HP 83572C
RF PLUG-IN
(Including Options 001 and 006)

SERIAL NUMBERS

This manual applies directly to HP 83572C RF plug-ins having serial number prefix 3011A or 2911A.

For additional information about serial numbers, refer to "Instruments Covered By Manual" in Section 1.

MANUAL PART NO. 83572-90043

Printed: JUNE 1991

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 Institute of Standards and Technology (NIST, formerly NBS), to the extent allowed by the Institute'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 the 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.

BP20.3

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 or adhered to, 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.

SAFETY EARTH GROUND

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power, cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

BEFORE APPLYING POWER

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an autotransformer make sure the common terminal is connected to the neutral (grounded side of the mains supply).

SERVICING

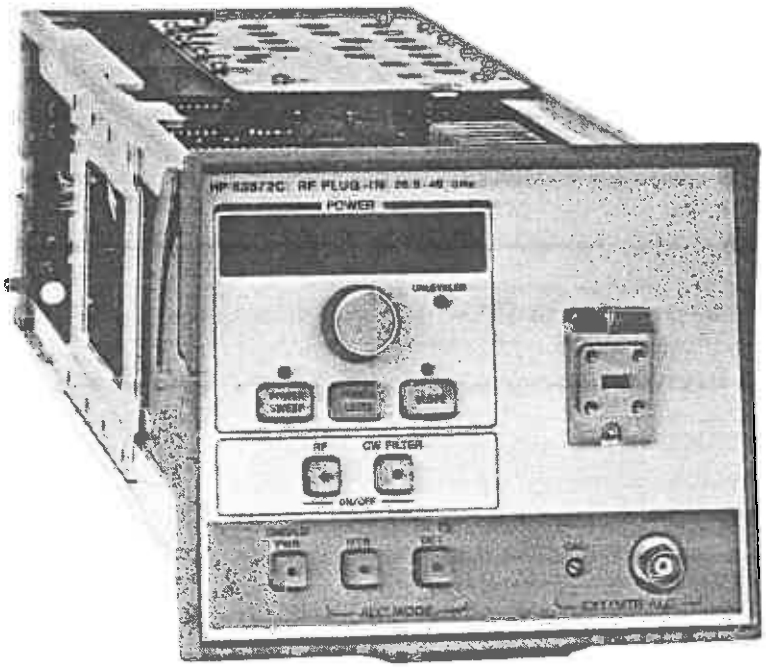
WARNING

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.

Capacitors inside this product may still be charged even when disconnected from their power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.



HP 83572C

Figure 1-1. HP 83572C RF Plug-in

Section 1. General Information

INTRODUCTION

This manual contains the information necessary to install, operate, test, adjust, and service the HP 83572C RF plug-in. This manual is divided into eight major sections:

Section 1. General Information

This section includes a brief description of the instrument, lists the specifications, supplemental characteristics, options and accessories available, explains instrument identification, and lists recommended test equipment.

Section 2. Installation

This section provides information for initial inspection of the instrument, preparation for use, storage, and shipment.

Section 3. Operation

This section explains the frequency resolution characteristics of the instrument in CW (continuous wave) and swept frequency modes. Operating instructions include FM (frequency modulation) 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.

Section 4. Performance Tests

This section gives the procedures to verify published instrument specifications.

Section 5. Adjustments

This section gives the procedures to adjust and align the RF plug-in after repair, or if the instrument fails a performance test.

Section 6. Replaceable Parts

This section includes the information required to order replaceable parts and assemblies.

Section 7. Backdating

This section contains information on earlier shipment configurations.

Section 8. Service

This section provides an overall instrument block diagram with troubleshooting and repair procedures. Each instrument assembly has a circuit description, schematic diagram, component location diagram, and troubleshooting information.

DESCRIPTION

HP 83572C RF Plug-in

The HP 83572C is an RF plug-in designed for use with the HP 8350 sweep oscillator. The standard HP 83572C covers the frequency range of 26.5 to 40.0 GHz in a single band. A YIG oscillator is used as the tunable RF frequency source. The standard HP 83572C offers an unleveled RF output power of at least +7 dBm (typically +8 dBm). Figure 1-1 shows the RF plug-in.

OPTIONS

Option 001

An Option 001 instrument offers calibrated externally leveled output power of at least +6 dBm in the **[SHIFT] [DET]** mode. In this mode the CAL light above the DET pushbutton is lit, and the displayed power level is calibrated across the entire frequency band. The Option 001 incorporates a 10 dB directional coupler, a crystal detector, a BNC cable calibrated to the plug-in, and a package of hex screws for attaching the waveguide flanges. The Option 001 front panel attachments are shown in figure 1-2.

In the Option 001 instrument the power sweep function allows the RF output power to be swept at least 11 dB during CW or swept frequency modes. Power sweep is selected with the front panel **[POWER SWEEP]** push button. Slope compensation contol up to 5 dB/GHz (11 dB/GHz total calibrated dynamic range) is also available by selecting the **[SLOPE]** pushbutton and rotating the HP 83572C RPG or manipulating the HP 8350 data entry controls. LEDs above the **[POWER SWEEP]** and **[SLOPE]** pushbuttons indicate when these functions are operative. The power sweep function and slope compensation may both be selected and modified through HP-IB control with the HP 8350.

Option 006

An Option 006 instrument provides internal squarewave modulation and external pulse and square-wave modulation capabilities, as well as RF amplitude markers. Internal squarewave modulation can be accessed by the HP 8350 front panel or through HP-IB. The modulation frquency is preset with a jumper in the HP 8350 either to 1 kHz or to 27.8 kHz for compatibility with Hewlett-Packard scalar network analyzers. For external pulse or squarewave modulation, a rear panel BNC connector accepts a modulating signal up to 1 MHz.

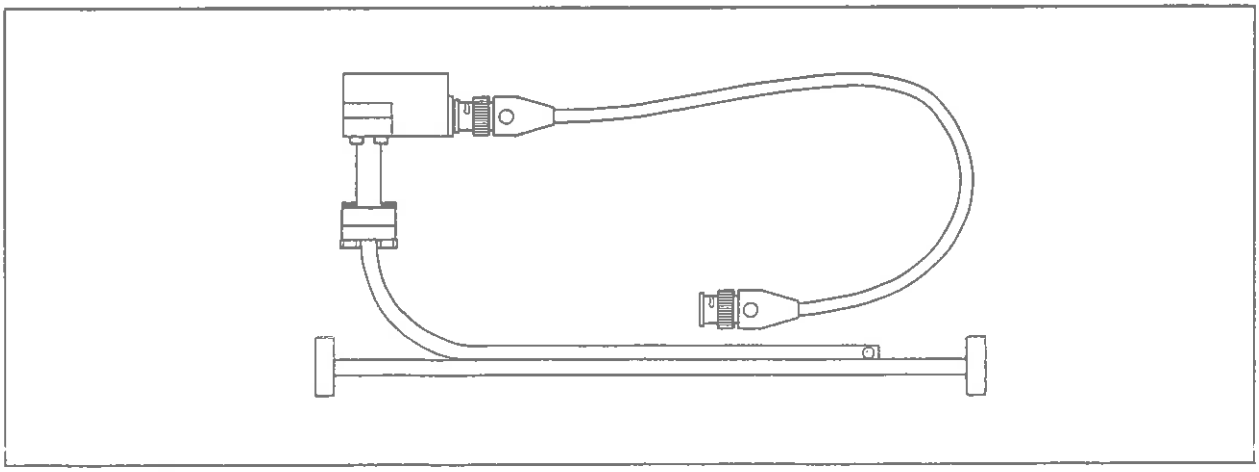


Figure 1-2. Option 001 Front Panel Attachments

Option W30 – Extended Service

Option W30 adds two additional years of return-to-HP hardware support, to follow the first year of warranty. Option W30 can be ordered at the time of sale only. Instruments ordered with Option W30 are identified on the serial number label, or on a special identification label supplied with the instrument.

Option 910 – Extra Operating and Service Manual

A standard instrument is supplied with one operating and service manual. Option 910 provides an additional operating and service manual. To order extra manuals after the initial shipment, use the manual part number listed on the title page of this manual.

SPECIFICATIONS

Table 1-1 lists instrument specifications. These specifications are the performance standards or limits against which the instrument is tested. Specifications apply after one hour warm-up. Table 1-2 lists supplemental performance characteristics. These are not specifications, but are intended to provide additional information useful to your application by giving typical (but not warranted) performance parameters.

INSTRUMENTS COVERED BY THIS MANUAL

A serial number label is attached to the instrument rear panel (see figure 1-3). The serial number is in two parts:

- The first four digits followed by a letter comprise the serial number prefix.
- The last five digits are a sequential suffix, unique to each instrument.

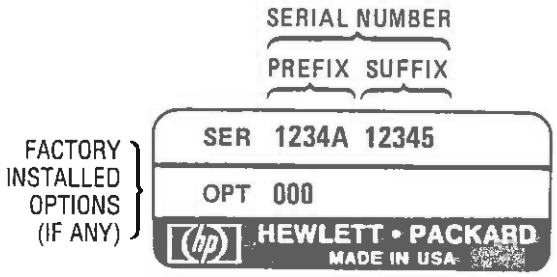


Figure 1-3. Typical Serial Number Label

The instrument you received with this manual is covered by this manual without change. Any other instrument with one of the serial number prefixes listed on the title page is also described by this manual.

Other instruments differ from the instruments covered directly by this manual. Those differences are documented in the "Manual Backdating" section. See the "Manual Backdating" section if the serial number prefix of your instrument is not listed on the title page.

ORDERING MANUAL/MICROFICHE

A manual part number and a microfiche part number are listed on the title page of this manual. You can use either part number to order extra copies of this manual. Microfiche are 10 X 15 cm (4 X 6 in) microfilm transparencies that contain reduced photocopies of the manual pages.

EQUIPMENT REQUIRED BUT NOT SUPPLIED

For a complete sweep oscillator unit, the plug-in must be installed in an HP 8350 sweep oscillator (see section 2, "Installation").

EQUIPMENT AVAILABLE

Service Accessories

Table 1-3 lists the service accessories available for servicing the HP 83572C and the HP 8350.

Power Meters and Crystal Detectors

A Hewlett-Packard power meter, or a negative polarity crystal detector can be used to externally level the plug-in RF output. See section 3, "Operation," for detailed information.

NOTE: The HP 435A and 436A Power Meters should not be used for external leveling of the 83572C.

HP 8756/8757 Scalar Network Analyzer

The HP 8350/plug-in combination is compatible with the HP 8756 and 8757 scalar network analyzers.

HP 8510 Vector Network Analyzer

The HP 8350/plug-in combination is compatible with the HP 8510 vector network analyzer.

RECOMMENDED TEST EQUIPMENT

Table 1-4 lists the equipment required to test and adjust the RF plug-in. Other equipment may be substituted if it meets or exceeds the indicated critical specifications. Adapters may be required that are not listed or shown in the equipment set-ups.

Table 1-1. HP 83572C Specifications

FREQUENCY CHARACTERISTICS [1]

Frequency Range ..... 26.5 to 40.0 GHz

Frequency Accuracy (25° C ±5° C)
CW Mode [2] ..... ±100 MHz
All Sweep Modes (sweep ≥100 ms) ..... ±150 MHz
Frequency Markers . ±150 MHz ±0.5% of sweep width
(sweep time ≥100 ms)

Stability (CW mode with CW filter)
With 10% Line Voltage Change ..... ± 1 MHz
With 10 dB Power Level Change ..... ±200 kHz
With 3:1 Load SWR ..... ±100 kHz
Residual FM (10 Hz to 10 kHz BW) ..... <60 kHz peak

OUTPUT POWER [1]
(25° C ±5° C) [3]

Minimum Unleveled Output Power ..... +7 dBm
Option 001
(at output of external leveling coupler 1.0 dB less than std
Option 006
(at waveguide ouput of plug-in) .... 1.5 dB less than std
Option 001/006
(at output of external leveling coupler) 2.5 dB less than std

Power Variation
Externally Leveled
Negative Crystal Detector [4, 5] ..... ±0.2 dB
Power Meter ALC Mode [6] ..... ±0.2 dB

Residual AM in 100 kHz BW
(in dB below carrier) ..... ≥50 dB

Spurious Signals (in dB below carrier)
Inband ..... ≥50 dB

Output SWR
Unleveled ..... <2.0
Option 001 (externally leveled) [4] ..... <1.5

Resolution (displayed) ..... 0.1 dB/GHz

Remote Programming (settable) ..... ±0.01 dB

MODULATION CHARACTERISTICS

External AM
Maximum Input 15V

Internal Squarewave Modulation (Option 006 only)
Selectable (by internal jumper in HP 8350) to 1 kHz or 27.8 kHz squarewave modulation. The 27.8 kHz modulation allows operation with the scalar network analyzers.

On/Off Ratio (25° C ±5° C) ..... ≥20 dB

Symmetry ..... 50% ±5%

External FM
Maximum deviations for modulation frequencies:

	Cross Over Coupled (MHz)	Direct Coupled (MHz)
DC to 100 Hz	±150	±6
100 Hz to 1 MHz	±7	±7

GENERAL SPECIFICATIONS

Minimum Sweep Time (over full range) ..... 10 ms

RF Output Connector .....Type WR28 waveguide
(mates with JAN UG-599 flange)

1. Unless otherwise noted, all specifications are at the RF OUTPUT connector and at 0° to 55°C.
2. Approach desired frequency from low end of band.
3. For temperatures greater than 30°C, maximum leveled output power typically degrades 0.1 dB/°C.
4. Sweep time ≤100msec.
5. Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −200 mV.
6. Use the HP 432A power meter. Sweep duration ≥100 seconds.
7. Crossover-coupled and direct-coupled external FM capabilities are selectable by internal switch in the RF plug-in.

Table 1-2. HP 83572C Supplemental Specifications

NOTE

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

FREQUENCY CHARACTERISTICS [1]

Frequency Accuracy (25°C ±5°C)
CW Mode, typically [2] ..... ±20 MHz
Manual Sweep ..... ≤±100 MHz
All Sweep Modes ..... ≤±100 MHz
(sweep time 10 ms to 100 ms)
Sweep Mode Linearity ..... ≤±50 MHz

Stability
With Temperature ..... ±8 MHz/°C
With Time ..... ±4 MHz
(in a 10 minute period after one hour warmup at the same frequency setting)

Residual FM, Peak ..... <10 kHz
(10 Hz to 10 kHz bandwidth, CW mode with CW filter)

OUTPUT CHARACTERISTICS [1]

Output Power
Stability with Temperature ..... ±0.1 dB/°C

Range of Power Level Control
Unleveled Output ..... 30 dB
Externally Leveled
Option 001 ..... 11 dB
Option 001/006 ..... 9.5 dB

Power Level Accuracy (25°C)
Externally Leveled(Option 001) ..... ±1.5 dB

Power Variation
Unleveled Output ..... ±3 dB

Spurious Signals (in dB below carrier)
Second Harmonic, typically ..... ≥20 dB

Output SWR
Unleveled ..... <1.6
Externally Leveled (Option 001) ..... <1.3

Power Sweep [3]
Calibrated Range
Option 001 ..... ≥11 dB
Option 001/006 ..... ≥9.5 dB
Accuracy (including linearity) ..... ±1.5 dB

Slope Compensation
Option 001
Linearity ..... <0.2 dB
Calibrated Range ..... 11 dB
(up to 5 dB/GHz for full sweep width)
Option 001/006 ..... 9.5 dB

MODULATION CHARACTERISTICS

External AM
Frequency Response ..... DC to 10 kHz
Input Impedance, approximately ..... 30k ohms
Range of Amplitude Control, typically
Unleveled ..... 30 dB
Externally Leveled
Option 001 ..... 11 dB
Option 001/006 ..... 9.5 dB
Sensitivity (Option 001)
Externally Leveled ..... 1 dB/V

External Pulse and Squarewave Modulation
(Option 006 only, unleveled output)
TTL Compatible ..... Logic HIGH=RF ON, Logic LOW=RF OFF
Rise Time ..... 300 ns
Fall Time ..... 50 ns
Minimum Pulse Width ..... 500 ns
Modulation Rate ..... 500 Hz to 1 MHz
On/Off Ratio ..... 26 dB

External FM
Frequency Response (DC to 200 kHz) ..... ±3 dB
Sensitivity (switch selectable)
FM Mode, typically ..... −20 MHz/V
Phase Lock Mode, typically ..... −6 MHz/V
Direct Coupled ..... −20 MHz/V
Input Impedance, approximately ..... 2k ohms

GENERAL CHARACTERISTICS

Weight ... Net 5.1 kg (11.3 lb), Shipping 8.4 kg (18.6 lb)

83572-60071 DC1 DIRECTIONAL COUPLER 10 dB

Frequency (GHz) ..... 26.5 to 40
Mean Coupling Accuracy [4] ..... ≤±0.8 dB
Coupling Variation ..... ≤±0.6 dB
Directivity ..... ≥36 dB
SWR (main guide) ..... ≤1.05
SWR (auxiliary arm) ..... ≤1.2

1. Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0° to 55°C.
2. Approach desired frequency from low end of band.
3. Power sweep and slope compensation total must not exceed 11 dB for the HP 83572C (9.5 dB for Option 001/006).
4. Mean coupling is the average of the maximum and minimum coupling values.

Table 1-3. Service Accessories

Name	HP Part Number	Description
Service Accessories Kit	08350-60020	HP 8350 sweep oscillator/ RFplug-in service accessories kit
RF Plug-in Extender Cables	08350-60034*	Extends RF plug-in interface connector (P2)
	08350-60035*	Extends RF plug-in power supply interface connector (P1)
44-pin Printed Circuit Board Extender	08350-60031*	Extends printed circuit boards
IC Test Clips	1400-0734*	16-pin IC test clip
	1400-0979*	20-pin IC test clip
	1400-1097*	40-pin IC test clip
Hex Balldriver	8710-0523*	Removes HP 8350 front panel hold down plate hex screws
Adjustment Tool	8830-0024	Fits miniature adjustment slot on potentiometers
Wrenches	09555-20097	5/16 inch slotted box/open end
	8710-0846	15/64 inch open end
Service Cables	8120-1578	18 inch coax with SMA (m) connector on each end

* Part of the Service Accessories Kit.

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

Instrument	Critical Specification	Recommended Model/ Part Number
Sweep Oscillator	no substitute	HP 8350
Digital Voltmeter (DVM)	Range: −50V to +50V Accuracy: ±0.01% Input Impedance: ≥10 MΩ	HP 3456A
Function Generator	Frequency Range: 0.1 Hz to 10 MHz Output Level: 10 V p-p into 50 Ohms Sinewave and Squarewave Output Output Level Flatness: < ±3% from 10 Hz to 100 kHz < ±10% from 100 kHz to 10 MHz	HP 3312A
Power Meter	Power Range: −20 to +10 dBm (no substitute when used for external power meter leveling)	HP 432A
Power Sensor	Frequency Range: 26.5 MHz to 40 GHz	HP R486A
Oscilloscope	Dual Channel Bandwidth: DC to 100 MHz Vertical Sensitivity: ≤5 mV/DIV Horizontal Sweep Rate: ≤0.1 μS/DIV External Sweep Capability	HP 1740A
Oscilloscope Probes	1:1 General Purpose Probe 10:1 Probe	HP 10008B HP 10040A
Spectrum Analyzer	Frequency Range: 18.6 to 40.0 GHZ Residual FM: <100 Hz peak Compatible with the HP 11970A External Harmonic Mixer	HP 8566B
Microwave Power Amplifier	no substitute	HP 11975A
External Harmonic Mixer	no substitute	HP 11970A
Crystal Detector	Frequency Response: 26.5 to 40 GHz Maximum Input Power: 100 mW Waveguide Connecter Size: WR28	HP R422C
Frequency Meter	Frequency Accuracy: ≤0.12% Calibration Increments: ≤10 MHz Frequency Range: 26.5 to 40 GHz Waveguide Connector Size: WR28	HP R532A or equivalent
Directional Coupler	Frequency Range: 26.5 to 40 GHz Nominal Coupling: 10 dB Maximum Coupling Variation: ±0.6 dB Minimum Directivity: 40 dB Waveguide Connector Size: WR28	HP R752C

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

Instrument	Critical Specification	Recommended Model/ Part Number
RMS Voltmeter	dB Range: −20 to −70 dBm (0 dBm = 1 mW into 600 Ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: ±5% of full scale	HP 3400A
Vane Attenuator	Frequency Range: 26.5 to 40 GHz Incremental Attenuation: 0 to 50 dB Calibration Accuracy: ≤ ±0.1 dB Waveguide Connector Size: WR28	HP R382A
Adjustable Short	Frequency Range: 26.5 to 40 GHz Waveguide Connector Size: WR28	HP R920C
60 cm (24 in) Cable	Limits bandwidth to approximately 100 Hz	HP 11170B
Adjustable AC Line Transformer	100V to 120V 220V to 240V	General Radio W5MTB W10HHM73
Line Monitor	120V 240V	RCA WV 120B RCA WV 503A
PC Board Extender	44-pin, extends printed circuit boards	HP Part Number 08350-60031

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 83572C

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.

Section 2. Installation

INTRODUCTION

Along with plug-in installation instructions, this section provides information on the following:

- Initial inspection.
- Damage claims.
- Preparation for use.
- Packaging.
- Storage.
- Shipment.

INITIAL INSPECTION

If the shipping container or cushioning material is damaged, keep it until the contents of the shipment are checked for completeness, and the instrument is checked both mechanically and electrically.

Procedures for checking electrical performance are given in section 4, "Performance Tests." If the plug-in and mainframe do not pass the electrical performance tests, see section 8, "Service."

Notify your nearest Hewlett-Packard office if any of the following conditions exist:

- The instrument does not pass the performance tests and, using the troubleshooting procedures in this manual, you cannot correct the problem.
- The instrument does not pass the performance tests and you do not wish to troubleshoot the instrument yourself.
- The shipping contents are incomplete.
- There is mechanical damage or a defect.

Notify the carrier if the shipping container is damaged or if the cushioning material shows signs of stress. Keep all shipping material for the carrier's inspection. Hewlett-Packard will arrange for repair or replacement without waiting for a claim settlement.

PREPARATION FOR USE

Power Requirements

When properly installed, the RF plug-in receives all power from the HP 8350 Sweep Oscillator through the rear panel interface connectors.

Configuration Switches

Configuration switch A3S1 is an 8-section multiple switch located on the A3 digital interface assembly. Six of the eight sections correspond to separate RF plug-in functions, and can be modified, as required for your application. See section 3, "Operation", for a complete description of the configuration switch and instructions on how to set each function.

Interconnections

The RF plug-in has two rear panel interconnections to the HP 8350 Sweep Oscillator:

- The power supply interface connector (P1)
- The RF plug-in interface connector (P2)

See figures 2-1 and 2-2 for the pins and associated signals of these connectors.

Operating Environment

The following are the permissible enviromental limits for operation of the RF plug-in. Operating within these limits, no damage will occur to the instrument. See "Specifications" in "General Information" for environmental limitations on specified performance.

Temperature: 0 to +55°C (+32 to +131°F).

Humidity: Non-condensing environment.

Altitude: Up to 4,572 metres (15,000 feet).

Cooling: When the RF plug-in is properly installed in the HP 8350 Sweep Oscillator, the RF plug-in receives all its airflow cooling by forced ventilation from the sweep oscillator fan.

A diagram of the airflow cooling paths within the sweep oscillator appears in the *HP 8350 Sweep Oscillator Operating and Service Manual* installation section. Ensure that all airflow passages in both instruments are clear before installing the RF plug-in in the sweep oscillator.

Installation Instructions

To use the RF plug-in, it must be installed properly in an HP 8350 Sweep Oscillator:

1. Turn the sweep oscillator off.
2. To prevent damage, remove all connectors and accessories from the plug-in front and rear panel connectors.
3. Fully raise the plug-in latching handle. The handle should raise easily and hold that position by spring tension.
4. Ensure that the sweep oscillator plug-in channel is clear; align the plug-in in the channel and slide it carefully into place. It should slide back easily, without binding.

NOTE: The latching handle slot engages with the locking pin just before the plug-in is fully seated in position.

5. While still pushing in on the plug-in, press the latching handle down until it is fully latched (down), and the plug-in front panel is aligned with the sweep oscillator front panel.

STORAGE AND SHIPMENT

The instrument must be stored or shipped in environments within the following limits:

Environment

Temperature: -40° to +75°C (−40° to +167°F).

Humidity: Non-condensing environment.

Altitude: Up to 15,240 metres (50,000 ft).

Packaging

Containers and materials identical to those used in factory packaging are available through your Hewlett-Packard office (see figure 2-3). If you choose to package the instrument with commercially available material, follow these instructions:

1. Wrap the instrument in heavy paper.
2. Use a strong shipping container. A double-wall carton made of 159 kg (350 lb) test material is adequate.
3. Use a 76 to 102 mm (3 to 4 in.) layer of shock absorbing material around all sides of the instrument to provide a firm cushion and prevent movement inside the container.
4. Seal the shipping container securely.
5. Mark the shipping container *FRAGILE*.

Returning an Instrument for Service

If you ship the instrument to a Hewlett-Packard office or service center, include a blue service tag (found at the end of this section), on which you provide the following information:

1. Your company name and address.
2. A technical contact person within your company, and their complete phone number.
3. The complete model and serial number of the instrument.
4. The type of service required.
5. Any other information that may expedite service.

When you make an inquiry, either by correspondence or by telephone, refer to the instrument by model number and full serial number.

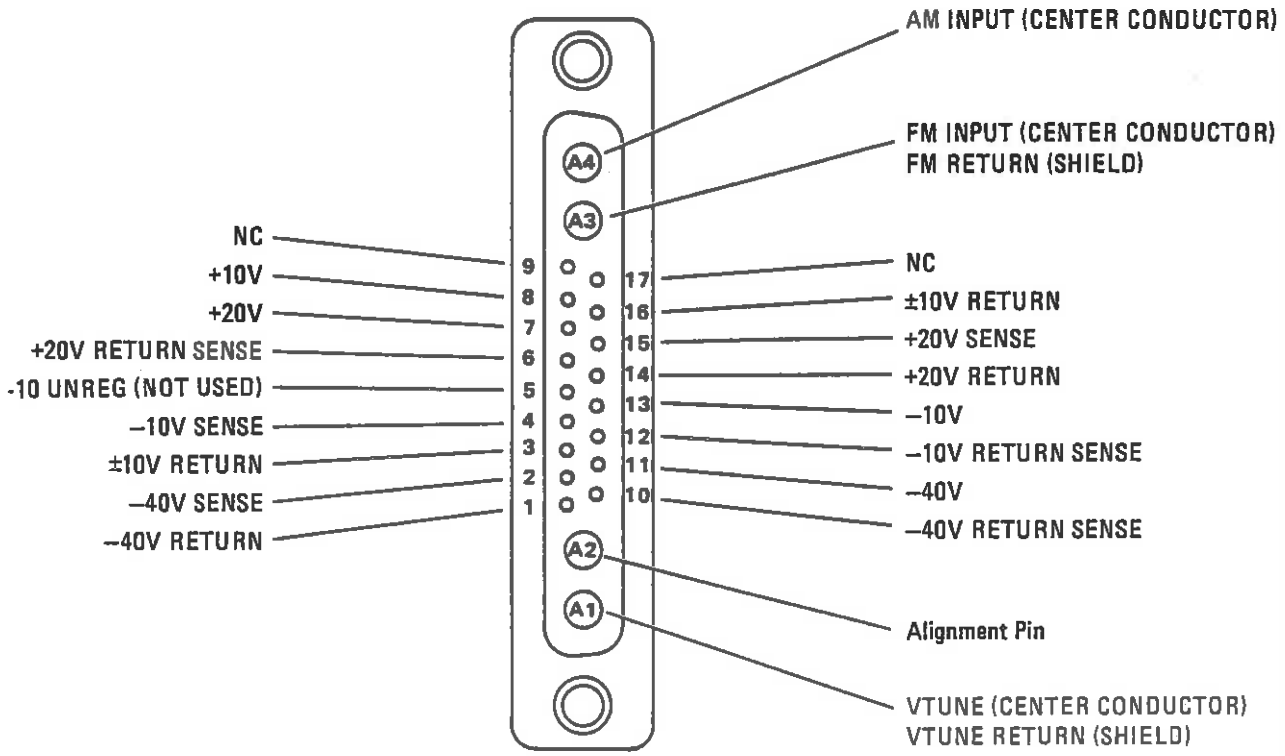


Figure 2-1. Interface Signals on Rear Panel Connector P1 (Front View)

