
A7R24	OFS	5-16	Adjusts Offset DAC input signal to U21 YTM Summing Amplifier.
A7R42	SEQ HI	5-22	Adjusts offset of YTM delay compensation signal at high end of sequential band sweeps.
A7R43	SEQ LO	5-22	Adjusts offset of YTM delay compensation signal at low end of sequential band sweeps.
A7R45	SEQ TC	5-22	Adjusts gain of YTM delay compensation signal in sequential band sweeps.
A7R46	SGL TC	5-22	Adjusts gain of YTM delay compensation signal in single band sweeps.
A7R51	BI OFS	5-20	Adjusts offset of U21 Summing Amplifier in single band sweeps.
A7R55	RTC COMP	5-22	Adjusts the pulse width of YTM retrace compensation signal.
A7S1	OFFSET	5-20	Adjusts low end of band YTM to YO tracking at slow sweep speeds.
A7S2	GAIN	5-20	Adjusts high end of band YTM to YO tracking at slow sweep speeds.
A8R10	HI	5-19	Adjusts YO delay compensation at high frequency end of band.
A8R12	LO	5-19	Adjusts YO delay compensation at low frequency end of band.
A8R18	Z	5-16, 5-19	Adjusts offset to minimize the difference between CW and ΔF ±0 with YO delay compensation circuits.
A8R19	GAIN	5-16	Adjusts Scaled Voltage Tune DAC input signal to U20 Summing Amplifier.
A8R22	ZRO	5-16	Adjusts supply correction voltage to U20 Summing Amplifier.

Table 5-1. Adjustable Components (4 of 4)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A8R24	OFS	5-16	Adjusts Offset DAC input signal to U20 Summing Amplifier.
A8R44	−10V	5-14	Sets −10 volt reference voltage source.
A8R55	RTC COMP	5-18	Adjusts the pulse width of the YO retrace compensation signal.
A8S1	OFFSET	5-17	Adjusts the low end of band YO frequency accuracy.
A8S2	GAIN	5-17	Adjusts the high end of band YO frequency accuracy.
A13A1R4		none	Factory adjusted.
A14A1R11		none	Factory adjusted.
A14A1R13		none	Factory adjusted.
A14A1R14		none	Factory adjusted.
A14A1R15		none	Factory adjusted.
A14A1R16		none	Factory adjusted.
A14A1R18		none	Factory adjusted.

Table 5-2. Adjustments

Paragraph	Adjustments	Paragraph	Adjustments
5-13	Configuration Switch A3S1	5-22	YTM Delay Compensation
5-14	−10 Volt Reference On A8 YO Driver	5-23	Band Overlap Adjustment
5-15	Sweep Control Adjustments	5-24	Frequency Reference 1V/GHz Output
5-16	YO and YTM DAC Calibration	5-25	Sample & Hold Compensation
5-17	Preliminary Frequency Accuracy	5-26	ALC Power Calibration
5-18	YO Retrace Compensation	5-27	ALC Gain Check
5-19	YO Delay Compensation	5-28	Internal Leveled Flatness
5-20	Slow Speed YTM to YO Tracking	5-29	Power Sweep
5-21	SRD Bias	5-30	FM Driver Adjustments

Table 5-3. Factory Selected Components

Reference Designator	Adjustment Paragraph	Allowable Range of Values	Basis of Selection
A4R72	5-27		Selected at factory for best ALC gain
A5R31	5-30	200 to 300 Ohms	Selects scaling of current drive of YO FM coil near 100 kHz.
A7R34	none		Selected at factory to correct for frequency nonlinearity in YTM.
A7R35−39	none		
A7R66−71	none		
A8R36	none		Selected at factory to correct for frequency nonlinearity in the YO.
A8R37−39	none		
A13A1R1	none		Selected at factory to optimize YO bandwidth, power, and harmonics.
A13A1R2	none		

5-25. Sample & Hold Compensation

NOTE: To completely adjust the leveling loop, perform procedures 5-25 through 5-28 in the order given. Doing these adjustments out of order can cause leveling and/or power variation problems.

EQUIPMENT

Sweep Oscillator Mainframe	HP 8350
Extender Board	HP 08350-60031
Adapter 3.5(f) to Type-n(m)	HP P/N 1250-1744
Oscilloscope	HP 1741A
Crystal Detector	HP 8473C
10 dB Attenuator	HP 8493C Option 010
Adapter 3.5(f) to Type-N(m)	HP Part Number 1250-1744

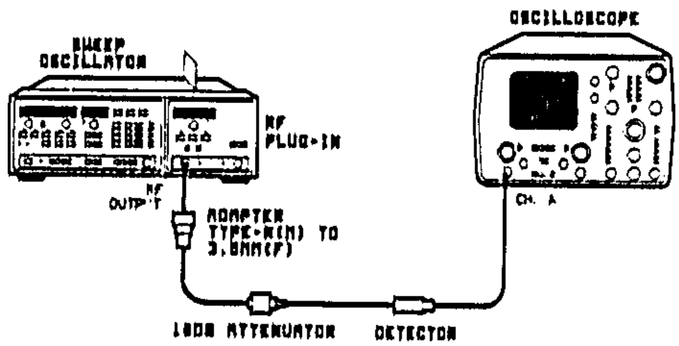


Figure 5-33. Sample & Hold Test Setup

PROCEDURE

NOTE: Turn AC power OFF when you remove or install an assembly.

NOTE: This procedure assumes that A3S1 is set to the factory-set position.

1. With AC power OFF, put the A4 assembly on an extender board and connect the equipment as shown in Figure 5-33.

5-25. Sample & Hold Compensation (Cont'd)

2. On the sweep oscillator:
   a. Turn power on and press [INSTR PRESET].
   b. Press [CW] [2] [.] [5]] [GHz].
   c. Turn square wave modulation on.

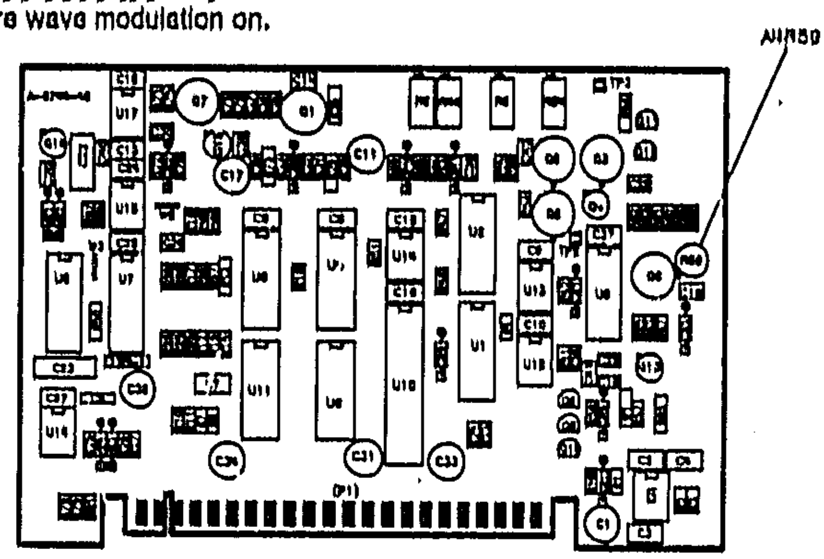


Figure 5-34. Sample & Hold Compensation Adjustment Locations

3. Observing the RF output on the oscilloscope, adjust A4R59 for the best square wave.
4. Install the A4 assembly in the plug-in and re-check the square wave. Repeat steps 3 and 4 as necessary.

5-26. ALC Power Calibration

NOTE: To completely adjust the leveling loop, perform procedures 5-25 through 5-28 in the order given. Doing these adjustments out of order can cause leveling and/or power variation problems.

EQUIPMENT

Sweep Oscillator Mainframe	HP 8350
Scalar Network Analyzer	HP 8757A
Detector	HP 85025B
10 dB Attenuator	HP 8493C Option 010
Adaptor 3.5(f) to Type-n(m)	HP P/N 1250-1744
Power Meter	HP 436A
Power Sensor	HP 8485A
Adaptor 3.5(f) to Type-N(m)	HP Part Number 1250-1744

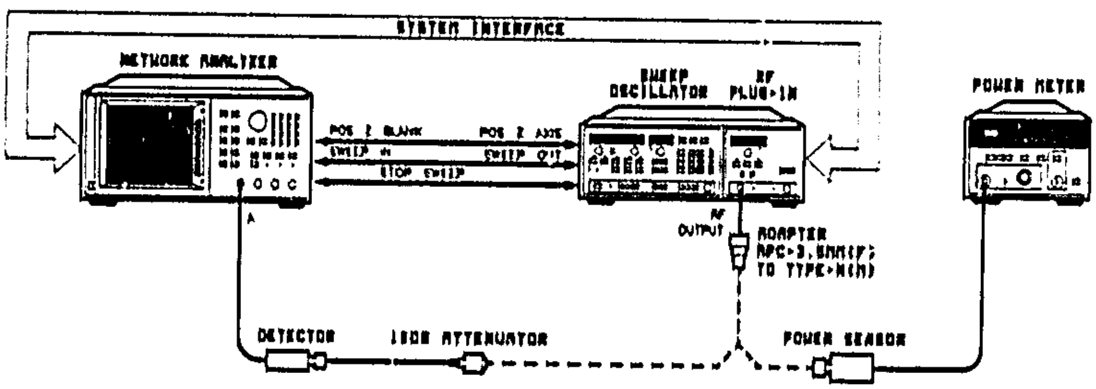


Figure 5-35. ALC Power Calibration Adjustment Setup

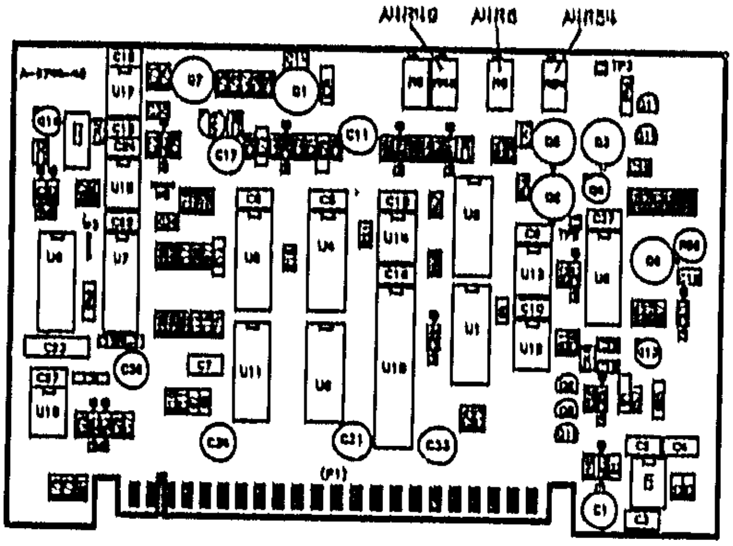


Figure 5-36. ALC Power Calibration Adjustment Locations

PROCEDURE

NOTE: This procedure assumes that A3S1 is set to the factory-set position.

1. Connect the network analyzer as shown in Figure 5-35, and press [INSTR PRESET] on the analyzer.
2. On the sweep oscillator, press [CW] [2] [.] [4] [GHz].
3. Repeat the following, as necessary:
   a. Set power to −5 dBm and adjust A4R6 for −5 ±0.1 dBm.
   b. Set power to 0 dBm and adjust A4R54 for 0 ±0.1 dBm.
   c. Set power to +10 dBm and adjust A4R49 for +10 ±0.1 dBm.
4. To check the power accuracy, step from −5 to 10 dBm in 1 dB increments. The power meter reading should be within ±0.1 dBm at each setting.

5-27. ALC Gain Check

NOTE: To completely adjust the leveling loop, perform procedures 5-25 through 5-28 in the order given. Doing these adjustments out of order can cause leveling and/or power variation problems.

EQUIPMENT

Function Generator .... HP 3325A
Oscilloscope .... HP 1740A
Detector .... HP 8473C
10 dB Attenuator .... HP 8493C Option 010
Adapter 3.5(f) to Type-n(m) .... HP P/N 1250-1744

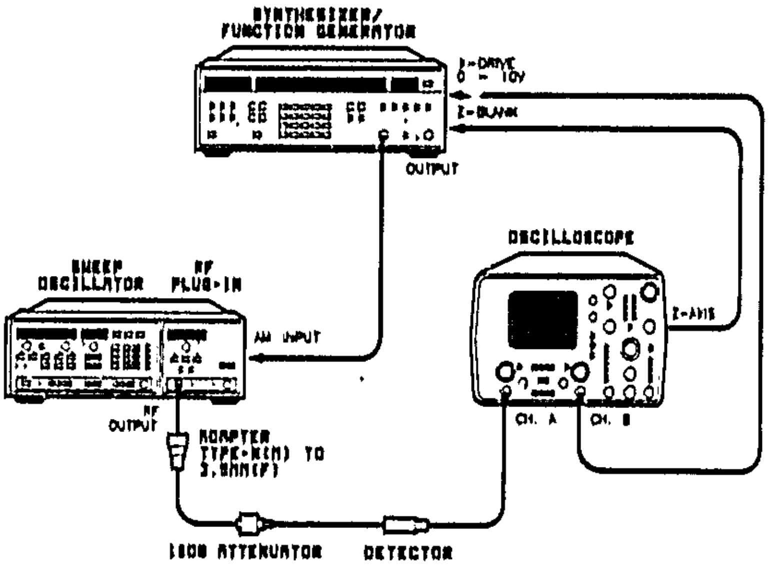


Figure 5-36a. ALC Gain Check Test Setup

PROCEDURE

NOTE: This procedure assumes that A3S1 is set to the factory-set position.

1. On the function generator, connect the Vp-p output to the oscilloscope CHANNEL A INPUT.

5-27. ALC Gain Check (Cont'd)

2. Set instrument controls as follows:

Sweep Oscillator:

Start	2 GHz
Stop	20 GHz
Sweep Mode	Manual

RF Plug-In:

Power Level	-5 dB
ALC	Internal

Function Generator:

Start Frequency	1 kHz
Stop Frequency	300 kHz
Function	[∿]
Time	0.5 sec
Amplitude	2V
[START CONT]	

Oscilloscope:

Mode	A vs B
Channel A Input	AC
Channel A V/Div	0.005V
Channel B Input	DC
Channel B V/Div	1V
Display	A

3. Connect the equipment as shown in Figure 5-36a.
4. On the oscilloscope, use the CHANNEL A knob CAL to adjust the left edge of the signal for two divisions p-p.
5. Monitoring CHANNEL A, manually sweep the plug-in frequency range and note the frequency at which the highest gain peaking occurs. This point should measure less than four divisions p-p (see Figure 5-36b).
6. Change the plug-in power level to +3 dBm and repeat step 5, adjusting the oscilloscope for a two division p-p display at the left edge of the CRT.
7. Change the plug-in power level to +10 dBm (+7 dBm for option 002) and repeat step 5, adjusting the oscilloscope for a two division p-p display at the left edge of the CRT.

5-27. ALC Gain Check (Cont'd)

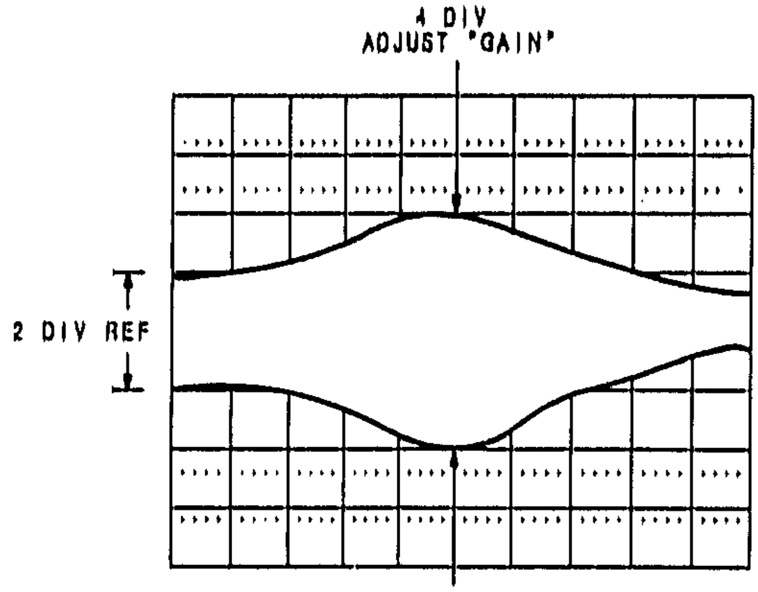


Figure 5-36b. Maximum Allowable ALC Gain Peak

8. If the gain is too high, increase A4R72. An increasing value decreases loop gain.

NOTE: Extreme value changes can affect the bandwidth and stability of A4U17B (the mod driver).

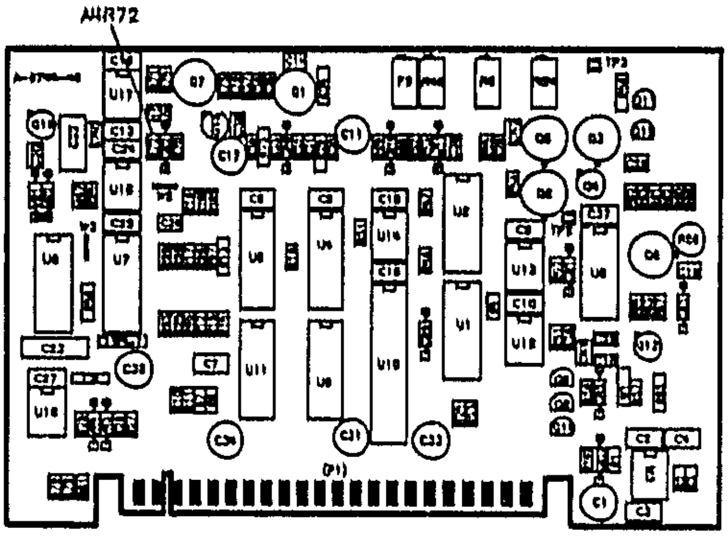


Figure 5-36c. ALC Gain Adjustment Locations

5-28. Internal Leveled Flatness

NOTE: To completely adjust the levelling loop, perform procedures 5-25 through 5-28 in the order given. Doing these adjustments out of order can cause levelling and/or power variation problems.

DESCRIPTION

Four parallel circuits on the A5 assembly provide adjustments for ALC flatness. BP1 through BP4, and SL1 through SL4 determine the shape of the flatness compensation signal.

EQUIPMENT

Sweep Oscillator Mainframe .... HP 8350
Scalar Network Analyzer .... HP 8757A
Detector .... HP 85025B
10 dB Attenuator .... HP 8493C Option 010
Adapter 3.5(f) to Type-n(m) .... HP P/N 1250-1744

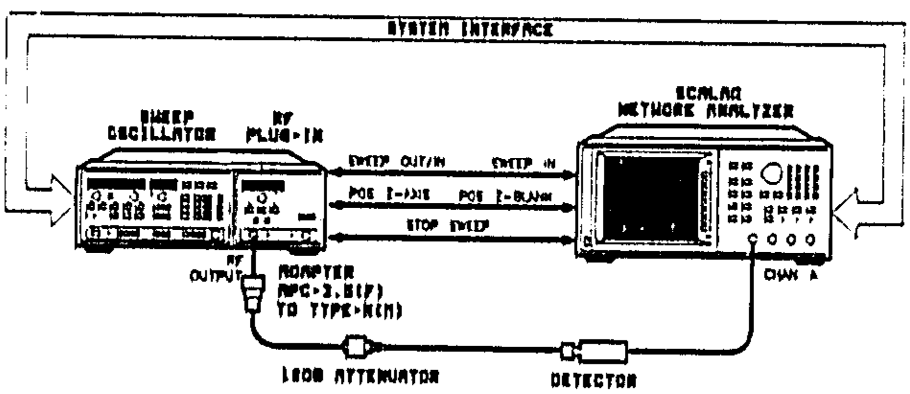


Figure 5-36d. Internal Leveled Flatness Adjustment Test Setup

PROCEDURE

1. Connect the equipment as shown in Figure 5-36d and allow 30 minutes for warm-up.

5-28. Internal Leveled Flatness (Cont'd)

2. On the scalar network analyzer:

   a. Press [PRESET], and select [CHANNEL 2 OFF].
   b. Press [SYSTEM], and select [MODE DC].
   c. Select [CAL] [DC DET ZERO] [MANUAL].

3. On the plug-in, turn the RF power off.

4. On the analyzer, select [CONT].

5. On the plug-in, press [RF] to turn the power back on.

The sweep oscillator/RF plug-in should be in full sweep range, and the sweep time should be 0.2 seconds.

Preset the Adjustments

6. Set A5R34, A5R36, A5R38, and A5R40 (BP1 to 4) fully CW. Set A5R41 through A5R44 (SL1 to 4) to mid-range.

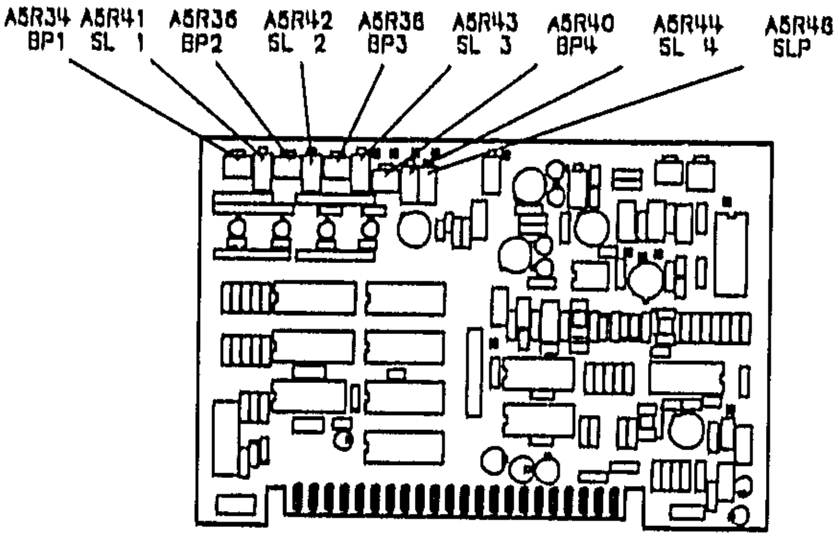


Figure 5-36e. Internal Leveled Flatness Adjustment Locations

7. On the scalar network analyzer:

   a. Press [SCALE] [1] [dB].
   b. Press [REF] and select [REF LEVEL]. Use the rotary knob to center the trace on the display.
   c. Adjust [REF POSN] to center the reference line (see Figure 5-36f).

8. Adjust A5R48 (SLP) for the flattest scalar network analyzer display (see Figure 5-36g).

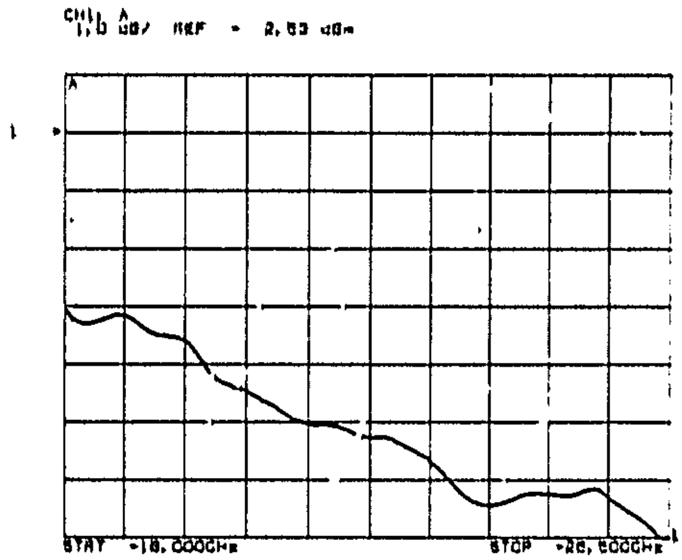


Figure 5-36f. Trace Before Adjustments

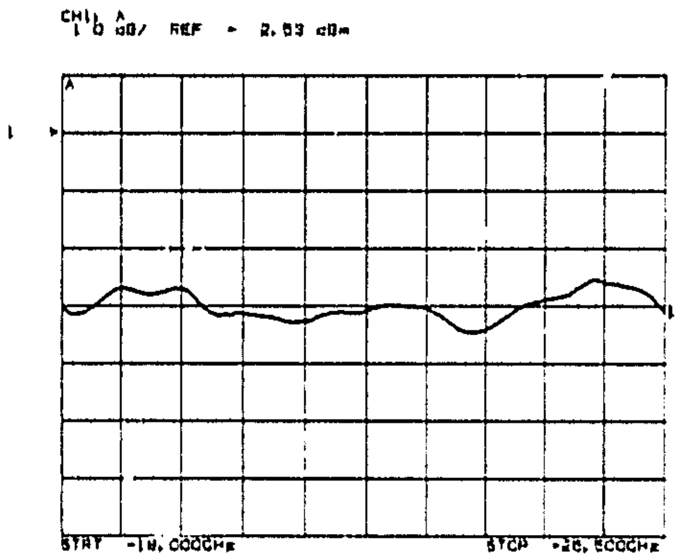


Figure 5-36g. Trace After Main Slope Adjustment

9. The following adjustments affect the displayed output from left to right, with A5R34 (BP1) and A5R41 (SL1) having the greatest affect. Adjust the breakpoint and slope adjustments in pairs (e.g. adjust A5R34 (BP1) and A5R41 (SL1) before you continue to A5R36 (BP2) and A5R42 (SL2), etc.).

10. Identify the breakpoint (it appears as a pivot point on the trace). Adjust A5R34 (BP1) so that the adjustment point lies, as closely as possible, on the breakpoint.

    If needed, use the scalar network analyzer SCALE function to increase the displayed resolution.

5-28. Internal Leveled Flatness (Cont'd)

11. Adjust A5R41 (SL1) to rotate the slope and bring it closer to a flatter display. Iterate between A5R34 (BP1) and A5R41 (SL1) for the flattest display.

12. Repeat step 11 for the following adjustment pairs:

    A5R36 (BP2) and A5R42 (SL2)
    A5R38 (BP3) and A5R43 (SL3)
    A5R40 (BP4) and A5R44 (SL4)

    The final, properly adjusted trace should be similar to Figure 5-36h. If the trace is not adjusted properly, return to step 6. Do not attempt to readjust from the middle of the procedure.

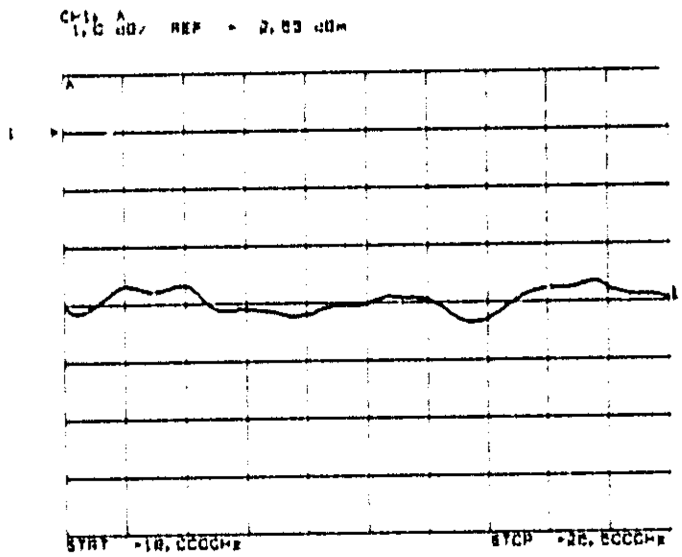


Figure 5-36h. Properly Adjusted Power

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3U6	1820-1202	7	2	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3U7	1820-1197	9	3	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
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

See introduction to this section for ordering information

*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Description
A4	33590-60105	Board Assembly-ALC
A4C1	0160-3771	1.0 uF PCAP
A4C2	0160-4084	0.1 uF CAP
A4C3	0160-4084	0.1 uF CAP
A4C4	0160-4084	0.1 uF CAP
A4C5	0160-4084	0.1 uF CAP
A4C6	0160-4084	0.1 uF CAP
A4C7	0160-4084	0.1 uF CAP
A4C8	0160-4535	1.0 uF CAP
A4C9	0160-4084	0.1 uF CAP
A4C10	0160-4084	0.1 uF CAP
A4C11	0160-3770	2.2 uF PCAP
A4C12	0160-4084	0.1 uF CAP
A4C13	0160-4084	0.1 uF CAP
A4C14	0160-3879	0.01 uF CAP
A4C15	0160-4084	0.1 uF CAP
A4C16	0160-4084	0.1 uF CAP
A4C17	0160-3833	22 uF PCAP
A4C18	0160-3879	0.01 uF CAP
A4C19	0160-3875	22 pF PCAP
A4C20	0160-3874	10 pF CAP
A4C21		Not Assigned
A4C22	0160-0945	910 pF CAP
A4C23	0160-0128	2.2 uF PCAP
A4C24	0160-4084	0.1 uF CAP
A4C25	0160-4084	0.1 uF CAP
A4C26		Not Assigned
A4C27	0160-4084	0.1 uF CAP
A4C28	0160-3879	0.01 uF CAP
A4C29	0160-0572	2200 pF CAP
A4C30		Not Assigned
A4C31	0160-3831	10 uF PCAP
A4C32	0160-3831	10 uF PCAP
A4C33	0160-3831	10 uF PCAP
A4C34	0160-3831	10 uF PCAP
A4C35	0160-0572	2200 pF CAP
A4C36		Not Assigned
A4C37	0160-4084	0.1 uF CAP
A4C38	0160-0572	2200 pF CAP
A4C39	0160-3879	0.01 uF CAP
A4C40	0160-3874	10 pF CAP
A4C41	0160-0573	220 pF CAP
A4C42	0160-4389	100 pF CAP
A4CR1	1901-1098	P-N DIODE
A4CR2	1901-1098	P-N DIODE
A4CR3	1901-1098	P-N DIODE
A4CR4		Not Assigned
A4CR5	1901-0535	SCHOTTKY DIODE
A4CR6	1901-1098	P-N DIODE
A4CR7		Not Assigned
A4CR8		Not Assigned
A4CR9	1901-1098	P-N DIODE
A4CR10	1901-0535	SCHOTTKY DIODE
A4CR11	1901-0535	SCHOTTKY DIODE
A4CR12	1901-0535	SCHOTTKY DIODE
A4CR13		Not Assigned
A4MP1	1251-2194	CONN SGL CONT 02
A4MP2	1251-2194	CONN SGL CONT 02
A4MP3	1251-2194	CONN SGL CONT 02
A4MP4	1251-2194	CONN SGL CONT 02
A4MP5	5000-9043	PIN
A4MP6	5040-6848	EXTRACTOR, YELLOW

See introduction to this section for ordering information.

*Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Description
A4Q1	1853-0075	TRANSISTOR, DUAL PNP
A4Q2	1853-0075	TRANSISTOR, DUAL PNP
A4Q3	1853-0075	TRANSISTOR, DUAL PNP
A4Q4	1855-0386	N-CHANNEL JFET
A4Q5	1854-0296	TRANSISTOR, DUAL NPN
A4Q6	1853-0316	TRANSISTOR, DUAL PNP
A4Q7	1853-0075	TRANSISTOR, DUAL PNP
A4Q8	1855-0423	N-CHAN E-MODE MOSFET
A4Q9	1855-0423	N-CHAN E-MODE MOSFET
A4Q10	1855-0423	N-CHAN E-MODE MOSFET
A4Q11		Not Assigned
A4Q12	1855-0423	N-CHAN E-MODE MOSFET
A4Q13	1853-0451	TRANSISTOR, PNP
A4Q14		Not Assigned
A4Q15	1854-0477	TRANSISTOR, NPN
A4Q16	1855-0386	N-CHAN JFET
A4R1	0698-7284	100K .05W RESISTOR
A4R2	0698-7284	100K .05W RESISTOR
A4R3	0698-7284	100K .05W RESISTOR
A4R4	0698-7285	110K .05W RESISTOR
A4R5		Not Assigned
A4R6	2100-3753	TRIMMER RESISTOR 17T 200K
A4R7*	0698-7280	68.1K .05W RESISTOR
A4R8		Not Assigned
A4R9		Not Assigned
A4R10	0698-7272	31.6K .05W RESISTOR
A4R11	0698-7262	12.1K .05W RESISTOR
A4R12	0698-7254	5.62K .05W RESISTOR
A4R13		Not Assigned
A4R14	0698-7235	909 .05W RESISTOR
A4R15	0698-7263	13.3K .05W RESISTOR
A4R16	0698-7263	23.7K .05W RESISTOR
A4R17	0698-7260	10K .05W RESISTOR
A4R18	0698-7260	10K .05W RESISTOR
A4R19		Not Assigned
A4R20		Not Assigned
A4R21		Not Assigned
A4R22		Not Assigned
A4R23	0698-7212	100 .05W RESISTOR
A4R24	0698-7243	1.96K .05W RESISTOR
A4R25	0698-7212	100 .05W RESISTOR
A4R26	0698-7212	100 .05W RESISTOR
A4R27	0698-7243	1.96K .05W RESISTOR
A4R28	0698-7238	1.21K .05W RESISTOR
A4R29	0698-8827	1M .125W RESISTOR
A4R30	0698-7236	1M .05W RESISTOR
A4R31	0698-7243	1.96K .05W RESISTOR
A4R32	0698-7248	3.16K .05W RESISTOR
A4R33	0698-7242	1.96K .05W RESISTOR
A4R34	0698-8824	562K .124W RESISTOR
A4R35	0698-7270	26.1K .05W RESISTOR
A4R36	0698-7284	100K .05W RESISTOR
A4R37	0698-7234	825 .05W RESISTOR
A4R38	0698-7224	316 .05W RESISTOR
A4R39	0698-7212	100 .05W RESISTOR
A4R40	0698-3463	196K .125W RESISTOR
A4R41	0698-7243	1.96K .05W RESISTOR
A4R42	0698-7233	750 .05W RESISTOR
A4R43	0698-7233	750 .05W RESISTOR
A4R44	0698-7260	10K .05W RESISTOR
A4R45		Not Assigned

See introduction to this section for ordering information.

*Indicates factory selected value.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Description
A4R46	0698-6959	619K .125W RESISTOR
A4R47	0698-7236	1K .05W RESISTOR
A4R48	0698-7247	2.87K .05W RESISTOR
A4R49	2100-3749	TRIMMER RESISTOR 17T 5K
A4R50		Not Assigned
A4R51	0698-7237	1.1K .05W RESISTOR
A4R52	0698-7246	2.61K .05W RESISTOR
A4R53	0698-7246	2.61K .05W RESISTOR
A4R54	2100-3759	TRIMMER RESISTOR 17T 2K
A4R55		Not Assigned
A4R56		Not Assigned
A4R57	0698-7243	1.96K .05W RESISTOR
A4R58	0698-7243	1.96K .05W RESISTOR
A4R59	2100-2216	TRIMMER RESISTOR 1T 5K
A4R60	0698-7253	5.11K .05W RESISTOR
A4R61	0698-7242	1.78K .05W RESISTOR
A4R62	0698-7265	16.2K .05W RESISTOR
A4R63	0698-7257	7.5K .05W RESISTOR
A4R64	0698-7251	4.22K .05W RESISTOR
A4R65		Not Assigned
A4R66	0698-7247	2.87K .05W RESISTOR
A4R67	0811-3887	0 OHM .05W RESISTOR
A4R68	0698-7243	1.96K .05W RESISTOR
A4R69	0698-7285	110K .05W RESISTOR
A4R70	0698-7243	1.96K .05W RESISTOR
A4R71	0698-7223	287 .05W RESISTOR
A4R72*	0698-7246	2.61K .05W RESISTOR
A4R73	0757-0421	825 .125W RESISTOR
A4R74	0698-7212	110 .05W RESISTOR
A4R75	0698-7265	16.2K .05W RESISTOR
A4R76	0698-7246	2.61K .05W RESISTOR
A4R77		Not Assigned
A4R78	0698-7219	196 .05W RESISTOR
A4R79	0698-7277	51.1K .05W RESISTOR
A4R80		Not Assigned
A4R81	0698-7251	4.22K .05W RESISTOR
A4R82*	0698-7269	23.7K .05W RESISTOR
A4R83	0698-7267	19.6K .05W RESISTOR
A4R84	0698-7274	2.87K .05W RESISTOR
A4R85	0698-3440	196 .125W RESISTOR
A4R86		Not Assigned
A4R87	0698-7284	100K .05W RESISTOR
A4R88		Not Assigned
A4R89		Not Assigned
A4R90		Not Assigned
A4R91		Not Assigned
A4R92		Not Assigned
A4R93		Not Assigned
A4R94		Not Assigned
A4R95		Not Assigned
A4R96		Not Assigned
A4R97		Not Assigned
A4R98		Not Assigned
A4R99		Not Assigned
A4R100	0698-7260	10K .05W RESISTOR
A4R101	0698-7284	100K .05W RESISTOR
A4R102	0698-7246	2.15K .05W RESISTOR

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Description
A4RT1	0837-0119	THERMISTOR 5K, .7%/DEG C
A4TP1	0360-0535	PCB TEST POINT
A4TP2	0360-0535	PCB TEST POINT
A4TP3	0360-0535	PCB TEST POINT
A4TP4-7	1251-7624	TEST POINT HEADER
A4U1	1826-0610	MPI MUX-24
A4U2	1826-0610	MPI MUX-24
A4U3	1826-1128	LF 412 DUAL OP-AMP
A4U4	1826-1166	PMI SW-06
A4U5	1826-0616	PMI OP-11 QUAD OP-AMP
A4U6	1826-1166	PMI SW-06
A4U7	1826-1166	PMI SW-06
A4U8	1820-1425	TTL QUAD 2-INPUT NAND
A4U9	1820-1216	TTL 3-8 DECODER
A4U10	83592-60057	TTL PAL20X8, PROGRAMMED
A4U11	1826-0752	AD7542 12-BIT DAC
A4U12	1826-0962	PMI OP-37
A4U13	1826-1049	PMI OP-27
A4U14	1826-0752	PMI OP-37
A4U15	1826-1128	LF 412 DUAL OP-AMP
A4U16	1826-1221	LM 311 COMPARATOR
A4U17	1826-1128	LF 412 DUAL OP-AMP
A4VR1	1902-0049	6.19V ZENER DIODE
A4VR2	1902-0049	6.19V ZENER DIODE
A4VR3	1902-3070	4.22V ZENER DIODE
A4VR4	1902-3070	4.22V ZENER DIODE
A4W1	8159-0005	0 OHM RESISTOR
A4W2	1460-1489	SERVICE JUMPER
A4W3	1460-1489	SERVICE JUMPER

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
A5	83592-60005	5		BOARD ASSEMBLY-FM	28480	83592-60005
A5C1	0160-0575	4	4	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 .1 UF ±20% 50VDC CER	28480	0160-4084
A5C4	0160-0945	2		CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
A5C5	0160-0577	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		CAPAICOTR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C8	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C9	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C10	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C11	0140-0198	5	1	CAPACITOR-FXD 200PF ±5% 300VDC MICA	72136	DM15F201 J0300WV1C4
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

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
A8C18	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C19				NOT ASSIGNED		
A8C20	0160-2249	3	2	CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2249
A8C21				NOT ASSIGNED		
A8C22				NOT ASSIGNED		
A8C23	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C24	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C25	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C26	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A8C27	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C28	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C29	0180-2617	1	4	CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A8C30	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A8C31	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A8C32	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A8C33	0180-3307	6	1	CAPACITOR-FXD 100UF±10% 10VDC TA	56289	150D107X9010R2
A8C34	0180-0474	4	6	CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A8C35	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A8C36	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A8C37	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A8C38	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A8C39	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A8C40	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C41	0160-2249	3		CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2249
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	1901-0047	8	2	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A8CR4	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A8CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A8CR6	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A8CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A8CR8	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	00040	1N4150
A8CR9	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8K1	0490-0916	8		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A8K2	0490-1063	8	1	RELAY-REED 2A 500MA 50VDC 5VDC-COIL 10VA	28480	0490-1063
A8L1	9100-1626	0	1	INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1626
A8L2	9100-1619	2	4	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A8L3	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A8L4	08803-60001	5	4	COIL TOROID	28480	08803-60001
A8L5	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A8L6	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A8MP1	5040-6881	3	1	EXTRACTOR	28480	5040-6881
A8MP2	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A8MP3	4330-0145	9	6	INSULATOR-BEAD GLASS	28480	4330-0145
A8MP4	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A8MP5	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A8MP6	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A8MP7	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A8MP8	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A8Q1	1854-0829	0	4	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0829
A8Q2	1854-0829	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0829
A8Q3	1854-0829	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0829
A8Q4	1854-0829	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0829
A8Q5	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A8R1	0698-0083	8	2	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A8R2	0698-3154	0	5	RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A8R3	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A8R4	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A8R5	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A8R6	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A8R7	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A8R8	0698-3158	4	2	RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A8R9	0698-6360	6	6	RESISTOR 10K .1% .125W F TC=0±25	28480	0698-6360
A8R10	0699-0124	0	1	RESISTOR 10.2K .1% .125W F TC=0±25	28480	0699-0124
A8R11	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0±100	24546	C4-1/8-T0-4641-F
A8R12	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-[illegible]-F
A8R13	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-T0-383R-F
A8R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A8R15	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A8R16				NOT ASSIGNED		
A8R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A8R19	2100-3749	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A8R20	0757-0458	7	3	RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A8R21	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0±100	24546	C4-1/8-T0-1782-F
A8R22	0698-6360	6		RESISTOR 10K .1% .125W F TC=0±25	28480	0698-6360
A8R23	0698-3161	7	1	RESISTOR 2.87K 1% .125W F TC=0±100	24546	C4-1/8-T0-2871-F
A8R24				NOT ASSIGNED		

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

A4 ALC (AUTOMATIC LEVELING CONTROL) ASSEMBLY CIRCUIT DESCRIPTION

INTRODUCTION

The A4 ALC assembly is part of a closed loop power levelling function that controls the RF output power amplitude. The following describes both loop operation, including some components external to the A4 assembly, and the A4 assembly circuits.

GENERAL

The power control and power levelling circuits can be broken into two categories: internal loop circuitry, and components external to the loop (see Figure 8-24).

The ALC power level reference leg establishes the desired power level. To use this leg, either press the plug-in [POWER LEVEL] key and rotate the RPG, or enter the desired reference using the sweep oscillator front panel data entry keys. The ALC leg is not an interdependent part of the loop.

The ALC loop feedback path samples the actual RF output power and produces a voltage proportional to the 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 that is amplified and converted to a current drive for the RF modulators, which vary the transmitted RF power to correct the error.

POWER LEVEL REFERENCE, BLOCK B

A 12-bit DAC (U11) is controlled by the sweep oscillator microprocessor. Depending on the plug-in operating mode, the DAC's output is summed with:

- AM
- power sweep
- detector compensation (vs frequency)
- an offset voltage used to calibrate the loop at the extreme low end of its power range.
- external and power meter levelling

The reference voltage is negative, decreasing approximately 300 mV per dB change in power level. A thermistor compensates for the log amp's 0.3%/°C temperature coefficient. R17 sums the reference and feedback voltages.

DIGITAL CONTROL/DECODING, BLOCK D

U9 decodes lines from the sweep oscillator microprocessor to enable U10, a 24-pin PAL, whose 10 outputs control analog switches and logic gates on the board. U10 latches in data at each bandswitch or when the ALC mode is changed from the front panel.

U10 logic:

- B1 — always high
- PM — high in power meter leveling
- L INT — low in internal leveling
- INT — the complement of L INT
- L SLP — low in internal leveling (L SLP = L INT + B1)
- EXT — high in external leveling
- L PULSE EN — low when pulse modulation is enabled (always)
- MUX A0, A1, A1B — see Table 8-12

Table 8-12. Leveling Control Lines

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

LOGARITHMIC FEEDBACK AMPLIFIERS, BLOCK G

There are two logarithmic feedback amplifiers:

The Power Meter Logger

U5C and Q1, switched in by U4A, form a non-inverting logger that amplifies a positive voltage. R30 forms a voltage divider with the power meter's internal source impedance, keeping the logger input voltage less than 0.5V. R29 applies a small positive voltage to the logger input when the plug-in is not in power meter leveling.

When the logger input is negative, CR6 provides feedback for U5C, protecting Q1. U17A forms a buffer (with a gain of five) and the phase lead network for loop compensation. In power meter mode, U6A switches the power meter logger into the loop summing node through R37.

The Dual-Slope Logger

U12 (a non-inverting buffer with a gain of approximately seven), 13, and 14 form the internal dual-slope logger. Q8, Q9, and Q10 switch between the internal and external detector returns. CR1 clamps U13, similarly to CR6 in the power meter logger. Q5 forms a dual current source to bias the logger's breakpoint. The breakpoint current is set by R49 and R50, and selected by U2A. R46 sets the logger zero-crossing current, which corresponds to a −2 mV detector input voltage.

U14 is a non-inverting buffer whose gain is adjusted by R54 and R55 (selected by U2B) for power level calibration. CR11, R44, and C42 clamp the logger output from going too far negative. CR9 provides feedback for U14. In internal and external leveling, U6C switches the internal logger to the loop summing node through R51, and U6D switches the internal logger to the summing node through C17 (a differentiating capacitor), Q4, and R39. Q4 acts as a sample and hold switch for the charge on C17 when 27.8 kHz square wave modulation is used in the power meter leveling mode.

MAIN ALC AMPLIFIER, BLOCK C
SAMPLE AND HOLD DRIVER, BLOCK L

C22 and R64 set the time constant for integrator U15A, whose input is the weighted sum of the reference voltage and the logger output voltage. VR1 and VR2 clamp to +7V on the integrator output. When W3 is removed and power meter leveling is used, U6B switches in C23 to increase the time constant, lowering the loop gain. Q16, C20 and C40 sample and hold in pulse modulation, 27.8 kHz square wave modulation, and RF blanking during bandswitch and retrace.

Q16 and Q4 are controlled by the sample and hold driver. The collectors of Q6 drive Q16 and C20 differentially. R59 adjusts the differential signal amplitude to C20, compensating for the gate-source capacitance of Q16. C19 and C40 optimally match the rise time on the Q6 drive lines. Q6 is a switching circuit (one-half of the pair is always off).

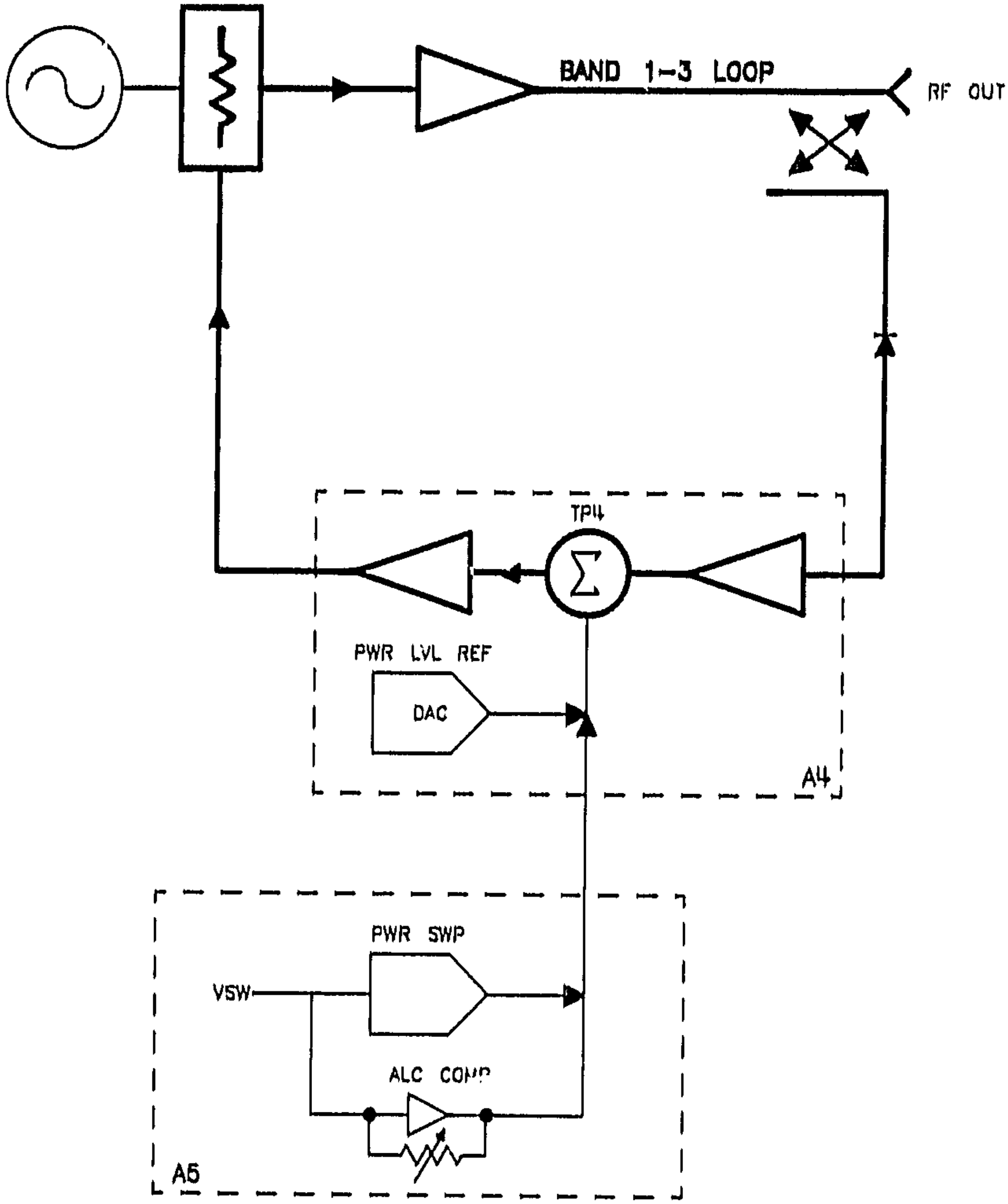
The loop is on hold when L RFB is active (bandswitces and blanking pulses), and when the RF is turned off in square wave modulation or pulse modulation. To keep the loop in the hold mode long enough for all switching translents to subside, each input to Q6 is delayed by one of three delay networks, one each for square wave modulation, pulse modulation, and blanking.

BAND 1 PIN MODULATOR DRIVER, BLOCK J

The output of the current source formed by U17B, Q7, and Q15 is approximately proportional to the exponential of the input voltage (with a scaling factor). C35 and R71 provide stability for U17B, and help reduce residual AM on the RF output. R72 adjusts the gain of this circuit.

Be careful when adjusting the value of R72 (factory select value); increasing the value reduces the stability margin of U17B, and reducing the value lowers the bandwidth and can, if lowered too much, also hurt stability. CR2 provides U17B feedback when the input is positive, and C26 compensates for parasitic capacitance at the inverting input of U17B to ground.

For open loop control and troubleshooting, remove W2 and connect TP6 to TP5 through a 10K resistor. The front panel power control then affects the output power over a small range.



NOTE

Darker lines represent the band 1-3 leveling loop. Lighter lines represent circuitry that contributes to, but is not contained within, the loop.

Figure 8-41. Simplified ALC Block Diagram

A4P1 Pin-Outs

A4P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 23	EXT DET RET EXT DET	IN IN	J2 J2	P B
2 24	L UNLVL EXT CAL	OUT IN	A6P1-40, A10J1-12 A10J1-41	M H
3 25	PWR REF	OUT	NOT USED NOT USED	C
4 26	AM	IN	P1-A4 NOT USED	C
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 RFS	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	OUT IN	A10-E1 A6P1-25	N K
20 42	INT DET 1 INT DET RET	IN IN	CR1 CR1	B B
21 43	 −10V REF	 IN	NOT USED A8P1-3	 C
22 44	MOD DRIVE	OUT	NOT USED NOT USED	L

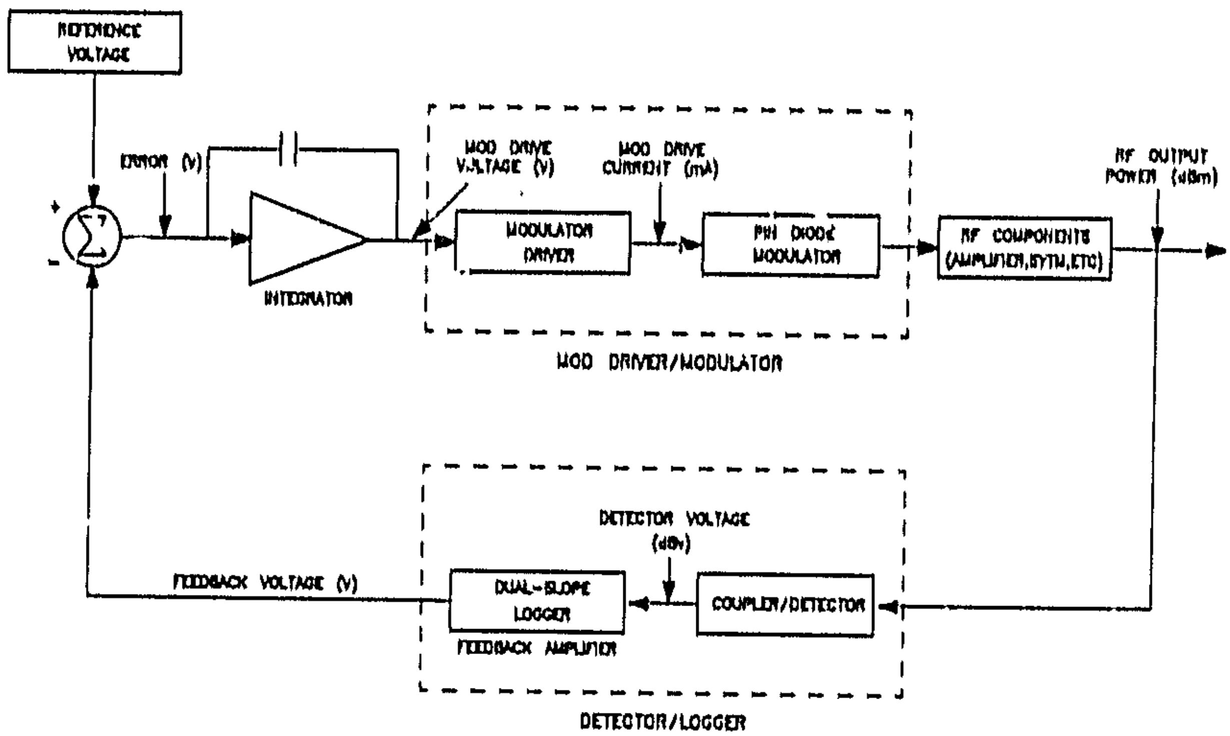
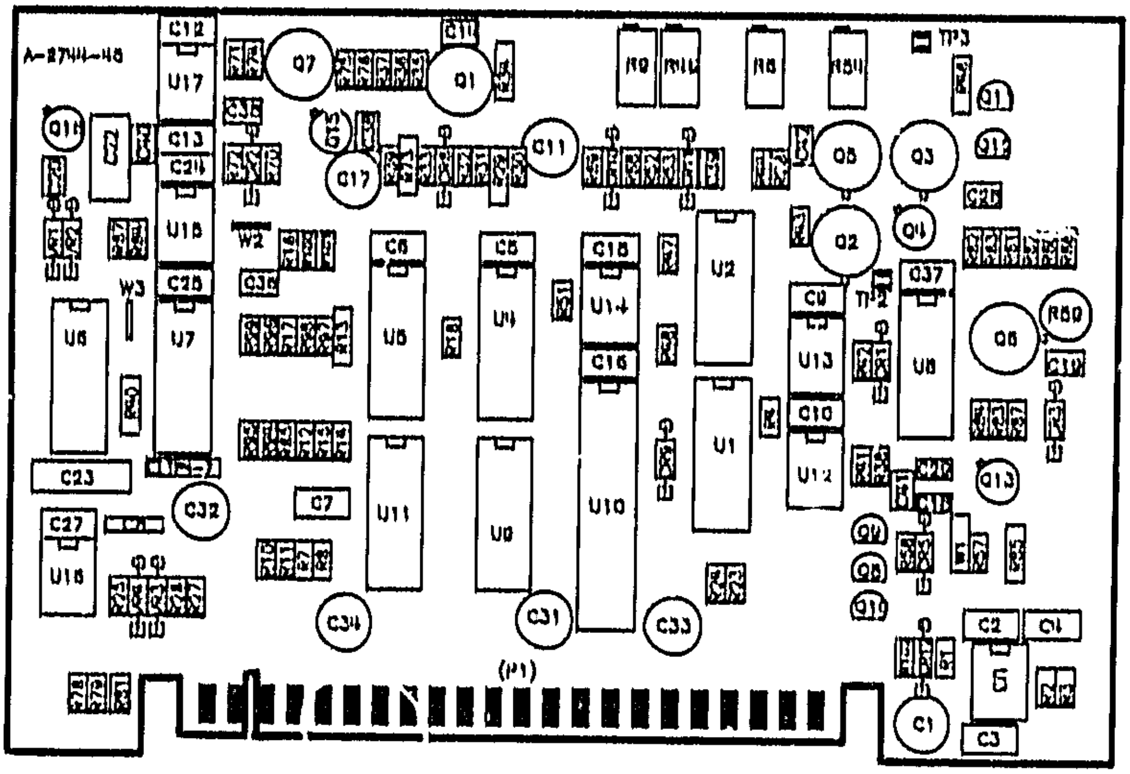
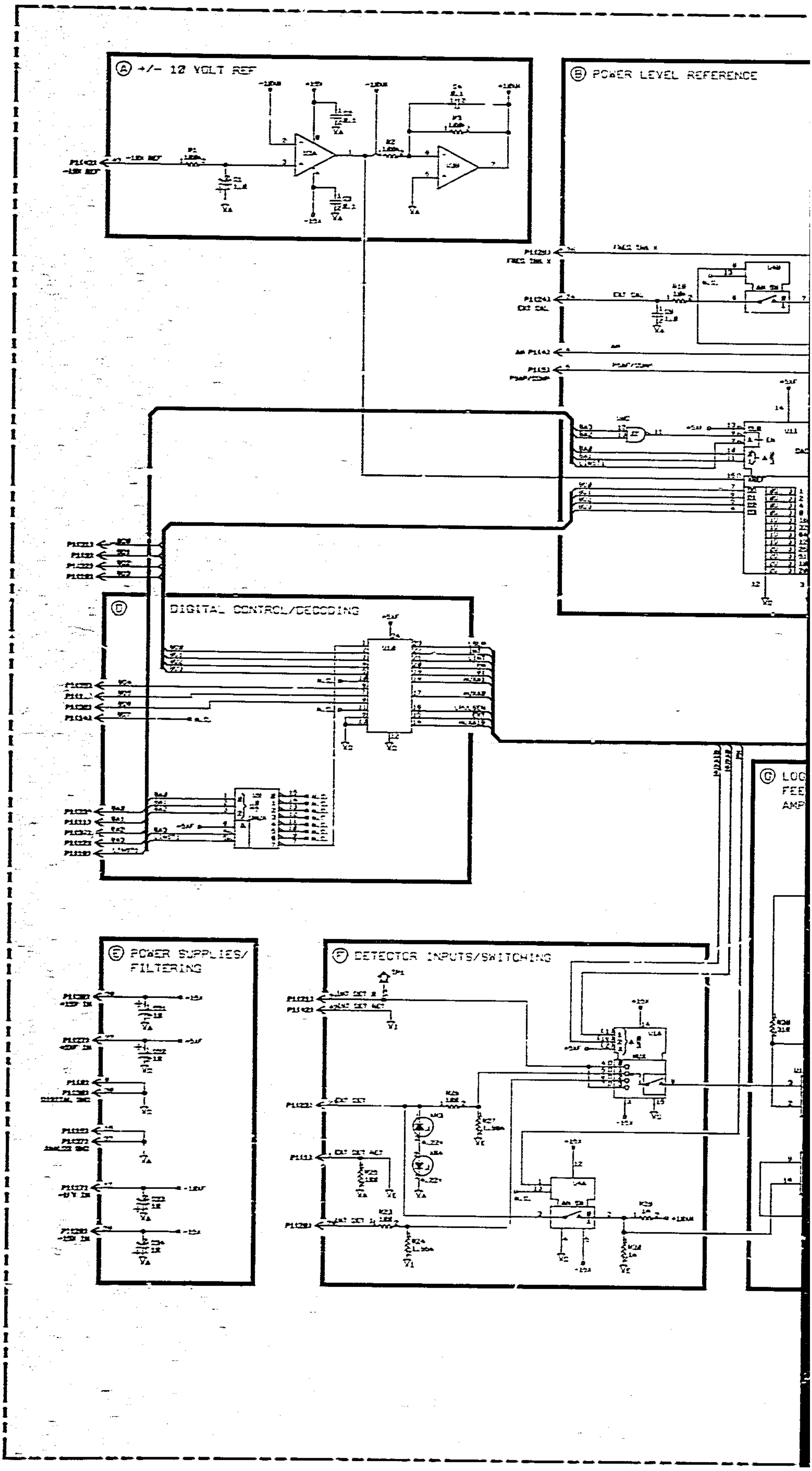


Figure 8-28. A4 ALC, Block Diagram

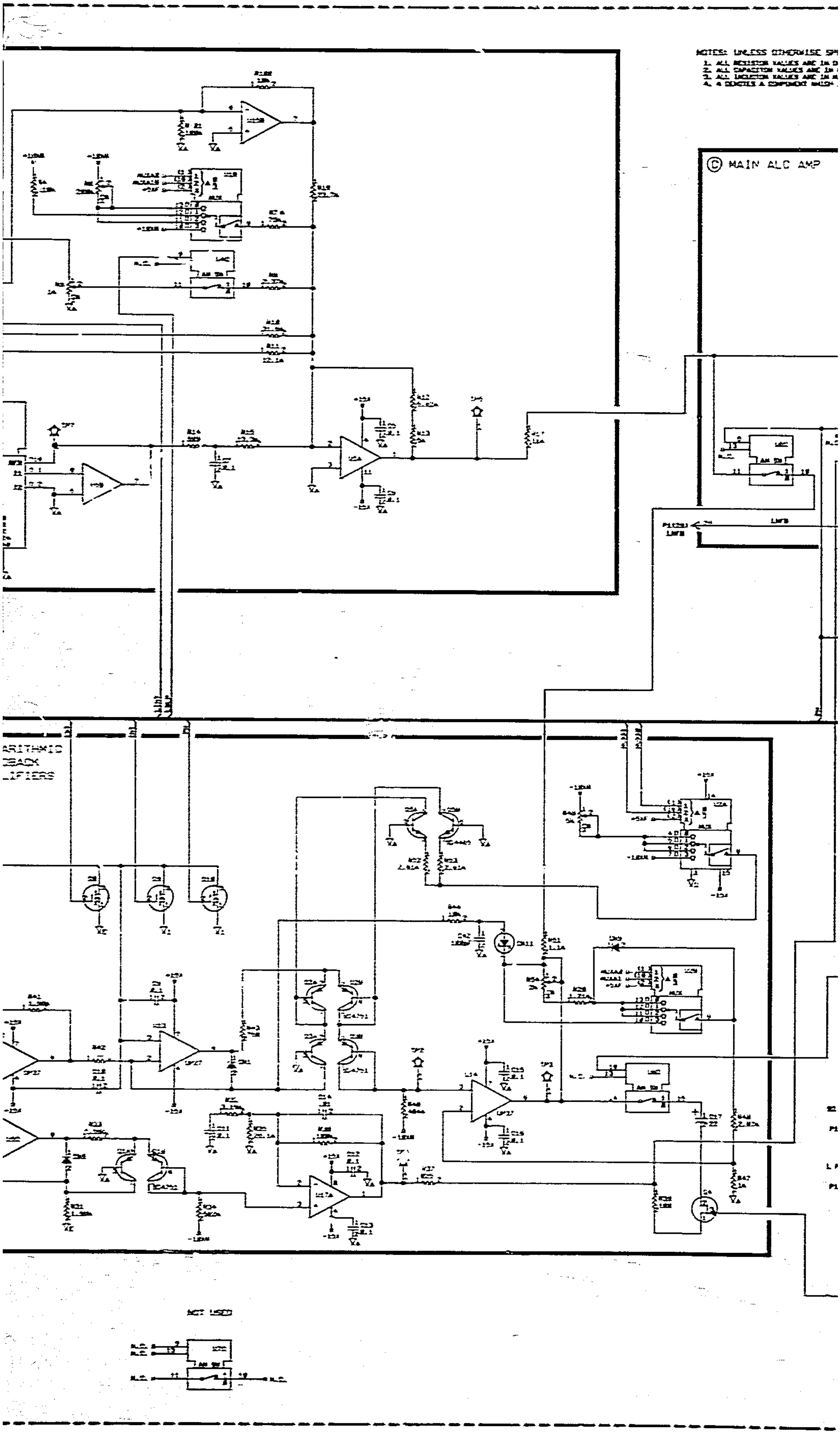


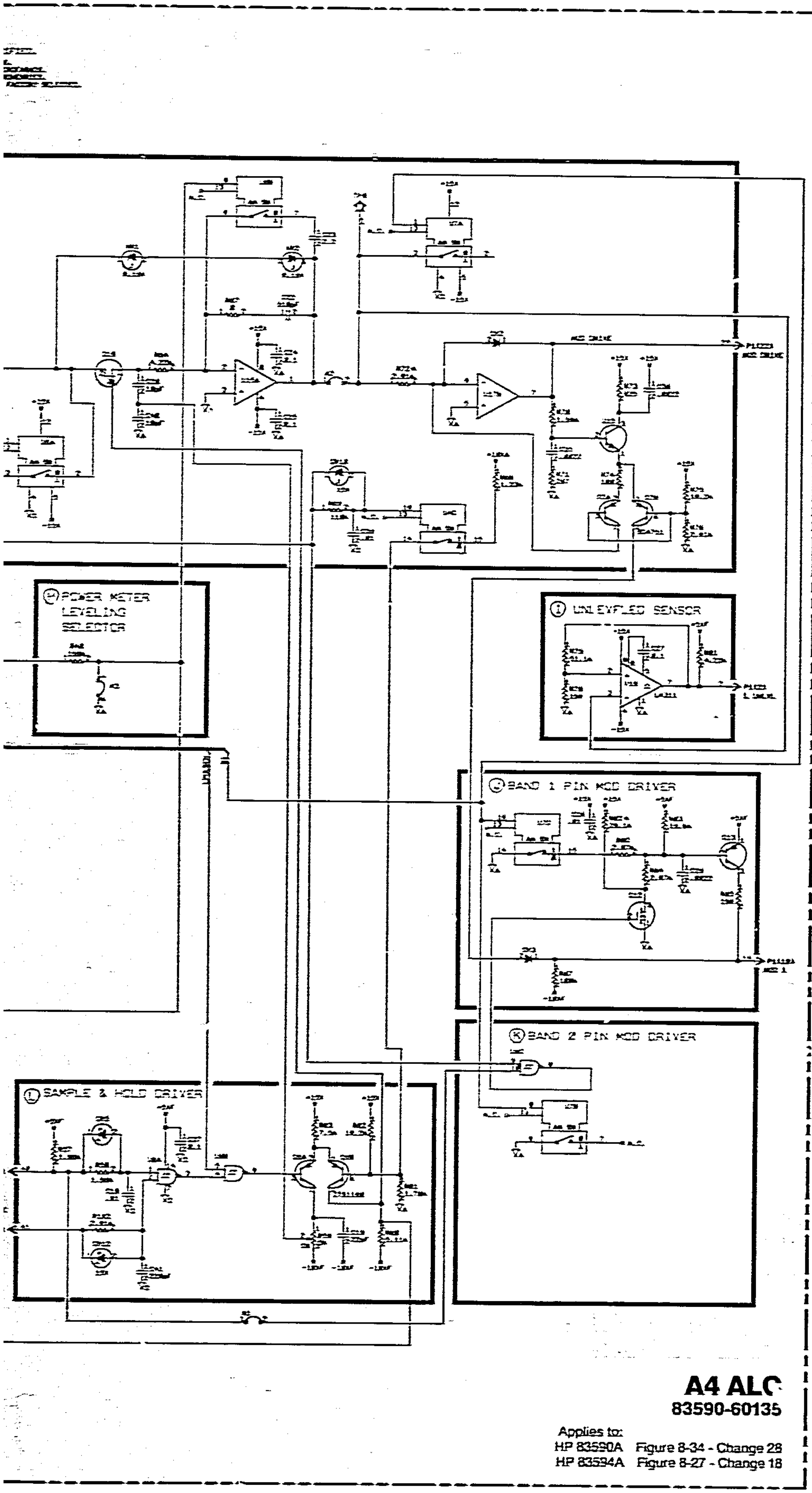
HP Part Number 83590-60135

Figure 8-29. A4 ALC Component Locations



A +/- 12 VOLT REF
B POWER LEVEL REFERENCE
D DIGITAL CONTROL/DECODING
E POWER SUPPLIES/ FILTERING
F DETECTOR INPUTS/SWITCHING
G LOG FEE AMP


NOTES: UNLESS OTHERWISE
© MAIN ALC AMP
NOT USED



A4 ALC
83590-60135

Applies to:
HP 83590A Figure 8-34 - Change 28
HP 83594A Figure 8-27 - Change 18

MANUAL IDENT'FICATION

HP Model Number: HP 83590A
Manual Part Number: 83590-90005
Date Printed: February 1982

CHANGE 32

Change 32 documents serial prefix 2030A.