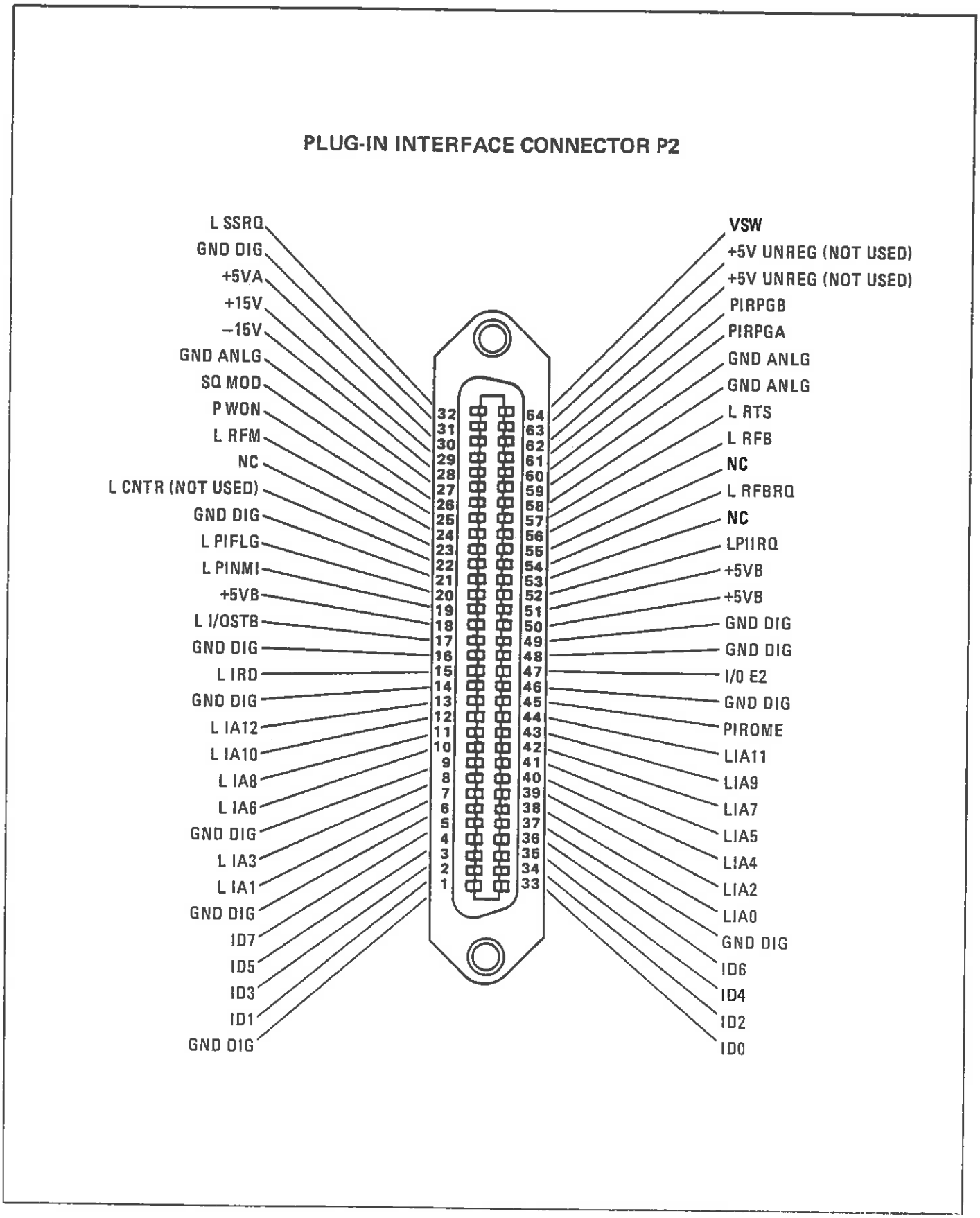
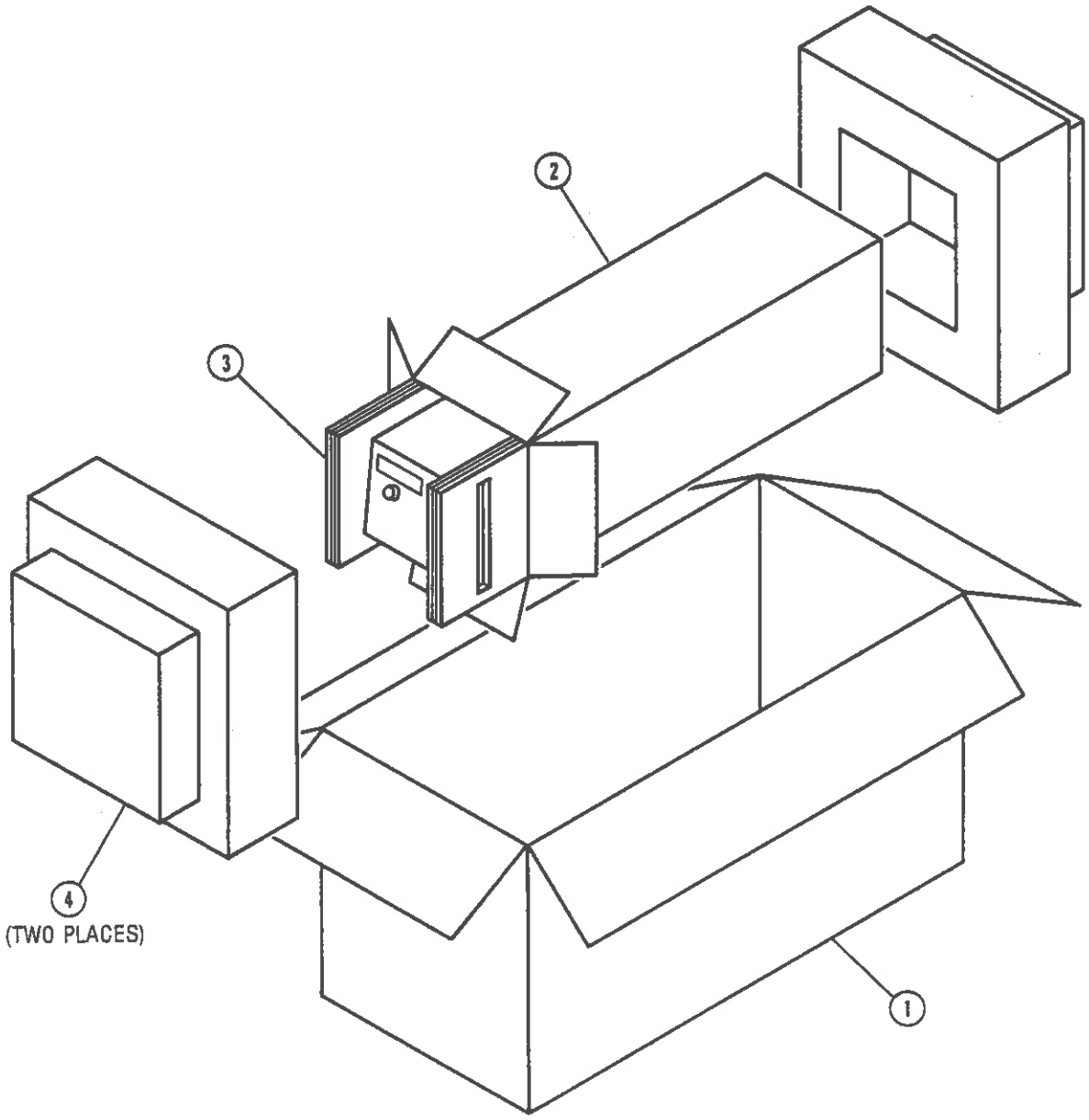


Figure 2-2. Interface Signals on Rear Panel Connector P2 (Front View)



Item	Quantity	HP Part Number	C D	Description
1	1	9211-4781	0	Outer Carton
2	1	9211-4782	1	Inner Carton
3	2	5180-8469	3	Foam Pads
	1	9222-0943	1	Anti-static Bag - to cover instrument

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

Section 3. Operation

INTRODUCTION

This section is divided into several parts. Front and rear panel features are shown with descriptions. Operator's Checks are referenced, with information on RF plug-in error codes. Operating Instructions provide crystal detector and power meter leveling procedures, and configuration switch settings. Operator's Maintenance provides information on fuses and service tags.

PANEL FEATURES

Front and rear panel features are described in Figures 3-1 and 3-2 respectively.

OPERATOR'S CHECKS

The Operator's Checks (Local and Remote) in the Operating and Service Manual for the HP 8350 sweep oscillator provide a quick evaluation of the main functions of both the 8350 and the RF plug-in. Change the test setup for the Local Operator's Check by deleting the attenuator and using an R-band detector. The Local Operator's Check verifies both the sweep oscillator and the RF plug-in; therefore, if the correct indications are not obtained, the trouble may be in either of the units. Error codes E050 to E059 are indications of RF plug-in errors: further information on RF plug-in error codes is provided in Section 8 of this manual. If the RF plug-in is suspected, follow the troubleshooting information in Section 8 to isolate the problem.

OPERATING INSTRUCTIONS

Unleveled Power

The unleveled power mode can be accessed by pressing either **[INSTR PRESET]** or **[UNLVLD PWR]**. The power level can be changed with the step keys, the keyboard, or the POWER knob. The change is nonlinear and generally will not correspond with the power displayed in the POWER display. The CAL adjust is enabled in this mode. It can be used to adjust the POWER display equal to a power meter reading in either CW or swept frequency modes. The output power will remain unleveled in this mode.

External Leveling
External Crystal Detector Leveling

The RF output power may be leveled externally using a directional coupler and a negative output crystal detector. The directional coupler samples a portion of the RF output signal, and the crystal detector produces 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 is amplified by the ALC amplifier before being applied as modulator drive to a ferrite modulator which changes the output power level. Figure 3-3 illustrates and describes a typical crystal detector leveling setup.

Calibrated External Crystal Detector Leveling (Option 001)

The Option 001 calibrated external leveling includes an external R-band 10-dB coupler, an R-band crystal detector, and a BNC cable, calibrated together at the factory to the individual plug-in. This leveling system uses the Option 001 coupler to sample a portion of the RF output signal with the 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. The difference voltage is then amplified by the ALC amplifier before being applied as modulator drive to a ferrite modulator, which changes the output to keep a constant RF output power level. With Option 001, the power level at the output of the Option 001 coupler is the same as the front panel POWER display at all available power levels and all frequencies. This mode can be accessed only by pressing **[SHIFT] [DET].** In this mode the CAL light above the DET pushbutton is lit, and the CAL adjust is disabled.

External Power Meter Leveling

RF output power may also be leveled with a power meter and a directional coupler as shown in Figure 3-4. A sweep time of 100 seconds must be used with this leveling method. 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 plug-in 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 ferrite modulator.

External FM

The plug-in RF output signal can be frequency modulated using an external modulating signal applied to the HP 8350 rear panel FM INPUT connector. The external FM function provides a means of obtaining an output frequency that varies under the control of an internal modulating signal. A positive-going voltage at the FM INPUT causes the output frequency to decrease, while a negative-going volage causes the output frequency to increase. The sensitivity and coupling of the modulating signal can be set with configuration switch A3S1. Figure 3-5 lists the available configuration switch settings. The configuration switch settings override the HP 8350 sweep oscillator's nonvolatile memory settings at instrument preset.

External Amplitude Modulation
Pulse Modulation (Option 006)

The Option 006 provides the squarewave modulation capabilities necessary for the HP 8350/83572C to function with the HP 8755/56/57 scalar network analyzer. For compatibility with the scalar analyzer, the internal squarewave modulation frequency is preset to 27.8 kHz with a jumper on the sweep generator board of the HP 8350. The on/off ratio of internal squarewave modulation is greater than 20 dB. The ⌐¬ MOD key on the front panel of the HP 8350 activates the internal squarewave modulation feature.

The PULSE IN connector on the rear panel of the HP 83527C Option 006 allows the RF signal to be pulsed or squarewave modulated by an external signal. The PULSE IN input is normally at a TTL HIGH level (approximately +3 volts DC). When a TTL LOW signal (approximately 0 volts DC) is applied, the RF output is turned off. The on/off power ratio is typically greater than 26 dB. With unleveled power, a pulse repetition rate of up to 1 MHz is achievable. See the specifications and supplemental performance characteristics in Section 1 for more details on the modulation characteristics when using this input.

Amplitude Modulation

The AM INPUT on the rear panel of the HP 8350 allows the RF signal to be externally amplitude modulated. In the unleveled power mode, amplitude changes as wide as 30 dB are available, not proportional to the modulating input voltage. AM frequency response is typically limited to 10 kHz.

In all the externally leveled modes, amplitude changes can be achieved as wide as 7 dB, which are logarithmically proportional to the modulating input voltage (1 dB/volt nominal). Again, frequency response is typically limited to 10 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 +0.5 dBm for a plug-in with calibrated power control from +6 dBm to −5 dBm). The center of the power control range can be selected with the front panel power controls or by applying a DC bias voltage on the external modulating signal. A positive (+) DC voltage into the AM INPUT causes an increase in RF output power, and a negative (−) DC voltage causes a decrease in RF output power.

OPERATOR'S MAINTENANCE

Fuses

Power circuits for the plug-in are fused in the HP 8350 sweep oscillator mainframe. Refer to the HP 8350 Operating and Service Manual for fuse replacement information.

Blue Service Tags

If the plug-in requires service, it may be sent to the nearest Hewlett-Packard service organization as described in Section 2. Before returning the instrument, fill out and attach one of the blue service tags included at the end of this section. Record any error codes noted in the FAILURE SYMPTOMS/ SPECIAL CONTROL section of the tag.

Front Panel Features

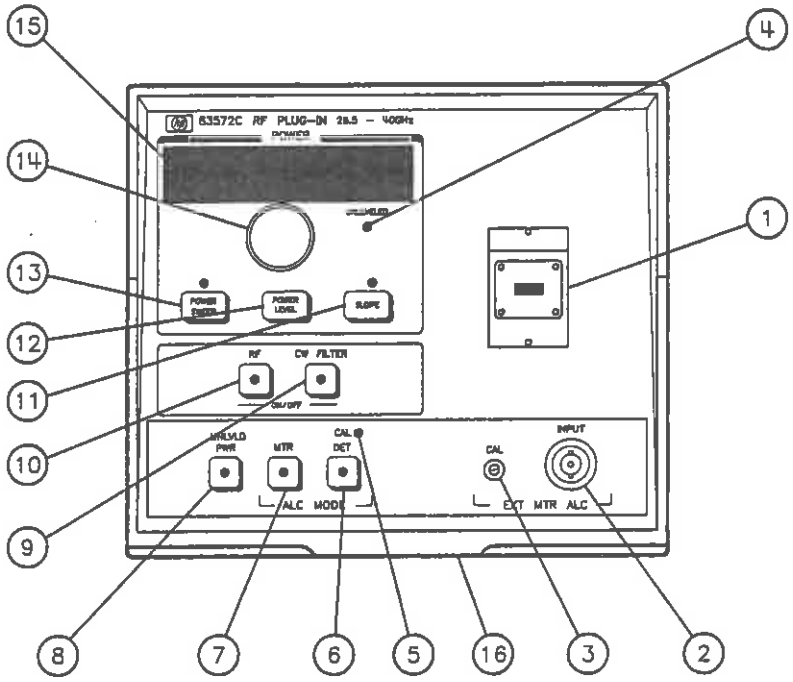


Figure 3-1. Front Panel Features

1. RF output waveguide connector (EIA size WR 28 waveguide) mates with JAN UG-599 flange.
2. BNC connector for power meter or external crystal detector leveling inputs (including Option 001).
3. ALC CAL adjustment, for setting power level in external power meter or crystal detector leveling.
4. UNLEVELED lamp lights when output power is unleveled.
5. CAL lamp lights when **[SHIFT] [DET]** is pressed or enabled. In this mode Option 001 calibration is enabled and CAL adjust is disabled.
6. External crystal detector leveling selection.
7. Power meter leveling control selection (HP 432 power meter only).
8. Unleveled power control selection.
9. CW filter enables an oscillator tuning voltage filter in CW mode.

10. RF on/off key. Turns RF power on or off. Used for zeroing a power meter or referencing an X-Y recorder.

11. SLOPE provides a linear increase in power with frequency (dB/GHz) to compensate for system/ cable losses at higher frequencies (Option 001 only).

12. POWER LEVEL provides control of output power.

13. POWER SWEEP sweeps power at a CW frequency. POWER LEVEL sets the starting point; POWER SWEEP sets the power sweep width in dB (Option 001 only).

14. Power control knob for controlling power sweep, power level, or slope.

15. Display provides readout of selected power mode in dBm, dB/GHz, or dB/SWP to 0.1 dB.

16. Latch handle is used to remove, install, and latch the RF plug-in in the sweep oscillator mainframe.

Rear Panel Features

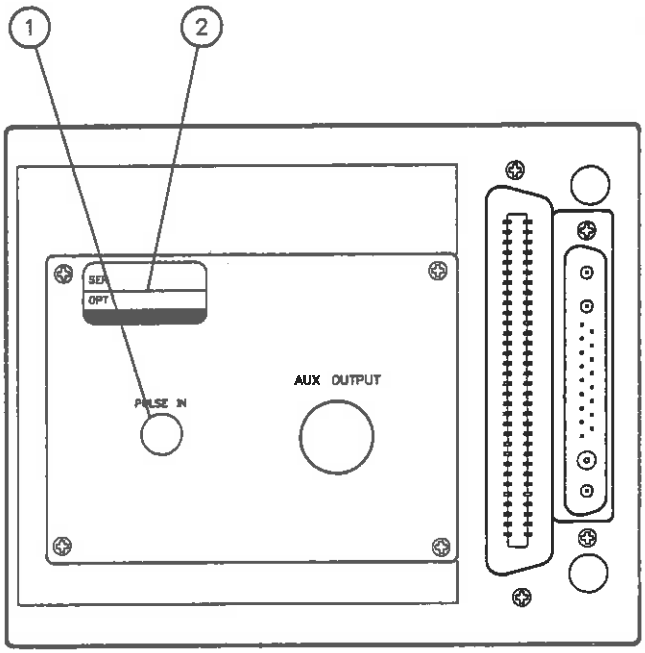


Figure 3-2. Rear Panel Features

1. PULSE IN connector is used to input external pulse or squarewave modulation signals (Option 006 only).
2. Serial number plate has a ten digit serial number (used in any correspondence concerning the RF plug-in), as well as Option number if applicable.

EXTERNAL CRYSTAL DETECTOR LEVELING

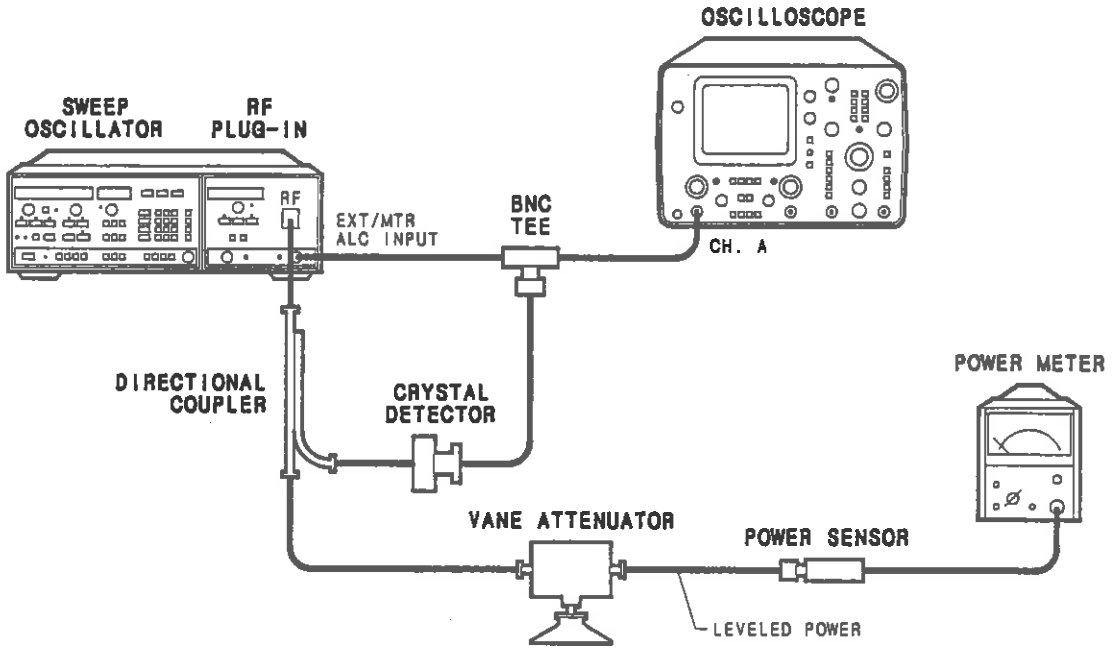


Figure 3-3. External Crystal Detector Leveling

EQUIIPMENT

Sweep Oscillator	HP 8350
RF Plug-in	HP 83572C
Oscilloscope	HP 1740A
Power Meter	HP 432A
Power Sensor	HP R486A
Crystal Detector	HP R422C
Directional Coupler	HP R752C
Vane Attenuator	HP R382A

Procedure

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

1. Connect the equipment as shown in the test setup.
2. Switch on the HP 8350 LINE power and press **[INSTR PRESET]**. The START and STOP indicators should be on. On the plug-in, press ALC MODE **[DET]**.
3. Set the vane attenuator to 10 dB.

4. Set the power meter range to 0 dBm.

5. Adjust the EXT/MTR ALC CAL for a power meter reading of −4 dB (this corresponds to +6 dBm at the output of the waveguide coupler).

NOTE: The power level at the output of the directional coupler is typically 1.0 dB less than at the RF output of the plug-in.

6. To use leveled RF power for testing external equipment, make a connection at the point in the test setup marked "Leveled Power."

EXTERNAL POWER METER LEVELING

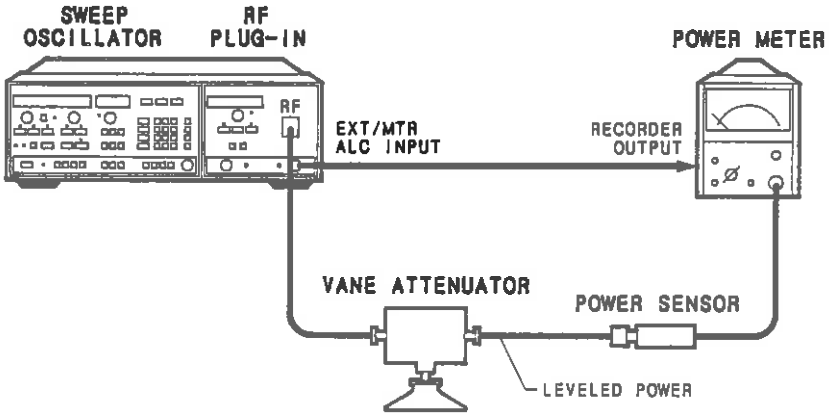


Figure 3-4. External Power Meter Leveling

EQUIPMENT

Sweep Oscillator	HP 8350
RF Plug-in	HP 83572C
Power Meter	HP 432A
Thermistor Mount	HP 486A
Vane Attenuator	HP R382A

NOTE: For power meter leveling, a sweep rate of 100 sec/sweep should be used 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 can be used.

Procedure

1. Connect the equipment as shown in the test setup.
2. Turn on the power to the sweep oscillator. Press **[INSTR PRESET] [SWEEP TIME] [1] [0] [0] [SEC]**.
3. On the plug-in, set the output power to maximum specified, and press ALC MODE **[MTR]**.
4. Set the vane attenuator to 10 dB.
5. Set the power meter range to 0 dBm.
6. Adjust the EXT/MTR ALC CAL for a power meter reading of −4 dB (this corresponds to +6 dBm at the RF output of the plug-in). On the HP 8350, press the SWEEP TRIGGER **[SINGLE]** key twice to set the single sweep mode and start a sweep.
7. To use leveled RF power for testing external equipment, make a connection at the point in the test setup marked "Leveled Power."

Code Description	Switch Number 1	2	3	4	5	6	7	8
Plug-in								
HP 83572C	1	0	0	X	X	X	X	X
HP 83572C Option 001	1	1	0	X	X	X	X	X
HP 83572C Option 006	1	0	1	X	X	X	X	X
HP 83572C Option 001/006	1	1	1	X	X	X	X	X
No RF Power at INSTR PRESET	Z	Z	Z	1	X	X	X	X
Maximum RF Power at INSTR PRESET	Z	Z	Z	0	X	X	X	X
−6 MHz/V FM Sensitivity	Z	Z	Z	X	1	X	X	X
−20 MHz/V FM Sensitivity	Z	Z	Z	X	0	X	X	X
Direct-Coupled FM (−20 MHz/V)	Z	Z	Z	X	X	1	X	X
Cross-Over Coupled FM	Z	Z	Z	X	X	0	X	X

NOTES

1. Switch Positions
   1 = switch open = High
   0 = switch closed = Low (ground)
   X = don't care
   Z = determined by options installed
2. Switch is set at the factory as follows:

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

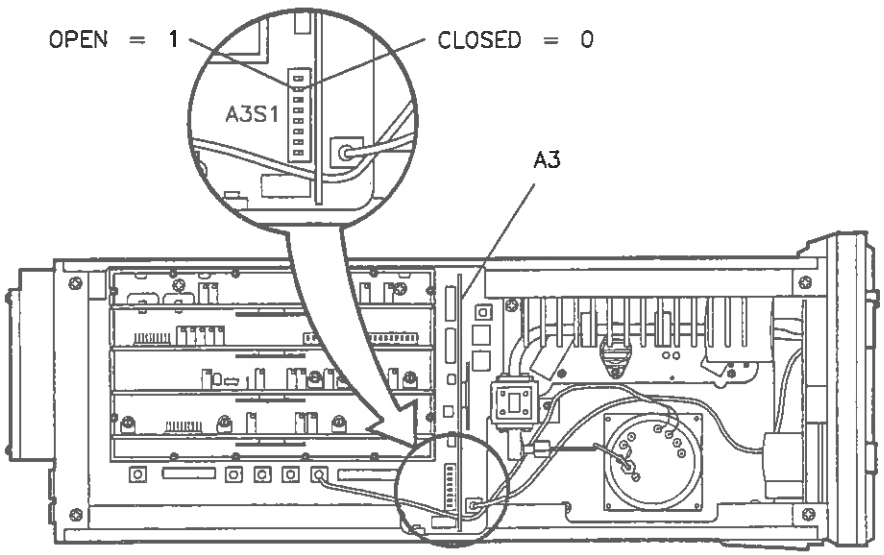


Figure 3-5. Configuration Switch A3S1

Section 4. Performance Tests

INTRODUCTION

Use the procedures in this section to test the electrical performance of the sweep oscillator/RF plug-in combination. Use the specifications listed in Table 1-1, in GENERAL INFORMATION, as the performance standards. You do not have to access the interior of the RF plug-in to perform these tests. Due to the extended frequency range of the HP 83572, the performance tests in the HP 8350 Operating and Service Manual do not apply.

NOTE: Let the sweep oscillator/RF plug-in warm up for at least one hour before you begin a performance test.

EQUIPMENT REQUIRED

The equipment required to test the RF plug-in is listed in Table 1-4, in GENERAL INFORMATION. Any equipment that satisfies the critical specifications listed in the table may be substituted for the recommended model.

OPERATION VERIFICATION

To verify operation, perform the following tests:

- Frequency Range and Accuracy
- Output Amplitude

You can verify HP-IB functions using the program listed in Section IV of the *HP 8350 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).

TEST RECORD

Table 4-2 provides a tabulated index of the performance tests, their acceptable limits, and a column for recording actual measurements. Use this test record when you perform a calibration (100% verification).

RELATED ADJUSTMENTS

Table 4-1 lists the performance tests and their related adjustments (in Section 5). If the plug-in fails a performance test, the associated adjustment(s) may correct the problem.

TEST SEQUENCE

Perform the tests in the order they appear within each subsection.

CALIBRATION CYCLE

Perform the tests in this section at least once every twelve months.

Table 4-1. Performance Tests and Related Adjustments

Performance Tests	HP 83572C Adjustment	HP 8350 Related Adjustment
4-1. Frequency Range and Accuracy		
CW Frequency Accuracy	5-2, 5-3, 5-4	5-19
Swept Frequency Accuracy	5-3 through 5-6, 5-10	
Marker Accuracy	5-2 through 5-5	
4-2. Output Amplitude		
Minimum Unleveled Output Power	5-5	
Power Variation		
Crystal Detector Leveling	5-5 through 5-10	
Power Meter Leveling	5-5 through 5-10	
4-3. Residual AM	none	5-11
4-4. Frequency Stability	none	5-11
4-5. Residual FM	none	5-11
4-6. Spurious Signals	none	
4-7. Output SWR	none	
4-8. External Frequency Modulation	5-1 and 5-12	
4-9. AM ON/OFF Ratio and Square Wave Symmetry	5-13	

4-1. Frequency Range and Accuracy Test

Description

A spectrum analyzer is used to check frequency range and accuracy in the CW mode. An external harmonic mixer extends the frequency range of the spectrum analyzer into the 26.5 to 40 GHz range. A frequency meter is used to check swept frequency accuracy and markers in the start/stop mode.

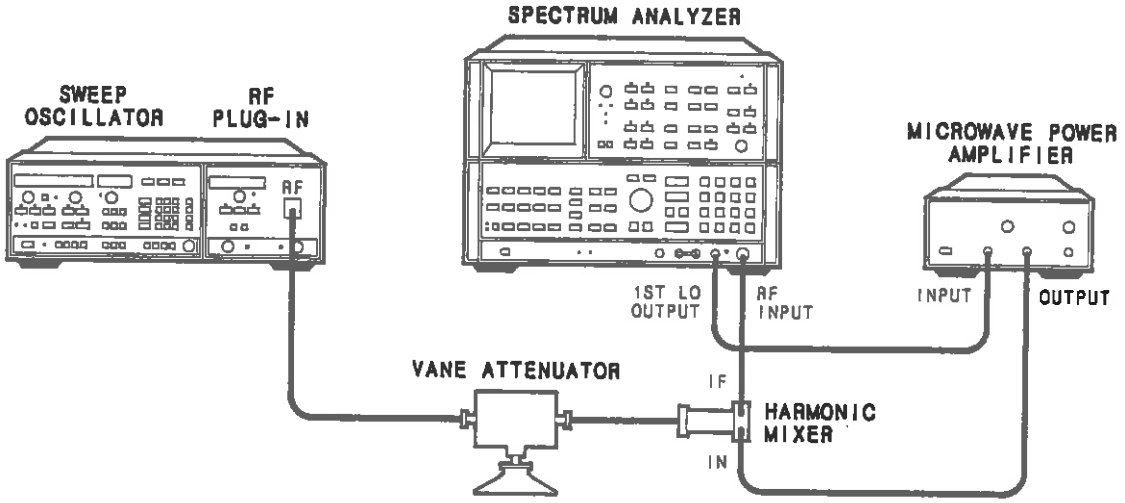


Figure 4-1. Frequency Range and CW Accuracy Test Setup

Equipment

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A
Frequency Meter	HP R532A
Oscilloscope	HP 1740A
Crystal Detector	HP R422C

NOTE: When the frequency range of the spectrum analyzer is extended using the external harmonic mixer, the response is not preselected. Many signals are displayed, and a signal identification procedure is required. The signals of interest are an identical pair with a separation of 642.8 MHz, and the left one of the pair is frequency calibrated. To center the RF signal from the RF Plug-In on the spectrum analyzer CRT, press **[PEAK SEARCH] [SIGNAL TRACK] [SHIFT] [FREE RUN]** on the spectrum analyzer.

Procedure

1. Connect the equipment as shown in figure 4-1. Set the vane attenuator to 20 dB.
2. On the spectrum analyzer, set:

   [SHIFT] [▲]
   [CENTER FREQUENCY] [26.5] [GHz]
   [FREQUENCY SPAN] [300] [MHz]

3. On the sweep oscillator, press **[INSTR PRESET]**. Notice that the start frequency displayed is 26.5 GHz and the stop frequency displayed is 40 GHz.

Frequency Range

4. On the sweep oscillator, press:

   [CW] [26.5] [GHz]

   If the frequency observed on the spectrum analyzer is greater than 26.50 GHz, rotate the sweep oscillator CW control counterclockwise until the frequency on the spectrum analyzer is at or below 26.50 GHz.

   Enter the spectrum analyzer reading on the test record.

5. On the spectrum analyzer, press:

   [CENTER FREQUENCY] [40] [GHz]

6. On the sweep oscillator, press:

   [40] [GHz]

If the frequency observed on the spectrum analyzer is lower than 40.00 GHz, rotate the sweep oscillator CW control clockwise until the spectrum analyzer indicates a frequency of 40 GHz or above. Enter the spectrum analyzer reading on the test record.

Frequency Accuracy

7. Set the sweep oscillator CW frequency to 28.00, 32.00, and 39.00 GHz and check that the spectrum analyzer reading at each frequency is accurate ±100 MHz. Record the spectrum analyzer readings on the test record.

Swept Frequency Accuracy

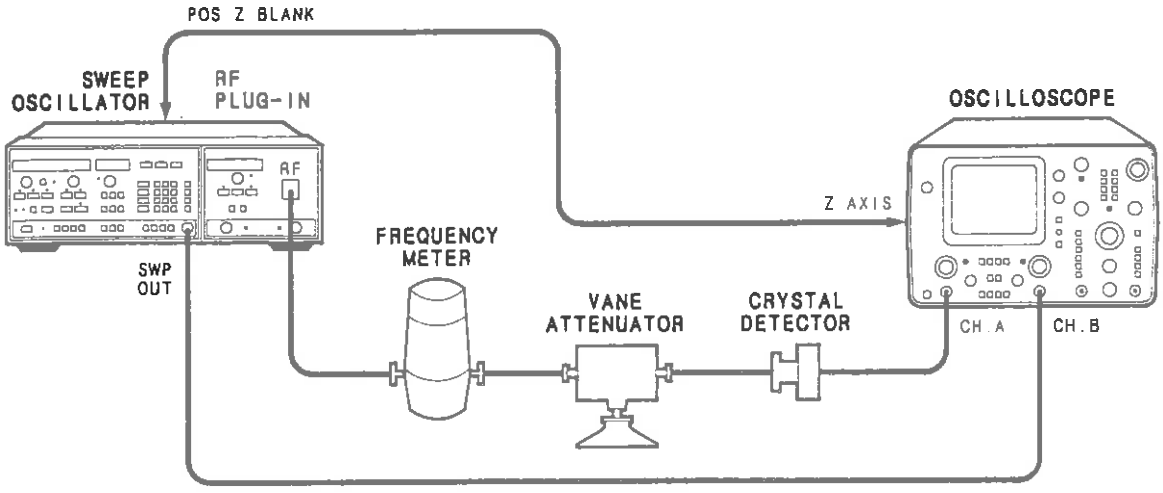


Figure 4-2. Swept Frequency Accuracy Test Setup

8. Connect the equipment as shown in figure 4-2. Set the vane attenuator to 15 dB.

9. On the oscilloscope, set:

   Mode: A vs B
   Channel A: 50 mV/DIV
   Channel B: 1 V/Div

10. On the sweep oscillator, press:

    [INSTR PRESET]
    [SWEEP TIME] [105] [msec]

11. Set the frequency meter to position the lowest point of the dip at the start of the oscilloscope trace (left edge).

12. Verify that the frequency meter indication is 26.5 GHz ±150 MHz. Enter the reading on the test record.

13. Set the frequency meter to position the lowest point of the dip at the end of the oscilloscope sweep (right edge of the trace).

14. Verify that the frequency meter indication is 40 GHz ±150 MHz. Enter the reading on the test record.

Frequency Marker Accuracy

15. On the sweep oscillator, press:

    [INSTR PRESET]
    [SWEEP TIME] [105] [msec]
    [M1] [27] [GHz]
    [M2] [33] [GHz]
    [M3] [39] [GHz]

16. Set the frequency meter dip coincident with each marker and verify that the frequency meter indicates the marker frequency ±217 MHz (±150 MHz ±0.5% of sweep width). Enter the frequency meter indications on the test record.

4-2. OUTPUT AMPLITUDE TEST

Description

The sweep oscillator is set to a 100 second sweep time and the minimum power point is measured with a power meter.

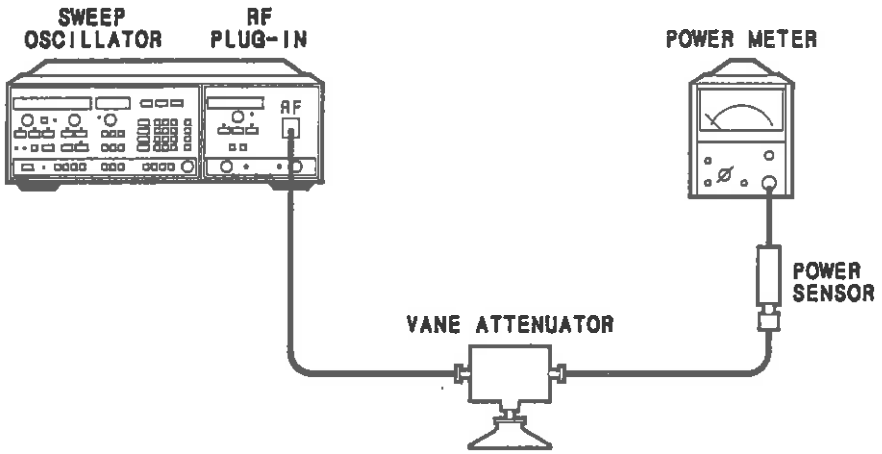


Figure 4-3. Output Amplitude Test Setup

Equipment

Power Meter	HP 432A
Power Sensor	HP R486A
Vane Attenuator	HP R382A
Oscilloscope	HP 1740A
Crystal Detector	HP R422C
Directional Coupler	HP R752C

Procedure

Minimum Unleveled Output Power

1. Connect the equipment as shown in figure 4-3. Set the vane attenuator to 10 dB. Calibrate the power meter/sensor.

2. On the sweep oscillator, press:

   [INSTR PRESET]
   [SINGLE TRIGGER]
   [SWEEP TIME] [100] [s]
   [POWER LEVEL] [15] [dBm]

3. Press **[SINGLE]** to initiate a sweep and note the minimum power level indication on the power meter during the forward sweep. (Be sure to account for the calibration factor of the power sensor.) Add 10 dB to the power meter reading to account for the 10 dB loss through the attenuator. Enter this calculated power level on the test record.

Power Variation (Externally Leveled)

A. Negative Crystal Detector Leveling

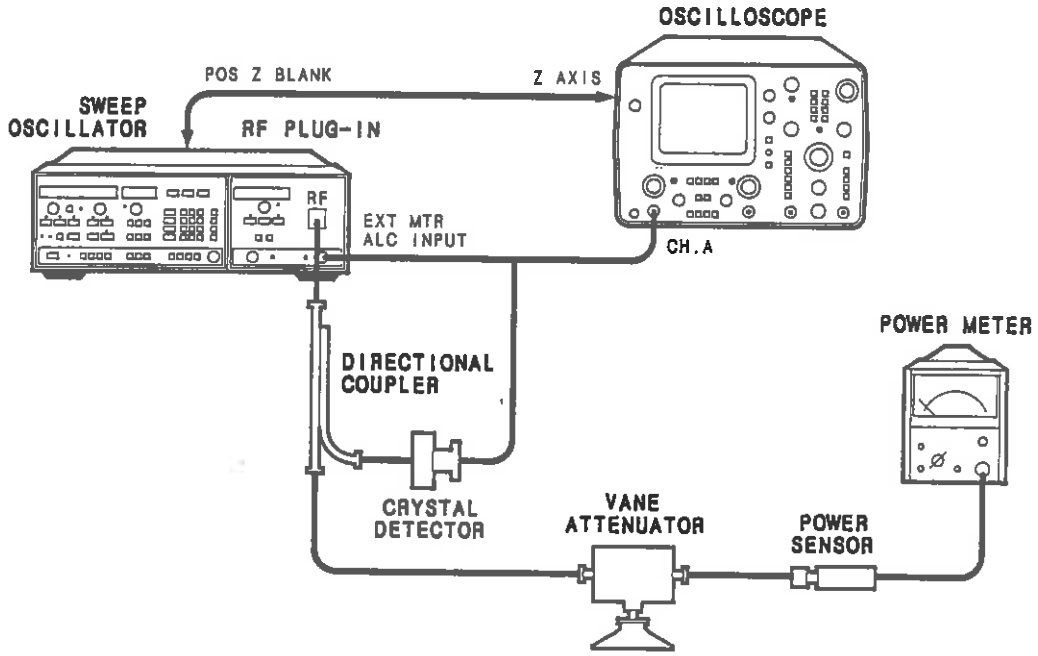


Figure 4-4. Crystal Detector Leveling Test Setup

4. Connect the equipment as shown in figure 4-4. Set the vane attenuator to 10 dB.

5. On the sweep oscillator, press:

   [INSTR PRESET]
   [TIME] [.1] [s]
   [CW]

   On the RF plug-in, reduce the displayed power level by 1 dB unless the instrument is an Option 001.

6. On the RF plug-in, press:

   [EXT] ALC MODE

   Adjust the ALC CAL to calibrate the power meter reading with the plug-in POWER display, taking into account the 10 dB loss through the vane attenuator.

7. On the RF plug-in, vary the RF output power ±0.1 dB from this reference as noted on the power meter, and mark the level of the oscilloscope trace at both extremes.

8. Return the RF output power to its original setting. Press **[START]** on the sweep oscillator. The entire trace on the oscilloscope should be within the window between the two marks.

B. Power Meter Leveling

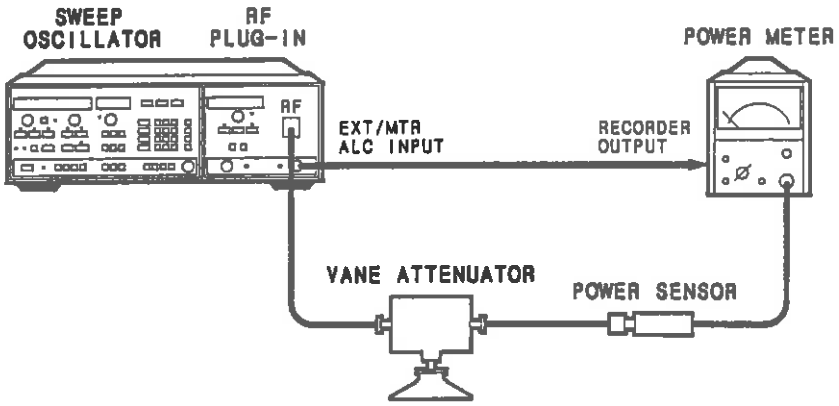


Figure 4-5. Power Meter Leveling Test Setup

9. Connect the equipment as shown in figure 4-5. Set the vane attenuator to 10 dB.

10. On the sweep oscillator, press:

    [INSTR PRESET]
    [TIME] [100] [s]
    [CW]

11. On the RF plug-in, press:

    [[MTR] ALC MODE and adjust the ALC CAL for a power meter reading equal to the RF plug-in POWER reading plus 10 dB (the loss through the vane attenuator).

12. On the sweep oscillator, press **[START]**. The entire sweep should be within a 0.1 dB window on the power meter. Record the value of the maximum deviation on the test record.

4-3. Residual AM Test

Description

The RF output signal from the RF plug-in is amplitude modulated with a square wave applied from a function generator. The modulated signal is used to establish a reference on the RMS voltmeter that is 9 dB below the actual carrier signal. The 9 dB reduction occurs because of the voltmeter's response to the square wave and the square-law response of the crystal detector. The modulating signal is then removed and the magnitude of the residual AM component is measured with respect to the established reference.

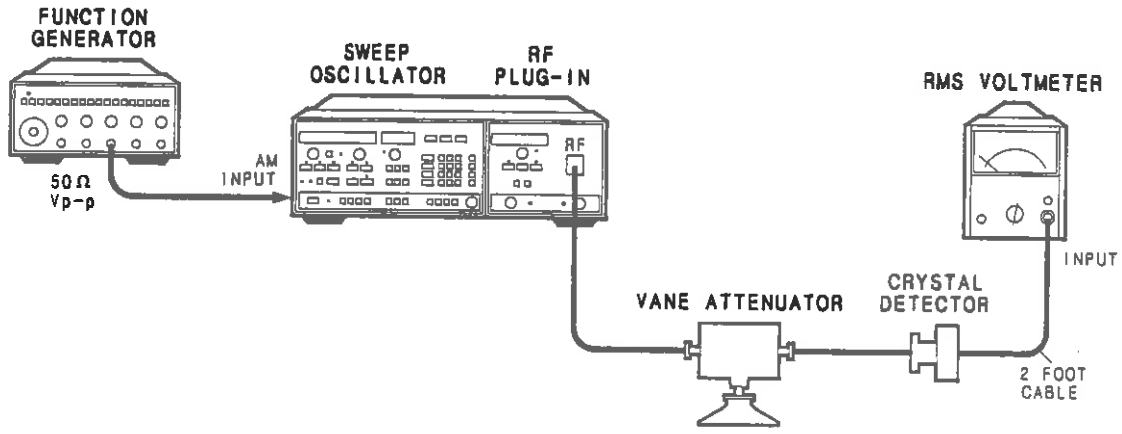


Figure 4-6. Residual AM Test Setup

Equipment

RMS Voltmeter	HP 3400A
Crystal Detector	HP R422C
Vane Attenuator	HP R382A
60 cm (24 in) cable (Limits bandwidth to approximately 100 kHz)	HP 11170B
Function Generator	HP 3312A

Procedure

1. Connect the equipment as shown in figure 4-6. Set the vane attenuator to 20 dB.
2. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW]
   DISPL BLANK (LED off)

3. Set the function generator for a 0 to −10 volt 1 kHz squarewave output.

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's response to a square wave and the square-law response of the crystal detector.

4. Vary the attenuation of the vane attenuator to obtain a reading on the RMS voltmeter of −28 dB ±3 dB. This ensures that the signal is in the square-law region of the crystal detector. Enter the voltmeter reading in the test record.

5. Disconnect the function generator from the sweep oscillator. Change the range of the RMS voltmeter to obtain an on-scale reading. Calculate the difference between this and the reading noted in step 4 and add −9 dB to compensate for square-law inequities. The result should be at least 50 dB below the RF output signal. Enter this result in the test record.

4-4. Frequency Stability Tests

Description

A spectrum analyzer is used to check changes in frequency due to line voltage changes, output power level changes, and load impedance changes.

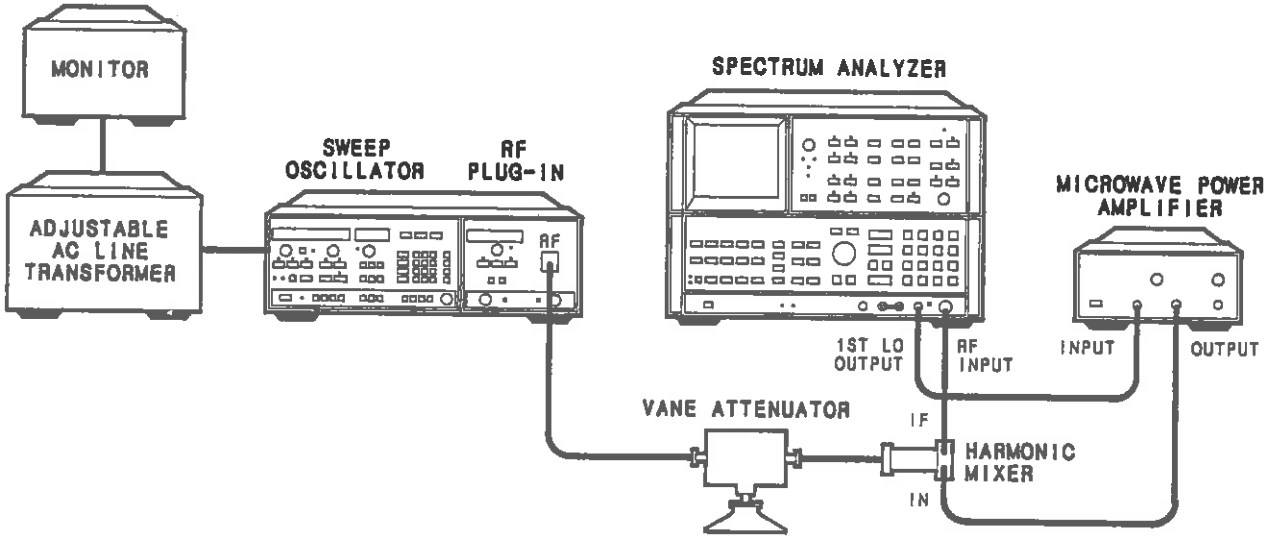


Figure 4-7. Frequency Change with Line Voltage Test Setup

Equipment

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A
Directional Coupler	HP R752C
Adjustable Short	HP R920C
Adjustable AC Line Transformer and Monitor (Select for line voltage needed)	
100-120V	General Radio W5MTB
120V Monitor	RCA WV 120B
220-240V	General Radio W10HM73
240V Monitor	RCA WV 503A

Procedure

Frequency Change with Line Voltage Change

1. Connect the equipment as shown in figure 4-7. Set the sweep oscillator LINE switch to ON. Set the vane attenuator to 20 dB.

2. Check the line voltage setting on the sweep oscillator power module. Using the appropriate monitor, set the adjustable line transformer to the same voltage as the sweep oscillator. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW] [33] [GHz]

Table 4-3. High and Low Line Voltage Selection Table

Nominal Line Voltage	100V	120V	220V	240V
Low Line Voltage	90V	108V	109V	216V
High Line Voltage	105V	126V	231V	252V

3. On the spectrum analyzer, press:

   [SHIFT] [⏏]
   [CENTER FREQUENCY] [33] [GHz]
   [FREQUENCY SPAN] [500] [MHz]
   [PEAK SEARCH] [SIGNAL TRACK] [SHIFT] [FREE RUN]

   Wait five minutes to allow the RF output signal frequency to stabilize, then change the spectrum analyzer frequency span to 10 MHz. Note the RF output frequency on the spectrum analyzer, and enter this in the test record.

4. Set the adjustable line transformer to the low line voltage shown in table 4-3 using the appropriate monitor for the selected nominal line voltage. Note the difference in frequency from the reading in step 3 (this should be $\leq \pm 1$ MHz) and enter this difference in the test record.

5. Set the adjustable line transformer to the high line voltage shown in table 4-3 using the appropriate monitor for the selected nominal line voltage. Note the difference in frequency from the reading in step 3 (this should be $\leq \pm 1$ MHz) and enter this difference in the test record.

Frequency Change with 10 dB Power Level Change

6. Set the adjustable line transformer voltage to nominal. On the RF plug-in, press:

   [UNLVLD PWR] [POWER LEVEL] [15] [dBm]

7. Slowly decrease the RF plug-in power level with the control knob until the RF power indication on the spectrum analyzer starts to decrease. On the sweep oscillator, press **[SAVE] [1]**.

8. Note the signal amplitude on the spectrum analyzer, then use the RF plug-in power level control knob to decrease the actual RF power 10 dB. Press **[SAVE] [2]**.

9. On the spectrum analyzer, set the frequency span to 5 MHz and recenter the signal.

10. On the sweep oscillator, alternate between **[RECALL] [1]** and **[RECALL] [2]**. Note the actual frequency difference between the two recall registers (this should be $\leq \pm 200$ kHz). Enter this difference in the test record.

Frequency Change With 3:1 Load SWR

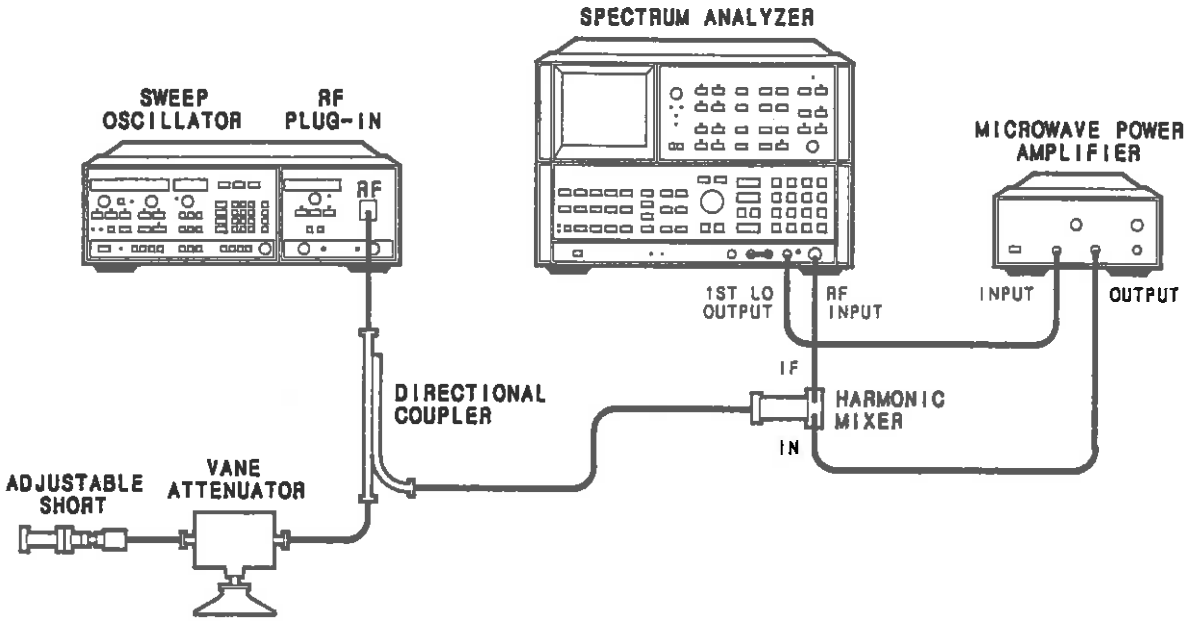


Figure 4-8. Frequency Change with 3:1 Load SWR Test Setup

11. Connect the equipment as shown in figure 4-8. Set the vane attenuator to 3 dB.
12. On the sweep oscillator, press:

    [INSTR PRESET]
    [CW] [33] [GHz]

13. On the spectrum analyzer, press:

    [SHIFT] [◂]
    [CENTER FREQUENCY] [33] [GHz]
    [FREQUENCY SPAN] [300] [MHz]
    [PEAK SEARCH] [SIGNAL TRACK] [SHIFT] [FREE RUN]

14. Reduce the spectrum analyzer frequency span to 2 MHz and recenter the signal.
15. Note the RF output frequency on the spectrum analyzer, and enter this in the test record.
16. Vary the adjustable short through its range while observing the spectrum analyzer for the greatest plus and minus frequency change (this should be $\leq \pm 100$ kHz). Note the frequency difference between the maximum plus and minus frequency changes, and enter this difference in the test record.

4-5. Residual FM Test

Description

The demodulation sensitivity of the spectrum analyzer is determined using slope detection. The filtered CW RF output of the RF plug-in is then displayed on the vertical axis using the zero-span mode of the spectrum analyzer. The residual FM of the RF plug-in corresponds directly to the vertical deviation of the spectrum analyzer display, measured in units of kHz/div.

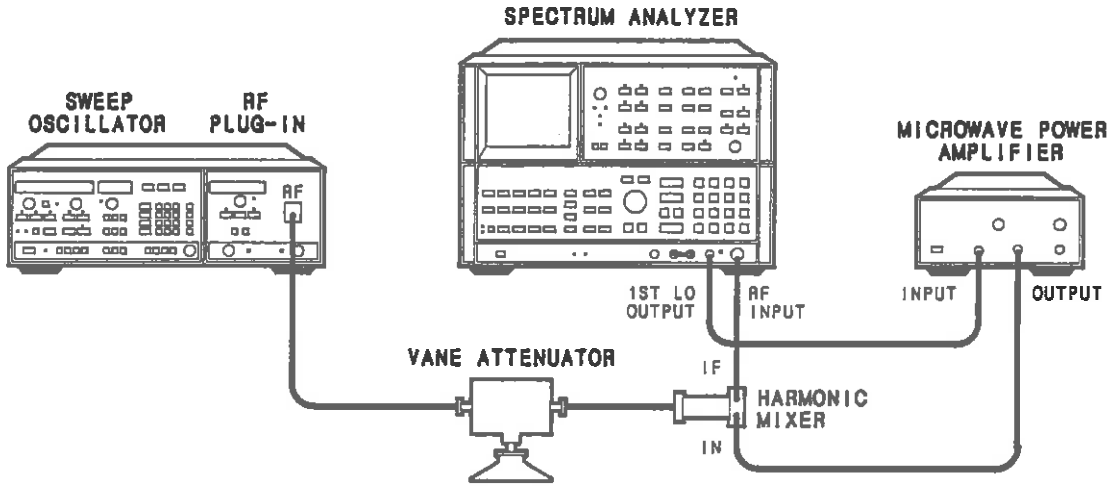


Figure 4-9. Residual FM Test Setup

Equipment

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A

Procedure

1. Connect the equipment as shown in figure 4-9 but do not connect the mixer output yet. Set the vane attenuator to 20 dB.
2. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW] [40] [GHz]

NOTE: To minimize drift, allow five minutes warmup time before continuing with this test.

Slope Detection

3. On the spectrum analyzer, press:

   [INSTR PRESET]
   [CENTER FREQUENCY] [0] [MHz]
   [FREQUENCY SPAN] [5] [MHz]
   [RES BW] [300] [kHz]
   [REFERENCE LEVEL] [-10] [dBm]
   LOG **[10] [dB/div]**
   [VIDEO BW] [10] [kHz]
   [ATTEN] [MANUAL]

4. Center the LO feedthrough signal on the spectrum analyzer display and set the peak of the expanded trace at the reference level (top) graticule line by pressing the following key sequence:

   [SHIFT] [PEAK SEARCH] [SIGNAL TRACK]
   [ENTER dB/DIV] [1] [dB]
   [MKR-REF LEVEL] [MARKER OFF]

5. Demodulation sensitivity is measured over an 8 dB section of the linear portion of the IF bandwidth skirt. To obtain a good display of this linear portion of the signal, on the spectrum analyzer, press:

   [REF LEVEL] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [▼]
   [FREQUENCY SPAN] [1] [MHz]
   [CENTER FREQUENCY] Adjust the center frequency to center one side of the filter on the CRT.
   [FREQUENCY SPAN] [200] [kHz]

6. Observe a linear ramp centered on the CRT display.

7. On the spectrum analyzer, press **[NORMAL]**, and adjust the RPG knob to place a marker 1 dB down from the top reference line. Press [Δ] to activate the delta marker function, and tune the second marker 1 dB above the bottom of the trace. The portion of the trace between the markers should be linear.

8. Observe the delta marker frequency (difference in frequency between the markers), and divide by 8 divisions. This will give a demodulation sensitivity typically of about 20 kHz/div.

Measuring Residual FM

9. Connect the sweep oscillation/RF plug-in through the vane attenuator to the external mixer. On the spectrum analyzer, press:

   [INSTR PRESET]
   [SHIFT] [▲]
   [CENTER FREQUENCY] [40] [GHz]
   [FREQUENCY SPAN] [100] [MHz]
   LOG **[10] [dB/DIV]**
   [REFERENCE LEVEL] [10] [dBm]
   [RES BW] [300] [kHz]

10. Both the upper and the lower sidebands of the RF plug-in 40 GHz signal are displayed on the spectrum analyzer CRT. Adjust the spectrum analyzer reference level to place the peak of the lower sideband signal trace at the reference level (top) graticule line.

11. Expand the spectrum analyzer display scale to 1 dB/DIV and repeat step 10 if necessary.

12. Reduce the frequency span to 0 while keeping the signal centered on the CRT with the tuning control.

13. Decrease the reference level by 8 dB and position the trace at mid screen by adjusting the center frequency.

14. Reduce the sweep time to 1 second. Observe the maximum peak-to-peak deviation in divisions of the spectrum analyzer trace. The peak deviation is one-half of the peak-to-peak deviation. Multiply the peak deviation by the modulation sensitivity calculated in step 7 to arrive at the value of residual FM.

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

    = _____ kHz

15. Verify that the residual FM is less than 60 kHz peak, and enter in the test record.

4-6. Spurious Signals Test

Description

The RF output signal from the RF plug-in is displayed on a spectrum analyzer. When the frequency range of the spectrum analyzer is extended using an external harmonic mixer, the response is unpreselected and multiple signals are displayed. Responses are examined to determine whether they are true in-band spurious signals and to verify that they are at or below the specified level.

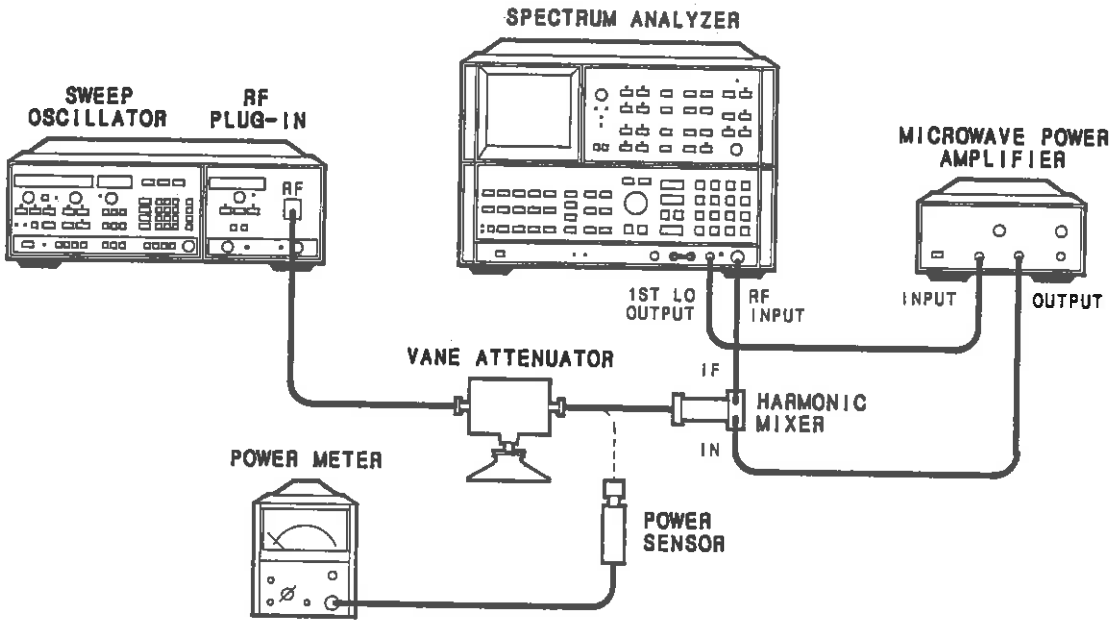


Figure 4-10. Spurious Signals Test Setup

Equipment

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A
Power Meter	HP 432A
Power Sensoe	HP R486A
Directional Coupler	HP R752C
Crystal Detector	HP R422C

Procedure

1. Connect the equipment as shown in figure 4-10 with the RF plug-in RF output connected through the external mixer to the spectrum analyzer. Set the vane attenuator to 20 dB.

2. On the sweep oscillator, press:

   [INSTR PRESET]
   [SHIFT] [DET]

   Adjust the power level for maximum leveled power. Then press:

   [CW] [33.25] [GHz]

3. On the spectrum analyzer, press:

   [SHIFT] [◆]
   [START FREQ] [26.5] [GHz]
   [STOP FREQ] [40] [GHz]
   [FREQUENCY SPAN] [300] [MHz]
   [RES BW] [1] [MHz]
   [CENTER FREQUENCY] Adjust the signal to the center of the display.

4. On the microwave power amplifier, adjust the output power level to maximize the signal *without* exceeding +16 dBm.

5. Calculate the reference level offset for the spectrum analyzer as follows: On the external harmonic mixer, find the average value of conversion loss from the table on the side panel. This is a minus dB value. Add +20 dB to this value to compensate for the loss through the vane attenuator. The total is the adjusted reference line offset.

   Example: −7 dB + 20 dB = +13 dB adjusted reference line offset

6. On the spectrum analyzer, press:

   [SHIFT] [REFERENCE LEVEL] Enter the calculated adjusted reference line offset.