This change documents an improvement to the A8 YO driver assembly.

INSTRUCTIONS

Replace the title page with the title page in this change packet.

Page 6-16, Table 6-3:
Change A8C16 to 0160-3742, CD3, Capacitor-MPC 1.0μf 50V

Page 6-17, Table 6-3:
Change A8R49, R50, and R51 to 0757-0465, CD6, Resistor 100K 1% 0.12W

Page 8-69:
Replace Figure 8-71 with Figure 8-71 in this change packet.

HP 83590A
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBERS

This manual applies directly to HP 83590A RF plug-in having serial number prefix 2146A.

For instruments with serial prefix 2143A and below, refer to Section 7 Manual Backdating

For additional information about serial numbers, refer to INSTRUMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: 1 NOV 1988

Change	Documents Prefix		Change	Documents Prefix		Change	Documents Prefix
1	2216A		17	2428A			
2	2217A		18	2451A			
3	2221A		19	2502A			
4	2233A		20	2507A			
5	2234A		21	2519A			
6	2249A		22	2543A			
7	2252A		23	2602A			
8	2306A		24	2619A			
9	2313A		25	2645A			
10	2316A		26	2718A			
11	2338A		27	2726A			
12	2410A		28	2809A			
13	2411A		29	N/A			
14	2411A		30	N/A			
15	2412A		31	2836A			
16	2413A		32	2839A			

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MANUAL PART NO. 83590-90005
Microfiche Part Number 83590-90006

Printed: FEBRUARY 1982

HEWLETT PACKARD

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.

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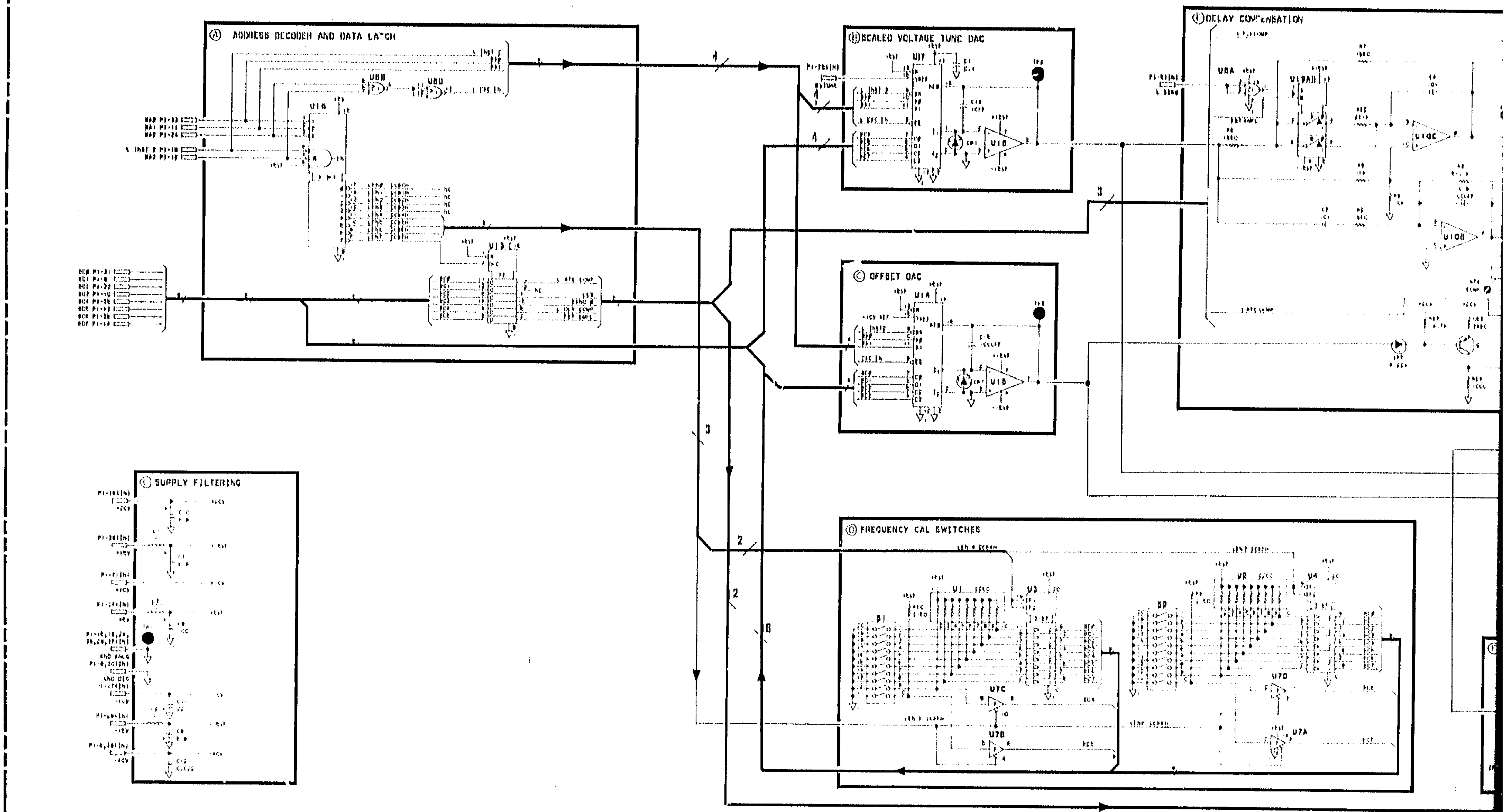
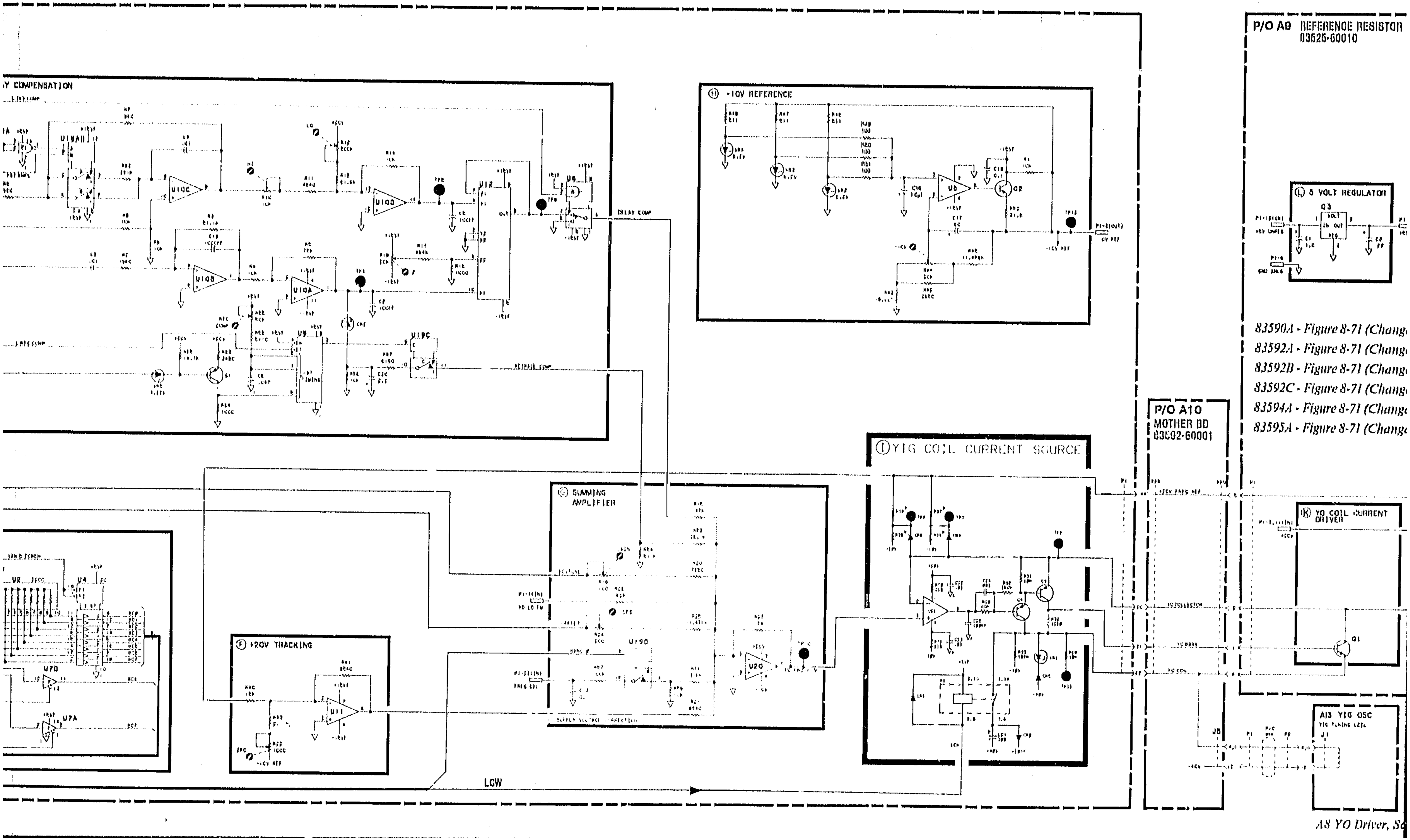
For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

BF? ?

A8 YO DRIVER
83595-60070





83590A - Figure 8-71 (Chang

83592A - Figure 8-71 (Chang

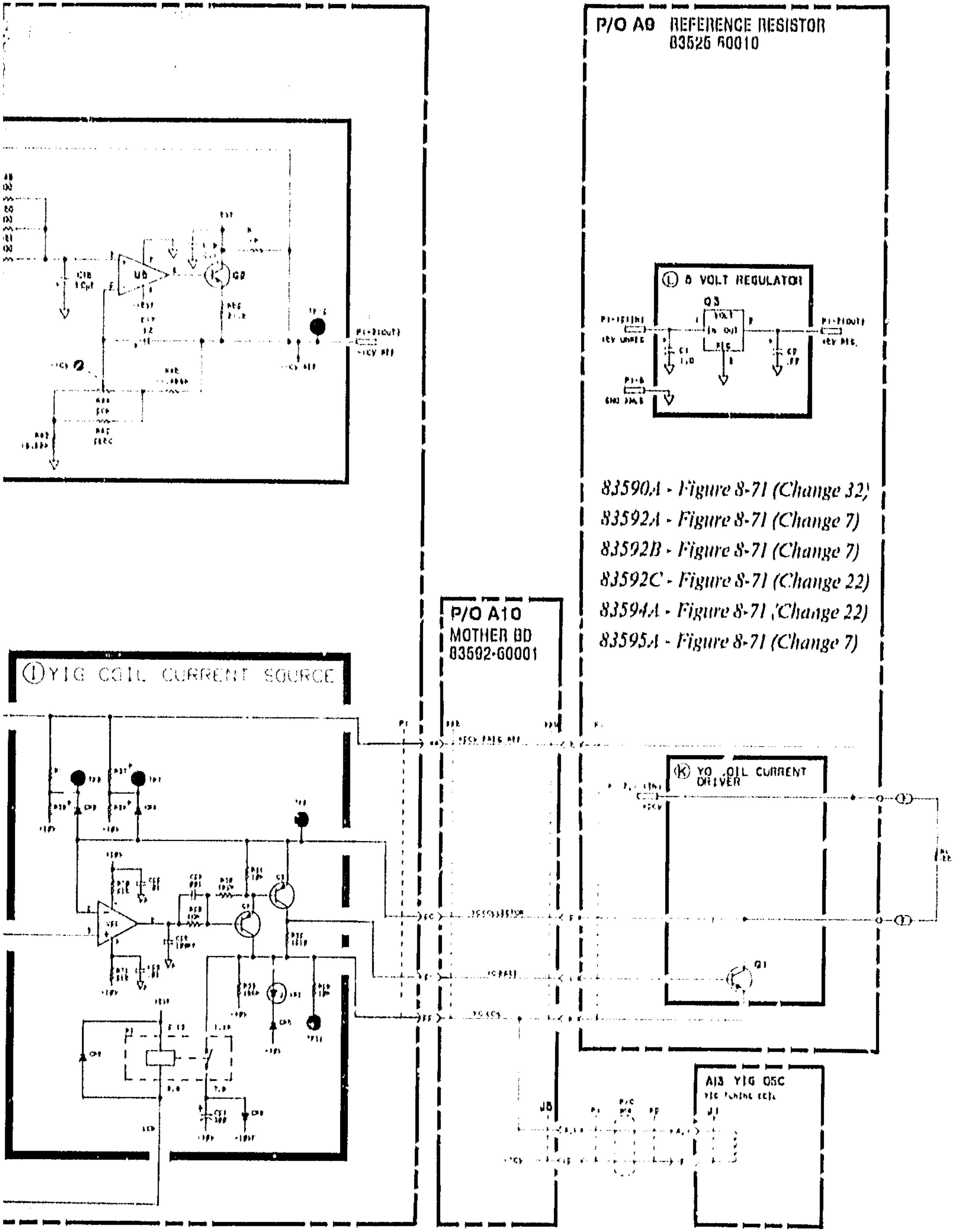
83592B - Figure 8-71 (Chang

83592C - Figure 8-71 (Chang

83594A - Figure 8-71 (Chang

83595A - Figure 8-71 (Chang

A8 YO Driver, Sc



A8 YO Driver, Schematic Diagram

SERVICE INFORMATION

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for troubleshooting and repairing the Model 83590A RF Plug-in. Information includes circuit descriptions, troubleshooting procedures, block diagrams, schematics, and component location maps for each PC board assembly.

WARNING

Adjustments or repairs inside the 8350A/83590A with the top or bottom cover removed and the ac power connected should be avoided whenever possible. Any procedure requiring a cover to be removed from the instrument and ac power connected to the mainframe SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED. With the ac power cable connected to the instrument, the ac line voltage is present on the terminals of the line power module on the rear panel, and at the LINE power switch, whether the switch is ON or OFF. The ac line voltage on these terminals can, if contacted, produce fatal electrical shock. You must also be aware that capacitors inside the instrument may remain charged even though the instrument has been disconnected from its ac power source.

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

8-3. SERVICE SHEETS

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

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

8-6. SCHEMATIC DIAGRAM NOTES

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

8-8. MNEMONICS

8-9. The Motherboard Wiring List (Service Sheet A10) lists alphabetically and defines all 83590A 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 83590A.

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.

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.

Table 8-1. Index of Service Sheets

BASIC COMPONENT SYMBOLOGY

Symbol	Description
R, L, C	Resistance is in ohms, inductance is in henries, capacitance is in microfarads, unless otherwise noted.
P/O	Part of.
*	Indicates a factory selected component.
	Panel Control.
	Screwdriver adjustment.
	Encloses front panel designation.
	Encloses rear panel designation.
	Circuit assembly borderline.
	Other assembly borderline.
	Heavy line with arrows indicates path and direction of main signal.
	Indicates path and direction of main feedback.
	Earth ground symbol.
	Assembly ground. May be accompanied by a number or letter to specify a particular ground.
	Chassis ground.
n	Represents n number of transmission paths.
	Test Point: Terminal provided for test probe.
	Pin Edge Connector output of PC board.
	Indicates wire or cable color code. Color code same as resistor color code. First number indicates base color, second and third numbers indicate colored stripes.
	Indicates shielding conductor for cables.
	Indicates a plug-in connection.
	Indicates a soldered or mechanical connection.
	Connection symbol indicating a male connection.
	Connection symbol indicating a female connection.
	Resistor.
	Variable Resistor.
	General purpose diode.
	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
	Summing Point.
	Oscillator; RPG (Rotary Pulse Generator).
	Fan, Motor.
	Toroidal Transformer

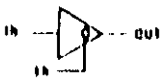
LOGIC SYMBOLOGY

Symbol	Description
	AND Gate
	OR Gate
	NAND Gate
	NOR Gate
	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)

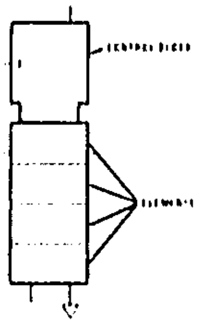
INTEGRATED CIRCUIT SYMBOLOGY

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.

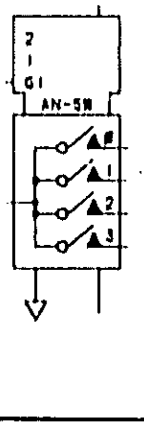


3-State Buffer: Three States:
Enable (EN) input low: High impedence output.
Enable input high: Output = 0 or Output = 1

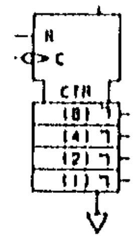
Data Flip-Flop: Set (S) and Reset (R) are asynchronous controls. Active S sets the noninverting output high and the inverting output (O—) low; active R resets both outputs. When S and R are both inactive, the outputs remain latched in the last state. An active clock (-[>) enables the D input, at which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



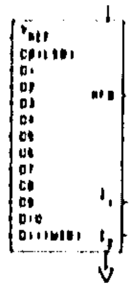
Control Block: All controlling inputs (gates, clocks, inhibits, etc.) connect to the control block.
Elements: Can be one or more of any logic function (flip-flop, counter, gate, RAM, etc.). Data inputs are on the left side of element, data outputs on the right.



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



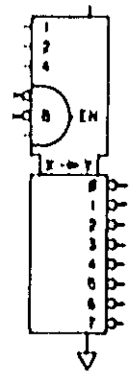
Counter: Binary-weighted registers count on the falling edge of each clock pulse. Active (high) R clears all registers.



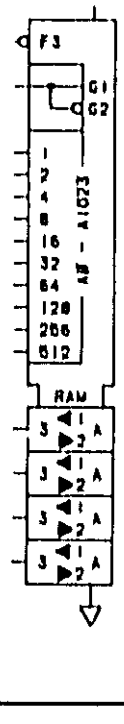
Digital to Analog Converter (DAC): Provides a scaled current output (I_1), the product of V_{REF} and the fractional binary input:

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

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)

8-14. 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 83590A 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 83590A. If a failure in the 83590A is detected during SELF-TEST, error code E001 will be displayed. Table 8-2 lists other error codes associated with the 83590A RF Plug-in.

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

8-20. OPERATOR-INITIATED TESTS

8-21. The 8350A microprocessor services several operator-initiated tests of the 83590A 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 83590A 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 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.

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.) Hex address entry must be made prior to any of the following:

Table 8-2. Error Codes Associated with 83590A

Error Code	Circuit Tested
E001	Addresses 83590A 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
SHIFT 50	Power Level DAC	A4	A4TP2
SHIFT 51	Power Sweep DAC	A5	A5TP8
SHIFT 52	Scale/Offset DACs	A7,A8	A7TP1, A7TP9, A8TP2, A8TP3
SHIFT 53	Address Decoder; checks major address decoder lines.	A7,A8	A3U6, A3U7, A3U9, A3U13
SHIFT 54	Address Decoder; checks individual board address decoders.	A4 thru A8	Address Decoders
SHIFT 55	Interrupt Control	A3	A3U4 pin 38
SHIFT 56	Bandswitch DAC	A6	A6TP1

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

NOTE

Before addressing an 83590A component, determine whether or not the 8350A microprocessor can READ or WRITE to that particular device The majority of 83590A digital chips 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 through 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 83590A 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.

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

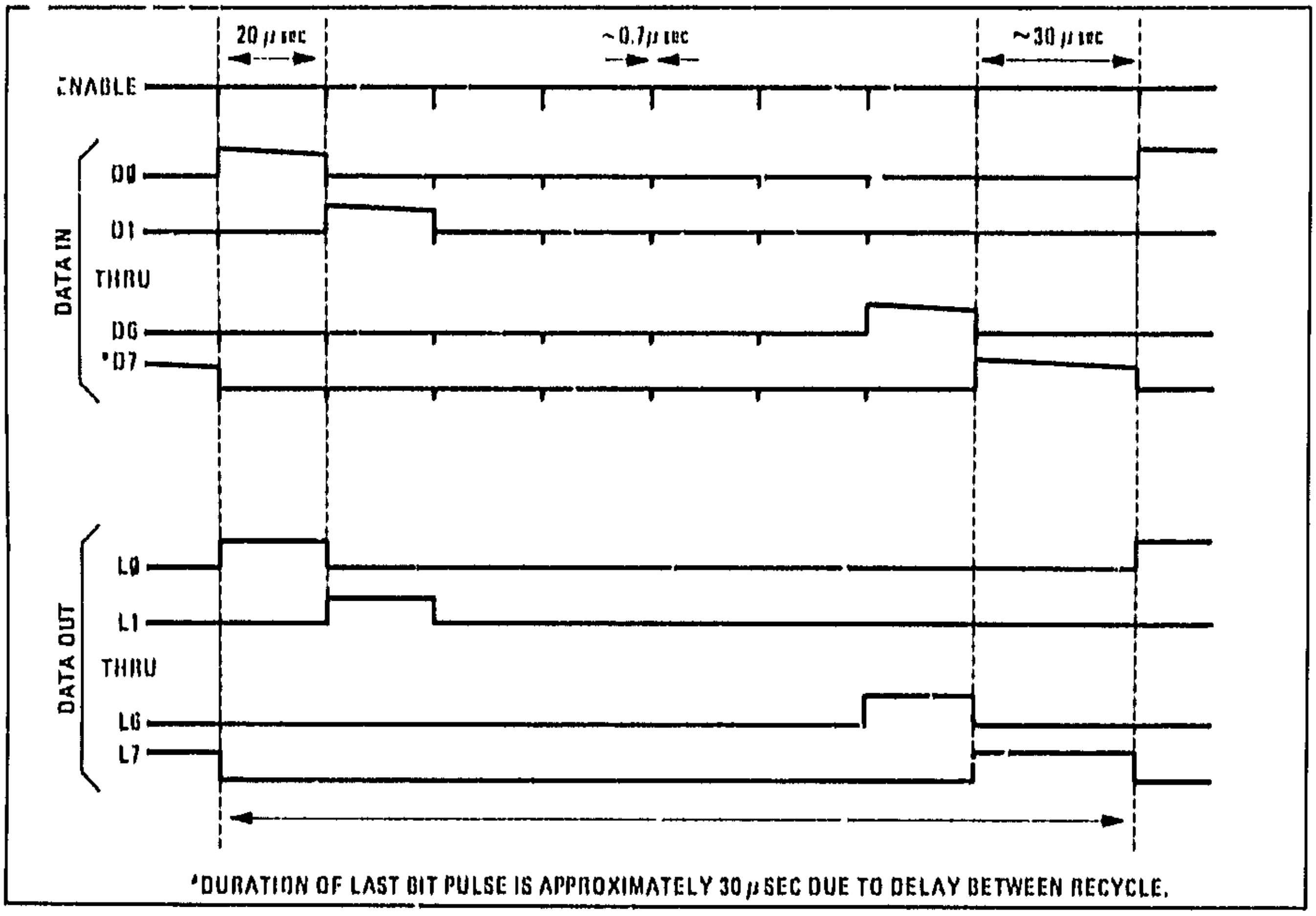


Figure 8-2. Hex Data Rotation Write — Bit Pattern

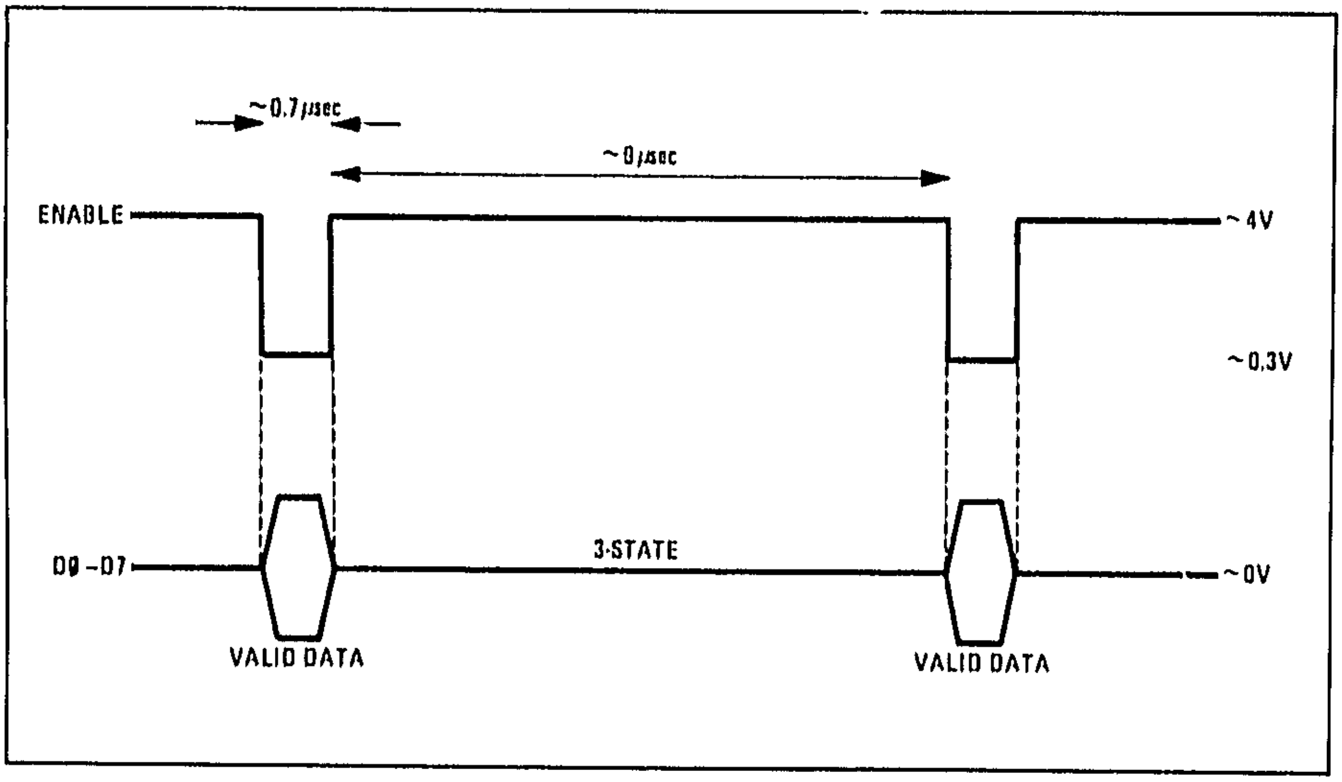


Figure 8-3. Hex Addressed Fast Read — Timing Diagram

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

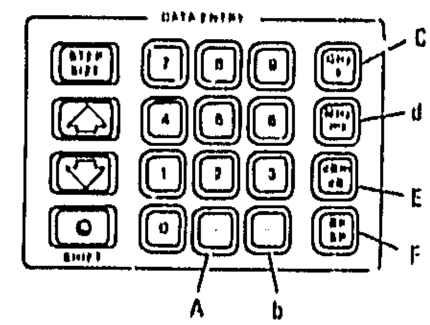


Figure 8-4. Hex Entry Keys

8-27. RECOMMENDED TEST EQUIPMENT

8-28. Test equipment required to maintain the Model 83590A 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.

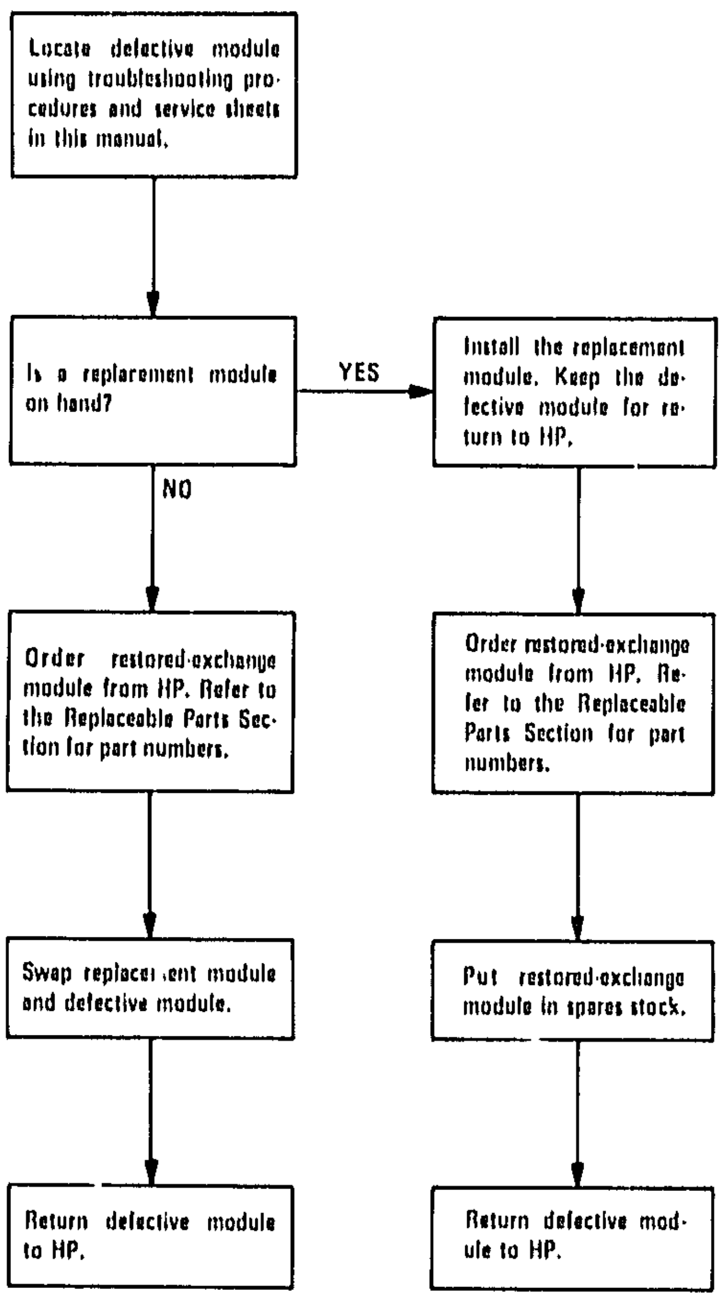
8-33. If you are not going to return the defective module to Hewlett-Packard, or if you are ordering a module for spare parts stock, etc., order a new module using the new module part number listed in Table 6-3.

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 YO A13, YTM A12, YO Driver A8, or YTM Driver A7

8-36. Each YIG Oscillator (YO) or YIG Tuned Multiplier (YTM) requires a unique set of resistors to be installed on its respective driver board (A7 or A8) for proper YIG coil drive. The values of these resistors are documented on labels attached to the side of the 83590A near the RF section. If the driver assembly (A7 or A8) is replaced, the resistor header containing these resistors must be installed on the new board. Also, if the YO or YTM is replaced, the resistor header shipped with the YO or YTM must be installed on the driver board in place of the old resistors. (In some cases, some or all of the resistors may be deleted, depending on the drive requirements of the individual YO or YTM.)

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



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

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.

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.

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

Figure 8-5. Module Exchange Procedure

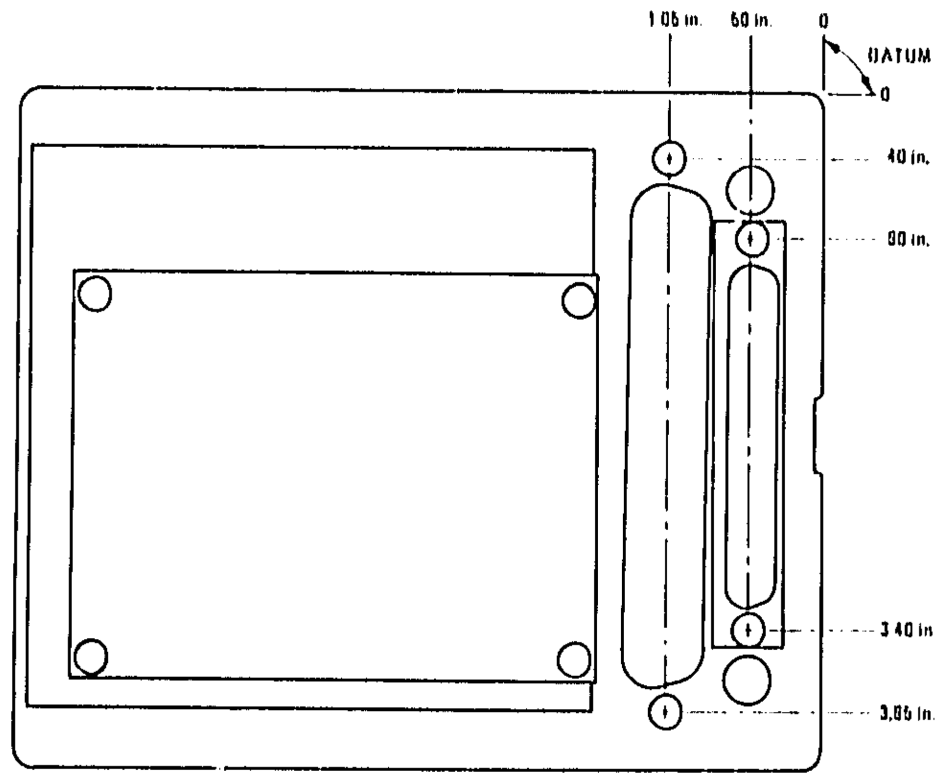


Figure 8-6. Rear Panel Connector Alignment

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.

83590A RF PLUG-IN OVERALL BLOCK DIAGRAM DESCRIPTION

The operating principles of the 83590A RF Plug-in are described in two levels. The Functional Block Diagram Description describes major functional areas of the instrument. The Overall 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 83590A RF Plug-in, used with the 8350A Sweep Oscillator, covers the 2.0 to 20.0 GHz frequency range in three bands with up to +10 dBm of leveled RF power (+8 dBm between 18.6 and 20.0 GHz). In addition to internal leveling, external detectors or power meters can be used to level the RF power. Furthermore, the 83590A can sweep power proportional to either frequency or sweep.

The 83590A can be broken down into four functional sections:

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

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

Digital Control/Front Panel

The entire 83590A is digitally controlled by the 8350A microprocessor. It must be emphasized that nearly all functions are commanded by the 8350A: very few activities take place without microprocessor intervention.

The Digital Control section of the 83590A is the focal point of all communication between Plug-in and mainframe. It receives commands ordered by the microprocessor along the 8350A's instrument bus. Once in the 83590A, 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 the rest of the Plug-in. It receives and stores information to be presented by the numerical display or annunciators through the Digital Control block, and continuously refreshes the display. It also receives the user's commands through the front panel pushbuttons and Rotary Pulse Generator (RPG), and sends them back through the Digital Control block to the 8350A microprocessor. Certain analog signals, such as EXT/MTR ALC, pass through the Front Panel Interface directly to the appropriate part of the 83590A.

Frequency Control

The Frequency Control block is responsible for converting the tuning ramp (VTUNE) from the 8350A Sweep Oscillator into drive currents for controlling the YIG Oscillator (YO) and YIG Tuned Muliplier (YTM). The tuning voltage is offset, scaled and buffered to provide a buffered tuning voltage for both the YO and YTM drivers. The two drivers each digitally scale and offset the buffered tuning voltage (BVTUNE) to yield tuning voltages that enable the YTM (which is basically a harmonic generator followed by a tunable bandpass filter) to track the YO fundamental frequency or one of its harmonics (Bands 2 and 3 use the second and third harmonics of the YO). Each driver develops a delay compensation signal that is summed with the scaled tuning voltage on each driver to compensate for delay in the YO or YTM. Lastly, low-frequency components of external frequency modulation (FM) are filtered and also summed in to produce total YO and YTM control voltages. However the YO and YTM are current controlled devices, so Current Drivers convert the control voltages to drive currents for the YO and YTM.

The high-frequency FM components cannot be summed in with the drive currents due to the limited dynamic response of the YO and YTM. The YO contains a separate coil that allows smaller yet faster frequency modulation. The amount of deviation is limited and is within the bandpass characteristics of the YTM, so the YTM does not require any frequency control for high-frequency modulation.

The Sweep Interrupt block monitors the tuning voltage (VTUNE) when the 83590A is performing a sweep requiring more than one band. When a tuning voltage corresponding to the end of a 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.

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 modulators 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.

RF detectors provide 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 RF modulators and correct the output power level.

RF Section

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

The 2 to 20.0 GHz frequency range is covered in three bands. The YIG Oscillator (YO) is the tunable source for all bands. Bands 1 through 3 are obtained by amplifying the direct YO output and then generating harmonics in the YTM. The YTM contains a tunable bandpass filter that is tuend to the desired RF output frequency. As a result the YTM passes the desired RF output frequency and rejects unwanted harmonics.

A directional coupler with detector senses the RF power level and sends a voltage to the ALC circuit for power leveling.

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

OVERALL BLOCK DIAGRAM DESCRIPTION

DIGITAL CONTROL/FRONT PANEL

A3 Digital Interface

The A3 Digital Interface assembly acts as the 83590A'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 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 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 configure the 83590A according to the parameters selected. As Interrupt Control, the circuits monitor the L SRQ line, and send an interrupt (L PIIRQ) to the 8350A to begin each bandswitch. During a 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, A6 Sweep Control, A7 YTM Driver, and A8 YO Driver assemblies. The control lines, which complete the internal bus, come directly from the Address Decoder. This internal bus sends control 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 detect this, sets the FLAG line to alert the microprocessor, and transmits the encoded data 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 that display the status of various functions. However, the Unleveled annunciator is not digitally controlled, but is driven from a separate Unleveled circuit which monitors the ALC assembly.

The Power Control interface digitally controls several functional areas. Three of the lines are buffered by the Attenuator Control, which operates the A19 Step Attenuator in instruments equipped with Option 00'. The RF On circuits control the biasing for the A13 YIG Oscillator and the A17 Amplifier. When the RF is turned off, the bias to these assemblies is removed, shutting off the oscillator and amplifier for minimum RF output.

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 YTM DRIVE V, a voltage proportional to the RF output frequency. Its output tracks the RF output frequency, and is used to compensate for frequency-dependent non-linearities in the ALC loop. The 1V/GHz circuit further processes this signal to produce a rear-panel output supplying 1 Vdc per GHz of output frequency for use with external equipment.

Miscellaneous front panel controls must pass through the A1 and A2 assemblies. The RPG produces pulses when rotated, and sends them directly back to the 8350A Sweep Oscillator to be decoded and processed to adjust the power or fine-tune the YTM bandpass frequency. 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 drive currents are developed for tuning the A13 YIG Oscillator and A12 YIG Tuned Multiplier. Frequency Modulation (FM) is also processed in these circuits.

A6 Sweep Control

The A6 Sweep Control assembly scales and offsets the tuning voltage from the 8350A Sweep Oscillator to provide a series of 0 to −10V ramps (one ramp for each band) during a multiband sweep. For single band sweeps, the A6 Sweep Control assembly just buffers and inverts the the 0 to 10V VTUNE ramp from the 8350A.

The Bandswitch Comparator and Sweep Control/Interrupt Logic sections monitor the buffered tuning voltage. When the sweep ramp requires a change of band, this circuit issues "stop sweep" and blanking pulse requests. At the same time, an interrupt is sent to the mainframe through the A3 assembly, requesting service for the bandswitch. After this point, the microprocessor completes the bandswitch sequence through the Sweep Control circuits.

SRD and PIN Switch Bias circuits control the Switched YTM for band selection, and Step Recovery Diode (SRD) biasing. The SRD BIAS output optimizes the SRD biasing for the frequency band of operation.

A8 YO Driver, A9 Reference Resistor Assembly

The A8 YO Driver assembly scales and offsets the buffered tuning voltage from the A6 Sweep Control assembly and converts it to a current for controlling the A13 YIG Oscillator (YO) frequency.

The buffered tuning voltage BVTUNE is scaled, offset, and summed with various correction signals to produce the tuning current for the A13 YIG Oscillator. The scaling and offsetting is used to change the frequency range of the YIG Oscillator depending on the band of operation. For each band, the 0 to 10V ramp must tune the YIG Oscillator over a different frequency range as shown in Table 8-5.

Table 8-5. YO Frequency Bands

Band	YO Frequency Range (GHz)
Band 1	2.0 to 7.0 GHz
Band 2	3.5 to 6.75 GHz
Band 3	4.5 to 6.67 GHz

The Scaling and Offset DACs are also used to compensate for differences in oscillator sensitivities. The amount of scaling and offset is set by the Frequency Cal switches. At initial power on or Instrument Preset, the status of the Cal switches is read by the 8350A and stored in RAM. This information is then used along with frequency range (band) information to program the DACs. The −10V Reference generates a stable voltage source used as a reference on the A6 Sweep Control, A7 YTM Driver, A8 YO Driver, and A4 ALC assemblies.

The Delay Compensation circuit produces signals 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 reactance of the electromagnets, there is a delay between the applied voltage and resultant current flow through the coils. The Delay Compensation circuit 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 +20V Tracking circuit monitors the +20V supply, producing an output which follows this voltage. Since 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, delay compensation, +20V tracking voltage, and offset compensation. The YO LO FM from the A5 FM Driver (described below) is also added. The product is the YO DRIVE V, a signal proportional to the YO frequency.

The remainder of the A8 circuits and the A9 components convert the YO DRIVE V to a current to control the YO frequency. The final current drive transistor is controlled by the A8 assembly. The current through this transistor, and hence the YO, generates a proportional voltage across the chassis-mounted 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 requires 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 Frequency Cal switches set the frequency end-point accuracy. These switches are set when the Plug-in is calibrated, and are read by the 8350A during Instrument Preset or initial power on. This information is used to program the Scale and Offset DACs.

A7 YTM Driver, A9 Reference Resistor Assembly

The A7 YTM Driver assembly scales and offsets the buffered tuning voltage from the A6 Sweep Control assembly and converts it to a current for controlling the A12 YIG Tuned Multiplier (YTM) frequency.

The buffered tuning voltage BVTUNE is scaled, offset, and summed with various correction signals to produce the tuning current for the A12 YTM. The scaling and offsetting is used to change the frequency range of the YTM depending on the band of operation. For each band, the 0 to 10V ramp must tune the YTM over a different frequency range as shown in Table 8-6.

Table 8-6. YTM Frequency Bands

Band	YTM Frequency Range (GHz)
Band 1	2.0 to 7.0 GHz
Band 2	7.0 to 13.5 GHz
Band 3	13.5 to 20.0 GHz

The Scaling and Offset DACs are also used to compensate for differences in YTM sensitivities. The amount of scaling and offset is set by the Frequency Cal switches. At initial power on or Instrument Preset, the status of the Cal switches is read by the 8350A and stored in RAM. This information is then used along with frequency range (band) information to program the DACs. The −10V Reference from the A8 YO Driver is a stable voltage source used as a reference for the Offset DAC.

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

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

The summing junction adds together the scaled tuning voltage, offset, delay compensation, +20V tracking voltage, and offset compensation. The YTM LO FM from the A5 FM Driver (described below) is also added. The product is the YTM DRIVE V, a signal proportional to the RF Output frequency.

The remainder of the A7 circuits and the A9 components convert the YTM DRIVE V to a current to control the YTM bandpass frequency. The final current drive transistor is controlled by the A7 assembly. The current through this transistor, and hence the YTM, generates a proportional voltage across the chassis-mounted reference resistor, which is monitored and compared to the YTM DRIVE V. Any errors between the two are corrected in a closed loop, producing a current proportional to the YTM DRIVE V. Compensation elements (Comp) correct for nonlinearities in the YTM. If the YTM is replaced, this section of circuitry requires changing.

The Frequency Cal switches set the YTM's frequency end-point accuracy for tracking the YO frequency. These switches are set when the Plug-in is calibrated, and are read by the 8350A during Instrument Preset or initial power on. This information is used to program the Scale and Offset DACs.

P/O A5 FM Driver

The A5 FM Driver assembly splits the external FM signal, passed through the mainframe, into two frequency ranges (Low Frequency and High Frequency). The low frequency modulation is added to the main coil tuning voltages for both the YO and YTM; the high frequency modulation is routed to a separate coil inside the YO dedicated to high-frequency FM.

The external FM Input is routed to the A5 FM Driver assembly, where it splits into two paths. One path is lowpass filtered, removing high frequency components; the other path 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. Two Sensitivity Select circuits determine the FM sensitivity (RF Output deviation of −20 or −6 MHz/volt) and select either crossover or direct coupling.

The low frequency path is further divided into two paths, one for driving the YIG Oscillator and the other for the YTM. Since, for Bands 2 and 3, the RF output is actually a harmonic of the YO frequency, the FM sensitivity of the YO (in relation to changes in the RF output frequency) varies between bands. Also, if the rear panel Aux Output (YO fundamental frequency) is used for phaselocking, the FM sensitivity for the YTM varies between bands. Thus, variable gain amplifiers (controlled by band select logic) scale the FM driver outputs according to the band of operation and phaselock source (as selected by the A3S1 Configuration Switch).

The YO LO FM is eventually added to the YO DRIVE V, and modulates the YO output frequency through its main coils. The YTM LO FM is added to the YTM DRIVE V, and modulates the YTM bandpass frequency through its main coils. Thus, for low frequency modulation, both the YO and YTM track each other in frequency.

The YO and YTM main coils cannot respond to fast deviations due to inductive and magnetic delays. Therefore, the YO contains a separate, small, but fast-acting "FM coil". The HI FREQ FM is sent to this coil, allowing limited high-frequency modulation. Since this modulation is limited, and does not extend beyond the bandwidth of the YTM, no high-frequency modulation is required for the YTM.

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 RF output power level, comparing it to a fixed reference voltage, and adjusting RF modulators 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 +10 and −5 dBm. (Instruments with Option 002 use an RF step attenuator to achieve power control down to −75 dBm. However, this is not part of the leveling loop.) The power sweep and power slope functions are obtained by adding a scaled voltage ramp offset to the reference power level.

A4 ALC Assembly

The A4 ALC assembly receives its inputs from the various detectors, and selects one of them for leveling. The sources include Detector CR1, 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 A8 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, a voltage proportional to the desired RF output power.

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

The ultimate goal of the leveling loop is to make the actual RF power equal to the desired RF power. A third summing junction compares the voltages representing these two quantities, and yields a signal representing the error between actual and desired power. This error voltage is sampled and held during pulse modulation to prevent subsequent circuits from saturating. The held error signal is amplified, and the RF blanking signal added to switch off the RF power during bandswitch, retrace, and internal squarewave modulation (from the 8350A), without saturating any other components in the path. 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.

P/O A5 FM Driver

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

The ALC Compensation is a "four breakpoint, adjustable slope network" which compensates for fixed frequency-dependent nonlinearities in the RF path, typically the couplers and detectors. Its input is FREQ TRK V, a voltage proportional to frequency. This signal drives an array of four pairs of transistors, whose outputs are summed together to yield the ALC compensation signal. The gain of each transistor, and the voltage at which they conduct, is 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 Reference signal on the A4 assembly.

RF SECTION

The RF Section includes the microcircuits and their bias boards that produce the actual RF output power. These components include A13, A14, A16, A19, AT1, DC2, and CR1.

The A13 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is the fundamental frequency-controllable microwave source for the 83590A RF Plug-in, ranging from 2.0 to 7.0 GHz. The YO's frequency is determined by the current flowing through large electromagnetic coils inside, supplied by the A8 and A9 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 when faster rates are needed.

The A16 Modulator/Coupler provides pulse modulation and amplitude control for leveling, and couples part of the YO output to the rear panel AUX OUTPUT connector.

For Bands 1 through 3, the fundamental YO output is amplified by the A14 Power Amplifier. The AT1 Isolator provides 20 dB of isolation between the Power Amplifier and the A12 YTM. The fundamental YO frequency from the isolator is applied to a Step recovery Diode (SRD) in the YTM. The SRD passes not only the fundamental frequency, but also generates an output that is rich in harmonics. The YIG Tuned Filter is a bandpass filter that is tuned to the desired RF output frequency by the A7 YTM Driver. Thus, the YTM uses the YO fundamental frequency to generate an RF output corresponding to either the YO fundamental frequency (Band 1) or one of its harmonics (Bands 2 and 3).

The A17 Amplifier boosts the mixed-down low-power output from the A18 assembly. The amplifier also serves to remove unwanted high-frequency mixing products. The A17A1 Amplifier Bias assembly is connected directly to the microcircuit, has no adjustable or replaceable parts, and is not separately replaceable.

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

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

The RF output is finally directed to the front panel RF Output connector. On instruments with Option 004, different 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).

83590A OVERALL TROUBLESHOOTING

The purpose of this troubleshooting information is to provide an aid in isolating a problem in the 83590A 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 83590A is calibrated and functionally operating.

A failure in the 83590A 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, sweep control problems or power losses due to the YTM not tracking the YO frequency. If the 8350A VTUNE output and power supplies are verified, the problem is most likely on the A5, A6, A7, A8, 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 A8 YO Driver assembly. Power losses that can be corrected with the front panel PEAK control indicate that the YO/YTM Tracking needs calibration (Refer to Section V, Adjustments).

- 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. If low power is the problem, try adjusting the front panel PEAK control to peak the power. If the power losses are eliminated, perform the YO/YTM Tracking adjustments in Section V.

- 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, try peaking the power with the front panel PEAK control, then refer to the A4 ALC Troubleshooting before suspecting the RF components.

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

- Sweep Mode related — Is problem only for swept modes of operation, or does it also exist in CW operation? If problem still exists in CW operation, troubleshoot in this mode (it is easier to check waveforms and voltages in CW operation). For problems that occur only for swept operation, check if problem exists for single band sweeps. If the problem occurs only for multiband sweeps, suspect the Bandswitch control circuit on the A6 Sweep Control assembly.

- 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 (e.g. 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 A8 YO Driver assembly. If it is necessary to adjust the front panel PEAK control for different sweep times, the trouble is probably caused by the Delay Compensation circuit on the A7 YTM Driver.

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 8-7. 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 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 L 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 (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, and a single band sweep is less complicated than a multiband sweep.

NOTE

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

Frequency Accuracy Problem for All Bands. Frequency accuracy problems that affect all bands are most likely caused by the A8 YO Driver being out of calibration. Perform the related adjustments 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 A8 YO Driver 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.

Low Power. If unable to obtain specified maximum leveled power try peaking the power with the front panel PEAK function. Set the 83590A to External ALC mode (this opens the ALC loop), press SHIFT POWER LEVEL , and adjust the POWER control to maximize the RF Output power over the 2.0 to 20 GHz frequency range. If this works, perform the YO/YTM Tracking adjustments in Section V. Otherwise refer to the RF Section service sheet for further troubleshooting.

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.

Table 8-7. 83590A Error Codes

Error Code	Function Tested	Operator Initiated Test	Troubleshooting Hints
E001	8350A/83590A		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.

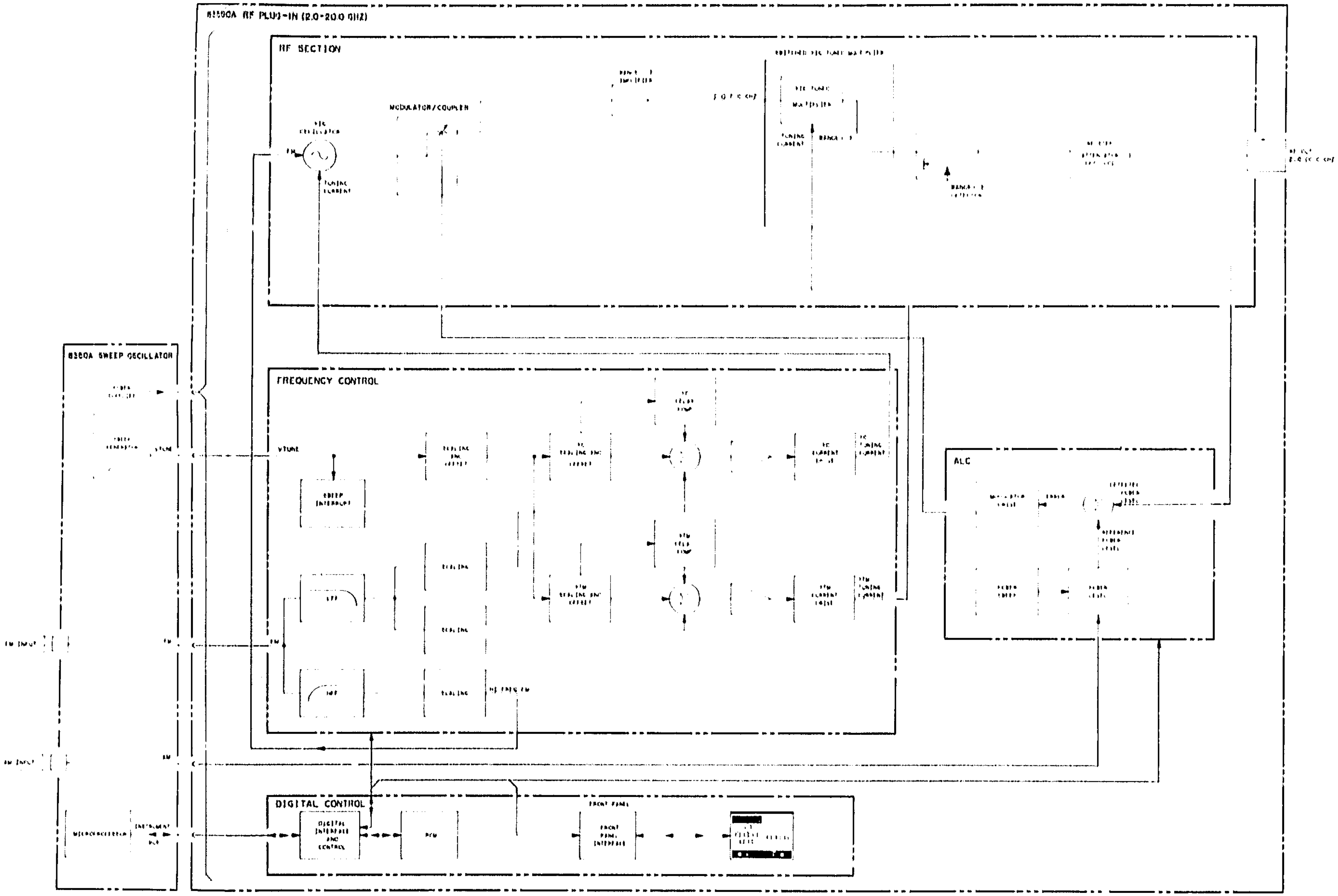


Figure 8-7. 83590A RF Plug-in Simplified Block Diagram

Figure 8-8. 83590A RF Plug-in Overall Block Diagram

83590A RF PLUG-IN OVERALL BLOCK DIAGRAM

A1 FRONT PANEL and A2 FRONT PANEL INTERFACE, CIRCUIT DESCRIPTION

GENERAL

The A1 Front Panel and A2 Front Panel Interface assemblies provide communication between the instrument and the user. Keyboard and RPG commands are transmitted to the 8350A microprocessor for appropriate action. The numerical power level and Plug-in status information is displayed on front panel LEDs. External ALC power calibration and frequency calibration inputs are passed through the front panel to the Plug-in. Also, the programmable step attenuator controls and "1V/GHz" outputs are processed on the A2 assembly.

KEYBOARD

Push Button Switch Matrix A1: J

Keyboard/Display Interface A2: A

The push button keyboard is arranged in a column-row matrix. The column lines are sequentially strobed, while the row lines are simultaneously sensed to determine when a key is depressed. The matrix scanning and sensing, along with the debouncing functions, are performed by U6, the Keyboard/Display Interface. U6 is a large-scale integrated device capable of monitoring the keyboard without continual attention from the 8350A microprocessor. When a key is depressed, U6 eliminates contact bounce, encodes and stores the column/row information in an internal register, and sets the FLAG line. When the microprocessor detects the flag, the keyboard codes are read from U6 and processed.

POWER DISPLAY

Power Display A1: K

Keyboard/Display Interface A2: A

Power Display Driver A2: D

The numerical power display is a four-digit, seven-segment LED configuration. Only one digit is enabled at any one time by the DIGn lines. These lines are continuously scanned by the buffered keyboard column lines from U6, providing a flicker-free display. The seven-segment and decimal point information corresponding to the enabled digit is provided by buffered lines from U6. When the display is updated, data is sequentially written into U6 from the microprocessor and stored internally. U6 is then responsible for scanning the display without requiring constant attention from the 8350A.

UNLEVELED ANNUNCIATOR DRIVER

LED Annunciators A1: H

Unleveled Annunciator Driver A2: F

U12A is one half of a dual timer serving as a triggered monostable, or one-shot. When the unleveled condition is detected, the trigger line pulses low. The monostable then goes high for a 50 millisecond period beginning at the trigger's falling edge. This ensures that the LED will stay lit long enough to be visible when triggered by a very narrow pulse. When L BP2 (Low=Blanking Pulse) is low and U9A is open, the trigger input is held high by CR6 so that the monostable cannot be triggered during retrace.

LED ANNUNCIATOR LATCH

LED Annunciators A1: H

LED Annunciator Latch A2: B

Octal latches U7 and U5 control the various front panel and push button LED annunciators. When clocked by the FP3 or FP4 line from the A3 Digital Interface assembly, the latches store a byte of data from the data bus, and light the LEDs determined by the bit pattern. (Low=ON).

RF POWER CONTROL LATCH A2: C

U8 is a hex latch which stores six of eight data bits when clocked by the FP5 line from A3. These data lines control the programmable step attenuator (Option 002), RF on/off relay, and "1V/GHz" circuitry. The step attenuator has 10, 20, and 40 dB pads internally, combining to provide up to 70 dB of attenuation in 10 dB steps. The enable (ENn) lines are inverted by U10A to provide disable (DISn) signals. The attenuator is a latching relay type, so that current is drawn only during switching. When the Plug-in RF OFF is selected, relay K1 opens and shuts down the RF path. When K1 is open, bias is removed from the low band RF amplifier (to increase on/off ratio), and the YIG Oscillator and the RF are shut off. CR3 protects U8 from high transient voltages when K1 turns off.

1V/GHz

Frequency Tracking Amplifier A2: E

1V/GHz Amplifier A2: G

U1B scales and offsets the YTM tuning voltage for the 1V/GHz circuit, providing a 0 to 6 volt ramp proportional to frequency. Switch U9D introduces an additional offset in the low frequency band only, since the RF output frequency is mixed down from a higher YO frequency. When internal leveling is used, U9C passes this voltage through Q3 to the A4 ALC and A5 FM Driver assemblies where it is used to compensate for frequency-dependent nonlinearities in various elements of the leveling loop. When external leveling is selected, U9B turns off Q3 to disable the compensation circuitry.

U1A further offsets and scales this voltage to provide 1V per GHz up to 18 GHz where U1A approaches the limit of its power supplies (current source Q2 increases this upper limit beyond the level U1A alone can produce). The 1V/GHz output is scaled regardless of the band chosen. This output is available at the rear panel of the Plug-in for use with 8410B Network Analyzers.

RPG (Rotary Pulse Generator) A1: I

External Leveled Power Calibration Control A1: M

The RPG provides control as selected by the keys below it (Power Sweep, Power Level, Peak, Slope), and encodes rotation into digital form for the microprocessor to use, providing a digitally-compatible control with an analog "feel". The two RPG lines pass directly to the 8350A's A2 Front Panel Interface assembly, passing through both Plug-in and mainframe motherboards. CAL adjustment introduces an offset to the leveling loop to match absolute RF power output to external leveling devices.

A1/A2 Troubleshooting

NOTE

Troubleshooting information for both the A1 Front Panel and A2 Front Panel Interface assemblies is combined. All reference designators refer to the A2 assembly unless otherwise noted.

NOTE

The entire Plug-in depends on the A3 Digital Interface assembly for control, address, and data signals. Before troubleshooting the A1/A2 assembly, verify proper functioning of A3. See Overall Troubleshooting for verification procedures.

Visually inspect the cabling inside the Plug-in for damaged or loose connections. Check that the large ribbon cable connections (W29, P1 and P2) are properly seated over the correct pins on Motherboard A10J2 and A3 Digital Interface A3J1. (On Plug-ins with Opt 002 Attenuator, W29P2 may be difficult to see). Check that W3 ribbon cable connections are securely seated over A10J1 and A2J1.

Check power supplies to the front panel: +5V at A10XA3, pins 6 and 7. Then check continuity between these points and A10J1, pin 2.

Digital Display

The Plug-in display can be directly commanded by the 8350A microprocessor using Hex Data Write (see paragraph 8-22 for an explanation of Hex Data programming). An effective test pattern can be input which toggles the states of adjacent segment lines. The pattern should detect shorted lines or defective flip-flops. Press 8350A CW . Enter key sequence:

SHIFT 0 0	Hex Data mode
2 MHz ms 0 0	Address location 2d00 (U6)
M2	Hex Data Write
5 5 . . 5 5 . .	Enters four hex bytes: 55 AA 55 AA

The pattern seen in the Plug-in display should match that shown in Figure 8-9. If the patterns match, the Plug-in display is working properly, and any failures are probably due to the mainframe or Plug-in ROM.

Error Codes

Error codes E050 and E051 indicate a communication problem between the Front Panel Interface assembly and the 8350A microprocessor. Code implications and further troubleshooting hints are discussed later, under the subheading **Keyboard**.

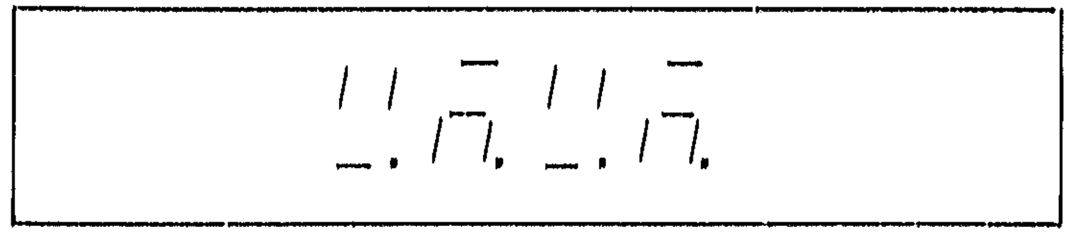


Figure 8-9. Display Test Pattern

If any of the digits in the display window appear to be stuck, or if the above test fails, remove the front panel and check the 200 kHz SCAN CLK at U6, pin 3. If no signal is detected, trace the line back through U4B to the A3 Digital Interface assembly.

Then, check the DIG1 through DIG4 lines for sequential low pulses. These can be accessed at the back of A1/A2 interconnect A2P1, pins 3, 5, 7, and 9. If they are absent, trace the problem back to U6.

The seven-segment lines, Ca through Cg, and Cdp, can be tested by programming the test pattern in Figure 8-9, then verifying activity at A2P1. Trace any problems back to U6.

To check for burned out display LEDs, make the key entry outlined above, except enter data: 0 0 0 0 0 0 0 0 . All segments, with decimal points, should light up.

Display problems may be due to A3 Digital Interface failures. Check the L FP1 line at U6, pin 11, using Hex Data Rotation Write (see paragraph 8-22 for details).

SHIFT 0 0	Hex Data mode
2 MHz ms 0 0	Address location 2d00 (U6)
M4	Hex Data Rotation Write

The data lines should also be checked in this mode. (Input and output patterns are illustrated in Figure 8-2.) Trace any problems back through A3.

Annunciators

Check for burned out LEDs by pressing and holding the INSTR PRESET key. All LEDs should light, except for units indicator (dBm, dB/GHz, and dB/Swp) and UNLEVELED annunciators.

Use Hex Data Write as follows, to check annunciator control capability. Press 8350A CW and enter:

SHIFT 0 0	Hex Data mode
2 dBm dB 0 0	Address location 2E00 (U7)
M2	Hex Data Write
5 5	Hex Data 55
. .	Hex Data AA

Alternate between 55 and AA, and check that each addressed annunciator is lit for one case and out for the other (excluding the UNLEVELED annunciator). Plug-in annunciators are controlled by two locations. Repeat the procedure for address location 2E80 (U5).

If these tests fail, remove the front panel assembly to expose the A2 assembly. Use Hex Data Rotation Write as follows:

SHIFT 0 0	Hex Data mode
2 dBm dB 0 0	Address location 2E00 (U7)
M4	Hex Data Rotation Write

Check the enable lines for activity. The data bus inputs and latched outputs should also be checked for the patterns illustrated in Figure 8-2. Units 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.

The UNLEVELED light is driven by pulse-stretching timer U12A, which is 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 UNLEVELED light is not functioning properly, select 8350A **RF BLANK** and disengage 83590A **RF** to turn the power off. In this mode, L UNLVL, J1-12, should be low during forward sweep, and high during retrace. Connect oscilloscope channel B to the 8350A Sweep Out, and select the A vs B mode to externally sweep the oscilloscope with the 8350A sweep ramp. Check the input (pin 6) and output (pin 5) of timer U12A. 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 CR5 and CR7, or 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 any Plug-in front panel key is pressed, the appropriate hexadecimal key code should appear in the mainframe FREQUENCY/TIME display window. The appropriate key codes are given in Table 8-8.

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 0 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 8-13.

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

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

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

Rotary Pulse Generator (RPG)

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

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

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

Analog Circuitry

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

Check that the YTM DRIVE V signal is present at TP1. It should resemble the waveform shown in Figure 8-15. If it doesn't, trace the problem back to the A7 YTM Driver assembly.

If it is present, check TP3 for the waveform shown in Figure 8-16. If it is present on the A2 assembly, but FREQ TRK V is missing on the A4 and A5 boards, probe the emitter of Q3 for the same waveform offset by approximately 6.6 Vdc.

Analog switches U9B, U9C, and U9D are controlled by latch U8. These switches turn off FREQ TRK V when external leveling is used. These can be exercised by using Hex Data Write. Press 8350A CW and enter:

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

Note that these switches are not identical. U9B is open for logic 0, while U9C 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 8-17. If there is no signal at TP2, but there is a ramp at TP3, the problem is in U1A.

RF Power Control Latch

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

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

NOTE

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

Initiate the check as follows:

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

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

To check the RF ON relay, K1, make the same key entries as above, except enter **M2** for Hex Data Write. Then alternate between data 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 EXT/MTR ALC CAL offset is generated by A1 potentiometer, with the wiper running between +10 Vdc and −10 Vdc. If the signal is absent, check for the +10V and−10V supplies. If the offset voltages still cannot be produced, replace the defective potentiometer, R4.

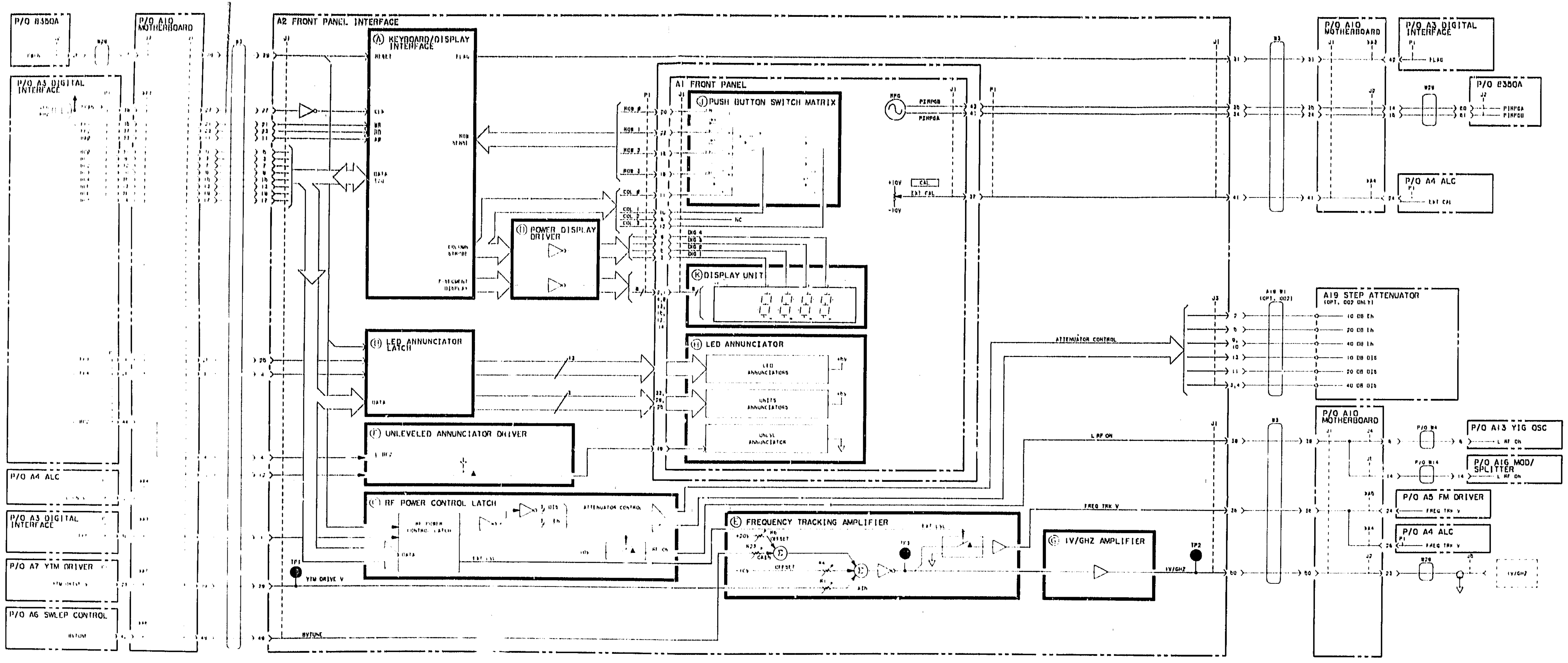


Table 8-8. Plug-In Key Codes

Key	Code	Column	Row
POWER SWEEP	9B	0	0
POWER LEVEL	9A	0	1
SLOPE	99	0	2
RF	98	0	3
CW FILTER	92	1	1
NOT USED	91	1	2
NOT USED	90	1	3
NOT USED	8B	2	0
NOT USED	8A	2	1
NOT USED	89	2	2
NOT USED	88	2	3
INT	82	3	1
EXT	81	3	2
MTR	80	3	3

If depressing a key results in the wrong keycode being displayed, read the associated column and row lines. Troubleshoot with a continuity checker. If the matrix lines are good, suspect A2U6.