7. On the spectrum analyzer, press:

   [REFERENCE LEVEL] Adjust signal to top graticule.
   LOG **[10] [dB/DIV]**
   [START FREQ] [26.5] [GHz]
   [STOP FREQ] [40] [GHz]
   DISPLAY LINE Adjust to center of CRT (5 divisions from top)
   THRESHOLD Adjust 4 divisions above bottom graticule
   [SAVE] [1]

8. On the sweep oscillator, press:

   [START]
   SWEEP **[MAN]**

   Manually tune across the frequency range, verifying that the power is leveled across the band within ±2 dB.

9. On the spectrum analzyer, press:

   [START FREQ] [26.5] [GHz]
   [STOP FREQ] [32.928] [GHz]
   [SAVE] [2]

   [START FREQ] [30] [GHz]
   [STOP FREQ] [36.428] [GHz]
   [SAVE] [3]

   [START FREQ] [33.572] [GHz]
   [STOP FREQ] [40] [GHz]
   [SAVE] [4]

Storage registers 2, 3, and 4 in the spectrum analyzer store three frequency bands, covering the total range from 26.5 to 40 GHz. Each frequency band covers a span of 6.428 GHz. Each signal displayed on the spectrum analyzer appears twice, in the form of the upper and lower sideband mixing products. Therefore, any true in-band signal appears as an identical pair with a frequency spacing of 642.8 MHz, or exactly one division.

To examine a signal, use the spectrum analyzer **[NORMAL]** and **[Δ]** keys to place markers on the upper and lower sidebands (it may be necessary to narrow the frequency span for better resolution). If the frequency spacing is not 642.8 MHz, the signal is not a true in-band signal. Rather it is either a local oscillator or mixer-induced harmonic product, and it should be ignored.

10. On the spectrum analyzer, press **[RECALL] [2]**.

11. Manually tune the RF plug-in slowly from 26.5 to 40 GHz, checking for identical pairs of spurious signals that have a spacing of exactly one division. These are true spurious signals. Any spurious signal that is above the display line on the spectrum analyzer exceeds specifications. If a spurious signal is between the threshold and the display line, it is in the ambiguity region and must be checked further (steps 14 through 20) to determine whether it exceeds specifications.

12. On the spectrum analyzer, press **[RECALL] [3]** and repeat step 11.

13. On the spectrum analyzer, press **[RECALL] [4]** and repeat step 11.

14. If any pair of spurious signals appears in the ambiguity region on the spectrum analyzer, note the displayed frequency of the RF plug-in. Also note the frequency of the lower sideband of the pair of signals.

15. Disconnect the harmonic mixer from the vane attenuator. Connect the power sensor to the vane attenuator as shown in figure 4-10. Verify that the vane attenuator is set to 20 dB.

16. Use the power meter to measure the absolute power in dBm of the RF plug-in output signal. Note this reference power level.

17. Tune the RF plug-in to the frequency of the spurious signal noted in step 15. Adjust the vane attenuator to obtain a power meter reading at this frequency equal to the level noted in step 17.

    Example: If a fundamental signal at 29 GHz with an absolute power level of +3 dBm (-17 dBm at the output of the attenuator) causes a spurious signal at 30 GHz, tune the RF plug-in to 30 GHz and use the vane attenuator to set the power meter reading to −17 dBm.

18. Disconnect the power sensor from the vane attenuator. Do not change the vane attenuator setting or the RF plug-in frequency. Reconnect the harmonic mixer and spectrum analyzer. Center the lower sideband of the RF plug-in fundamental signal on the spectrum analyzer CRT and use the spectrum analyzer reference level to set the peak of the signal to the top of the screen. (In the example, this would give a reference level of −17 dBm.)

19. Tune the RF plug-in back to the frequency that originally caused the spurious signal (29 GHz in the example). Set the vane attenuator back to 20 dB.

20. Check the level of the spurious signals on the spectrum analyzer CRT. If the spurious signals are at least 50 dB below the top of the screen, they are within specification.

4-7. Output SWR Test

Description

Output SWR is a measure of the impedance mismatch of the RF plug-in RF OUTPUT waveguide connector. The RF output signal is measured using a directional coupler, crystal detector, and oscilloscope. The signal at the oscilloscope contains the incident signal from the oscillator and the reflected signal. The reflected signal is developed as follows: The incident signal travels down the waveguide, encounters the open end, and is reflected back to the source. If the reflected signal at the RF OUTPUT connector encounters a perfect 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.

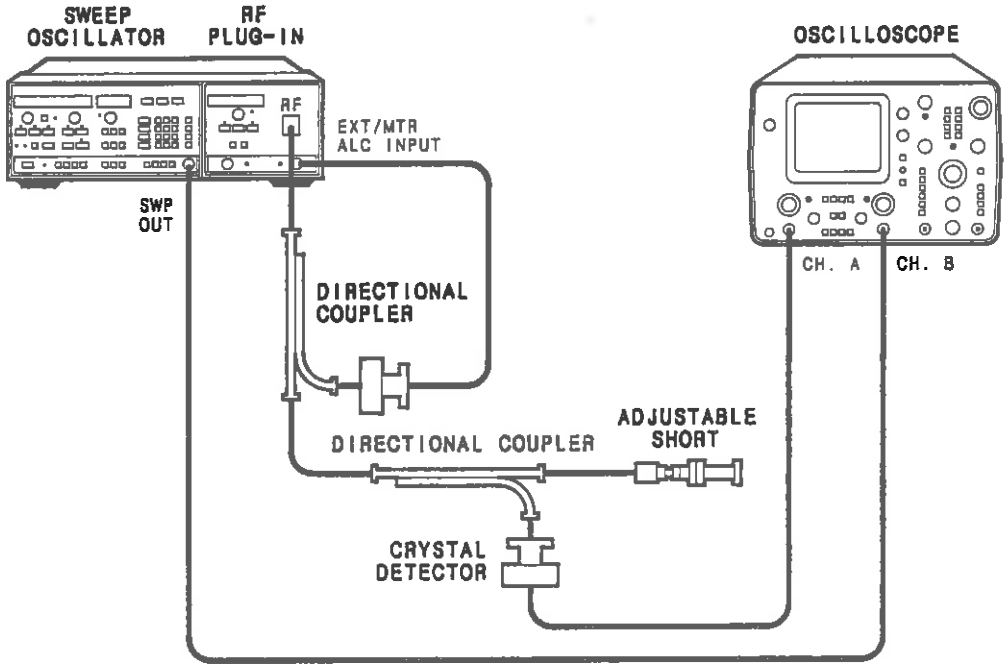


Figure 4-11. Output SWR Test Setup

Equipment

Oscilloscope	HP 1740A
Crystal Detector	HP R422C
Directional Coupler 26.5 to 40 GHz	HP R752C
Adjustable Short	HP R920C

Procedure

1. Connect the equipment as shown in figure 4-11. If the RF plug-in is not an Option 001, connect the directional coupler directly to the waveguide RF output connector.

2. On the sweep oscillator, press:

   [INSTR PRESET]
   [DET]
   DISPL BLANK (LED off)
   RF BLANK (LED on)

3. Adjust the POWER control on the RF plug-in to obtain a maximum trace amplitude of −25 mV peak on the oscilloscope display, in order to keep the crystal detector in the square law output range.

4. Vary the adjustable short through its entire range and select points on the trace where V MAX and V MIN appear to have the greatest separation and calculate V MAX/V MIN for each point.

5. Convert the greatest V MAX/V MIN ratio noted in step 4 into source match SWR using the 1.0 dB loss line in figure 4-12. The SWR should be less than 2.0 for a standard instrument or less than 1.5 for an Option 001. Enter the calculated SWR in the test record.

6. To check the output SWR of an Option 001 in the unleveled condition, remove the Option 001 directional coupler and crystal detector and connect the test coupler to the RF output of the plug-in.

7. On the RF plug-in, press **[UNLVLD PWR]**.

8. Repeat steps 3 through 5. The SWR should be less than 2.0 for an Option 001 with unleveled power. Enter the calculated SWR in the test record.

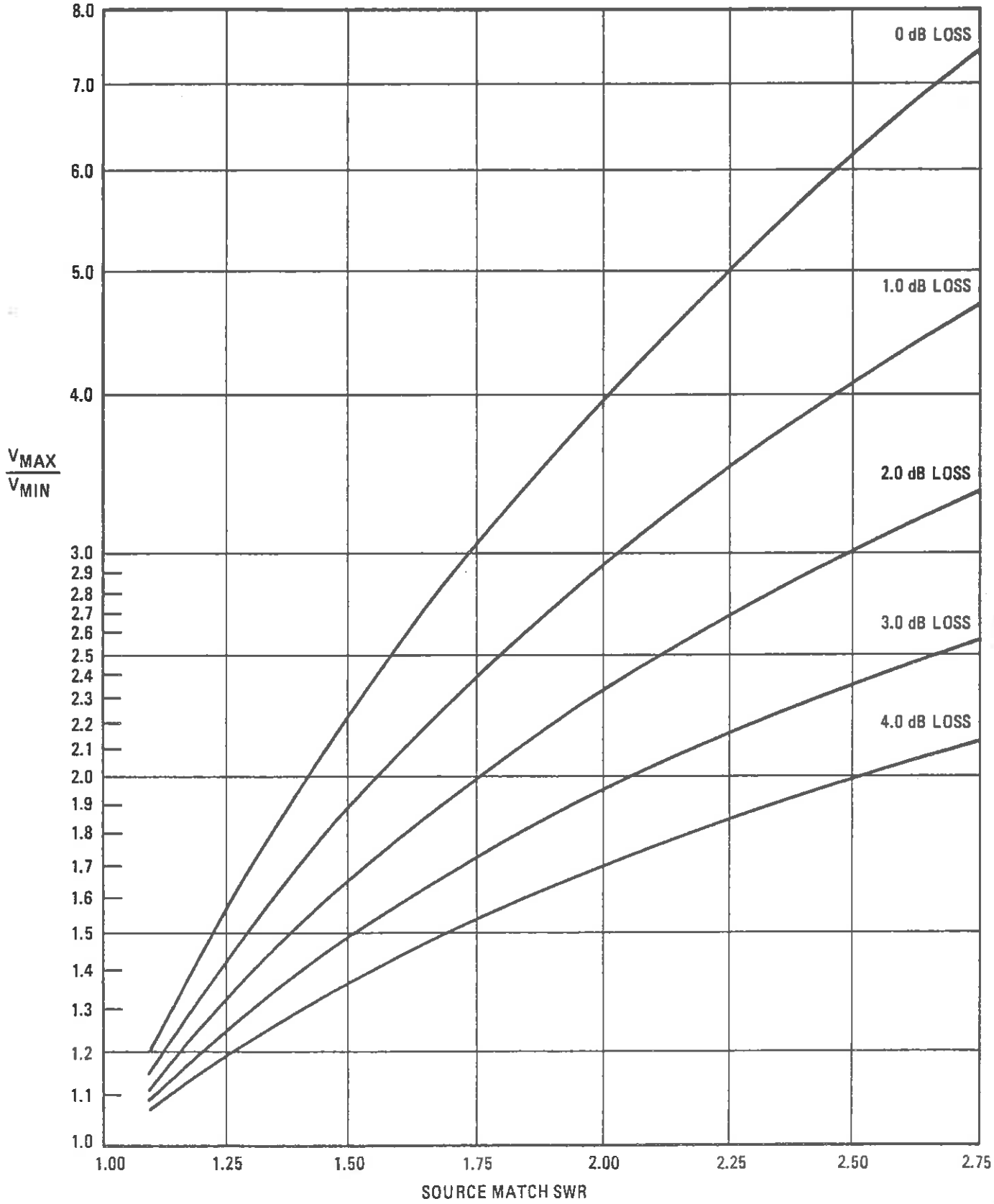


Figure 4-12. Conversion of Oscilloscope Trace to Source Match SWR

4-8. External Frequency Modulation Test

Description

The RF output is modulated with an external signal at 100 Hz and at 200 kHz. The deviations are measured directly on a spectrum analyzer.

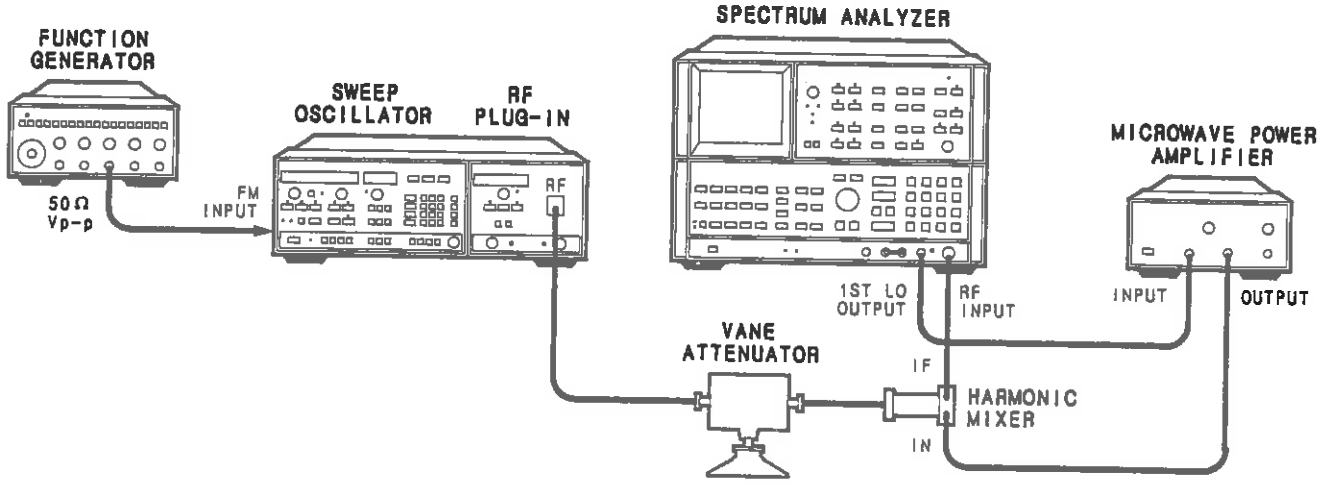


Figure 4-13. External Frequency Modulation Test Setup

Equipment

Spectrum Analyzer	HP 8566B
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Function Generator	HP 3312A
Vane Attenuator	HP R382A

Procedure

Direct Coupled, 100 Hz Modulation

1. Ensure that the RF plug-in modulation sensitivity is set to −20 MHz/Volt and the modulation coupling is set to DC. See section 3 for information on setting the configuration switch. Connect the equipment as shown in figure 4-13. Set the vane attenuator to 20 dB.

2. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW]
   CW FILTER (LED off)

3. On the spectrum analyzer, press:

   [SHIFT] [◆]
   [CENTER FREQUENCY] [33.25] [GHz]
   [FREQUENCY SPAN] [20] [MHz]

   Center the fundamental signal on the spectrum analyzer display.

4. Set the function generator frequency to 100 Hz sinewave and the amplitude fully counterclockwise. Adjust the function generator amplitude control slowly clockwise while monitoring the display on the spectrum analyzer. Deviation from the center line should be symmetrical at first, then become non-symmetrical as deviation increases.

5. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 6$ MHz). Record the highest observed symmetrical deviation frequency on the test record. Disconnect the function generator.

Direct Coupled, 200 kHz Modulation

6. On the spectrum analyzer, press:

   [FREQUENCY SPAN] [10] [MHz]

   Center the fundamental signal on the spectrum analyzer display.

7. Reconnect the function generator and set the frequency to 200 kHz sinewave and the amplitude fully counterclockwise. Adjust the function generator amplitude slowly clockwise while monitoring the display on the spectrum analyzer. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 3.5$ MHz). Enter the highest observed symmetrical deviation frequency in the test record. Disconnect the function generator.

Crossover Coupled, 200 kHz Modulation

8. Turn off the sweep oscillator LINE switch. Remove the RF plug-in and reset the configuration switch for crossover modulation coupling (see Section 3). Reinstall the RF plug-in and turn on the sweep oscillator LINE switch.

9. Leave the spectrum analyzer frequency span set to 10 MHz. Center the fundamental signal on the spectrum analyzer display. Reconnect the function generator. Leave the function generator frequency set to 200 kHz and set the amplitude fully counterclockwise. Adjust the function generator amplitude control slowly clockwise while monitoring the display on the spectrum analyzer. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 3.5$ MHz). Enter the highest observed symmetrical deviation frequency in the test record. Disconnect the function generator.

Crossover Coupled, 100 Hz Modulation

10. Set the spectrum analyzer frequency span to 500 MHz. center the fundamental signal on the spectrum analyzer display. Reconnect the function generator and set its frequency to 100 Hz and amplitude fully counterclockwise. Adjust the function generator amplitude control slowly clockwise while monitoring the display on the spectrum analyzer. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 150$ MHz). Enter the highest observed symmetrical deviation frequency in the test record.

4-9. AM On/Off Ratio and Square Wave Symmetry Test (Options 006 and 001/006 only)

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

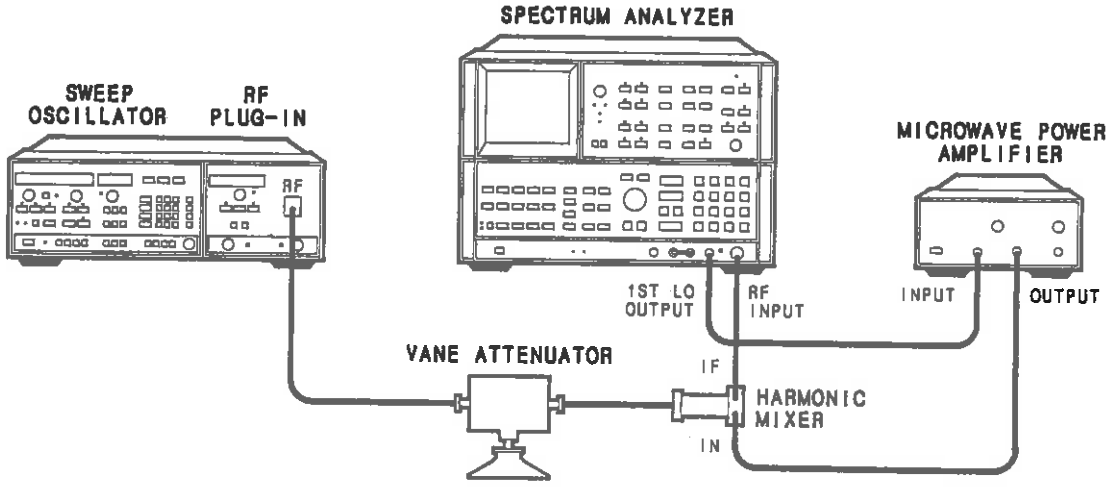


Figure 4-14. AM ON/OFF Ratio and Square Wave Symmetry Test Setup

Equipment

Spectrum Analyzer	HP 8566B
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A

Procedure

1. Connect the equipment as shown in figure 4-14. Set the vane attenuator to 20 dB.
2. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW] [MOD]

3. On the spectrum analyzer, press:

   [INSTR PRESET]
   [SHIFT] [▲]
   [CENTER FREQUENCY] [33.25] [GHz]
   [FREQUENCY SPAN] [500] [MHz]

4. Adjust the spectrum analyzer tuning control to center the signal on the CRT. Adjust the reference level to set the peak of the signal on the top graticule.

5. On the spectrum analyzer, press:

   [FREQUENCY SPAN] [10] [MHz]
   [ENTER dB/DIV] [5] [dB]

6. Repeat step 4.

7. On the spectrum analyzer, press:

   [RES BW] [3] [MHz]
   [VIDEO BW] [3] [MHz]
   [SWEEP TIME] [100] [us]
   [FREQUENCY SPAN] [0] [MHz]
   [VIDEO TRIGGER] Adjust LEVEL

8. The AM on/off ratio is the amplitude difference between the on and off portions of the square wave. Verify that the on/off ratio is at least 20 dB. Enter the AM on/off ratio in the test record.

9. The symmetry of the square wave is the percentage of on time to off time. Verify that the symmetry of the modulated signal is 50% ±5%. Record the symmetry in the test record.

Table 4-2. Performance Test Record (1 of 2)

HP 83572C RF PLUG-IN

Tested by_____

Serial No._____ Date_____

Humidity*_____ Temperature*_____

(*optional)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-1. FREQUENCY RANGE AND ACCURACY TEST					
CW Mode					
26.5 to 40.0 GHz: ±100 MHz	4.	Start Frequency=26.5 GHz			26.5 GHz
	5.	Stop Frequency=40.0 GHz	40.0 GHz		
	6.	CW Frequency=28.00 GHz	27.90 GHz		28.1 GHz
		CW Frequency=32.00 GHz	31.90 GHz		32.1 GHz
		CW Frequency=39.00 GHz	38.90 GHz		39.1 GHz
Swept Frequency Accuracy					
26.5 to 40.0 GHz: ±150 MHz	9.	Start Frequency=26.5 GHz	26.35 GHz		26.65 GHz
	11.	Stop Frequency=40.0 GHz	39.85 GHz		40.15 GHz
Marker Accuracy					
26.5 to 40.0 GHz: ±150 MHz ±0.5% of sweep width	14.	Sweep Width: 26.5 to 40.0 GHz			
		M1=27 GHz	26.783 GHz		27.217 GHz
		M2=33 GHz	32.783 GHz		33.217 GHz
		M3 =39 GHz	38.783 GHz		39.217 GHz
4-2. OUTPUT AMPLITUDE					
Minimum Unleveled Output Power	3.	Power = +15 dBm			
83572C: Std			+7 dBm		
Option 001			+6 dBm		
Option 006			+5.5 dBm		
Option 001/006			+4.5 dBm		
Crystal Detector Leveled: ±0.1 dB	8.				<02. dB
Power Meter Leveled: ±0.1 dB	12.				<0.2 dB
4.3 RESIDUAL AM					
26.5 to 40.0 GHz: ≥50 dB	2.	CW Frequency=33 GHz			
	4.	In dB below carrier	≥50 dB		

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

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-4. FREQUENCY STABILITY					
+5 to −10% V Line Change:					
26.5 to 40.0 GHz: ±1 MHz	2.	CW frequency=33 GHz			
	4.	Low line voltage		_____	±1 MHz
	5.	High line voltage		_____	±1 MHz
10 dB Power Change:					
26.5 to 40 GHz: ±200 kHz		CW Frequency=33 GHz			
	10.	Reduce power 10 dB		_____	±200 kHz
3:1 Load SWR					
26.5 to 40 GHz: ±100 kHz		CW frequency=33 GHz			
	15.			_____	±100 kHz
4-5. RESIDUAL FM					
26.5 to 40.0 GHz: <60 KHz	2.	CW Frequency=40.0 GHz			
	15.			_____	<60 kHz
4-6. SPURIOUS SIGNALS					
Inband: ≥50 dB		In dB below carrier			
	20.		≥50 dB	_____	
4-7. OUTPUT SWR					
Unleveled <2.0		Range 26.5 to 40 GHz			
Leveled: <1.5	5.			_____	<2.0
				_____	<1.5
4-8. EXTERNAL FM					
Direct Coupled:	1.	A3S1: Close switch 5, open 6			
DC to 100 Hz: ±6 MHz	5.		±6 MHz	_____	
Direct/Cross Over Coupling:					
100 Hz to 200 kHz: ±3.5 MHz	7.		±3.5 MHz	_____	
	8.	A3S1: Close switch 6			
	9.		±3.6 MHz	_____	
Cross Over Coupled:					
DC to 100 Hz: ±150 MHz	10.		±150 MHz	_____	
4.9 AM ON/OFF RATIO					
Squarewave Symmetry					
(Option 006 or 001/006)					
On/Off Ratio: ≥20 dB	2.	CW Frequency=33.25 GHz			
Symmetry: 50% ±5%	7.		<20 dB	_____	
	8.		45%	_____	55%

Section 5. Adjustments

INTRODUCTION

This section provides adjustment procedures for the HP 83572C RF plug-in. These procedures should not be performed as routine maintenance but should be used after replacement of a part or component, or when performance tests show that the specifications of Table 1-1 cannot be met. Table 5-1 lists all of the adjustable components by reference designation, adjustment name, number, and description. Each procedure includes a test setup illustration and one or more adjustment location illustrations.

NOTE: Allow the HP 83572C RF plug-in and the HP 8350 sweep oscillator mainframe to warm up for one hour prior to making any adjustments. Use a non-metallic adjustment tool whenever possible.

SAFETY CONSIDERATIONS

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.

EQUIPMENT REQUIRED

The equipment required for the procedures is listed in Section 1. 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 equipment required for each adjustment is referenced in each procedure.

FACTORY SELECTED COMPONENTS

Table 5-2 contains a list of factory selected components that includes the reference designation, adjustment number, allowable range of values and 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 standard value replacement components are given in Table 5-3.

RELATED ADJUSTMENTS

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

ADJUSTMENT PROCEDURE

Procedures are given in the proper sequence to allow for interrelated adjustments. However, adjustments having to do with the ALC leveling loop are interactive and should be performed as a group.

Table 5-1. Adjustable Components

Reference Designation	Adjustment Name	Adjustment Number	Description
A3S1	Config. Switch	5-1	Selects plug-in code. Presets power, FM sensitivity, and FM coupling.
A4R3	1 HI	5-6, 5-8	Calibrates high end of power range.
A4R5	1 LO	5-6, 5-8	Calibrates low end of power range.
A4R8	1MD	5-6, 5-8	Calibrates midrange power.
A4R9	PM	5-10	Sets power meter leveling calibration.
A4R11	GAIN	5-9	Sets the gain of the main ALC amplifier.
A4R47	OFS 1	5-6	Adjusts for zero offset through U7-Q6 log amplifier circuit.
A4R56	OFS 2	5-6	Adjusts for zero offset through U5 log amplifier circuit.
A4R59	OFS 3	5-6	Adjusts for zero offset through U8-Q1, Sample and Hold circuit.
A4R67	OFS 4	5-6	Adjusts for zero offset through U11 Main ALC amplifier.
A5R19	FM	5-12	Sets DC offset to U10 video amplifier.
A5R33	BP 1	5-7	Breakpoint that works with SL1 (slope 1) for ALC flatness.
A5R35	BP 2	5-7	Breakpoint that works with SL2 (slope 2) for ALC flatness.
A5R37	BP 3	5-7	Breakpoint that works with SL3 (slope 3) for ALC flatness.
A5R39	BP 4	5-7	Breakpoint that works with SL4 (slope 4) for ALC flatness.
A5R41	SL 1	5-7	Slope adjustment for best ALC flatness.
A5R42	SL 2	5-7	Slope adjustment for best ALC flatness.
A5R43	SL 3	5-7	Slope adjustment for best ALC flatness.
A5R44	SL 4	5-7	Slope adjustment for best ALC flatness.
A5R49	SLP	5-7	Sets overall slope of internal leveling ALC.
A5R50	PWSP	5-11	Sets range for power sweep.
A6R14	HI	5-4	Sets delay compensation at high end of band.
A6R15	OFS	5-4	Sets delay compensation at low end of band.
A6R26	Z (zero)	5-4	Adjusts for offset inaccuracies out of the delay compensation circuit.
A6R33	−25V	5-2	Sets −25V reference.
A6R59	−10V	5-2	Sets −10V reference.
A6S1	OFFSET	5-3	Sets low end frequency.
A6S2	GAIN	5-3	Sets high end frequency
A7R12	MAX P	5-5	Adjusts for maximum power across the band.
A7R17	MIN P	5-5	Adjusts for minimum power across the band.
A7R69	LO	5-13	Optimizes ON/OFF ratio at low end of band.
A7R71	HI	5-13	Optimizes ON/OFF ratio at high end of band.

Table 5-2. Factory Selected Components

Reference Designator	Adjustment Number	Allowable Range of Values	Basis of Selection
A4R49	5-8	9.09KΩ to 26.1KΩ	To optimize the 1LO adjustment on Opt. 001 or 001/006.
A4R54	5-8	6.3KΩ to 10KΩ	To center the range of the 1MD adjustment.
A5R31	—	90.9Ω to 250Ω	To make the FM coil sensitivity equal to the main coil sensitivity.
A6R38-49	None	Not replaceable	

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

RESISTORS

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

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
10.0	0757-0346	2	464	0698-0082	7	21.5K	0757-0199	3
11.0	0757-0378	0	511	0757-0416	7	23.7K	0698-3158	4
12.1	0757-0379	1	562	0757-0417	8	26.1K	0698-3159	5
13.3	0698-3427	0	619	0757-0418	9	28.7K	0698-3449	6
14.7	0698-3428	1	681	0757-0419	0	31.6K	0698-3160	8
16.2	0757-0382	6	750	0757-0420	3	34.8K	0757-0123	3
17.8	0757-0294	9	825	0757-0421	4	38.3K	0698-3161	9
19.6	0698-3429	2	909	0757-0422	5	42.2K	0698-3450	9
21.5	0698-3430	5	1.0K	0757-0280	3	46.4K	0698-3162	0
23.7	0698-3431	6	1.1K	0757-0424	7	51.1K	0757-1458	7
26.1	0698-3432	7	1.21K	0757-0274	5	56.2K	0757-0459	8
28.7	0698-3433	8	1.33K	0757-0317	7	61.9K	0757-0460	1
31.6	0757-0180	2	1.47K	0757-1094	9	68.1K	0757-0461	2
34.8	0698-3434	9	1.62K	0757-0428	1	75.0K	0757-0462	3
38.3	0698-3435	0	1.78K	0757-0278	9	82.5K	0757-0463	4
42.2	0757-0316	6	1.96K	0698-0083	8	90.9K	0757-0464	5
46.4	0698-4037	0	2.15K	0698-0084	9	100K	0757-0465	6
51.1	0757-0394	0	2.37K	0698-3150	6	110K	0757-0466	7
56.2	0757-0395	1	2.61K	0698-0085	0	121K	0757-0467	8
61.9	0757-0276	7	2.87K	0698-3151	7	133K	0698-3451	0
68.1	0757-0397	3	3.16K	0757-0279	0	147K	0698-3452	1
75.0	0757-0398	4	3.48K	0698-3152	8	162K	0757-0470	3
82.5	0757-0399	5	3.83K	0698-3153	9	178K	0698-3243	8
90.0	0757-0400	9	4.22K	0698-3154	0	196K	0698-3453	2
100	0757-0401	0	4.64K	0698-3155	1	215K	0698-3454	3
110	0757-0402	1	5.11K	0757-0438	3	237K	0698-3266	5
121	0757-0403	2	5.62K	0757-0200	7	261K	0698-3455	4
133	0698-3437	2	6.19K	0757-0290	5	287K	0698-3456	5
147	0698-3438	3	6.81K	0757-0439	4	316K	0698-3457	6
162	0757-0405	4	7.50K	0757-0440	7	348K	0698-3458	7
178	0698-3439	4	8.25K	0757-0441	8	383K	0698-3459	8
196	0698-3440	7	9.09K	0757-0288	1	422K	0698-3460	1
215	0698-3441	8	10.0K	0757-0442	9	464K	0698-3260	9
237	0698-3442	9	11.0K	0757-0443	0			
261	0698-3132	4	12,1K	0757-0444	1			
287	0698-3443	0	13.3K	0757-0289	2			
316	0698-3444	1	14.7K	0698-3156	2			
348	0698-3445	2	16.2K	0757-0447	4			
383	0698-3446	3	17.8K	0698-3136	8			
422	0698-3447	4	19.6K	0698-3157	3			

Table 5-4. Related Adjustments

Assembly Replaced or Repaired	Related Assemblies	Adjustment Required (by number)
A2 YIG Oscillator	A7, A6, A4, A5	5-3 through 5-10, 5-12
A3 Digital Interface	A3	5-1
A4 ALC	A4, A7, A5	5-5 through 5-11
A5 FM Driver	A4, A5	5-6 through 5-12
A6 YO Driver	A6	5-2 through 5-4
A7 Bias	A7, A4, A6	5-2, 5-5 through 5-10, 5-13

Table 5-5. Adjustment Procedures

Number	Adjustments
5-1	A3S1 Configuration Switch
5-2	−10V/−25V Reference on A6 YO Driver
5-3	Frequency Accuracy
5-4	Delay Compensation
5-5	Maximum and Minimum Power
5-6	ALC Adjustment
5-7	ALC Leveled Flatness
5-8	Power Calibration
5-9	ALC Gain Adjustment
5-10	Power Meter Leveling Calibration
5-11	Power Sweep
5-12	FM Driver
5-13	ON/OFF Ratio

5-1. Configuration Switch A3S1

Description

Configuration switch A3S1 is set at the factory for a specific combination of operating modes (see table 5-6). Other operating modes can be selected by resetting the switch positions on A3S1.

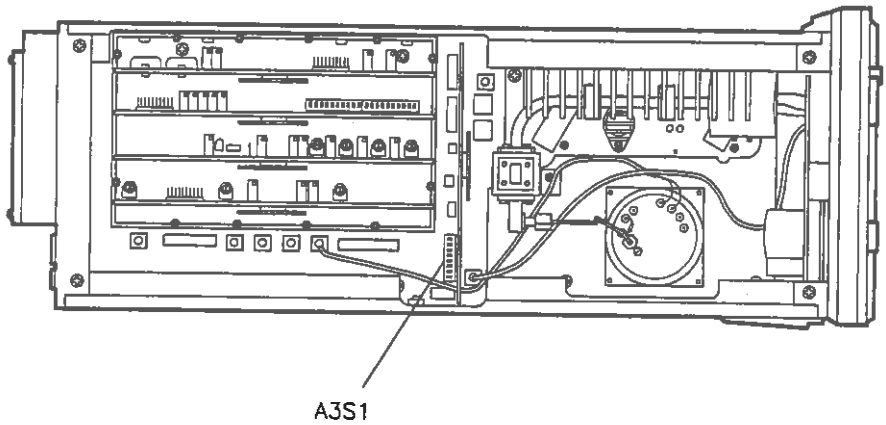


Figure 5-1. Configuration Switch A3S1 Location

Procedure

NOTE: A3S1 must be in the factory-set position for all adjustment procedures and performance tests. After adjustments or performance tests are completed, A3S1 can be set to any other operating mode.

1. Refer to table 5-6 and determine if the factory-set position for A3S1 is correct for your application.
2. Set configuration switch A3S1 (figure 5-1) for the desired operating mode.

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

CODE DESCRIPTION	SWITCH NUMBER 1	2	3	4	5	6	7	8
INSTRUMENT/OPTION								
Standard 83572C	1	0	0	X	X	X	X	X
83572C Option 001	1	1	0	X	X	X	X	X
83572C Option 006	1	0	1	X	X	X	X	X
83572C Option 001/006	1	1	1	X	X	X	X	X
No RF Power at INSTR PRESET	Z	Z	Z	1	X	X	X	X
Maximum RF Power at INSTR PRESET	Z	Z	Z	0	X	X	X	X
−6 MHZ/V FM Sensitivity	Z	Z	Z	X	1	X	X	X
−20 MHz/V FM Sensitivity	Z	Z	Z	X	0	X	X	X
Direct-Coupled FM (−20 MHz/V)	Z	Z	Z	X	X	0	X	X
Cross-Over Coupled FM	Z	Z	Z	X	X	0	X	X

NOTES

1. Switch Positions
   1 = switch open = High
   0 = switch closed = Low (ground)
   X = don't care
   Z = determined by instrument and options installed
2. Switch is set at the factory as follows:

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

3. With the configuration switch set for the Instrument Preset condition of "RF Power OFF", bias is removed from A2 YIG Oscillator. In addition, the 8350A/B 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 using 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 intial power up, and thus prevents overshoot.

5-2. −10V/−25V Reference on A6 YO Driver

Description

The −25V power supply is used as a reference voltage for the YO linearity compensation circuit. The −10V REF in A6 is used as a reference voltage for the Offset DAC in A6, and for the power level reference DAC on the A4 assembly; it is also used as an adjustment reference on the A7 Bias board.

Equipment

Digital Voltmeter (DVM) ..... HP 3456A

Procedure

1. Connect the DVM to A6TP7 (see figure 5-2). Connect ground to A6TP5.
2. Adjust A6R33, −25V, for −25.000 V dc ±0.005 V dc.
3. Connect the DVM to A6TP1.
4. Adjust A6R59, −10V, for −10.00 V dc ±0.001 V dc.

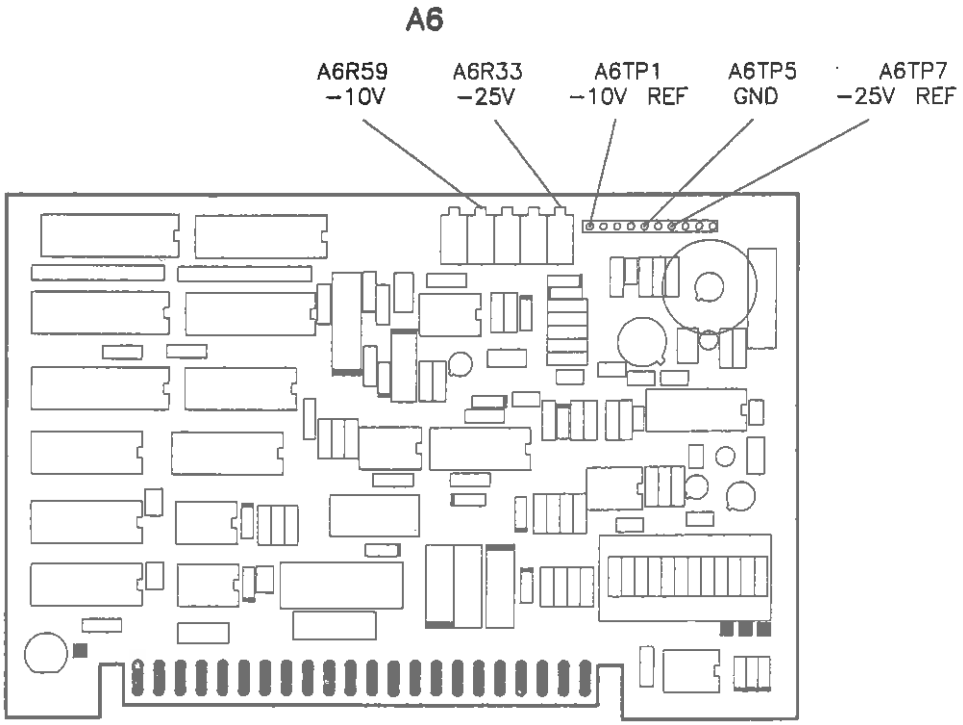


Figure 5-2. −25V and −10V Reference Points and Adjustments

5-3. Frequency Accuracy

Description

Frequency endpoints are adjusted using calibration modes provided through software. **[SHIFT] [90]** (low end) and **[SHIFT] [91]** (high end) initiate the frequency calibration mode in which the microprocessor reads the FREQ CAL switches on the A6 assembly and displays the byte in hexadecimal form in the POWER window. As the plug-in RPG is adjusted, the plug-in ROM reads the count, adjusts the POWER display, and updates the offset DAC (low end) or scaling DAC (high end) to correct the output frequency. When the spectrum analyzer and sweep oscillator front panel FREQUENCY readings match, the hex digits displayed in the POWER window indicate the proper settings for the FREQ CAL switch, A6S1 or A6S2.

NOTE: When the spectrum analyzer with external mixing is used to measure frequency, there will be many signals displayed. The signals of interest will be an identical pair with a separation of 642.8 MHz, and the left one of the pair will be frequency calibrated. To center the RF signal from the RF plug-in on the spectrum analyzer CRT, press **[PEAK SEARCH] [SIGNAL TRACK] [SHIFT] [FREE RUN]** on the spectrum analyzer.

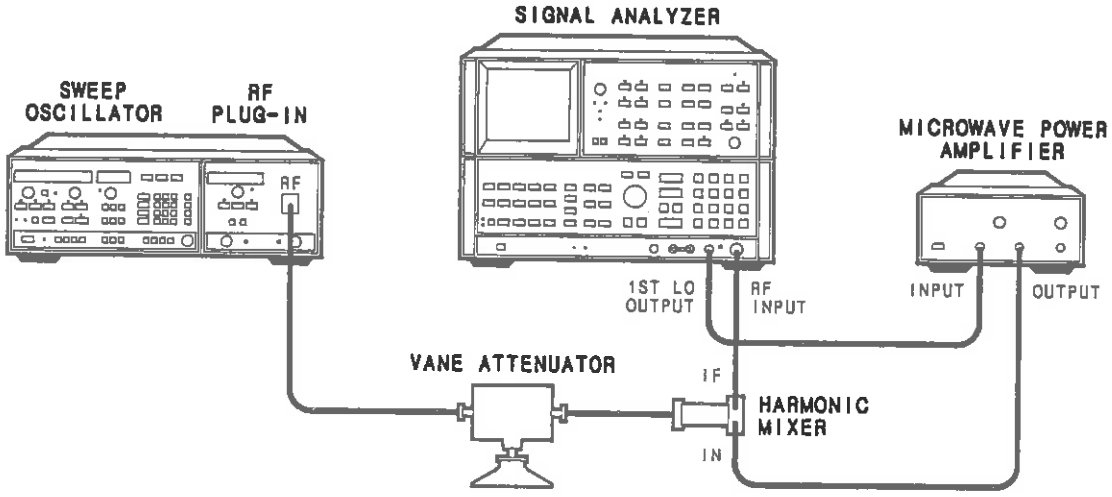


Figure 5-3. Frequency Accuracy Adjustment Setup

Equipment

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A

Procedure

NOTE: A3S1 must be in the factory-set position (see table 5-6).

1. Connect the equipment as shown in figure 5-3. Set the vane attenuator to 20 dB.

2. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW] [26.5] [GHz]
   [STEP SIZE] [500] [MHz]
   [SAVE] [1]
   [CW] [40] [GHz]
   [SAVE] [2]

3. On the sweep oscillator, press:

   [RECALL[[1]
   [RECALL[[2]
   [RECALL[[1]

   26.500 GHz will be displayed in the FREQUENCY window.

4. On the spectruum analyzer, press:

   [SHIFT] [◆]
   [START FREQ] [26] [GHz]
   [STOP FREQ] [28] [GHz]
   [PEAK SEARCH] [SIGNAL TRACK]
   [SHIFT] [FREE RUN] (Repeat this if necessary.)

5. On the sweep oscillator, press:

   [SHIFT] [90]

   This selects the low end frequency calibration mode.

6. Adjust the RF plug-in RPG for a spectrum analyzer marker frequency of 26.5 GHz.

7. Set switch A6S1 (see figure 5-4) for the value displayed in the POWER window. Note the hex number for subsequent verification (refer to the diagram in figure 5-5).

8. On the sweep oscillator, press:

   [INSTR PRESET]
   [RECALL] [1]
   [RECALL] [2]
   [RECALL] [1]

9. Verify that a setting of 26.500 GHz on the sweep oscillator produces an indication of 26.500 GHz ±30 MHz on the spectrum analyzer. If the frequency displayed does not meet this specification, press **[SHIFT] [90]**. The hex digits now displayed in the POWER window correspond to the A6S1 switch settings. If this number does not agree with the number obtained in step 7, the switch was not set properly. Repeat the procedure.

10. On the sweep oscillator, press:

    [INSTR PRESET]
    [RECALL] [1]
    [RECALL] [2]
    [RECALL] [1]

Step up the CW frequency, using the [◆] key, until 40.000 GHz is displayed in the FREQUENCY window. Tune the spectrum analyzer to 40.000 GHz.

11. On the sweep oscillator, press:

    [SHIFT] [91]

    This selects high end frequency calibration mode.

12. Adjust the RF plug-in RPG for a spectrum analyzer display of 40.00 GHz.

13. Set A6S2 (see figure 5-4) for the reading displayed in the POWER window. Note the hex number for subsequent verification.

14. On the sweep oscillator, press:

    [INSTR PRESET]
    [RECALL] [1]

    Repeat from step 10 as required.

15. Verify that a setting of 40.000 GHz on the sweep oscillator produces an indication of 40.000 GHz ±30 Mhz on the spectrum analyzer. If the frequency displayed does not meet this specification, press **[SHIFT] [91]**. The hex digits now displayed in the POWER window correspond to the A6S2 switch settings. If this number does not agree with the number obtained in step 13, the switch was not set properly. Repeat the procedure starting with step 10.

16. On the sweep oscillator, press:

    [INSTR PRESET]
    [RECALL] [1]

Step the RF plug-in and spectrum analyzer across the frequency range and check for spectrum analyzer readings that correspond with the RF plug-in displayed frequency ±100 MHz.

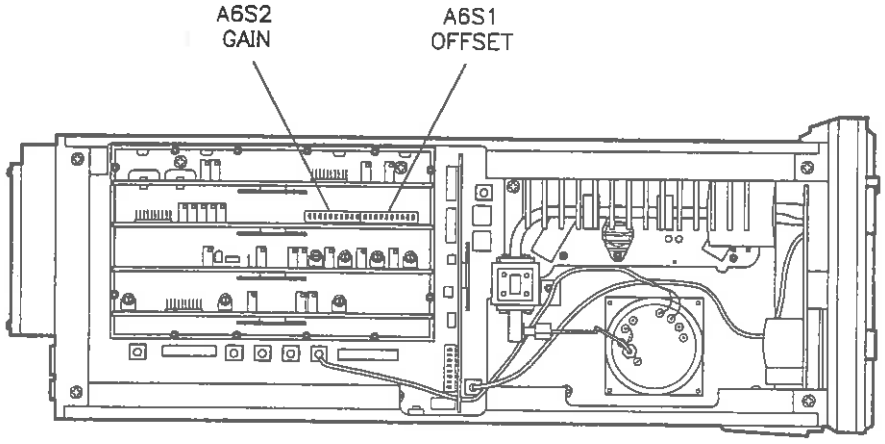
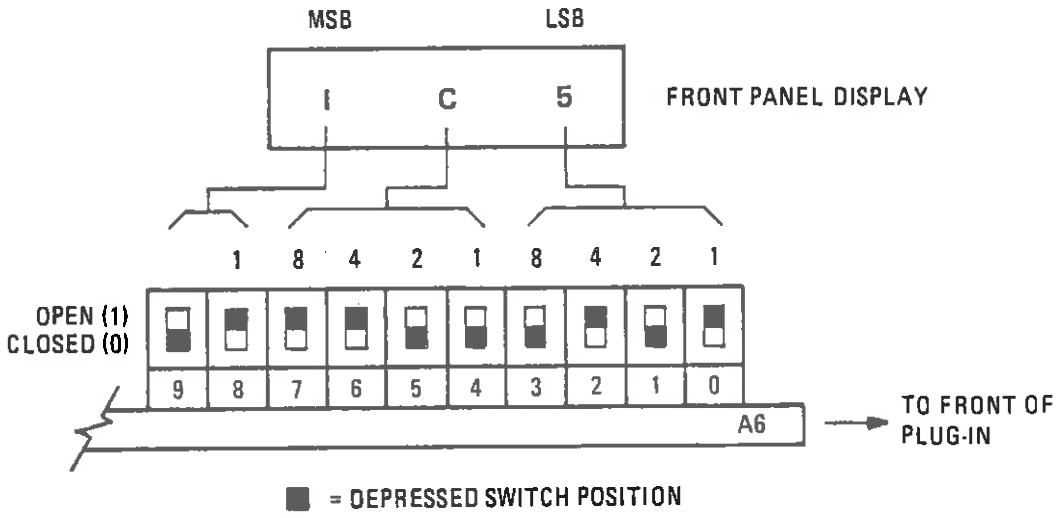


Figure 5-4. A6S1 and A6S2 Switch Locations



NOTE: SWITCH NUMBER 9 IS NOT USED

Figure 5-5. A6S1 and A6S2 Switch Configurations

5-4. Delay Compensation

Description

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

Delay compensation adjustments are made while observing the shift between marker pips at a sweep time of 10 milliseconds (worst case). At sweep times greater than 100 milliseconds, delay should not exceed ±61 MHz.

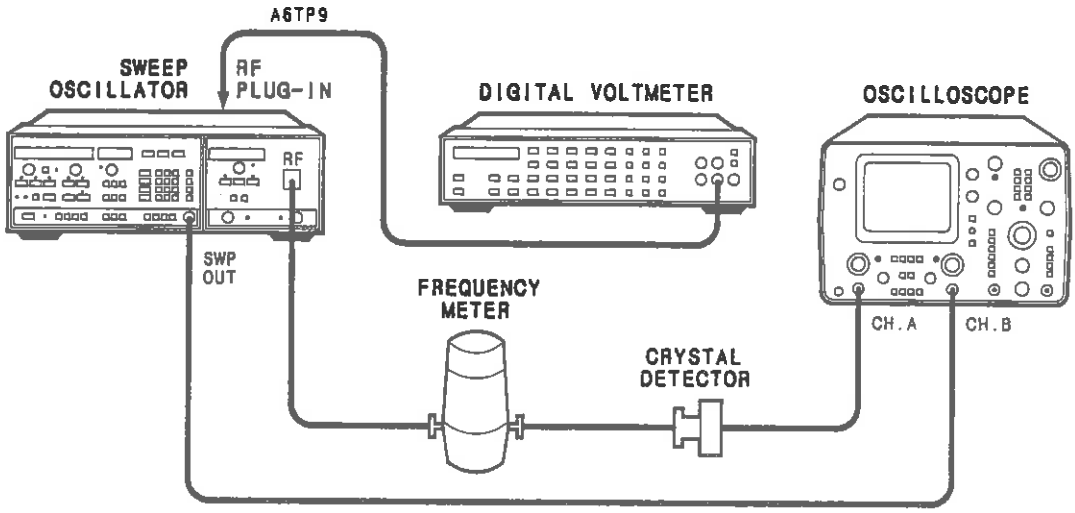


Figure 5-6. Delay Compensation Adjustment Setup

Equipment

Digital Voltmeter (DVM)	HP 3456A
Oscilloscope	HP 1740A
Frequency Meter 26.5 to 40 GHz	HP R532A
Crystal Detector	HP R422C

Procedure

NOTE: A3S1 must be in the factory-set position (see table 5-6).

1. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW]

2. Using the DVM, measure and record the voltage at A6TP9.

3. On the sweep oscillator, press:

   [CF] [ΔF] [0] [MHz]

4. Adjust A6R26, Z, (figure 5-7) for the same reading at A6TP9 that was obtained in step 2.

5. Repeat steps 2, 3, and 4 until the voltage at A6TP9 is the same for both conditions.

6. Connect the equipment as shown in figure 5-6. Select oscilloscope mode A vs B to obtain a CRT trace of amplitude versus frequency.

7. On the sweep oscillator, press:

   [INSTR PRESET]
   [M1] [28] [GHz]
   RF BLANK (LED on)
   [AMPTD MKR] Option 006 only
   [TIME] [1] [s]
   [SAVE n] [1]
   [M2] [37] [GHz]
   [SAVE n] [2]
   [RECALL n] [1]

8. 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 frequency meter so that the peak of the pip is on the leading edge of the 28 GHz marker.

9. On the sweep oscillator, step the sweep time down to 10 milliseconds and note the relative change in position between the two markers.

10. Adjust A6R16, LO, (figure 5-7) to minimize the movement between markers while stepping the sweep time between 1 second and 10 milliseconds.

11. Verify that the delay is accurate by manually adjusting the sweep time from 10 milliseconds to 1 second. Reset A6R16, LO, as necessary to provide the best overall delay setting (minimum delay per change in sweep time). The position of the frequency meter pip should typically stay within ±61 MHz as read on the frequency meter across the 10 millisecond to 1 second range.

12. On the sweep oscillator, press:

    [RECALL n] [2]

13. Set the frequency meter so that the peak of the pip is coincident with the leading edge of the 37 GHz marker.

14. On the sweep oscillator, step the sweep time down to 10 milliseconds and note the relative change in position between the two markers.

15. Adjust A6R14, HI, (figure 5-7) to minimize the movement between markers while stepping the sweep time between 1 second and 10 milliseconds.

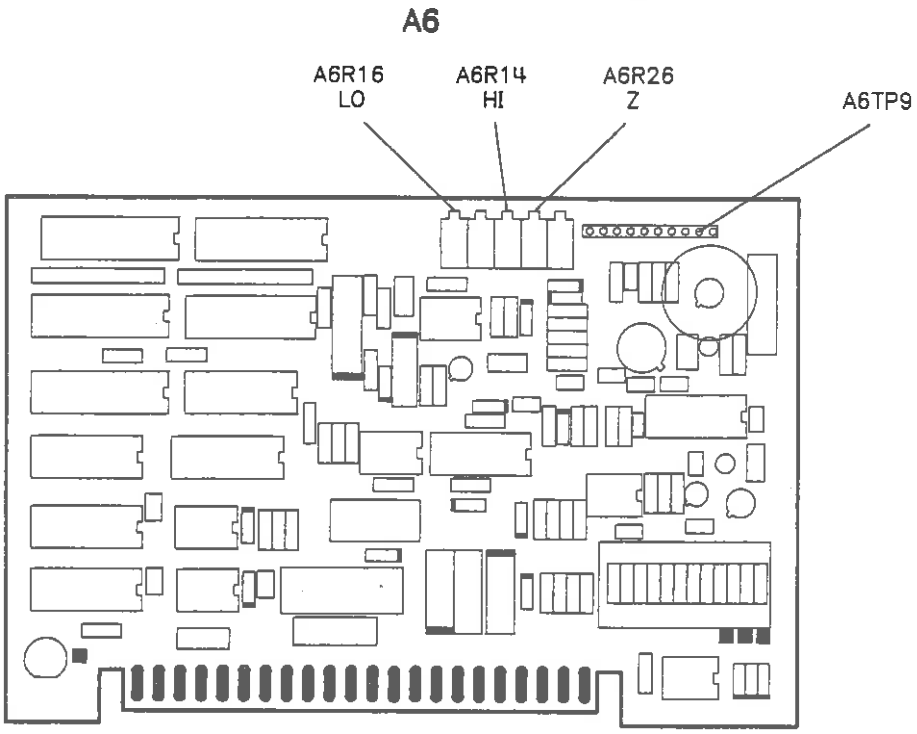


Figure 5-7. Delay Compensation Adjustment Locations

16. Verify that the delay is accurate by manually adjusting the sweep time from 10 milliseconds to 1 second. Reset A6R14, HI, as necessary to provide the best overall delay setting (minimum delay per change in sweep time). The position of the frequency meter pip should typically stay within ±61 MHz as read on the frequency meter across the 10 millisecond to 1 second sweep speed range.

5-5. Maximum and Minimum Power

Description

The scale and offset of the YO Bias assembly are adjusted to control the current to the modulator. This optimizes the output power from −15 dBm to maximum power over the full frequency range.

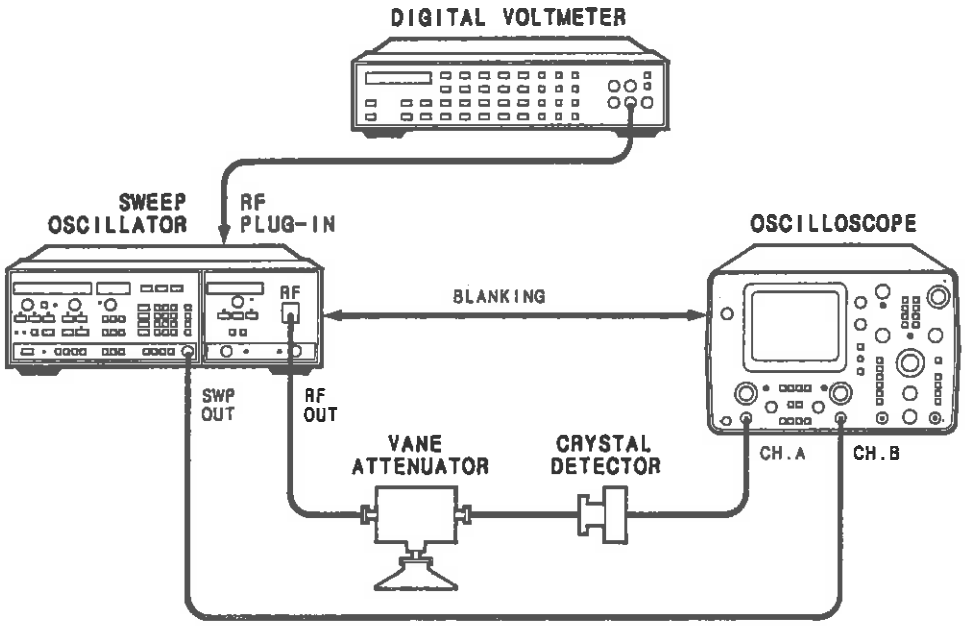


Figure 5-8. Maximum and Minimum Power Adjustment Setup

NOTE: The oscilloscope and crystal detector are used in this procedure to simplify the test setup for the standard RF plug-in which does not have pulse modulation capabilities. However, if the RF plug-in is an Option 006, it is easier to determine small power variations if an HP 8757 Scalar Network Analyzer is used to display the RF output power.

Equipment

Digital Voltmeter (DVM)	HP 3456A
Oscilloscope	HP 1740A
Crystal Detector	HP R422C
Vane Attenuator	HP R382A

Procedure

1. Connect the equipment as shown in figure 5-8.
2. On the sweep oscillator/RF plug-in, press:

   [INSTR PRESET]
   [DET]
   [RF] (LED off)

   Measure and note the dc voltage at A4TP6 with the DVM.

3. Connect the DVM to A7TP5. On the RF plug-in, press:

   [UNLVLD PWR]
   [RF] (LED on)

   Set the RF plug-in power level to −25 dBm and adjust the EXT CAL control for the same voltage as noted in step 2.

4. Adjust A7R17, MIN PWR, for minimum RF output power over the full frequency range as displayed on the oscilloscope.

NOTE: Since the HP R422C is a negative crystal detector, the displayed output is negative. Therefore, the minimum RF output power is displayed on the oscilloscope as minimum *negative* voltage and is the highest level displayed on the CRT. Likewise, maximum RF output power is displayed as minimum negative voltage and is the lowest level on the CRT.

5. Adjust the RF plug-in POWER LEVEL control for +0 V dc at A7TP5.

6. Adjust A7R12, MAX PWR, for maximum RF output power over the full frequency range as displayed on the oscilloscope (maximum negative voltage).

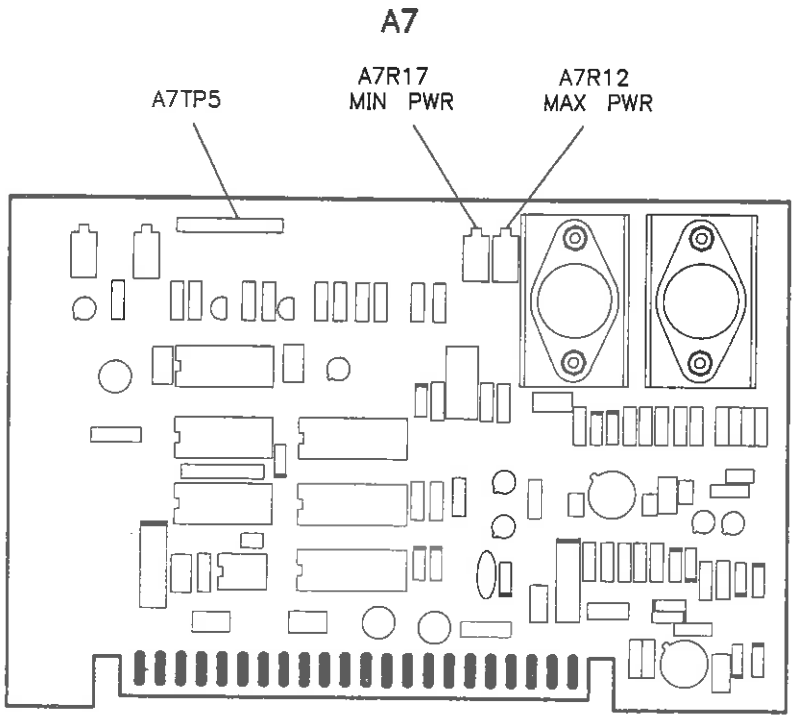


Figure 5-9. Maximum and Minimum Power Adjustment Locations

5-6. ALC Adjustment (Option 001 Only)

NOTE: Complete adjustment of the leveling loop requires that adjustments 5-6 through 5-11 be performed in successive order. Deviation from this order may cause improper leveling or flatness problems.

Description

Adjustments compensate for dc offsets in the detected RF path and the main ALC amplifier. Power is roughly calibrated.

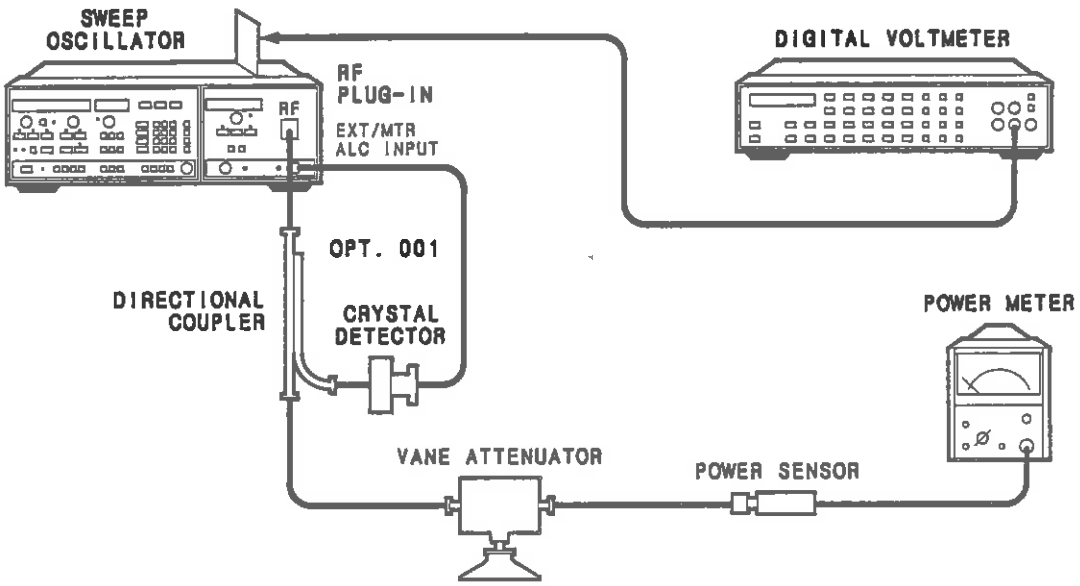


Figure 5-10. ALC Adjustment Setup

Equipment

Digital Voltmeter (DVM)	HP 3456A
Power Meter	HP 432A
Power Sensor	HP R486A
Vane Attenuator	HP R382A
Extender Board	HP P/N 08350-60031

Procedure

NOTE: A3S1 must be in the factory-set position (see table 5-6).