No keycode is defined for Row 0 at Column 1 or Column 3. A problem in this area of the matrix may result in Error Code E051.

A1/A2

Figure 8-10. A1 Front Panel/A2 Front Panel Interface, Block Diagram

Figure 8-18. A1 Front Panel/A2 Front Panel Interface, Schematic Diagram

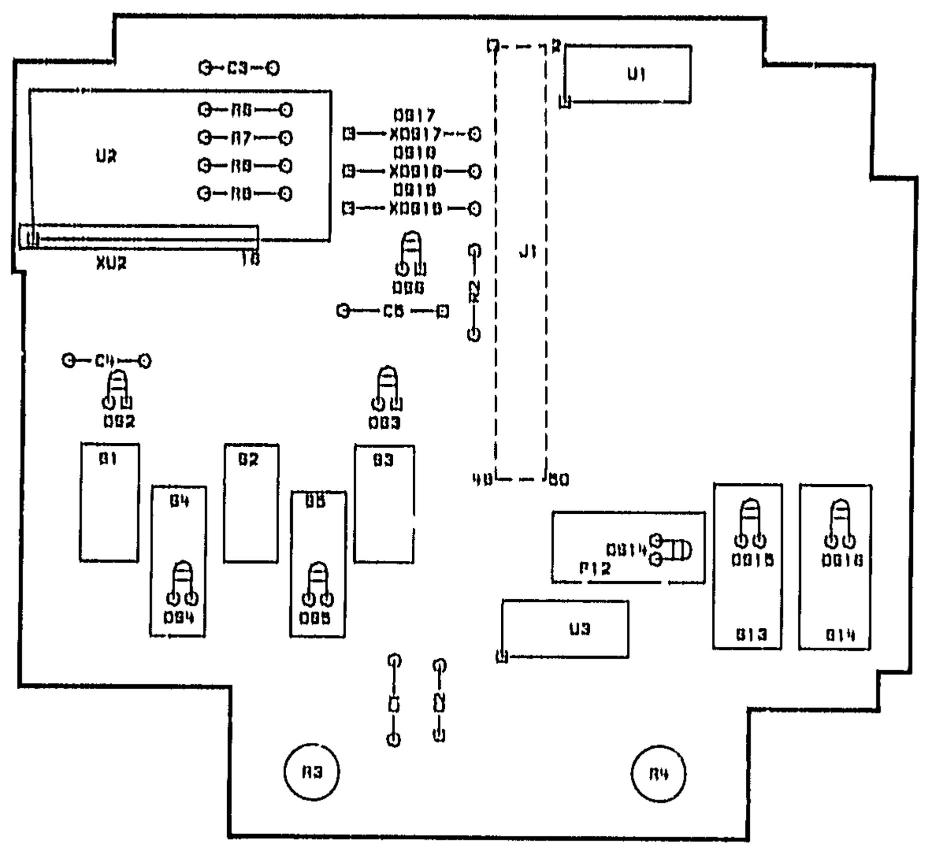
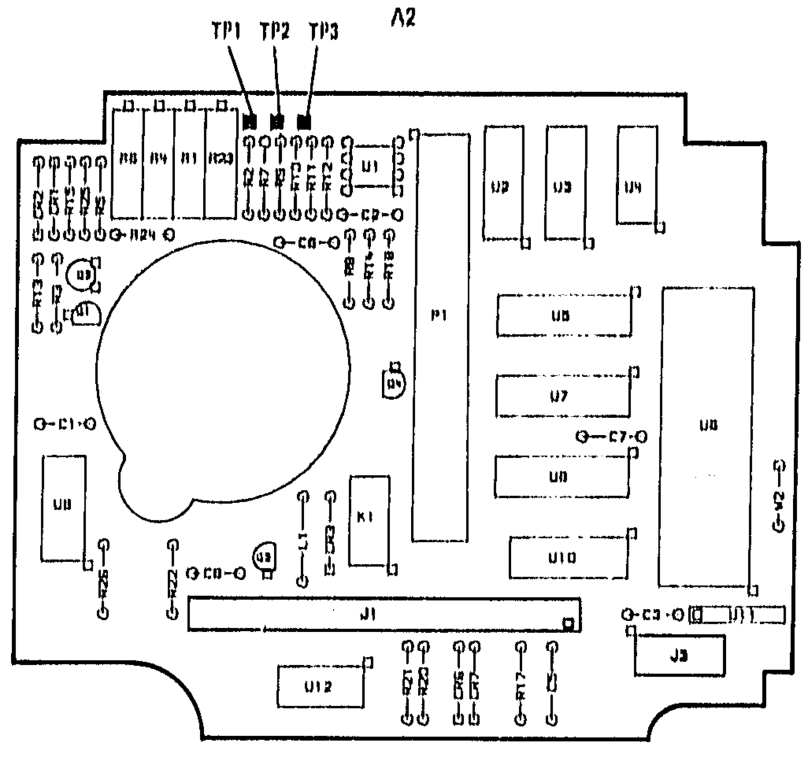


Figure 8-11. A1 Front Panel, Component Locations



Shaded components on far side.

Figure 8-12. A2 Front Panel Interface, 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 BANDSWITCH INTERRUPT, PRESS 8350A CW .

A2J1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 2	L FP5 +5V	IN IN	A3P1-30 A3P1-6,7	C D
3 4	BD1 UN LMP EN	I/O IN	A3P1-9 A6P1-16	ABC F
5 6	BD0 L FP4	I/O IN	A3P1-31 A3P1-26	ABC B
7 8	BD2 GND DIG	I/O	A3P1-32	ABC D
9 10	BD3	I/O	A3P1-10 NOT USED	ABC
11 12	BA0 L UNLVL	IN IN	A3P1-33 A4P1-2	A F
13 14	BD5	I/O	A3P1-13 NOT USED	ABC
15 16	BD4	I/O	A3P1-35 NOT USED	ABC
17 18	BD7	I/O	A3P1-14 NOT USED	ABC
19 20	BD6	I/O	A3P1-36 NOT USED	ABC
21 22	L FP1	IN	A3P1-15 NOT USED	A
23 24	L FP2	IN	A3P1-37 NOT USED	A
25 26	L FP3	IN	A3P1-16 NOT USED	B
27 28	SCAN CLK	IN	A3P1-38 NOT USED	A
29 30	PWON	IN	P2-25 NOT USED	ABC
31 32	FLAG	OUT	A3P1-42 NOT USED	A
33 34	 PIRPGB	 OUT	NOT USED P2-61	
35 36	PIRPGB FREQ TRK V	OUT OUT	P2-60 A4P1-36,A5P1-24	 E
37 38	FREQ CAL L RF ON	OUT OUT	A8P1-23 A10J4-6,A10J5-14	 C
39 40	YTM DRIVE V −10V	IN IN	A7P1-23 P1-13	E D
41 42	EXT CAL +20V	OUT IN	A4P1-24 P1-7	 D
43 44			NOT USED NOT USED	
45 46	 +10V	 IN	NOT USED P1-8	 D
47 48	 GND ANLG		NOT USED	 D
49 50	BVTUNE 1V/GHz	IN OUT	A6P1-42 J4,A10J2-23	E G

A2P1 – A1J1 INTERCONNECT JACK

A2P1 PIN	BLOCK	SIGNAL	TO/FROM	BLOCK	A1J1 PIN
1 2	D D	Cb Ca	→ →	K K	1 2
3 4	D D	DIG1 Cc	→ →	K K	3 4
5 6	D A	DIG2 COL2	→ →	K J	5 6
7 8	D D	DIG3 Cd	→ →	K K	7 8
9 10	D A	DIG4 COL1	→ →	K J	9 10
11 12	A A	COL0 COL3	→ →	J J	11 12
13 14	D D	Ce Cdp	→ →	K K	13 14
15 16	D A	Cf ROW2	→ ←	K J	15 16
17 18	D A	Cg ROW3	→ ←	K J	17 18
19 20	N A	+5V ROW1	→ ←	D J	19 20
21 22	N A	GND DIG ROW1	 ←	F J	21 22
23 24		NOT USED NOT USED			23 24
25 26	B	db/SWP NOT USED	→	H	25 26
27 28		FREQ CAL NOT USED	←	L	27 28
29 30	B	dBm NOT USED	→	H	29 30
31 32	N	GND ANLG NOT USED		D	31 32
33 34	B	dB/GHz NOT USED	→	H	33 34
35 36	N B	+10V POWER SWP	→ →	D H	35 36
37 38	 B	EXT CAL PWR SLOPE	← →	L H	37 38
39 40	 B	NOT USED CW FIL	 →	 H	39 40
41 42	 B	PIRPGB RF ON/OFF	← →	I H	41 42
43 44		PIRPGA NOT USED	←	I	43 44
45 46	 B	NOT USED MTR ALC	 →	 H	45 46
47 48	 B	NOT USED EXT ALC	 →	 H	47 48
49 50	F B	UNLEVELED INT ALC	→ →	H H	49 50

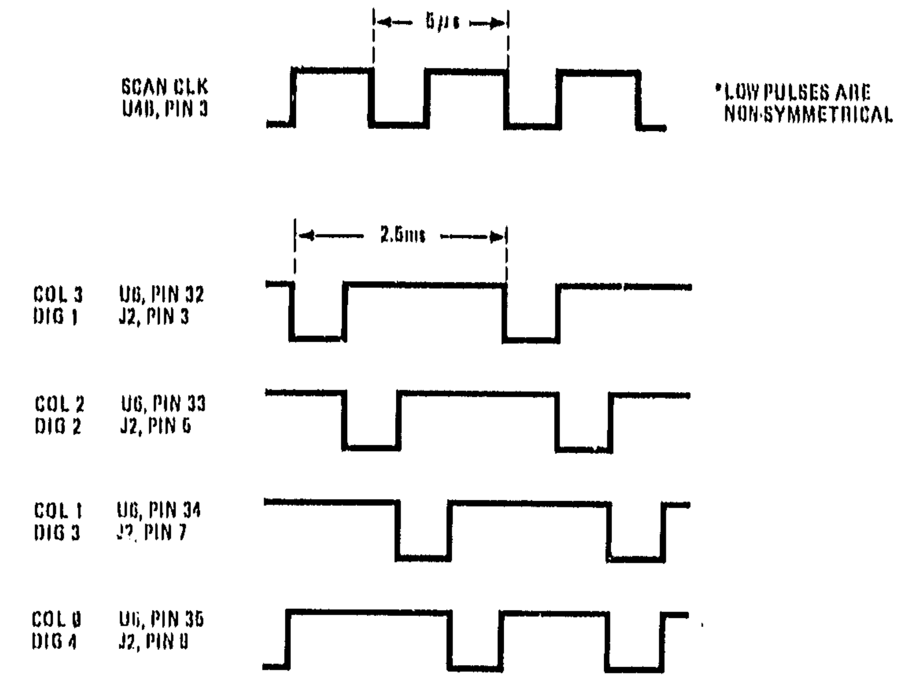


Figure 8-13. Column Strobing

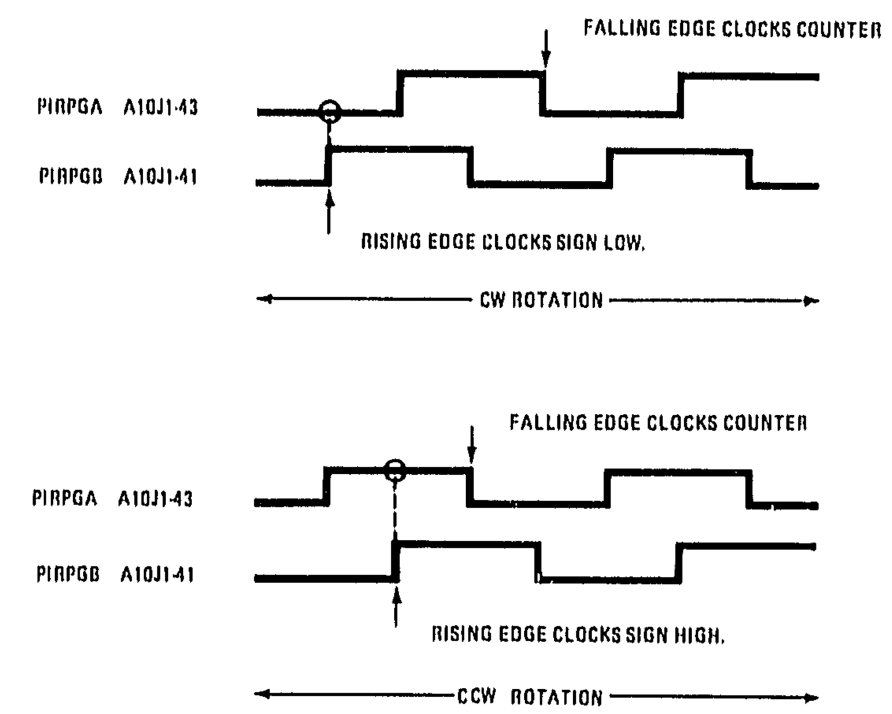


Figure 8-14. RPG Pulse Train

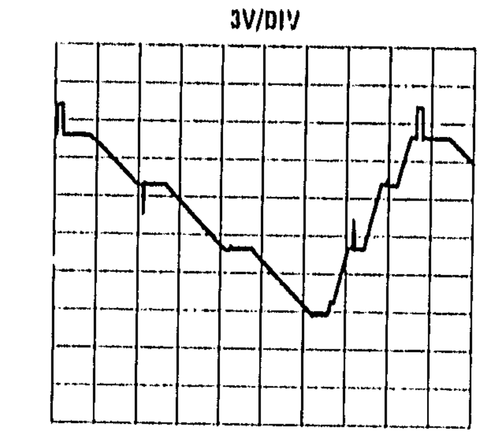


Figure 8-15. YTM Drive V (A2TP1)

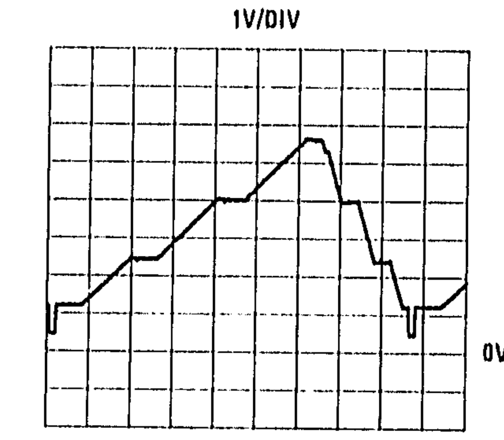


Figure 8-16. Frequency Voltage (A2TP3)

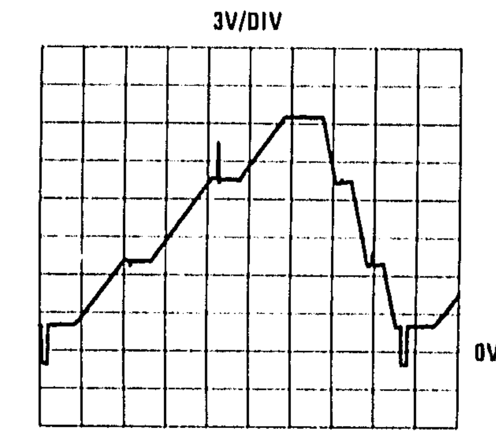


Figure 8-17. A2TP2

A3 DIGITAL INTERFACE, CIRCUIT DESCRIPTION

The A3 Digital Interface assembly receives digital address, data, and control signals from the 8350A Sweep Oscillator. These signals are processed and then routed to the rest of the RF Plug-in. The ROM (Read-Only Memory) contains software dedicated to the RF Plug-in. The Interrupt Control circuit provides timing signals (which are controlled by the 8350A A3 Microprocessor) during band-switching and at the beginning and end of each sweep. The A3 Digital Interface also provides data and timing information for the A2 Front Panel Interface and A1 Front Panel assemblies, as well as data, address and control signals for the rest of the RF Plug-in.

Sweep Oscillator Interface (A)

The digital data, address, and control signals from the 8350A Sweep Oscillator pass through the RF Plug-in interconnect and ribbon cable to J1 on the A3 Digital Interface assembly. They are buffered and inverted by Schmitt trigger inverters before passing on to the rest of the RF Plug-in. 100-ohm resistors in series with each line are included to reduce ringing on the instrument bus. U7A and U7D enable the bi-directional data buffer when either the Plug-in ROM (L BPIROME) or the Plug-in itself (L BI/OE2) is enabled. Blanking pulse L BP2 passes directly through A3 and is not buffered. It is used on the A2 Front Panel Interface for blanking the UNLEVELED light during retrace. Lastly, U10F receives the FLAG from the A2 Front Panel Interface and passes it back to the Sweep Oscillator.

Address Decoder (B)

The Address Decoder decodes the address and control lines to provide control signals throughout the RF Plug-in. Table 8-9 shows the decoded address lines and where they are used in the RF Plug-in.

ROM (C)

The RF Plug-in's Read-Only Memory consists of two 4k by 8-bit ROMs. This memory contains all of the firmware dedicated to the individual RF Plug-in for use by the microprocessor in the 8350A. Addresses 4000H through 4FFFH are read from U1, while 5000H through 5FFFH are found in U2. The A12 line, decoded in the Address Decoder, selects which ROM is enabled. The remaining twelve address lines (A0 through A11) determine the individual ROM address being read.

200 kHz Clock (D)

U3 is a simple oscillator with external timing elements configured to provide a stable 200 kHz pulse train. This signal is used to clock the Interrupt Control counters in U5 for interrupt timing. The 200 kHz clock is also used on the A2 Front Panel Interface to scan the keyboard and refresh the display.

Interrupt Control/Configuration Switch (E)

Triple programmable counter U5 contains three programmable down-counters and control circuitry. The counters are preloaded by the data bus, then down-counted by the 200kHz Clock. When the count reaches zero, a pulse is produced on the corresponding output. In this way, the microprocessor can command a time interval of any duration, and will receive an interrupt when the count-down is complete.

Table 8-9. Digital Interface Address Decoding

Mnemonic	Address	Address Decoder Components	Components Addressed	Read or Write	Description
L WR	2800H to 287FH	U9	A3U5	Write	Write data to programmable interval timer.
L RD	2880H to 28FFH	U9	A3U5	Read	Read data from programmable interval timer.
L PIAE	2900H to 29FFH	U7B, U7C, U8A, U10D	A3U4	RD/WR	Enable Peripheral Interface Adapter. (Also addressed 2B00H to 2BFF)
L INST1	2C00H to 2C7FH	U10D, U13	A4, A5, A6	Write	Write control for A4 ALC, A5 FM Driver, and A6 Sweep Control
L INST2	2C80H to 2CFFH	U10D, U13	A7, A8	RD/WR	Write to A7 YTM Driver and A8 YO Driver Control and read Offset and Gain switches.
L FP1	2D00H to 2D7FH	U10D, U13	A2	Write	Write to front panel displays.
L FP2	2D80H to 2DFFH	U10D, U13	A2	Read	Read front panel keyboard.
L FP3	2E00H to 2E7FH	U10D, U13	A2	Write	Write to front panel annunciators
L FP4	2E80H to 2EFFH	U10D, U13	A2	Write	Write to front panel annunciators
L FP5	2F00H to 2F7FH	U10D, U13	A2	Write	Write to RF control latch
L ROM1	4000H to 4FFFH	U6C, U10A, U10B	A3U1	Read	Enable ROM U1
L ROM2	5000H to 5FFFH	U6B, U10B	A3U2	Read	Enable ROM U2

U4 is a Peripheral Interface Adapter (PIA) which controls the interrupts from U5 and reads the configuration switch, S1. As an interrupt controller, U4 can be microprocessor-programmed to mask or enable any of four possible interrupts. These interrupts mark the end of important timing intervals used during band-switching.

Configuration Switch S1 is encoded with information about the type of RF Plug-in and the options included, as well as operator-chosen parameters such as FM sensitivity and power-up conditions. (See Table 8-10 for details.) The microprocessor addresses U4 to read the switch status at power-on or when Instrument Preset is initiated, and uses the information in subsequent calculations involving frequency range, power range, marker values, and many other Plug-in dependent parameters.

RF Plug-In Interface (F)

U17 and U14 buffer the address and data signals required throughout the rest of the RF Plug-in. U17 is a bi-directional, 8-bit data buffer, enabled when BI/OSTB, A10, and BI/OE2 are all high. Its direction is controlled by the L WRITE line. U14 is enabled by L BI/OE2 to pass four address lines (A0 through A3) to the rest of the RF Plug-in's circuitry.

TROUBLESHOOTING

The A3 Digital Interface assembly is the principle exchange for digital data, address, and timing signals used throughout the RF Plug-in. The Read Only Memory (ROM) on the A3 assembly contains software and constants used for Plug-in interrupt routines. Major enable lines used on the front panel and throughout the Plug-in are decoded on this assembly. Note that some digital control lines (e.g. the Stop-Sweep Request (L SSRQ) and RPG lines) do not pass through the Digital Interface assembly.

A failure in the A3 Digital Interface typically disables the entire RF Plug-in, and causes large errors in frequency, amplitude, and control. The front panel displays will probably be inoperative, and front panel controls will not produce any effect.

The 8350A Sweep Oscillator may or may not be disabled by a Plug-in failure. A simple test to determine whether the 8350A is at fault is to remove the Plug-in and press INSTR PRESET on the 8350A. If E001 is displayed, the 8350A is probably good. A different error code, especially E005, indicates problems in the 8350A.

General Troubleshooting

Visually inspect the Plug-in for damage, frayed cables, and loose connectors. Check ribbon cable W29 between the Plug-in interface and A3 assembly. Check the ribbon cable in the 8350A leading from its motherboard to the Plug-in interface.

Check the +5VB line at A3J1 pins 35, 36, or 38, to make sure power is being supplied to the Plug-in. The A3 assembly supplies +5V to the rest of the Plug-in; check A3P1 pins 6 or 7 for +5Vdc.

Check configuration switch A3S1 and make sure that it corresponds to the model, options, and user-configurations as shown in Table 8-10.

The A3 Digital Interface assembly is made accessible for service with the following procedure:

1. Remove the RF Plug-in from the 8350A.
2. Disconnect W29P1 from A3J1, and remove the A3 assembly from the Plug-in.
3. Replace the Plug-in in the 8350A.
4. Remove the top cover of the 8350A.
5. Insert a 44-pin extender board into A10XA3.
6. Install the A3 assembly on the extender board, and reconnect W29P1.

RF Plug-In Self Test

Major portions of the A3 Digital Interface assembly and the Instrument Bus connecting it to the 8350A are tested by the Self Test routine performed at Instrument Preset or power-on.

The Plug-in ROM is tested by reading a test pattern out of ROM, then performing a "checksum" on the entire range of ROM. If the test passes, this ensures that the data bus, address bus, and major timing lines to the A3 assembly, as well as the ROM address decoding and ROM itself, are good. If the test fails, error code E001 appears, indicating a fault in these components or the Instrument Bus.

Other Error Codes (between E050 to E099) indicate specific problems in the Plug-in. These can occur either at Instrument Preset or power-on, or during normal operation, and are discussed in greater detail below.

The L IRD, FLAG, and PIIRQ lines are not tested by the routine, nor are the internal data (BD0 – BD7) and address (BA0 – BA3) busses.

An Error Code indicates a failure in specific components. If Self Test passes, these components are very probably working correctly. Hence, the troubleshooting information below is broken into three sections:

- Error Code E001 "Plug-in Failure"
- Other Error Codes
- No Error Code Displayed

Refer to the appropriate section indicated by the Self Test results.

Error Code E001

Error Code E001 indicates a failure in one or more of the following areas:

- Connections between 8350A/Plug-in interface and Instrument Bus
- 8350A/Plug-in interface
- Connections between 8350A/Plug-in interface and A3 assembly
- Plug-in buffers
- ROM Address Decoding
- ROM

The Instrument Bus internal to the 8350A is checked during Self Test and will produce error E005 on failure. However, branches from the Instrument Bus leading to the Plug-in are not tested.

In the 8350A, check cables between the Motherboard and the 8350A chassis connectors J2 and J3 leading to the Plug-in for damage or loose connections. Likewise, in the 83590A, check the cabling between chassis P1 and P2 and the A10 Motherboard or A3 Digital Interface. Next, check the individual pins and sockets of the 8350A/Plug-in interface connectors for bent or missing pins.

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

Perform the Hex Data Read by entering:

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

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

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

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

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

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

On the 8350A, enter:

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

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

On the 8350A, enter:

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

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

Other Error Codes

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

Error Code E052

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

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

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

Error Code E053

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

No Error Code

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

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

If problems occur only when a multiband sweep is performed, suspect the programmable timer, U5. If the 8350A displays show the wrong frequencies, first check configuration switch S1 against Table 8-10, and then troubleshoot the PIA, U4.

Address Decoder

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

SHIFT 5 3

Then check the outputs of U6B, U6C, U7B, U9, and U13 for the signals shown in Figure 8-22. The address lines have been verified by the Self Test. Therefore, if the L PIAE 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 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 Interrupts from the Triple Timer

NOTE

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

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

CW	Sets the 8350A into CW mode
SHIFT 0 0	Enters 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 8-20 should be observed. Refer to "Other Error Codes" for details on these error codes and the SHIFT 5 5 Operator Initiated Self Test.

Figure 8-19. A3 Digital Interface, Block Diagram

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Figure 8-23. A3 Digital Interface, Schematic Diagram

A3

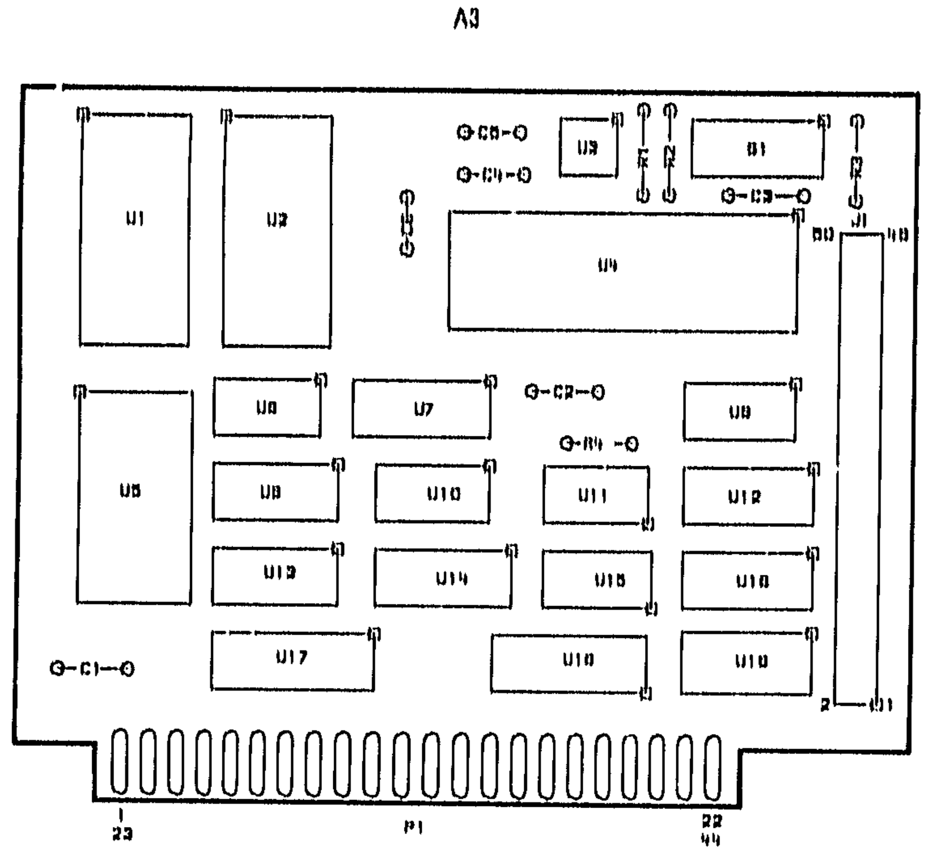


Figure 8-20. A3 Digital Interface, Component Locations

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 BANDSWITCH INTERRUPT, PRESS 8350A CW

A3P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 23			NOT USED NOT USED	
2 24			NOT USED NOT USED	
3 25			NOT USED NOT USED	
4 26	GND DIG L FP4	 OUT	 A2J1-6	G B
5 27	GND DIG		 NOT USED	G
6 28	+5V	OUT	 NOT USED	G
7 29	+5V L INST2	OUT OUT	 A7P1-18,A8P1-18	B B
8 30	L INST1 L FP5	OUT OUT	A4/A6P1-18,A5P1-5 A2J1-1	B B
9 31	BD1 BD0	I/O I/O		F F
10 32	BD3 BD2	I/O I/O		F F
11 33	BA1 BA0	OUT OUT		F F
12 34	BA3 BA2	OUT OUT		F F
13 35	BD5 BD4	I/O I/O		F F
14 36	BD7 BD6	I/O I/O		F F
15 37	L FP1 L FP2	OUT OUT	A2J1-21 A2J1-23	B B
16 38	L FP3 SCAN CLK	OUT OUT	A2J1-25 A2J1-27	B E
17 39			NOT USED NOT USED	
18 40	L SIRQ	IN	A6P1-3 NOT USED	E
19 41			NOT USED NOT USED	
20 42	 FLAG	 IN	NOT USED A2J1-31	 A
21 43			NOT USED NOT USED	
22 44	PWON L BP2	IN OUT	P2-25 A2J1-4	E A

A3J1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 2	GND DIG IO0	 I/O	 P2-33	G A
3 4	IO1 IO2	I/O I/O	P2-2 P2-34	A A
5 6	IO3 IO4	I/O I/O	P2-3 P2-35	A A
7 8	IO5 IO6	I/O I/O	P2-4 P2-36	A A
9 10	IO7 GND DIG	I/O	P2-5	A G
11 12	GND DIG L I/O	 IN	 P2-38	G A
13 14	L IA1 L IA2	IN IN	P2-38 P2-39	A A
15 16	L IA3 LIA4	IN IN	P2-8 P2-40	A A
17 18	GND DIG L IA5	 IN	 P2-41	G A
19 20	L IA6 L IA7	IN IN	P2-10 P2-42	A A
21 22	L IA8 L IA9	IN IN	P2-11 P2-43	A A
23 24	L IA10 L IA11	IN IN	P2-12 P2-44	A A
25 26	L IA12 PIROME	IN IN	P2-13 P2-45	A A
27 28	GND DIG GND DIG			G G
29 30	L IRD I/OE2	IN IN	P2-15 P2-47	A A
31 32	GND DIG GND DIG			G G
33 34	L I/OSTB GND DIG	IN	P2-17	A G
35 36	+5VB +5VB	IN IN	P2-18 P2-50	G G
37 38	 +5VB	 IN	NOT USED P2-51	 G
39 40	L PIFLG L PIIRQ	OUT OUT	P2-20 P2-52	A E
41 42	GND DIG L BP2	 IN	 P2-53	G A
43 44			NOT USED NOT USED	

Table 8-10. Configuration Switch on A3 Digital Interface Board

Description	Switch Number 1	2	3	4	5	6	7	8
Plug-in: 83590A	x	x	x	x	x	x	x	x
Normal Sweep	0	x	x	x	x	x	x	x
Sequential Sweep Only	1	x	x	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 Modulation (- 20 MHz/V)	x	x	x	x	x	1	x	x
Cross-Over Coupled FM Modulation	x	x	x	x	x	0	x	x
Step Attenuator Option	x	x	x	x	x	x	1	x
No Step Attenuator Option	x	x	x	x	x	x	0	x
AUX OUT Phase Lock	x	x	x	x	x	x	x	1
RF OUTPUT Phase Lock	x	x	x	x	x	x	x	0

NOTE

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

*With the configuration switch set for an Instrument Preset condition of "RF Power OFF", bias is removed from A13 YIG Oscillator. 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 microcircuit 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.

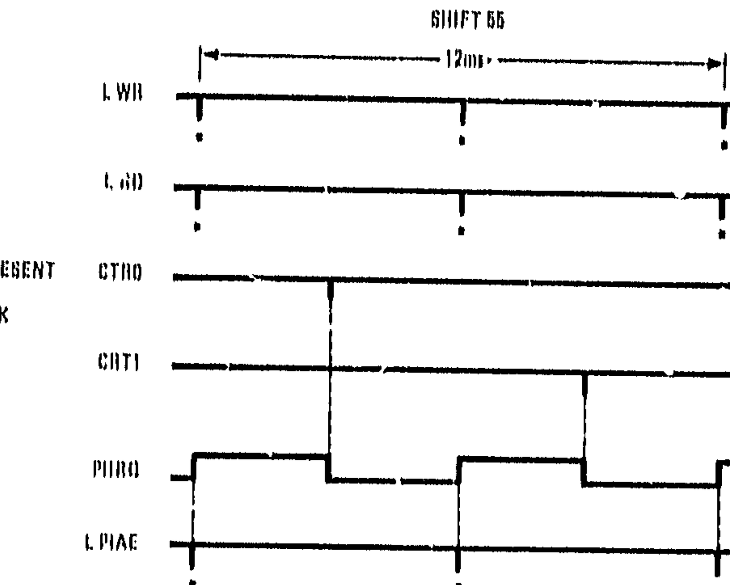


Figure 8-21. Interval Timer Self Test Timing Diagram

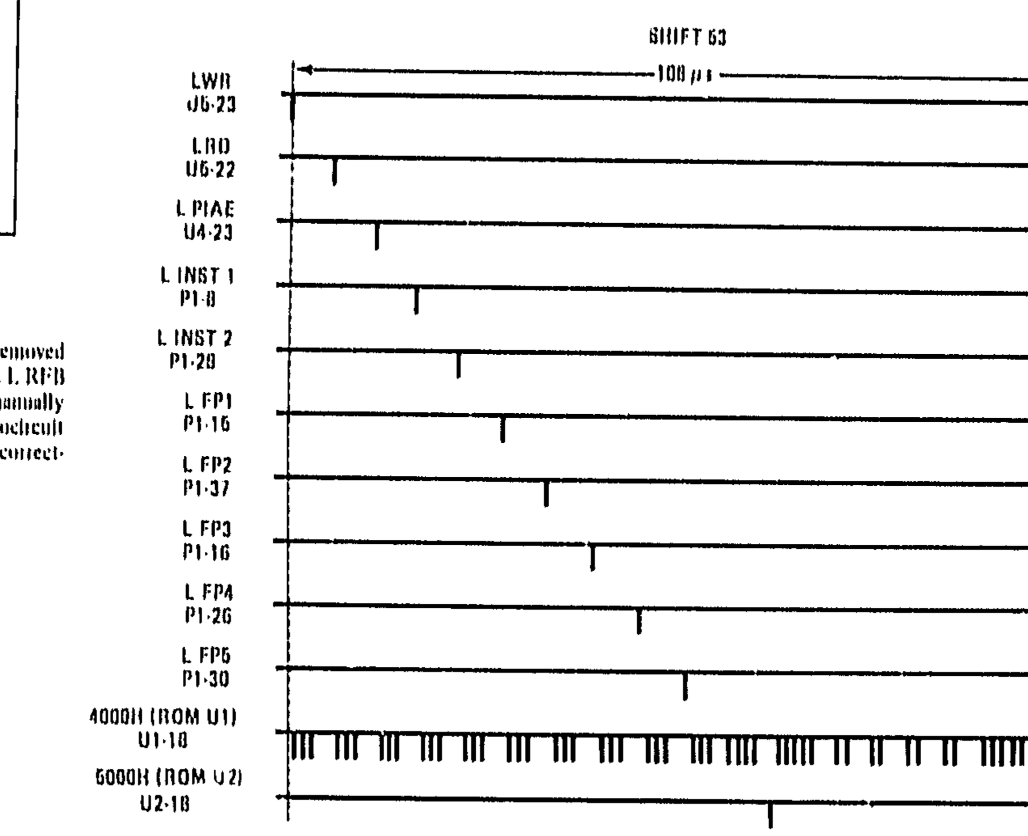


Figure 8-22. Major Address Decoder Self Test Timing Diagram

PREFIX: 2146A

A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION

The A4 Automatic Level 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 broken into two categories: internal loop circuitry, and external components of the loop. Figure 8-24 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 8350A front panel DATA ENTRY keys. This leg of the ALC is not an interdependent part of the loop as shown in Figure 8-24.

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 (TP4) 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.

Detector Inputs and Selection Switches (B)

Control lines MUX A0 and MUX A1 are encoded with leveling mode and band selection information. The lines are decoded in Table 8-12. U6 decodes these control lines to select the proper detector input for the desired operating mode.

EXT/MTR ALC input provides external crystal leveling capability within the −10 to −200 mV range. VR1 and VR2 provide protection against transients. Two schottky diodes, CR2 and CR3, are mounted between the EXT/MTR ALC connector and the front panel casting for similar protection.

When MTR (power meter) leveling is selected, U1 inverts the positive RECORDER output (approximately 0 to +1 Vdc full scale) of the HP 432A. R41 and C9 compensate for power meter response. Additional compensation occurs in the Main ALC Amp (I).

Sample and Hold Driver (H)

Q2B switches between saturation and cutoff, controlling both of the sampling FETs, Q1 and Q3. The Sample and Hold function of the ALC loop is used in conjunction with pulse modulation. When PULSE ENABLE is high, and either L PULSE or SQ MOD input is low, Q2B will saturate, initiating the Hold mode.

The frequency of the sampling mode is dependent on the L PULSE or SQ MOD input. When the system is used with the HP 8755 Swept Amplitude Analyzer, the SQ MOD input will be a 27.8 kHz square wave, controlling the gates of Q1 (D) and Q3 (G). (Refer to 8350A Operating and Service Manual, Section V, for 27.8/1 kHz Oscillator adjustment.) This ensures that sampling occurs only during the ON pulse. The sample level is maintained during the OFF pulse, thus preventing saturation of the Log and Main ALC amplifiers.

The SQ MOD input is also connected to the PIN Mod 0 and PIN Mod 1 Drivers (K) (L) for RF modulation when using the 8350A internal squarewave modulation.

Input Sample and Hold (D)

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

U8 is a unity gain follower with internal feedback which buffers the detector input. R59 compensates for the offset voltage of the operational amplifier. Q1 and C11 perform the sample and hold function. Q7 and Q8 in the Log Amplifier select the appropriate detector return for INTernal and EXTernal leveling modes.

Log Amplifier (E)

The logarithmic scaling function is performed by Q6A in the feedback loop of U7. Q6A collector current is proportional to the voltage at TP12 and exponentially related to its base-emitter voltage. Therefore, Q6A emitter voltage is logarithmically related to the input voltage at TP12.

Q6B compensates the Log Amp against changes in reverse saturation current with temperature.

CR4 provides a positive current path preventing U7 from saturating when the input is greater than or equal to 0 volts.

U6 decodes MUX A0 and MUX A1 (Table 8-12) 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.

U5 amplifies the logged output for comparison with the Power Level Summing (F) signal. R7 and R8 adjust the gain of U5, and calibrate midrange power levels for their respective bands. R9 is selected during power meter leveling to adjust the gain of the log amp for compatibility with the HP 432A Power Meter.

Guarded-gate FETs, Q7 and Q8, select the appropriate detector return for INTernal and EXTernal leveling.

Power Level Reference (C)
Power Level Summing (F)

U14 is a 12-bit microprocessor-compatible D/A converter, which latches data in three 4-bit nibbles. The −10V REF input sets the DAC for a maximum output (TP2) of +10V. The voltage at TP2 is the product of −10 VREF 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. U3A sums PWR SWP/COMP and AM inputs. In addition, selected feedback resistor R3 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 U3C. R31, in the feedback loop of U3C, provides temperature compensation for the Log Amplifier and detectors.

Error, Sample and Hold (G)

TP4 is the summing junction for the Power Level Summing output, Log Amplifier output, and FREQ TRK V. FREQ TRK V is a 0 to 5 volt ramp proportional to the YTM DRIVE Voltage.

Under leveled power conditions, the voltage at TP4 is zero. A non-zero voltage represents an error and forces a change in modulator current until power is again level.

U3D buffers the error voltage. Q3 provides sample and hold capability during pulse modulation. R69 reduces the coupling effect of parasitic capacitance in Q3.

Main ALC Amp (I)
Unlevel Signal (J)

Both inputs to integrator U11 are at virtual ground under level power conditions, allowing for immediate response to an input error voltage.

R11 optimizes the speed at which the loop responds to power level changes.

L RFB goes low during bandswitching to blank the RF power, thus preventing the loop from saturating. When 8350A RF BLANK is selected, L RFB goes low during retrace also: U2D closes, pulling current through C22, forcing TP6 high and turning on the PIN modulators.

C21 compensates for the response time of the ALC loop during power meter leveling to prevent oscillations.

Under unleveled conditions, VR4 and VR5 will clamp the output of U11 at approximately −4 and +4 volts, preventing negative or positive saturation. When the output of U11 approaches −2 volts, comparator U15 activates the front panel LED indicating unleveled power.

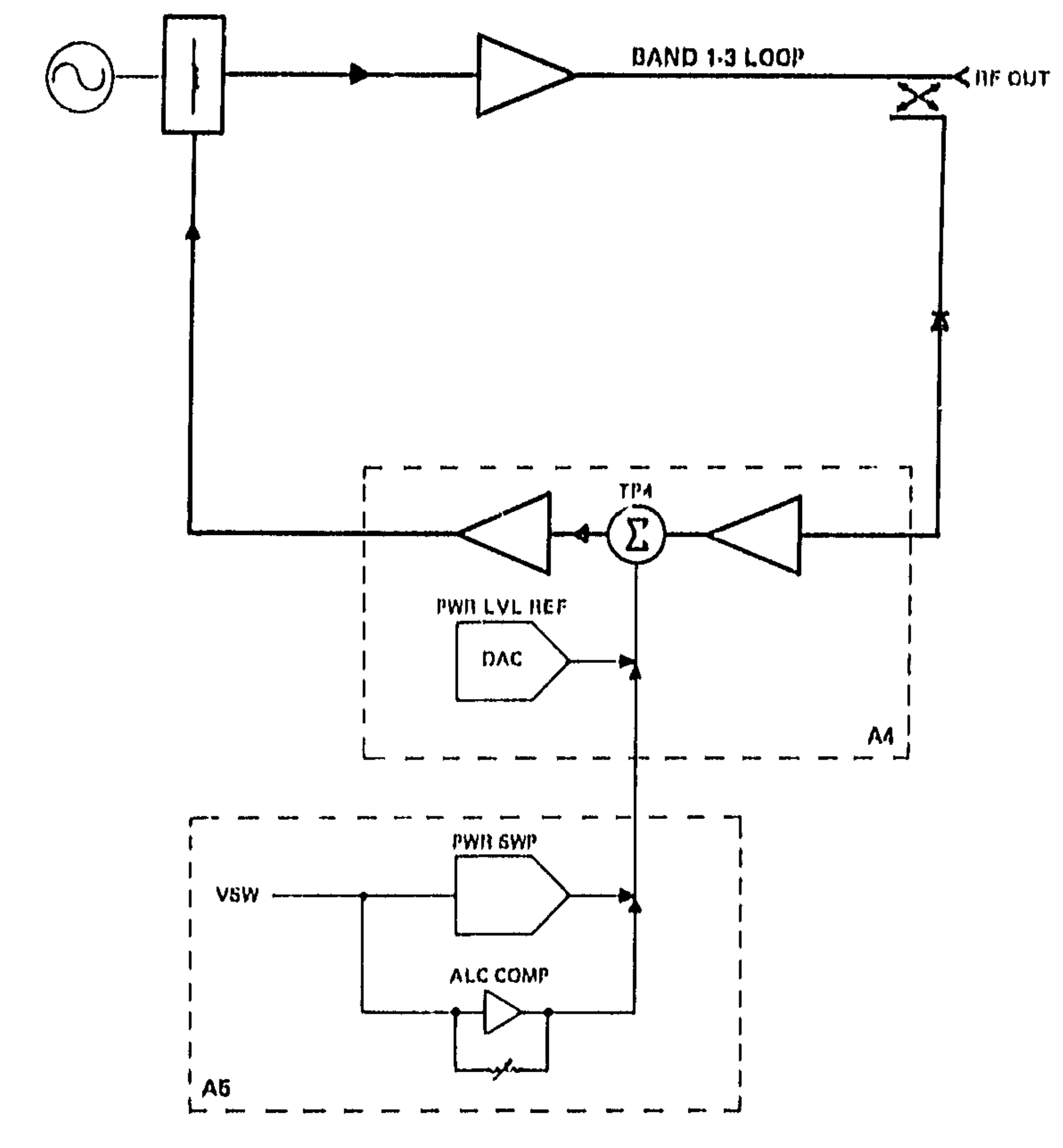


Figure 8-24. Simplified ALC Block Diagram

Collector current in common base transistor Q14 is exponentially related to the base-emitter voltage. PIN modulators are driven exponentially to maintain constant loop gain.

Emitter follower Q13, CR7, and CR9 control the gain of the exponential current drive.

PIN Mod 0 Driver L
PIN Mod 1 Driver K

R97 compensates for the loss of modulator sensitivity under high power conditions.

Q10 K increases isolation in Band 1 by shutting off the modulator in the inactive band. Q16 and Q17 also provide square wave modulation and RF blanking, when selected.

A4 ALC TROUBLESHOOTING

Since the Automatic Level Control (ALC) function of the 83590A 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. The key to troubleshooting, then, 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 Drop—outs)
FULL UNLEVELED POWER
NO POWER (Single Band)
NO POWER (All Bands)
POWER SWEEP / FLATNESS

Evaluating the failure mode may require an HP 432A Power Meter or the HP 8755C Swept Amplitude Analyzer with the 11664B Detector. (However, a crystal detector with an "A vs B" oscilloscope may often be substituted.) Figure 8-25 configures a typical test set up. Initiate all tests with the INSTR PRESET condition.

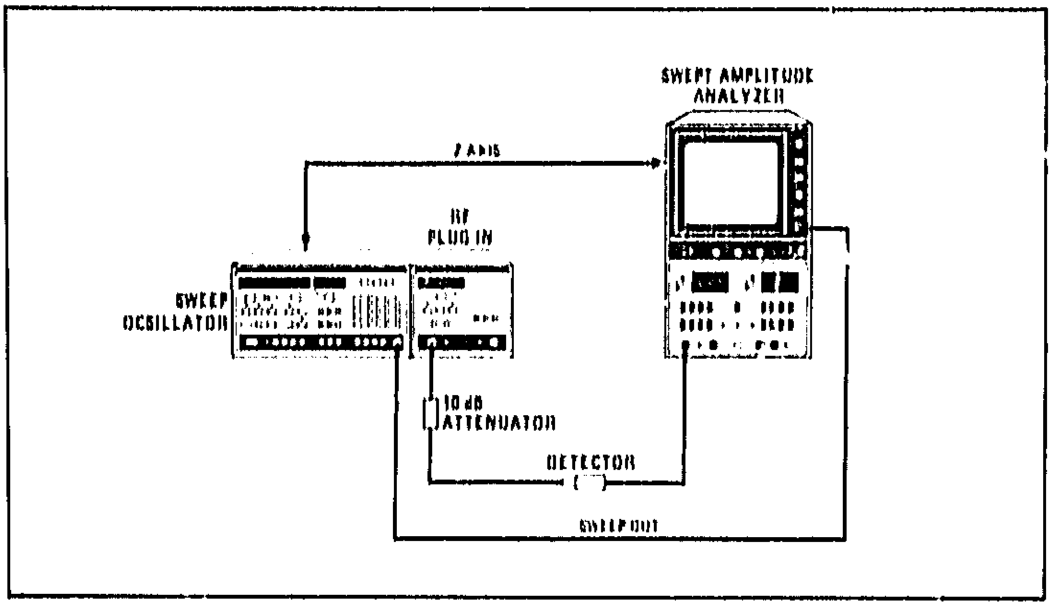


Figure 8-25. Typical ALC Troubleshooting Setup

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 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 8350A mainframe.

UNLEVELED (LED)

If the UNLEVELED light turns on during the sweep, enter a sweep time of 20 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 is on during the entire forward sweep, suspect components common to all bands.

- If the UNLEVELED light flashes on briefly twice during the sweep (at 7 and 13.5 seconds into the trace), the problem occurs at the bandswitch points. Check for the RF blanking (L RFB) pulses during bandswitch at A4P1-29, as shown in Fig. 8-30. If the signal is missing, trace the problem back through the 8350A, to the blanking request (L RFBRQ) line on the RF Plug-in A6 assembly. If L RFB is present, but A4TP6 does not clamp at +4 Vdc during blanking, suspect A4U2D or A4U11.

- 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. 8-25. Optimize the output power with the front panel PEAK control.

- 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 +10 and −5 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 (One or More Bands)

If power is unleveled in Band 1 or Bands 2−3 only, select a sweep width within the unleveled band(s). If power is unleveled in all bands, continue to sweep the Plug-in's full range.

- Attempt to level the power externally using the HP 432A Power Meter as shown in Figure 8-26. Select MTR leveling, and enter a 100 seconds sweep time. If the RF power is now leveled then the failure is most likely in the detectors or the Detector Selection Switch, A4U6. Refer to the following paragraph. If this does not prove to be the case, the problem may be in the two analog switches U4B and U6A. It may be necessary to perform the ALC adjustments in Section V of this manual.

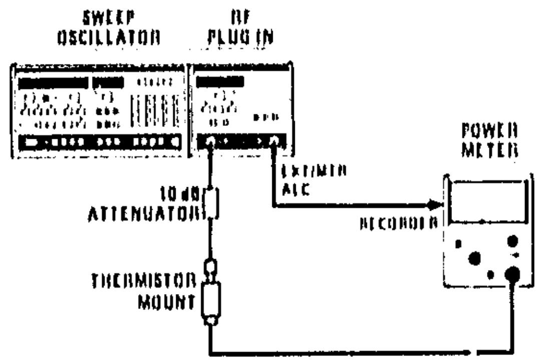


Figure 8-26. Power Meter Leveling Setup (Using HP 432A Power Meter)

- 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 doesn't match the output, check the MUX A0 and MUX A1 lines (see Table 8-12). Also check U12 and U13 as described under Digital Control.

- Check the voltage at TP6. If it is at +4 Vdc, suspect the Mod Drivers or Modulators. If it is below −2 Vdc, suspect the Detectors and Detector Leg.

NO POWER (Single Band Only)

If no power is detected in one band, but there is leveled power in another band, suspect the components of the RF path appropriate to the faulty band within the ALC loop.

NOTE

Turn off line switch before removing or installing any assembly.

With the ALC assembly removed from the Plug-in, 27.8 kHz square wave modulation from the 8350A is not available. However, the 8755 27.8 kHz square wave can be connected to the rear panel PULSE IN connector to maintain 8755 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 +12 dBm) is then detected in all bands, the RF amplifier (A14), and YTM (A12) are verified. Suspect primarily the appropriate detector. Also inspect the modulator, as well as the A4 Mod Drivers and Detector Selection Switch.

- If there is no RF signal in any of the bands, check the A6 SRD and PIN Diode Bias circuit.

NO POWER (All Bands)

NOTE

Turn off line power before removing or installing any assembly.

- If no power is detected in any band, remove the A4 ALC assembly. This removes all bias from the modulator, and should allow full RF power to be transmitted. If there is still no power, check the rear panel AUX OUTPUT for approximately 0 dBm to verify that the A13 YIG Oscillator is providing an RF output. Refer to RF Troubleshooting for details.

- If removing the A4 assembly causes full unleveled RF power to appear, reinstall the board and check A4TP6. If less than −2 Vdc is found, verify that TP9 is approximately −8 Vdc in Bands 1−3. If A4TP6 is at +4 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)
DETECTORS / DETECTOR SELECTION SWITCH (B) , DC1, CR1
DETECTOR LEG (D) (E)
MODULATOR LEG (G) (I)
MOD DRIVERS (L) (K)
MODULATORS A17, A13

DIGITAL CONTROL (A)

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

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

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

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

If the Digital Control section is working, the primary outputs of U13 are easily controlled by selecting the appropriate front panel function while in the CW sweep mode. (e.g., B1 is held high by selecting a CW frequency in Bands 1 through 3; selecting MTR leveling holds the PM line high, etc.).

REFERENCE POWER LEVEL Ⓒ Ⓕ

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, 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 (−5 dBm displayed) to +10 Vdc (+20 dBm displayed) at TP2. (This breaks down to a voltage step of 0.40 Vdc per 1.0 dB of power over the dynamic range, or 6.00 Vdc at +10 dBm.)

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

SHIFT 5 0

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

- If the waveform at TP2 is not correct, check for −10V REF, and trace any problem back to the A8 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 and CR3. Use the EXT MTR mode to by-pass these diodes while troubleshooting.

U3C adds the front panel amplitude adjustment (EXT CAL) used with external leveling. The following levels should be seen at TP1 with A5 removed and INT leveling selected: +0.3 Vdc for −5 dBm, and +7.0 Vdc for +20 dBm. An amplitude modulation (AM) signal of 1.0 Vp-p at P1-4 will produce roughly 260 mV p-p at TP1. (Note that U4A, CR2, and CR3 in the feedback path around U3A change the gain depending on the band and desired power level. This may result in a 1.0 Vdc difference between bands at +20 dBm.)

DETECTORS / DETECTOR SELECTION SWITCH (B), DC1, CR1

Detector CR1 is tested simply by checking the output voltages under full leveled power or full unleveled power conditions.

NOTE

The 27.8 kHz modulation signal required for 8755 compatibility is not available from the 8350A when the A4 assembly is removed from the Plug-in and must be supplied from the 8755 through the rear panel PULSE IN connector.

- If no power is measured in the suspected band, 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 two narrow strips of cellophane tape to the pin-edge connector to isolate the outputs of the modulator drivers from the modulators (P1-19 and P1-44). Reinstall the A4 board. This removes bias from the modulators, allowing full RF power transmission, while providing detector bias.

If full leveled power (+10 dBm) or full unleveled power (at least +12 dBm) is measured, sweep only the band in question and check the voltages at the detector inputs against the values shown in Table 8-11. (Use high-impedance 10:1 probes.)

Table 8-11. Detector Voltages

	Full Leveled +10 dBm	Full Unleveled +20 dBm
Bands 1-3 (A4P1-20)	−100 to −120 mV	−200 to −600 mV

If the Detectors are working and the Detector Selection Switch is suspected, sweep only in the faulty 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 Detectors and Detector Selection Switch are working correctly. See above.

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

MODULATOR LEG

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

U3D is a non-inverting unity-gain summing amplifier. Under leveled conditions, both TP4 and TP7 should be nearly 0.0 Vdc. Under any conditions (except during "hold"), 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 −4 Vdc. If not, suspect U2D or U11. When TP7 is negative, TP6 should be at +4 Vdc. If this is not the case, suspect U11.

- The following procedure can be used to check U3D and U11:
  1. Remove jumper W3.
  2. Set power for −5 dBm at any CW frequency.
  3. Press 83590A EXT ALC.
  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 and VR5) at −4 Vdc and +4 Vdc, respectively. (When sweeping across a bandswitch, RF blanking pulses will saturate TP6 at +4 Vdc regardless of input.)
  6. Reinstall jumper W3.

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

MODULATOR DRIVERS

The voltage-to-current conversion and current gain needed to drive the modulator is provided by Q13 and Q14 on the output of the Main ALC Amplifier. As the voltage increases at TP6 so does the current to the Modulator, shunting more RF energy to ground and allowing less to pass through. Since the modulator is essentially current-controlled, the voltages measured at TP9, P1-19, and P1-44 do not vary much over a wide range of modulator attenuations.

Q13 is an emitter-follower followed by a common-base stage (Q14), with two diodes in between. Check the biases and base-emitter voltages to check for damaged transistors.

- To establish a bias level for the Mod Driver stage, TP6 can be forced high (+4 Vdc). Remove jumper W3. Press 8350A CW and select a CW frequency in the appropriate band. Select EXT ALC, and enter an RF power level of −5 dBm via front panel controls. Rotate the EXT/MTR ALC CAL knob fully counter-clockwise. Verify a signal level of approximately +4 Vdc at TP6. Reinstall jumper W3.

MODULATORS

The internal modulator for this Plug-in is housed in a combination microcircuit package, A16 Modulator/Coupler. Figure 8-27 provides a simplified schematic for these positive-bias shunt-type attenuators. As more current is supplied through the modulator bias pin, the shunt diode turns on harder, sinking more RF power to ground and allowing less to reach the front panel.

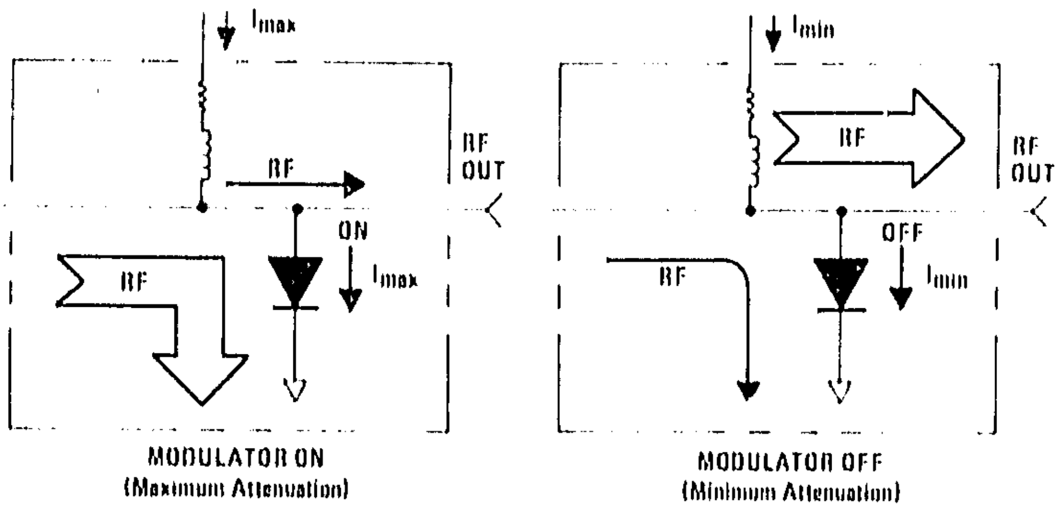


Figure 8-27. Simplified Modulator Schematic

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

NOTE

Turn off line power before removing or installing any assembly.

- If low or no RF power is observed, remove all modulator bias currents 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 83590A EXT ALC. Remove jumper W3. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully clockwise. This should result in −4 Vdc at TP6, essentially removing bias from the modulator. Check for 0 Vdc at TP9. If this is not the case, isolate the modulator from the drive circuitry by applying a piece of cellophane tape to the pin edge connection P1-19. If TP9 still does not measure 0 Vdc, the modulator diode may be shorted.

NOTE

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

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

2. If power is low in all bands, check the RF level at the rear panel AUX OUT connector. Refer to the RF Schematic Diagram at the end of Section VIII for the proper levels.

3. Check the RF levels around A14 Power Amplifier with no modulation. A14 should output approximately +26 dBm with about +13 dBm at the input.

- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted). Select 83590A EXT ALC. Remove jumper W3. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully counter-clockwise. The voltage level at TP6 should be +4 Vdc. Concurrently, the voltage level at the output of the Mod Driver, P1-19, 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 TP9 for approximately +2.0 Vdc. The difference between the test point and the corresponding pin-edge connector gives an indication of how much current is flowing to the modulator.

A4

Figure 8-28. A4 ALC, Block Diagram

Figure 8-34. A4 ALC, Schematic Diagram

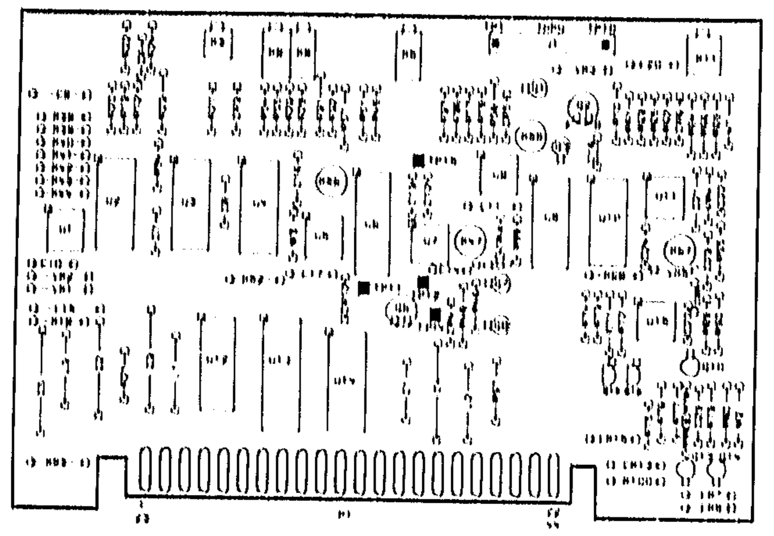


Figure 8-29. A4 ALC, Component Locations

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 BANDSWITCH INTERRUPT, PRESS 8350A CW.

Table 8-12 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	FUNCTION
1 23	EXT DET RET EXT DET	IN IN	J2 J2	M B
2 24	L UNLVL EXT CAL	OUT IN	A6P1-4 A10J1-12 A10J1-41	J F
3 25	PWR REF	OUT	NOT USED NOT USED	C
4 26	AM FREQ TRK V	IN IN	P1-A4 A10J1-36	C G
5 27	PWR SW/COMP +5V	IN IN	A5P1-23 A3P1-6,7	C M
6 28	 −15V	 IN	NOT USED P2-28	 M
7 29	+10V L RFB	IN IN	P1-8 P2-60	M I,L
8 30	GND DIG GND DIG			M M
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			M M
16 38	 +15V	 IN	NOT USED P2-20	 M
17 39	−10V −40V	IN IN	P1-13 P1-11	M M
18 40	L INST1 SQ MOD	IN IN	A3P1-8 P2-26	 H,L
19 41	MOD1 L PULSE	OUT IN	A10E1 A6P1-26	K H
20 42	INT DET 1 INT DET RET	IN IN	CR1 CR1	B M
21 43	INT DET 0 −10V REF	IN IN	A10-E4 A8P1-3	B C
22 44	MOD DRIVE MOD 0	OUT OUT	NOT USED A10J6-16	I L

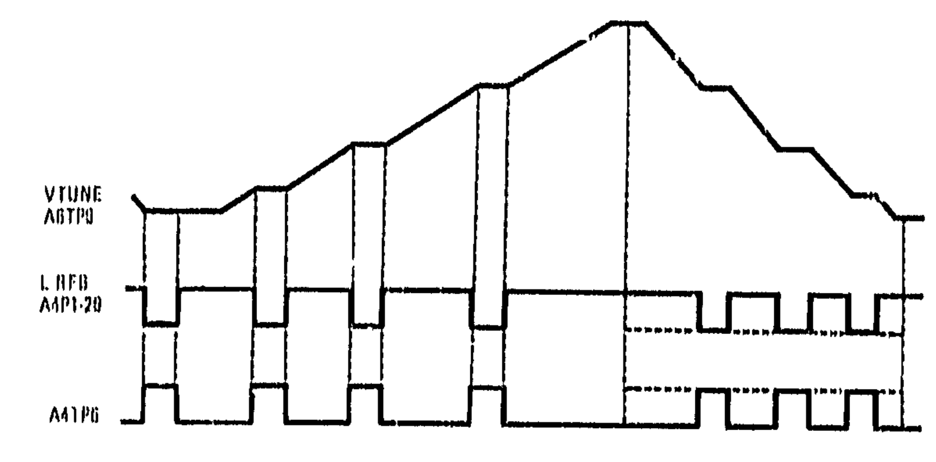


Figure 8-30 Bandswitch/Retrace Blanking Waveforms

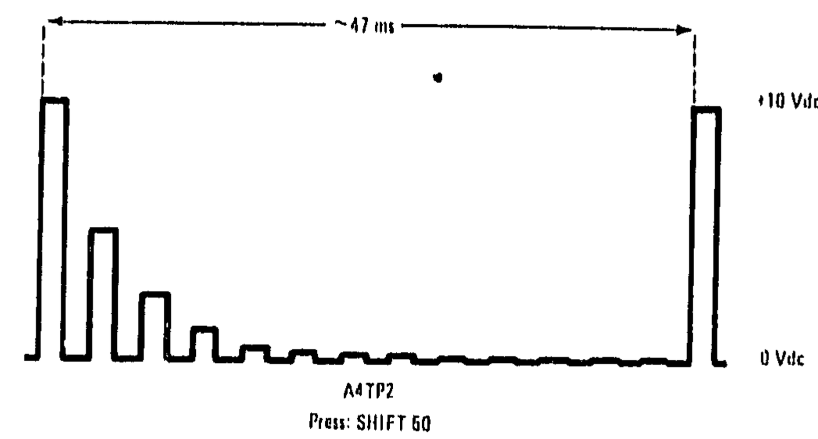
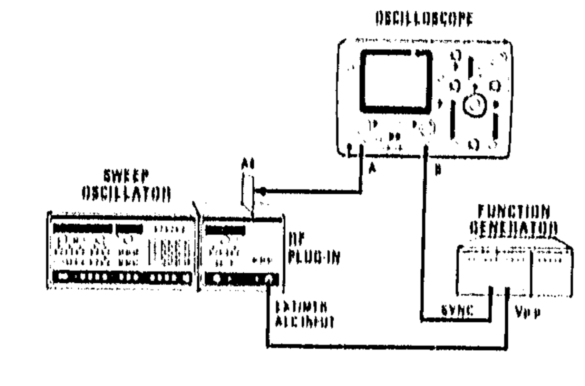


Figure 8-31. ALC DAC Test Waveform



Open Loop Procedure Test Setup

EQUIPMENT:

Function Generator .... HP 3312A
Oscilloscope .... HP 1740A

PROCEDURE:

1. Press 8350A **INSTR PRESET**
2. Press 83590A **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. Adjust the 3312 OFFSET knob to ensure the waveform at TP15 does not go positive. Check for the waveforms shown in Figure 8-33.

NOTE

The HP 3312A OFFSET knob may have to be adjusted slightly to produce the waveforms given in Figure 8-33. 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 8-33 and those obtained on individual ALC assemblies. This is due to the many adjustments on the A4 assembly.

Figure 8-32 Open Loop Procedure

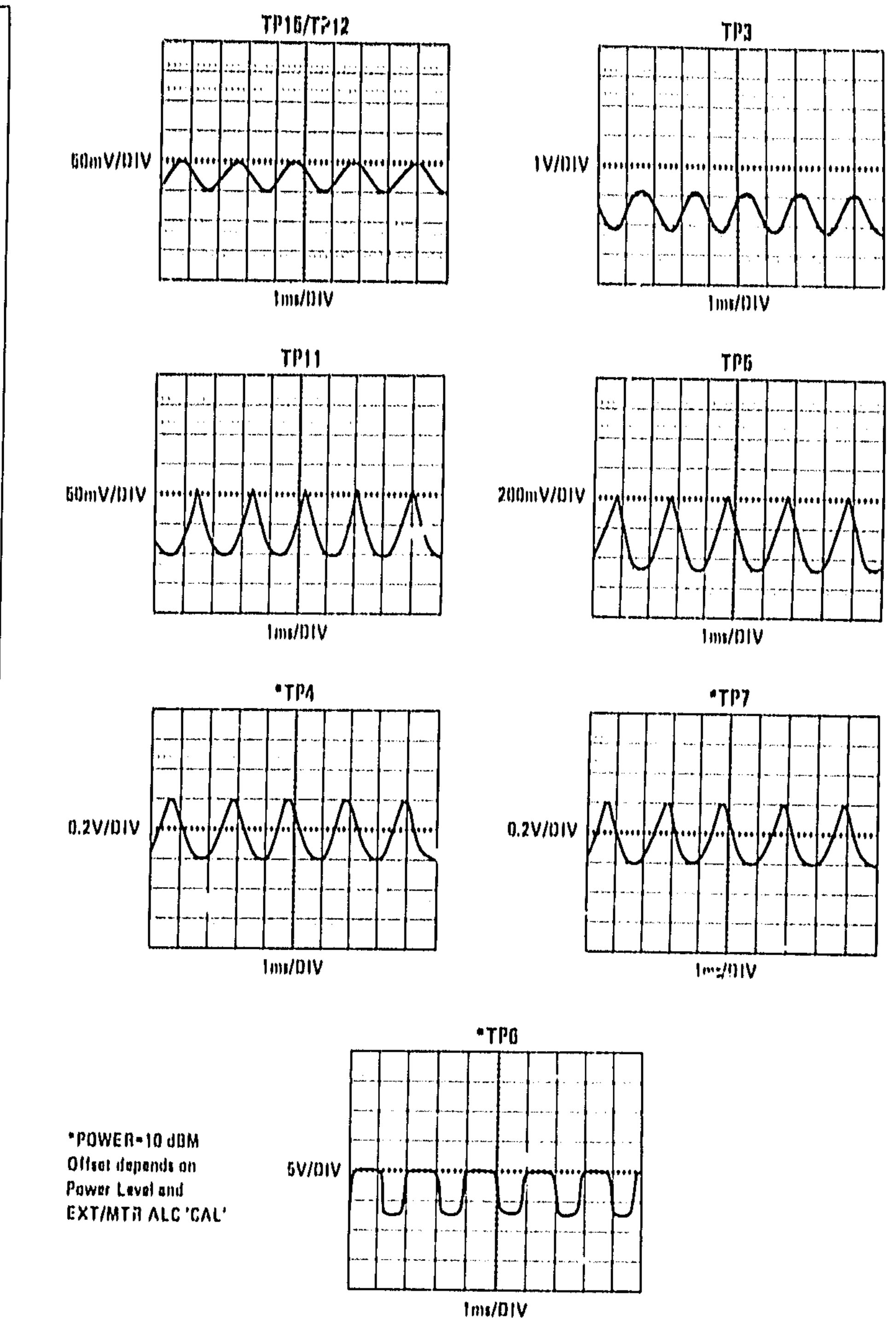


Figure 8-33. Open Loop Waveforms

A5 FM DRIVER, CIRCUIT DESCRIPTION

The A5 FM Driver is divided into three major sections: the YO/YTM Main Coil FM Drivers, the YO 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 YO/YTM Main Coil and FM Coil Driver circuits. For low frequency FM inputs, the YO and YTM Band Select Amplifiers scale and buffer the FM signal to produce outputs that are summed with the tuning voltage on their respective driver board assemblies (A7 YTM Driver and A8 YO Driver). Thus, these low frequency FM outputs are an extra tuning voltage input to the YO and YTM drivers, 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 10MHz) FM applications. A current drive for the YTM is not necessary because the YTM bandwidth is wide enough to pass small frequency variations. 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).

YO and YTM Main Coil FM Drivers C D H

The YO and YTM Main Coil FM Drivers scale and buffer the 8350A rear panel FM input signal for FM frequencies between DC and 700 Hz to produce two outputs which are summed with the tuning voltage for the YO main coil on the A8 YO Driver board and the YTM on the A7 YTM Driver board. Low Frequency Amplifier/Filter and the YO and YTM Band Select Amplifiers make up the YO and YTM 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 both the YO and YTM Band Select Amplifier circuits. Relay K2 is used to control the overall gain of inverting amplifiers U7B and U14D for the two sensitivities by changing the value of the input resistance. Relay K2 is either open or closed (shorting across parallel resistors R8 and R78) 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 6MHz/V SEL is determined by the position of the Configuration Switch on the A3 Digital Interface board. Since the YTM may be tuned to the second or third harmonic of the YO, the LO FM outputs to the YO and YTM drivers must be scaled according to the band of operation. This scaling is accomplished by the YO and YTM Band Select Amplifier circuits. The gain of each amplifier is set by the YO and YTM SEL inputs to the analog switches in their feedback paths. Table 8-13 lists the logic levels of these lines for each band. The YO Band Select Amplifier output (TP3) is summed directly with main coil tuning voltage on the A8 YO Driver board, and the YTM Band Select Amplifier output (TP2) is summed directly with the YTM tuning voltage on the A7 YTM Driver board. The YO and YTM Band Select Amplifiers are shut off with analog switches U3C and U13A 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.

YO FM Coil Driver E F I

The YO FM Coil Driver scales and buffers the 8350A rear panel FM input for frequencies between DC and 10MHz to produce an output current that drives the YO 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 3dB cutoff frequency of about 700Hz. 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 700Hz and the low-pass filter in the Main Coil Driver circuits will pass signals below 700Hz. 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 10MHz.

Selectable sensitivities of −6MHz/Volt and −20MHz/Volt are available and determined by the state of control line 6MHz/V SEL (1 = −6MHz/V, 0 = −20MHz/V). When 6MHz/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 6MHz/V SEL is low, relay K2 is activated, shorting capacitors C4−C6 and resistor R11. The combination of C2, C3 and R12 still forms a high-pass filter with a cutoff of 700Hz. Note that in the DC coupled mode the sensitivity is always −20MHz/Volt.

The output of the filter network is limited to about ± 3V 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 8-35 shows the approximate response versus frequency of the YO FM coil and the compensation network. Adjustments R19 (FM OFFSET), R75 (HI), 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 YO FM coil. The overall voltage gain of the Output Current Driver is determined by the YO SEL inputs to analog switches U12B, C, and D and is selected according to the frequency band of operation. Resistive divider R30 through R32 sets the FM coil drive scale factor.

Address Decoder A

Address Decoder U18 generates three control lines (L EN 4, L EN 5 and L EN 6) by decoding the state of address lines BA0−3 and control line L INST 1. L EN 4 (Low Enable 4) and L EN 6 (Low Enable 6) load data into the Control Latches and L EN 5 (Low Enable 5) loads data into the Power Sweep DAC.

Control Latches C

Control latch U6 stores the state of six control lines that are used to control the amplification factor of the FM input signal according to the frequency band of the RF output. The control lines are loaded into U6 from data bus lines BD0−BD5 when the L EN 6 signal from U18 makes a low to high transition.

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−BD5 when the L EN 4 signal from U18 makes a low to high transition.

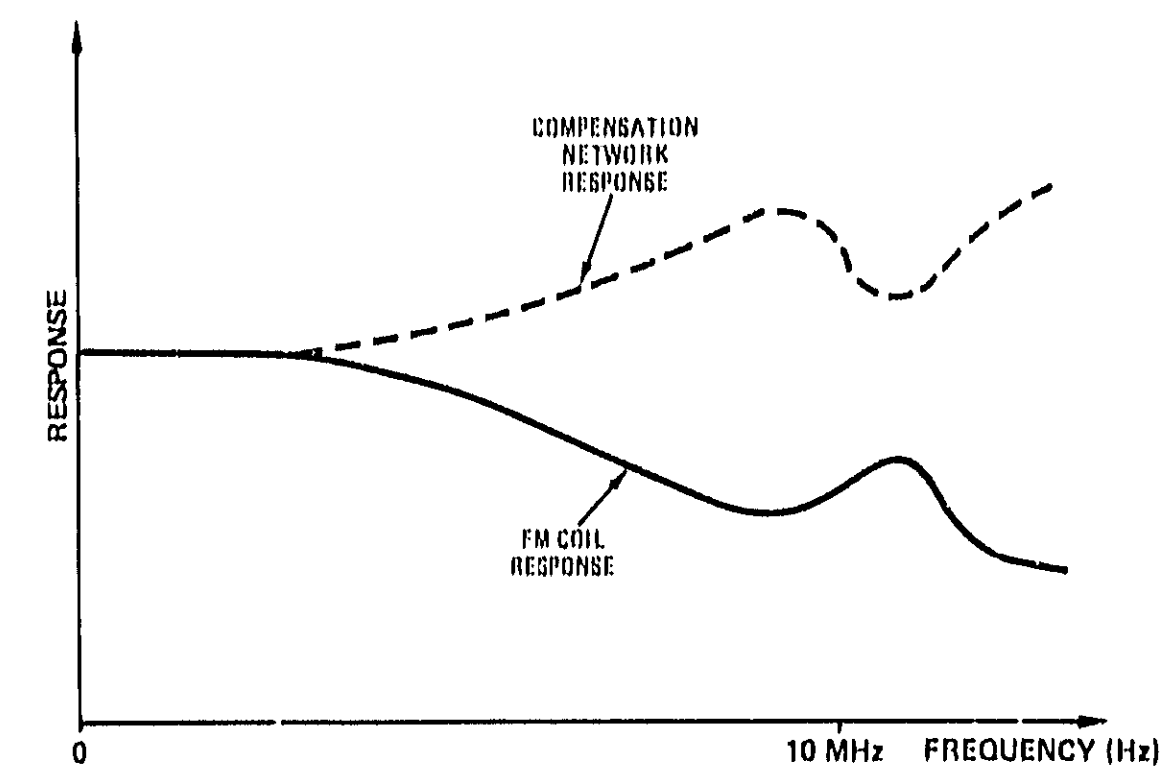


Figure 8-35. Plot of FM Coil Response Versus Modulation Frequency

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 5 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 5 Volt range.

The FREQ TRK V ramp is applied to four parallel circuits, each one adjusted to take effect 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 forms 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 signals 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 B

When POWER SWEEP mode is selected at the front panel, L EN 4 (Low Enable 4) is generated by U18, enabling U17 on. This allows power sweep data from data lines BDO through BD7 to be loaded into U17. This data selects the gain of U14B by connecting or removing resistors in series with the input to U14B. The signal path of the VSW 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, then goes through amplifier A14A 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.

A5 FM DRIVER TROUBLESHOOTING

For troubleshooting purposes, the A5 FM Driver is divided into three groups.

- YO/YTM Main Coil FM Driver and YO FM Coil Driver circuits.
- FM Configuration Control circuits.
- Power Sweep and ALC Flatness Adjustment circuits.

YO/YTM Main Coil FM Driver and YO 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 is divided into two ranges of modulation frequency. For FM frequencies less than or equal to 700 Hz, Table 8-14 provides voltages for troubleshooting. For FM frequencies greater than or equal to 700 Hz, Figure 8-41 provides waveforms for troubleshooting. The voltages and waveforms are arranged horizontally by test point and vertically by the FM input frequency. Figure 8-40 shows the test setup required to obtain the waveforms.

NOTE

Before altering the switch settings on A3S1, write down the present configuration. Return the switches to their original status after troubleshooting.

Prior to performing the test procedure, preset the A3S1 Configuration Switch sections 5, 6, and 8 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 A3S1–5 to the open (1) position.
- For 20 MHz/V sensitivity – set A3S1–5 to the closed (0) position.
- For DC coupled mode – set A3S1–6 to the open (1) position.
- For cross-over coupled mode – set A3S1–6 to the closed (0) position.
- For Front Panel Phaselock mode – set A3S1–8 to the closed (0) position.
- For the AUX OUT Phaselock mode – set A3S1–8 to the open (1) 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 a 1 volt peak-to-peak waveform at TP11 for the frequency tested.

2. Verify the waveforms and voltages in the corresponding row.

Table 8-13. YO and YTM Gain Select Truth Table

	Front Panel Phase Lock (A3S1-8=0)			Aux Out Phase Lock (A3S1=1)		
	B1	B2	B3	B1	B2	B3
YO SEL 1	0	1	1	0	0	0
YO SEL 2	0	0	1	1	1	1
YO SEL 3	0	0	0	0	0	0
YTM SEL 1	1	1	0	1	0	0
YTM SEL 2	0	0	0	0	1	0
YTM SEL 3	0	0	0	0	0	1

FM Configuration Control Circuits Troubleshooting

The FM configuration control circuits include the Address Decoder, Control Latches, relays K1 and K2, and analog switches U3C 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 L EN4, L EN5, and L EN6 as shown in Figure 8-36.

Control Latches. Control latches U6 and U16 are checked by performing a hexadecimal data rotation write to U6 and U16, and then checking the outputs for the waveforms shown in Figure 8-2. The Oscilloscope should be triggered from pin 15 of the addressed data latch.

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.

To check control latch U6, press INSTR PRESET then repeat the above key entry sequence using address location 2C06.

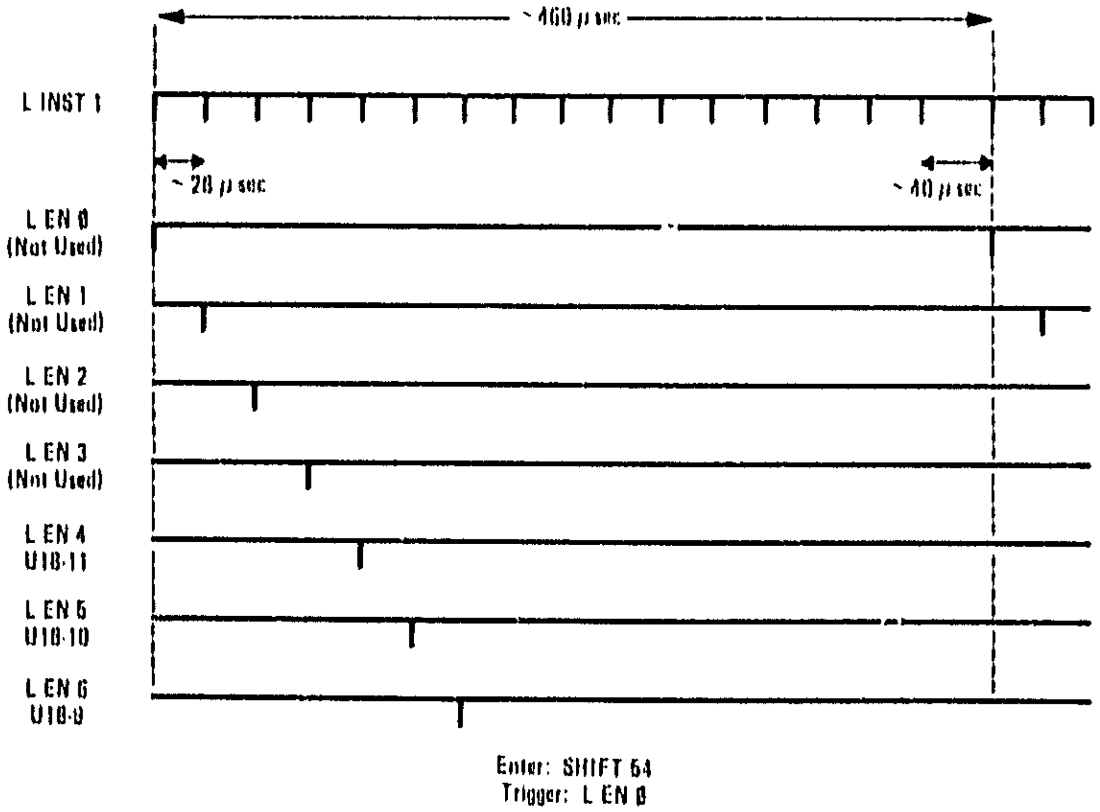


Figure 8-36. Address Decoder Timing Diagrams

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

To check relay K1, enter on the 8350A:

SHIFT 0 0	Enters Hex Data command
2 GHZ 8 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.

High/Low FM Switching. Analog switches U3C, U13A, and U11 are checked by using the Hex Data Write feature of the 8350A to control the switches. A known FM input is applied and switch operation is verified.

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

On the 8350A, enter:

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

Analog switches U3C and U13A should be closed. Verify there is a signal at TP3 and TP2.

On the 8350A, enter:

M2 dBm dB 0	Hex Data Write E0

Analog switches U3C and U13A should be open. Verify that there is no signal at TP3 and TP2.

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 Hex Data Write EC

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

Power Sweep/ALC Adjustments Troubleshooting

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

SHIFT 5 1 Initiate Power Sweep DAC self test

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

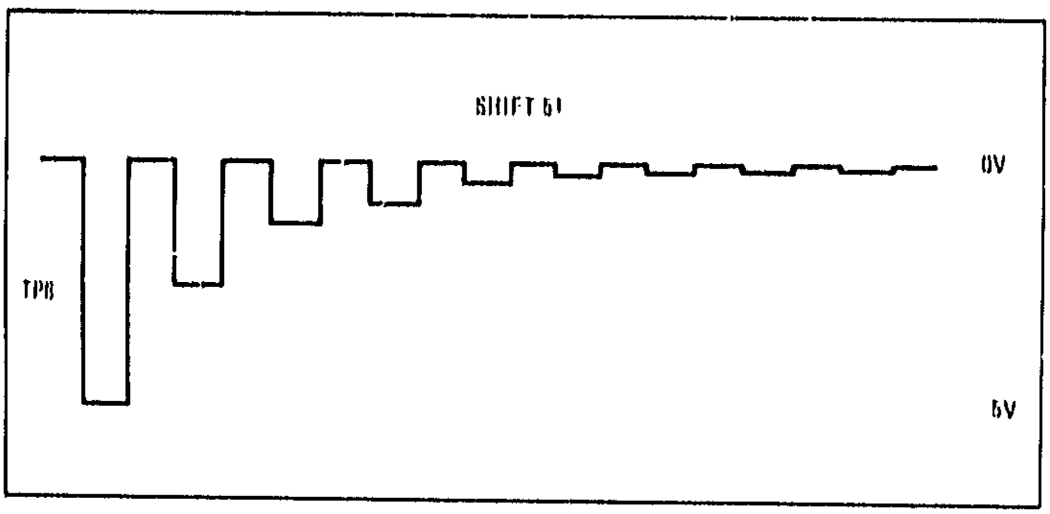


Figure 8-37. Power Sweep DAC Self Test Waveform

Figure 8-38. A5 FM Driver, Block Diagram

Figure 8-42. A5 FM Driver, Schematic Diagram

A6

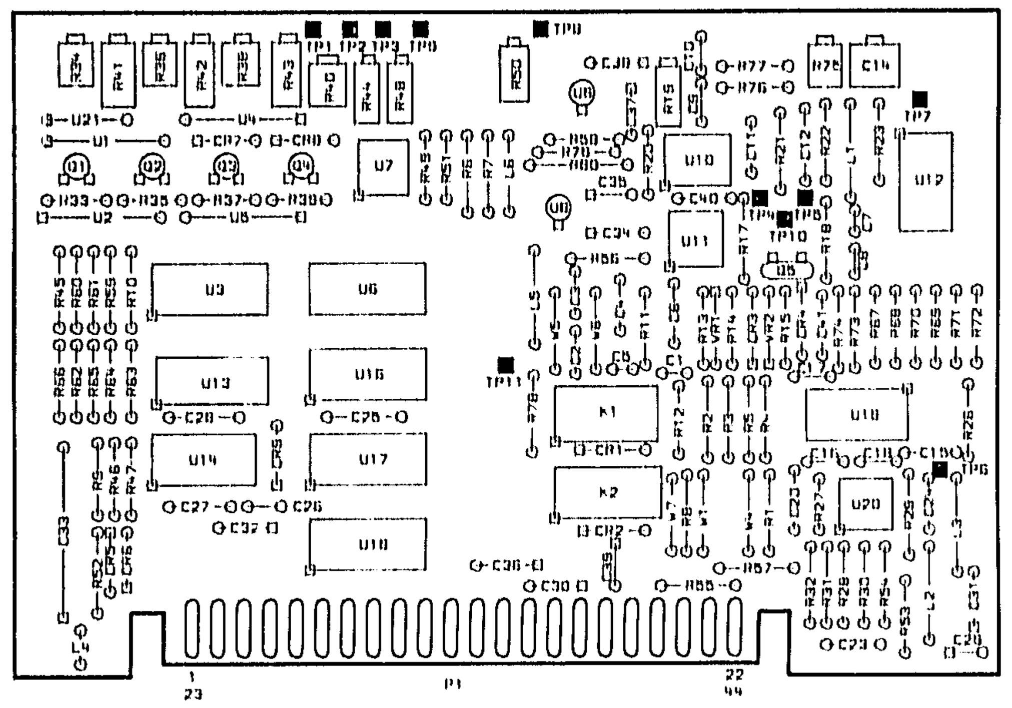


Figure 8-39. A5 FM Driver, Component Locations

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 BANDSWITCH INTERRUPT, PRESS 8350A CW .

A5P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 23	YTM LO FM PWR SW/COMP	OUT OUT	A7P1-1 A4P1-5	H J
2 24	YO LO FM FREQ TRK V	OUT IN	A8P1-1 A2J1-36	D J
3 25	VSW	IN	NOT USED P2-64	G
4 26			NOT USED NOT USED	
5 27	L INST1 +5V	IN IN	A3P1-8 A3P1-6,7	A K
6 28	−15V	IN	NOT USED P2-28	K
7 29	+10V	IN	P1-8 NOT USED	K
8 30	GND DIG GND DIG			K K
9 31	BD1 BD0	IN IN	A3P1-9 A3P1-31	B,G B,G
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	G G
15 37	GND ANLG GND ANLG		NOT USED	J
16 38	+20V +15V	IN IN	NOT USED P2-29	K
17 39	−10V FM RET	IN IN	P1-13 P1-A3	K C,E
18 40	FM IN	IN	NOT USED P1-A3	C,E
19 41	FM RET	IN	NOT USED P1-A3	C,E
20 42	HI FREQ FM RET	OUT	A13A1J1 NOT USED	I
21 43	HI FREQ FM	OUT	A13A1J1 NOT USED	I
22 44	HI FREQ FM RET	OUT	A13A1J1 NOT USED	I

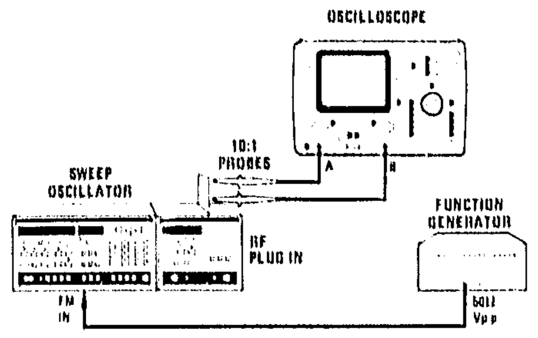


Figure 8-40. A5 Troubleshooting Test Setup

Table 8-14. LO Frequency FM Troubleshooting Voltages

Setup Condition	U7-7	TP2		TP3	
		20 MHz/V	6 MHz/V	20 MHz/V	6 MHz/V
FM INPUT = 100 Hz A5TP11 = 1Vp-p F.P. Phaselock (A3S1-8 Closed)	.8Vp-p All Bands	.8Vp-p All Bands	.48Vp-p All Bands	Band 1 = .8Vp-p Band 2 = .4Vp-p Band 3 = .28Vp-p	Band 1 = .48Vp-p Band 2 = .24Vp-p Band 3 = .16Vp-p
FM INPUT = 100 Hz A5TP11 = 1Vp-p AUX OUT Phaselock (A3S1-8 Open)	.8Vp-p All Bands	Band 1 = .8Vp-p Band 2 = 3.2Vp-p Band 3 = 4.8Vp-p	Band 1 = .48Vp-p Band 2 = .96Vp-p Band 3 = 1.44Vp-p	.8Vp-p All Bands	.48Vp-p All Bands
FM INPUT = 700 Hz A5TP11 = 1Vp-p F.P. Phaselock (A3S1-8 Closed)	.64Vp-p All Bands	.64Vp-p All Bands	.2Vp-p All Bands	Band 1 = .64Vp-p Band 2 = .32Vp-p Band 3 = .22Vp-p	Band 1 = .2Vp-p Band 2 = .1Vp-p Band 3 = .07Vp-p
FM INPUT = 700 Hz A5TP11 = 1Vp-p AUX OUT Phaselock (A3S1-8 Open)	.64Vp-p All Bands	Band 1 = .64Vp-p Band 2 = 1.28Vp-p Band 3 = 1.9Vp-p	Band 1 = .2Vp-p Band 2 = .4Vp-p Band 3 = .6Vp-p	.68 Vp-p All Bands	.2Vp-p All Bands

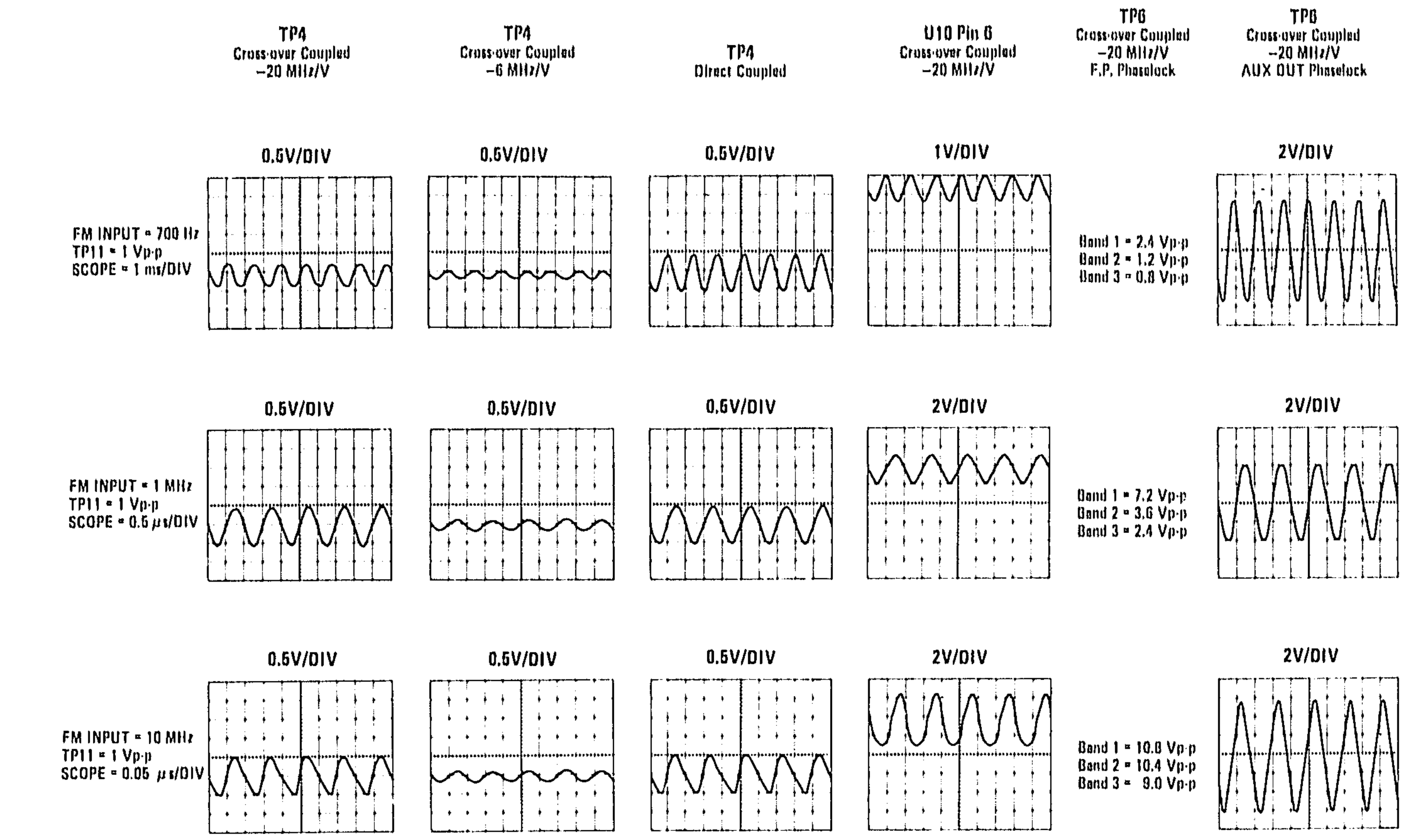


Figure 8-41. A5 Troubleshooting Waveforms

Figure 8-42. A5 FM Driver, Schematic Diagram

A6 SWEEP CONTROL, CIRCUIT DESCRIPTION

General

The Sweep Control assembly buffers and scales the VTUNE (Tuning Voltage) from the 8350A mainframe for use by the A7 YTM and A8 YO Driver assemblies. The A6 assembly also controls each bandswitch sequence. The SRD and PIN Diode Bias circuit provides optimum biasing of the YTM Step Recovery diode for the frequency band selected and also biases the YTM PIN diode switch to select the YTM RF input for Bands 1 through 3. The Pulse Modulation circuit provides a drive current (PULSE MOD) to pulse modulate the RF output power. This modulation is initiated by the rear panel Pulse In input or the amplitude marker from the 8350A mainframe.

Address Decoder (A)

The A6 Sweep Control uses hexadecimal address locations 2C00 through 2C0B. L INST1, BA0, BA1, and the L DAC EN output of U8D are decoded by the Bandswitch DAC as hexadecimal addresses 2C08 through 2C0B. U17 is a 3-to-8 decoder that is enabled when L INST1 and address line BA3 are both low. U17 decodes address lines BA0 through BA2.

Data Latches and Output Data Buffer (D)

Two octal latches (U3 and U9) store various signals including the digital data for controlling the Bandswitch Comparator and Sweep Control/Interrupt Logic circuits. Each latch is clocked by a separate line from the Address Decoder to store the byte of data appearing on the Data Bus. The data is latched into U3 and U9 when their respective L EN clock inputs pulse low. Refer to the various circuit function blocks for detailed descriptions of these control lines.

Output buffer U13 outputs data to the 8350A microprocessor that relates to the current status of the sweep. Data is output when the L EN2 clock input to U13 is pulsed low.

Tuning Voltage Buffer Amplifier (B)

U6 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 noninverting terminal. This provides good common mode rejection to eliminate noise picked up on the cable. The waveform at TP5 is an inverted ramp, ranging from 0 to −10V for single band sweeps (Band 1, 2, or 3), or for sweeping the full frequency range of the Plug-in. However, if the Configuration Switch (A3S1) in the A3 Digital Interface is selected for Sequential Sweep mode only, the tuning voltage (VTUNE) is not rescaled to a 0 to +10V ramp for single band sweeps. Figure 8-47 shows the tuning voltage waveform for a 2.0 to 20.0 GHz sweep.

Bandswitch DAC (C)

Bandswitch DAC U18 provides an offset voltage at TP1 that is proportional to the next bandswitch point. This voltage is used as a reference voltage by the Bandswitch Comparator for initiating the next bandswitch sequence. This voltage is also summed with the output of the TV Buffer in the Variable Gain Amplifier.

U18 is a 12-bit multiplying DAC which scales a stable −10V REF voltage according to the binary pattern loaded at its inputs. Inverting amplifier U19 works with the DAC's internal feedback resistor to provide a programmable offset voltage between 0 and +10V at TP1. See Figure 8-47. CR2 protects the DAC from turn-on transients. C20 and the DAC's internal feedback resistor determine the bandwidth of the circuit.

For single band sweeps, the DAC is held in a reset condition by a logic low on the SEQ BAND input. This causes the voltage at TP 2 to be held at 0 volts.

Variable Gain Amplifier (E)

The purpose of the Variable Gain Amplifier is to rescale the tuning voltage input into a series of 0 to −10V ramps, with each ramp corresponding to a frequency band (Band 1, 2, or 3). The Bandswitch DAC output is summed in as an offset voltage to set the amplifier output to 0V at the beginning of each band. Amplifier gain is changed by analog switch U4 selecting a different feedback resistor for each band. Potentiometers B0 through B3 set the amplifier gain for each band. Analog switch U10D shorts across the feedback resistors for single band sweeps to disable the amplifier.

Figure 8-47 shows the relationship between the TV Buffer output, Bandswitch DAC output, and the resultant Variable Gain Amplifier output for a 2.0 to 20 GHz sweep.

Single Band Switching (G)

The Single Band Switching circuit selects between the Variable Gain Amplifier output and the TV Buffer output to provide BVTUNE (Buffered Tune Voltage) to the YO and YTM Driver assemblies. The SEQ BAND (Sequential Band) input to analog switch U10B determines which input is used for BVTUNE. When the 83590A is sweeping a single band only, SEQ BAND is a logic low, and the TV Buffer output is selected. When the 83590A is in a multiband sweep or the configuration switch on A3 is set for Sequential Sweep mode only, SEQ BAND is a logic high, and the output of the Variable Gain Amplifier is selected. U20 is a noninverting voltage follower.

Bandswitch Comparator (F)

The Bandswitch Comparator circuit generates a FWD SWP BSW output to initiate each bandswitch during forward sweeps, and RTC BSW to generate each bandswitch during a sweep retrace.

A bandswitch point during a forward sweep is initiated by comparator U23. The buffered tuning voltage (TP5) appears at the inverting input of comparator U23. When the tuning voltage reaches a bandswitch point (as determined by the reference voltage applied to the inverting input of U23), the output of U23 changes. R42 provides hysteresis feedback to U23. If the selected frequency sweep does not require changing bands, switch U11D is opened, and R36 pulls the input to the comparator to +10V disabling the bandswitch circuitry. The reference voltage for comparator U23 (TP2) is supplied by the Bandswitch DAC through operational amplifier U24A. This reference voltage is set during retrace or a bandswitch point to correspond to the next bandswitch point. The SP adjustment provides an offset to set accurate bandswitch points. During a sweep retrace, L RTS goes low to turn off Q7. This places a positive offset voltage at the inverting input of U24A and effectively disables comparator U23 during sweep retrace by offsetting the reference voltage beyond any bandswitch points generated by Retrace Comparator U14. FET Q1 is turned on when Band 3 is selected; this grounds the comparator output to disable a bandswitch at the end of a sweep.

Retrace Comparator U14 initiates a bandswitch during a sweep retrace each time the Variable Gain Amplifier output (TP7) equals 0V. During sweep retrace, the L RTS input (inverted by U22A) turns on FET Q3, to set a 0V reference at the noninverting input of comparator U14. The inverting input comes from the Variable Gain Amplifier. Each time the amplifier output reaches 0V, comparator U14 outputs a logic high to initiate a bandswitch. During a forward sweep, FET Q3 is turned off, and a positive offset voltage is applied through R56 and R57. This offsets the reference input beyond any bandswitch points generated by the Forward Sweep Bandswitch Comparator (U23). When Band 1 is selected, Q1 is turned on to disable comparator U14 from initiating a bandswitch at the end of a sweep retrace.

Sweep Control/Interrupt Logic (H)

NOTE

Most of the signals discussed in this section are illustrated in Figure 8-48.

The Sweep Control/Interrupt Logic circuit provides the stop sweep (L SSRQ), Blanking Request (L BPRQ) and Sweep Interrupt (L SIRQ) signals at bandswitch points. End of Sweep Interrupt circuitry (U8B) provides requests for interrupts at the beginning or end of sweep.

Whenever the Bandswitch Comparator outputs an active FWD SWP BSW or RTC BSW the output of U2C goes high. Pin 13 of U2D is prevented from tracking pin 12 by C16. Consequently, the output of the XOR, U2D, will go high everytime U2C changes states. Each pulse from U2D clocks flip-flop U8A.

The high output at U8A performs three functions: 1)U16B issues a L SSRQ (Low=Stop Sweep Request) to halt the sweep ramp generator in the 8350A mainframe; 2) U16A issues a L BPRQ (Low=Blanking Pulse Request) for display blanking during bandswitching; and 3) U16C issues a L SIRQ (Low=Sweep Interrupt Request) to alert the 8350A microprocessor that a bandswitch needs to be made.

The microprocessor now takes over control of the bandswitch by writing command bits to Data Latch U3. First, the SSHOLD (Stop Sweep Hold) line goes high, maintaining the stop sweep (L SSRQ) and blanking (L BPRQ) requests. Simultaneously, the L SSRES (Low=Stop Sweep Reset) line goes low, resetting U8A and clearing the interrupt request (L SIRQ). The microprocessor now reads buffer U13 to determine what caused the sweep interrupt request (Forward Sweep Bandswitch, Retrace Bandswitch, Start or End of Retrace, or the Unleveled indicator turned on). Based on this information, the microprocessor blanks the RF power (when L RFBRQ goes low), updates the DACs, changes the Variable Gain Amplifier gain, changes various band-dependent control lines, and readies the Plug-in for sweeping the new band. After the YO has settled, the RF power is turned back on. After the RF power has come up, the sweep is resumed and the display is unblanked by releasing the SSHOLD line. The time intervals required for YO settling and RF power-up are provided by the programmable counter on the A3 Digital Interface assembly.

In addition to bandswitch points, the microprocessor is also interrupted at the beginning and end of each sweep. Each time L RTS (Low=Retrace Strobe) changes from high to low, or low to high, U2A pulses high. (Pin 2 of U2A is prevented from tracking pin 1 by C17. Consequently, the output of XOR U2A will pulse high everytime L RTS changes states). Each pulse from U2A clocks flip-flop U8B. The noninverting output of U8B is ORed together with the bandswitch interrupt to pull L SIRQ low and request microprocessor attention. L RTS is read through U13 to determine whether the forward sweep is beginning (L RTS=high) or ending (L RTS=low). U8B is then reset by L ESRES, and the microprocessor services the interrupt.

L RFBRQ goes low during bandswitch and sends an RF Blank Request to the 8350A to produce the blanking signal L RFB, for the A4 ALC assembly.

SRD AND PIN DIODE BIAS (I)

The SRD and PIN Diode Bias circuit provides two bias voltages for the Switched YIG Tuned Multiplier (YTM). For Bands 1 through 3, analog switch U11C is closed, and a negative bias is applied to the diode, enabling Bands 1 through 3.

The Step Recovery Diode in the YTM is biased by SRD BIAS. This bias is optimized for each band and changes in power level. Voltage follower/Subtractor U24 provides a voltage for optimum biasing of the SRD for each frequency band. BVTUNE is applied to both its inverting and noninverting inputs. If only BVTUNE was applied (and both inputs have the same gain) the U24 output would always be zero volts. Analog switches U11A and U11B sum in offset voltages for Band 1 resulting in a large negative bias to ensure maximum feedthrough of the fundamental oscillator frequency. Analog switches U1D, U1B and U1C provide an offset and affect the noninverting input gain. As a result, the U24 output for Bands 2 through 3 is offset from 0V (as determined by the two band "L" adjustments) with the slope determined by the two band "H" adjustments.

U26 is a variable gain differential amplifier tht provides an output current for Bands 2 and 3 for controlling the SRD BIAS. The amplifier gain is determined by the U24 output applied through analog switch U1A to U26 pin 5. Analog switch U1A is open for Band 1, so the SRD BIAS for these bands is determined only by the output of U24 (applied through R63 to the base of Q8). Threshold adjustment A6R78 (T) determines at what modulator drive voltage (MOD 1) that power level compensation is provided. CR12 prevents U26 from affecting SRD BIAS when MOD 1 is more positive than the threshold voltage set by R78(T).

Pulse Modulation (J)

The Pulse Modulation circuit provides a PULSE MOD output to the A16 Modulator/Coupler that is used to pulse modulate the RF output. The L PULSE output is used on the A4 ALC assembly in a sample and hold circuit to maintain a leveled power condition (refer to the A4 Circuit Description for more details). The L PULSE output goes active low when either the L RFM (Low= RF Marker from the 8350A) or PULSE IN (from the rear panel Pulse In connector) go low. If the PULSE IN input from the rear panel exceeds a TTL level, it is translated to a TTL level by the resistor diode network on the U21A pin 13 input. When the L PULSE output is active low (switching RF power off), Q4 is biased on and Q6 is biased off: this provides a positive bias to the PIN diode in the modulator and attenuates the RF output power. When L PULSE is a logic high, Q6 is biased on and Q4 is biased off: this provides a negative bias to the PIN diode in the modulator so that it has no effect on the RF power level.

A6 SWEEP CONTROL TROUBLESHOOTING

The A6 Sweep Control assembly rescales the tuning voltage (VTUNE) from the 8350A for use by the A7 YTM Driver and A8 YO Driver. The A6 assembly also initates all bandswitch sequences.

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).

Buffered Tuning Voltage

NOTE

The BVTUNE output is normally scaled by the Variable Gain Amplifier only for multiband (sequential) sweeps (with the TV Buffer output used for single band sweeps). However, the A3S1 Configuration Switch (position 1) may be set to disable the selection of the TV Buffer output for single band sweeps. This procedure assumes that A3S1 switch position 1 is set to the open positon, thus enabling the A6 assembly to change scaling of the BVTUNE signal for single band and multiband sweeps.

A failure with the BVTUNE signal may cause both the YO and YTM to sweep between improper frequency endpoints, or not sweep at all. For a full band SWEEP (2.0 to 20 GHz), the BVTUNE output at TP8 should be a series of 0 to −10V ramps (See Figure 8-47). For a single band sweep (e.g. 2.0 to 7.0 GHz), BVTUNE should be a single 0 to −10V ramp.

1. If both waveforms are incorrect, verify the TV Buffer output at TP5.

2. If BVTUNE is incorrect for only the full band sweep, the problem is most likely with the Bandswitch DAC, Variable Gain Amplifier, or the Bandswitch circuitry. (The TV Buffer is verified in single band sweep.)

   a. Check the Bandswitch DAC output at TP1 as shown in Figure 8-47. If this signal is incorrect, run the Bandswitch DAC test by entering SHIFT 5 6 . Then check TP1 for the waveform shown in Figure 8-46.

   b. Verify correct operation of the Variable Gain Amplifier by checking waveforms at TP4 and TP7 according to Figure 8-47. If any of the voltage levels are slightly out of tolerance, perform the Sweep Control and Band Overlap adjustments in Section V. If the voltage at TP4 is 0V, verify that analog switch U10D is open.

c. Verify operation of the bandswitch circuitry under the **Interrupt Control** section.

3. If BVTUNE is incorrect only for single band sweeps, verify that the SEQ BAND input to analog switch U10B,C is a logic low when sweeping only a single band. Also verify that Configuration Switch A3S1 switch number 1 is in the open position.

Interrupt Control

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

1. Verify operation of the Bandswitch Comparator by checking the FWD SWP BSW (U23 pin 7) and RTC BSW (U14 pin 7) waveforms as shown in Figure 8-48.

   a. If the FWD SWP BSW signal is not correct, check the Bandswitch DAC output at TP1 and the TV Buffer output at TP5 as shown in Figure 8-47.

   b. If the RTC BSW signal is incorrect, check the Variable Gain Amplifier output at TP7. Also verify that the noninverting input to U14 is about 0V during a sweep retrace.

2. With an Oscilloscope, check the following edge-connector pins: P1-3 (L SIRQ), P1-1 (L RTS), and P1-23 (L SSRQ). The appropriate waveforms are shown in Figure 8-48.

   a. L RTS should go low at the end of each forward sweep. If it does not, race the problem back through the Plug-in interconnect to the 8350A.

   b. L SIRQ should pulse low briefly for end-of-sweep interrupts. If these pulses are missing, but L RTS is present, suspect U2A, U8B, U16C, or control lines from U3.

   c. L SIRQ should also pulse low for bandswitch interrupts. If these pulses are missing, but FWD SWP BSW and RTC BSW show the proper waveforms, suspect U2C/D, U8A, U16C, or control lines from U3.

   d. If L SIRQ stays low, or the pulses are exceptionally wide, check U3 with the procedure outlined under **Digital Control** section. If U3 is functioning, the 8350A microprocessor probably did not receive the interrupt. Trace this signal back to the 8350A.

Digital Control

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

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

1. Examine L INST1 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.

2. If L INSTI is functional, check each of the L ENn lines (U17) for the pulses shown in Figure 8-45. If these are incorrect, but the address lines show activity, replace U17. If the address lines seem locked high or low, troubleshoot the address buffer on the A3 assembly.

3. To check output buffer U13, press INSTR PRESET. Set the 8350A for a 5-second sweep rate and make the following key entry:

SHIFT 0 0	Enters the Hex Data command
2 GHz s 0 2	Address location 2C02 (U13)
M3	Hex Data Read

The hex digits displayed in the 8350A front panel FREQUENCY/TIME window should change as the status read by U13 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 U13.

4. Exercise U3 and U9 with Hex Data Rotation Write. Enter:

SHIFT 0 0	Enters Hex Data command
2 GHz s 0 0	Address location 2C00 (U3)
M4	Hex Data Rotation Write

Check the outputs of U3 against the waveforms shown in Figure 8-2. Verify operation of U9 by substituting hex address 2C01 (U9) in the procedure above.

SRD and PIN Diode Bias

A failure in the PIN Diode Bias circuit is indicated by a decrease or complete loss of RF output power for Bands 1–3. Check that the voltage at TP6 is −4.8V for Bands 1–3.

A failure in the SRD Bias circuit is usually indicated by low RF output power in Bands 1–3. Check that the voltage at TP3 is −5V for Band 1. If these voltages are correct, perform the SRD Bias adjustment in Section V.

Pulse Modulation

The Pulse Modulation circuit can be checked by entering an amplitude marker on the 8350A and checking for activity on the L PULSE and PULSE MOD outputs. If L PULSE has activity, but PULSE MOD does not, disconnect W6 at A10J4 to eliminate the possibility of the modulator loading down the signal.

A6

Figure 8-43 A6 Sweep Control, Block Diagram

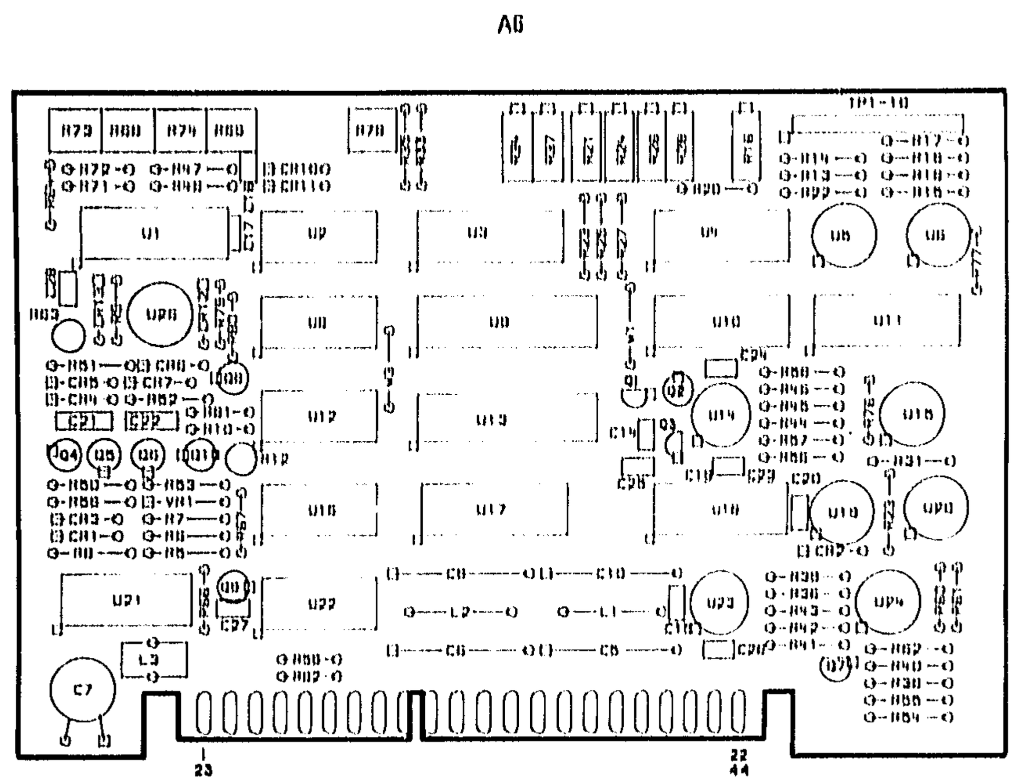


Figure 8-44. A6 Sweep Control Component Locations

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 BANDSWITCH INTERRUPT, PRESS 8350A CW .

A6P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 23	L RTS L SSRQ	IN OUT	P2-57 A7P1-5 A8P1-5 P2-32	D,F,H H
2 24	L BPRQ L RFDRQ	OUT OUT	P2-55 P2-54	H H
3 25	L SIRQ L PULSE	OUT OUT	A3P1-18 A4P1-41	H J
4 26	L UNLVL PULSE IN	IN IN	A4P1-2 J5	D,H J
5 27	PWON +5V	IN IN	P2-26 A3P1-6,7	D K
6 28	MOD 1 −15V	 IN	A4P1-18 P2-18	I K
7 29	+10V PIN SW	IN OUT	P1-8 A10J4-15	K I
8 30	GND DIG GND DIG			
9 31	BD1 BD0	I/O I/O	A3P1-9 A3P1-31	C,D C,D
10 32	BD3 BD2	I/O I/O	A3P1-10 A3P1-32	C,D C,D
11 33	BA1 BA0	IN IN	A3P1-11 A3P1-33	A,D A,D
12 34	BA3 BA2	IN IN	A3P1-12 A3P1-34	A A
13 35	BD5 BD4	I/O I/O	A3P1-13 A3P1-35	D D
14 36	BD7 BD6	I/O I/O	A3P1-14 A3P1-36	D D
15 37	L BP2 GND ANLG	IN	P2-53	H K
16 38	 +15V	 IN	NOT USED P2 20	 K
17 39	−10V −10VREF	IN IN	P1-13 A8P1-3	K C
18 40	LINST 1 L RFM	IN IN	A3P1 8 P2 24	A J
19 41	BAND 0 AMP GND ANLG	OUT	A10J5-7	D K
20 42	VTUNE BVTUNE	IN OUT	P1-A1 A7P1-25 A8P1-25	B G
21 43	VTUNE RET GND ANLG	IN	P1-A1	B K
22 44	SRD BIAS PULSE MOD	OUT OUT	A10J4-14 A10E8	I J

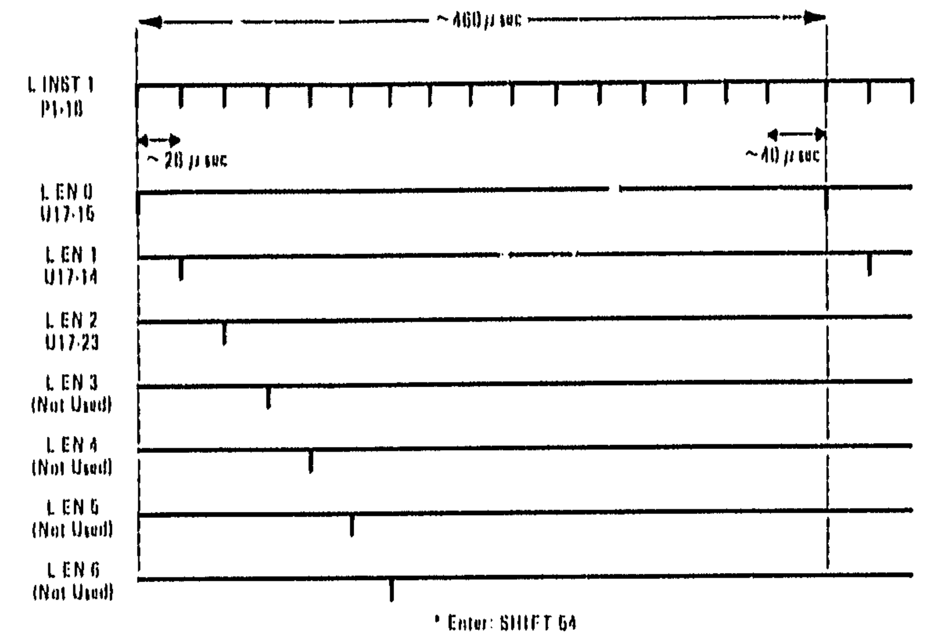


Figure 8-45. A6 Address Decoder Timing Diagrams

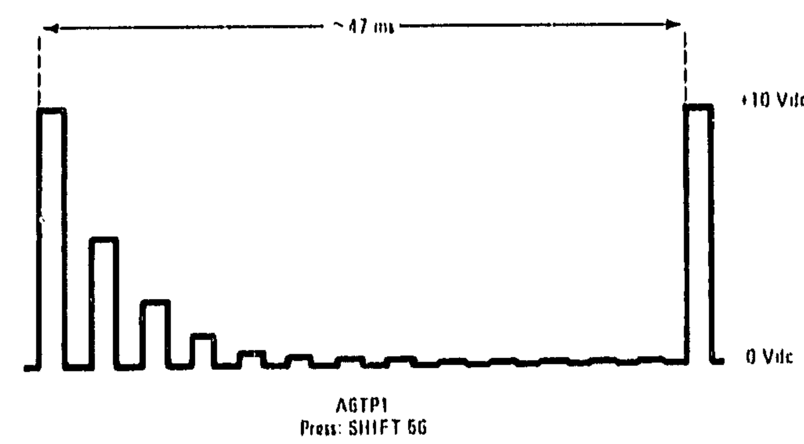


Figure 8-46. Bandswitch DAC Test Waveform

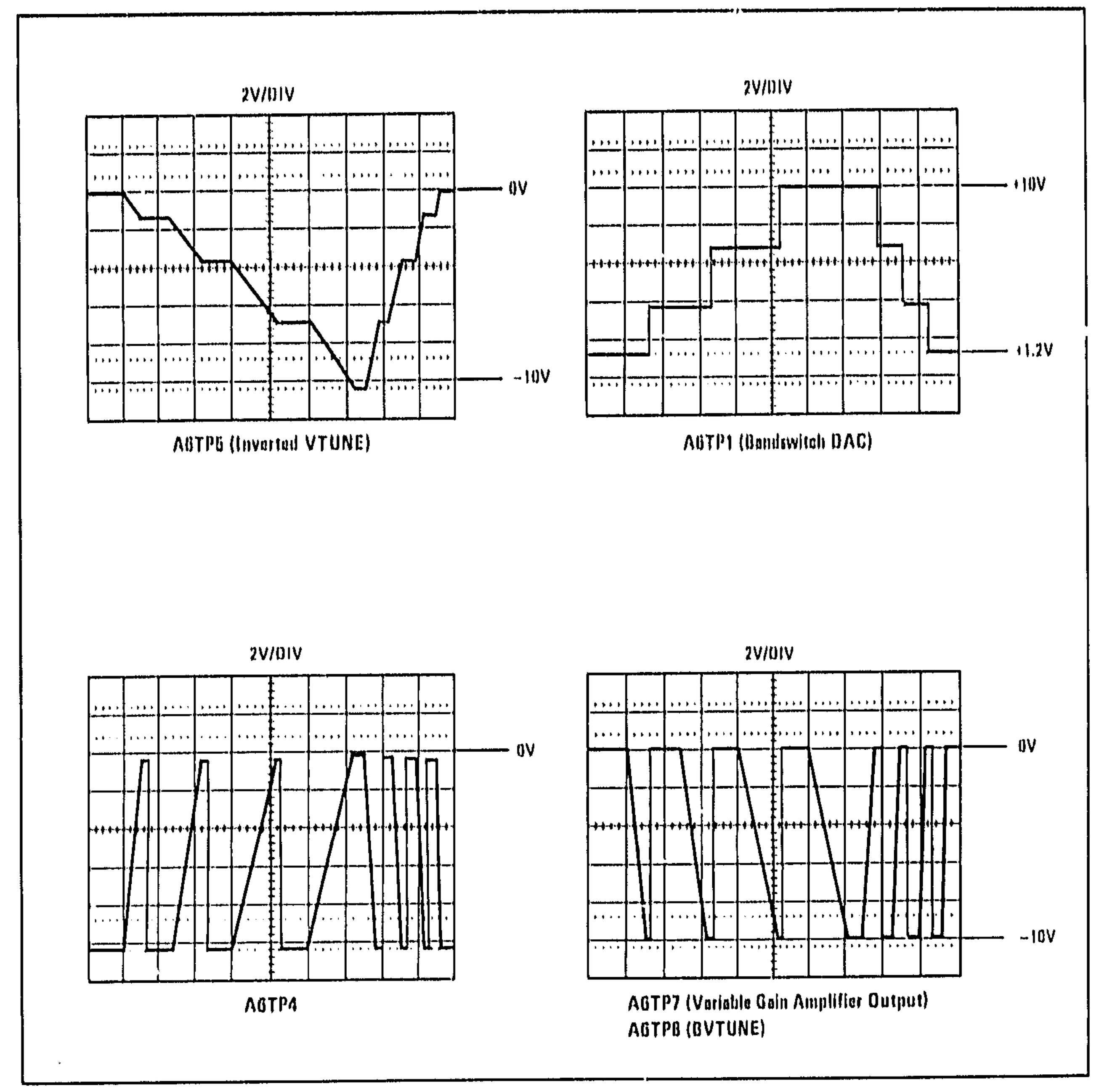


Figure 8-47. Buffered Tuning Voltage Waveforms

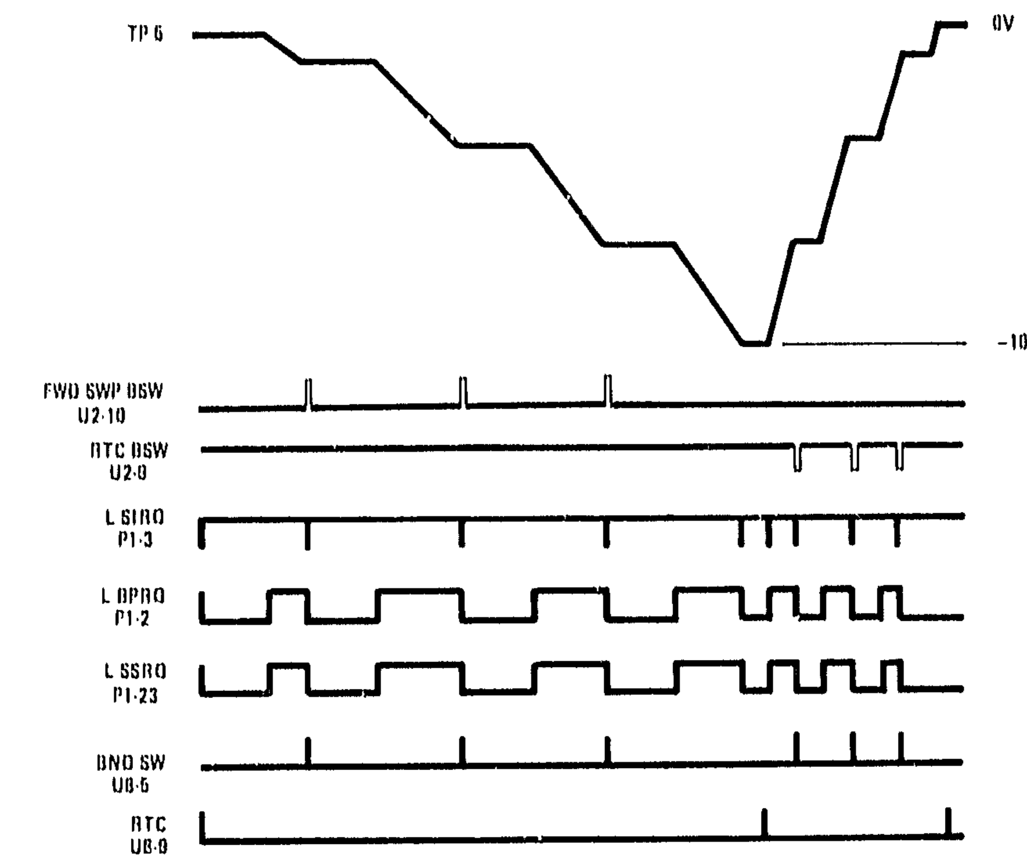


Figure 8-48. Sweep Control/Interrupt Logic Waveforms

Figure 8-49. A6 Sweep Control, Schematic Diagram

A7 YTM DRIVER / A9 REFERENCE RESISTOR, CIRCUIT DESCRIPTION

NOTE

All reference designators refer to the A7 assembly unless otherwise noted.

General

The A7 YTM Driver assembly converts the buffered tuning voltage from the A6 Sweep Control assembly into a drive current. The A9 Ref Resistor assembly provides the current driver to control the frequency of the YIG Tuned Multiplier (YTM).

Multiplying Digital-to-Analog Converters (DACs) scale and offset the buffered tuning voltage to the frequency end-points in each band. Delay compensation is generated and summed with the tuning voltage. Also summed with the tuning voltage are low frequency external FM and a Band 1 offset. The resultant waveform at TP6 is then converted to a current-drive for the YTM's Main Coil.

Address Decoder and Data Latch (A)

The A7 YTM Driver uses hexadecimal address locations 2C88 through 2C8F. L INST2, BA0, BA1, and the L DAC EN output of U8C are decoded by the Scaled Voltage Tune and Offset DACs as hexadecimal addresses 2C88 through 2C8B. (Note that these addresses from U16 are not used.) U16 is a 3-to-8 decoder that is enabled when L INST2 is active low and address line BA3 is active high. U16 decodes address lines BA0 through BA2.

U12 is a control latch which stores commands from the 8350A for the control lines used on the A7 YTM Driver assembly, primarily for delay compensation. The command byte is latched into U12 when L EN 7 pulses low. Refer to the Delay Compensation, and Summing Amplifier sections for detailed descriptions of these control lines.

Scaled Voltage Tune DAC (B)

Offset DAC (C)

The Scaled Voltage Tune and Offset DACs function together to determine the bandpass frequency of the YTM. The Offset DAC determines the start frequency of each band while the Scaling DAC sets scales the BVTUNE input to tune the YTM over the required frequency range for each band.

BVTUNE is a series of 0 to −10V ramps with each ramp corresponding to a frequency band. DAC U17 scales each ramp differently according to the frequency range the YTM must sweep to cover the frequency range of the band. (See SCVTUNE waveform at TP9 in Figure 8-56.) Since the YTM is not used as a filter for Band 0, the DAC output is set to 0V for Band 0.

U17 and U13 are 12-bit microprocessor-compatible DACs, which latch data in three four-bit nibbles. These DACs share the same address locations, but are loaded by different data lines (D0−D3 load U13 and D4−D7 load U17).

U17 scales the buffered tuning voltage (BVTUNE) according to the binary pattern loaded at its inputs. Inverting amplifier U18 is included in the feedback path to convert the current output of the DAC to a voltage. CR1 prevents transients from damaging the DAC during turn-on. C18, along with the DAC's internal feedback resistor, determines the bandwidth of the circuit. The waveform at TP9 is a scaled ramp (sawtooth waveform for multiband sweeps), with a maximum range of 0 to +10Vdc. See Figure 8-56.

U13 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 TP1. See Figure 8-57. CR7 protects the DAC from turn-on transients. C15 and the DAC's internal feedback resistor determine the bandwidth of the circuit.

Delay Compensation (E)

The delay compensation circuit is used to compensate the A12 YTM for the inherent inaccuracy caused by delay in the magnets at fast sweeps. SCVTUNE (a scaled ramp from the Scaled Voltage tune DAC), OFFSET (an offset voltage that sets the start frequency of each band), and YTM LO FM (a voltage proportional to the low frequency FM applied to the 8350A rear panel FM INPUT) are summed by U19 to provide a voltage with a slope proportional to the change in YTM frequency. This voltage ramp 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 points. 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 mulitiplied in the Analog Multiplier U20. The delay compensation is summed into the main coil driver voltage in the Summing Amplifier.

During retrace, and momentarily during bandswitching, analog switch U10B closes. In this condition, U11C together with R6, R8, R9, and R7 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 U10B closed, C4 charges to one half the value of the input signal (R8 and R9 form a voltage divider). U10B opens again during the sweep which leaves only C4 in the feedback path of U11C. Since there is no discharge path with U10B and U10A open, C4 remains charged to the level it had just before U10B was opened. U11C now operates as a voltage follower, with the output level shifted by the voltage across C4. Therefore, the output of U11C has one half the slope of the input signal and returns to 0V whenever U10B is closed during retrace and bandswitching. Two sets of scaling (HI) and offset (LO) adjustments on the output of U11C accurately scale and offset the Voltage Follower/Subtractor output for both a single (SGL) and sequential (SEQ) band sweep. Analog switches U10D and U10C select the correct input for inverting amplifier U11D. 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. When U9A is closed by a low on the L SSRQ control line to U8A, C4 slowly recharges through R62. Thus when L SSRQ is pulled the output of U11C 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. When L SSRQ goes high again and the sweep continues, U9A opens and U11C resumes its voltage follower operation.

The U19 summing anplifier output is also applied to a Differentiator (U11B) with a time constant that is selected by analog switches U9A and U9B. By selecting either C6 (for sequential sweep) or C13 (for single band sweep) in parallel with C3, the U11B output is scaled for either single or multiband (sequential) sweeps. The output is amplified and inverted by U11A and is applied at TP2 to the second input of the analog multiplier. The output at TP4 is connected to U20 pin 7 to provide feedback for an operational amplifier internal to U20.The Z adjust at U20 pin 6 allows nulling of the offset voltage appearing at DLY COMP. This is done when in CF ΔF mode where ΔF equals zero.

During sweep retrace, the YTM must change frequency rapidly from the high end of its range to the low end, and does not have enough time to naturally settle to the proper start frequency. Unless the YTM is forced to the low end of its range, this could result in a frequency tracking error, and a resultant loss of output power, at the start of each sweep. In order to force the YTM to settle quicker, C17 is charged during the YTM retrace by the differentiator output through CR2. Timer U5 is triggered by L RTC COMP at the end of sweep retrace. The timer pulse output momentarily closes analog switch U9C, and C17 discharges through R57 and is applied as Retrace Compensation to the Summing Amplifier. This compensation voltage forces the YTM to the low end of its range to avoid frequency tracking errors after a retrace. The amount of compensation applied is proportional to the pulse width of the timer output, and is adjusted by R55.

+20V Tracking (F)

Inverting amplifier U15 monitors the +20V line used to supply current to the YTM. If the +20V supply becomes loaded down or drifts, the YTM Main Coil current and, consequently, the YTM bandpass frequency, will try to change. However, U15 senses any drift in the +20V FREQ REF line, and provides a correction signal so that the resultant YTM DRIVE Voltage (TP6) is compensated for the drift. ZRO adjustment R22 compensates for inaccuracies between U15 and summing amplifier U21.

Summing Amplifier (G)

U21 provides the summing point for the scaled tuning and offset voltages, and provides a drive voltage (YTM DRIVE V) for the Current Driver. Several correction signals are summed at this junction:

SCVTUNE provides the scaled ramp portion of theYTM DRIVE Voltage. R19, GAIN, fine-tunes the range of the scaling DAC.

OFFSET adjusts the YTM DRIVE Voltage so that the YTM Coil is driven between the proper end points, as determined by the front panel controls. R24, 'OFS', fine-tunes the range of the Offset DAC.

SUPPLY VOLTAGE CORRECTION provides a compensation signal, from the +20V Tracking Amplifier, to offset changes in the reference supply.

DLY COMP, from the Delay Compensation circuit, is added to correct for lags in the response time of the YTM. This compensation is derived from SCVTUNE.

RTC COMP, from the Delay Compensation circuit, is a momentary correction voltage that forces the YTM to the low end of its frequency range after a sweep retrace. This compensation is derived from SCVTUNE.

B1 OFS is summed in through U9D when the BAND 1 line from U12 is high.

YTM LO 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 detail.) 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 A7 YTM assembly.

Frequency Cal Switches/Output Data Buffers (D)

DIP switches S1 and S2, with their corresponding data bus buffers, are used to digitally calibrate the low and high end frequencies in Band 2. The data on these switches is read by the microprocessor during power-up and INSTR PRESET and is used to calculate the settings for the Scale and Offset DACs. S1, with pull-up resistor package U1, is read through U3 when enabled by L EN4. 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 L EN5. This establishes the Scale DAC values, and calibrates the high end frequency. The ninth and tenth 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 8-55 illustrates the switch configurations.

YTM Coil Current Source (H)

YTM Coil Current Driver A9 (I)

The YTM Coil Current Driver works with the chassis mounted Reference Resistor R2 and YTM Coil Driver A9Q2 to drive a current proportional to the drive voltage through the YTM's main tuning coil.

U22, Q1, Q2, and A9Q2 comprise a voltage-to-current converter and current driver for the YTM's main coil. The non-inverting input of U22 receives the YTM DRIVE Voltage signal. The inverting input of U22 monitors the voltage drop across reference resistor R2, which is directly proportional to the coil current. If the drive current is not tracking the drive voltage, U22 will produce an error voltage to correct the difference. Emitter-follower Q2 and common-emitter-stage Q1 provide the current gain needed to drive A9Q2. Q2 and Q1 emitter currents are also drawn through chassis mounted R2, and therefore, sensed by U22. VR1 and CR5 protect the current drive transistors by limiting voltage spikes due to sudden changes in the coil current. R33 helps to dampen ringing caused by the parasitic capacitance and the inductance of the YTM coil.

CR3, CR4, CR6, CR8, and their associated factory-select resistors provide a four break-point compensation network to correct for non-linearities in the YTM characteristics.

NOTE

The values of the factory-select resistors are stamped on a label, attached to the RF casting. Matching resistor sets (mounted on a header) are supplied with replacement YTMs and must be installed on the A7 YTM assembly. The new label indicating the replacement resistor values should be attached to the RF casting.

If the A7 YTM Driver Assembly is replaced, the shaping resistors from the defective board (which are mounted on a header) must be reinstalled in the new assembly.