1. Turn off the sweep oscillator LINE switch. Place the A4 ALC assembly on an extender board. Turn on the LINE switch. Sweep the full range of the RF plug-in at any leveled power. Set the vane attenuator to 5 dB.

2. Float the ground on the digital voltmeter and measure the voltage between A4TP12 and A4TP14 (see figure 5-11). Adjust A4R47, OFS 1, for 0.000 V ±0.001 V.

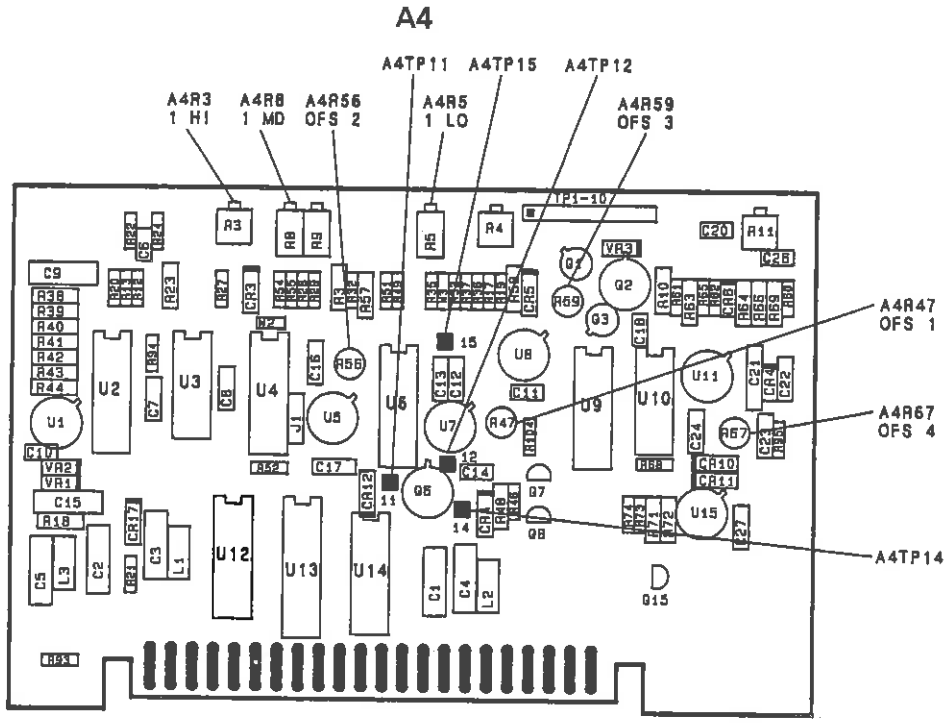


Figure 5-11. A4 ALC Board Adjustment Locations

3. Connect the DVM between A4TP12 and A4TP15. Adjust A4R59, OFS 3, for 0.000 V ±0.001 V.

4. Attach a jumper from A4TP11 to ground. The UNLEVELED light will go on. Connect the DVM ground lead to chassis ground. Connect the DVM to A4TP5. Adjust A4R56, OFS 2, for 0.000 V ±0.001 V. Remove the jumper.

5. On the sweep oscillator, press:

   [CW] [26.5] [GHz]

   Ensure that the power is leveled (UNLEVELED light is off). If it is not, adjust CW to any leveled frequency. Connect the DVM to A4TP7 and adjust A4R67, OFS 4, for 0.000 V ±0.001 V.

6. Turn off the sweep oscillator LINE switch. Remove the A4 assembly from the extender board and reinsert A4 directly into the instrument. Turn on the sweep oscillator LINE switch. Connect the power meter sensor to the RF plug-in RF output.

7. On the sweep oscillator/RF plug-in, press:

   [CW] [26.5] [GHz]
   [SHIFT] [DET]
   [POWER LEVEL] [-] [5] [dBm]

   Set the CAL FACTOR % dial on the power meter according to the power sensor label. Adjust A4R5, 1 LO, for a power meter reading that agrees with the RF plug-in POWER display (allow for the 5 dB attenuator setting).

8. Set the RF plug-in for a POWER reading of 0 dBm. Adjust A4R8, 1 MD, for a power meter reading that agrees with the RF plug-in display (allow for the 5 dB attenuator setting).

9. Repeat steps 7 and 8 until both low and midpower ranges are calibrated. A4R5 and A4R8 are interactive adjustments.

10. Set the RF plug-in output power to +6 dBm. Adjust A4R3, 1 HI, for a power meter reading that agrees with the RF plug-in POWER display (allow for the 5 dB attenuation).

11. This roughly calibrates the RF power. Fine calibration is documented in later adjustments.

5-7. ALC Leveled Flatness (Option 001 Only)

NOTE: Complete adjustment of the leveling loop requires that adjustments 5-6 through 5-11 be performed in successive order. Deviation from this order may cause improper leveling or flatness problems.

Description

This adjustment only has an effect when the RF plug-in CAL light is on (SHIFT DET). 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.

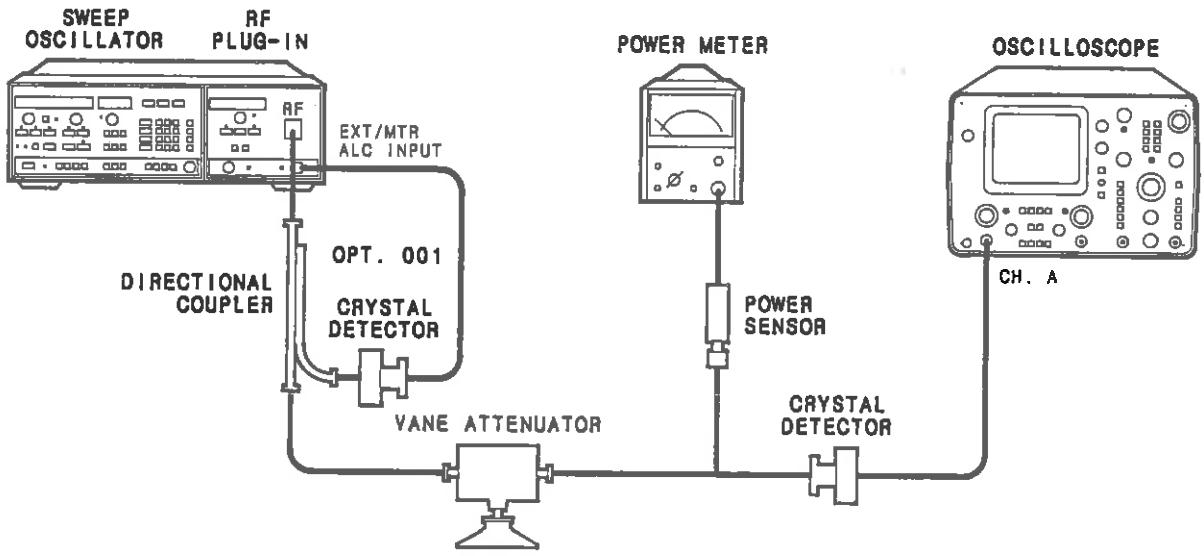


Figure 5-12. Internal Leveled Flatness Adjustment Setup

Equipment

Power Meter	HP 432A
Power Sensor	HP R486A
Vane Attenuator	HP R382A
Oscilloscope	HP 1740A
Crystal Detector	HP R422C

Procedure

NOTE: A3S1 must be in the factory-set position (see table 5-6).The following steps provide a calibrated flatness reference line for the crystal detector with the vane attenuator at the specified maximum leveled output power of the RF plug-in.

1. Remove the A5 FM Driver Assembly from the RF plug-in. Set the vane attenuator to 14 dB. Connect the power meter and sensor through the vane attenuator to the RF plug-in as shown in figure 5-12.

2. On the sweep oscillator/RF plug-in, press:

   [INSTR PRESET]
   [CW] [26.5] [GHz]
   [SHIFT] [DET]

   Note that the RF plug-in CAL LED is on. Set the CAL FACTOR % dial on the power meter according to the power sensor label.

   Adjust the RF power level to obtain a power meter reading of −8 dBm (+6 dBm at the output of the dirctional coupler). For Option 006, the power meter reading should be −9.5 dBm (+4.5 dBm at the output of the directional coupler).

3. Disconnect the power sensor and connect the oscilloscope through the crystal detector and vane attenuator to the RF plug-in output. On the oscilloscope, set:

   Mode: A vs B
   Channel A: dc coupled
   0.005 V/Div
   Channel B: dc coupled
   1 V/Div

4. With the oscilloscope position controls, place the trace on the center left edge of the display.

5. Using a grease pencil, mark the screen exactly where the trace dot appears.

6. Disconnect the crystal detector and reconnect the power sensor. On the sweep oscillator, press:

   [CW] [30] [GHz]

   Set the CAL FACTOR % dial on the power meter according to the power sensor label. Adjust the RF plug-in RF power level to obtain the same power meter reading as in step 2.

7. Disconnect the power sensor and reconnect the crystal detector to the RF plug-in. With the grease pencil, mark the position of this second trace dot on the CRT.

8. Repeat this process at 33, 36, and 40 GHz. (The calibration factor of the power sensor must be compensated at all frequencies.) Then connect all the marks with the grease pencil. This line represents the frequency response of the crystal detector. When the RF output flatness of the plug-in is adjusted, this line represents 0 dB variation.

9. On the sweep oscillator, press:

   [CW] [33] [GHz]

   Set the RF plug-in power level to coincide with the calibration line on the oscilloscope.

10. Decrease the vane attenuator setting by 1.5 dB and note the deviation of the trace below the calibration line. Increase the vane attenuator setting by 3 dB. The trace should now indicate 1.5 dB deviation above the calibration line. These deviations are the flatness adjustment limits. Set the vane attenuator to return the trace to the calibration line.

11. Replace the A5 FM Driver Assembly in the RF plug-in. Connect the equipment shown in figure 5-12 with the crystal detector/oscilloscope monitoring the RF output. On the sweep oscillator, press:

    [INSTR PRESET]
    [SHIFT] [DET]

    The trace displayed by the oscilloscope represents the flatness across the full sweep of the RF plug-in. Adjust the POWER LEVEL so the start of the oscilloscope trace coincides with the calibration line.

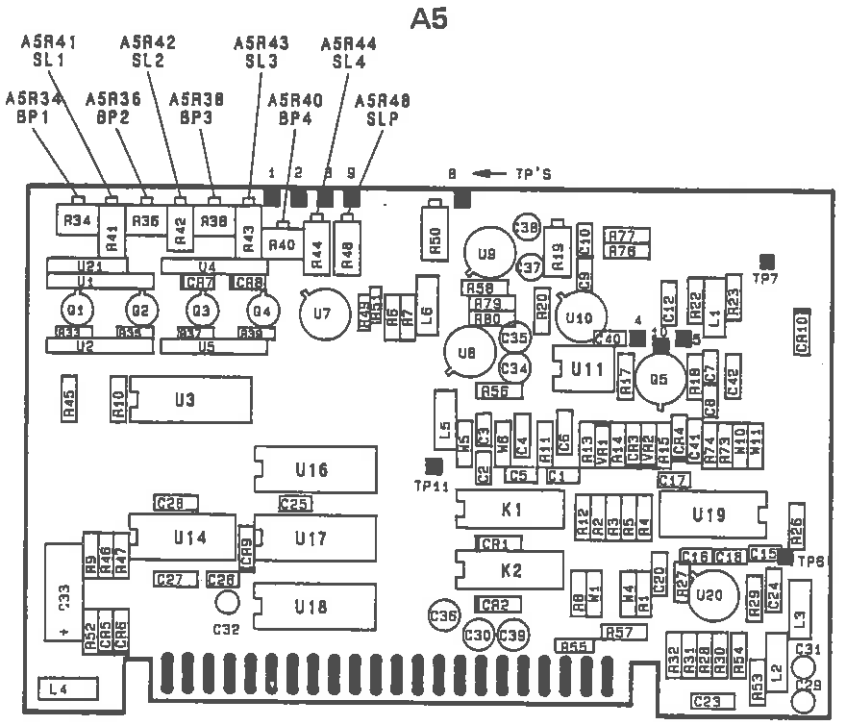


Figure 5-13. ALC Leveling Adjustment Locations

NOTE: The following step may be omitted if the display matches the grease pencil mark within ±1.5 dB as calibrated in step 11. If power flatness is significantly beyond these limits, it is best to remove all adjustments as described in the following step.

12. Adjust A5R48 fully counterclockwise. Adjust all the breakpoint potentiometers fully clockwise against the stops; these are A5R34 (BP1), A5R36 (BP2), A5R38 (BP3), and A5R40 (BP4), illustrated in figure 5-13. This effectively removes the circuit from the leveling loop.

13. BP1 through BP4 and SL1 through SL4 (figure 5-13) are interactive adjustments used to remove RF power variations. Potentiometers BP1 through BP4 set the frequency break points at which the slope adjustments SL1 through SL4 take effect. It may not be necessary to adjust all of the potentiometers.

14. While observing the display, adjust BP1 to set a breakpoint at the first point on the trace where flatness compensation is needed. Then adjust SL1 for best power flatness about that breakpoint.

15. Repeat this process using BP2 and SL2, BP3 and SL3, and BP4 and SL4 until the displayed trace is within ±1.5 dB of the grease pencil line across the screen.

16. Disconnect the crystal detector and oscilloscope, and connect the power sensor through the vane attenuator to the plug-in RF output. Press **[CW]** and manually sweep the range of the RF plug-in while monitoring power variations on the power meter. Remember to compensate the power meter for the calibration factor of the power sensor - this can cause a difference of as much as 3 dB between frequencies. Any discrepancies between power meter and oscilloscope indications are due to measurement uncertainties. The power meter provides the more accurate indication of RF power flatness.

5-8. Power Calibration (Option 001 Only)

NOTE: Complete adjustment of the leveling loop requires that adjustments 5-6 through 5-11 be performed in successive order. Deviation from this order may cause improper leveling or flatness problems.

Description

Power is calibrated at a CW frequency which is in the middle of the power variation range. Adjustments are made at three break points over the leveled power range: −5 dBm, 0 dBm, and maximum leveled power.

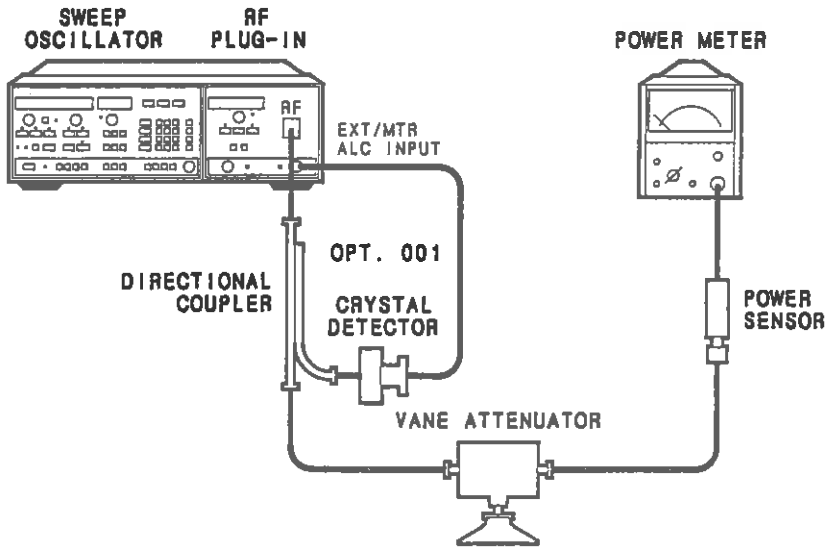


Figure 5-14. Power Calibration Adjustment Setup

Equipment

Power Meter	HP 432A
Power Sensor	HP R486A
Vane Attenuator	HP R382A

Procedure

NOTE: A3S1 must be in the factory-set position (see table 5-6).

1. Connect the equipment as shown in figure 5-14. Set the vane attenuator to 5 dB. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW] [26.5] [GHz]
   [SHIFT] [DET] (CAL LED on)

   Slowly tune the CW frequency across the band and select a frequency where the power is approximately in the center of the power variation range (middle of the power meter variations). Ensure that the power meter CAL FACTOR % is adjusted to compensate for the calibration factor of the power sensor. Enter the frequency selected.

2. Set the RF plug-in output power for a front panel indication of −5 dBm. Adjust A4R5, 1 LO, (figure 5-15) for a power meter reading of −10 dBm ±0.1 dB (this corresponds to −5 dBm at the output of the directional coupler).

3. Set the RF plug-in output power for a front panel indication of 0 dBm. Adjust A4R8, 1 MD, for a power meter reading of −5 dBm ±0.1 dB (0 dBm at the output of the directional coupler).

4. Recheck the −5 dBm level and readjust A4R5 if necessary.

5. Set the RF plug-in output power for maximum leveled power as indicated by the front panel UNLEVELED light. Adjust A4R3, 1 HI, for a power meter reading that corresponds with the RF plug-in POWER LEVEL display (for example, if the POWER LEVEL display is +4 dBm, the power meter should indicate −1 dBm; if the POWER LEVEL display is +6 dBm, the power meter should indicate +1 dBm).

6. Step the RF plug-in output power in 1 dB intervals from −5 dBm to maximum leveled power. The power meter reading should match the RF plug-in front panel power setting within ±0.2 dB, typically.

7. Repeat steps 2 through 6 as necessary, and make adjustments for the best compromise over the power range.

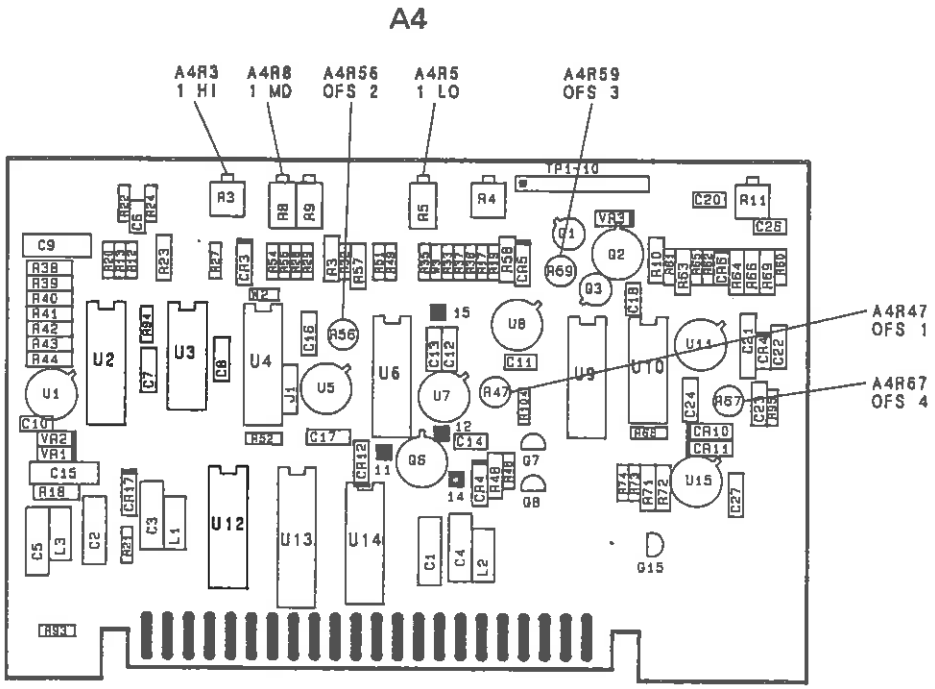


Figure 5-15. A4 ALC Board Adjustment Locations

5-9. ALC Gain Adjustment (Option 001 Only)

NOTE: Complete adjustment of the leveling loop requires that adjustments 5-6 through 5-11 be performed in successive order. Deviation from this order may cause improper leveling or flatness problems.

Description

A4R11, at the inverting input of A4U11, adjusts the gain of the main ALC amplifier. A4R11 is adjusted for maximum gain without oscillations and minimum overshoot when RF power is turned on at the beginning of the sweep (with RF blanking).

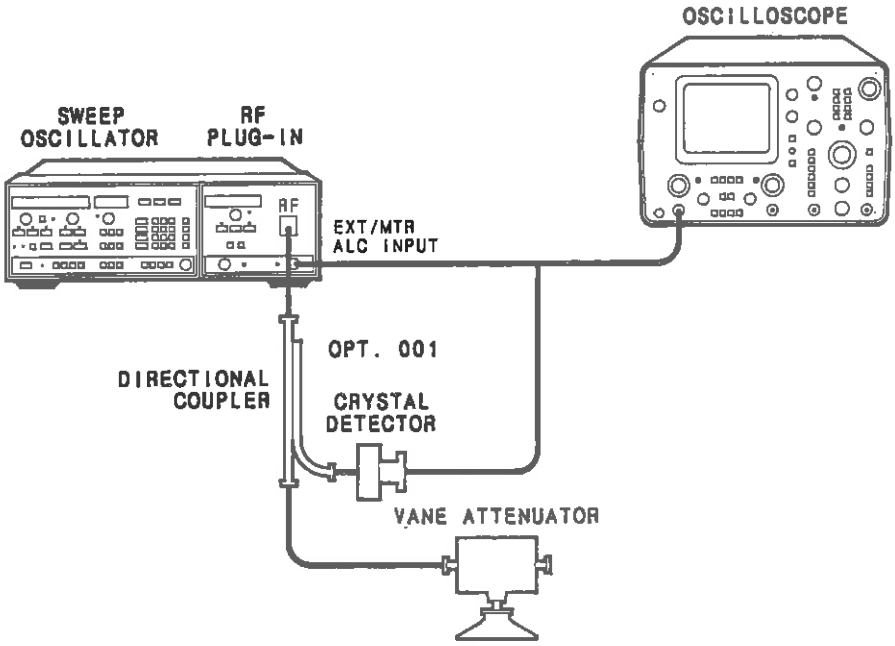


Figure 5-16. ALC Gain Adjustment Setup

Equipment

Oscilloscope	HP 1740A
Vane Attenuator	HP R382A

Procedure

NOTE: A3S1 must be in the factory-set position (see table 5-6).

1. Connect the equipment as shown in figure 5-16.
2. On the sweep oscillator, press:

   [INSTR PRESET]
   [SHIFT] [DET]

   Set the RF plug-in power level to the maximum power at which the UNLEVELED LED remains out.

3. On the sweep oscillator, press RF BLANK (LED on).
4. Set the oscilloscope to display both the retrace and the forward sweep of the detected RF output.
5. Note the point on the oscilloscope where RF power is switched on. Adjust A4R11, GAIN, (figure 5-17) clockwise for maximum gain without overshoot when the RF power is switched on. Also verify that there are no oscillations during forward sweep and that the UNLEVELED LED is off.

A4

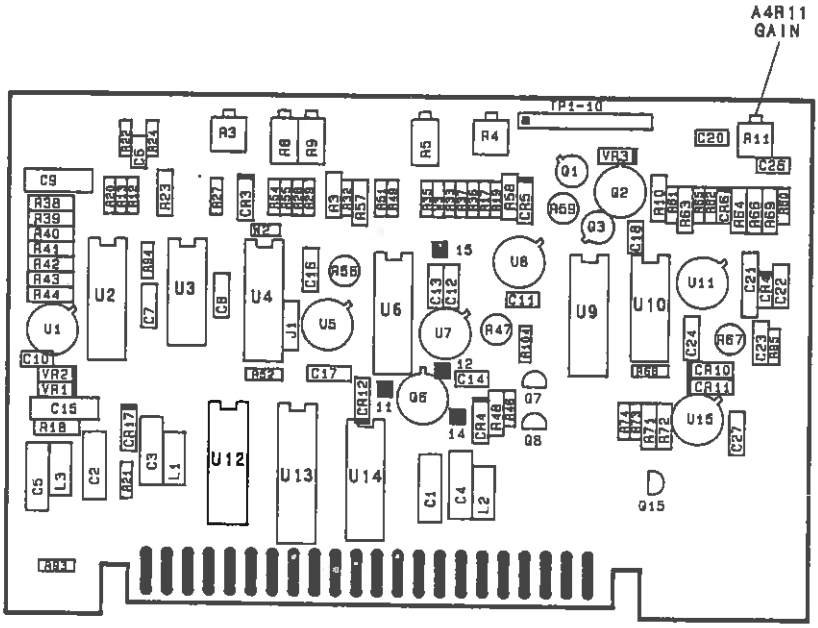


Figure 5-17. ALC Gain Adjustment Location

5-10. Power Meter Leveling Calibration

NOTE: Complete adjustment of the leveling loop requires that adjustments 5-6 through 5-11 be performed in successive order. Deviation from this order may cause improper leveling or flatness problems.

Description

The power meter leveling gain potentiometer A4R9, PM, calibrates the gain of the ALC loop to full-scale deflection of the power meter.

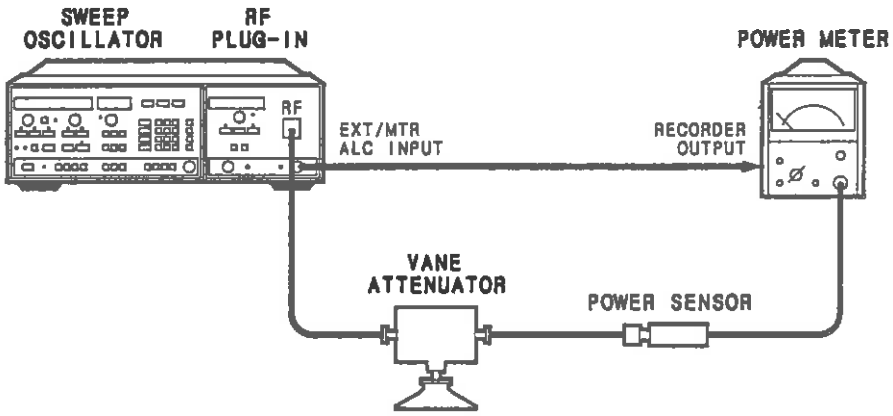


Figure 5-18. Power Meter Leveling Adjustment Setup

Equipment

Power Meter	HP 432A
Power Sensor	HP R486A
Vane Attenuator	HP R382A

Procedure

1. Connect the equipment as shown in figure 5-18. Set the vane attenuator to 10 dB. Set the power meter to the 0 dBm range. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW] [MTR]

2. Set the RF plug-in power level to −5 dBm. Set the power meter RANGE switch to −10. Adjust the RF plug-in EXT/MTR ALC CAL to obtain a power meter reading of −15 (RF output minus 10 dB attenuation).

3. On the sweep oscillator, press:

   [POWER LEVEL] [STEP SIZE] [1] [dB]

   Use the up arrow key [▲] to increase the RF plug-in power level by exactly 5.0 dB. Adjust A4R9, PM, (figure 5-19) for a power meter reading of −10. The RF plug-in front panel power indication should read +0 dBm.

4. Use the sweep oscillator down arrow key [▼] to step down 5 dB, and adjust the front panel CAL potentiometer for a −15 dBm reading on the power meter.

5. Repeat, as required, between sweep oscillator power level settings of −5 and 0 dBm, adjusting the front panel CAL potentiometer and A4R9 respectively, until no further adjustment is necessary.

6. On the sweep oscillator, press:

   SWEEP TRIGGER **[SINGLE]**
   [SWEEP TIME] [100] [s]
   [START]

7. Set the EXT/MTR ALC CAL control for approximately 5 dB less on the power meter. Set the power meter range to −5 dBm. Set the RF plug-in power level to its specified maximum leveled power. Set the EXT/MTR ALC CAL control for a corresponding power meter reading.

8. On the sweep oscillator, press:

   SWEEP TRIGGER **[SINGLE]**

   Observe the power meter indication. The deviation should be no greater than 0.4 dB over the full sweep.

A4

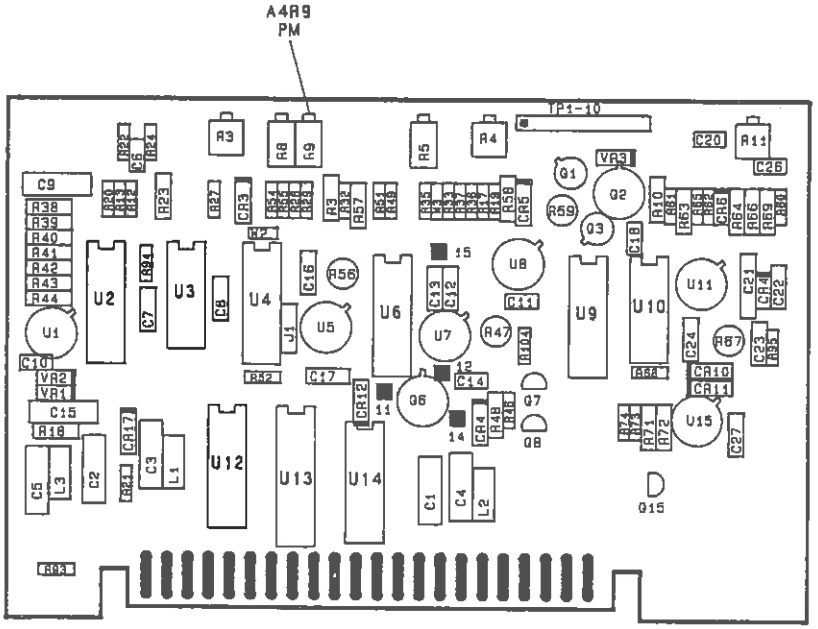


Figure 5-19. Power Meter Leveling Adjustment Location

5-11. Power Sweep (Option 001 Only)

NOTE: Complete adjustment of the leveling loop requires that adjustments 5-6 through 5-11 be performed in successive order. Deviation from this order may cause improper leveling or flatness problems.

Description

A power sweep mode of 11 dB is displayed on the power meter (1.5 dB less if the instrument is an Option 001/006). A5R50 is adjusted for the correct sweep and power slope.

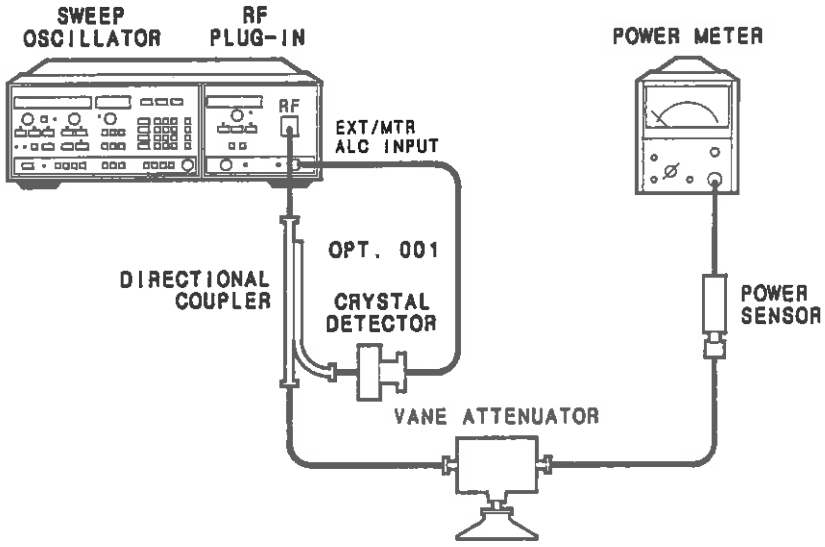


Figure 5-20. Power Sweep Adjustment Setup

Equipment

Power Meter	HP 432A
Power Sensor	HP R486A
Vane Attenuator	HP R382A

Procedure

NOTE: A3S1 must be in the factory-set position (see table 5-6)

1. Connect the equipment as shown in figure 5-20. Set the vane attenuator to 5 dB.
2. Set the power meter to the 0 dBm range.
3. On the sweep oscillator, press:

   [SHIFT] [CW]
   [SHIFT] [DET]
   [POWER LEVEL] [-5] [dBm]
   [SWEEP TIME] [5] [s]

4. Adjust the RF plug-in power level for a convenient reference reading on the power meter. The reference must be at least 11 dB below the range selected (9.5 dB below if it is an Option 001/006).

5. On the sweep oscillator, press:

   [POWER SWEEP] [11] [dB] (Option 001)

   [POWER SWEEP] [9.5] [dB] (Option 001/006)

6. While observing the power meter display of the RF output, adjust A5R50, PWSP, (figure 5-21) for 11 dB/sweep (1.5 dB less if the RF plug-in is an Option 001/006).

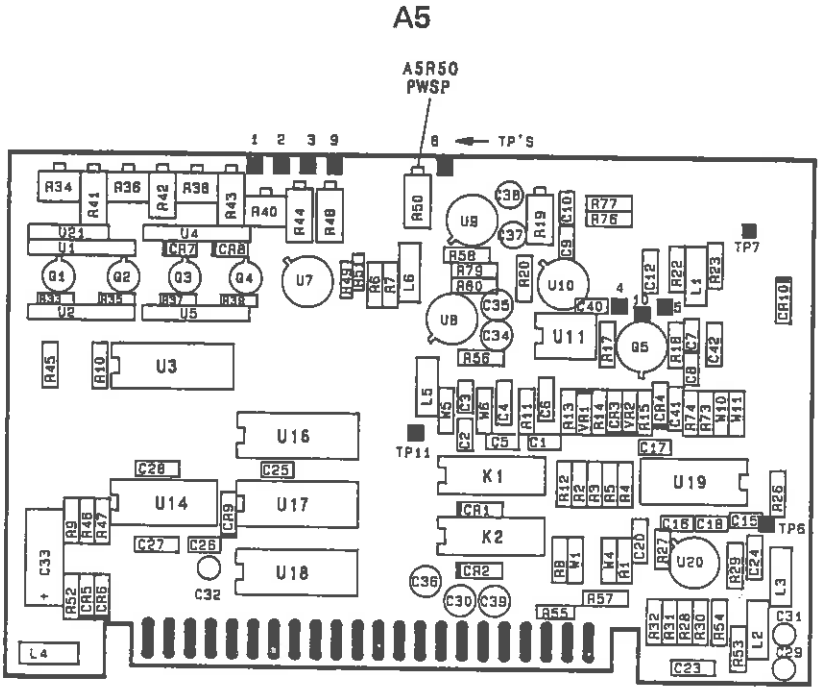


Figure 5-21. Power Sweep Adjustment Location

5-12. FM Driver

Description

The FM Driver high frequency offset is adjusted for zero volts drive with no FM applied.

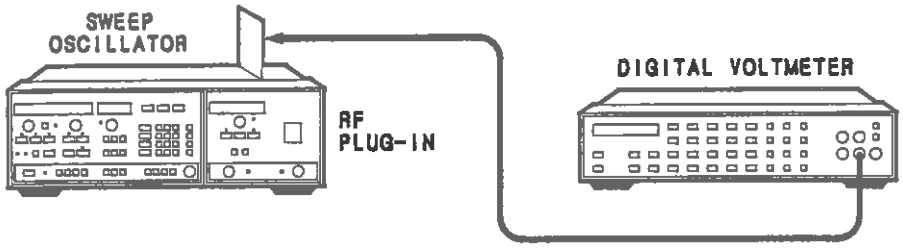


Figure 5-22. FM Driver Adjustment Setup

Equipment

Digital Voltmeter (DVM) ..... HP 3456A

Procedure

NOTE: Turn AC power *off* when removing or installing PC boards.

NOTE: A3S1 must be in the factory-set position (see table 5-6)

1. Place the A5 FM Driver on an extender board.
2. Set configuration switch A3S1 as follows (table 5-6):

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

Positions: 1=Open; 0=Closed; X=Don't Care; Z=According to the instrument (A or B) and the Options installed

NOTE: The A3S1 switch positions select the RF plug-in code, maximum RF power at power-up, −20 MHz/V FM sensitivity, and cross-over coupled FM (AC coupled).

3. On the sweep oscillator, press **[INSTR PRESET]**.
4. Connect the DVM between the A5 board connector pin 21 and A5TP7 (ground) (see figure 5-23). Adjust A5R19, FM OFFSET, for 0 V dc ±0.1 mV dc.
5. Disconnect the DVM from the test points, remove the extender board, and reinstall the A5 FM Driver in the RF plug-in.

A5

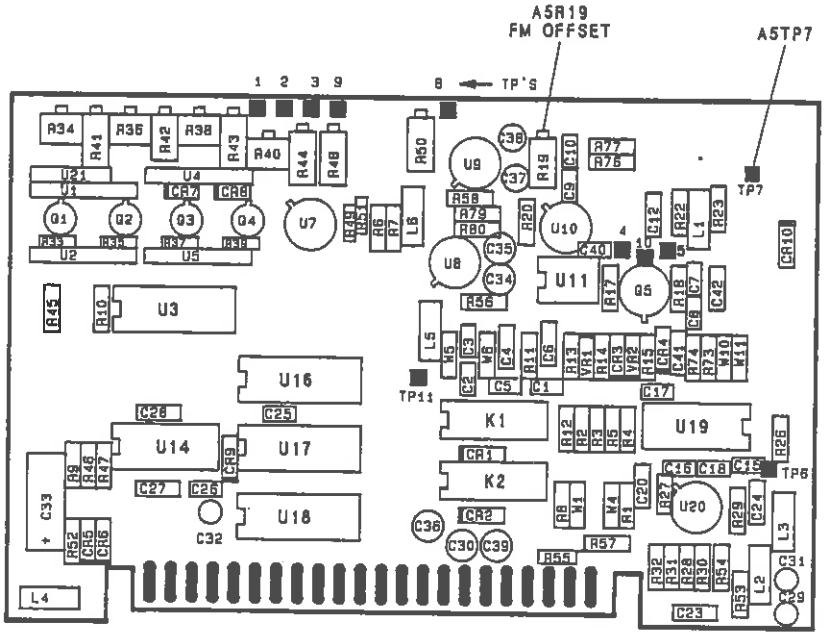


Figure 5-23. FM Driver Adjustment Locations

5-13. ON/OFF Ratio (Option 006 Only)

Description

Two potentiometers on the A7 bias assembly adjust for the minimum power level of the off portion of the square wave.

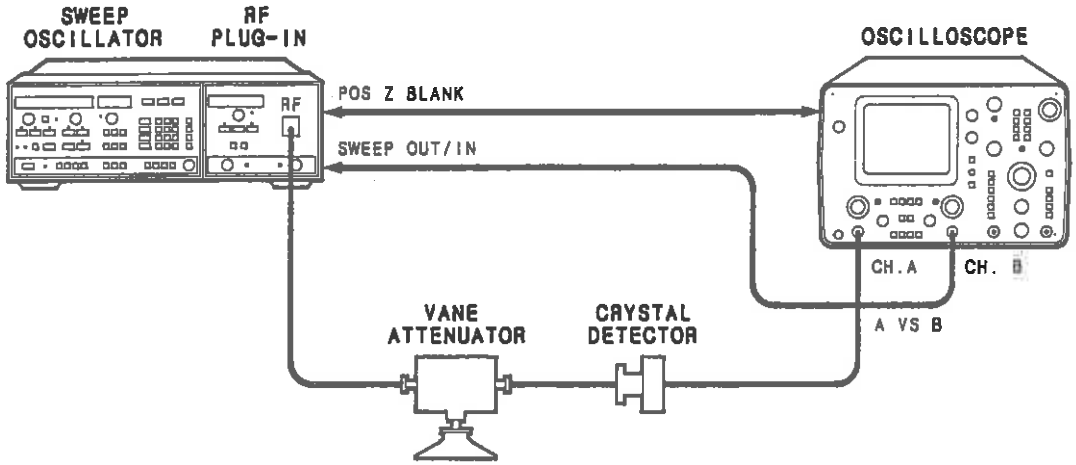


Figure 5-24. On/Off Ratio Adjustment Setup

Equipment

Oscilloscope	HP 1740A
Crystal Detector	HP R422C
Vane Attenuator	HP R382A

Procedure

1. Connect the equipment as shown in figure 5-24.
2. On the sweep oscillator, press:

   [INSTR PRESET] [⌐¬ MOD].

3. Adjust A7R69 (figure 5-25) for the minimum difference between 0 V dc and the top of the modulation envelope over the first two divisions of the oscilloscope trace.
4. Adjust A7R71 for the minimum difference between 0 V dc and the top of the modulation envelope over the remainder of the oscilloscope trace.

A7

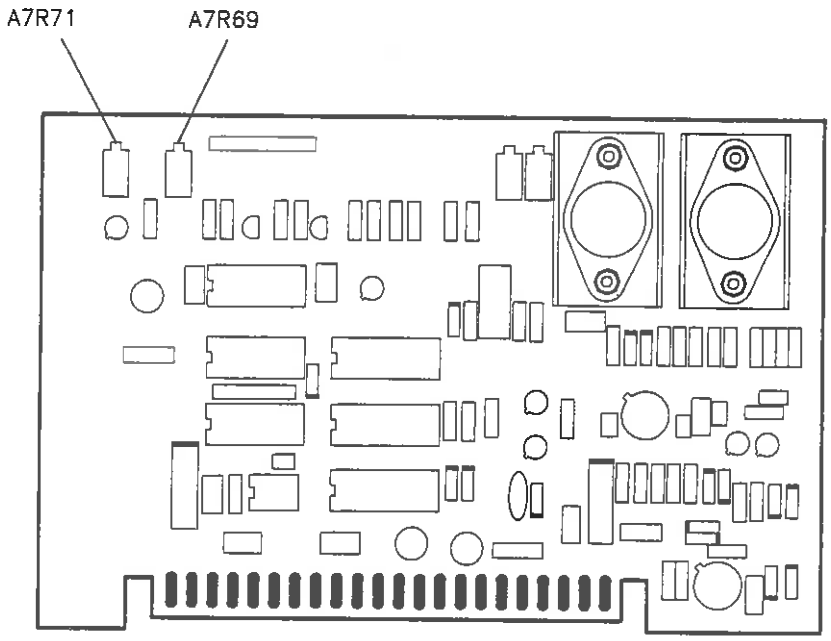


Figure 5-25. On/Off Ratio Adjustment Locations

Section 6. Replaceable Parts

INTRODUCTION

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

TWO-YEAR WARRANTY AND RESTORED EXCHANGE PARTS

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 that 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 6-1 identifies the components within the instrument that have a two-year warranty as well as those that are available as restored exchange parts.

ABBREVIATIONS

Table 6-2 contains three major sections:

- Reference Designations explain the designators used in the parts list.
- Abbreviations define all abbreviations used in the descriptions of replaceable parts.
- Manufacturer's Code List references the name and address of a typical manufacturer with the code number provided in the parts list.

REPLACEABLE PARTS LIST

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

- Electrical assemblies and their components in alpha-numerical order by reference designation and option.
- Chassis-mounted parts in alpha-numerical order by reference designation and option.
- Miscellaneous parts.

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.

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

ILLUSTRATIONS

Figures 6-1 through 6-3 provide the location of major assemblies, front and back panel, and exterior frame replaceable mechanical parts. These parts are numbered for reference and are listed at the end of this section.

ORDERING INFORMATION

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.

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.

SPARE PARTS KIT

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 "Spares Parts Kit" may be ordered through your nearest Hewlett-Packard office.

Table 6-1. Two Year Warranty and Restored Exchange Parts

Reference Designation	Description	New Part Number	Restored Exchange Part
A2	YIG oscillator replacement kit (includes W8 and W9 and twelve factory-select resistors for the A6 YO driver assembly.	83572-60083	Not Available

Table 6-2. Reference Designations, Abbreviations, and Manufacturer's Code List (1 of 4)

REFERENCE DESIGNATIONS

A . . . . . Assembly
AT . . . . . Attenuator, Isolator, Limiter, Termination
B . . . . . Fan, Motor
C . . . . . Capacitor
CP . . . . . Coupler
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
M . . . . . Meter
MP . . . . . Miscellaneous Mechanical Part
P . . . . . Electrical Connector (Movable Portion), Plug
Q . . . . . Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R . . . . . Resistor
RT . . . . . Thermistor
S . . . . . Switch
T . . . . . Transformer
TB . . . . . Terminal Board
TP . . . . . Test Point
U . . . . . Integrated Circuit, Microcircuit
V . . . . . Electron Tube
VR . . . . . Breakdown Diode (Zener), Voltage Regulator
W . . . . . Cable, Transmission Path, Wire
X . . . . . Socket
Y . . . . . Crystal Unit (Piezoelectric, Quartz)
Z . . . . . Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

A . . . . . Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ . . . . . Adjust, Adjustment
AL . . . . . Aluminum
ALC . . . . . Alcohol, Automatic Level Control
AMP . . . . . Amperage
AMPL . . . . . Amplifier
ANDZ . . . . . Anodized
ANLG . . . . . Analog
ASSY . . . . . Assembly
ASTBL . . . . . Astable
ATTEN . . . . . Attenuation, Attenuator
AWG . . . . . American Wire Gauge

B

BCKT . . . . . Bracket
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
CRP . . . . . Crepe, Crimp
CTR . . . . . Center
CURRNT . . . . . Current

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, Flourine, Frequency
FDTHRU . . . . . Feed Through
FEM . . . . . Female
FF . . . . . Flange, Female Connection; Flip Flop
FL . . . . . Flash, Flat, Fluid
FLEX . . . . . Flexible
FLG . . . . . Flange
FLTR . . . . . Filter, Floater
FT . . . . . Current Gain Bandwidth
FM . . . . . Flange, Male Connection; Foam, Frequency Modulation Product (Transition Frequency); Feet, Foot
FXD . . . . . Fixed

G

GEN . . . . . General, Generator
GHZ . . . . . Gigahertz
GP . . . . . General Purpose Group
GL . . . . . Glass
GRN . . . . . Green
GRV . . . . . Grooved

Table 6-2. Reference Designations, Abbreviations, and Manufacturer's Code List (2 of 4)

H

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

I

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

J

JFET . . . . . Effect Transistor

K

K . . . . . Kelvin, Key, 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 . . . . . Millacandela
MICPROC . . . . . Microprocessor
MIN . . . . . Miniature, Minimum, Minor, Minute
MLD . . . . . Mold, Molded
MM . . . . . Magnetized Material (Restricted Articles Code), Millimeter
MO . . . . . Metal Oxide, Milliounce, Molybdenum
MOD . . . . . Model, Modified Modular, Modulated, Modulator
MOM . . . . . Momentary, Motherboard
MTG . . . . . Mounting
MTLC . . . . . Metallic
MTR . . . . . Meter
MULTIPLXR . . . . . Multiplexer
MULTR . . . . . Multiplier
MUW . . . . . Music Wire
MW . . . . . Milliwatt

N

N-CHAN . . . . . N-Channel Metal Oxide Semiconductor
NB . . . . . Niobium
NCH . . . . . Notched
NEG . . . . . Negative
NH . . . . . Nanohenry
NM . . . . . Nanometer, Nonmetallic
NO . . . . . Normally Open, Number
NPN . . . . . Negative Positive Negative (Transistor)
NS . . . . . Nanosecond, Non-Shorting, Nose
NYL . . . . . Nylon (Polyamide)

O

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

P

PAN-HD . . . . . Pan Head
PC . . . . . Picocoulomb, Piece, Printed Circuit
P.C. . . . . Printed Circuit
PCB . . . . . Printed Circuit Board
PD . . . . . Pad, Palladium, Pitch Diameter, Power Dissipation
PF . . . . . Picofarad; Pipe, Female Connection; Power Factor
PKG . . . . . Package
PL . . . . . Phase Lock, Plain, Plate, Plug
PL-MTG . . . . . Plate Mounting
PLSTC . . . . . Plastic
PN . . . . . Part Number
PNP . . . . . Positive Negative Positive (Transistor)
POLYC . . . . . Polycarbonate
POLYE . . . . . Polyester
POLYI . . . . . Polyimide
POS . . . . . Position, Positive
POZI . . . . . Pozidrive Recess
PRCN . . . . . Precision
PRIM . . . . . Primary
PRL . . . . . Parallel
PRP . . . . . Purple, Purpose
P/S . . . . . Power Supply
PT . . . . . Part, Pint, Platinum, Point, Pulse Time
PVC . . . . . Polyvinyl Chloride
PW . . . . . Power Wirewound, Pulse Width

Q

QUAD . . . . . Set of Four

R

RBN . . . . . Ribbon
RCVR . . . . . Receiver
RECT . . . . Rectangle, Rectangular, Rectifier
RES . . . . . Research, Resistance, Resistor, Resolution
RET . . . . . Retaining
RF . . . . . Radio Frequency
RFI . . . . . Radio Frequency Interference
RFLTR . . . . . Regulator
RKR . . . . . Rocker
RND . . . . . Round
RPG . . . . . Rotary Pulse Generator
RR . . . . . Rear
RVT . . . . . Rivet, Riveted

S

SCR . . . . . Screw, Scrub, Silicon Controlled Rectifier
SEC . . . . . Secondary
SER . . . . . Serial, Series
SGL . . . . . Single
SHFT . . . . . Shaft
SHLDR . . . . . Shoulder
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)

Table 6-2. Reference Designations, Abbreviations , and Manufacturer's Code List (3 of 4)

SNP ..... Snap
SPCL ..... Special
SQ ..... Square
SST ..... Stainless Steel
STDF ..... Standoff
SZ ..... Size

T

T ..... Tab Width, Taper, Teeth, Temperature, Tera, Tesla, Thermoplastic (Insulation), Thickness, Time, Timed, Tooth, Turns Ratio, Typical
TA ..... Ambient Temperature, Tantalum
TC ..... Thermoplastic
TFE ..... Polytetrafluro - ethylene, Teflon
THD ..... Thread, Threaded
THK ..... Thick
TO ..... Package Type
TPL ..... Triple
TRIG ..... Trigger, Triggerable, Triggering, Trigonometry
TRMR ..... Trimmer
TRN ..... Turn, Turns
TTL ..... Tan Translucent, Transistor, Transistor Logic

U

UCD ..... Microcandela
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

YIG ..... Yytrium-iron-garnet
YTM ..... YIG Tuned Multiplier

Z

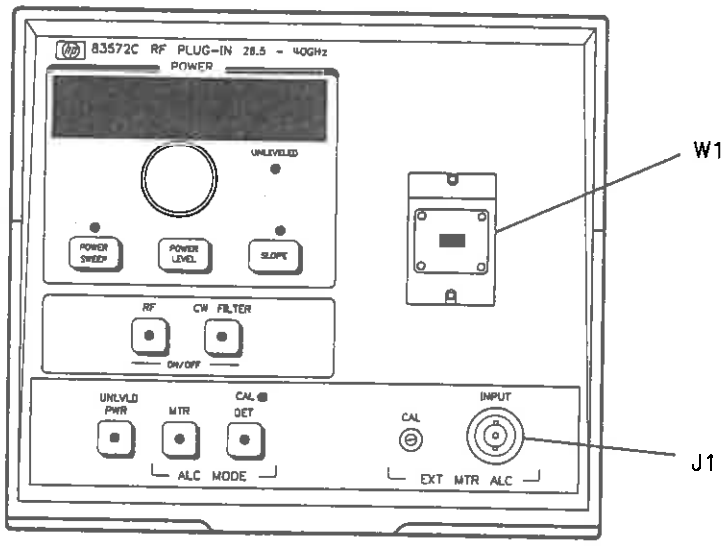
ZN-P ..... Zinc Plate
ZNR ..... Zener

MANUFACTURER'S CODE LIST

Mfr Code	Manufacturer Name	Address		Zip Code
00000	Any Satisfactory Supplier			
00046	Unitrode Corp	Lexington	MA	02173
00746	Rohm Corp	Irvine	CA	92713
01074	Holsworthy Electronics Ltd	Holsworthy	EG	
01125	Lewis Screw Co	Chicago	IL	60609
01339	Gettig Engrg & Mfg Co Inc	Spring Mills	PA	16875
01380	AMP Inc	Harrisburg	PA	17111
01468	Stettner & Co	Lauf	Germany	D-8560
01607	Allen-Bradley Co	Milwaukee	WI	53204
01698	Texas Instruments Inc	Dallas	TX	75265
01708	Jubulation	Santa Cruz	CA	95060
01760	Matsuo Electronics of America	Huntington Beach	CA	92648
01854	RCL Electronics Inc	Northbrook	IL	60062
01993	Markel Corp	Santa Clara	CA	95051
02010	AVX Corp	Great Neck	NY	11021
02037	Motorola Inc	Roselle	IL	60195
02121	Lyn-Tron Inc	Burbank	CA	91505
02180	Precision Monolithics Inc.	Santa Clara	CA	95050
02194	Robinson Nugent Inc	Palo Alto	CA	94303
02210	Milton Ross Co	Southhampton	PA	18966
02367	Cornell-Dubilier/Sangamo	Wayne	NY	07470
02440	Thompson Bremer Div Vare	Chicago	IL	60622
02483	CTS Corp Asheville Div	Skyland	NC	28776
02582	Clarostat Mfg Co Inc	Los Altos	CA	94022
02608	Thermalloy Inc	Dallas	TX	75234
02744	Elec-Trol Inc	San Diego	CA	92121
02788	M/A-Com Inc	Burlington	MA	01803
02805	Cooper Industries Inc	Houston	TX	77210
02883	Siliconix Inc	Santa Clara	CA	95054
02910	Signetic Corp	Sunnyvale	CA	94086
02946	Dupont E I De Nemours & Co	Wilmington	DE	19801
02995	Mepco/Centralab Inc	Riviera	FL	33404
03273	Gowanda Electronics Corp	Gowanda	NY	14070

Table 6-2. Reference Designations, Abbreviations , and Manufacturer's Code List (4 of 4)

MANUFACTURER'S CODE LIST				
Mfr Code	**Manufacturer Name**	**Address**		**Zip Code**
01380	AMP Inc.	Harrisburg	PA	17100
03285	Analog Devices Inc	Norwood	MA	02062
03394	Methode Electronics Inc	Chicago	IL	60656
03406	National Semiconductor Corp	Santa Clara	CA	95052
03744	Bourns Inc	Riverside	CA	92507
03799	Harris Corp	Melbourne	FL	32901
03811	Intel Corp	Santa Clara	CA	95054
03981	Penn Engineering & Mfg Corp	Doylestown	PA	18901
04055	Overland Products Co	Phoenix	AZ	68025
04200	Sprague Electric Co	Lexington	MA	02173
04486	ITT Corp	New York	NY	10022
04604	Federal Screw Products Co	Chicago	IL	60618
04726	3M Co	St. Paul	MN	55144
04805	Illinois Tool Works Inc Shakeproof	Elgin	IL	60126
04990	Grayhill Inc	Cupertino	CA	95014
05176	American Shizuki Corp	Canoga Park	CA	91304
05518	Augat Inc	San Jose	CA	95128
06352	TDK Corporation of America	Torrance	CA	90505
06784	Midwest Components	Muskegon	MI	49443
07608	Wright Engineered Plastics	Santa Rosa	CA	95403
09002	Valmark Industries Inc	Fremont	CA	94538
12355	Interconnection Products Inc.	Santa Ana	CA	92707
12532	EPC Identification Systems	Rohnert Park	CA	94928
28480	Hewlett Packard Company	Palo Alto	CA	94304
03211	GM Nameplate Inc	Seattle	WA	98119



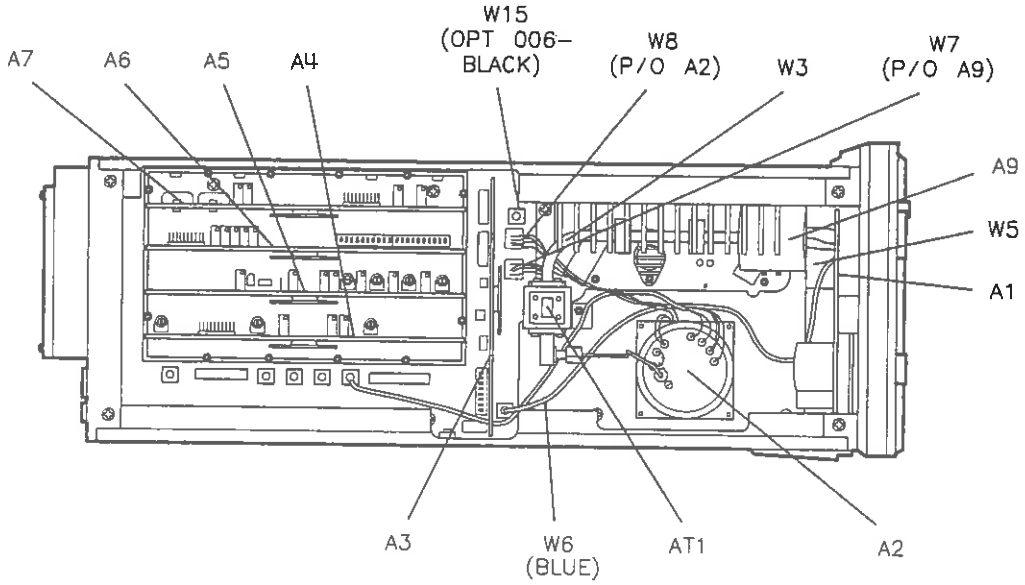
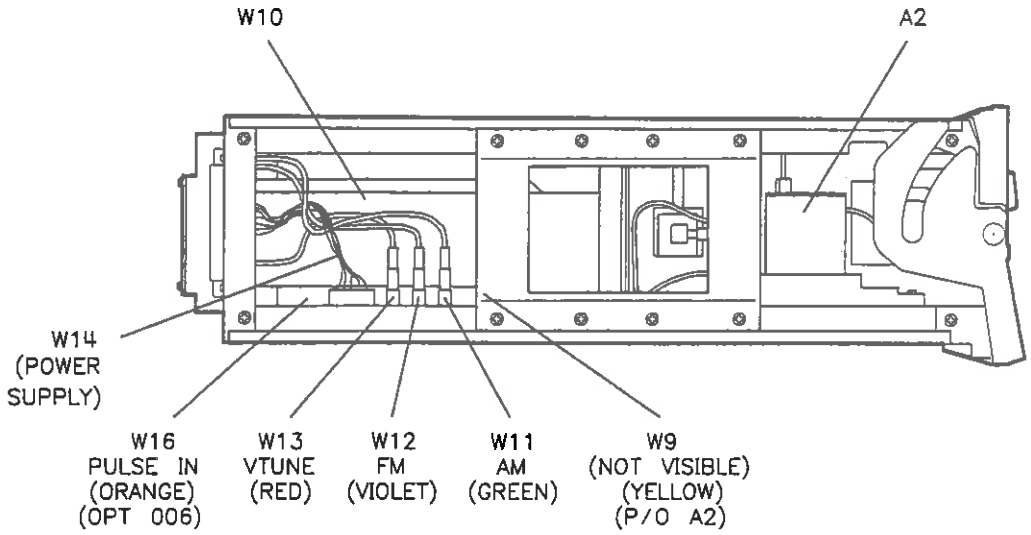


Figure 6-1. Major Assemblies (1 of 4)



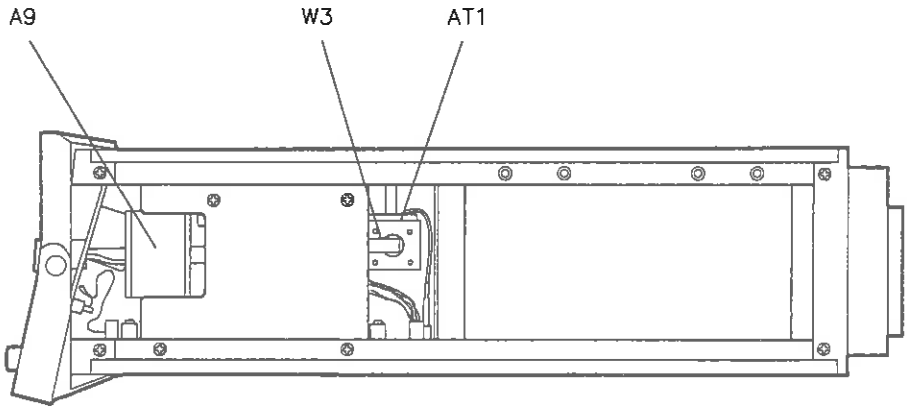


Figure 6-1. Major Assemblies (2 of 4)