NOTE

If the YTM needs little or no compensation, some or all of the factory-select resistors may be omitted.

A7 YTM Driver/A9 Reference Resistor Assemblies Troubleshooting

NOTE

All reference designators refer to the A7 assembly, unless otherwise noted.

The A7 YTM Driver and A9 Reference Resistor assemblies are primarily responsible for controlling the YTM bandpass frequency. A failure in these assemblies usually results in a low RF power output. (Power losses that change with sweep time are usually related to delay compensation.) Power losses that may be corrected with the front panel PEAK control 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 A7 assembly) and −40V (on the A12A1 assembly) supply the YTM. Ensure that cable plugs are correctly seated over the correct jacks throughout the Plug-in. With the line power off, remove and reseat the A7 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 YTM to tune between improper frequency endpoints, or not sweep at all. If the YTM Drive Voltage is incorrect or missing, the instrument will have low RF output power for Bands 1 through 3.

1. Check the YTM DRIVE V (TP6) for the waveform shown in Figure 8-59. If this waveform is correct, troubleshooting should continue with the YTM Current Driver section below.

   a. If YTM DRIVE V is incorrect, check BVTUNE (A6TP8) for a series of 0 to −10V ramps. If they are missing or of the wrong amplitude, refer to the A6 Sweep Control service sheet for further troubleshooting.

   b. If the waveform at TP6 appeared to be level-shifted, check −10 VREF (A8TP12) for exactly −10 Vdc. Next, with the Plug-in sweeping its entire range, check OFFSET (TP1) for the waveform in Figure 8-57. If this signal is incorrect, select a CW frequency of 20.0 GHz and press SHIFT 5 2 . Check TP1 for the waveform shown in Figure 8-54. If this fails, check address decoding using the Digital Control troubleshooting procedure described below.

2. If BVTUNE is correct, check SCVTUNE (TP9) against the waveform shown in Figure 8-56. If it appears to be bad, run the Scale DAC Test by setting a CW frequency of 20.0 GHz and pressing SHIFT 5 2 . Check that U17 pin 15 is at −10 Vdc. Then check TP9 for the waveform shown in Figure 8-56. If this fails, check address decoding using the Digital Control troubleshooting below.

3. Check +20V FREQ REF (TP8) for +20 Vdc ±10 mV. If it is not, trace the supply voltage back to the 8350A. Then check that SUPPLY VOLTAGE CORRECTION (U15 pin 6) is at approximately −10 Vdc. If it is not, troubleshoot U15.

4. Finally, check that the summing junction, U21 pin 2, is at 0 Vdc. If it is not, troubleshoot U21.

Delay Compensation

A failure in the Delay Compensation circuit is usually indicated by RF output power variations that change with sweep time. The delay compensation has little effect at sweep times greater than 100 milliseconds. On the 8350A enter INSTR PRESET and check waveforms in Figure 8-58.

YTM Drive Circuits

1. Check +20V FREQ REF at TP8 for +20V ±10 mV. If it is not, troubleshoot back to the mainframe supply.

The circuitry surrounding U22 and A9Q2 is responsible for converting the YTM DRIVE V to a drive current for the YTM coil. A failure here will usually result in extreme RF power losses for Bands 1−3.

2. Press INSTR PRESET to sweep the entire range of the Plug-in. Check TP7 for the waveform shown in Figure 8-59. This represents the voltage (not the current) across the YTM's main coil, and will give an indication as to whether current is passing through the coil. If this waveform is correct, suspect the A12 YTM or the SRD Bias circuit on the A6 Sweep Control assembly. Refer to the RF Section Service Sheet.

3. Check TP3. This voltage should track the YTM DRIVE V (Figure 8-59). If it does not, troubleshoot U22, Q1, Q2, chassis mounted R2, and A9Q2.

   a. Chas''s mounted R2 should be checked by removing the A9 assembly from the instrument. The ohm   er reading should be approximately 59Ω.

   b. While the A9 assembly is removed from the instrument, check the collector-base and base-emitter junctions of A9Q2 with an ohmmeter. These junctions should show only a few hundred ohms when forward biased, and a high impedance in the reverse direction. If A9Q2 is found to be shorted or opened, make sure that protection diodes VR1 and CR5 are good before replacing the transistor.

   c. Q1 and Q2 can be checked, using the procedure above, while they are still in the circuit. The line power should be off.

   d. If the above che'   verify the components, replace U22.

Digital Control

The Address Decoder and Data Latch and Frequency Cal Switches comprise the digital control for the A7 assembly. A failure in these components usually results in large power losses for Bands 1 through 3, and will often cause an unleveled power condition.

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

1. Examine L INST2 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.

2. If L INST2 is functional, check each of the L ENn lines (U16) for the pulses shown in Figure 8-53. If these are incorrect, but the address lines show activity, replace U16. 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 A7S1 and A7S2, write down 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 output buffer U7, press INSTR PRESET, and make the following key entry:

SHIFT 0 0	Enters the Hex Data command
2 GHz s 8 dBm dB	Address location 2C8E (U7)
M3	Hex Data Read

   The hex digits displayed in the 8350A front panel FREQUENCY/TIME window should change when the S1 and S2 switch positions 8 and 9 are toggled.

4. U3 and U4 can each be checked with Hex Data Read (see above) at address 2C8C or 2C8D. The hex digits should change when the corresponding Freq Cal switches are changed.

5. Exercise U12 with Hex Data Rotation Write. Enter:

SHIFT 0 0	Enters Hex Data command
2 GHz s 8 BKSP	Address location 2C8F (U12)
M4	Hex Data Rotation Write

   Check the outputs of U12 against the waveforms shown in Figure 8-2.

A9P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1	YO BASE	IN	A8P1-21	
7	+5V REG	OUT	A10J4-7,A10J5-3,11	
2	YO COLLECTOR	OUT	A8P1-1	
8	YTM COIL	OUT	A7P1-22,A10J4-8	I
3	+20V	IN	P1-7	I
9	YTM BASE	IN	A7P1-21	I
4	YO COIL	OUT	A8P1-22	
10	YTM COLLECTOR	IN	A7P1-20	I
5	+20V FREQ REF	OUT	A7P1-44,A8P1-44	I
11	+20V	IN	P1-7	I
6	GND ANLG		P2-27,58-60	I
12	+5V UNREG	IN	P2-63	

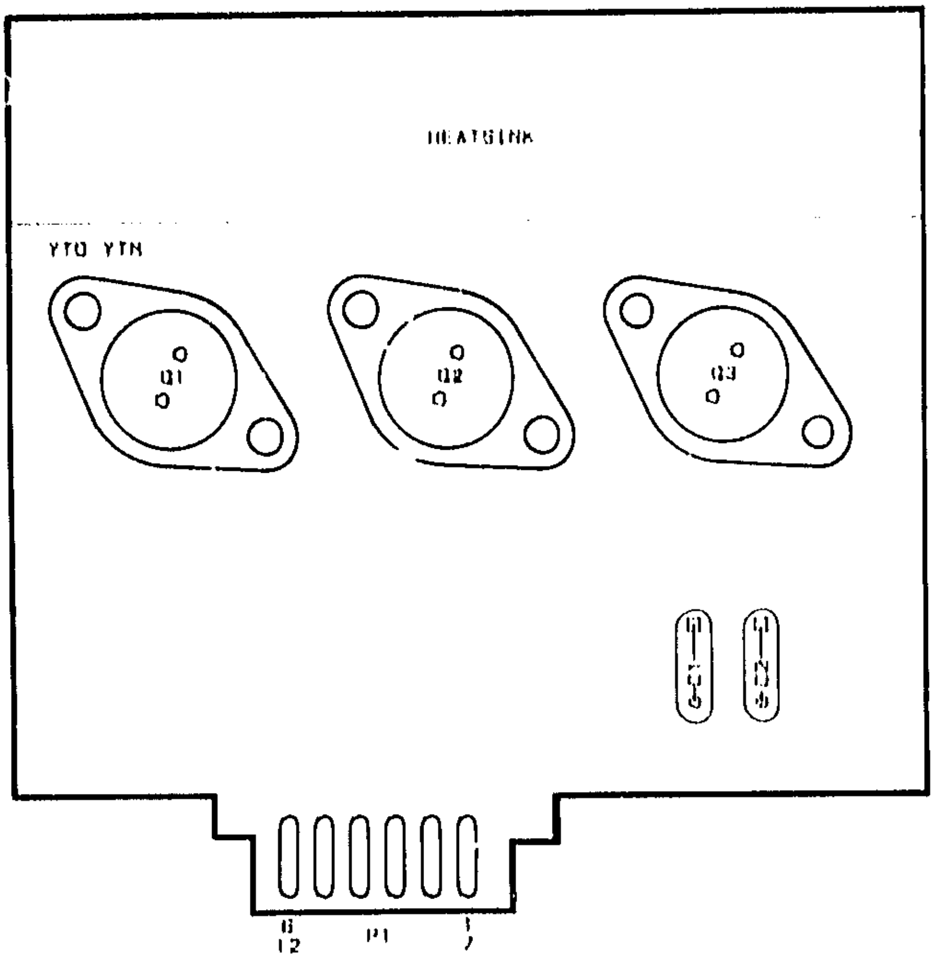


Figure 8-50. A9 Reference Resistor, Component Locations

Figure 8-51. A7 YTM Driver, Block Diagram

Figure 8-60. A7 YTM Driver, Schematic Diagram

A7

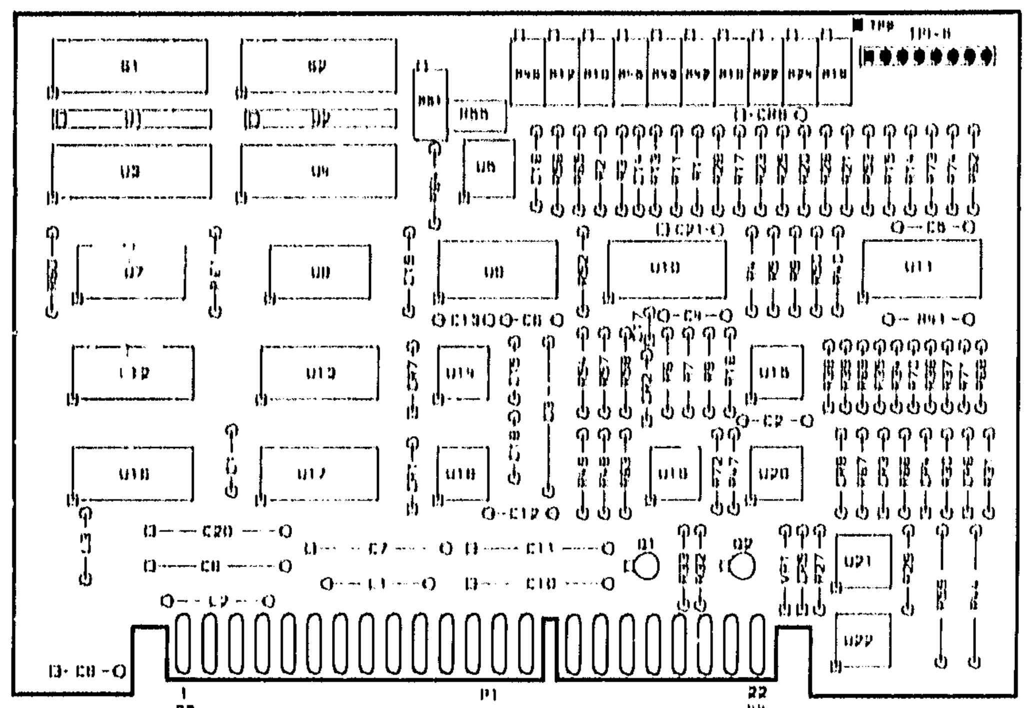


Figure 8-52. A7 YTM Driver, Component Locations

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 BANDSWITCH INTERRUPT, PRESS 8350A CW .

A7P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1 23	YTM LO FREQ FM YTM DRIVE V	IN OUT	A6P1-1 A10J1-30	E,G G
2 24	 GND ANLG		NOT USED	 J
3 25	-10VREF SVTUNE	IN IN	A8P1-5 A6P1-42	C B
4 26	 GND ANLG		NOT USED	 J
5 27	L SSRQ +5V	IN IN	A6P1-23 A3P1-6,7	E J
6 28	-40V -15V	IN IN	P1-11 P2-28	J J
7 29	+10V GND ANLG	IN	P1-8	J
8 30	GND DIG GND DIG			J J
9 31	BD1 BD0	I/O I/O	A3P1-9 A3P1-31	A,C,D A,C,D
10 32	BD3 BD2	I/O I/O	A3P1-10 A3P1-32	A,C,D A,C,D
11 33	BA1 BA0	IN IN	A3P1-11 A3P1-33	A,B,C A,B,C
12 34	BA3 BA2	IN IN	A3P1-12 A3P1-34	A A
13 35	BD5 BD4	I/O I/O	A3P1-13 A3P1-35	A,B,D A,B,D
14 36	BD7 BD6	I/O I/O	A3P1-14 A3P1-36	B,D B,D
15 37	GND ANLG GND ANLG			J J
16 38	+20V +15V	IN IN	P1-7 P2-20	J J
17 39	-10V -40V	IN IN	P1-13 P1-11	J J
18 40	L INST 2	IN	A3P1-20 NOT USED	A
19 41	GND ANLG		 NOT USED	J
20 42	YTM COLLECTOR		A9P1-10 NOT USED	H
21 43	YTM BASE	OUT	A9P1-9 NOT USED	H
22 44	YTM COIL +20V FREQ REF	 IN	A9P1-8 A9P1-5	H H

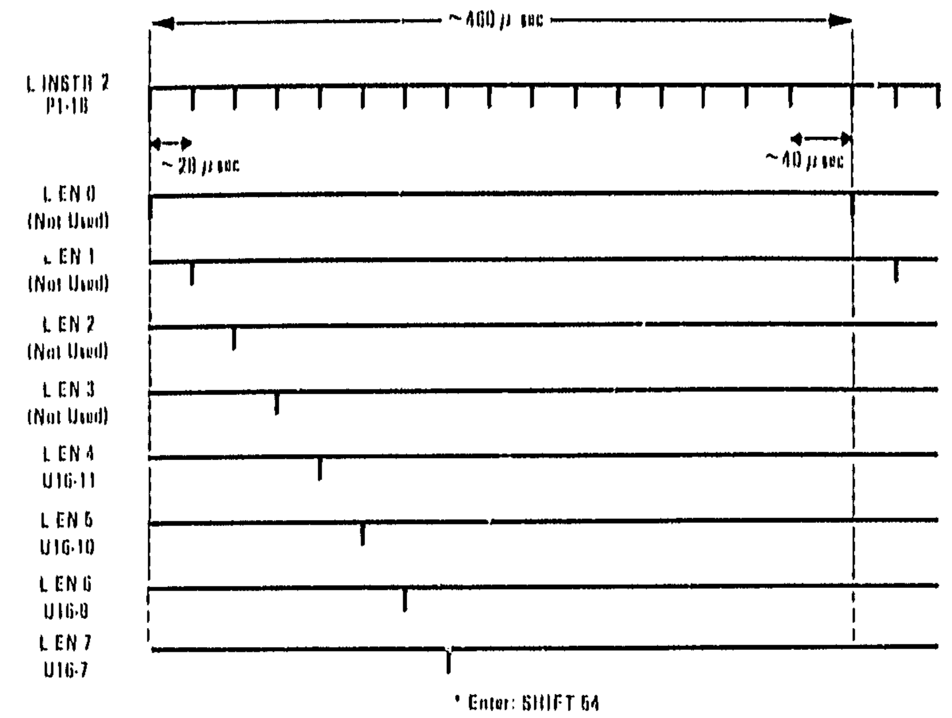


Figure 8-53. A7 Address Decoder Timing Diagrams

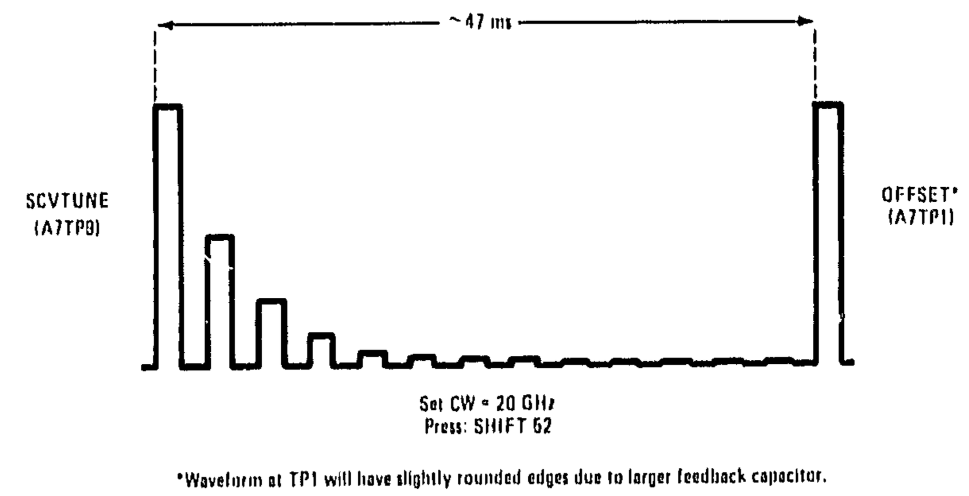
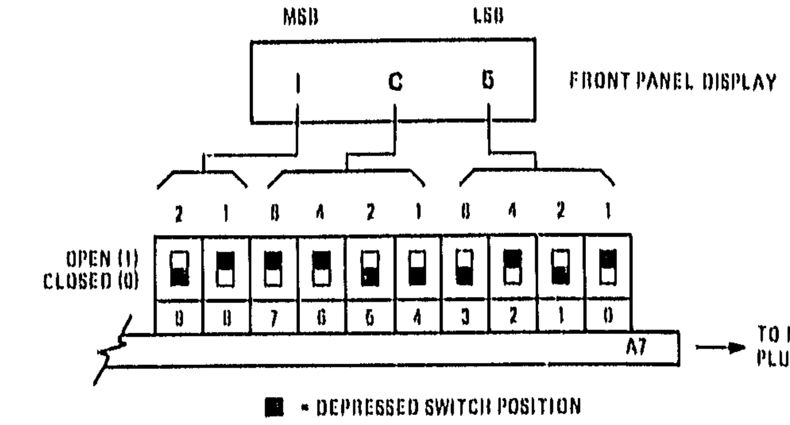


Figure 8-54. DAC Test



Hexadecimal	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 8-55. A7S1/S2 Switch Configuration

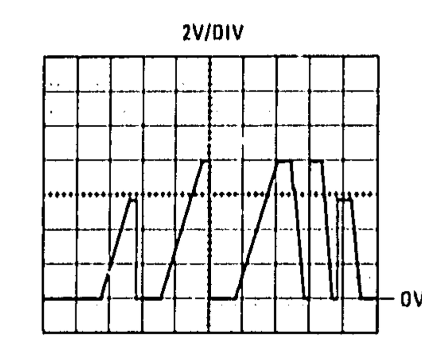


Figure 8-56. Scaled Tuning Voltage (A7TP9)

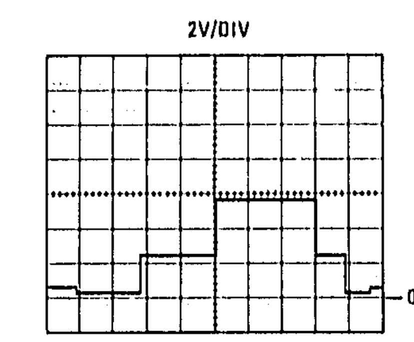


Figure 8-57. Offset Voltage (A7TP1)

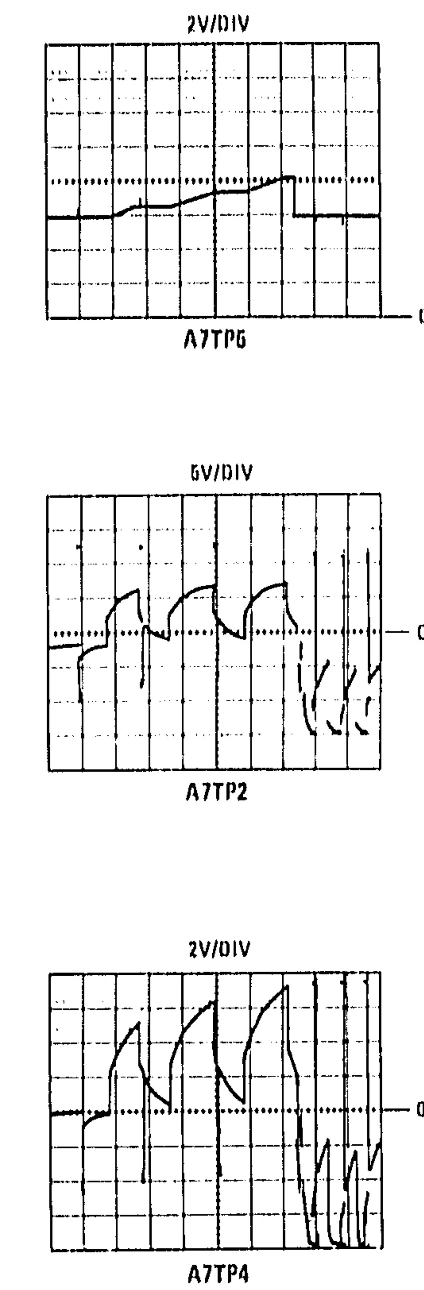


Figure 8-58. YTM Delay Compensation Waveforms

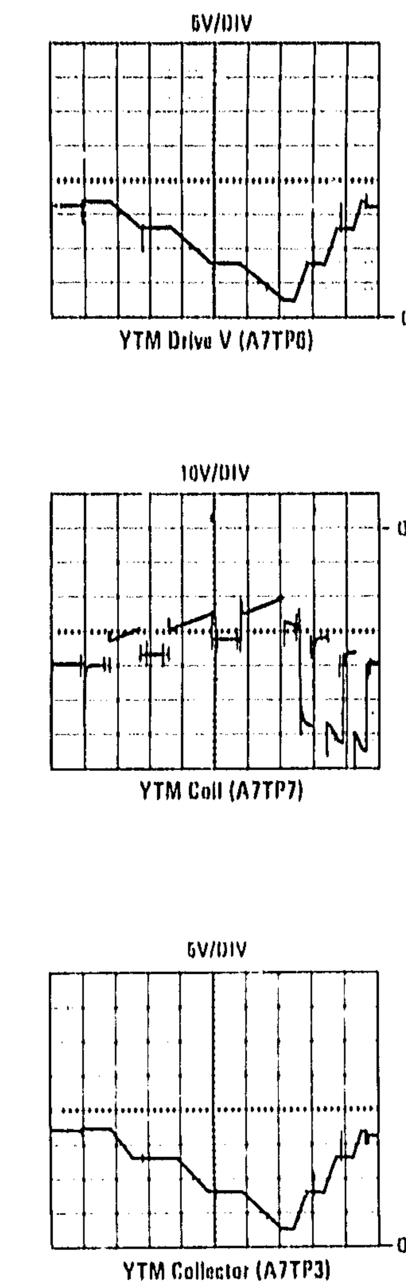


Figure 8-59. YTM Coil Current Source Waveforms

SERIAL PREFIX: 2146A

Figure 8-60. A7 YTM Driver, Schematic Diagram

A8 YO DRIVER / A9 REFERENCE RESISTOR, CIRCUIT DESCRIPTION

NOTE

All reference designators refer to the A8 assembly unless otherwise noted.

GENERAL

The A8 YO Driver assembly converts the buffered tuning voltage from the A6 Sweep Control assembly into a drive current. The A9 Ref Resistor assembly provides the current driver to control the frequency of the YIG Oscillator (YO).

Multiplying Digital-to-Analog Converters (DAC's) scale and offset the buffered tuning voltage to the frequency end-points in each band. Delay compensation is generated and summed with the tuning voltage. Also summed with the tuning voltage is low frequency external FM. The resultant waveform at TP10 is then converted to a current-drive for the YO's Main Coil.

Address Decoder and Data Latch (A)

The A8 YO Driver uses hexadecimal address locations 2C80 through 2C87. L INST2, BA0, BA1, and the L DACEN output of U8D are decoded by the Scaled Voltage Tune and Offset DAC's as hexadecimal addresses 2C80 through 2C83. (Note that these addresses from U16 are not used.) U16 is a 3-to-8 decoder that is enabled when L INST2 and address line BA3 are both low. U16 decodes address lines BA0 through BA2.

U13 is a control latch which stores commands from the 8350A for the control lines used on the A8 YO Driver assembly, primarily for delay compensation. The command byte is latched into U13 when L EN 7 pulses low. Refer to the Delay Compensation, Summing Amplifier, and YO Coil Current Source sections for detailed descriptions of these control lines.

Scaled Voltage Tune DAC (B)

Offset DAC (C)

The Scaled Voltage Tune and Offset DAC's function together to determine the frequency of the YIG oscillator. The Offset DAC determines the start frequency of each band while the Scaling DAC scales the BVTUNE input to tune the YIG oscillator over the required frequency range for each band.

BVTUNE is a series of 0 to −10V ramps with each ramp corresponding to a frequency band. DAC U17 scales each ramp differently according to the frequency range the YO must sweep to cover the frequency range of the band. (See SCVTUNE waveform at TP2 in Figure 8-67.)

U17 and U14 are 12-bit microprocessor-compatible DACs, which latch data in three four-bit nibbles. These DAC's share the same address locations, but are loaded by different data lines (D0−D3 load U14 and D4−D7 load U17).

U17 scales the buffered tuning voltage (BVTUNE) according to the binary pattern loaded at its inputs. Inverting amplifier U18 is included in the feedback path to convert the current output of the DAC to a voltage. CR1 prevents transients from damaging the DAC during turn-on. C14, along with the DAC's internal feedback resistor, determines the bandwidth of the circuit. The waveform at TP2 is a scaled ramp (sawtooth waveform for multiband sweeps), with a maximum range of 0 to +10Vdc. See Figure 8-67.

U14 scales a stable −10V REF voltage according to the binary pattern loaded at its inputs. Inverting amplifier U15 works with the DAC's internal feedback resistor to provide a programmable offset voltage between 0 and +10Vdc at TP3. See Figure 8-68. CR7 protects the DAC from turn-on transients. C15 and the DAC's internal feedback resistor determine the bandwidth of the circuit.

Delay Compensation (E)

The delay compensation block circuitry is used to compensate the A13 YIG Oscillator for the inherent inaccuracy caused by delay in the magnets at fast sweeps. The input signal is SCVTUNE, a scaled ramp from the Scaled Voltage tune DAC, the slope of which is proportional to the change in frequency. SCVTUNE 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 points. 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 U12. If the Sweep Oscillator is in a swept mode, U6 enables the delay compensation which is summed into the main coil driver voltage in the Summing Amplifier.

During retrace, and momentarily during bandswitching, analog switch U19B closes. In this condition, U10C together with R6, R8, R9, and R7 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 U19B closed, C4 charges to one half the value of the input signal (R8 and R9 form a voltage divider). U19B opens again during the sweep which leaves only C4 in the feedback path of U10C. Since there is no discharge path with U19B and U19A open, C4 remains charged to the level it had just before U19B was opened. U10C now operates as a voltage follower, with the output level shifted by the voltage across C4. Therefore, the output of U10C has one half the slope of the input signal and returns to 0V whenever U19B is closed during retrace and bandswitching. The output of U10C is scaled by the HI adjust potentiometer and is applied, with an offset from the LO adjust potentiometer, to inverting amplifier U10D. 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. When U19B is closed by a low on the L SSRQ control line to U8A, C4 slowly recharges through R62. Thus when L SSRQ is pulled the output of U10C 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. When L SSRQ goes high again and the sweep continues, U19A opens and U10C resumes its voltage follower operation.

SCVTUNE is also applied to Differentiator C3 and U10B. The output is amplified and inverted by U10A and is applied at TP4 to the second input of the analog multiplier. The output at TP9 is connected to U12 pin 7 to provide feedback for an operational amplifier internal to U12.The Z adjust at U12 pin 6 allows nulling of the offset voltage appearing at DLY COMP. This is done when in CF ΔF mode where ΔF equals zero.

During sweep retrace or at bandswitch points, the YIG Oscillator must change frequency rapidly from the high end of its range to the low end, and does not have enough time to naturally settle to the proper start frequency. Unless the YO is forced to the low end of its range, this could result in a frequency error at the start of each sweep and each bandswitch point. In order to force the YO to settle quicker, C20 is charged during the YO retrace by the differentiator output through CR2. Timer U9 is triggered by L RTC COMP at each bandswitch point and at the end of sweep retrace. The timer pulse output momentarily closes analog switch U19C, and C20 discharges through R67 and is applied as Retrace Compensation to the Summing Amplifier. This compensation voltage forces the YO to the low end of its range to avoid frequency errors after a retrace or bandswitch. The amount of compensation applied is proportional to the pulse width of the timer output, and is adjusted by R55. As the 83590A is sequentially sweeping up between bands, the frequency range the YO must retrace to reach the start frequency of the next band decreases. Thus, the amount of retrace compensation required is reduced. The timer output pulse width is reduced accordingly. This is accomplished by inverting the Offset DAC output through Q1, and applying this negative voltage to the timer control voltage input at U9 pin 5. VR5 level shifts the Offset DAC output for proper biasing of Q1.

+20V Tracking (F)

Inverting amplifier U11 monitors the +20V line 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 (TP10) is compensated for the drift. ZRO adjustment R22 compensates for inaccuracies between U11 and summing amplifier U20.

Summing Amplifier (G)

U20 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:

SCVTUNE provides the scaled ramp portion of the YO DRIVE Voltage. R19 GAIN, fine-tunes the range of the scaling DAC.

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. R24, 'OFS', fine-tunes the range of the Offset DAC.

SUPPLY VOLTAGE CORRECTION provides a compensation signal, from the +20V Tracking Amplifier, to offset changes in the reference supply.

DLY COMP, from the Delay Compensation circuit, is added to correct for lags in the response time of the YIG Oscillator. This compensation is derived from SCVTUNE.

RTC COMP, from the Delay Compensation circuit, is a momentary correction voltage that forces the YIG oscillator to the low end of its frequency range after a sweep retrace and each bandswitch point. This compensation is derived from SCVTUNE.

YO LO 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 detail.) 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 A8 YO assembly.

−10V Reference (H)

Operational amplifier U5 generates a −10V output from the −6.2V reference voltage at its noninverting input. The amplifier gain is determined by feedback resistors R43, R44, and R45. Emitter follower Q2 provides the current. The −6.2V reference input to U5 is developed across 3 parallel zener diodes to reduce noise. Further noise reduction is provided by the RC network on the noninverting input of U5 and C17 across the feedback path. −15VF, through R1, provides the initial start-up bias.

Frequency Cal Switches/Output Data Buffers (D)

DIP switches S1 and S2, with their corresponding data bus buffers, are used to digitally calibrate the low and high end frequencies in Band 2. The data on these switches is read by the microprocessor during power-up and INSTR PRESET and is used to calculate the settings for the Scale and Offset DACs. S1, with pull-up resistor package U1, is read through U3 when enabled by L EN4. 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 L EN5. This establishes the Scale DAC values, and calibrates the high end frequency. The ninth and tenth 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 8-66 illustrates the switch configurations.

YO Coil Current Source (I)

YO Coil Current Driver A9 (K)

The YIG Coil Current Driver works with the chassis mounted Reference Resistor R1 and YO Coil Driver A9Q1 to drive a current proportional to the drive voltage through the YIG's main tuning coil.

U21, Q3, Q4, and A9Q1 comprise a voltage-to-current converter and current driver for the YO's main coil. The non-inverting input of U21 receives the YO DRIVE Voltage signal. The inverting input of U21 monitors the voltage drop across reference resistor R1, which is directly proportional to the coil current. If the drive current is not tracking the drive voltage, U21 will produce an error voltage to correct the difference. Emitter-follower Q4 and common-emitter-stage Q3 provide the current gain needed to drive A9Q1. Q4 and Q3 emitter currents are also drawn through chassis mounted R1, and therefore, sensed by U21. VR1 and CR5 protect the current drive transistors by limiting voltage spikes due to sudden changes in the coil current. R33 helps to dampen ringing caused by the parasitic capacitance and the inductance of the YO coil.

When 8350A CW and 83590A CW FILTER are selected, L CW goes low, energizing relay K1. C21 filters out noise in the YIG coil current, reducing the residual FM noise in the CW mode.

CR4, CR8, and their associated factory-select resistors provide a two break-point compensation network to correct for non-linearities in the YO characteristics.

NOTE

The values of the factory-select resistors are stamped on a label, attached to the RF casting. Matching resistor sets (mounted on a header) are supplied with replacement YOs and must be installed on the A8 YO assembly. The new label indicating the replacement resistor values should be attached to the RF casting.

If the A8 YO Driver Assembly is replaced, the shaping resistors from the defective board (which are mounted on a header) must be reinstalled in the new assembly.

NOTE

If the YO needs little or no compensation, some or all 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.

A8 YO Driver/A9 Reference Resistor Assemblies Troubleshooting

NOTE

All reference designators refer to the A8 assembly, unless otherwise noted.

The A8 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 may, or may not, be independent of sweep time. (Frequency errors that change with sweep time are usually related to delay compensation.) 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 A8 asembly) and −40V (on the A13A1 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 A8 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 (TP10) for the waveform shown in Figure 8-70. If this waveform is correct, troubleshooting should continue with the YO Current Driver section below.

   a. If YO DRIVE V is incorrect, check BVTUNE (A6TP8) for a series of 0 to −10V ramps. If they are missing or of the wrong amplitude, refer to the A6 Sweep Control service sheet for further troubleshooting.

   b. If the waveform at TP10 appeared to be level-shifted check −10 VREF (TP12) for exactly −10 Vdc. Next, with the Plug-in sweeping its entire range, check OFFSET (TP3) for the waveform in Figure 8-68. If this signal is incorrect, select a CW frequency of 20.0 GHz and press SHIFT 5 2. Check TP3 for the waveform shown in Figure 8-65. 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 (TP2) against the waveform shown in Figure 8-67. If it appears to be bad, run the Scale DAC Test by setting a CW frequency of 20.0 GHz and pressing SHIFT 5 2. Check that U17 pin 15 is at −10 Vdc. Then check TP2 for the waveform shown in Figure 8-65. If this fails, check address decoding using the Digital Control troubleshooting below.

3. Check +20V FREQ REF (A7TP12) for +20 Vdc ±10 mV. If it is not, trace the supply voltage back to the 8350A. Then check that SUPPLY VOLTAGE CORRECTION (U11 pin 6) is at approximately −7.5 Vdc. If it is not, troubleshoot U11.

4. Finally, check that the summing junction, U20 pin 2, is at 0 Vdc. If it is not, troubleshoot U20.

Delay Compensation

A failure in the Delay Compensation circuit is indicated by frequency errors that change with sweep time. For sweep times greater than 100 milliseconds, delay compensation has little effect on the frequency accuracy. On the 8350A, enter INSTR PRESET and check waveforms in Figure 8-69.

YO Drive Circuits

1. Check +20V FREQ REF at A7TP12 for +20V ±10 mV. If it is not, troubleshoot back to the mainframe supply.

The circuitry surrounding U21 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 extreme frequency errors.

2. Press INSTR PRESET to sweep the entire range of the Plug-in. Check TP11 for the waveform shown in Figure 8-70. 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 TP6. This voltage should track the YO DRIVE V (Figure 8-70). If it does not, troubleshoot U21, Q3, Q4, chassis mounted R1, and A9Q1.

   a. To verify proper operation of U21, ground TP6 (R1 is a 25 Watt resistor). Press 8350A CW . Vary the voltage at U21 pin 3 by changing the CW frequency as indicated on the front panel (20.0 GHz = −5V; 2.4 GHz ≈ +12V). With TP6 at 0 Vdc, U21 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 U21.

   b. Chassis mounted R1 should be checked by removing the A9 assembly from the instrument. The ohmmeter reading should be approximately 155Ω.

   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 CR5 are good before replacing the transistor.

   d. Q3 and Q4 can be checked, using the procedure above, while they are still in the circuit. The line power should be off.

Digital Control

The Address Decoder and Data Latch, and Frequency Cal Switches comprise the digital control for the A8 assembly. A failure in these components usually results in large frequency errors.

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

1. Examine L INST2 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.

2. If L INST2 is functional, check each of the L ENn lines (U16) for the pulses shown in Figure 8-64. If these are incorrect, but the address lines show activity, replace U16. 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 A8S1 and A8S2, write down 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 output buffer U7, press INSTR PRESET , and make the following key entry:

SHIFT 0 0	Enters the Hex Data command
2 GHz 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 S1 and S2 switch positions 8 and 9 are toggled.

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 U13 with Hex Data Rotation Write. Enter:

SHIFT 0 0	Enters Hex Data command
2 GHz 8 7	Address location 2C87 (U13)
M4	Hex Data Rotation Write

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

−10V REFERENCE

Check TP12 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 the anodes of VR2−4 for −6.2 Vdc. If a voltage is incorrect, replace the zener diode. Check U5 pins 2 and 3 for −6.2 Vdc ±0.15 mV. If either measurement is incorrect, troubleshoot U5 and associated circuitry.

5V Regulator

Check A9U1 pin 1 for slightly over +5 Vdc (+5V UNREG from the 8350A). Remove RF ribbon cables W4 and W14 to check for the possibility of excess loading. Then check A9U1 pin 2 for +5 Vdc. If incorrect, replace A9U1.

CW Filter

Relay K1 and C2[illegible] [illegible]duce residual FM by filtering the noise from the YO Coil current. The rel[illegible] [illegible]uated by a line from U13. To check the data line, press 8350A CW . Enter

SHIFT 0 0	Enters Hex Data command
2 GHz 8 7	Address location 2C87 (U13)
M2	Hex Data Write
0 0 / BKSP BKSP	Enters hex data 00 and FF

Alternate between 00 and FF. Check U13, pin 7. If it is inactive, make sure protection diode CR6 is good. Then replace U13.

If U13 is working, alternate between 00 and FF, as described above, and verify that contacts in relay K1 are opening and closing.

A9P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1	YO BASE	IN	A8P1-21	K
7	+5V REG	OUT	A10J4-7,A10J5-3,11	J
2	YO COLLECTOR	OUT	A8P1-1	K
8	YTM COIL	OUT	A7P1-22,A10J4-8	
3	+20V	IN	P1-7	K
9	YTM BASE	IN	A7P1-21	
4	YO COIL	OUT	A8P1-22	K
10	YTM COLLECTOR	IN	A7P1-20	
5	+20V FREQ REF	OUT	A7P1-44,A8P1-44	K
11	+20V	IN	P1-7	K
6	GND ANLG		P2-27,58,60	J
12	+5V UNREG	IN	P2-63	J

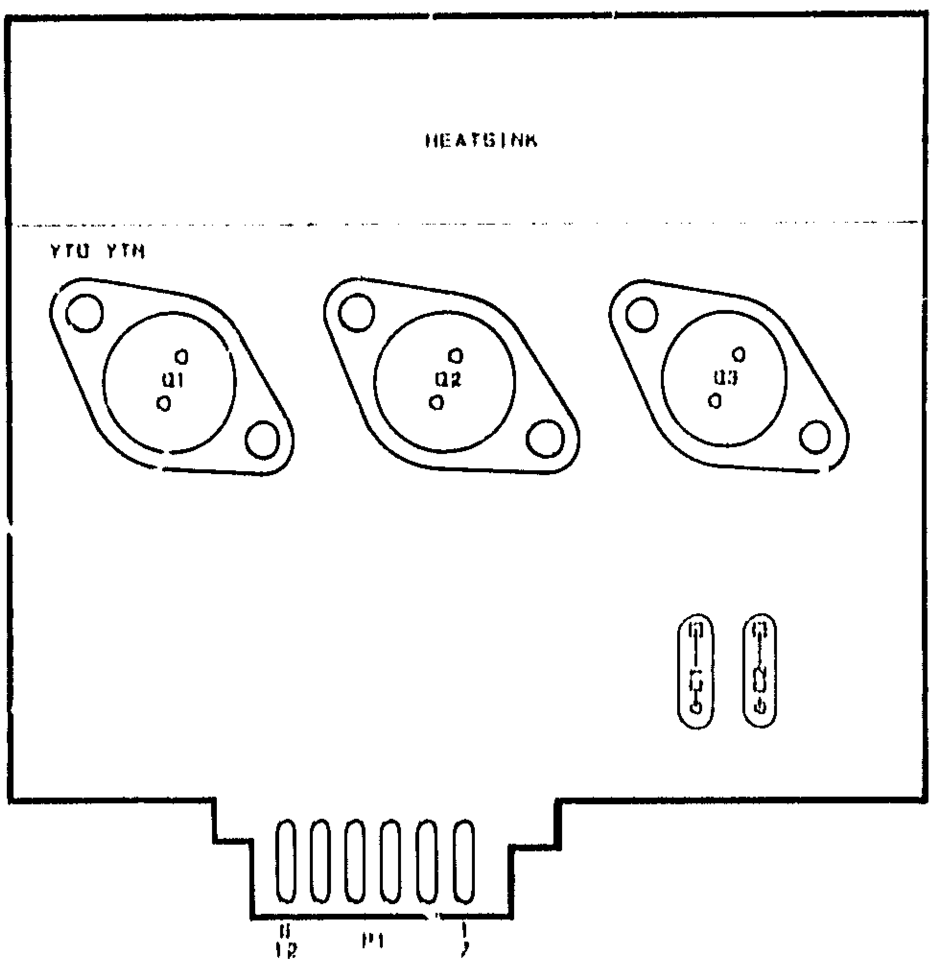


Figure 8-61. A9 Reference Resistor, Component Locations

SERIAL PREFIX: 2146A

A8

Figure 8-62. A8 YO Driver, Block Diagram

Figure 8-71. A8 YO Driver, Schematic Diagram

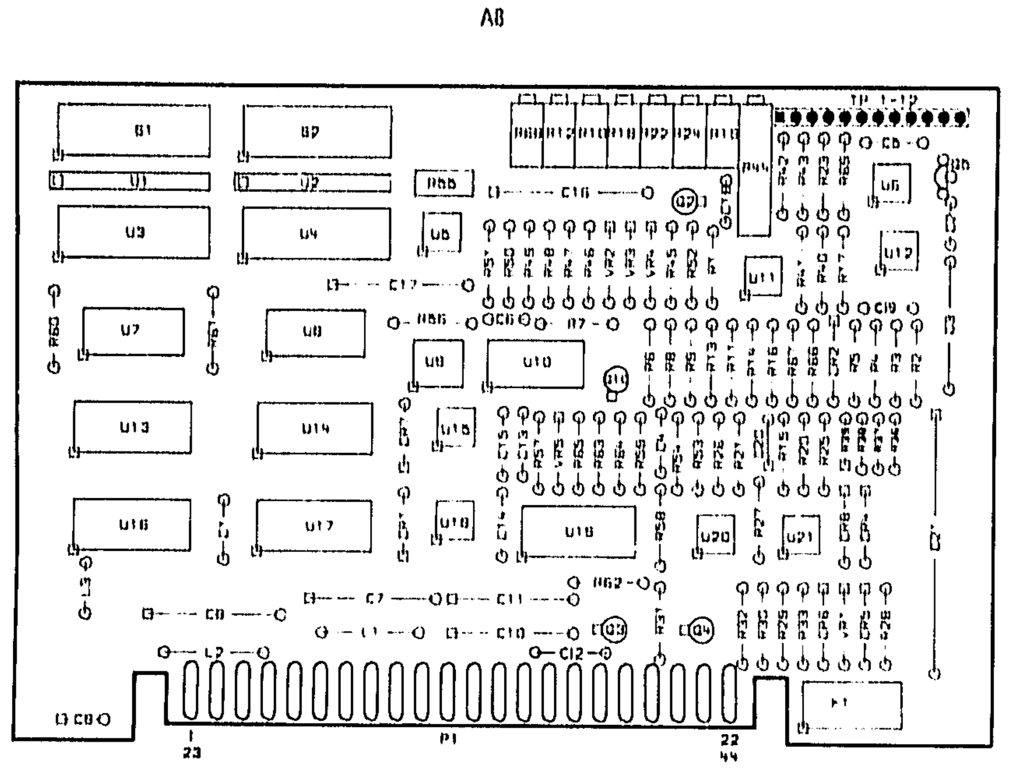


Figure 8-63. A8 YO Driver, Component Locations

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 BANDSWITCH INTERRUPT, PRESS 8350A CW.

A8P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1	YO LO FM	IN	A6P-2	G
23	FREQ CAL	IN	A10J1-37	G
2			NOT USED	
24	GND ANLG			L
3	−10VREF	OUT	A4P1-43,A6P1-30,A7P1-3	H
25	BVTUNE	IN	A6P1-42	B
4			NOT USED	
26	GND ANLG			L
5	L SSRQ	IN	A6P1-23	E
27	+5V	IN	A3P1-6,7	L
6	−40V	IN	P1-11	L
28	−15V	IN	P2-28	L
7	+10V	IN	P1-8	L
29	GND ANLG			L
8	GND DIG			L
30	GND DIG			L
9	BD1	I/O	A3P1-9	A,C,D
31	BD0	I/O	A3P1-31	A,C,D
10	BD3	I/O	A3P1-10	A,C,D
32	BD2	I/O	A3P1-32	A,C,D
11	BA1	IN	A3P1-11	A,B,C
33	BA0	IN	A3P1-33	A,B,C
12	BA3	IN	A3P1-12	A
34	BA2	IN	A3P1-34	A
13	BD5	I/O	A3P1-13	A,B,D
35	BD4	I/O	A3P1-35	A,B,D
14	BD7	I/O	A3P1-14	B,D
36	BD6	I/O	A3P1-36	B,D
15	GND ANLG			L
37	GND ANLG			L
16	+20V	IN	P1-7	L
38	+15V	IN	P2-29	L
17	−10V	IN	P1-13	L
39	−40V	IN	P1-11	L
18	L INST 2	IN	A3P1-20	A
40			NOT USED	
19	GND ANLG			L
41			NOT USED	
20	YO COLLECTOR		A9P1-2	I
42			NOT USED	
21	YO BASE	OUT	A9P1-1	I
43			NOT USED	
22	YO COIL		A9P1-4	I
44	+20V FREQ REF	IN	A9P1-5,A7P1-44	I

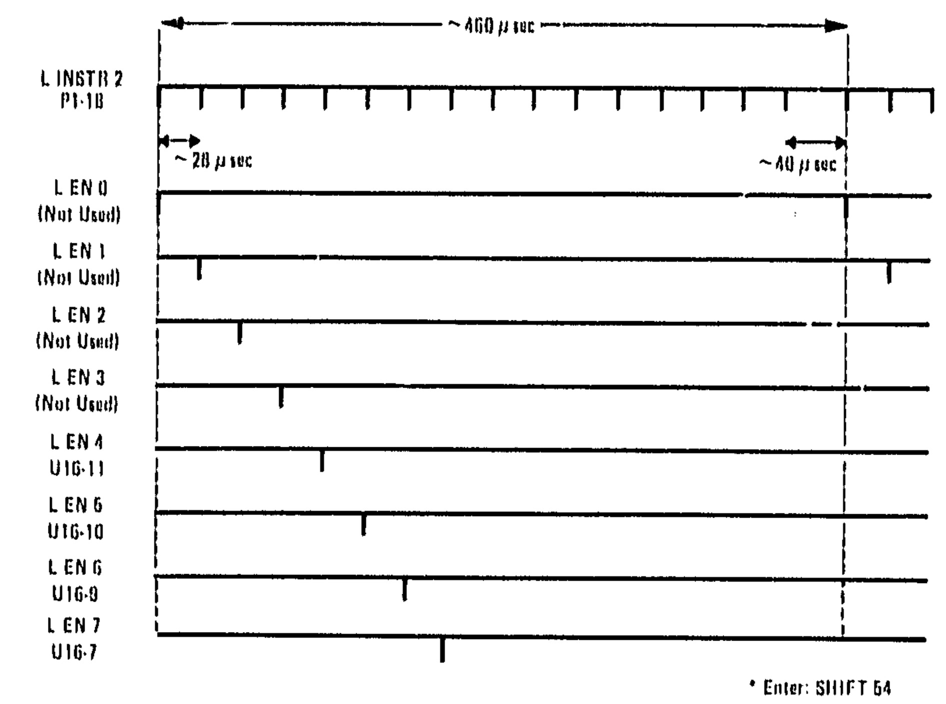


Figure 8-64. A8 Address Decoder Timing Diagrams

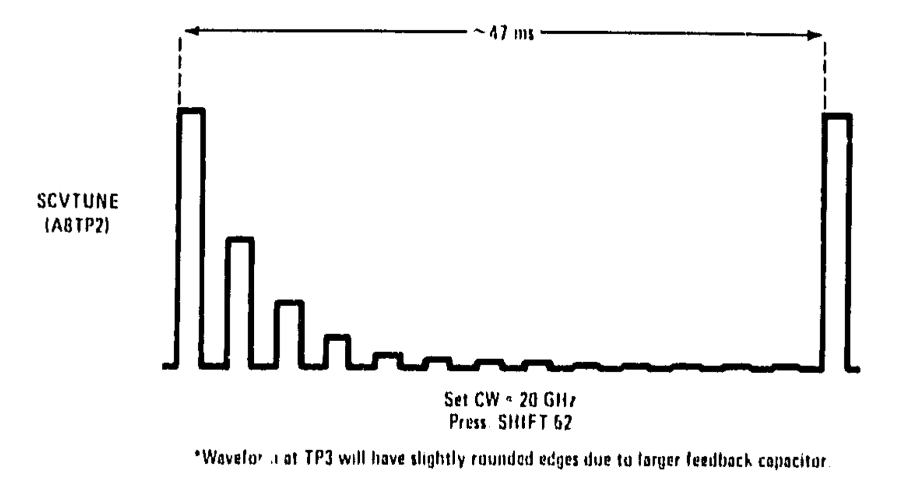
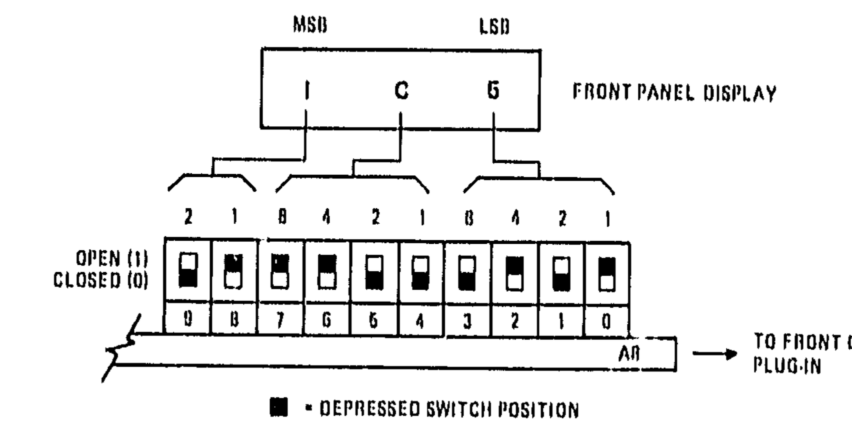


Figure 8-65. DAC Test



Hexadecimal	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 8-66. A8S1/S2 Switch Configuration

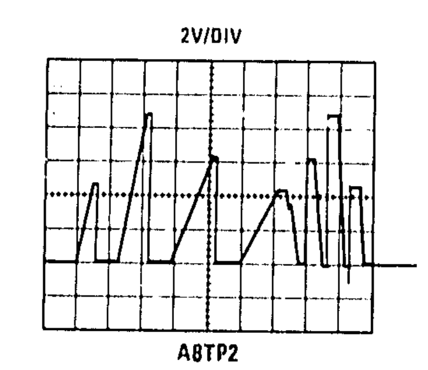


Figure 8-67. Scaled Tuning Voltage (A8TP2)

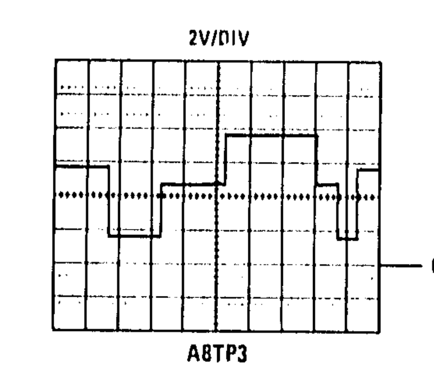


Figure 8-68. Offset Voltage (A8TP3)

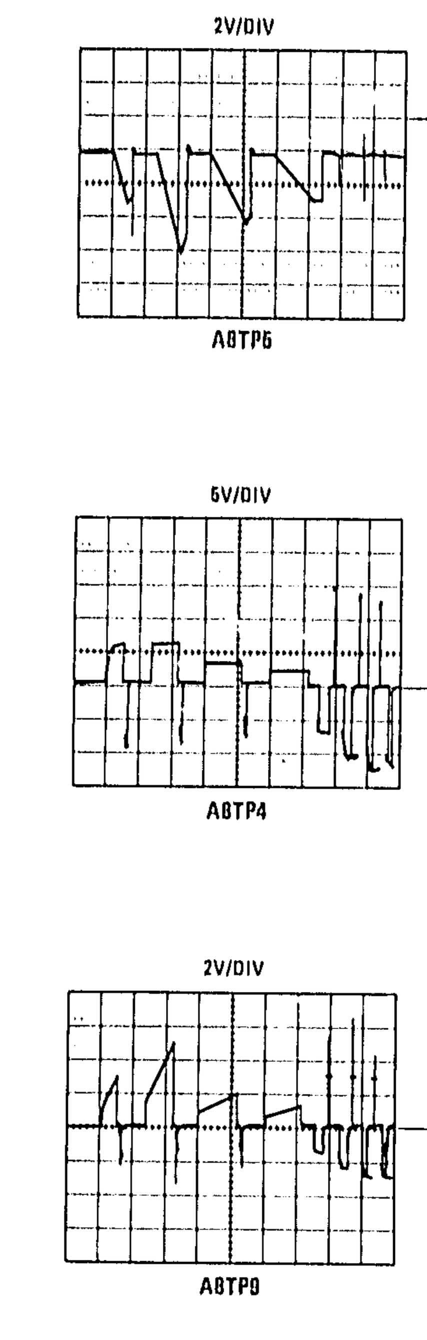


Figure 8-69. YO Delay Compensation Waveforms

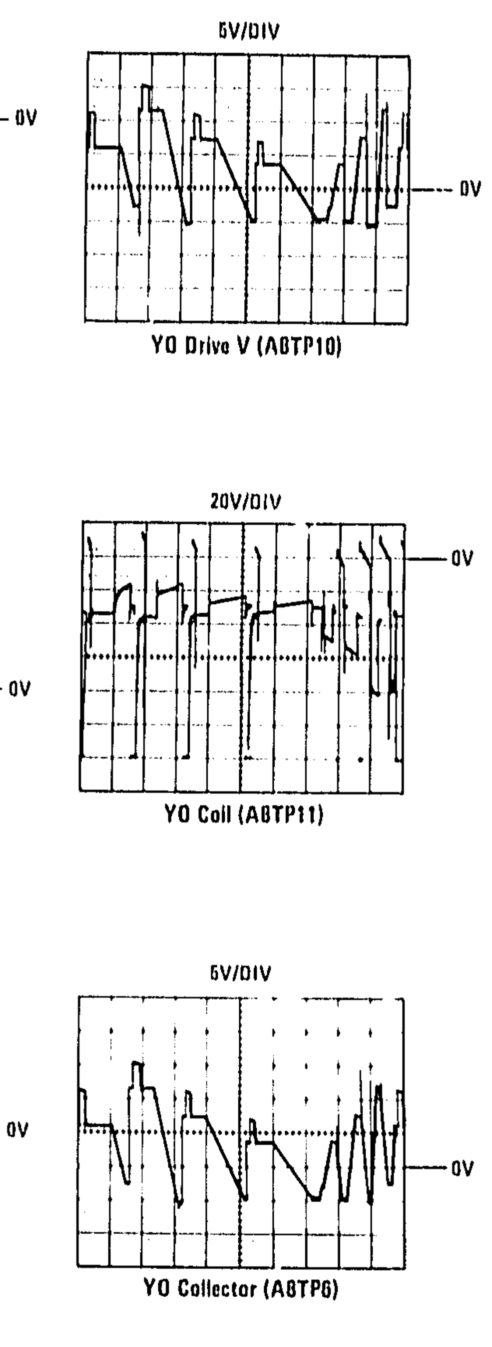


Figure 8-70. YO Coil Current Source Waveforms

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, A13, A14, A16, A19, AT1, DC2, and CR1. 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. Headings indicate in which frequency band(s) the assembly is active.

BANDS 1 THRU 3

A13 YIG Oscillator

The A13 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is a solid-state tunable microwave source. Its output frequency ranges from 2.0 to 7.0 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 bipolar transistor, providing the gain necessary to sustain oscillation. A FET amplifier provides the final output power gain.

The A13A1 YO Bias assembly supplies the biasing for the Oscillator and YO Amplifier. This board is matched to the YO, and cannot be separately replaced. 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. Factory adjustment R4 optimizes the FET gate bias for minimum harmonics

A16 Modulator/Coupler

The A16 Modulator/Coupler provides a modulator which is used for leveling and pulse modulation. The RF input from the YO is coupled off and supplied to the rear panel AUX OUTPUT with a power level of approximately 0 dBm.

The Modulator/Coupler uses a PIN diode modulator. The PULSE MOD input switches its PIN diode modulator full on or full off, and provides an RF on/off ratio of greater than 30 dB.

The MOD 1 input provides amplitude control for Bands 1 through 3 and is used for amplitude leveling.

A14 Power Amplifier

The A14 Power Amplifier amplifies the fundamental YO output, covering the 2.0 to 7.0 GHz range. The Amplifier provides approximately 25 dB of gain at maximum leveled power.

The A14A1 Amplifier Bias assembly contains several factory adjusted bias adjustments. These are adjusted at the factory to minimize harmonics

AT1 Isolator

AT1 provides 20 dB of isolation and is accountable for less than 1 dB of insertion loss. AT1 improves the match to the YTM.

BANDS 1 THROUGH 3

A12 YTM

The A12 Switched YIG Tuned Multiplier (YTM) RF input is applied through an impedance matching circuit to a Step Recovery Diode (SRD) which has an output that is rich in harmonics. The SRD BIAS applied to the diode is changed for each band to optimize the generation of the harmonic used for that band (Band 1 = Fundamental, Band 2 = Second Harmonic, Band 3 = Third Harmonic). The YIG Tuned Filter is a tunable bandpass filter which is tuned to the RF output frequency by the YTM Coil drive-current supplied by the A7 YTM Driver.

The filter's bandpass frequency is determined by a small YIG sphere with a resonant frequency that depends on the surrounding magnetic field strength. The magnetic field is established by an opposing pair of electromagnet coils. Changing the current through the coils changes the magnetic field strength, and hence the bandpass frequency.

The dynamic response of the YTM (i.e. how fast the bandpass frequency changes for a fast change in coil current) is 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. Since the range of deviation for high-frequency modulation is limited by the YIG oscillator, the RF frequency stays within the bandpass of the YTM, and the YTM does not need to be modulated at higher rates.

The J2 switched input is not used in the 83590A RF Plug-in.

DC2 Directional Coupler

The DC2 Directional Coupler has a −16 dB coupling coefficient. The reverse-coupled port is terminated. The coupled output is sent to the CR1 Detector for leveling in Bands 1 through 3 The insertion loss is less than 0.8 dB, not including the coupled power loss.

CR1 Detector

The CR1 Detector rectifies and filters the RF output coupled by the DC2 Directional Coupler for leveling in Bands 1 through 3. The internal diode is biased by circuitry on the A4 assembly.

A19 Step Attenuator (Option 002 Only)

On RF Plug-ins equipped with Option 002, the A19 Step Attenuator provides 70 dB of attenuation in 10 dB steps. Combined with the range of the ALC loop, this yields a maximum power range of +10 to −75 dBm. The Step Attenuator functions as three fixed attenuators, with 10, 20, and 40 dB of attenuation. (The 40 dB attenuator is actually two 20 dB attenuators which are selected as a pair.)

Latching relays close contacts which either insert these attenuators in 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, may be as much as 5 dB at 20 GHz (See specifications in Section 1).

RF OUTPUT Connector

On Standard, Option 002, or Option 005 instruments, the RF output is directed to the front panel. On plug-ins with Option 004 (with or without other options), the output is directed to the rear panel. The standard RF output connector is a female type-N; for Option 005, the RF output connector is an APC-7 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.

Four RF assemblies have bias boards attached directly to the microcircuit packages:

- The bias boards for A12 through A14 contain factory adjusted or factory selected components, and cannot be separately replaced. If a bias board component (e.g. protection diode or transistor) 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 sensitive 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.

Breaking RF connections within the ALC loop will cause the loop to go unleveled, producing abnormally high power levels (up to +20 dBm) and harmonic destortion. In Bands 1 through 3, the ALC loop includes connections between A6 Mod/Coupler and DC2 Directional Coupler. (Figure 8-24, 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 breaking 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.

NO RF POWER − All Bands

- A13 YIG OSCILLATOR. A YO failure is indicated if the RF power at the rear panel AUX OUTPUT connector is less than −10 dBm (nominally 0 dBm). Check power supplies and bias levels. L RF ON (TP "ON") should be at −10 Vdc. TP "G" should be approximately −2 Vdc. Check TP "M" for the waveform entitled YO COIL, Figure 8-70, within the A8 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.

- A16 Modulator/Coupler. A Modulator/Coupler failure is indicated if there is not at least −10 dBm at the rear panel AUX OUTPUT connector. Disconnect PULSE MOD input to A16A1J1 to eliminate the possibility of the Pulse Modulation circuit (on the A6 Sweep Control assembly) turning the RF power off. If there is still no RF output power, check the Modulator/Coupler output power at A16J2.

- A12 Switched YTM. The easiest place to access the A12 YTM RF output is at the W15 input to DC2 Directional Coupler. Also check the YTM power supplies and bias voltages.

NO RF POWER – Bands 1–3

- A16 Modulator/Coupler. Remove the A4 assembly. This removes all bias current from the modulator and provides an unrestricted path for RF. If full unleveled power is achieved, refer to A4 Troubleshooting. If Bands 1–3 remain dead, disconnect W20 and check the RF output directly out of A16 (open loop power should measure approximately +9 dBm).

- A14 Power Amplifier. Check power supplies. Verify that L AMP OFF is a logic high (it is pulled high on A14A1 and is a no-connection on the A10 Motherboard). The easiest place to access the A14 output power is at the output of the AT1 Isolator (approximately +26 dBm). If there is no power at this point check the power directly at the A14 output.

- A12 Switched YTM. Verify the PIN SW control voltage (A6TP6) is −5V for Bands 1–3. The easiest place to access the YTM RF output is at the W15 input to DC2 Directional Coupler.

MAXIMUM RF UNLEVELED POWER – All Bands

- Refer to this symptom under A4 Troubleshooting.

MAXIMUM UNLEVELED RF POWER – Bands 1–3

- CR1 DETECTOR. Select a CW frequency in Band 1 and check for maximum unleveled RF output power. Check the output of CR1 for approximately −0.05 Vdc, using an SMC tee or by probing A4P1−20.

- A16 Modulator/Coupler. If CR1 will output about −0.05 Vdc, check that A4TP6 is at +4 Vdc. If not troubleshoot A4. Then check MOD 1. It should be slightly negative. If it is approximately +4 Vdc the modulator diode is open. If MOD 1 is near 0.0 Vdc while A4TP6 measures +4 Vdc, check A4 Mod Drivers and the connections to the modulator.

HARMONIC DISTORTION – All Bands

- A13 YIG OSCILLATOR. Refer to Section V, Adjustments, and perform the harmonic adjustments. If harmonics are still unacceptable in all bands check the spectral purity of the YO output. If harmonics are less than 14 dB below the fundamental, replace A13.

HARMONIC DISTORTION – Bands 1–3

- A14 Power Amplifier. Check power supplies and biases. Check power levels into A14. Measuring power or spectral content into or out of A14 will break the ALC loop and cause distortion even without a failure. Refer to A4 Troubleshooting and perform the Open Loop Procedure. This procedure externally biases the modulators to level RF power while the ALC loop is open.

POWER DROP-OUTS -- Any Band

- A13 YIG OSCILLATOR. If power is present and leveled across part of a band, but drops out entirely for the rest of the band, suspect A13. Check for power dropouts at the rear panel AUX OUTPUT connector.

POWER HOLE -- Any Band

- 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 RF connectors internally. 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 this connector.

DC BIAS AT RF OUTPUT

- A12 Switched YTM. The YTM provides the DC blocking function for the 83590A output port. If a DC bias exists at the front-panel connector, the failure is almost certainly in A12.

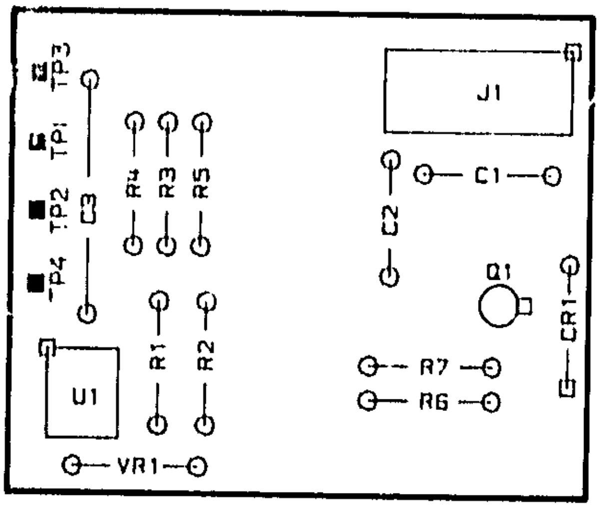


Figure 8-72. A12A1 YTM Bias, Component Locations

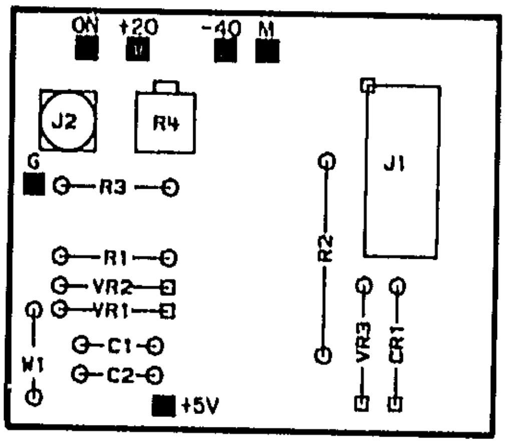


Figure 8-73. A13A1 YO Bias, Component Locations

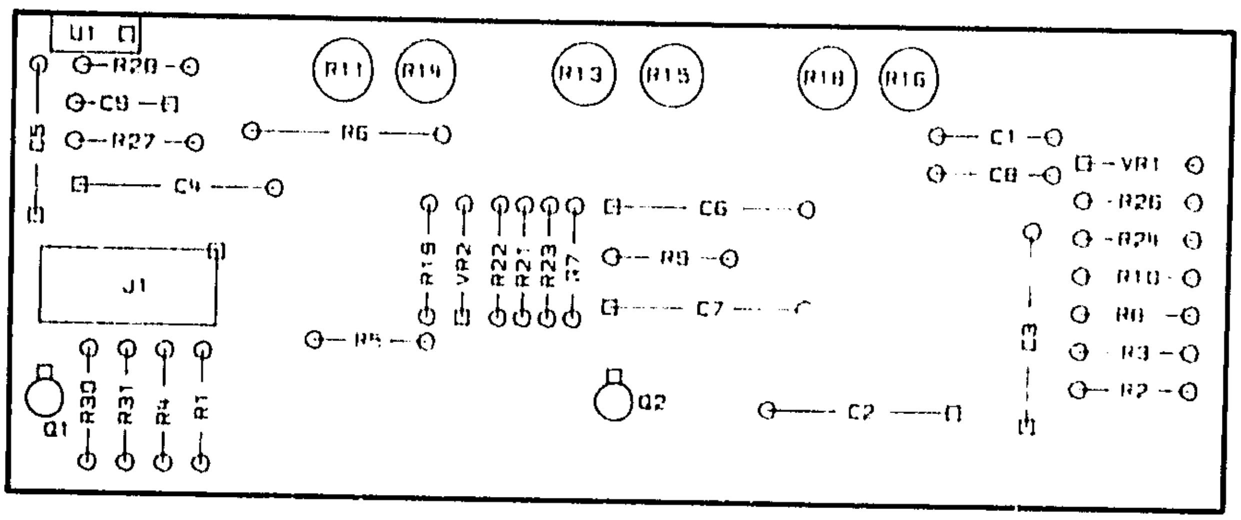


Figure 8-74. A14A1 Power Amplifier Bias, Component Locations

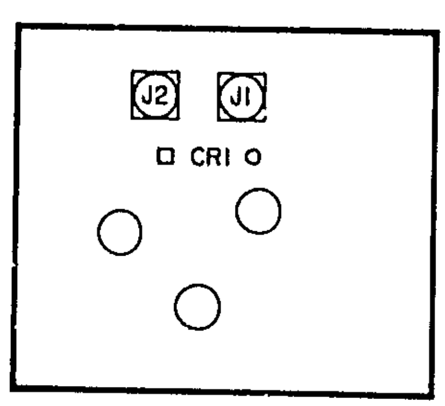


Figure 8-75. A16A1 Modulator/Coupler Connector, Component Locations

83590A RF SCHEMATIC DIAGRAM

SERIAL PREFIX: 2146A

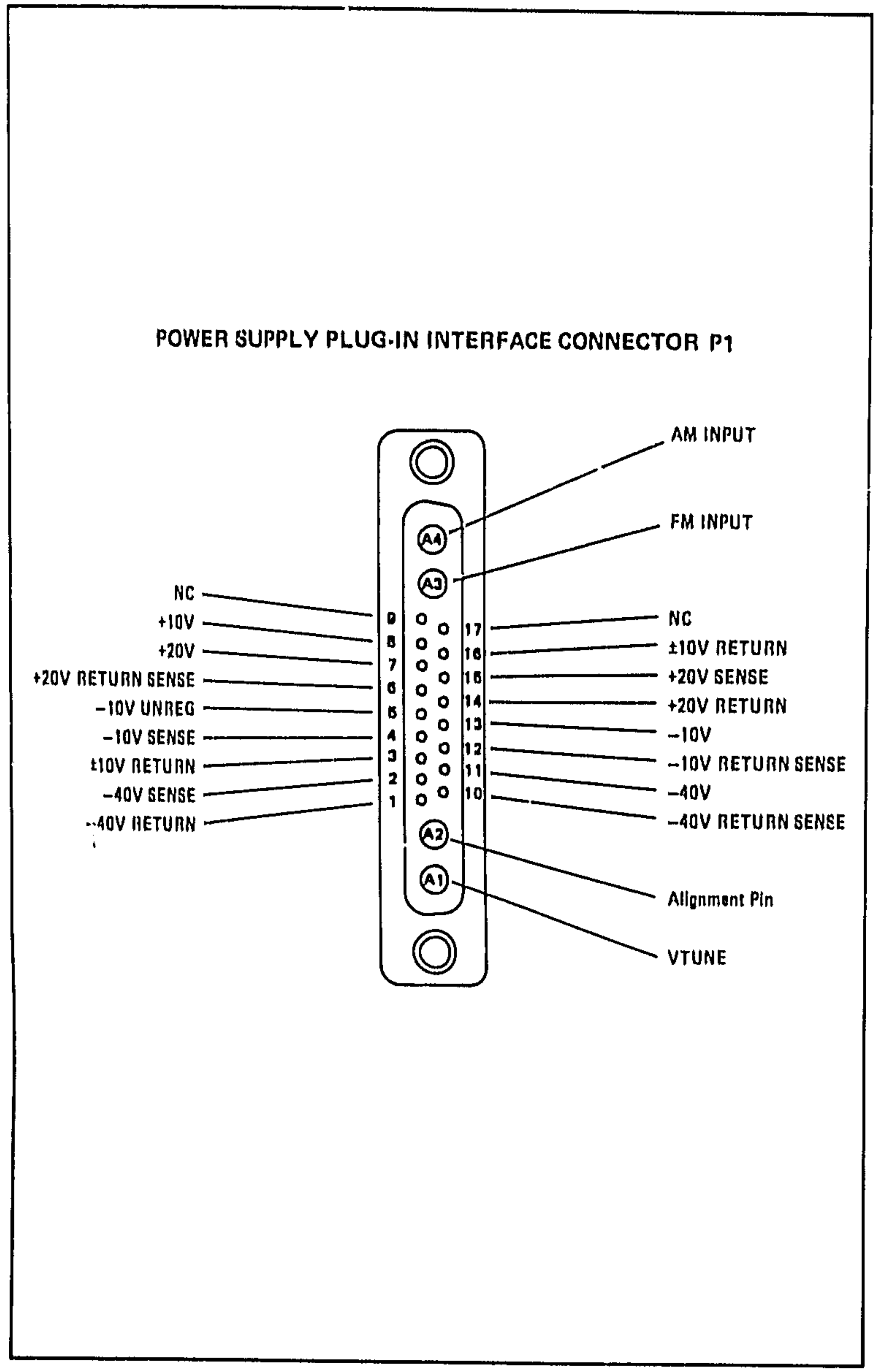


Figure 8-77. Interface Signals on Connector P1

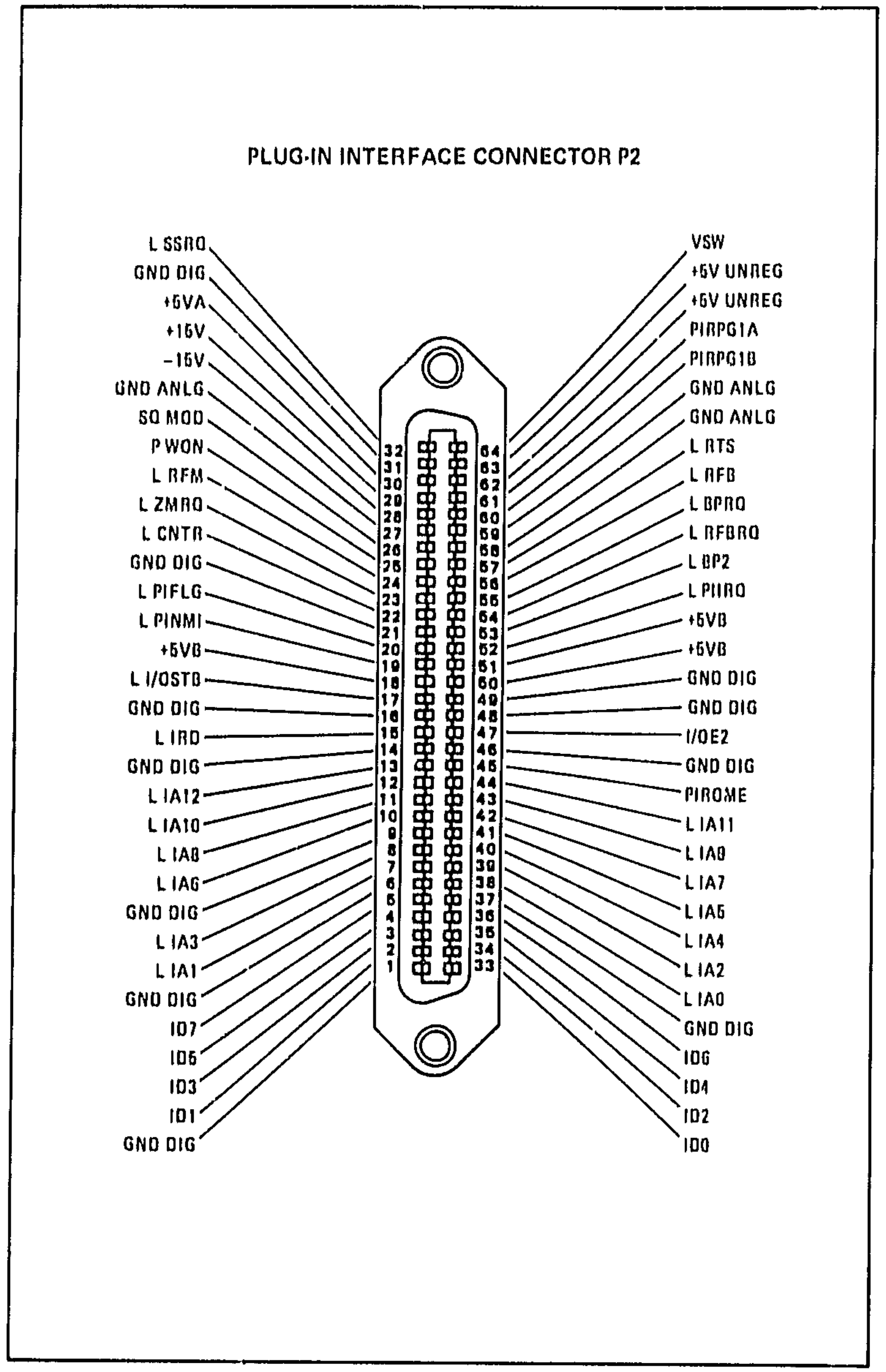


Figure 8-78. Interface Signals on Connector P2

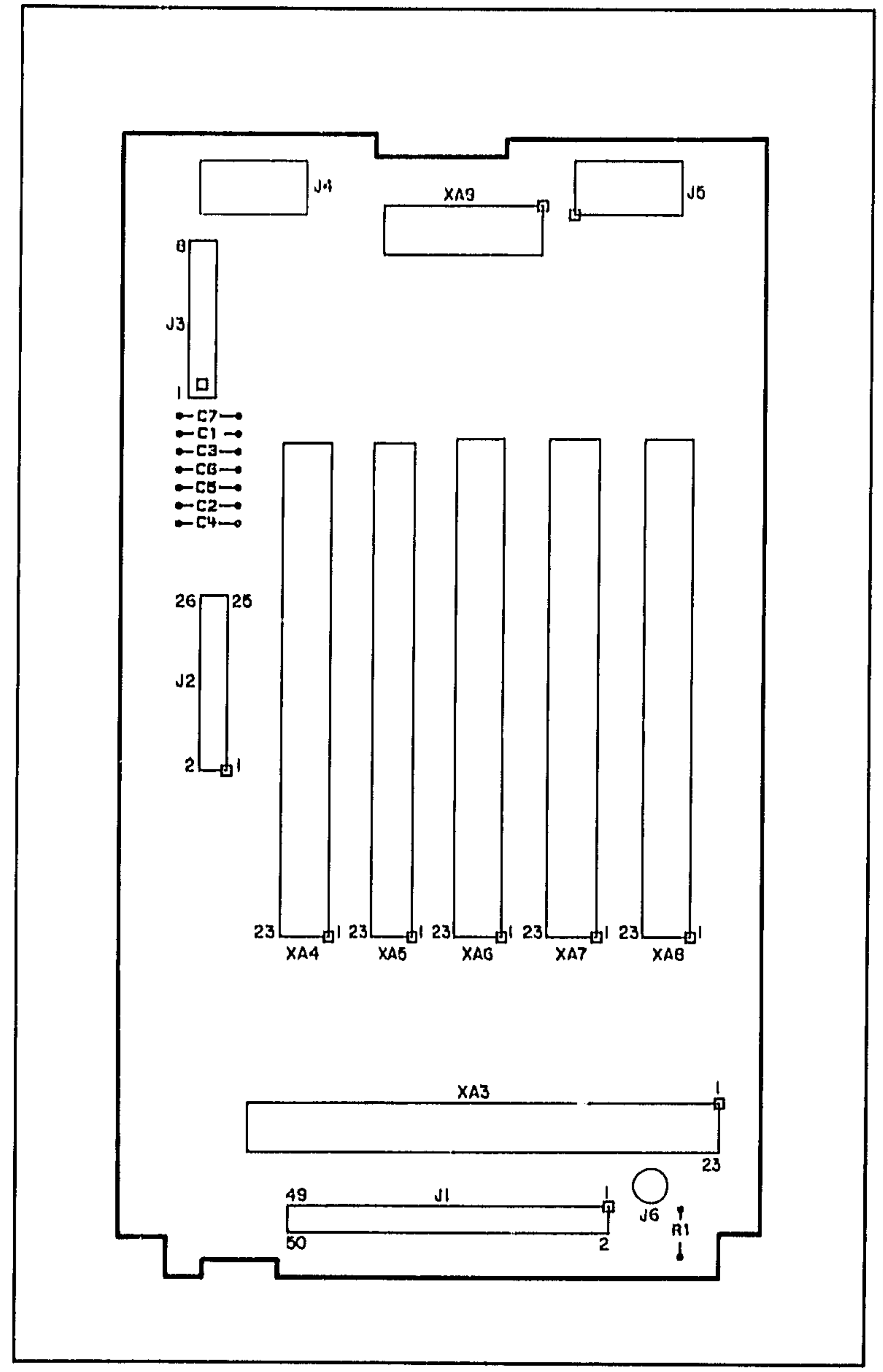


Figure 8-79. A10 Motherboard, Component Locations

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-In Interface P2	Dig Interface A3P1	Dig Interface A3J1	ALC A4P1	FM A5P1	Sweep Control A6P1	YTM A7P1	YO A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	YO/YTM Ribbon Cable A10 J5	RF Ribbon Cable A10J4	Miscellaneous
AM	P1-A4	Amplitude Modulation	A4-C				4											E2-C[1]
L AMP OFF	None	L=Amplifier Off (Not Used)																
BAND 0 AMP	A6P1-19	Band 0 RF Amplifier Enable							10								8 7	
BA0	A3P1-33	Buffered Addr 0			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							
BD0	A3P1-31	Buffered Data 0			31		31	31	31	31	31		6					
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					
L BPRQ	A6P1-2	L=Blanking Pulse Request							2									
L BP2	P2-53	L=Blanking Pulse		53	44	42			15					4				
BVTUNE	A6P1-42	Buffered Tune Voltage							42	25	25		49					
L CNTR	P2-22	L=Counter Trigger (Not Used)		22														
EXT DET	A10J6	External Leveling Input					23											J6-C[1]
EXT DET RET	A10J6	External Leveling Return					1											J6-S[2]
EXT CAL	A10J1-41	External Leveling Power Cal					24						41					
FLAG	A10J1-31	Front Panel Flag			42								31					
FM IN	P1–A3	Frequency Modulation Input	A3-C[1]						40									E3-C[1]
FM IN RET	P1-A3	Frequency Modulation Return	A3-S[2]						39, 41									E3-S[2]

[1] Coaxial Cable
[2] Shielded Cable
* Not used on this assembly

Table 8-15. 83590A 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	Sweep Control A6P1	YTM A7P1	YO A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	YO/YTM Ribbon Cable A10J5	RF Ribbon Cable A10J4	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 0 Freq Cal					26	24			23		37					
FREQ TRK V	A10J1-36	Freq Tracking Voltage											36					
HI FREQ FM	A5P1-21	YO FM Coil Drive						21										E6-C[1]
HI FREQ FM RET	A5P1-20,22	YO FM Coil Return						20,22										E6-S[2]
L IA0	P2-38	Instr Bus – Inv Addr 0		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												
ID0	P2-33	Instr Bus – Data 0		33		2												
ID1	P2-2	Instr Bus – Data 1		2		3												
ID2	P2-34	Instr Bus – Data 2		34		4												
ID 3	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
[2] Shielded Cable

Table 8-15. 83590A Motherboard Wiring List (2 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	Sweep Control A6P1	YTM A7P1	YO A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	YO/YTM Ribbon Cable A10J5	RF Ribbon Cable A10J4	Miscellaneous
L INS11	A3P1-8	L=Plug In Control			8		18	6	18									
L INS12	A3P1-20	L=Plug-In Control			20					18	18							
INT DET 0	J4-5	Band 0 RF Detector (NOT USED)					21											E4-C[1]
INT DET 1	CR1	Band 1 RF Detector					20											E6-C[1]
INT DET RET	CR1	Band 1 RF Detector Return					42											E6-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		20												
MOD 0	A4P1-44	Band 0 RF Modulation (NOT USED)					44											
MOD 1	A4P1-10	Bands 1 – 3 RF Modulation					10		6								16	
MOD DRIVE	A4P1-22	Modulator Drive (Not Used)					22											E1-C[1]
L PIFLG	A3A10J1-30	L=Plug-In Flag		20		30												
L PIIRQ	A3A10J1-40	L=Plug-In Interrupt Request		52		40												
L PINMI	(NC)	L=Plug-In Non-Maskable Interrupt		10														
PIN SW	A6P1-20	PIN Diode Switch for YTM							20							15		
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							26									E9-C[1]
L PULSE	A6P1-25	L=RF Pulse Mod					41		25									
PULSE MOD	A6P1-44	Pulse Modulation							44									
PWON	P2-25	Power On		25	22				5				20	7				E8
PWR REF	A4P1-3	Power Level Reference (Not Used)					3											
PWR SW/COMP	A5P1-23	Power Sweep, Level Compensation					5	23										
L RFB	P2-56	L=RF Blanking		56			28											
L RFBRQ	A6P1-24	L=RF Blanking Request		54										6				
L RFM	P2-24	L=RF Marker		24					24					2				
L RFON	A10J1-38	–10V=RF On, 0V=RF Off							40					5				
L RTS	P2-57	L=Retrace Strobe		57					1				38	8		6	14	

[1] Coaxial Cable
[2] Shielded Cable

Table 8-15. 83590A 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	Sweep Control A6P1	YTM A7P1	YO A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	YO/YTM Ribbon Cable A10J5	RF Ribbon Cable A10J4	Miscellaneous
SCAN CLK	A3P1-38	F.P. Scan Clock			38								27					
L SIRQ	A6P1-3	L=Sweep Interrupt Request			18				3									
SQ MOD	P2-26	Square Modulation (27.8,1.0 kHz)		26			40							9				
SRD BIAS	A6P1-22	Step Recovery Diode Bias							22							14		
L SSRQ	A6P1-23	L=Stop Sweep Request		32					23	5	5			21				
UNL LMP EN	A6P1-16	Unleveled Lamp Enable							16				4					
L UNLVL	A4P1-2	L=Unleveled					2		4				12					
VSW	P2-64	Sweep Voltage		64				25						22				
VTUNE	P1-A1	Tune Voltage	A1-C[1]						20									E7-C[1]
VTUNE RET	P1-A1	Tune Voltage Return	A1-S[2]						21									E7-S[2]
YO BASE	A8P1-21	YO Current Drive Control									21	1						
YO COIL	A8P1-22	YO Coil Current									22	4				4,11		
YO COLLECTOR	A8P1-20	YO Ref Resistor Sense									20	2						
YO LO FM	A5P1-2	YO Low Freq FM (Main Coil)						2			1							
YTM BASE	A7P1-21	YTM Current Drive Control								21		9						
YTM COIL	A7P1-22	YTM Coil Current								22		8				8		
YTM COLLECTOR	A7P1-20	YTM Ref Resistor Sense								20		10						
YTM DRIVE V	A7P1-23	YTM Drive Voltage								23			39					
YTM LO FM	A5P1-1	YTM Low Frequency FM						1		1								
1V/GHz	A10J1-50	1V per GHz Output											50	23				J4 (BNC)
−10V REF	A8P1-3	−10V Reference Voltage					43		39	3	3							
+20V FREQ REF	A8P1-5	+20V Frequency Reference Sense								44	44	5						

[1] Coaxial Cable
[2] Shielded Cable
* Not used on this assembly

Table 8-15. 83590A Motherboard Wiring List (4 of 5)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-In Interface P2	Dig Intfc A3P1	Dig Intfc A3J1	ALC A4P1	FM A5P1	Sweep Control A6P1	YTM A7P1	YO A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-In Interface A10J2	Power Supply Interface A10J3	YO/YTM Ribbon Cable A10J5	RF Ribbon Cable A10J4	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	3,11	42		3 6	3,9	2,10	C7
+15V	P2-29	+15V Regulated		29			38	38	38	38	38			15				C6
+10V +/−10V RET	P1-8 P1-3	+10V Regulated +/−10V Return	8 3				7	7	7	7	7		46		2		15	C5
+5V +5VA +5VB +5V REG +5V UNREG	A3P1-6,7 P2-30 P2-18,50,61 A9P1-7 P2-63	+5V Internal for RF Plug-In +5V for 8350A +5V for RF Plug-In +5V Regulated +5V Unregulated		 30 18,50,61 63	6,7	 35,36,38	27	27	27	27	27	 7 12	2	 18,20		 7	 3,11	 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		6	10	5	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				7	12,16	6	C1
GND ANLG	W28P1-8 P2-27,58,59	Analog Ground					15,37	15,37	37,41 43	15,19, 24,26, 29 37	15,19, 24,26, 29,37	6	48	10,11, 12,24	8	1,2 13	1,9	C1-C7, R1
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		8,30	8,30	8,30	8,30	8,30		8					R1
GND SENSE	W28P1-4	Analog Ground Sense													4			

1 Coaxial Cable
2 Shielded Cable
* Not used on this assembly

Table 8-15. 83590A Motherboard Wiring List (5 of 5)

Table 8-16. HP 83590A Cable List (1 of 2)

Table 8-16. HP 83590A Cable List (2 of 2)

Cable	Description	Connections	
W1	Cable Assembly, Rigid, RF, RF Out	DC2 J1	Directional Coupler Front Panel RF Output (Type N)
W2	Cable Assembly, Coax, Blue	J2 A10J6	Front Panel EXT/MTR ALC Input Motherboard
W3	Cable Assembly, Ribbon, Front Panel	A10J1 A2J1	Motherboard Front Panel
W4	Cable Assembly, Ribbon, RF Section	A10J4 A12 A13	Motherboard YTM YO
W5	Cable Assembly, Coax, White, Pulse In	J4 A10E9	Rear Panel BNC (Pulse In) Motherboard
W6	Cable Assembly, Coax, Red, Pulse Mod	A10E8 A16	Motherboard Modulator/Coupler
W7	Cable Assembly, Coax, Orange, Vtune	P1-A1 A10E7	Rear Panel Interface Motherboard
W8	Cable Assembly, Coax, Gray	CR1 A10E6	Detector (Bands 1-3) Motherboard
W9	Cable Assembly, Coax, Blue, FM	A10E5 A12A1J2	Motherboard YO (FM Coil)
W10	Not Assigned		
W11	Cable Assembly, Coax, Green, FM In	A10E3	Motherboard
W12	Cable Assembly, Coax, Brown, AM In	P1-A4 A10E2	Rear Panel Interface Motherboard
W13	Cable Assembly, Coax, Yellow, Mod 1	A10E1 A16	Motherboard Modulator/Coupler
W14	Cable Assembly, Ribbon, RF Section	A10J5 A14A1J1	Motherboard Power Amplifier (2.0 – 20.0 GHz)
W15	Cable Assembly, Rigid, RF	A12 DC2	YTM Directional Coupler
W16	Cable Assembly, Rigid, RF	AT1 A12	Isolator YTM
W17	Cable Assembly, Rigid, RF	A14 AT1	Power Amplifier (2.0 – 20.0 GHz) Isolator
W18	Not Assigned		
W19	Not Assigned		
W20	Cable Assembly, Rigid, RF	A16 A14	Modulator/Coupler Power Amplifier (2.0 – 20.0 GHz)
W21	Not Assigned		
W22	Not Assigned		
W23	Not Assigned		
W24	Not Assigned		
W25	Cable Assembly, Rigid, RF	A13 A16	YO Modulator/Coupler
W26	Cable Assembly, Rigid, RF	A16 J3	Modulator/Coupler Rear Panel Type N (AUX OUTPUT)
W27	Not Assigned		
W28	Cable Assembly, Power Supply	P1 A10J3	Rear Panel Interface Motherboard
W29	Cable Assembly, Ribbon	P2 A3J3 A10J2 J5	Rear Panel Interface Digital Interface Board Motherboard Rear Panel BNC (1V/GHz Output)

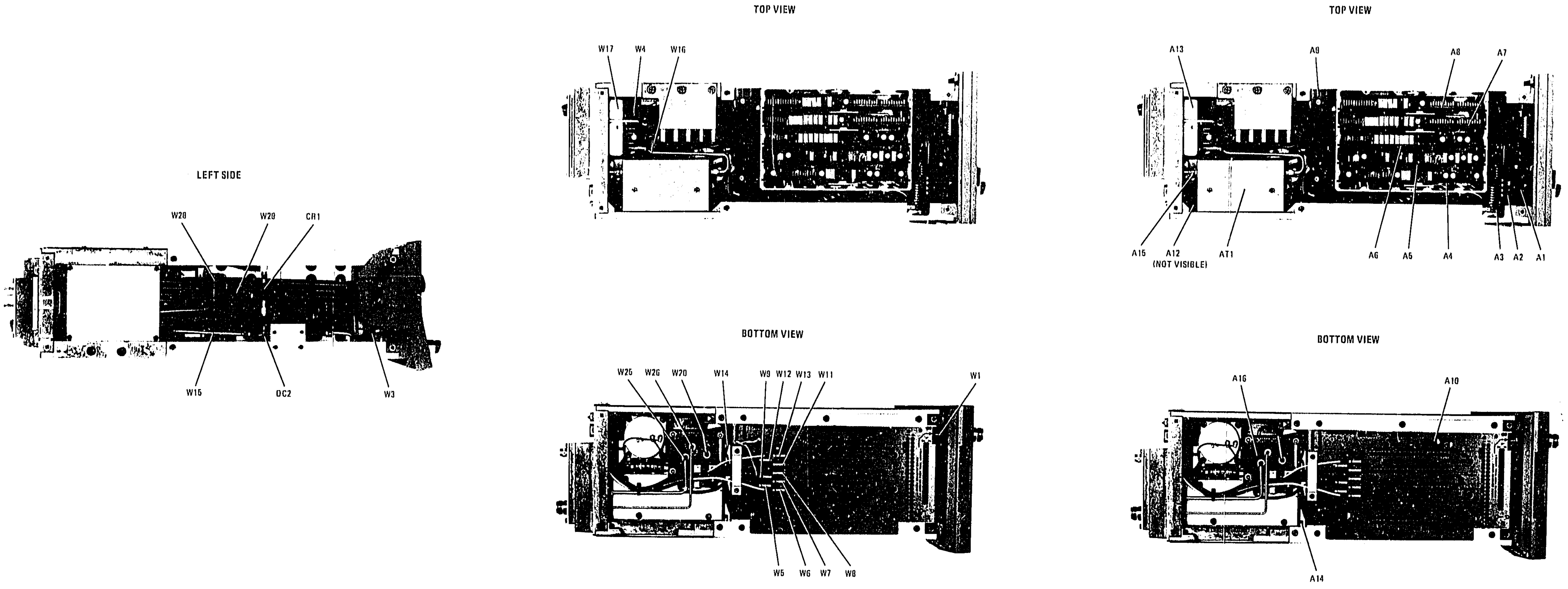


Figure 8-80. Major Assembly Location

MANUAL CHANGES

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 83590A
Date Printed: February 1982
Part Number: 83590-90005

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 12, 1986

HEWLETT PACKARD

Printed in U.S.A.

▶ – NEW ITEM

HP 83590A

Serial Prefix or Number	Make Manual Changes
2216A	1
2217A	1, 2
2221A	1 – 3
2233A	1 – 4
2234A	1 – 5
2249A	1 – 6
2252A	1 – 7
2306A	1 – 8
2313A	1 – 9
2315A	1 – 10
2338A	2 – 11
2410A	2 – 7, 9 – 12

Serial Prefix or Number	Make Manual Changes
2411A	2, 3, 5 9 – 14
2412A	2, 3, 5, 9, 11 – 15
2413A	2, 3, 5, 9, 11 – 16
2428A	2, 3, 5, 9, 11 – 17
2451A	2, 3, 5, 9, 11 – 18
2502A	2, 3, 5, 9, 11 – 19
2507A	2, 3, 5, 9, 11 – 20
2519A	2, 3, 5, 9, 11, 13 – 21
2543A	2, 3, 5, 9, 11, 13 – 22
2602A	2, 3, 5, 9, 13 – 23
2619A	2, 3, 5, 9, 13 – 24
▶ 2645A	2, 3, 5, 9, 13 – 25

▶ – NEW ITEM

Numbered Changes Index

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2216A	1	A2	83590-60060	Replaceable Parts Service
2217A	2	N/A	N/A	Replaceable Parts
2221A	3	A1, A16	N/A	Replaceable Parts
2233A	4	A4	N/A	Replaceable Parts
2234A	5	A16	5086-7395	Replaceable Parts
2249A	6	A4	N/A	Replaceable Parts Service
2252A	7	A4	N/A	Replaceable Parts Service
2306A	8	A6	N/A	Replaceable Parts Service
2313A	9	N/A	N/A	General Information
2315A	10	A3	83590-60073	Replaceable Parts Service
2338A	11	A2	83590-60072	Replaceable Parts Service
2410A	12	A6	83590-60091	Replaceable Parts Service
2411A	13 and 14	N/A A4	N/A 83590-60077	General Information Operation Performance Tests Adjustments Replaceable Parts Service
2412A	15	A3	83525-60080	Replaceable Parts Service
2413A	16	A2 and A7	N/A 83595-60068	Replaceable Parts Service
2428A	17	A3	N/A	Replaceable Parts

▶ = NEW ITEM

Numbered Changes Index

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2451A	18	A7	N/A	Replaceable Parts Service
2502A	19	A10	83595-60078	Replaceable Parts Service
2507A	20	A14	83592-60113	Replaceable Parts Service
2519A	21	A6	83590-60106	Replaceable Parts Service
2543A	22	Mechanical Parts	N/A	Replaceable Parts
2602A	23	A2	83590-60122	General Information Installation Operation Adjustments Replaceable Parts Service
2619A	24	A8	83595-60070	Adjustments Replaceable Parts Service
▶ 2645A	25	A4	83590-60098	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

Title Page:
Delete Option 005.

Page 1-1:
After paragraph 1-8 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 83590A

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 1-2, Table 1-1:
Delete all references to Stability with Time (in a 10-minute period after one-hour warmup).

Page 1-5, Table 1-2:
Add STABILITY WITH TIME (in a 10-minute period after one hour warmup at the same frequency setting):

2.0 to 7.0: $< \pm 100$ kHz
7.0 to 13.5: $< \pm 200$ kHz
13.5 to 20.0: $< \pm 300$ kHz
2.0 to 20.0: $< \pm 300$ kHz

Page 1-6, Table 1-2:
Change the PULSE IN characteristics as follows:

Pulse In (2.0 to 20.0 GHz)
TTL compatible: Logic high = RF on, Logic low = RF off
Squarewave modulation up to 30 kHz (absolute error for 8755 compatibility up to 2 dB, typically 1 dB)
Rise/Fall Time:
Unleveled: Rise Time 5 μs
Fall Time 5μs
Leveled: Rise Time 7 μs
Settling Time 7 μs
Fall Time 5 μs

Page 1-8:
Delete Paragraphs 1-29 and 1-30.

UPDATES (Cont'd)

Page 4-2, Section 4-13:
Change the specification for CW Mode (13.5 to 20.0) to ± 10 MHz.

Page 4-10, Paragraph 4-15, SPECIFICATION:
Delete all references to Stability with Time (in a 10-minute period after one hour warmup).

Page 4-12, Paragraph 4-15:
Delete Frequency Change with Time (10 minutes).
Delete steps 6 through 8.
Delete Table 4-8.

Page 4-16, Table 4-11:
Change Residual FM tolerances to: 5 kHz, 7 kHz, 9 kHz.

Page 4-30, Table 4-16, Section 4-13:
Change 13.5 to 20 GHz Accuracy to ± 10 MHz.
Change lower and upper limits at 17.0 GHz to 16.99, 17.010.
Change lower and upper limits at 14.0 GHz to 13.99, 14.010.
Change lower and upper limits at 20.0 GHz to 19.99, 20.010.

Page 4-35, Table 4-16, Section 4-15:
Delete all references to time (10 minutes) specifications.

Page 5-21, Paragraph 5-17:
Add [INSTR PRESET] before [RECALL] in step 9.
Add [INSTR PRESSET] before [RECALL] in step 14.
After step 15, add the following:
16. On the 83540A/B press [INSTR PRESET] [CW] [5] [0] [MHz]. While observing the frequency counter display, adjust the 83590A FREQ CAL control for 50 MHz.

Page 5-29, Paragraph 5-20:
Replace Paragraph 5-20 on pages 5-29 through 5-32 with **5-20. SLOW SWEEP SYTM TO YO TRACKING (UPDATES)** contained in this document.

Page 5-33, Paragraph 5-21:
Replace Paragraph 5-21 on pages 5-33 through 5-37 with **5-21. SRD BIAS (UPDATES)** contained in this document.

Page 5-51, Paragraph 5-28:
Replace Paragraph 5-28 on pages 5-51 through 5-54 with **5-28. ALC GAIN ADJUSTMENT (UPDATES)** contained in this document.

UPDATES (Cont'd)

Page 6-2, Paragraph 6-17:

Add the following after paragraph 6-17:

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	Switched YTM	Yes	Yes
A13	YO 2.3 - 6.7 GHz	Yes	Yes
[illegible]	2 - 7 GHz Power Amp	Yes	Yes
A1[illegible]	Mod/Coupler	Yes	No

Page 6-2, Table 6-1:

Change A12 New Part Number to 83592-60065, Rebuilt Part Number to 83592-60066, Description to Switched YTM Kit.

Change A13 New Part Number to 83590-60066, Rebuilt Part Number to 83590-60067, Description to YO 2.0 to 7.0 GHz Kit.

Add A19, New Part Number 83592-60123, Rebuilt Part Number 83592-60124, Description 70dB ATTENUATOR (OPT. 002).

Page 6-5, Table 6-3:

Change A1RPG1 to HP and Mfr. Part Number 0960-0683, CD 3 (recommended replacement).

Change A2J1 to HP and Mfr. Part Number 1251-5926, CD 3 (recommended replacement).

Page 6-6, Table 6-3:

Change A2R1 to: 2100-3103, CD 5, RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN, 04568, 889PR10K.

Change A2U9 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).

Change A3 to HP and Mfr. Part Number 83525-60030, CD 6, DIGITAL INTERFACE ASSEMBLY (does not include A3U1 and A3U2).

Change A3J1 to HP and Mfr. Part Number 1251-5926, CD 3 (recommended replacement).

Change A3U1 and A3U2 to A3U1/A3U2 (not separately replaceable), HP and Mfr. Part Number 83590-60074, CD 7, EPROM Replacement Kit (recommended replacement).

Change A3U5 to HP and Mfr. Part Number 1820-3093, CD 8 (recommended replacement).

Page 6-7, Table 6-3:

Add A3XU1 and A3XU2, HP and Mfr. Part Number 1200-0541, CD 1, SOCKET-IC 24-CONT DIP-SLDR (recommended addition).

UPDATES (Cont'd)

Page 6-9, Table 6-3:
Change A4U1 to HP and Mfr. Part Number 1826-1058.
Change A4U2 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A4U9 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A4VR4 to Part Number 1902-0111, CD 9, DIODE-ZNR 1N753A 6.2V 5% DO-7 PD = .4W (recommended replacement).

Page 6-14, Table 6-3:
Change A6U10 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A6U11 to HP and Mfr. Part Number 1826-1186 (recommended replacement).

Page 6-16, Table 6-3:
Change A7U19 to HP and Mfr. Part Number 1826-1349, CD 5 (recommended replacement).

Page 6-19, Table 6-3:
Change A12 to HP and Mfr. Part Number 83592-60065, CD 8, SWITCHED YIG TUNED MULTIPLIER KIT.
Change A12 to HP and Mfr. Part Number 83592-60066, CD 9, EXCHANGE 83592-60065 SWITCHED YTM KIT.
Change A13 to HP and Mfr. Part Number 83590-60066, CD 7, OSCILLATOR 2.0-7.0 GHz KIT.
Change A13 to HP and Mfr. Part Number 83590-60067, CD 8, EXCHANGE 83590-60066 OSC. KIT.
Delete A13A1C2 (recommended deletion).

Page 6-21, Table 6-3:
Change A16 to HP and Mfr. Part Number 5086-7395, CD 7 (recommended replacement).
Change J1 to HP and Mfr. Part Number 5061-5304, CD 2, CONNECTOR ASSY TYPE-N APC-7 DC BLOCK (recommended replacement).
Change J3 to HP and Mfr. Part Number 5061-5386, CD 0 (recommended replacement).
Delete MP6, KEY CAP-JADE GRAY.
Add E3, HP and Mfr. Part Number0960-0055, CD 1, CONNECTOR AND WIRE: RF SHORT.
Change MP3 to HP and Mfr. Part Number 83522-20028, CD 5.

Page 6-22, Table 6-3:
Change W13 to HP Part Number 83592-60014, CD 7.
Under Option 002, Option 004, and Option 002 and 004, change both HP and Mfr. Number of W8 to 83592-60012, CD 5.
Under OPT. 002 change the following item:
A19 HP and Mfr. Part Number 83592-60123, CD 9, EXCHANGE ATTENUATOR 70 dB (OPT. 002 ONLY).
Under OPT. 004change the following items:
MP1 to HP and Mfr. Part Number 83592-20062, CD 1.
W32 to HP and Mfr. Part Number 83590-20024, CD 3.
Under OPT. 002 and 004 change the following items:
A19 to HP and Mfr. Part Number 83592-60123, CD 9.
MP2 to HP and Mfr. Part Number 83592-20063, CD 2.
W33 to HP and Mfr. Part Number 83590-20025, CD 4.
Since OPT. 005 is no longer available, delete all references to OPT. 005 and combinations with other options. Specifically, delete titles and parts references associated with OPTION 005, OPTION 002 and 005, OPTION 004 and 005, and OPTION 002, 004, and 005.

Page 6-24, Figure 6-1:
Delete MP 6.

Page 8-31, Figure 8-18 (A1/A2 Schematic):
Change A2R1 to 10K.

Page 8-57, Figure 8-44:
Change the designation of the resistor between U19 and U20 to R32.

UPDATES (Cont'd)

Page 8-69, Figure 8-17:
In Block **E DELAY COMPENSATION** change the value of R17 to 287K.

Page 8-73, Figure 8-73:
Delete A13A1C2 from the component locations diagram (recommended deletion).

Page 8-75, Figure 8-76:
Delete A13A1C2 (recommended deletion).
On the male connector to the left of J2, draw a connecting line from the center conductor to the outer conductor (a short) and label E3.

5-20. SLOW SWEEP SYTM TO YO TRACKING (UPDATES)

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6 and A7

DESCRIPTION:

To obtain optimum output power, the Switched Yittrium-Iron-Garnet tuned multiplier (SYTM) passband peaking should track the output of the Yittrium-Iron-Garnet Oscillator (YO). The 83590A is set to sweep Bands 2 and 3 (7 to 20 GHz), and the Automatic Leveling Control (ALC) loop is opened by selecting the External (EXT) ALC MODE. The Step Recovery Diode (SRD) Bias for the SYTM is preset and will be adjusted in Paragraph 5-21. Special calibration modes are used for this procedure (SHIFT 92 for OFFSET and SHIFT 93 for GAIN of the frequency sweep). The output power is peaked for each calibration mode, and the appropriate calibration constant is entered into the calibration switches. A7S1 stores the OFF-SET constant, and A7S2 stores the GAIN constant.

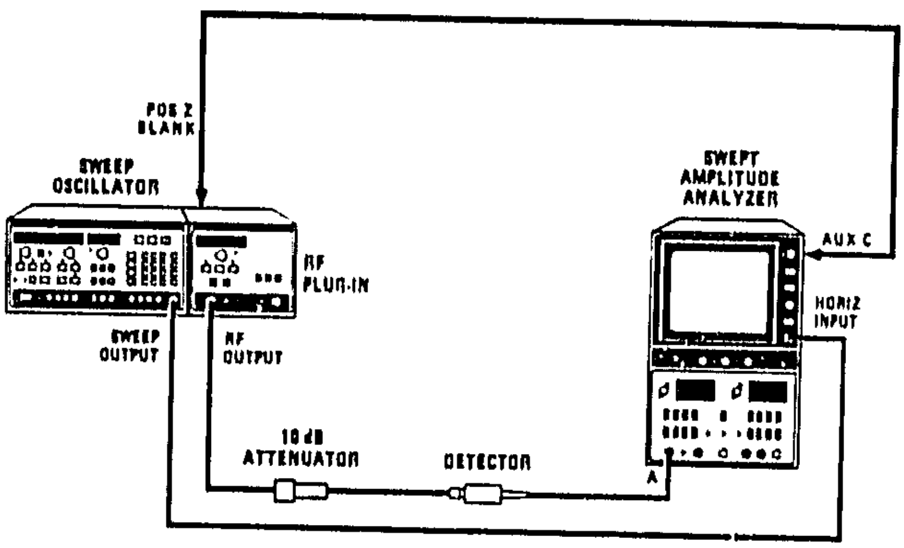


Figure 5-17. Slow Sweep SYTM to YO Tracking Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664B
10 dB Attenuator	Weinschel Model M9-10
Sweep Oscillator	HP 8350A/B

5-20. SLOW SWEEP SYTM TO YO TRACKING (UPDATES) (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3J1 is set to the factory-set position. Refer to Table 5-6.

NOTE

During this adjustment, a localized drop in power may occur. This drop in power is due to the SRD being over biased and is called squegging. If squegging occurs in Band 2, adjust A6R68 and R73 to eliminate the squegging and to maximize power across the band. If squegging occurs in Band 3, adjust A6R69 and R74.

1. Connect the equipment as shown in Figure 5-17. Allow the equipment to warm up for one hour.
2. On the 8350A/B, press [INSTR PRESET] [START] [7] [GHz] [SWEEP TIME] [2] [0] [0] [ms] [⊔⊓ MOD]. On the 83590A press [EXT ALC MODE]. The unleveled lamp light should be lit.
3. Preset A6R78 (T) one quarter turn from full clockwise position.
4. Select 5 dB/DIV display resolution on the 8755C and center the display.
5. On the 8350A/B, press [SHIFT] [9] [2] to enable the SYTM OFFSET DAC sub-routine. Using the 83590A POWER control, peak the power in the beginning of Band 2.
6. On the 8350A/B, press [SHIFT] [9] [3] to enable the SYTM GAIN DAC sub-routine. Using the 83590A POWER control, peak the power at the end of Band 3. Maximum peaking occurs when the power at the high end of Band 3 has been optimized without the power in other bands dropping out.
7. Iterate between steps 5 and 6. SHIFT 92/93 are interactive so the adjustments must be alternated until the best compromise is found.
8. Press [SHIFT] [9] [2]. Set A7S1 to the Hex-code on the plug-in display. Press [SHIFT] [9] [3]. Set A7S2 to the Hex-code on the plug-in display.
9. Press [INSTR PRESET] on the 8350A/B so that the new calibration data will be entered from the current switch settings.
10. On the 8350A/B, press [STOP] [7] [GHz] [⊔⊓ MOD] [SWEEP TIME] [4] [0] [0] [ms]. On the 83590A, press [EXT ALC MODE].
11. Adjust A7R51 (B1 OFS) to maximize the minimum power points of the Band 1 displayed trace.

5-21. SRD BIAS (UPDATES)

REFERENCE:

Performance Test: Paragraphs 4-17, 4-19
Service Sheet A4 and A6

DESCRIPTION:

The High Power SRD Bias is set by peaking the 8755C displayed trace with A6R68 (2H) and A6R73 (2L) in Band 2, A6R69 (3H) and A6R74 (3L) in Band 3.

The Low and Mid Power SRD Bias is adjusted by inserting a voltage through a 511 ohm current-limiting resistor to directly bias the Modulator/Splitter. With the 83590A at maximum RF output, the power supply voltage is increased (minimum voltage 0.5 Vdc, maximum voltage 5.0 Vdc) to set the RF output power just above the 8755C noise floor. Then A6R63 (3HL) is adjusted until minimum slope is obtained on the oscilloscope display. The voltage from the power supply is decreased until the lowest part of the trace, on the 8755C display, is 10 dB above the noise floor. Then A6R12 (C) is adjusted to peak the power in Bands 2 and 3. The power supply is then removed.

The 8750A is used to normalize system errors so an accurate measurement of the SYTM fundamental feedthrough can be made. A low pass filter is then inserted before the detected 8755C input. A comparison between the normalized and low pass inputs are made to determine the SYTM fundamental feedthrough.

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detectors (2)	HP 11664A
6 dB Attenuator	HP Weinschel Model M9-6
10 dB Attenuator	HP Weinschel Model M9-10
20 dB Attenuator	HP Weinschel Model M9-20
Directional Coupler	HP 0955-0125
Power Supply	HP 6214A
Low Pass Filter (6.8 GHz)	HP 11684A
Storage Normalizer	HP 8750A
Oscilloscope	HP 1740A
Extender Board	HP 08350-60031
Sweep Oscillator	HP 8350A/B
511 ohm Resistor	HP 0757-0416

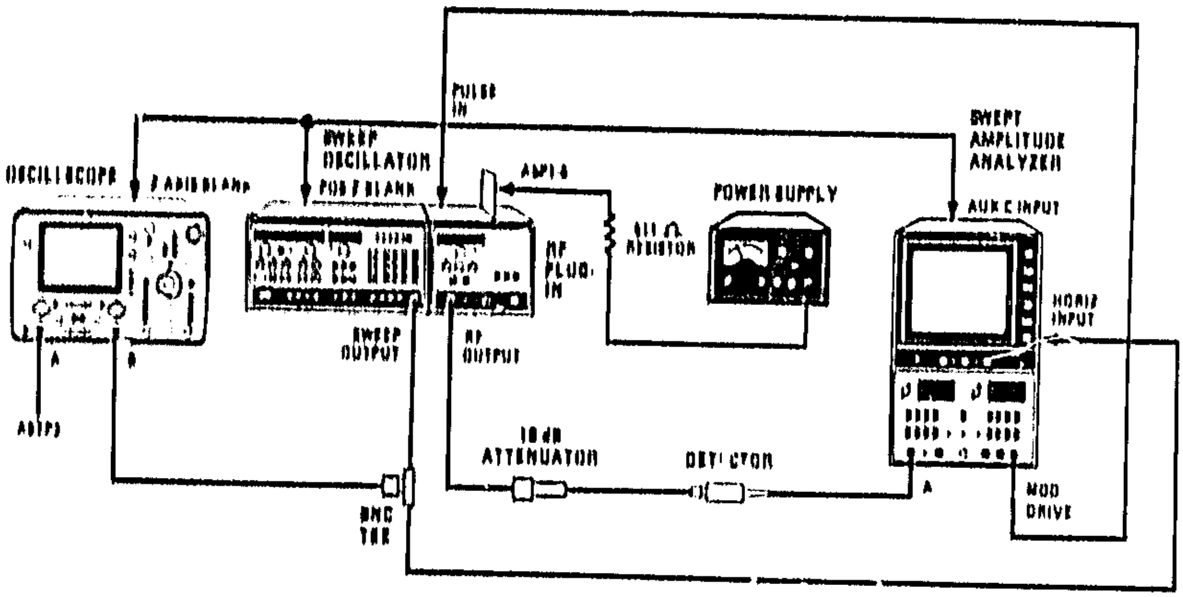
PROCEDURE:

NOTE

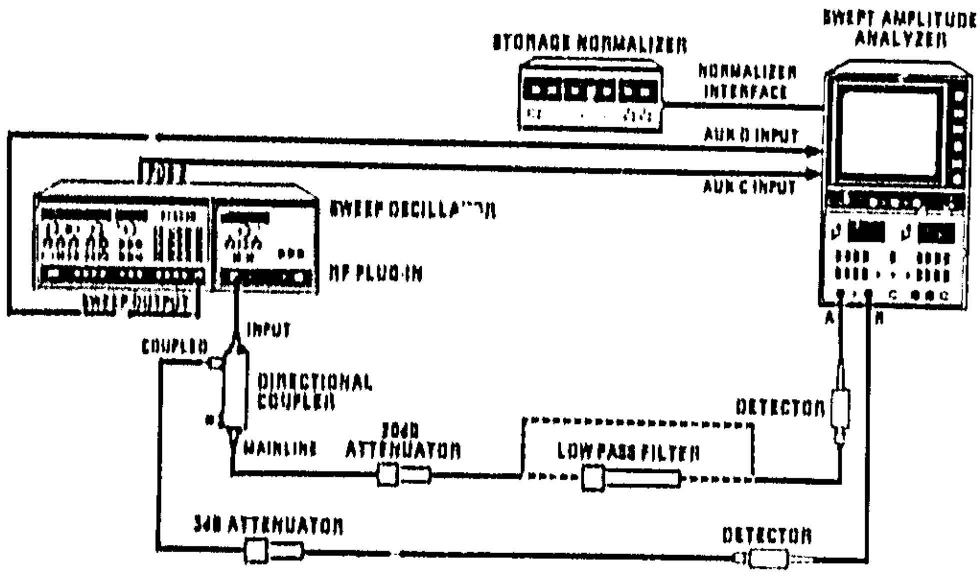
Turn the 8350A/B LINE power OFF when removing or installing PC boards.

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

5-21. SRD BIAS (UPDATES) (Cont'd)



a) Low and Mid Power Test Setup



b) YTM Fundamental Feedthrough Test Setup

Figure 5-21. SRD Bias Adjustment Test Setups

5-21. SRD BIAS (UPDATES) (Cont'd)

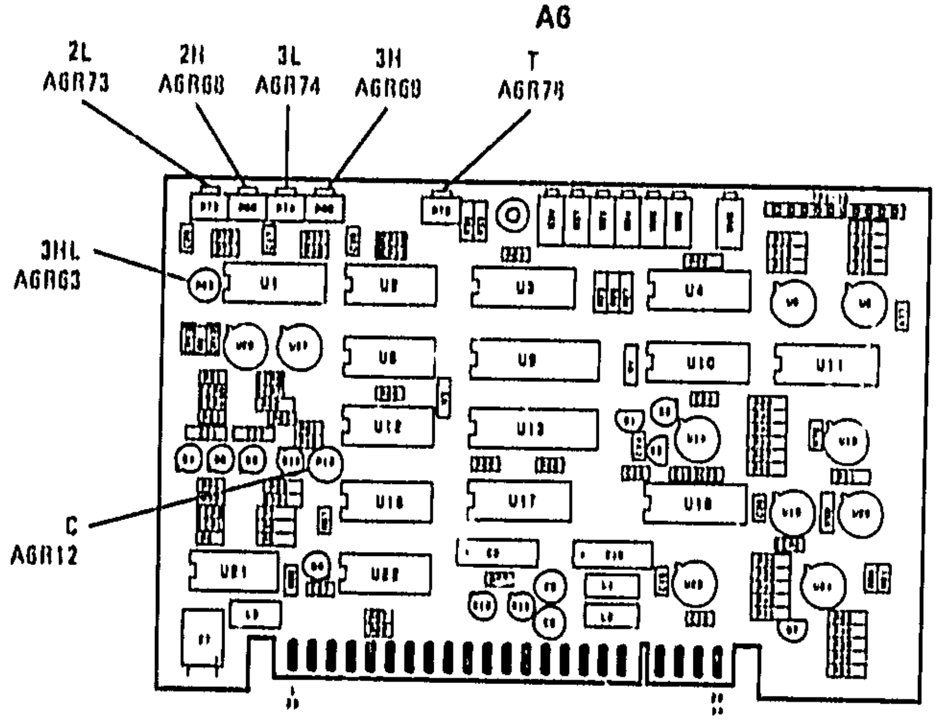


Figure 5-22. SRD Bias Adjustment Locations

High Power SRD Bias

1. Connect the equipment as shown in Figure 5-21a with the 83590A A6 Sweep Control board on an extender. Do not connect the power supply. With the LINE power OFF, remove the 83590A A4 ALC board. Connect the 8755C MODULATOR DRIVE output to the 83590A rear panel PULSE IN connector.

2. Allow the equipment to warm up for one hour.

3. On the 8350A/B press **[INSTR PRESET] [START] [6] [.] [9] [GHz] [STOP] [1] [3] [.] [5] [GHz] [SWEEP TIME] [4] [0] [0] [ms]**. On the 83590A select the **[EXT ALC MODE]**.

4. Set the 8755C display resolution for 5 dB/DIV and center the display.

5. Set up a zero volt reference on the ocilloscope.

NOTE

BEFORE beginning each adjustment, preset the potentiometer to the point where one side of the trace on the oscilloscope display is below zero volts. Adjustment locations labeled 2L and 3L set the left side of the displayed trace. Adjustment locations labeled 2H and 3H set the right side of the displayed trace. DO NOT preset more than one potentiometer at a time.

6. Observe the 8755C display, adjust A6R73 (2L) to peak the power at the low end of Band 2 without the power squegging. Then adjust A6R78 (2H) to peak the rest of the band. Iterate between (2L) and (2H) to peak the power across the band without any squegging.

7. On the 8350A/B press **[START] [1] [3] [.] [4] [GHz] [STOP] [2] [0] [GHz]**. Adjust A6R74 (3L) for the low end of Band 3 and A6R69 (3H) for the rest of the band to peak the power without squegging.

5-21. SRD BIAS (UPDATES) (Cont'd)

8. Check the SYTM to YO tracking to ensure it has not changed (refer to Paragraph 5-20). If retracking is necessary, repeat the steps above to eliminate any squegging that may have occurred.

Low and Mid Power SRD Bias

CAUTION

The voltage connected to A6P1-6 is to bias the Modulator/Splitter directly. If A6P1-7 (+10Vdc supply) is shorted to A6P1-6, the Modulator/Splitter will be damaged.

9. Set up the equipment as shown in Figure 5-21a, with a 511 ohm resistor connected to A6P1-6 (reference to ground). Remove the 83590A A4 ALC board. Connect the 8755C Swept Amplitude Analyzer MODULATOR DRIVE output to the 83590A rear-panel PULSE IN connector.
10. Allow the equipment to warm up for one hour.
11. On the 8350A/B, press **[INSTR PRESET] [SWEEP TIME] [2] [0] [0] [ms] [START] [7] [GHZ]**. Set the power on the 83590A to 20dB.
12. Set the 8755C display resolution for 10 dB/DIV and adjust the display to the top graticule. On the 1740A Oscilloscope, select A vs B, set Channel A to .5 B/DIV, set Channel B to 1 V/DIV, and DC-couple Channels A and B.
13. Set the 6214A voltage to .5 Vdc. Increase the voltage until the highest power point is 10 dB above the noise floor (**DO NOT EXCEED 5 Vdc**).
14. Monitor A6TP3 with the oscilloscope and adjust A6R63 until minimum slope (flat display) is obtained.
15. Decrease the 6214A voltage until the power at the lowest point between 6.9 and 20 GHz is 10 dB above the noise floor.
16. Set A6R12 (C) to a centered position and then adjust to peak the power between 6.9 and 20 GHz. Using the voltage source, keep the RF power at or near 10dB above the noise floor, then repeak A6R12 (C). If the power of the sweep drops at any frequency, maximum peaking has been exceeded.
17. Repeat step 14 to verify baseline flatness, readjust A6R63 as needed.

Threshold

NOTE

For this adjustment to be accurate, the attenuator must be in the 0.0dB step. (Opt 002 only)

18. On the 8350A/B press **[INSTR PRESET]**. Set the power level on the 83590A to −5dB.
19. Observe the 8755C with a 1dB/DIV reference. Preset A6R78 (T) clockwise then adjust A6R78 (T) counter-clockwise until squegging and/or oscillations are eliminated.
20. Observe the 8755C trace, increase power slowly to maximum specified power out. If squegging or oscillations reoccur, readjust A6R78 (T) in small increments. If excessive adjustment of A6R78 (T) is required, the SRD bias may be misadjusted.

5-21. SRD BIAS (UPDATES) (Cont'd)

SYTM Fundamental Feedthrough

21. Set up the equipment as shown in Figure 5-21b without the Low Pass Filter, and with the 83590A A4 ALC board installed.
22. Allow the equipment to warm up for one hour.
23. On the 8350A/B, press **[INSTR PRESET] [START] [8] [GHz] [SWEEP TIME] [2] [0] [0] [ms] [⊔⊓ MOD]**.
24. On the 8755C, select A/R DISPLAY and 5 dB/DIV. Center the display.
25. On the 8750A, press **[SELECT CH 1]**, and **[DISPLAY STORE INPUT]**. The display now shows the system error between Channel A and Channel R.
26. Press **[REFERENCE MEMORY STORE]** and then **[DISPLAY INPUT-MEM]**. The trace on the 8755C should be flat, showing that system errors have been removed. Note the position of the trace and the REFERENCE LEVEL. This will be used as a reference in step 27.
27. Install the Low Pass Filter at the location shown in Figure 5-21b.
28. Adjust the REFERENCE LEVEL so that the entire trace is on the display. The SYTM fundamental feedthrough is now displayed on the 8755C.
29. Determine how many dB the trace is below the reference position established in step 24. If the trace is less than 25dB below the reference between 8 GHz and 20 GHz, repeat paragraph 5-21.

5-28. ALC GAIN ADJUSTMENT (UPDATES)

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-25 through 5-28. 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

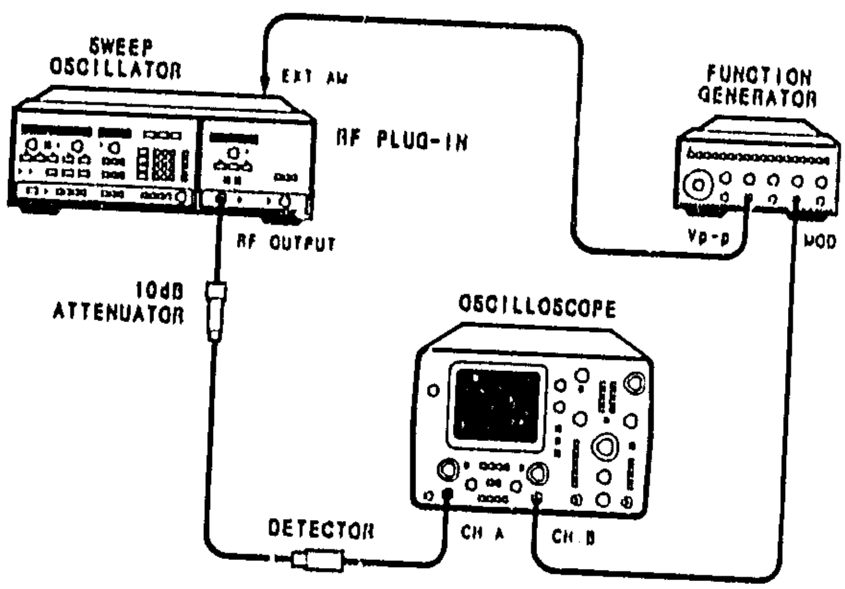


Figure 5-35. ALC Gain Adjustment Test Setup

5-28. ALC GAIN ADJUSTMENT (UPDATES) (Cont'd)

NOTE

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

A4

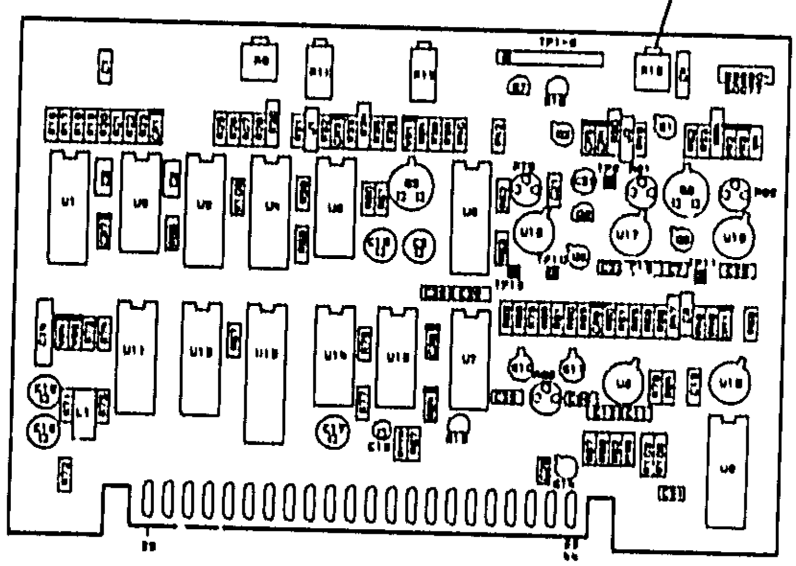


Figure 5-36. ALC Gain Adjustment Location

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 .... 2 GHz
STOP .... 20 GHz
SWEEP MODE .... MANUAL

83590A 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

5-28. 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 5-35.
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 5-36a)

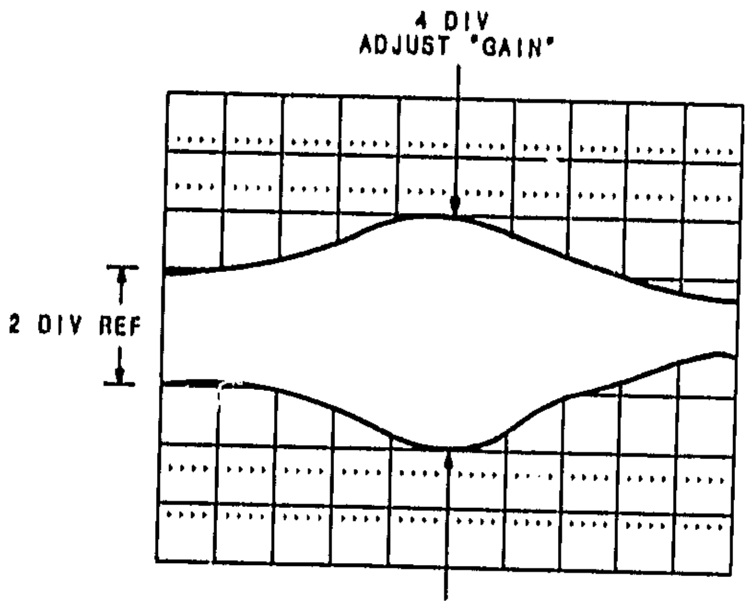


Figure 5-36a. ALC Gain Adjusted Correctly (Worst Case)

CHANGE 1

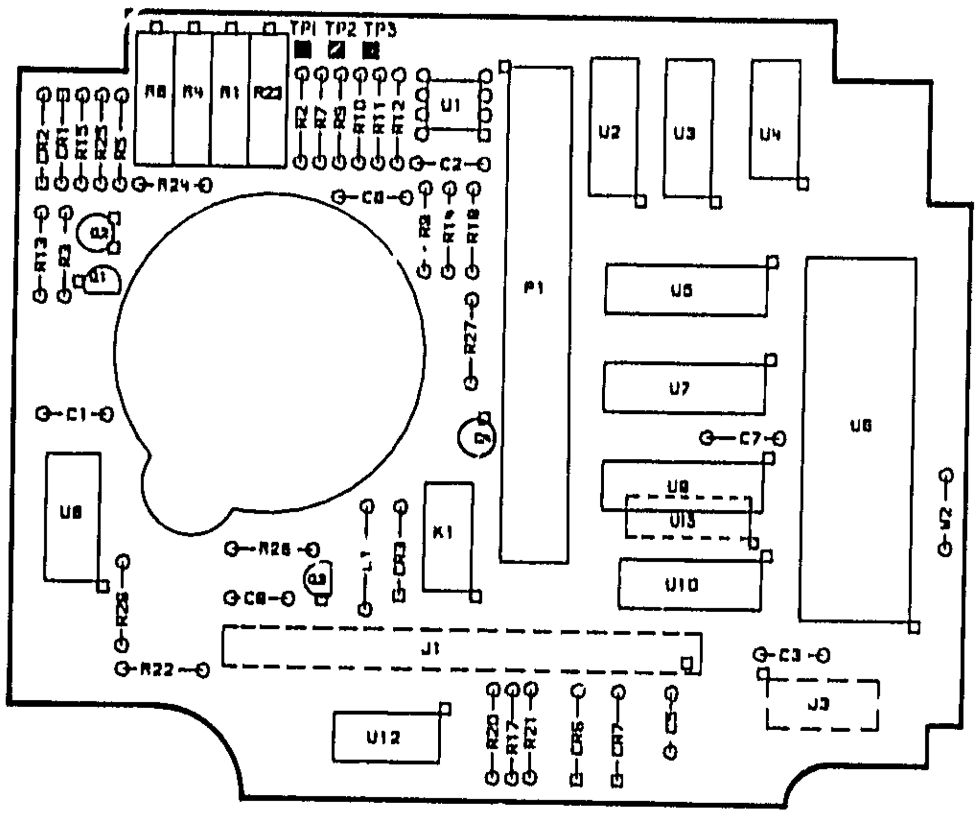
This change documents a new Front Panel Interface.

Page 6-5, Table 6-3:
Change A2 to HP and Mfr. Part Number 83590-60060, CD 1.

Page 6-6, Table 6-3:
Change A2Q4 to 1854-0477, CD 7, Qty 1, TRANSISTOR NPN SI CHIP FT=1.3 GHZ, 02037, SMCS1005.
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 1% .05W F TC=0±100, 03292, C3-1/8-TO-51R1-F.
Delete A2U11.
Add A2U13, 1820-1199, CD 1, Qty 1, IC INV TTL LS HEX 1-INP, 01698, SN74LS04N.

Page 8-31, Figure 8-12:
Replace the FRONT Component Locations diagram with *A2 Front Panel Interface, Component Locations (CHANGE 1)* from this document.

Page 8-31, Figure 8-18:
Change the A2 FRONT PANEL INTERFACE part number in the top left-hand corner of the A2 schematic to 83590-60060.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2216A.
Replace blocks A through G with the partial schematic *P/O A2 Front Panel Interface, Schematic Diagram (CHANGE 1)* from this document.

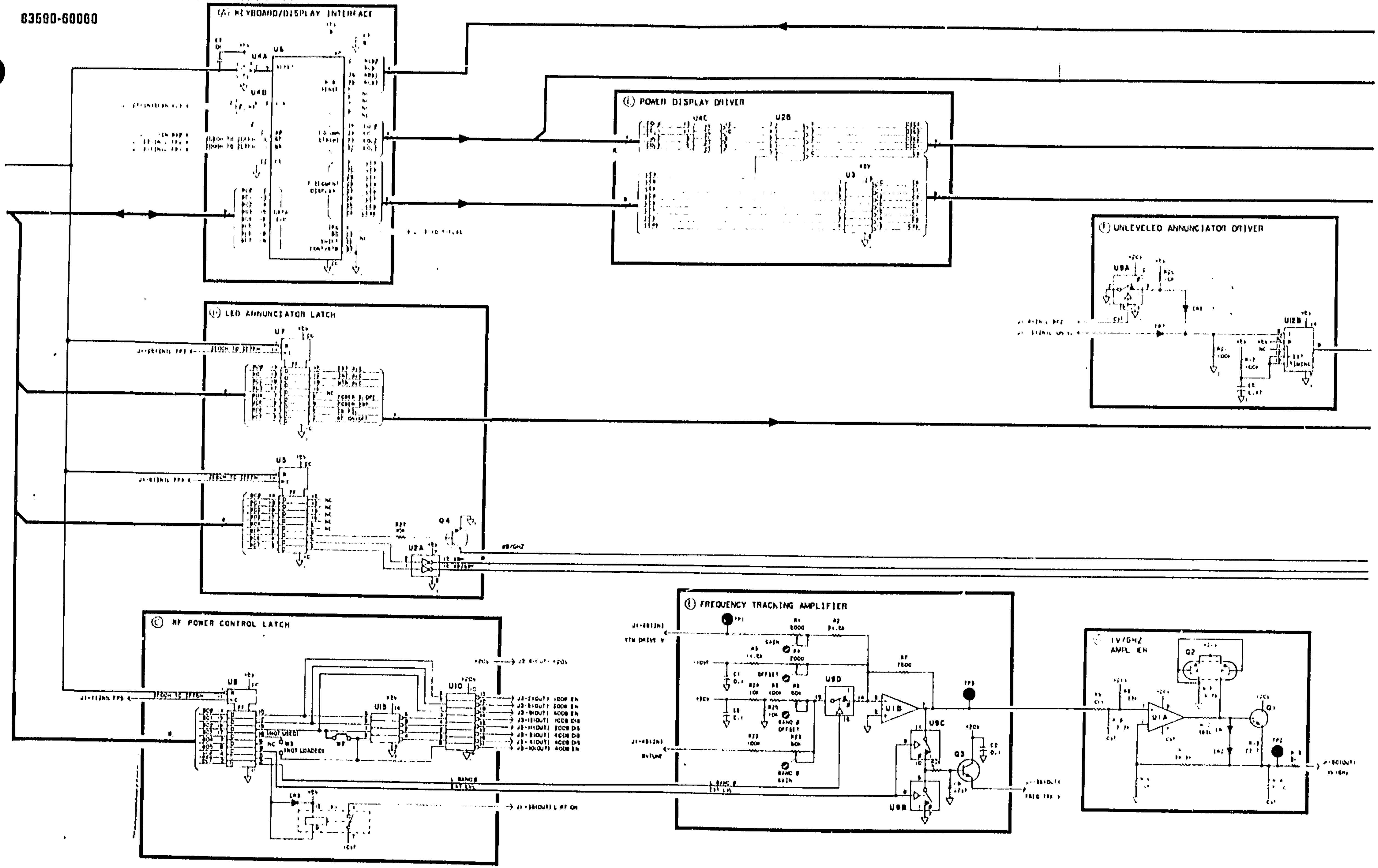


HP P/N 83590-60060

A2 Front Panel Interface, Component Locations (CHANGE 1)

A2 FRONT PANEL INTERFACE

08590-60000

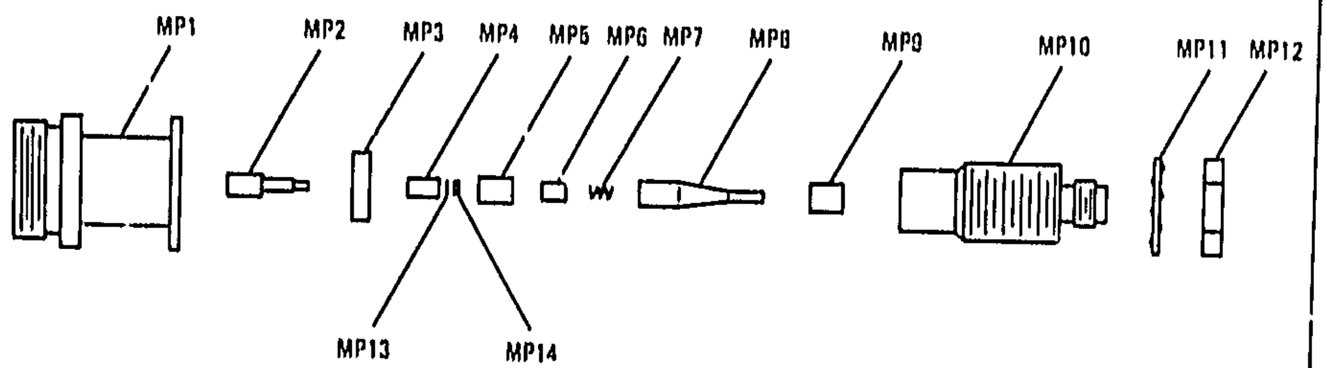


P/O A2 Front Panel Interface, Schematic Diagram (CHANGE 1)

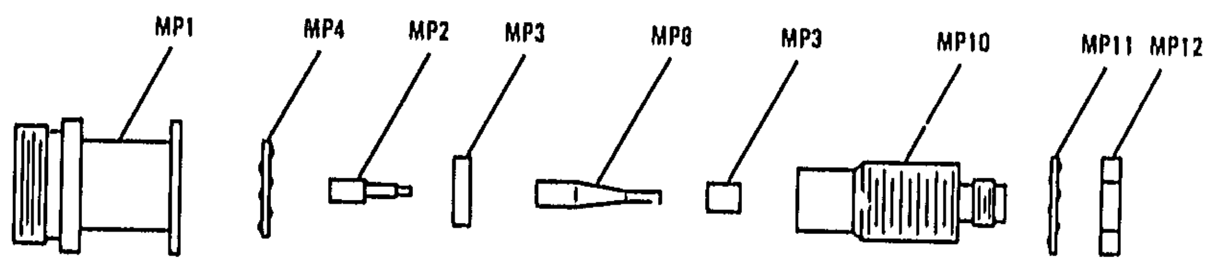
CHANGE 2

This change documents a new RF output connector.

Page 6-30, Figure 6-3:
Replace Figure 6-3 with *Figure 6-3. RF Output Connector (CHANGE 2)* from this document.



APC 7 CONNECTOR
OPT. 005



Reference Designator	HP Part Number	Description	Mfr. Code	Mfr. Part Number
J1	5061-5304	CONNECTOR ASSY (TYPE N) (RF OUT)	28480	5061-5304
J1	83592-60027	CONNECTOR ASSY (APC-7) (OPT. 005)	28480	83592-60027
J1MP1	5021-0141	TRMNATOR HYBRD	28480	5021-0141
J1MP2	1250-0816	CONT-RF CONN	05879	131-1054
J1MP3	5040-8856	INSULATOR	28480	5040-8856
J1MP3	5040-0306	INSULATOR (OPT. 005)	28480	5040-0306
J1MP4	5021-3559	CAP MT CTR	28480	5021-3559
J1MP5	5021-3558	CTR COND GUIDE SL	28480	5021-3558
J1MP6	8160-0393	RFI PLUG	28480	8160-0393
J1MP7	1460-1960	SPRING-CPRSM	00359	1460-1960
J1MP8	5021-3561	CTR COND CONT MT	28480	5021-3561
J1MP8	08555-20093	CONTACT JACK (OPT. 005)	28480	0855-20093
J1MP9	08761-2027	INSULATOR	28480	08761-2027
J1MP10	5021-3560	CONN BODY BLKHD	28480	5021-3560
J1MP10	08555-20094	BODY BULKHEAD	28480	0855-20094
J1MP11	2190-0104	WSHR-LK .439ID	000	OBD
J1MP12	2950-0132	NUT-HEX 7/16-28	000	OBD
J1MP13	0470-0562	COND EPOXY	28480	0470-0562
J1MP14	0160-5448	CAPACITOR	28480	0160-5448

Figure 6-3. RF Output Connector (CHANGE 2)

CHANGE 3

This change documents a new connector on A16 Modulator/Coupler.

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

Page 6-21, Table 6-3:
Change A16A1J3 to HP and Mfr. Part Number 1251-3172, CD 7, CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ-RND.
Delete MP6, KEY CAP-JADE GRAY.

CHANGE 4

This change increases the compensation effect of the 1 HI adjustment in Band 1.

Page 6-8, Table 6-3:

Change A4R23 to HP Part Number 0698-3162, CD 0, RESISTOR 46.4K 1% .125W F TC=0±100, Mfr. Part Number C4-1/8-TO-4642-F.

Change A4R24 to HP Part Number 0698-7262, CD 9, RESISTOR 12.1K 1% .05W F TC=0±100, Mfr. Part Number C3-1/8-TO-1212-F.

Page 8-47, Figure 8-34:

In Block **C POWER LEVEL REFERENCE**, change the value of R23 to 46.4K and change the value of R24 to 12.1K.

Change the SERIAL PREFIX number in the lower left-hand corner of the page to 2233A.

CHANGE 5

This change incorporates an Improved Modulator/Coupler.

Page 6-21, Table 6-3:
Change A16 HP and Mfr. Part Number to 5086-7395, CD 7.

CHANGE 6

This change modifies the A4 ALC Board to minimize squarewave overshoot.

Page 6-8, Table 6-3:

Change A4R11 to HP Part Number 2100-2521, CD 0, RESISTOR-TRMR 2K 10% Mfr. Code 32997, Mfr. Part Number 3329W-1-202.

Page 6-9:

Change A4R66 to HP Part Number 0698-3132, CD 4, RESISTOR 261 1%, Mfr. Part Number C4-1/8-TO-2610-F.
Change A4R71 to A4R71*, FACTORY SELECTED - NOT REPLACEABLE.
Change A4R80 to A4R80*, FACTORY SELECTED-NOT REPLACEABLE.
Change A4R97 to A4R97*, FACTORY SELECTED-NOT REPLACEABLE.

Page 8-47, Figure 8-34:

Change the SERIAL PREFIX number in the bottom left-hand corner to 2249A.
In Block I **MAIN ALC AMP** change the value of R66 to 261 and change the value of R11 to 2000.
In Block J **UNLEVELED SIGNAL** change the value of R71 to 2870.
In Block K **PIN MOD 1 DRIVER** change R80 to R80*, value 511; and change R97 to R97*, value 30.0K.

CHANGE 7

This change adds further improvements to the A4 ALC Board to compensate for modulator variations.

Page 6-7, Table 6-3:

Change A4C35 to HP Part Number 0160-0574, CD 3, CAPACITOR .022μF.
Delete A4CR13.
Add A4MP4, HP Part Number 1251-1277, CD 9, Qty 3, TERMINAL POST.

Page 6-8, Table 6-3:

Change A4R11 to HP Part Number 2100-2489, CD 9, RESISTOR-TRMR 5K.

Page 6-9, Table 6-3:

Change A4R66 to HP Part Number 0757-0416, CD 7, RESISTOR 511.
Change A4R71 to A4R71*, FACTORY SELECTED-NOT REPLACEABLE.
Change A4R89 to HP Part Number 0698-7267, CD 4, RESISTOR 19.6K.
Change A4R90 to HP Part Number 0698-7257, CD 2, RESISTOR 7.5K.
Delete A4R97.
Add A4R101*, FACTORY SELECTED-NOT REPLACEABLE.
Add A4R102, HP Part Number 0757-0424, CD 7, RESISTOR 1.1K 1% .125W F TC=0 ± 100.
Add A4R103, HP Part Number 0757-0394, CD 0, RESISTOR 51.1 1% .125W F TC=0 ± 100.

Page 6-13, Table 6-3:

Change A6R53 to HP Part Number 0698-3429, CD 2, RESISTOR 19.6.

Page 8-47, Figure 8-29 (A4 Component Locations):

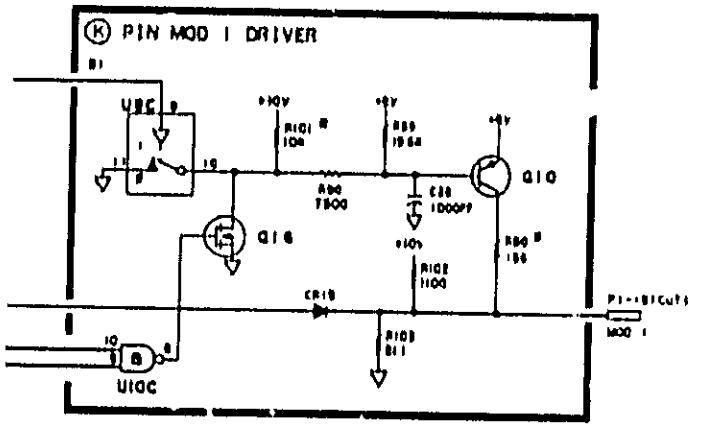
Delete R97.
Move R98 to a location directly above and parallel to CR15.
Move R78 to a location directly below Q15 and Q16 and parallel to R98.
Delete CR13 and in its place insert R103.
Add R101, mounted on the far side of the board. R101 is located diagonally between the top of R77 and the top of R90.
Add R102, mounted on the far side of the board. R102 is located diagonally between the bottom of R80 and a feedthrough pad below Q10 (where the top of R78 was formerly connected).

Page 8-47, Figure 8-34 (A4 Schematic):

In Block H SAMPLE AND HOLD DRIVER change the value of C35 to .022μF.
In Block I MAIN ALC AMP:
Change the value of R66 back to 511.
Change the value of R11 to 5000.
In Block J UNLEVELED SIGNAL change R71 to R71* and change the nominal value back to 2610.
Replace Block K PIN MOD I DRIVER with *P/O Figure 8-34, A4 ALC Schematic Diagram (CHANGE 7)* from this document.

Page 8-57, Figure 8-49 (A6 Sweep Control Schematic):

In Block J PULSE MODULATION, change the value of R53 to 19.6.



P/O A4 ALC Schematic Diagram (CHANGE 7)

CHANGE 8

This change modifies the A6 Sweep Control Assembly for improved modulator compatibility.

Page 6-12, Table 6-3:

Add A6MP3, HP Part Number 0360-0124, CD 3, CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND.
Change A6R51 to 0698-7225, CD 4, RESISTOR 348 1% .05W F TC=0±100, 28480, 0698-7225.

Page 6-14, Table 6-3:

Add A6R83, 0698-7242, CD 5, RESISTOR 1.78K 1% .05W F TC=0±100, 24546, C3-1/8-TO-1780-G.
Add A6R84, 0698-7238, CD 9, RESISTOR 1.21K 1% .05W F TC=0±100, 24546, C3-1/8-TO-1210-G.

Page 8-57, Figure 8-44:

Add *Figure 8-44A. A6 Component Mounting Diagram (CHANGE 8)* from this document.

Page 8-57, Figure 8-49:

Replace Block J PULSE MODULATION with *P/O Figure 8-49. A6 Sweep Control Schematic (CHANGE 8)* from this document.

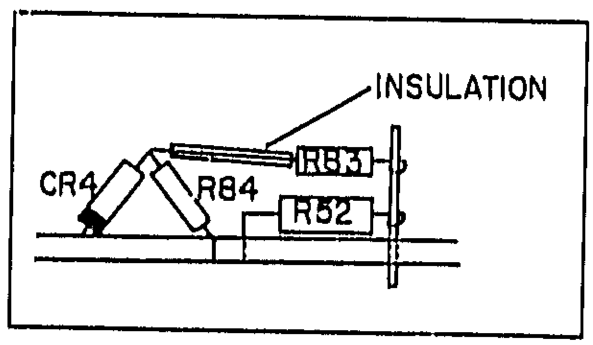
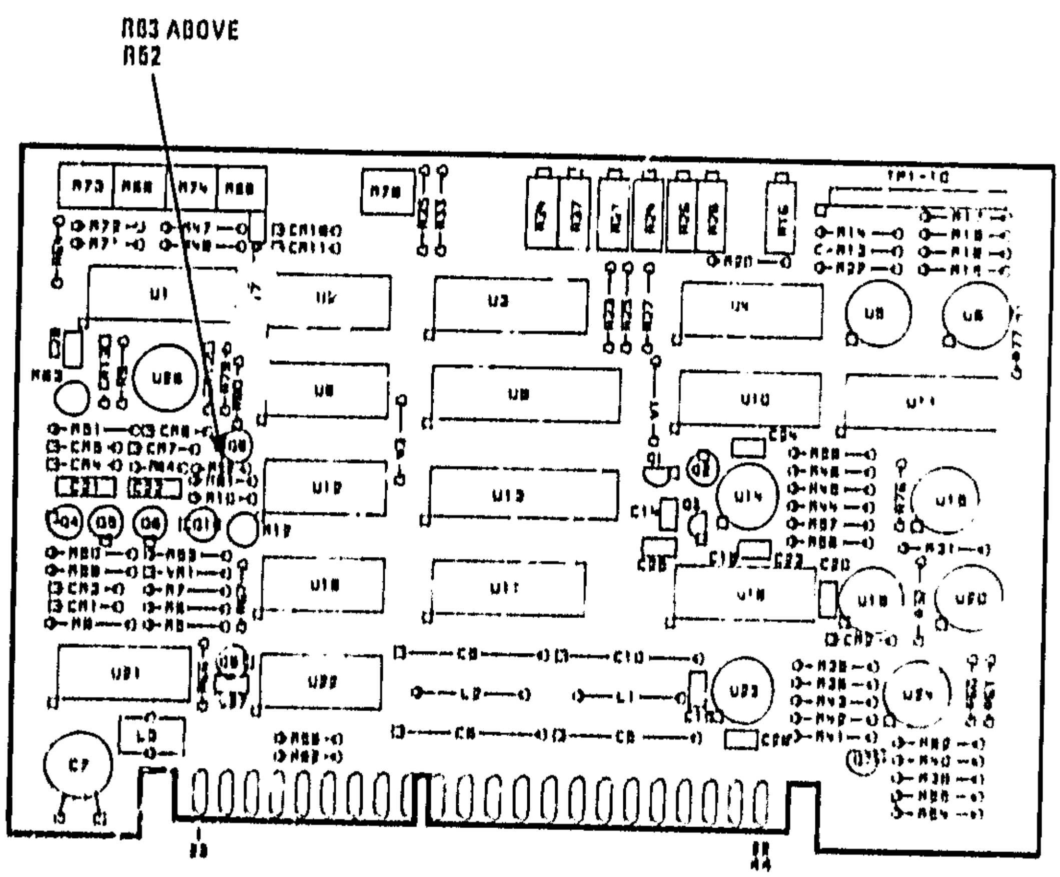
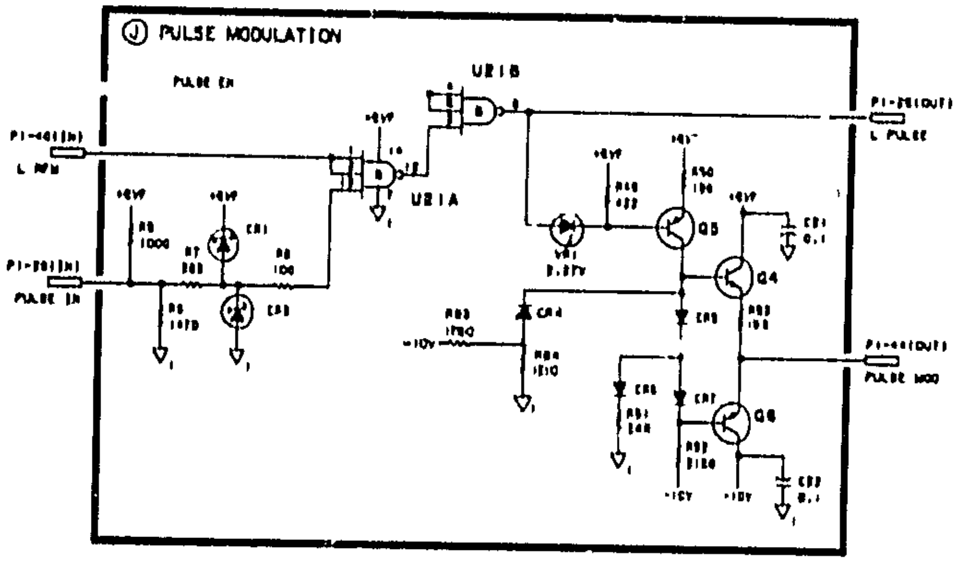


Figure 8-44A. A6 Component Mounting Diagram (CHANGE 8)



HP P/N 83590-60054

Figure 8-44. A6 Sweep Control Component Locations (CHANGE 8)



P/O Figure 8-49. A6 Sweep Control Schematic (CHANGE 8)

CHANGE 9

This change improves the output power specifications.

Page 1-2, Table 1-1, **POWER OUTPUT:**
Change the specifications as follows:

Maximum Leveled Output Power:					
2.0 to 7.0 GHz +10 dBm	**7.0 to 13.5 GHz** +10 dBm	**13.5 to 18.6 GHz** +10 dBm	**13.5 to 20.0 GHz** +10 dBm	**2.0 to 18.6 GHz** +10 dBm	**2.0 to 20 GHz** +10 dBm
With Option 002					
+8.5 dBm	+8 dBm	+8 dBm	+7 dBm	+7 dBm	+7 dBm

Note that the maximum leveled output power for the standard instrument is now +10 dBm across the entire frequency band.

CHANGE 10

This change updates the A3 Digital Interface Board with revised firmware (Revision 4).

Page 6-6, Table 6-3:

Change A3 Digital Interface Board to HP Mfr. Part Number 83590-60073, CD 6.
Change A3U1 to 83590-80003, CD 4, Qty 1, EPROM Lw.
Change A3U2 to 83590-80004, CD 5, Qty 1, EPROM Hi.

Page 8-35, Figure 8-23:

Change the A3 DIGITAL INTERFACE part number in the top left-hand corner of the schematic to 83590-60073.
Change the SERIAL PREFIX in the bottom left-hand corner of the schematic to 2315A.

CHANGE 11
(Supersedes CHANGE 1)

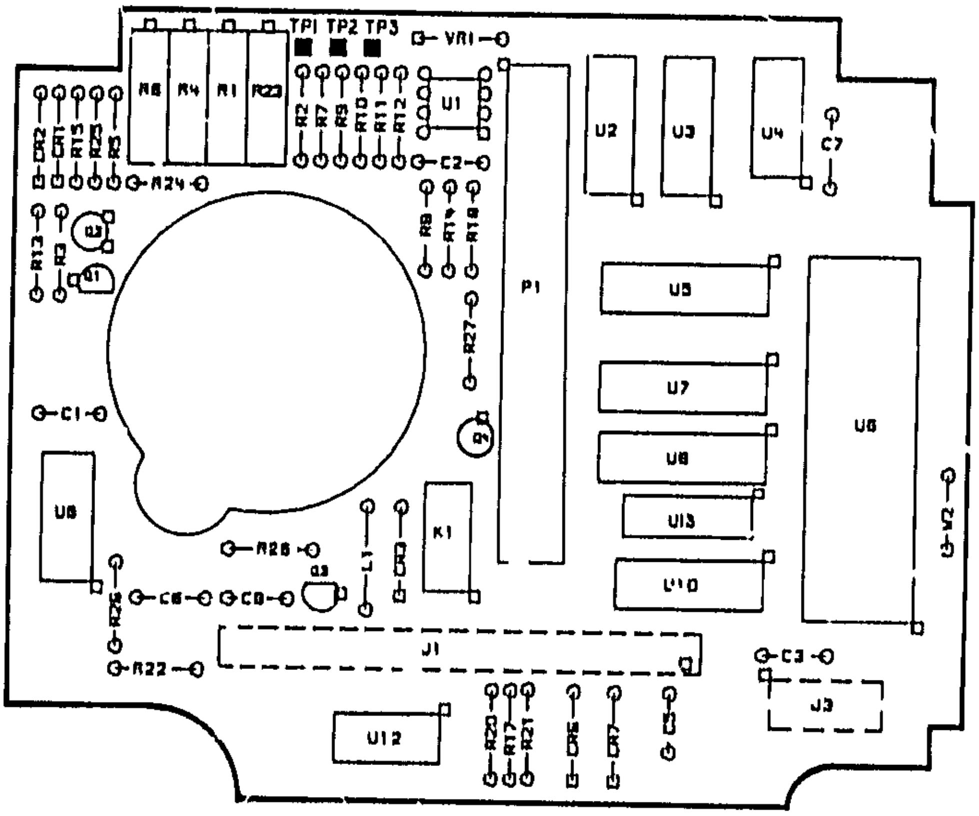
This change incorporates a new A2 Sub Panel Board.

Page 6-5, Table 6-3:
Change the A2 Board Assembly Sub Panel part number to 83590-60072, CD 5.

Page 6-6, Table 6-3:
Add A2VR1, 1902-0041, CD 4, DIODE-ZNR 5.11V 5% DO-35 PD=.4W.

Page 8-31, Figure 8- .2:
Replace the Component Locations Diagram with the *A2 Front Panel Interface, Component Locations (CHANGE 11)* from this document. Note that U13 is now mounted on the front of the board.

Page 8-31, Figure 8-18:
Change the A2 FRONT PANEL INTERFACE part number in the top left-hand corner of the A2 Schematic to 83590-60072.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2338A.
In Block G (1V/GHz Amplifier) add VR1 across R12, anode connected to pin 1 of U1A.



HP P/N 03590-00072

A2 Front Panel Interface, Component Locations (CHANGE 11)

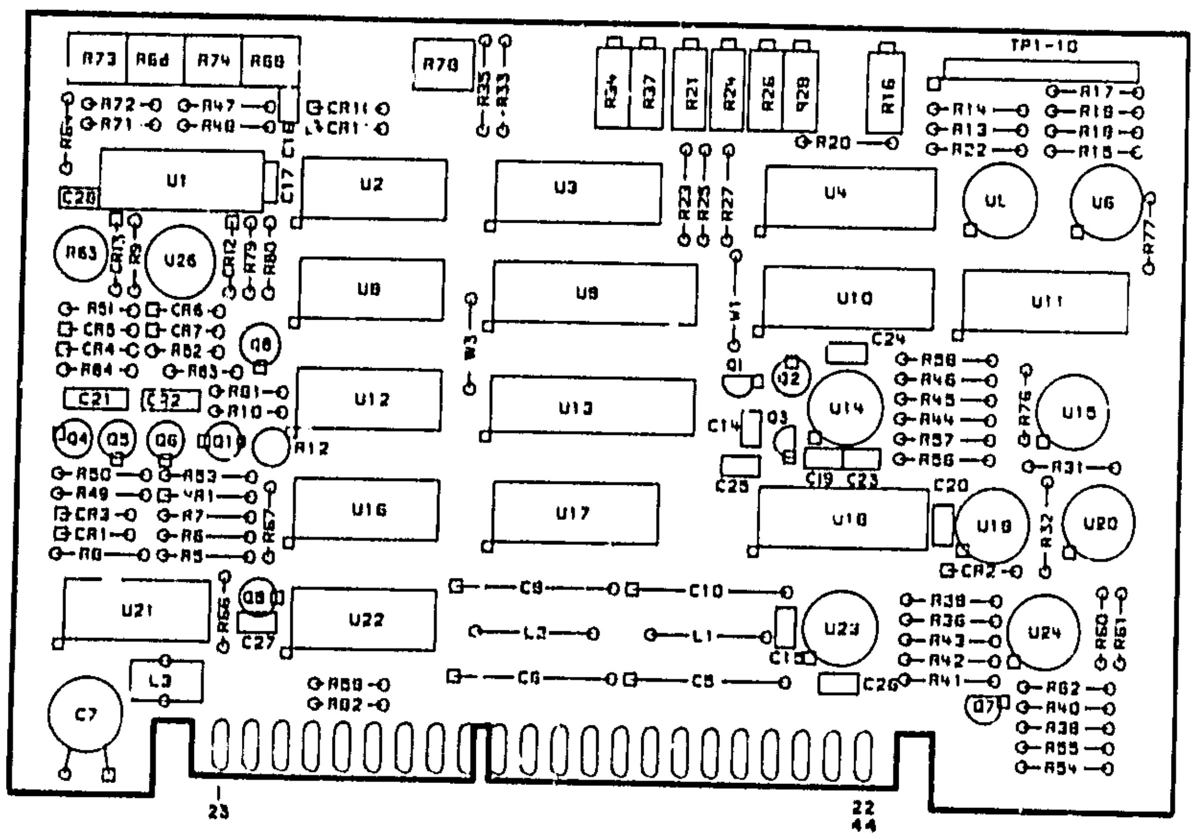
CHANGE 12
(Supersedes CHANGE 8)

This change incorporates a new A6 Sweep Control Board.

Page 6-12, Table 6-3:
Change the A6 Sweep Control Assembly HP and Mfr. Number to: 83590-60091, CD 8.

Page 8-57, Figure 8-44 (A6 Component Locations):
Replace Figure 8-44 with Figure 8-44 (CHANGE 12) in this change sheet.

Page 8-57, Figure 8-49 (A6 Schematic):
Change the A6 SWEEP CONTROL part numb r in the to; left-hand corner of the A6 Schematic to 83590-60091.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2410A.



HP P/N 83590-60091

Figure 8-44. A6 Sweep Control Component Locations (CHANGE 12)

CHANGE 13

Change not applicable.

CHANGE 14

(Supersedes CHANGES 4, 6, and 7)

This change introduces a new ALC board. It is now possible to power meter level the plug-in with the HP 436A and HP 438A as well as the HP 432A.

Page 1-4, Table 1-1, Note 9:

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 100 seconds for full sweep, typically greater than or equal to 5 seconds per GHz but not less than 10 seconds."

Page 1-9, 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 1-11, Table 1-4:

Across from the first listed "Power Meter" under **Critical Specifications** delete: "(No substitute when used for external power meter leveling)." Under **Recommended Model** add: "HP 436A," "HP 438A."

Across from the first listed "Thermistor Sensor" under **Recommended Model** delete: "HP 8478B" and replace with: "Unit compatible with power meter being used."

Across from the second listed "Thermistor Sensor" under **Recommended Model** delete: "HP K486" and replace with: "Unit compatible with power meter being used."

Page 3-3, Paragraph 3-25:

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 3-6, Figure 3-4, Number 1:

Delete: "(HP 432 only)."

Page 3-9, 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.**" and add: "**When using an HP 436A power meter, enable RANGE HOLD to lock power meter in one range.**"

Under PROCEDURE, number 5, delete all reference to "HP 432A."

Page 4-2, Table 4-1:

Across from "Squarewave Symmetry" under **83590A Adjustment** add "5-27."

Page 4-8, Power Meter Leveling:

Insert "13a. External leveling is shown using the HP 432A, HP 8478B, and HP K486A. However, the HP 432A/B/C, 436A, 438A meters and compatible sensors may also be used."

Page 5-2, Table 5-1:

Change A4R3 to A4R8.
Change A4R5 to A4R12.
Change A4R8 to A4R10.
Delete the line beginning with A4R9.
Change A4R11 to A4R15. Under **Description**, change U11 to U9.
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.

CHANGE 14 (Cont'd)

Page 5-6, Table 5-2:
Across from 5-27 under "**Adjustments**," delete "Power Meter Leveling Calibration" and replace with "Squarewave Symmetry Adjustment (CHANGE 14)."

Page 5-44, 5-29. ALC Adjustment:
Replace pages 5-44 through 5-46 with the 5-26. **ALC ADJUSTMENT (CHANGE 14)** procedure in this document.

Page 5-49, **POWER METER LEVELING CALIBRATION:**
Delete pages 5-49 and 5-50 and replace with 5-27. **SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 14)** procedure in this document.

Pages 5-51 to 5-54: **ALC GAIN ADJUSTMENT:**
Replace all reference to A4R11 with A4R15.

Page 5-51, DESCRIPTION:
Change A4U11 to A4U9.

Page 5-51, EQUIPMENT:
Across from "Power Meter," add: "436A, and 438A."
Across from both Thermistor Mounts delete: "HP 8478A" and "HP K486," and replace with "Unit compatible with power meter being used."

Page 5-54, Paragraph 5-36:
Add the following steps:

"27. With the Model 83590A set to −5 dBm, press **[INSTR PRESET] [CW]**. Set the oscilloscope to a 10 us sweep time. If the GAIN control (A4R15) has been over adjusted, the shape of the squarewave on the oscilloscope will be distorted."

"28. Back off on A4R15 and observe the squarewave. If the shape of the squarewave improves, back off until there is no more change. If there is no change, in the shape of squarewave as A4R15 is adjusted, return it to its initial position."

Page 6-7, Table 6-3:
Replace the parts list for the A4 Assembly with **A4 Replaceable Parts (CHANGE 14)** from this document.

Page 8-19, **A4 ALC Assembly:**
Add the following paragraph at the end of the A4 ALC assembly description:
"when used in the ALC MODE **[MTR]**, the A4 ALC 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 8-35, **A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION:**
Replace pages 8-35 to 8-46 with the **A4 ALC CIRCUIT DESCRIPTION (CHANGE 14)** from this document.

Page 8-47, Figure 8-28:
Replace Figure 8-28 with *Figure 8-28. A4 ALC Block Diagram (CHANGE 14)* from this document. Note this is a fold-out page.

Page 8-47, Figure 8-29:
Replace Figure 8-29, with *Figure 8-29. A4 ALC Component Locations (CHANGE 14)* from this document.

CHANGE 14 (Contd)

Page 8-47, Table 8-12:
Replace Table 8-12 with *Table 8-12. Leveling Control Lines (CHANGE 14)* from this document.

Page 8-47, A4P1 Pin-out Table:
Replace the A4P1 Pin-out Table with *A4P1 Pin-out Table (CHANGE 14)* from this document.

Page 8-47, Figure 8-32:
Under **NOTE**, change the middle paragraph to read: "**Adjustment of the EXT/MTR ALC CAL screw will affect the waveforms at TP8 and TP6. Adjust the CAL screw until the correct waveforms are obtained.**"

Page 8-47, Figure 8-33:
Replace Figure 8-33 with *Figure 8-33. Open Loop Waveforms (CHANGE 14)* from this document.

Page 8-47, Figure 8-34:
Replace Figure 8-34 with *Figure 8-34. A4 ALC Schematic Diagram (CHANGE 14)* from this document. Note this is a fold-out page.

5-25. ALC ADJUSTMENT (CHANGE 14)

NOTE

Complete adjustment of the ALC leveling loop requires procedures to be performed in the order prescribed, from Paragraph 5-25 through 5-28. 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.

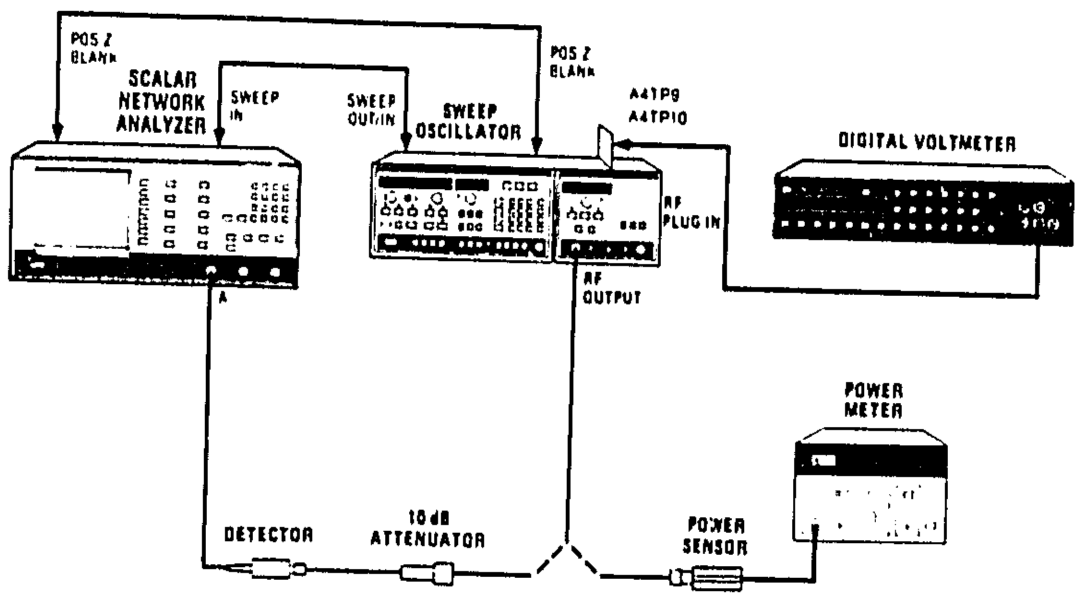


Figure 5-29. ALC Adjustment Test Setup

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

5-28. ALC ADJUSTMENT PROCEDURE (CHANGE 14) (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 that the 8350A/B Sweep Oscillator 27.8 kHz squarewave modulation is selected.

1. Remove the A5 FM Driver 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
A4R8 (I HI) .... Fully CW

A4

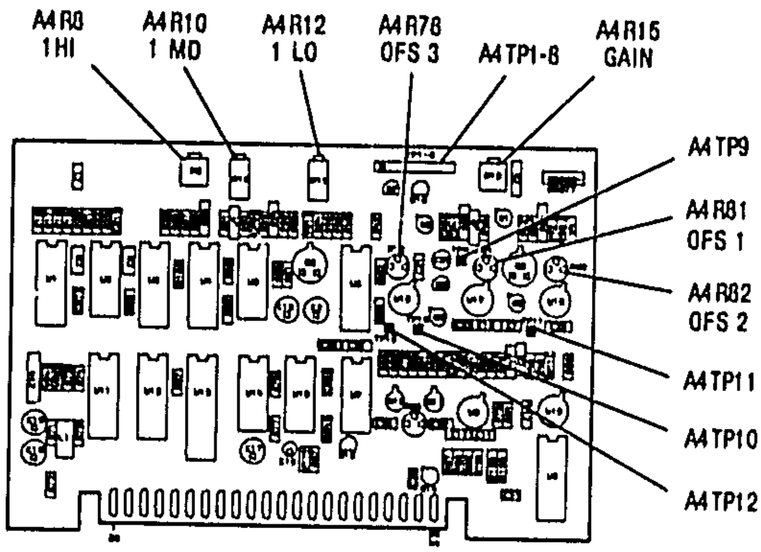


Figure 5-30. ALC Adjustment Locations (CHANGE 4)

5-25. ALC ADJUSTMENT PROCEDURE (CHANGE 14) (Cont'd)

2. Float the ground on the Digital Voltmeter and measure the voltage between A4TP9 and A4TP10. Refer to Figure 5-30 for adjustment locations. Adjust A4R81 (OFS 1) for 0.000 ± 0.001 Vdc.
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. 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] [2] [.] [0] [GHz s]**. Connect the Power Meter sensor to the HP 83590A RF OUTPUT.
6. Set the HP 83590A for a POWER reading of −5 dBm. Adjust A4R12 (1 LO) for an RF output power at the HP 83590A connector of −5 ± 0.1 dBm.
7. Set the HP 83590A for a POWER reading of +7 dBm. Adjust A4R10 (1 MD) for an RF output power at the HP 83590A connector of +7 ± 0.1 dBm.
8. Iterate steps 7 and 8 until both low and midpower ranges are calibrated and no readjustment is necessary.
9. Set the HP 83590A for a front panel POWER reading of +10 dBm. Adjust A4R8 (1 HI) for an RF output power at the HP 83590A connector of +10 ± 0.1 dBm.
10. Reinstall the A5 FM board assembly.

5-27. SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 14)

NOTE

Complete adjustment of the ALC leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-25 to 5-28. Deviation from this routine may cause improper leveling and/or power variation problems.

Turn AC power OFF when removing or installing PC boards.

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

REFERENCE:

Performance Tests: Paragraph 4-21
Service Sheet: A4

DESCRIPTION:

C23 (SYM 1) and R99 (SYM 2) minimize overshoot of the squarewave. R92 adjusts the duty cycle of the squarewave.

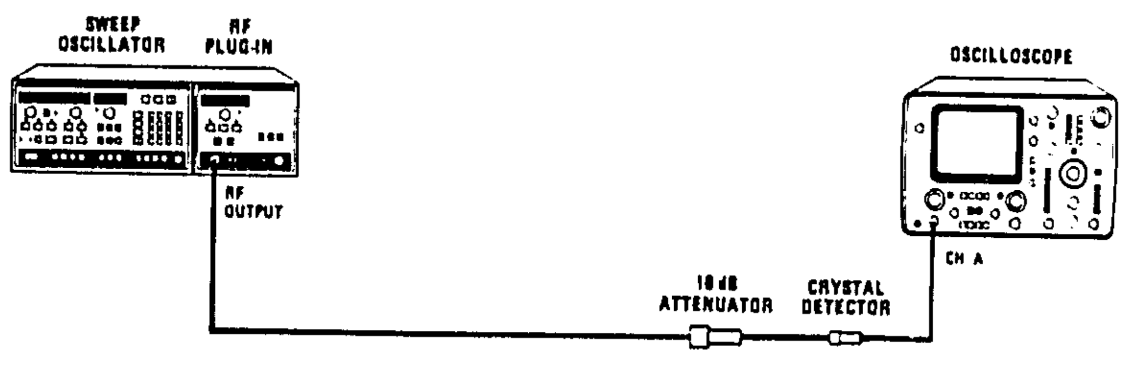


Figure 5-33. Squarewave Symmetry Adjustment Setup

EQUIPMENT:

Sweep Oscillator .... HP 8350A/B
Oscilloscope .... HP 1740A
Diode Detector .... HP 8473C
Attenuator .... HP 8491B-010

5-27. SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 14) (Cont'd)

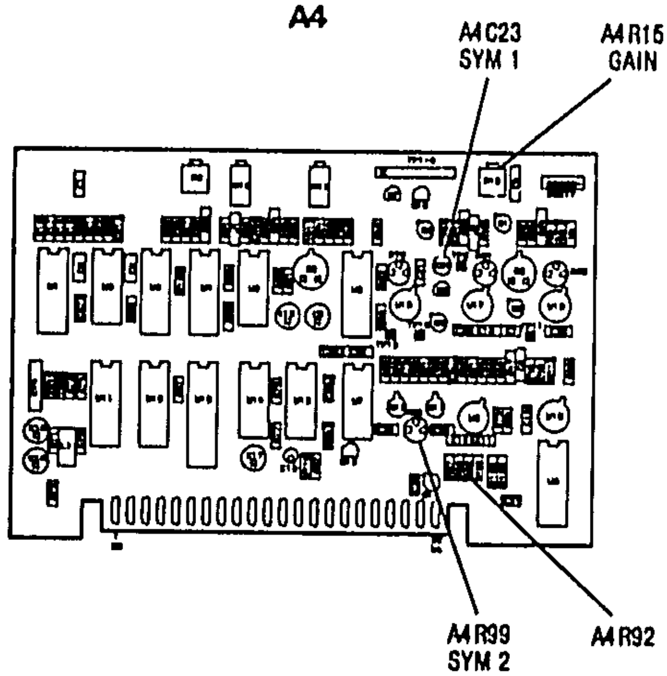


Figure 5-34a. Squarewave Symmetry Adjustment Locations

PROCEDURE:

1. Connect the equipment as shown in Figure 5-33, with A4 on an extender board. On the HP 8350A/B, press **[INSTR PRESET] [CW] [⊔⊓ MOD]**. Set the RF power level to 0 dBm and allow the equipment to warm up for one hour.

NOTE

Insure that you do not overdrive the detector as this will distort the squarewave.

2. On the oscilloscope, select MAIN SWEEP with a 10μs/DIV time. Set Channel A to .005V/DIV and Channel B to 1V/DIV.

3. Press **[CW] [3] [GHz s]**. Alternately adjust C23 (SYM 1) and R99 (SYM 2) for the waveform shown in Figure 5-34b.

4. Press **[CW] [10] [GHz s]**. Check that the squarewave resembles that shown in Figure 5-34b. If not, adjust C23 and R99 for best squarewave while alternately checking the squarewave at 3 GHz.

5. Repeat step 4 for 15 and 20 GHz. Optimize the shape of the squarewave over the entire range of the plug-in. Naturally there will be slight variations at each end of the plug-in's range.

6. With the A4 board on an extender, there may be a slight "pip" on the detected signal. This will disappear when the board is mounted in the plug-in.

7. If you are unable to obtain the correct waveshape, you may need to adjust the value of R92. Replace R92 with a potentiometer having a mid range value the same as that of R92. Vary its resistance until 50% duty cycle is obtained. Remove the potentiometer and measure its value. Replace with a fixed resistor closest to the measured value.

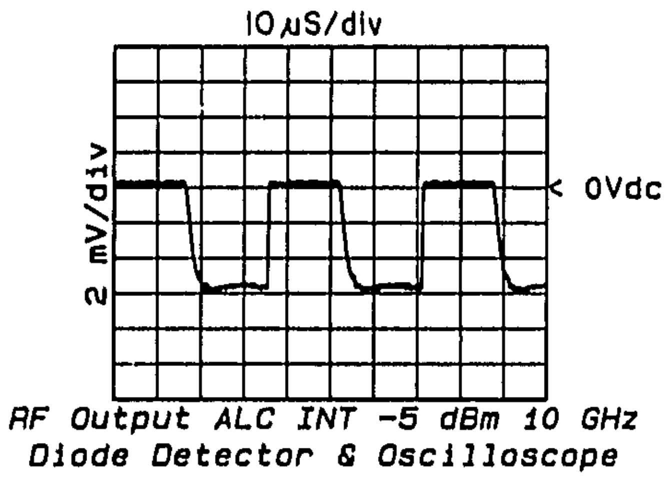


Figure 5-34b. Optimum Squarewave (CHANGE 14)

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Model 83590A Parts List (CHANGE 14) (1 of 5)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4	83590-60077	2	1	BD AY - ALC	28480	83590-60077
A4C1	0160-3879	7	4	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C3	0180-2617	1	1	CAPACITOR-FXD 6.8 UF ±10% 35VDC TA	25088	D6R8GS1B35K
A4C4	0160-0945	2	1	CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
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		CAPCITOR-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	0160-0572	1	2	CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A4C22	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A4C23	0121-0448	8	1	CAPACITOR-V TRMR-CER 2.5-5PF 63V PC-MTG	28480	0121-0448
A4C25	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C26	0160-3879	7	1	CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C28	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
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
A4C31	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4CR1	1901-1098	1	6	DIODE SWITCHING 1N5150 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
A4CR8	1901-0535	9		DIODE - SM SIG SCHOTTKY	28480	1901-0535
A4CR9	1901-0535	9		DIODE - SM SIG SCHOTTKY	28480	1901-0535
A4CR11	1901-1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901-1098

Model 83590A Parts List (CHANGE 14) (2 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	1	INDUCTOR RF--CH--MLD 100UH 5% 166DX 385LG	28480	9140--0210
A4MP2	5040--6840	1	1	BOARD EXTR YELLOW	28480	5040--6840
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--2679	0	1	LBL-IN 83590 14-IN-WD 4-IN-LG	28480	7121--2679
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
A4Q13	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q14	1853--0451	3	1	TRANSISTOR PNP 2N3799 SI TO--18 PD=360MW	01295	2N3799
A4Q16	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4R8	2100--2515	2	1	RESISTOR--TRMR 200K 10% C SIDE--ADJ 1--TRN	30983	ET50W204
A4R10	2100--0670	6	1	RESISTOR--TRMR 10K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--103
A4R12	2100--3753	2	1	RESISTOR--TRMR 200K 10% C SIDE--ADJ 17--TRN	28480	2100--3753
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
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	2	RESISTOR 11K 1% .05W F TC=0±100	24546	C3--1/8--T0--1102--F
A4R22	0698--7262	9	1	RESISTOR 12.1K 1% .05W F TC=0±100	24546	C3--1/8--T0--1212--F
A4R23	0698--7276	5	1	RESISTOR 46.4K 1% .05W F TC=0±100	24546	C3--1/8--T0--4642--F
A4R25	0698--7261	8		RESISTOR 11K 1% .05W F TC=0±100	24546	C3--1/8--T0--1102--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	1	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	0	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	0699--7248	2	2	RESISTOR 3.48K 1% .05W F TC=0±100	24546	C3--1/8--T0--3481--F

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Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
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	5	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
A4R40	0698--7280	9	1	RESISTOR 147K 1% .05W F TC=0±100	24546	C3--1/8--T0--1473--F
A4R41	0698--7284	5	1	RESISTOR 100K 1% .05W F TC=0±100	24546	C3--1/8--T0--1003--F
A4R42	0698--7256	1	3	RESISTOR 6.81K 1% .05W F TC=0±100	24546	C3--1/8--T0--6811--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 600--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--T0--51R1--F
A4R50	0757--0399	5	1	RESISTOR 82.5 1% .125W F TC=0±100	24546	C4--1/8--T0--82R5--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--T0--511R--F
A4R53	0698--7232	3	2	RESISTOR 681 1% .05W F TC=0±100	24546	C3--1/8--T0--681R--F
A4R54	0698--3151	7	1	RESISTOR 2.87K 1% .125W F TC=0±100	24546	C4--1/8--T0--2871--F
A4R56	0698--7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3--1/8--T0--1002--F
A4R57	0698--7248	2		RESISTOR 3.48K 1% .05W F TC=0±100	24546	C3--1/8--T0--3481--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--T0--511R--F
A4R60	0698--7247	1	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--T0--196R--F
A4R62	0698--7212	9	3	RESISTOR 100 1% .05W F TC=0±100	24546	C3--1/8--T0--100R--F
A4R63	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3--1/8--T0--1961--F
A4R64	0698--7256	1		RESISTOR 6.81K 1% .05W F TC=0±100	24546	C3--1/8--T0--6811--F
A4R68	0698--7222	1	1	RESISTOR 261 1% .05W F TC=0±100	24546	C3--1/8--T0--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--T0--100R--F
A4R73	0698--7212	9		RESISTOR 100 1% .05W F TC=0±100	24546	C3--1/8--T0--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--7205	0		RESISTOR 51.1 1% .05W F TC=0±100	24546	C3--1/8--T0--51R1--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

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Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4R83	0698-7334	5		RESISTOR 825 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-825R-F
A4R84	0698-7232	3		RESIL TOR 681 1% .05W F TC=0 ± 10024546	24546	C3-1/8-TO-681R-F
A4R85	0698-7260	7		RESISTOR 10K 1% .05W F TC=0 ± 10024546	24546	C3-1/8-TO-1002-F
A4R87	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1961-F
A4R88	0698-7264	1	2	RESISTOR 14.7K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1472-F
A4R89	0698-7263	0		RESISTOR 13.3K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1332-F
A4R90	0698-7264	1		RESISTOR 14.7K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1472-F
A4R91	0698-7240	3	1	RESISTOR 1.47K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1471-F
A4R92	0698-7270	9	1	RESISTOR 26.1K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-2612-F
A4R93	0698-7260	7		RESISTOR 10K 1% .05W F T''=0 ± 100	24546	C3-1/8-TO-1002-F
A4R94	0698-7242	5	1	RESISTOR 1.78K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1781-F
A4R96	0698-7251	0	1	RESISTOR 4.22K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-4221-F
A4R97	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1962-F
A4R98	0698-7257	2	1	RESISTOR 7.5K 1% .05W F TC=0 ± 100	28480	0698-7257
A4R99	2100-1738	9	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	820R10K
A4R102	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0 ± 100	24546	C4-1/8-TO-1101-F
A4R103	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-51R1-F
A4R106	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0 ± 100	24546	C4-1/8-TO-196R-F
A4R108	0698-4827	4	1	RESISTOR 1M 1% .125W F TC=0 ± 100	28480	0698-4827
A4R110	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0 ± 100	24546	C3-1/8-TO-1961-F
A4TP1-8	1251-5618	0	1	CONNECTOR 8-PIN M POST TYPE	28480	1251-5618
A4TP9	0360-0535	0	1	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
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	00000	ORDER BY DESCRIPTION
A4U1	1826-1186	8	3	IC SWITCH ANLG QUAD 16-DIP-C PKG		
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	0666	CP-11EY
A4U6	1826-0610	1		IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	0666	MUX24FQ
A4U7	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	0129	SN74LS00N
A4U8	1826-1186	8		IC SWITCH ANLG QUAD 16-DIP-C PKG		
A4U9	1826-0319	7	2	IC OP AMP WB TO-99 PKG	A3500	AD3591
A4U10	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A4U11	1826-0732	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	SN74LS138
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 NA"D 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

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Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4U10	1826--0319	7		IC OP AMP WB TO--99 PKG	A3500	AD3591
A4VR1	1902--0041	4	1	DIODE--ZNR 5.11V 5% DO--35 PD=.4W	28480	1902--0041
A4VR2	1902--0111	9	1	DIODE--ZNR 1N753A 6.2V 5% DO--7 PD=.4W	28480	1902--0111
A4VR3	1902--3070	5	1	DIODE--ZNR 4.22V 5% DO--35 PD=.4W	28480	1902--3070
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
A4W4	0159--0005	0	1	RESISTOR--ZERO OHMS 22 AWG LEAD DIA	28480	0159--0005

A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION (CHANGE 14)

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 8-24 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 8-24.

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 8-12. U6 decodes these control lines to select the proper detector input for the desired operating mode.

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 +1V 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.

A4 (ALC), CIRCUIT DESCRIPTION (CHANGE 14) (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 either L PULSE or SQ MOD 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 or SQ MOD input. When the system is used with the HP 8756A Scalar Network Analyzer, the SQ MOD 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). A time delay set by R64 and C26 causes an approximate 5 μsec delay, enabling the RF signal to come to full power before releasing HOLD and thus preventing overshoot. The sample level is maintained during the OFF pulse, thus preventing saturation of the Log and Main ALC amplifiers.

The SQ MOD input is also connected to the PIN MOD I Driver (Block N) for RF modulation when the Model 8350A/B internal squarewave modulation is used.

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 whick buffers the detector input. R78 compensates for the offset voltage of the operational amplifier. Q6 and C21 perform the sample and hold function. C23 is used to reduce error due to the gate to source capacitance of Q6.

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 14) (Cont'd)

U6A decodes MUX A0B and MUX A1B (Table 8-12) 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 and R10 adjust the gain of U18, and calibrate midrange power levels for their respective bands.

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 resistors R7 and R8 reduce 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 5 volt ramp proportional to the YTM DRIVE Voltage. R1 (SLP) adjusts the overall slope of Band 0.

Under leveled power conditions, the voltage at U2D pin 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 14) (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.

L RFB goes low during bandswitching to blank the RF power, thus preventing the loop from saturating. When Model 8350A/B RF BLANK is selected, L RFB goes low during retrace and U1D closes, pulling current through C4, forcing TP5 high and turning on the PIN modulators.

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.

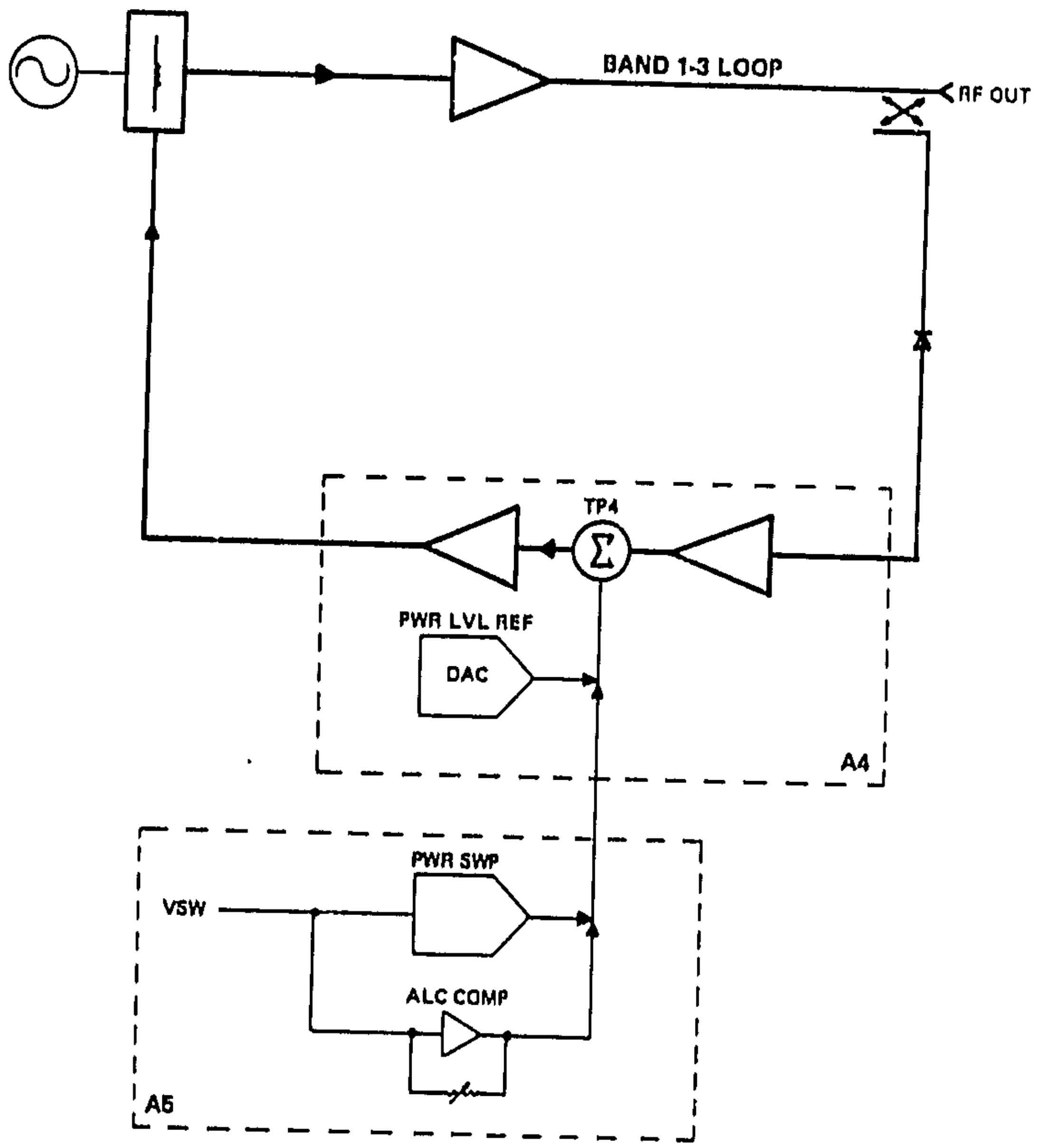
Collector current in common-base transistor Q1 is exponentially related to the base-emitter voltage. The PIN modulator is driven exponentially to maintain constant loop gain.

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

PIN Mod 1 Driver N

R105 compensates for the loss of modulator sensitivity with increasing bias current. Q13 and Q14 act to fully turn the modulator on when either SQ MOD or RF blanking is selected.

R92 is factory selected to match the modulator for best square wave modulation symmetry.



NOTE

DARKER LINES REPRESENT THE BAND 0 AND BAND 1-3 LEVELING LOOPS. LIGHTER LINES REPRESENT CIRCUITRY WHICH CONTRIBUTES TO, BUT IS NOT CONTAINED WITHIN, EITHER LOOP.

Figure 8-24. Simplified ALC Block Diagram (CHANGE 14)

A4 ALC TROUBLESHOOTING (CHANGE 14) (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 83590A 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 causes 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 (Single Band)
NO POWER (All Bands)
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 8-25 configures a typical test setup. Initiate all tests with the **[INSTR PRESET]** condition.

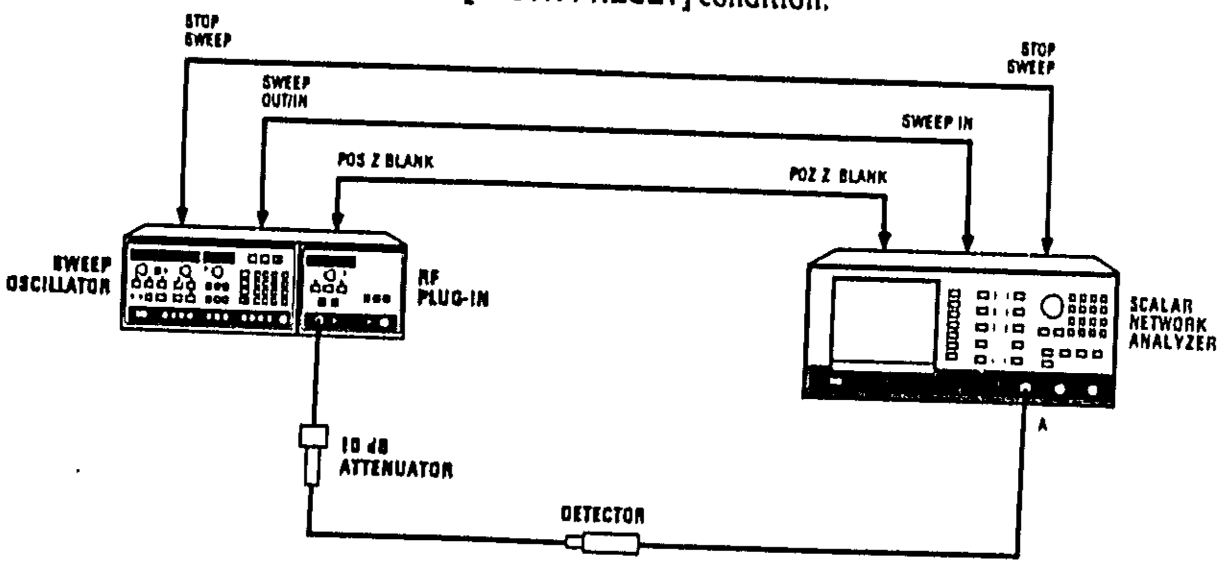


Figure 8-25. Typical ALC Troubleshooting Setup

A4 ALC TROUBLESHOOTING (CHANGE 14) (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 20 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 is on during the entire forward sweep, suspect components common to all bands.

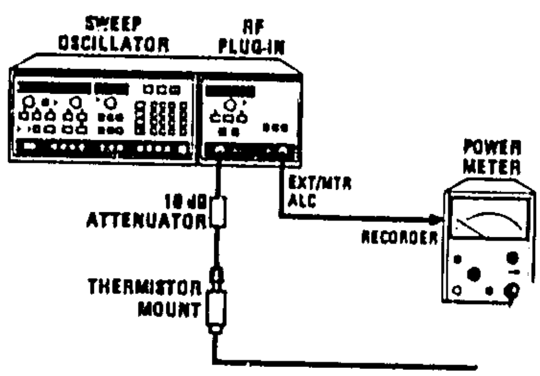


Figure 8-26. Power Meter Leveling Setup

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

- If the UNLEVELED light flashes on briefly three times during the sweep (at 7 and 13.5 seconds into the trace), the problem occurs at the bandswitch points. Check for the RF blanking (L RFB) pulses during bandswitch at A4P1-29, as shown in Figure 8-30. If the signal is missing, trace the problem back through the Model 8350A/B, to the blanking request (L RFBRQ) line on the RF Plug-In A6 assembly. If L RFB is present, but A4TP5 does not clamp at greater than or equal to +4 Vdc during blanking, suspect A4U2D or A4U9.

- 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 Dropouts)

Monitor the RF output with the HP 8756A as shown in Figure 8-25. Optimize the output power with the front panel PEAK control.

- 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 +10 and −5 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.

FULL UNLEVELED POWER (One or More Bands)

If power is unleveled in one Band only, select a sweep width within the unleveled band(s). If power is unleveled in all bands, continue to sweep the plug-in's full range.

- Attempt to level the power externally using the HP 432A/B/C, 436A, or 438A Power Meter as shown in Figure 8-26. Select MTR leveling, and enter a 100 second 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 U33 and U6A. It may be necessary to perform the ALC adjustments in Section V of this manual.

- 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 8-12). 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 Modulator. If it is below −2 Vdc, suspect the Detectors and Detector Leg.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

NO POWER (Single Band Only)

If no power is detected in one band, but there is leveled power in another band, suspect the components of the RF path appropriate to the faulty band within the ALC loop.

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 (at least +12 dBm from 2 to 20 GHz) is then detected in all bands, the RF Amplifier (A14), the DC Return (A15), the Isolator (AT1), and the YTM (A12) are verified. Suspect primarily the appropriate detector. Also inspect the modulator, as well as the A4 Mod Driver and Detector Selection Switch.
- If the RF signal for all bands is missing, check the A6 SRD and PIN Diode Bias circuit.

NO POWER (All Bands)

NOTE

Turn off line power before removing or installing any assembly.

- If no power is detected in any band, remove the A4 ALC assembly. This removes all bias from the modulator, and should allow full RF power to be transmitted. If there is still no power, check the rear panel AUX OUTPUT for approximately 0 dBm to verify that the A13 YIG Oscillator is providing an RF output. Refer to RF Troubleshooting for details.
- If removing the A4 assembly causes 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 approximatley 5 dB, refer to Section V, Adjustments, in this manual, and perform the Internal Leveled Flatness adjustment procedure.

A4 ALC TROUBLESHOOTING (CHANGE 14) (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, CR1
DETECTOR LEG	E F G
MODULATOR LEG	I L
MOD DRIVER	N
MODULATOR	A13
SAMPLE AND HOLD	E K

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., B1 is held high by selecting a CW frequency in Bands 1 through 3; 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, detector compensation, and power sweep signals.

The detector 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 U11 establishess the absolute power level. The −10V REF from the A6 assembly is scaled to yield from 0 Vdc (−5 dBm displayed) to the +10 Vdc (+20 dBm displayed) at TP2. (This breaks down to a voltage step of 0.40 Vdc per 1.0 dB of power over the dynamic range, or 6.00 Vdc at +10 dBm.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

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

[SHIFT] [5] [0]

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

- If the waveform at TP2 is not correct, check for −10V REF, and trace any problem back to the 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 CR1. Use the EXT MTR mode to bypass this diode while troubleshooting.

U2C adds the front panel amplitude adjustment (EXT CAL) used with external leveling. The following levels should be seen at TP1 with A5 removed and INT leveling selected: +0.3 Vdc for −5 dBm, and +7.0 Vdc for +20 dBm. An amplitude modulation (AM) signal of 1.0 V p-p at P1-4 will produce roughly 260 mV p-p at TP1. (Note that U3A and CR1 in the feedback path around U2A change the gain depending on the band and the desired power level. This may result in a 1.0 Vdc difference between bands at +20 dBm.)

DETECTOR CR1 / DETECTOR SELECTION SWITCH B

The detector CR1 is tested simply by checking the output voltage under full leveled power or full unleveled power conditions.

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 in the suspected band, 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 P1-19 to isolate the output of the modulator driver from the modulators. Reinstall the A4 board. This removes bias from the modulator, allowing full RF power transmission, while providing detector bias.

- If full leveled power (+10 dBm from 2 to 20 GHz) or full unleveled power (at least +2 dB higher than leveled) is measured, sweep only the band in question and check the voltages at the detector input against the values shown in Table 8-11. (Use high-impedance 10:1 probes.)

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

Table 8-11. Detector Voltages

	Full Leveled +10 dBm	Full Unleveled +20 dBm
Bands 1-3 (A4P1-20)	−100 to −120 mV	−200 to −600 mV

- If the detector is working and the Detector Selection Switch is suspected, sweep only in the faulty 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 8-32.

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 −5 dBm at any CW frequency.
  3. Press Model 83590A **[EXT]** ALC.

A4 ALC TROUBLESHOOTING (CHANGE 14) (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. (When sweeping across a bandswitch point, RF blanking pulses will saturate TP5 at +5 Vdc regardless of input.)

6. Remove jumper from A4TP11 to ground.

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

MODULATOR DRIVER N

The voltage-to-current conversion and current gain needed to drive the modulators 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 modulator, shunting more RF energy to ground and allowing less to pass through. Since the modulator is essentially current-controlled, the voltages measured at TP6, P1-19, 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 stages, TP5 can be forced high (+5 Vdc). Using a jumper, ground A4TP11. Press Model 8350A/B **[CW]** and select a CW frequency in the appropriate band. Select **[EXT]** ALC, and enter an RF power level of −5 dBm via front panel controls. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. Verify a signal level of approximately +5 Vdc at TP5. Remove jumper from A4TP11 to ground.

R92 is adjusted for 50% duty cycle of the square wave.

- Set the HP 8350A/B to CW, SQ MOD on. Connect the RF output to a crystal detector and oscilloscope. While observing the square wave, adjust R92 for 50% duty cycle.

MODULATOR

The internal modulator for this plug-in is housed in a combination microcircuit package: A16 Modulator/Coupler. Figure 8-27 provides a simplified schematic for this positive-bias, shunt-type attenuator. As more current is supplied through the modulator bias pin, the shunt diode turns on harder, sinking more RF power to ground and allowing less to reach the front panel.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

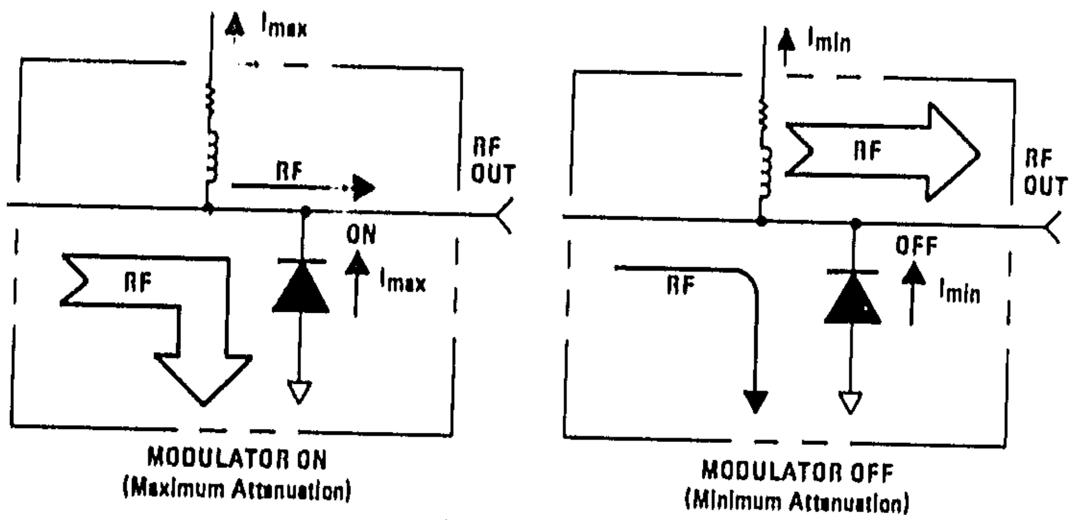


Figure 8-27. Simplified Modulator Schematic

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

NOTE

Turn off line power before removing or installing any assembly.

- If low or no RF power is observed, remove 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 Model 83590A **[EXT]** ALC. Attach a jumper from A4TP11 to ground. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully clockwise. This should result in −7 Vdc at TP5, essentially removing bias from the modulator. Measure the voltage across R49. It should be 0V. If this is not the case, isolate each modulator from its drive circuitry by applying a piece of cellophane tape to the pin edge connection: P1-19. 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 U8C and Q14. Remove jumper from A4TP11 to ground.

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 in all bands, check the RF level at the rear panel AUX OUTPUT connector. Refer to the RF Schematic Diagram at the end of Section VIII for the proper levels. Check the RF levels around the Power Amplifier A14 with no modulation. A14 should output approximately +26 dBm with about +13 dBm at the input.

A4 ALC TROUBLESHOOTING (CHANGE 14) (Cont'd)

- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted). Select Model 83590A **[EXT]** ALC. Attach a jumper from A4TP11 to ground. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. The voltage level at TP5 should be +5 Vdc. Concurrently, the voltage level at the output of the Mod Driver, P1-19, should be approximately +0.6 Vdc to +0.8 Vdc.

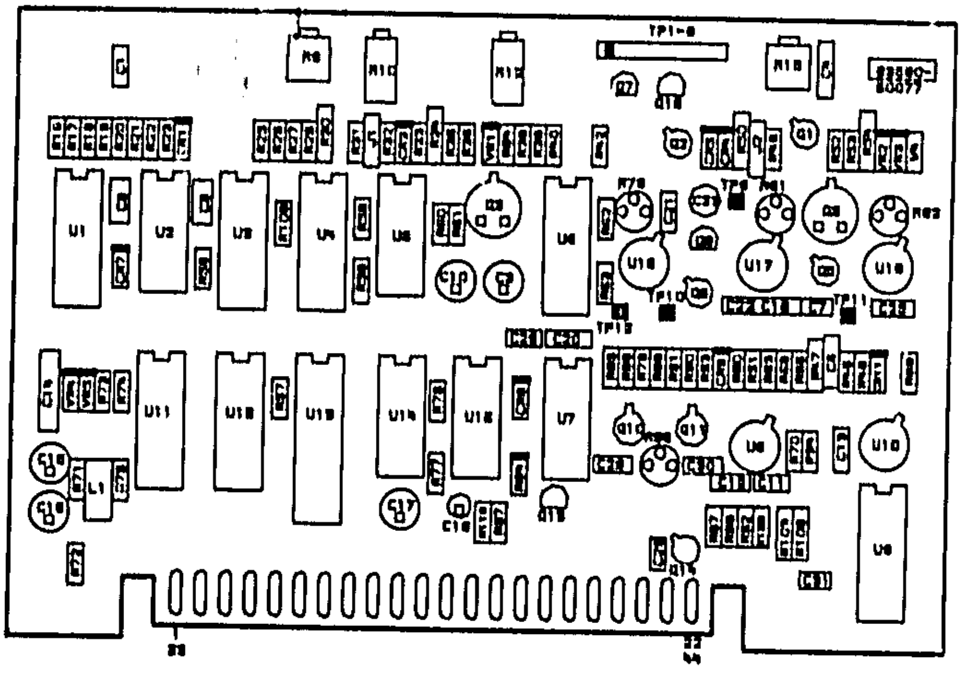
  1. If the voltages are significantly higher than this, the modulator diode is probably open.

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

SAMPLE AND HOLD E K

There are adjustments to improve the shape of the squarewave. C23 in block E and R99 in block K are used to eliminate offset in the Input Sample and Hold, and Error Sample and Hold circuits respectively. They act to effectively cancel charge passed through the gate to source capacitance of the FET. Refer to Paragraph 5-27 for the proper adjustment procedures.

A4



HP P/N 83590-60077

Figure 8-29. A4 ALC Component Locations (CHANGE 14)

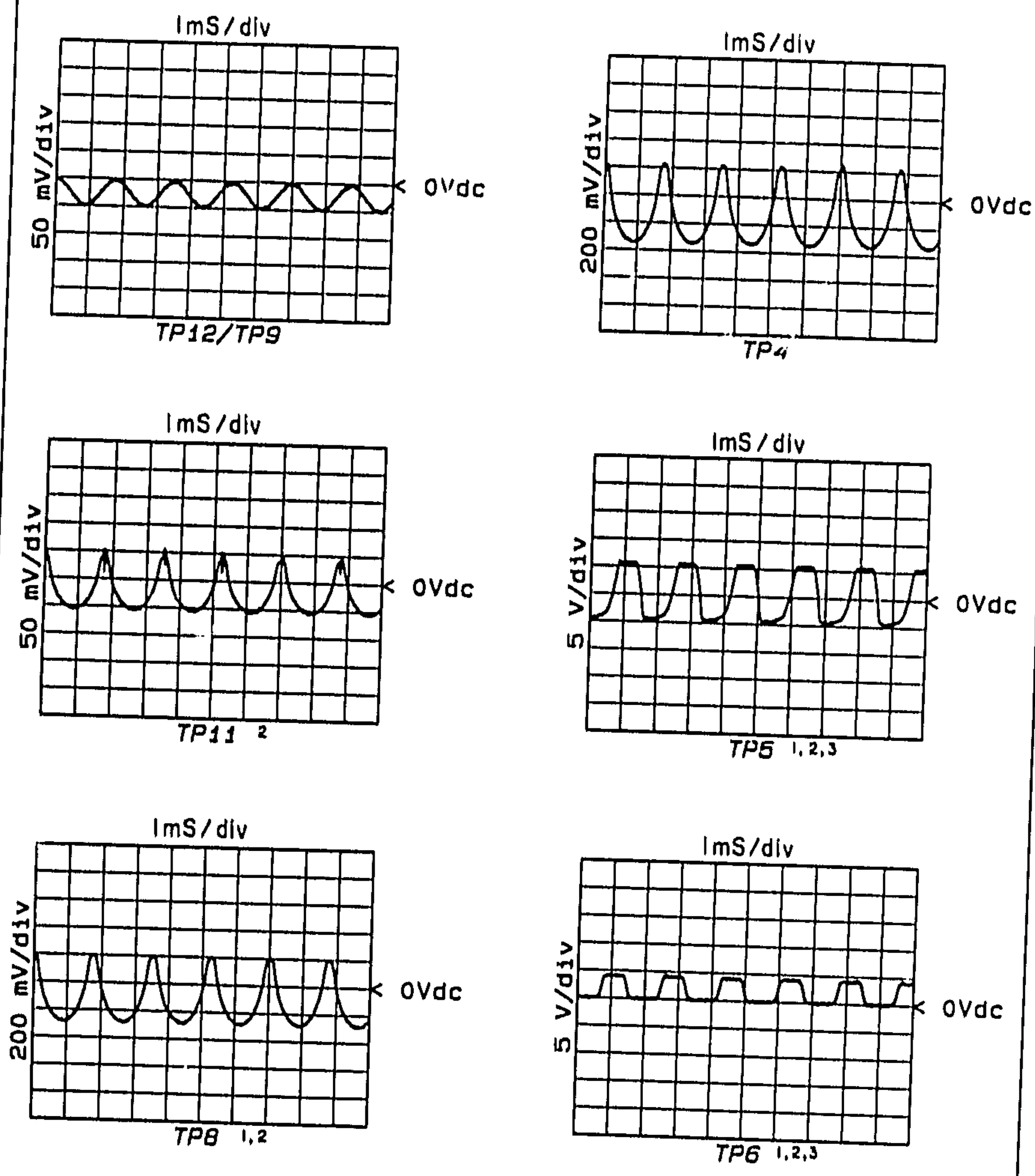
Table 8-12. Leveling Control Lines (CHANGE 14)

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

A4P1 Pin-out Table (CHANGE 14)

A4P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1	EXT DET RET	IN	J2	P
23	EXT DET	IN	J2	B
2	L UNLVL	OUT	A6P1-40, A10J1-12	M
24	EXT CAL	IN	A10J1-41	H
3	PWR REF	OUT	NOT USED	C
25			NOT USED	
4	AM	IN	P1-A4	C
26			NOT USED	
5	PWR SW/COMP	IN	A5P1-23	C
27	+5V	IN	A3P1-6,7	P
6			NOT USED	
28	−15V	IN	P2-28	P
7	+10V	IN	P1-8	P
29	L RFB	IN	P2-56	L, N
8	GND DIG			P
30	GND DIG			P
9	BD1	IN	A3P1-9	A, C
31	BD0	IN	A3P1-31	A, C
10	BD3	IN	A3P1-10	A, C
32	BD2	IN	A3P1-32	A, C
11	BA1	IN	A3P1-11	A, C
33	BA0	IN	A3P1-33	A, C
12	BA3	IN	A3P1-12	A, C
34	BA2	IN	A3P1-34	A, C
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			P
37	GND ANLG			P
16			NOT USED	
38	+15V	IN	P2-29	P
17	−10V	IN	P1-13	P
39	−40V	IN	P1-11	P
18	L INST1	IN	A3P1-8	A, C
40	SQ MOD	IN	P2-26	K, N
19	MOD 1	OUT	A10E1	N
41	L PULSE	IN	A6P1-25	K
20	INT DET	IN	CR1	B
42	INT DET RET	IN	CR1	
21			NOT USED	
43	−10V REF	IN	A8P1-3	C
22	MOD DRIVE	OUT	NOT USED	L
44			NOT USED	



1. Power: 10 dBm. Offset depends on power level and **EXT/MTR ALC "CAL"**.
2. CW mode.
3. Adjust **EXT/MTR ALC "CAL"** to obtain waveshape.

Figure 8-33. Open Loop Waveforms (CHANGE 14)

Figure 8-28. A4 ALC Block Diagram (CHANGE 14)

Figure 8-34 A4 ALC Schematic Diagram(CHANGE 14)

CHANGE 15

(Supersedes CHANGE 10)

This change installs Revision 6 firmware.

Page 6-6, Table 6-3:

Change A3 to HP and Mfr. Part Number 83525-60080 CD 6, DIGITAL INTERFACE ASSEMBLY (does not include A3U1 and A3U2).

Change A3U1 to HP and Mfr. Part Number 83590-80006 CD 7.

Change A3U2 to HP and Mfr. Part Number 83590-80007 CD 8.

Page 8-35, Figure 8-23:

Change A3 DIGITAL INTERFACE part number in the top left-hand corner of the schematic to 83525-60080.

Change the SERIAL PREFIX in the bottom left-hand corner of the schematic to 2412A.

CHANGE 16

This change incorporates modifications to the A2 Sub Panel Board and A7 YTM Driver Board.

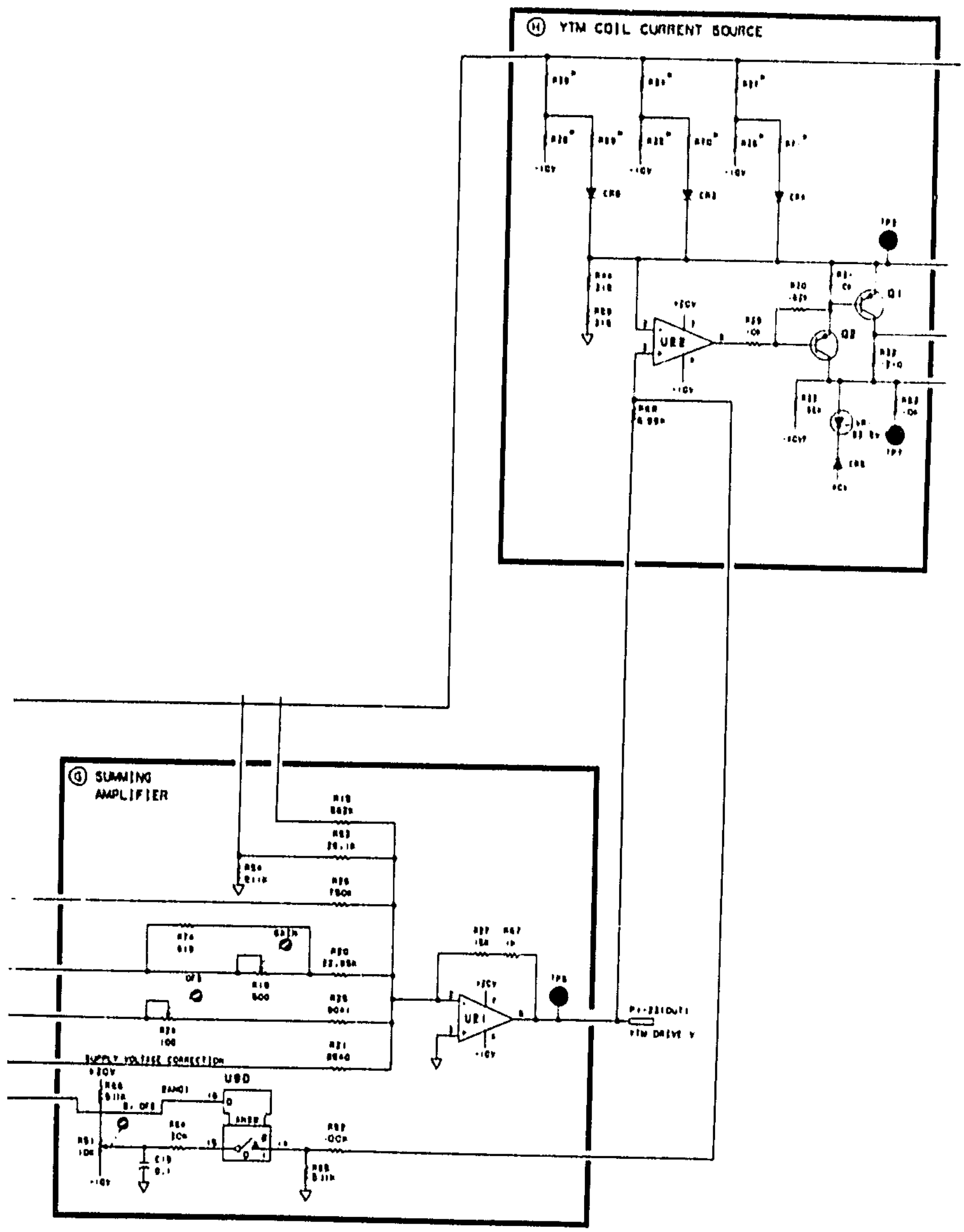
Page 6-6, Table 6-3:
Change A2R1 to HP Part Number 2100-3103, CD *.

Page 6-14, Table 6-3:
Change the A7 YTM Driver assembly HP and Mfr. Part Number to 83595-60068, CD 4.

Page 6-15, Table 6-3:
Change A7R52 to: 0698-6358, CD 2, RESISTOR 100K .1% .125W F TC=0 ± 25, 28480, 0698-6358.
Change A7R64 to: 0698-6977, CD 1, RESISTOR 30K .1% .125W F TC=0 ± 25, 28480, 0698-6977.
Change A7R65 to: 0757-0438, CD 3, RESISTOR 5.11K .1% .125W F TC=0 ± 100, 28480, 0757-0438.
Change A7R66 to: 0757-0438, CD 3, RESISTOR 5.11K .1% .125W F TC=0 ± 100, 28480, 0757-0438.
Change A5R67 to: 0698-6362, CD 8, RESISTOR 1K .1% .125W F TC=0 ± 25, 28480, 0698-6362.
Change A7R68 to: 0698-8469, CD 0, RESISTOR 6.99K .1% .1 W F TC=0 ± 4, 28480, 0698-8469.
Delete A7CR6.

Page 8-63, Figure 8-52 (A7 Component Locations):
Delete R68.
Change R66 to R68.
Change CR6 to R66.

Page 8-63, Figure 8-60 (A7 Schematic):
Replace the function blocks **G SUMMING AMPLIFIER** and **H YTM COIL CURRENT SOURCE** with *P/O A7 YTM DRIVER SCHEMATIC DIAGRAM (CHANGE 16)* in this document.
Change the part number in the top left-hand corner of the schematic to: 83595-60068.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2413A.



P/O A7 YTM Driver Schematic Diagram (CHANGE 16)

CHANGE 17

(Supersedes Part Numbers in CHANGE 16)

This change installs Revision 7 firmware.

Page 6-6, Table 6-3:
Change A3U1 to HP and Mfr. Part Number 83590-80010, CD 3.
Change A3U2 to HP and Mfr. Part Number 83590-80011, CD 4.

CHANGE 18

This change documents the increase in range of the sequential-band delay compensation adjustments.

Page 6-15, Table 6-3:

Change A7R42 to HP and Mfr. Part Number 2100-0544, CD 3, RES-TRMR 100K 10%.
Change A7R43 to HP and Mfr. Part Number 2100-3611, CD 1, RES-TRMR 50K 10%.

Page 8-63, Figure 8-60:

In block E DELAY COMPENSATION change the following items:

A7R42 to 100K
A7R43 to 50K

CHANGE 19

This change documents a revision to the Motherboard Assembly and Power Supply Cables.

Page 6-18, Table 6-3:
Change A10 to HP and Mfr. Part Number 83595-60078, CD 6.

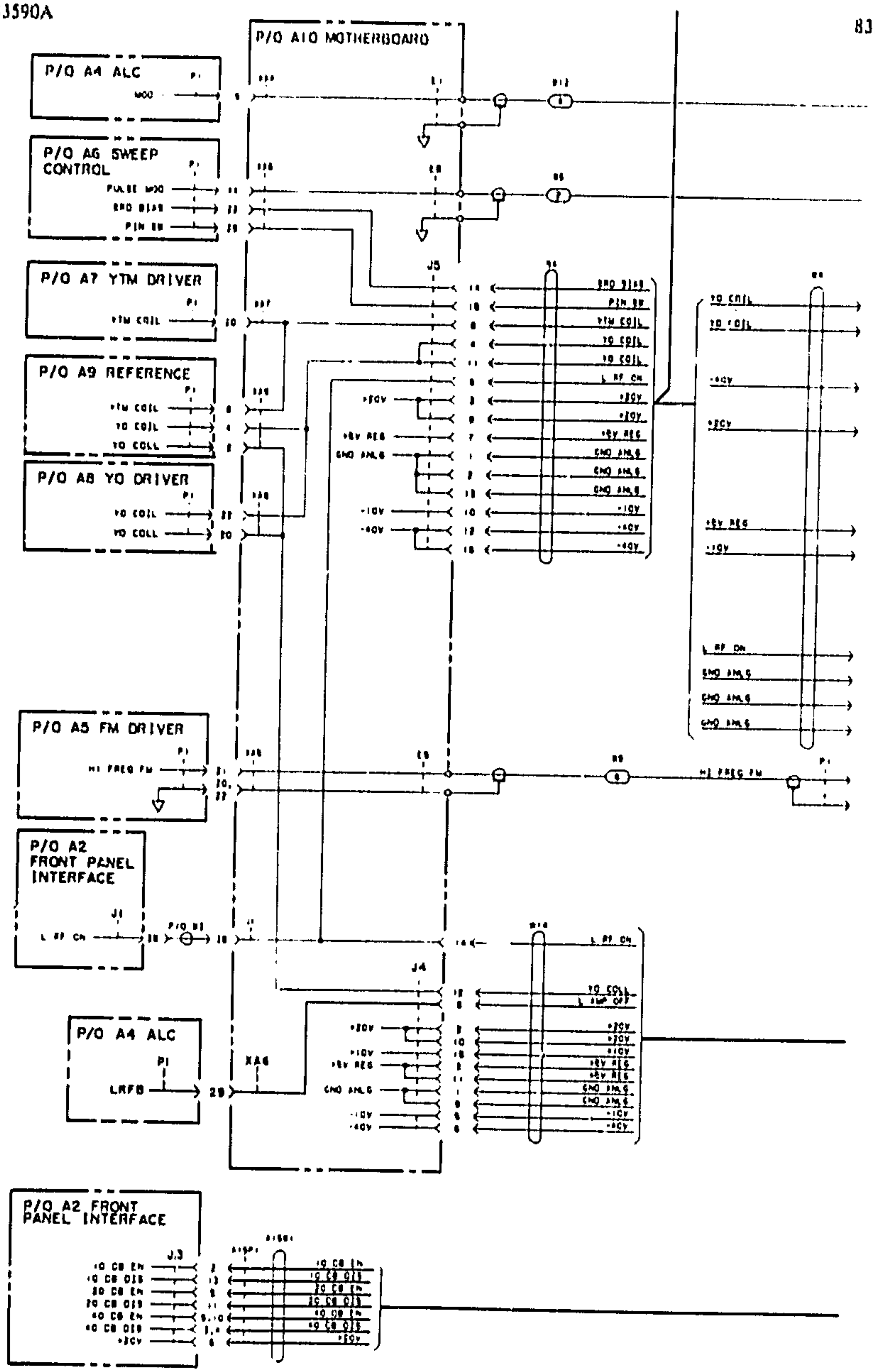
Page 6-19, Table 6-3:
Change A10J2 to HP and Mfr. Part Number 1251-6952, CD 7.
Change A10J3 to HP and Mfr. Part Number 1251-6343, CD 0.

Page 6-22, Table 6-3:
Change W28 to HP and Mfr. Part Number 83525-60066, CD 8.

Page 8-75, Figure 8-76. RF Schematic Diagram:
Replace left part of Figure 8-76 with *P/O Figure 8-76. RF Schematic Diagram (CHANGE 19)* in this document.

Page 8-76, Figure 8-79. A10 Motherboard Component Locations:
Replace Figure 8-79 with *Figure 8-79. A10 Motherboard Component Locations (CHANGE 19)* in this document.

Page 8-81, Table 8-15. 83590A Motherboard Wiring List (5 of 5):
Replace Table 8-15 with *Table 8-15. 83590A Motherboard Wiring List (5 of 5) (CHANGE 19)* in this document.



P/O figure 8-76. RF Schematic Diagram (CHANGE 19)

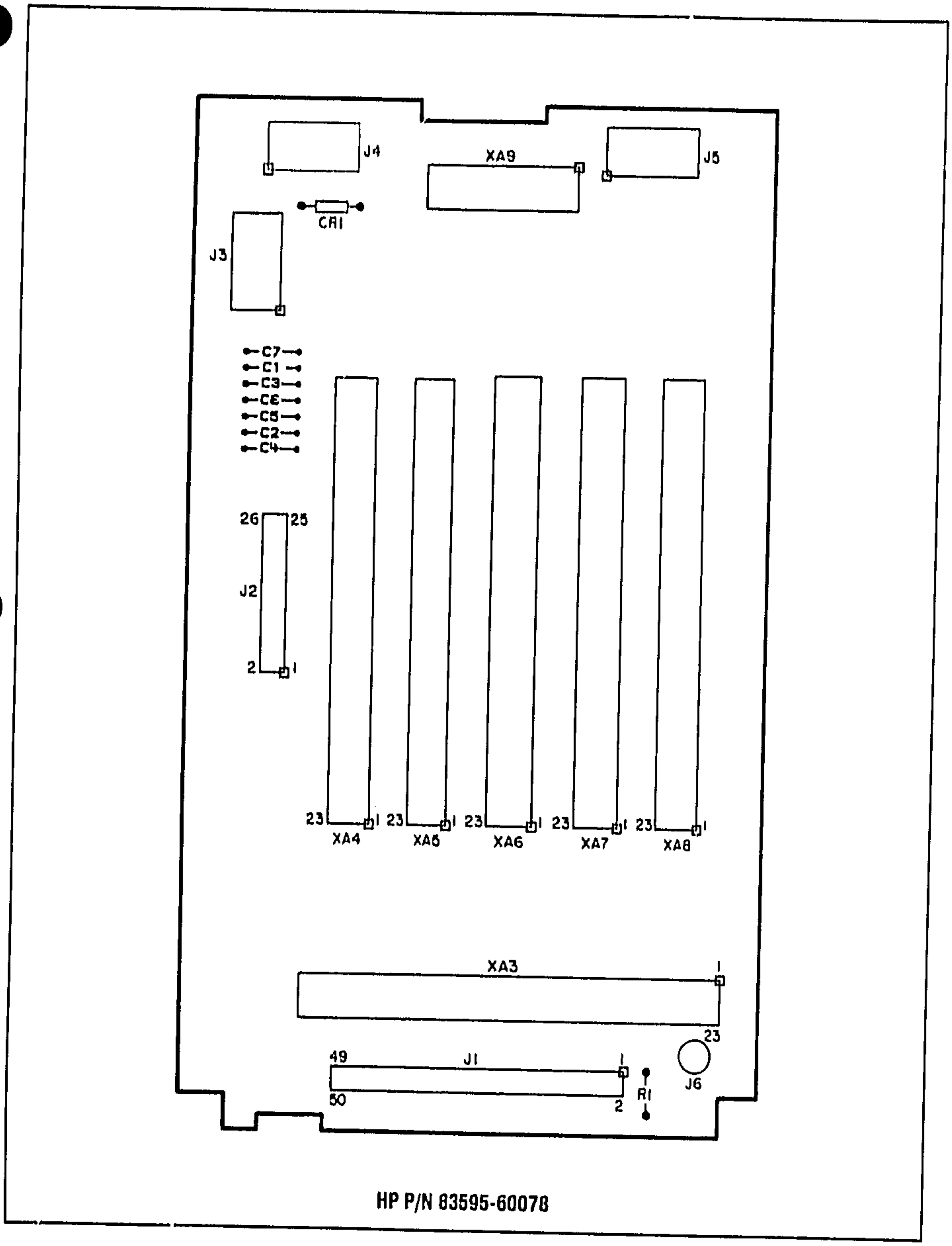


Figure 8-79. A10 Motherboard, Component Locations (CHANGE 19)

Mnemonic	Signal Source	Mnemonic Description	Power Supply Interface P1	Plug-In Interface P2	Dig Intfc A3P1	Dig Intfc A3J1	ALC A4P1	FM A5P1	Sweep Control A6P1	YTM A7P1	YO A8P1	Ref Resistor A9P1	F.P. Interface A10J1	P/O Plug-in Interface A10J2	Power Supply Interface A10J3	YO/YTM Ribbon Cable A.0J5	RF Ribbon Cable A10J4	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	3,11	42		7 14 6 15	3,9	2,10	C7
+15V	P2-20	+15V Regulated		20			38	38	38	38	38			15				C6
+10V +/−10V RET	P1-8 P1-3, 16	+10V Regulated +/−10V Return	8 3, 16				7	7	7	7	7		46		8 3,6		15	C5
+5V +5VA +5VB +5V REG +5V UNREG	A3P1-6,7 P2-30 P2-18,50,51 A9P1-7 P2-63	+5V Internal for RF Plug-In +5V for 8350A +5V for RF Plug-In +5V Regulated +5V Unregulated		30 18,50,51 63	6,7	35,36,38	27	27	27	27	27	7 12	2	18,20		7	3,11	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	10	5	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	12,16	6	C1
GND ANLG	W28P1-8 P2-27,58,59	Analog Ground					15,37	15,37	37,41 43	15,19, 24,26, 28 37	15,19, 24,26, 28,37	6	48	10,11, 12,24	10,12,14 16,1,3,6	1,2 13	1,9	C1-C7, R1
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		8,30	8,30	8,30	8,30	8,30		8					R1
GND SENSE	W28P1-4	Analog Ground Sense													4			

[1] Coaxial Cable
[2] Shielded Cable
* Not used on this assembly

Table 8-15. 83590A Motherboard Wiring List (5 of 5) (CHANGE 19)

CHANGE 20

This change documents a replacement kit and an exchange replacement kit for the Power Amplifier Assembly.

Page 6-2, Table 6-1:
Change A14 New Part Number to 83592-60113, Rebuilt Part Number to 83592-60114, Description to Power Amp. 2.3 to 7.0 GHz Kit.

Page 6-20, Table 6-3:
Change A14 to HP and Mfr. Part Number 83592-60113, CD 7, POWER AMPLIFIER KIT.
Change A14 to HP and Mfr. Part Number 83592-60114, CD 8, EXCHANGE POWER AMPLIFIER KIT.

Page 6-20, Table 6-3:
Change A14A1C4 to HP part number 0180-0228, 22ufd 15V CD 5.
Add A14A1C9 HP part number 0160-4084, .1ufd 50V CD 8.
Add A14A1CR1 and A14A1CR2 HP part number 1901-0033, 180V 2A CD 2.
Change A14A1J1 to HP part number 1200-0482 CD 5.
Change A14A1MP1 to HP part 5021-5320 CD 8.
Change A14A1MP3 to HP part number 1251-3172 CD 4.
Change A14A1MP5 to HP part number 1200-0173 CD 5.
Add A14A1Q3 HP part number 1854-0477 CD 7.
Add A14A1Q4 HP part number 1853-0281 CD9.

Page 6-21, Table 6-3:
Add A14A1R32 HP part number 0698-7253 5.11K 1% .05W CD 0.
Add A14A1R33 HP part number 0698-7284 100K 1% .05W CD 5.
Add A14A1R34 HP part number 0698-7270 26.1K 1% .05W CD 9.
Add A14A1R35 HP part number 0698-7243 1.96K 1% .05W CD 6.
Add A14A1R36 HP part number 0698-7234 825 1% .05W CD 5.
Add A14A1R37 HP part number 0698-7257 7.5K 1% .05W CD 2.
Add A14A1R38 HP part number 0698-3438 147 1% .12W CD 3.
Add A14A1R39 HP part number 0698-7284 100K 1% .05W CD 5.
Add A14A1R40 HP part number 0698-3440 196 1% .12W CD 7.
Add A14A1U2 HP part number 1826-1058 CD 5.

Page 8-74, Figure 8-74:
Replace Figure 8-74 with *Figure 8-74. A14A1 Power Amplifier Bias, Component Locations* (CHANGE 20).

Page 8-75, Figure 8-76:
Replace blocks A14A1 and A14 with *P/O Figure 8-76. RF Schematic Diagram* (CHANGE 20).
Change Serial Prefix on bottom left corner to 2507A.

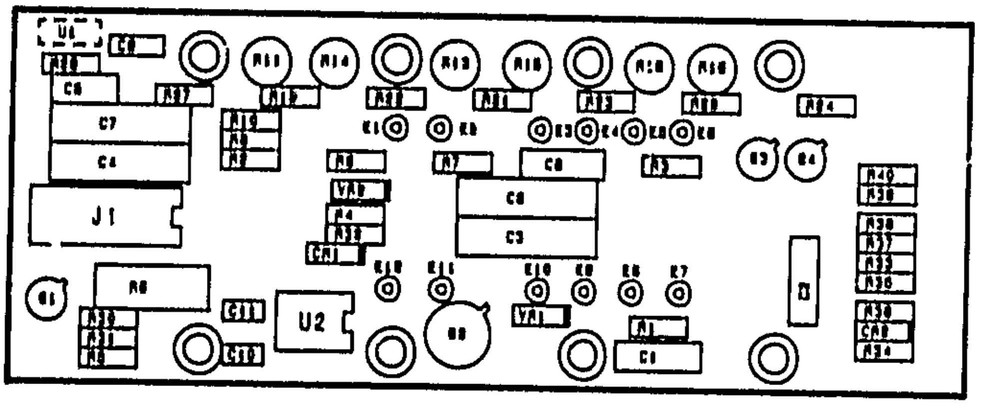
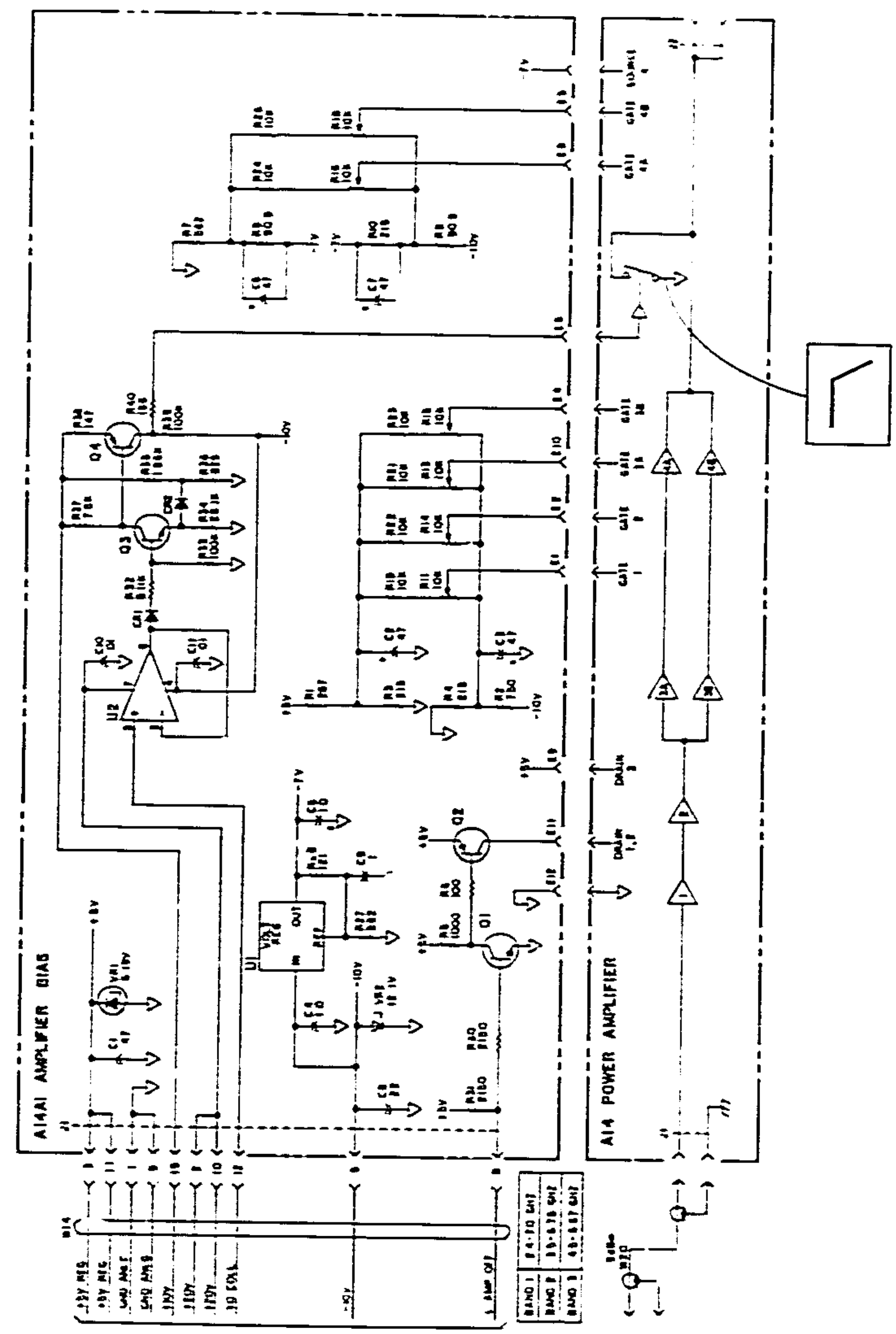


Figure 8-74. A14A1 Power Amplifier Bias, Component Locations (CHANGE 20)



P/O Figure 8-76. RF Schematic Diagram (CHANGE 20)

CHANGE 21

This change documents a modified A6 Sweep Control Assembly. (Supersedes Change 12)

Page 6-12, Table 6-3:
Replace All the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 21) (1 of 3)* in this document.

Page 6-13, Table 6-3:
Replace All the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 21) (2 of 3)* in this document.

Page 6-14, Table 6-3:
Replace All the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 21) (3 of 3)* in this document.

Page 8-57, Figure 8-44. A6 Sweep Control Component Locations:
Replace Figure 8-44 with *Figure 8-44. A6 Sweep Control Component Locations (CHANGE 21)* in this document.

Page 8-57, Figure 8-49. A6 Sweep Control Schematic Diagram:
Replace Figure 8-49 with *Figure 8-49. A6 Sweep Control Schematic Diagram (CHANGE 21)* supplied in this document.

P/O Table 6-3. Replaceable Parts (CHANGE 21) (1 of 3)

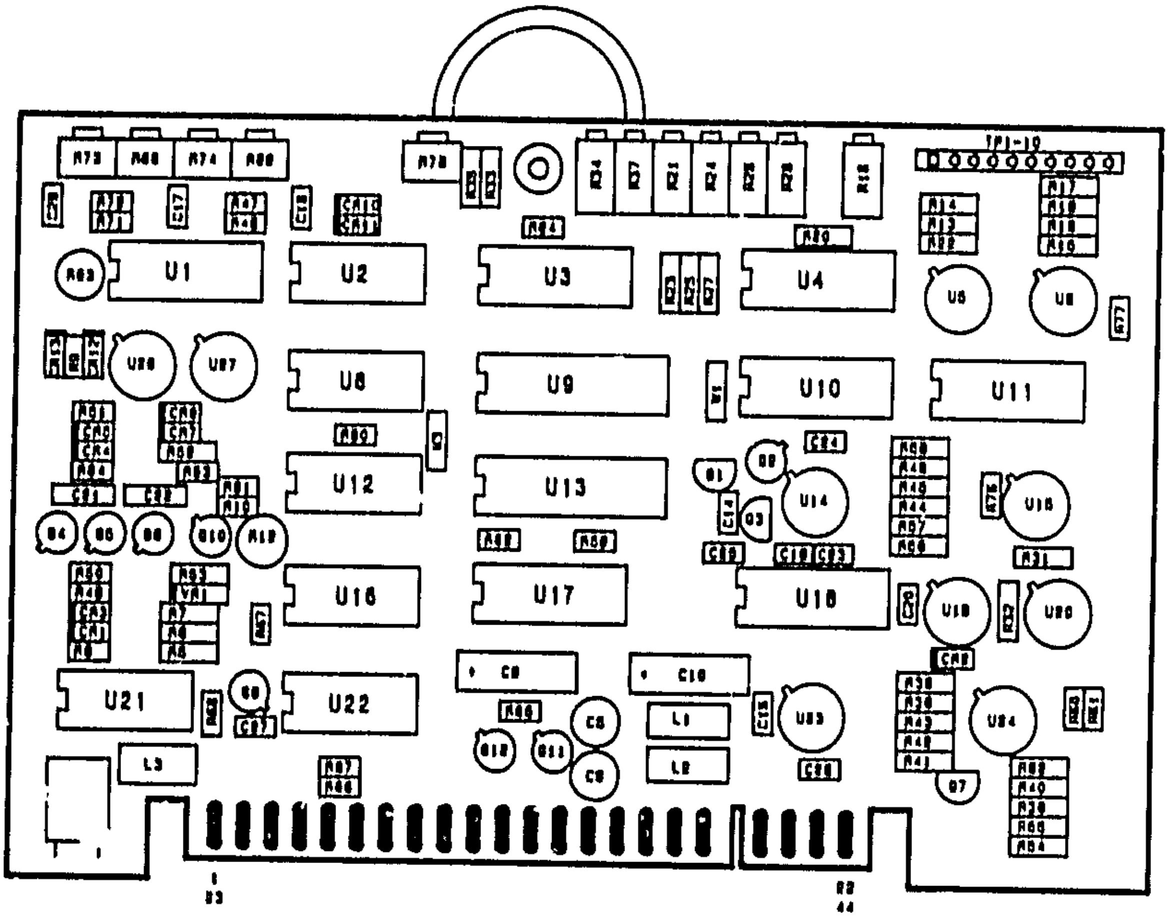
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	83590-60106	6	1	BOARD ASSEMBLY-SWEEP CONTROL	28480	
A6C1-A6C4				NOT ASSIGNED		
A6C5	0180-2617	1	2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C6	0180-2617	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C7	0180-2618	1	1	CAPACITOR-FXD 100UF+-20% 10VDC TA	28480	0180-2618
A6C8				NOT ASSIGNED		
A6C9	0180-0228	6	2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A6C10	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A6C11				NOT ASSIGNED		
A6C12				NOT ASSIGNED		
A6C13				NOT ASSIGNED		
A6C14	0160-3878	6	6	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C15	0160-0573	2	1	CAPACITOR-FXD 4700PF +-20% 100VDC CER	28480	0160-0573
A6C16	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C17	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C18				NOT ASSIGNED		
A6C19	0160-0575	4	2	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A6C20	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C21	0160-4084	8	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C22	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C23	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C25	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C26	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C27	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A6C28	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A6CR1	1901-0535	9	3	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR4	1901-0050	3	7	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR8				NOT ASSIGNED		
A6CR9				NOT ASSIGNED		
A6CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR13	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6L1	9140-0137	1	2	INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L3	08503-80001	8	1	COIL-TOROID	28480	08503-80001
A6MP1	5040-6049	8	1	EXTRACTOR P.C. BOARD BLUE	28480	5040-6049
A6MP2	5000-9043	6	1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A6MP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6Q1	1855-0423	5	3	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q2	1854-0477	7	2	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q3	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q4	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q5	1853-0405	9	2	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q6	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q7	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q8	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q10	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6Q11	1854-0009	9	2	TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0009
A6Q12	1854-0009	9		TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0009
A6R1				NOT ASSIGNED		
A6R2				NOT ASSIGNED		
A6R3				NOT ASSIGNED		
A6R4				NOT ASSIGNED		
A6R5	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R6	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R7	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R8	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R9	0698-7260	7	6	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R10	0698-7267	4	1	RESISTOR 19.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1962-F
A6R11	0698-7283	4	2	RESISTOR 90.9K 1% .05W F TC=0+-100	24546	C3-1/8-T0-9092-F
A6R12	2100-1738	9	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K

P/O Table 6-3. Replaceable Parts (CHANGE 21) (2 of 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R13	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R15	0698-8469	0	9	RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R16	2100-3756	5	1	RESISTOR-TRMR 20 10% C SIDE-ADJ 17-TRN	28480	2100-3756
A6R17	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R18	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R19	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R20	0699-0642	7	1	RESISTOR 10K .1% .1W F TC=0+-5	28480	0699-0642
A6R21	2100-3757	6	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A6R22	0699-0831	6	1	RESISTOR 9.96K .1% .1W F TC=0+-5	28480	0699-0831
A6R23	0699-0933	9	2	RESISTOR 27.362K .1% .1W F TC=0+-5	28480	0699-0933
A6R24	2100-3732	7	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R25	0699-0933	9		RESISTOR 27.362K .1% .1W F TC=0+-5	28480	0699-0933
A6R26	2100-3732	7		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R27	0699-0934	0	1	RESISTOR 35.650K .1% .1W F TC=0+-5	28480	0699-0934
A6R28	2100-3732	7	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R29				NOT ASSIGNED		
A6R30				NOT ASSIGNED		
A6R31	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R32	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R33	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R34	2100-3755	4	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3755
A6R35	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R36	0698-8827	4	3	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R37	2100-3750	9	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A6R38	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R39	0699-0164	6	1	RESISTOR 7.2K .1% .125W F TC=0+-25	28480	0699-0164
A6R40	0698-6067	8	1	RESISTOR 7.35K .25% .125W F TC=0+-50	28480	0698-6067
A6R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R42	0698-3260	9	2	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R43	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R45	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R46	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R47	0757-0421	4	2	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A6R48	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A6R49	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R50	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R51	0698-7212	9	1	RESISTOR 100 1% .05W F TC=0+-100	24546	C3-1/8-T0-100R-F
A6R52	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R53	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A6R54	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A6R55	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R56	0698-3158	6	1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A6R57	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2373-F
A6R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R59	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A6R60	0698-7277	6	2	RESISTOR 51.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5112-F
A6R61	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5112-F
A6R62	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A6R63	2100-2030	6	1	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A6R64	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R65				NOT ASSIGNED		
A6R66	0698-7272	1	1	RESISTOR 31.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3162-F
A6R67	0698-7253	8	1	RESISTOR 5.11K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5111-F
A6R68	2100-2516	3	2	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R69	2100-2516	3		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R70				NOT ASSIGNED		
A6R71	0698-7237	8	1	RESISTOR 1.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1101-F
A6R72	0698-7242	5	2	RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-F
A6R73	2100-2521	0	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R74	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R75				NOT ASSIGNED		
A6R76	0698-7283	4		RESISTOR 90.9K 1% .05W F TC=0+-100	24546	C3-1/8-T0-9092-F
A6R77	0698-7285	6	1	RESISTOR 110K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1103-F
A6R78	2100-2692	6	1	RESISTOR-TRMR 1M 20% C SIDE-ADJ 1-TRN	30983	ET50X105
A6R79	0699-7243	7	1	RESISTOR 1.96K 1% .05W F TC=0+-100	28480	0699-7243
A6R80*	0698-3162	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A6R81	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R82	0698-7243	6	1	RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-F
A6R83	0698-7242	5		RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-F
A6R84	0698-7238	9	1	RESISTOR 1.21K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1211-F
A6R85	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R86	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R87	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6TP1	1251-4672	4	10	CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP2	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP3	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP4	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672

P/O Table 6-3. Replaceable Parts (CHANGE 21) (3 of 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6TP5	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP6	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP7	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP8	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP9	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP10	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6U1	1826-0720	4	2	IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U2	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A6U3	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A6U4	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U5	1826-0471	2	6	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U6	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U7				NOT ASSIGNED		
A6U8	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U9	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U10	1826-1186	8	2	ANALOG SWITCH 4 SPST 16 -CERDIP	28480	1826-1186
A6U11	1826-1186	8		ANALOG SWITCH 4 SPST 16 -CERDIP	28480	1826-1186
A6U12	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U13	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U14	1826-0026	3	2	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U16	1820-1248	8	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS09N
A6U17	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U18	1826-0752	8	1	IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A6U19	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U20	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U21	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A6U22	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A6U23	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U24	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A6U25				NOT ASSIGNED		
A6U26	1826-0185	5	1	IC OP AMP SPCL TO-99 PKG	3L585	CA3080
A6U27	1826-0915	9	1	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-C PKG	01295	TL071ACJG (PER HP DWG)
A6VR1	1902-3002	3	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A6W1	8159-0005	0	2	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W2				NOT ASSIGNED		
A6W3				NOT ASSIGNED		
A6W4	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005



HP P/N 83590-60106

Figure 8-44. A6 Sweep Control Component Locations (CHANGE 21)

SERIAL PREFIX: 2618A

Figure 8-49. A6 Sweep Control, Schematic Diagram(CHANGE 21).

CHANGE 22

This change documents a new Front Panel casting and dress panel.

Page 6-21, Table 6-3:

Change MP4, FRONT PANEL-DRESS to HP Part Number 83590-00008, CD 1.
Change MP18, CASTING-FRONT to HP Part Number 83545-20081, CD 7.
Change MP19, RETAINER-PUSH ON to HP Part Number 0510-1267, CD 6.
Change MP 28, LATCH-SCREW to HP Part Number 83525-20069, CD 0.

▶ CHANGE 23
(Supersedes CHANGE 11)

This change documents a selectable FREQUENCY REFERENCE output.

Throughout the manual there are references to the 1.0 V/GHz rear panel output. Change all references to include 0.5 V/GHz. What follows are some specific areas to change.

Page 1-6, Table 1-2, (Supplemental Performance Characteristics):
Under **GENERAL CHARACTERISTICS:**
Change **Frequency Reference Output** to, selectable, 1.0 V/GHz ± 25 mV (0.01 to 18 GHz) or 0.5 V/GHz ± 25 mV (0.01 to 26.5 GHz) rear panel BNC output.

Page 1-8, paragraph 1-22:
Change to read as follows:
A rear panel 1.0 V/GHz (0.5 V/GHz) signal corresponds to the RF output frequency up to 18 GHz (26.5 GHz). This output voltage is selectable and may be used as a reference for pretuning external equipment. The HP 8410B/8411A network analyzer utilizes the 1.0 V/GHz output for phase-locking. The HP 83554A/55A/56A millimeter-wave source module uses the 0.5 V/GHz as its frequency reference for millimeter frequency applications.

Page 3-12:
After page 3-12 add page 3-13/3-14, *Figure 3-10. Frequency Reference Selection Switch* provided in this document.

Page 5-43, paragraph 5-24, **FREQUENCY REFERENCE 1V/GHz OUTPUT:**
Add the following:

NOTE

The frequency reference selection switch must be set to the 1.0 V/GHz position before performing this adjustment. Refer to Figure 3-10.

Page 6-5, Table 6-3:
Change A2 to HP and Mfr. Part Number 83590-60122, CD 6.
Add A2C9 HP and Mfr. Part Number 0160-4808, CD 4, CAPACITOR-FXD CER 470 pF 100 WV.

Page 6-6, Table 6-3:
Change to the following:

Reference Designation	HP Part Number	CD	Description
A2R8	0757-0463	4	RESISTOR-FXD 82.5K 1% .125W
A2R9	0698-7251	6	RESISTOR-FXD 4.22K 1% .05W
A2R10	0698-6320	8	RESISTOR-FXD 5K 0.1% .125W
A2R11	0698-6630	3	RESISTOR-FXD 20K 0.1% .125W
A2R18	0698-3159	5	RESISTOR-FXD 26.1K 1% .125W

Add the following:

Reference Designation	HP Part Number	CD	Description
A2R27	0698-7260	7	RESISTOR-FXD 10K 1% .05W
A2R29	0698-5437	6	RESISTOR-FXD 12K 0.1% .125W
A2S1	3101-2751	1	SWITCH ROCKER 2 POSITION DIP 1A
A2VR1	1902-0041	4	DIODE-ZNR 5.11V 5% DO-35 PD=.4W

Delete A2R28.

CHANGE 23 (Cont'd)

Page 6-21, Table 6-3:
Change MP35 to HP and Mfr. Part Number 83592-00028, CD 7.

Page 8-25, paragraph titled **1V/GHz Frequency Tracking Amplifier A2: E 1V/GHz Amplifier A2: G:**
Add the following: When A2S1 is closed 0.5 V/GHz frequency reference output is selected. U1A is now scaled to provide 0.5 V per GHz up to 26.5 GHz.

Page 8-31, Figure 8-12:
Replace the Components Location Diagram with *Figure 8-12. A2 Front Panel Interface, Components Locations (CHANGE 23)* provided in this document.

Page 8-31, Figure 8-18:
Replace Figure 8-18 with *Figure 8-18. A1 Front Panel/A2 Front Panel Interface, Schematic Diagram (CHANGE 23)* provided in this document.

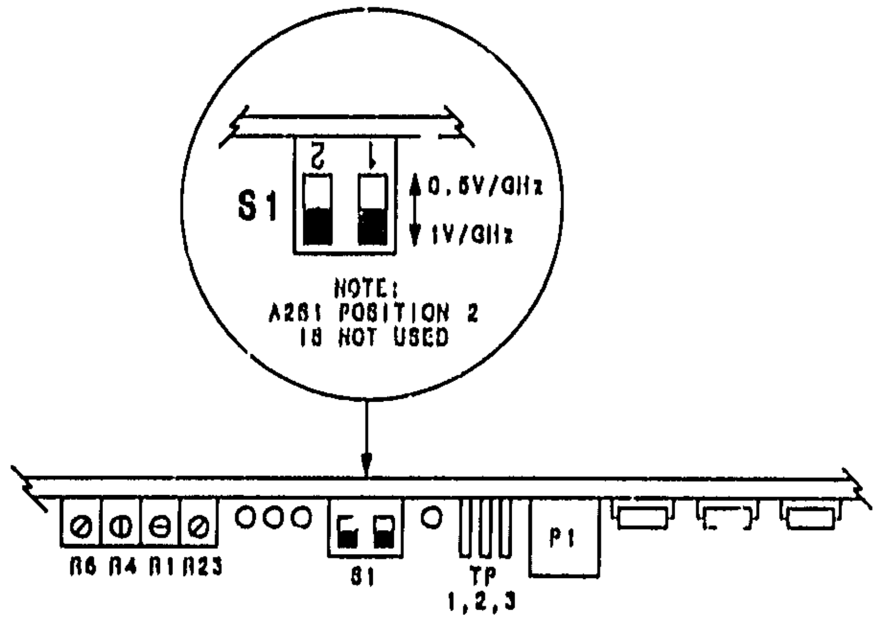
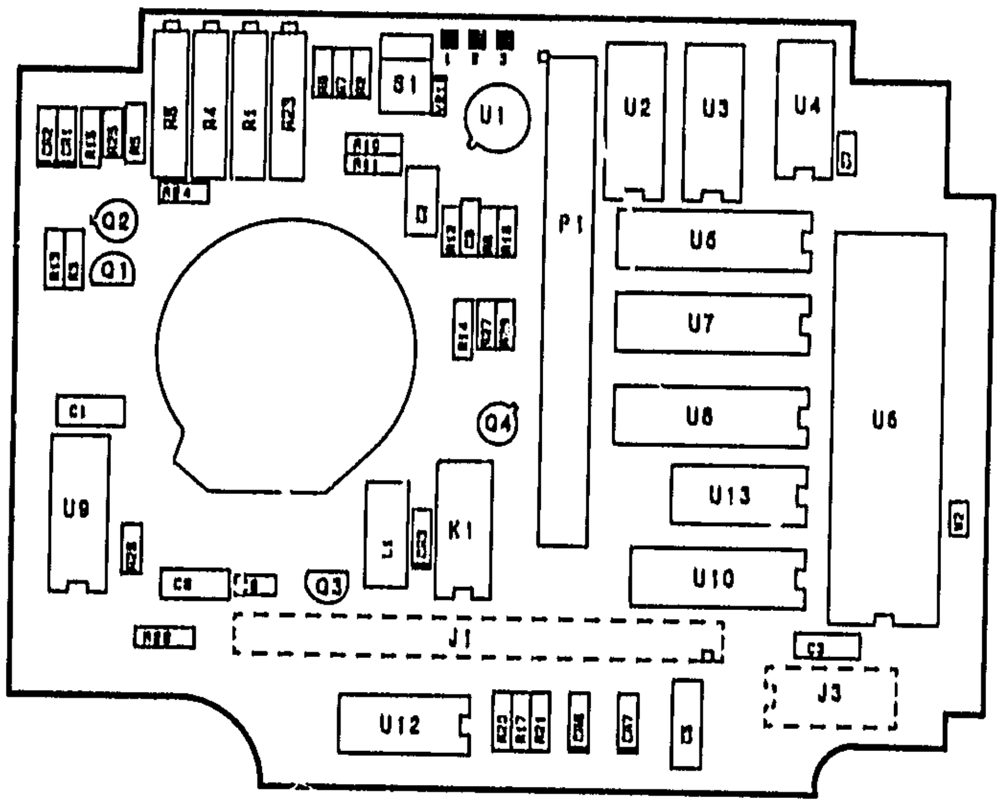


Figure 3-10. A2 Frequency Reference Selection Switch (CHANGE 23)



HP P/N 83590-60122

Figure 8-12. A2 Front Panel Interface, Component Locations (CHANGE 23)

83590A Figure 8-18. A1 Front Panel/A2 Front Panel Interface, Schematic Diagram (CHANGE 2)

CHANGE 24

This change documents a new YO Driver Board Assembly.

On the pages listed below, replace the figures with the new figures given.

Adjustments

Page 5-11, *Figure 5-2. −10V Reference Adjustment Location.*
Page 5-14, *Figure 5-4. Sweep Control Adjustment Location.*
Page 5-17, *Figure 5-7. YO and YTM DAC Calibration Adjustment Location.*
Page 5-25, *Figure 5-14. YO Retrace Compensation Adjustment Location.*
Page 5-28, *Figure 5-16. YO Delay Compensation Adjustment Location.*

Service

Page 8-69, *Figure 8-63. A8 YO Driver, Component Locations.*

Page 8-69, *Figure 8-71. A8 YO Driver, Schematic Diagram:*
Replace Block I YIG COIL CURRENT SOURCE with the partial schematic *P/O A8 YO Driver, Schematic Diagram (CHANGE 30)* from this document.

Page 6-16, Table 6-3:
Change the A8 Part No. to 83595-60070, CD 8, 83595-60070.
Add A8C22, 0160-3879, CD 7, CAPACITOR .01UF +20% 100VDC CER, 02010, SR201C103MAA.
Add A8C23, 0160-3879, CD 7, CAPACITOR .01UF +20% 100VDC CER, 02010, SR201C103MAA.
Add A8C24, 0160-3878, CD 6, CAPACITOR .001UF +20% 100VDC CER, 02010, SR201C102MAA.
Add A8C25, 0160-4801, CD 7, CAPACITOR 100 PF +5% 100VDC CER, 02010, SA101A101JAA.

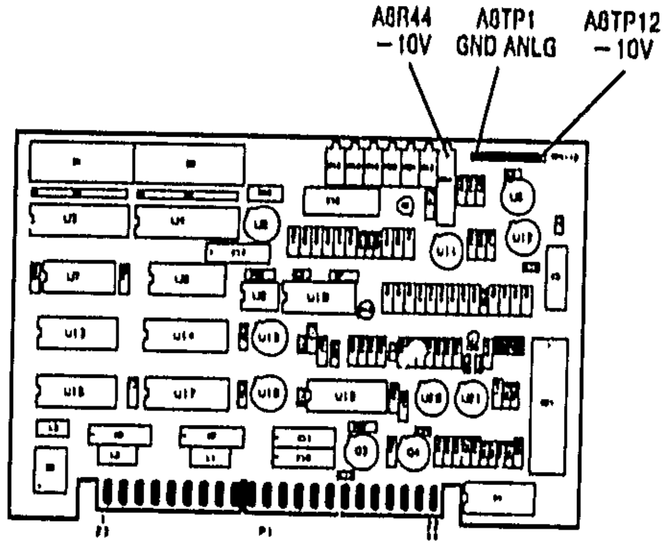
Page 6-17, Table 6-3:
Add A8CR9, 1901-0033, CD 2, DIODE-GEN PRP 180V 200MA DO-35, 00046, NDP692.

Page 6-18, Table 6-3:
Add A8R70, 0698-7220, CD 9, RESISTOR 215 1% .05W FTC=+100, 00746, CRB20.
Add A8R71, 0698-7220, CD 9, RESISTOR 215 1% .05W FTC=+100, 00746, CRB20.

Page 8-69, Figure 8-71 in the upper left hand corner:
Change the Part No. 83592-60002 to 83595-60070.

Page 8-69, Figure 8-71 in the lower left hand corner:
Change the Serial Prefix 2620A.

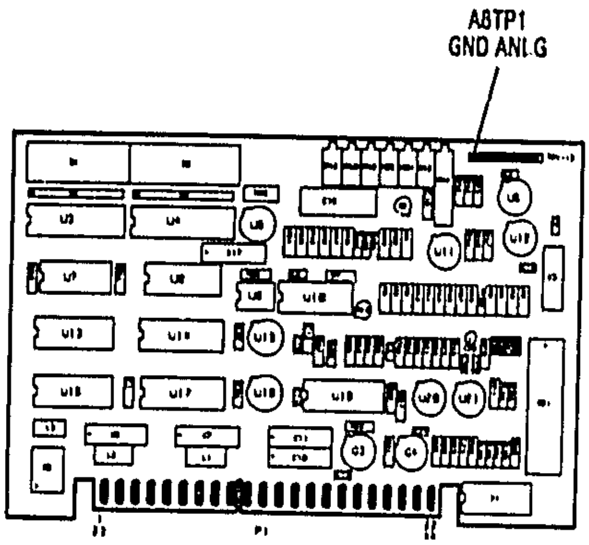
A8



HP P/N 83595-60070

Figure 5-2. −10V Reference Adjustment Location (CHANGE 24)

A8



HP P/N 83595-60070

Figure 5-4. Sweep Control Adjustment Locations (CHANGE 24)

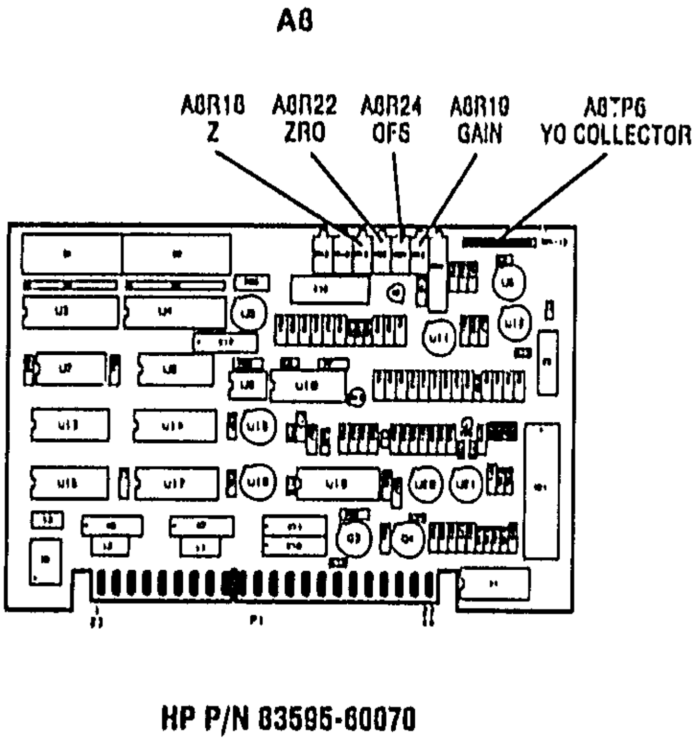


Figure 5-7. YO and YTM DAC Calibration Adjustment Locations (CHANGE 24)

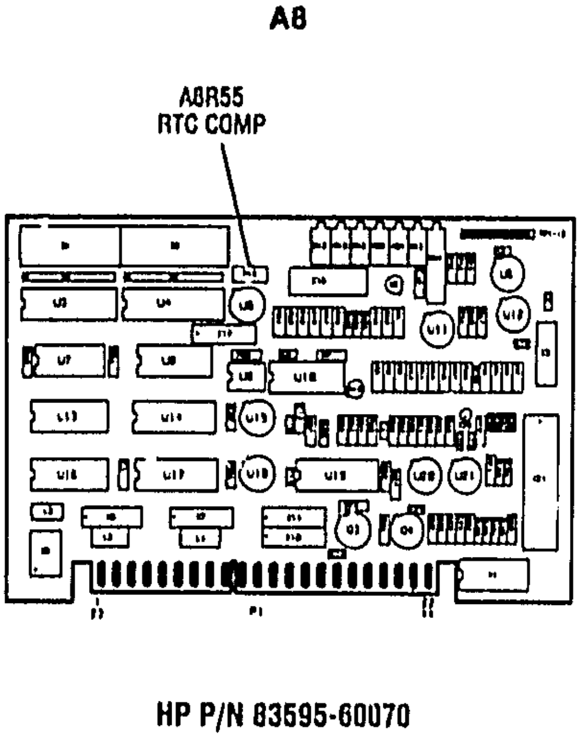
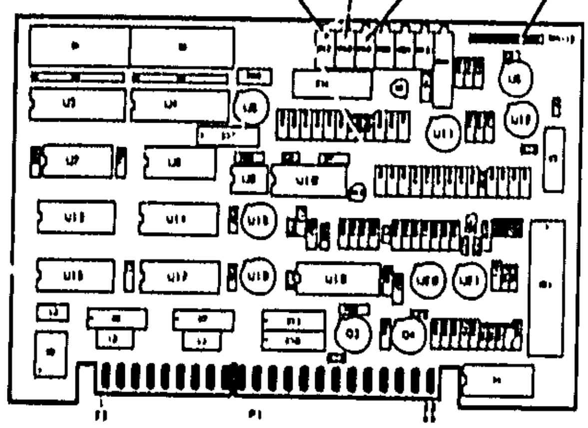


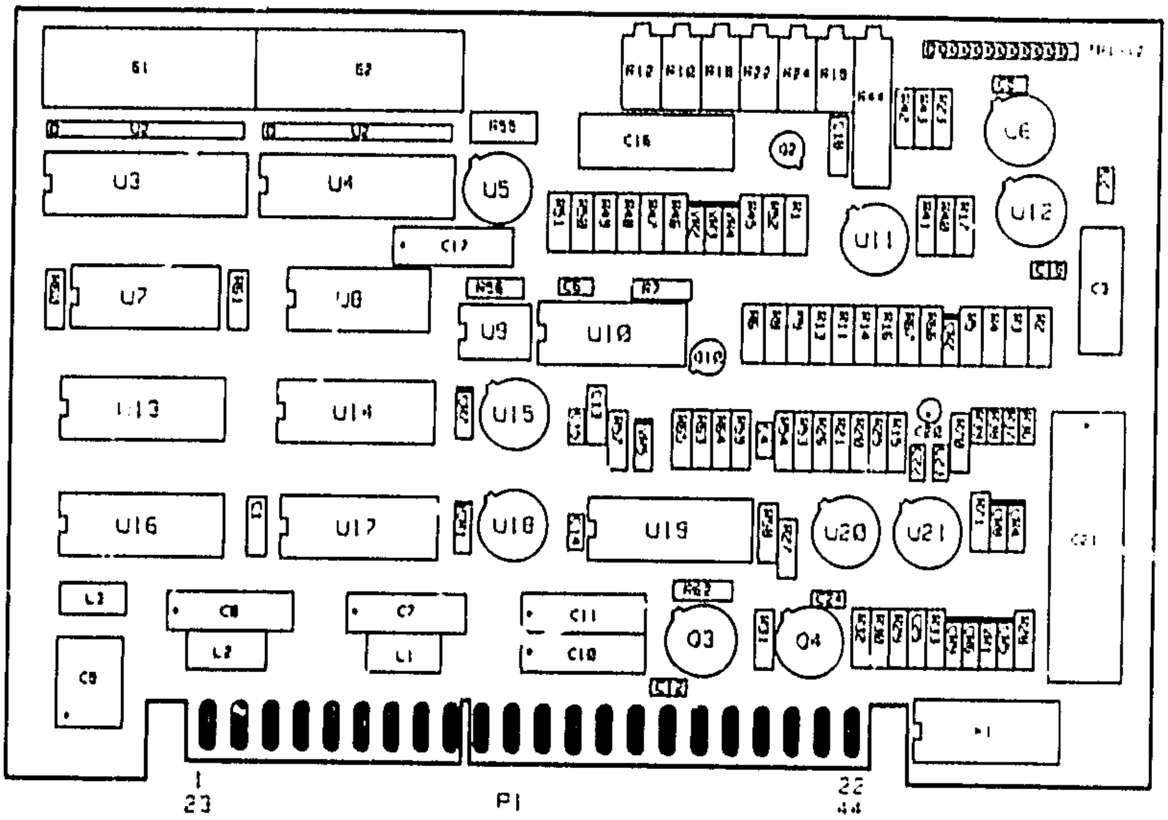
Figure 5-14. YO Retrace Compensation Adjustment Location (CHANGE 24)

A8



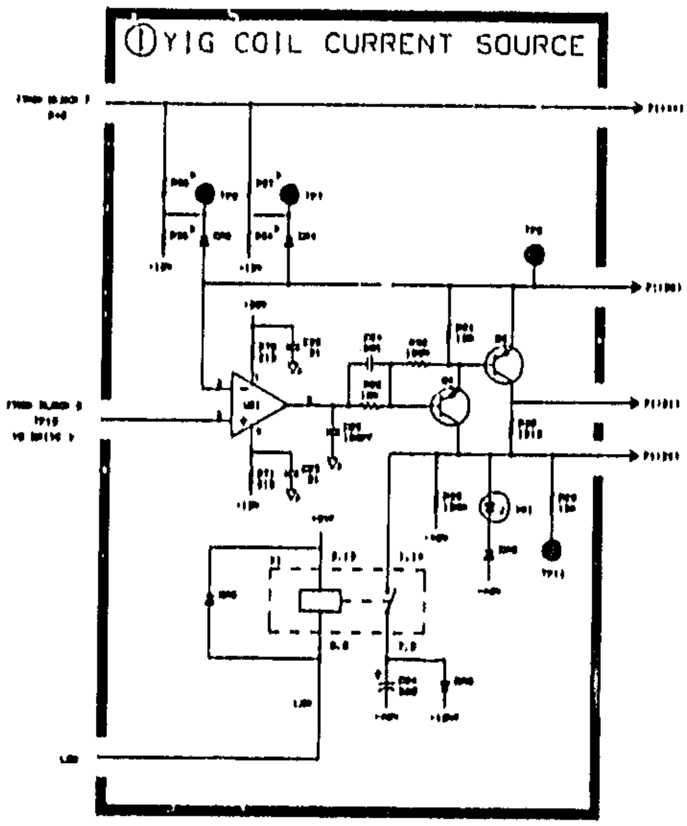
HP P/N 83595-60070

Figure 5-16. YO Delay Compensation Adjustment Location (CHANGE 24)



HP P/N 83595-60070

Figure 8-63. A8 YO Driver, Component Locations (CHANGE 24)



HP P/N 83595-60070

P/O Figure 8-71. A8 YO Driver, Schematic Diagram (CHANGE 24)

▶ CHANGE 25

This change documents the addition of a jumper to the A4 ALC assembly, it does not change any electrical functions of the ALC. Change 14 in this document is assumed to be incorporated prior to making the changes written in this change (Change 25).

Section VI, Replaceable Parts:
  Change A4 ALC assembly to HP and Mfr. Part Number 83590-60098, CD 5.
  Add A4W6, HP and Mfr. Part Number 8159-0005, CD 0, RESISTOR-ZERO OHMS 22 AWG LEAD DIA.

Page 8-47, Figure 8-29:
  Replace the Components Location Diagram with *Figure 8-29. A4 ALC, Component Locations (CHANGE 25)* provided in this document.

Page 8-47, Figure 8-34:
  Add A4W6 in series with the input to U15C pin 9 located in block N, PIN MOD 1 DRIVER.

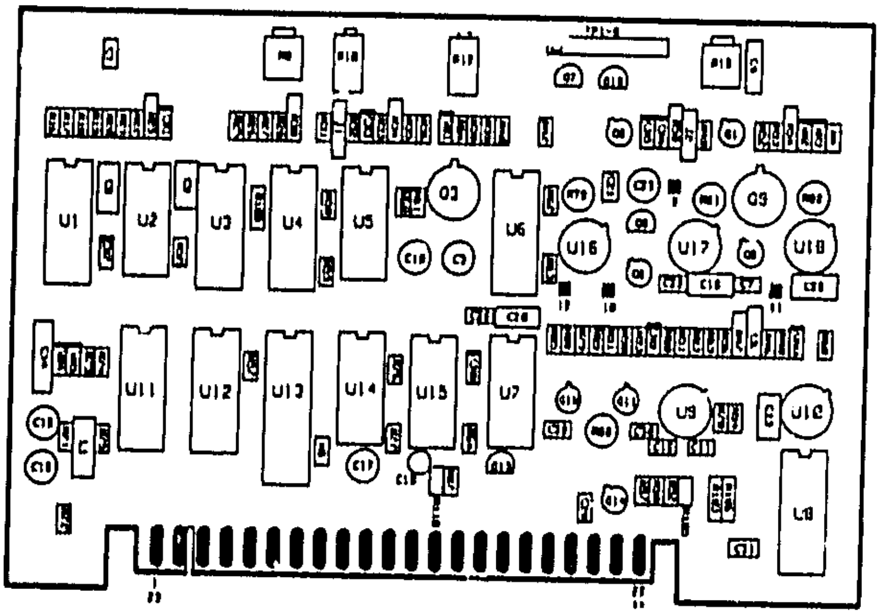


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Figure 8-29. A4 ALC Component Locations (CHANGE 25)