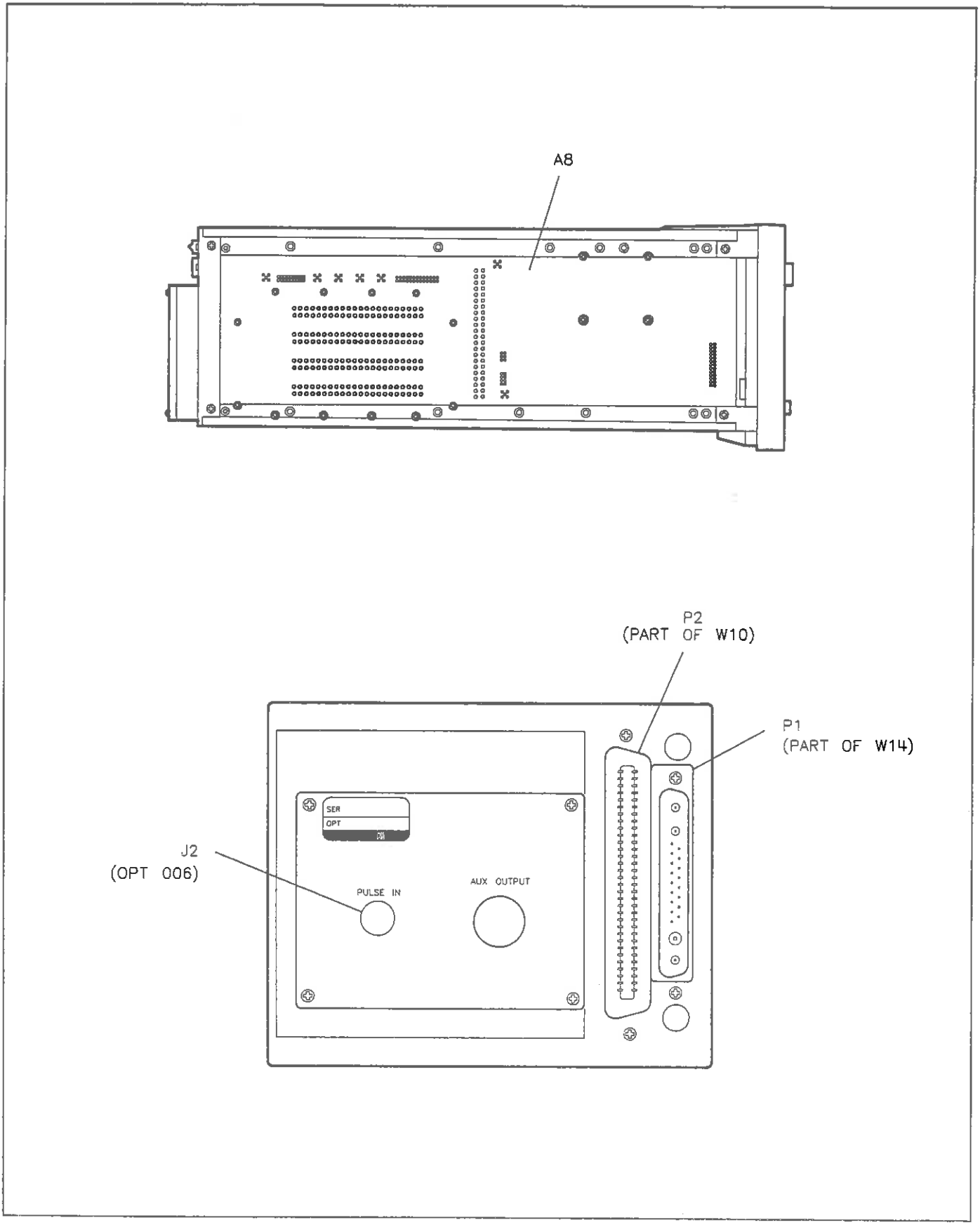


Figure 6-1. Major Assemblies (3 of 4)

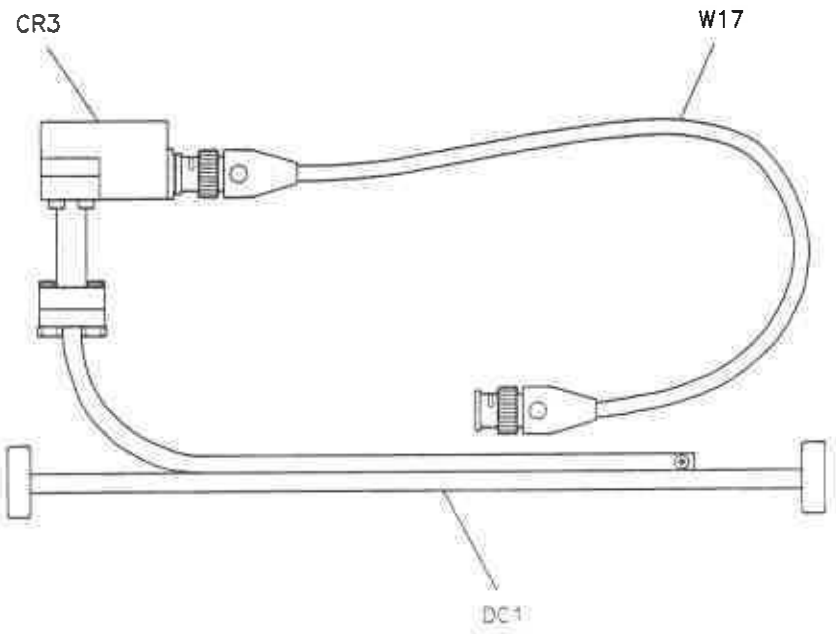


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Figure 6-1. Major Assemblies (4 of 4)

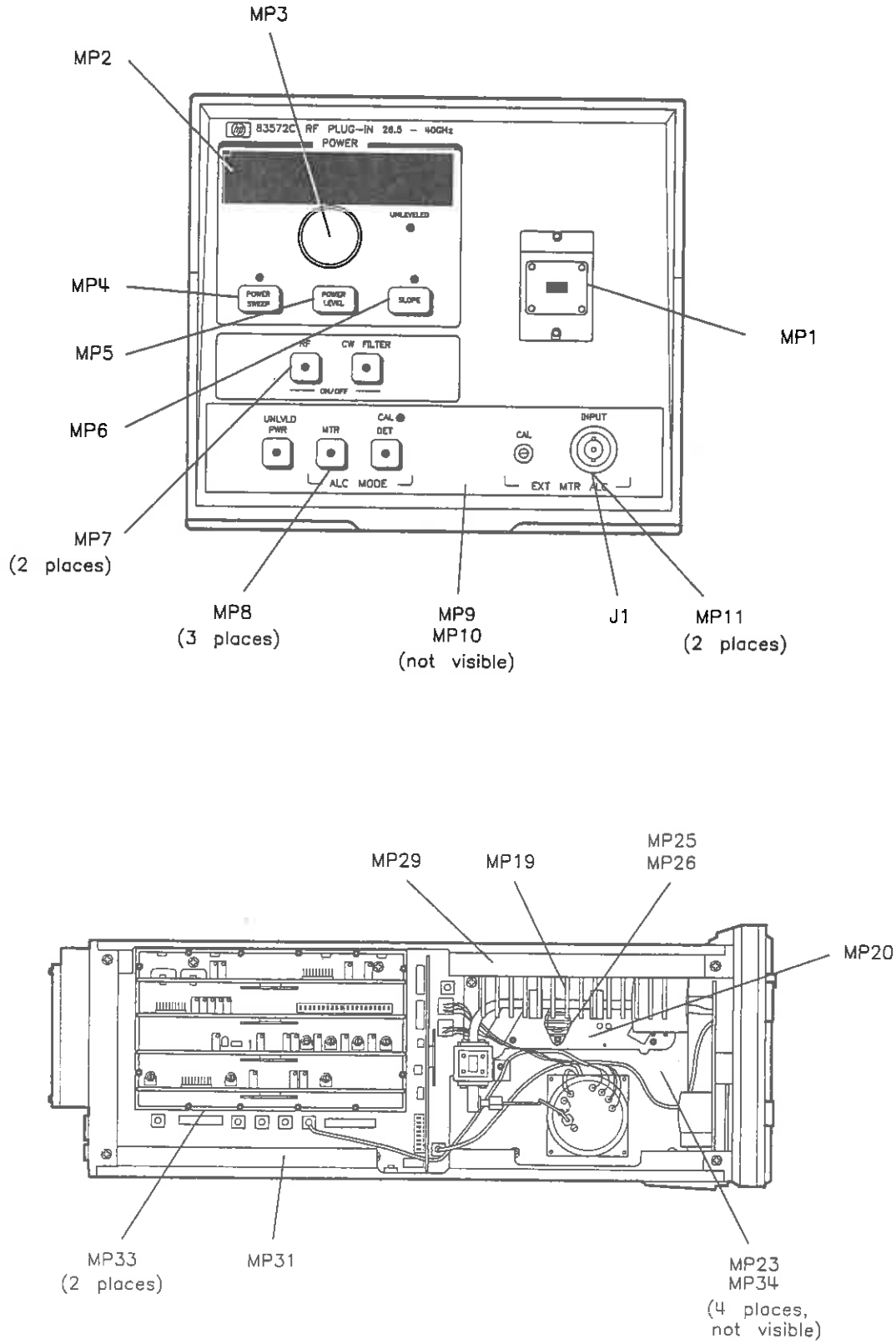


Figure 6-2. Mechanical Parts (1 of 3)

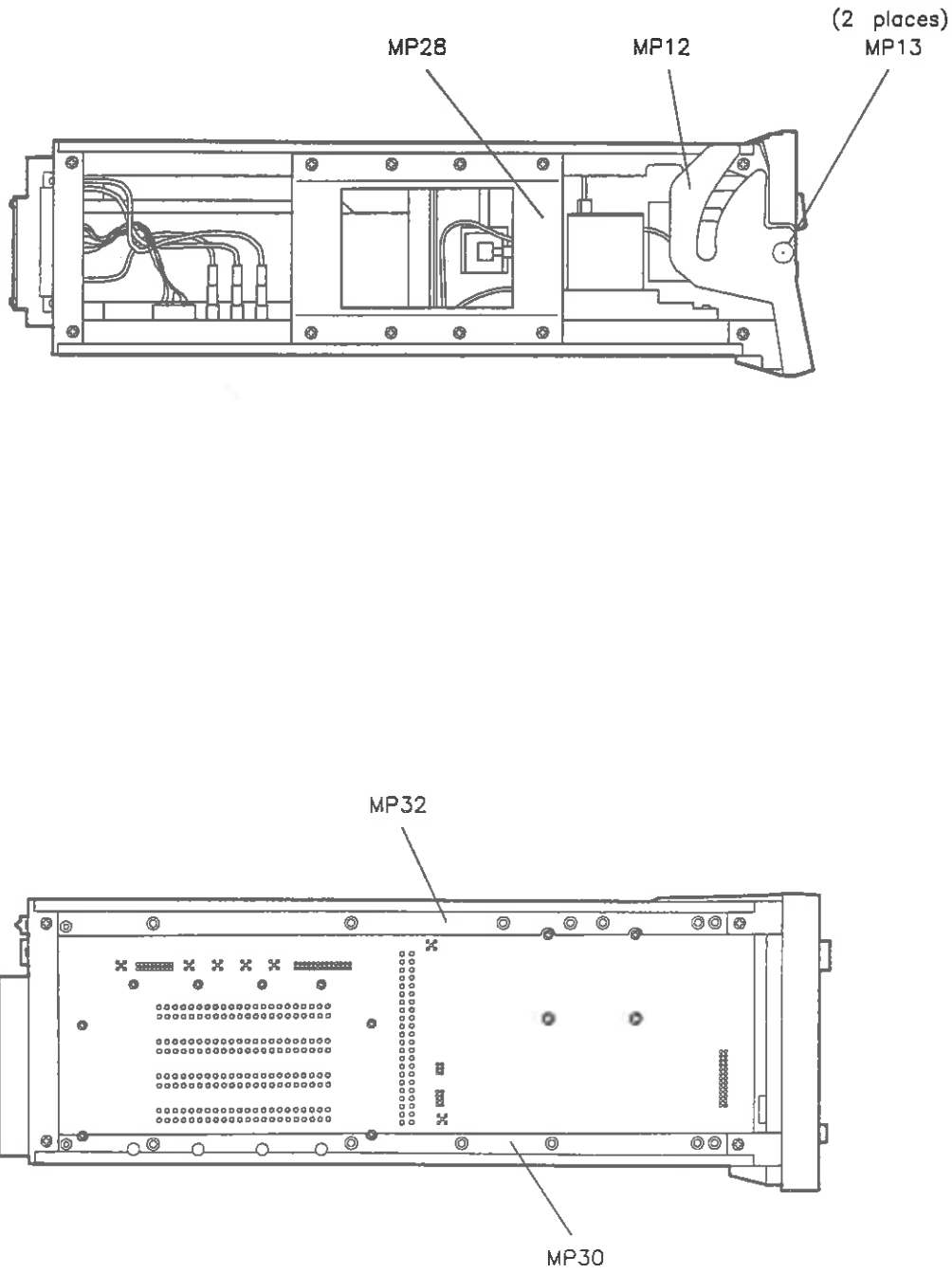


Figure 6-2. Mechanical Parts (2 of 3)

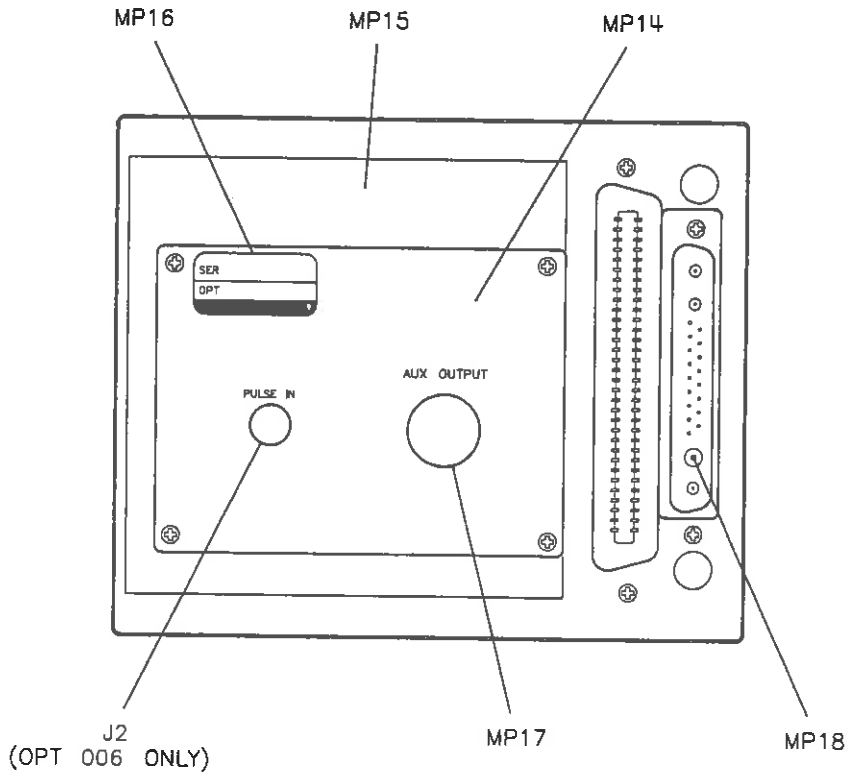


Figure 6-2. Mechanical Parts (3 of 3)

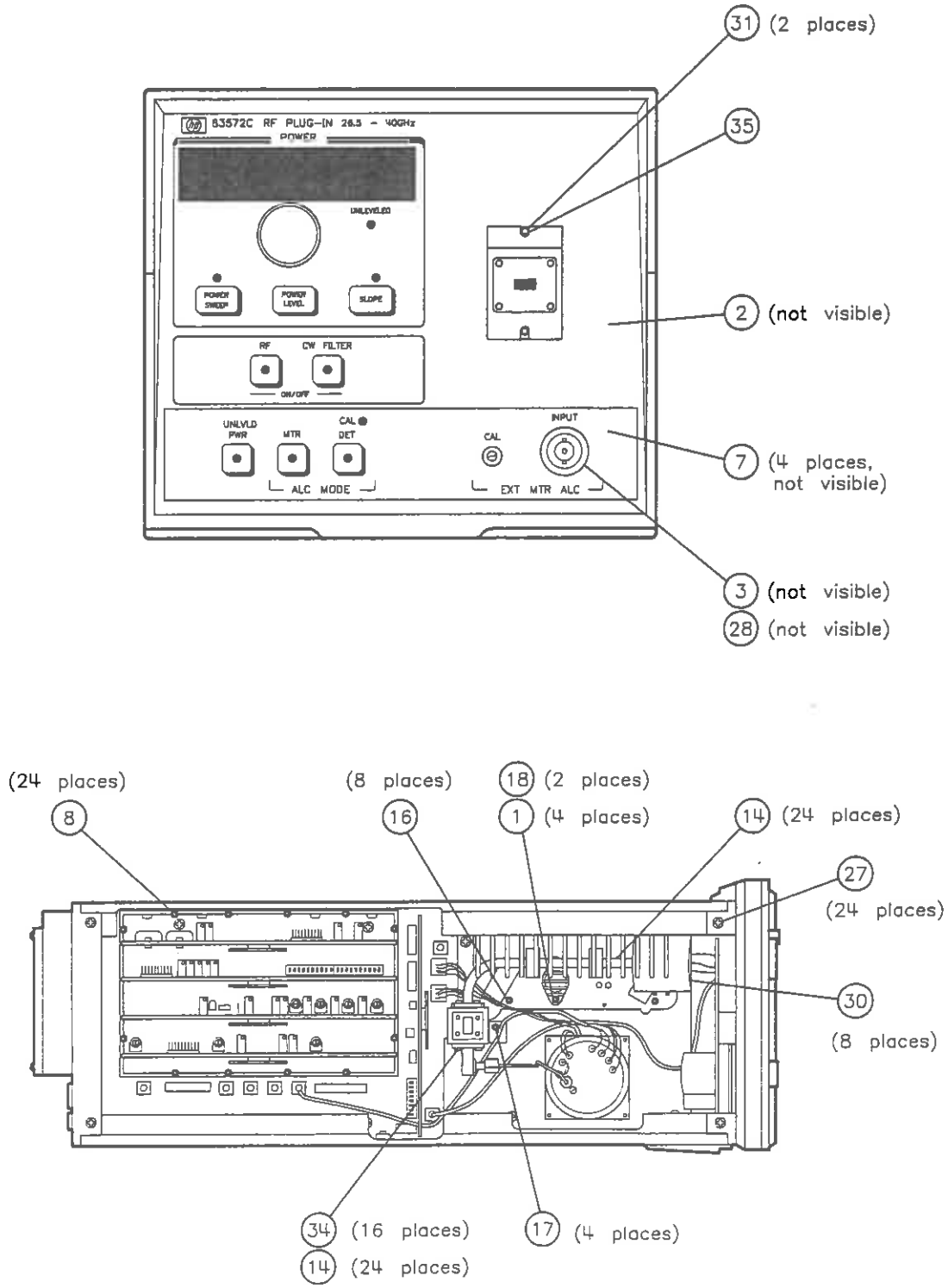
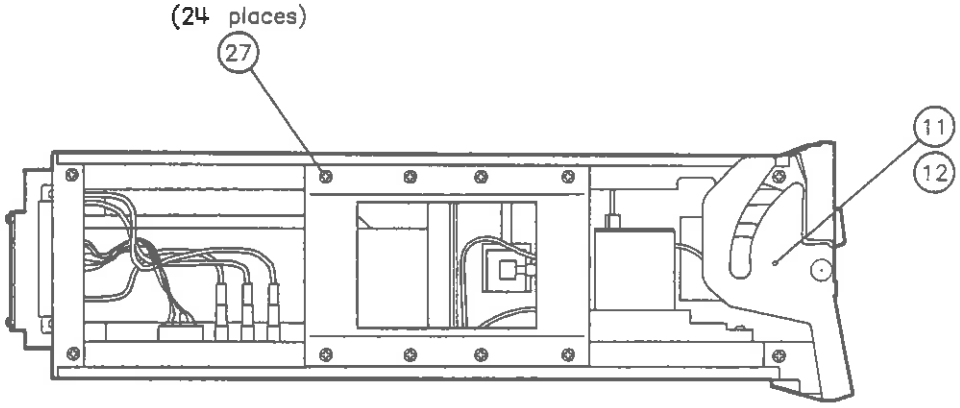


Figure 6-3. Attaching Hardware (1 of 3)



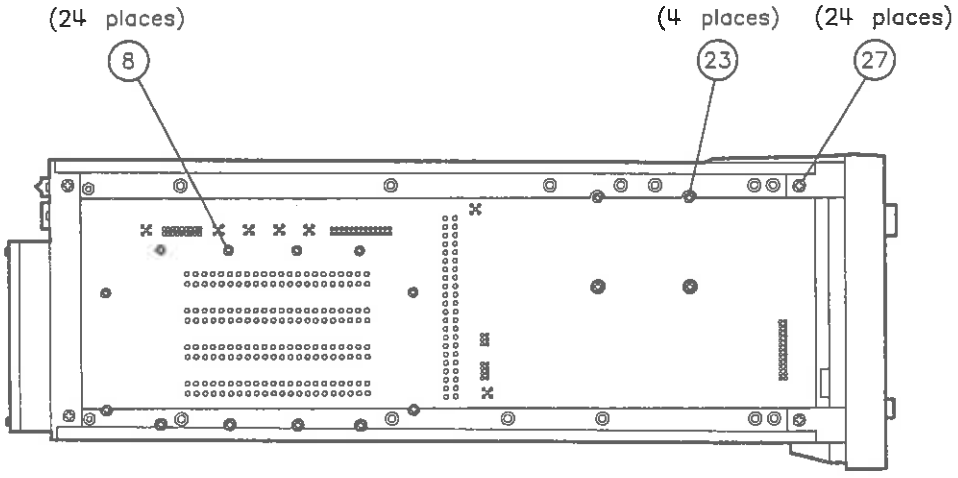


Figure 6-3. Attaching Hardware (2 of 3)

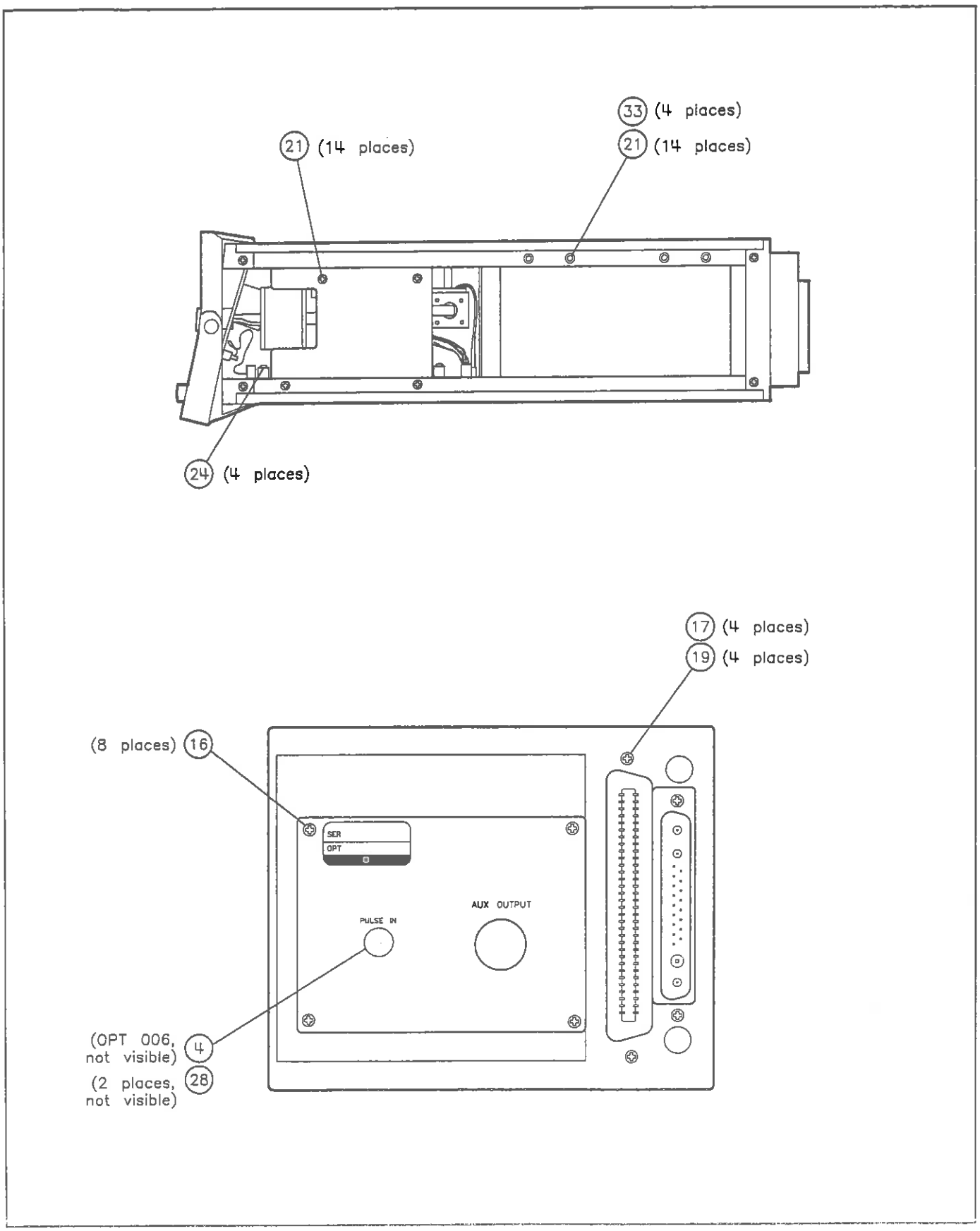


Figure 6-3. Attaching Hardware (3 of 3)

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	83572-60008	5	1	BD AY FRONT PNL	28480	83572-60008
C1	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C2	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C3	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C4	0160-4832	4	1	CAPACITOR-FXD .01UF ¢-10% 100VDC CER	02010	SA101C103KAAH
DS1	1990-0670	0	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	01542	HLMP-6400
DS10	1990-0699	3	1	LED-LIGHT BAR LUM-INT=13MCD IF=30MA-MAX	01542	HLMP-2350
DS11	1990-0699	3	1	LED-LIGHT BAR LUM-INT=13MCD IF=30MA-MAX	01542	HLMP-2350
DS12	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	01542	HLMP-1401
DS2	1990-0670	0	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	01542	HLMP-6400
DS3	1990-0670	0	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	01542	HLMP-6400
DS4	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	01542	HLMP-1401
DS5	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	01542	HLMP-1401
DS6	1990-0670	0	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	01542	HLMP-6400
DS7	1990-0670	0	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	01542	HLMP-6400
DS8	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	01542	HLMP-1301
DS9	1990-0699	3	1	LED-LIGHT BAR LUM-INT=13MCD IF=30MA-MAX	01542	HLMP-2350
J1	1252-0392	9	1	CONN-POST TYPE .100-PIN-SPCG 26-CONT	04726	3593-6003
MP1				NOT ASSIGNED		
MP2	0380-1233	9	4	SPACER-SPECIALTY .450 IN LG .175 IN OD	07608	
MP3	2190-0067	4	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	04805	1914-05
MP4	2950-0006	3	1	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	04604	9000
MP5	0890-0052	9		TUBING-HS 1-IN-D/.5-IN-RCVD .035-IN-WALL	01993	PO135VW-1/2-BLK
MP7	2190-0016	3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	02440	
MP8	2950-0001	8	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	02582	20/4-13
A1RPG1	0960-0683	1	1	ROTARY PULSE GENERATOR INPUT POWER: 5VDC	01542	QEDS-8830
Q1	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	02037	
R1	2100-4022	0	1	RESISTOR-VAR CONTROL CP 10K 10% LIN	02582	388X
R10	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
R11	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
R12	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
R13	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
R14	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
R15	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
R3	0698-3440	7	1	RESISTOR 196 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R4	0757-0398	4	1	RESISTOR 75 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R5	0757-0398	4	1	RESISTOR 75 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R6	0757-0398	4	1	RESISTOR 75 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R7	0698-7236	7	1	RESISTOR 1K ±1% .05W TF TC=0±100	00746	CRB20
R8	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
R9	0698-7224	3	1	RESISTOR 316 ±1% .05W TF TC=0±100	00746	CRB20
S1	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
S2	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
S3	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
S4	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
S5	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
S6	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
S7	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
S8	5060-9436	7	1	SWITCH-PB SPST-NO MOM	04486	5560-9436
U1	1858-0047	7	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	02037	
U2	1810-0124	7	1	NETWORK-RES 16-DIP 200.0 OHM X 8	02483	761-3-R200
U3	1990-0738	1	1	DISPLAY-NUM-SEG 5-CHAR .152-H RED		
U4	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	02037	
U5	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01698	SN74LS14N
U6	1820-2150	6	1	IC-PROGRAMMABLE KEYBOARD/DISPLAY INTERFA	03811	D8279-5
U8	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01698	SN74LS174N
U9	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01698	SN74LS273N
XU10	1200-0901	7	1	SOCKET-STRP 8-CONT SIP DIP-SLDR	02194	SBF-08B-100-G
XU11	1200-0901	7	1	SOCKET-STRP 8-CONT SIP DIP-SLDR	02194	SBF-08B-100-G
XU3	1251-5928	5	1	CONN-POST TYPE .100-PIN-SPCG 15-CONT	02946	68001-615
XU9	1200-0901	7	1	SOCKET-STRP 8-CONT SIP DIP-SLDR	02194	SBF-08B-100-G
A2	83572-60083	6	1	YIG OSCILLATOR REPLACEMENT KIT (INCLUDES W8 AND W9 AND FACTORY SELECT RESISTORS FOR THE A6 YO DRIVER ASSEMBLY)	28480	83572-60083

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	**83525-60080**	**6**	**1**	**BD AY-DIG INTFC**	**28480**	**83525-60080**
C1	0160-0127	2	1	CAP-FXD 1uF 50 V	02010	SR835E105MAAH
C2	0160-0127	2	1	CAP-FXD 1uF 50 V	02010	SR835E105MAAH
C3	0160-0127	2	1	CAP-FXD 1uF 50 V	02010	SR835E105MAAH
C4	0160-0127	2	1	CAP-FXD 1uF 50 V	02010	SR835E105MAAH
C5	0160-3537	4	1	CAP-FXD 680pF 100 V MICA	02367	CD15FC681JO3
C6	0180-0500	7	1	CAP-FXD 47uF 20 V TA	01760	202L2002-476-M6-552
J1	1251-5926	3	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	02946	67997-650
MP1				NOT ASSIGNED		
MP2	5040-6852	3	1	BOARD EXTRACTOR ORANGE	28480	5040-6852
MP3	5000-9043	6	1	PIN		
MP4	9320-5784	6		LBL-LNE-PTR .65-IN-WD X .2-IN-LG	12532	1EW10R
S1	3101-2243	6	1	SWITCH-DIP RKR 8-1A 0.05A 30VDC	04990	76YY22318S
R1	0757-0428	1	1	RESISTOR 1.62K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R2	0698-3153	9	1	RESISTOR 3.83K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R3	0698-3153	9	1	RESISTOR 3.83K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R4	0698-7212	9	1	RESISTOR 100 ±1% .05W TF TC=0±100	00746	CRB20
U10	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01698	SN74LS14N
U11	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01698	SN74LS14N
U12	1810-0338	7	1	NETWORK-RES 16-DIP 100.0 OHM X 8	02483	761-3-R100
U13	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01698	SN74LS138N
U14	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01698	SN74LS367AN
U15	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01698	SN74LS14N
U16	1810-0338	7	3	NETWORK-RES 16-DIP 100.0 OHM X 8	02483	761-3-R100
U17	1820-2075	4	2	IC TRANSCEIVER TTL LS BUS OCTL	01698	SN74LS245N
U18	1820-2075	4	2	IC TRANSCEIVER TTL LS BUS OCTL	01698	SN74LS245N
U19	1810-0338	7		NETWORK-RES 16-DIP 100.0 OHM X 8	02483	761-3-R100
U3	1826-0180	0	2	IC TIMER TTL MONO/ASTBL	01698	NE555P
U4	1820-2081	2	1	IC-PERIPHERAL INTERFACE ADAPTER (PIA) F=	02037	MC68A21P
U5	1820-3093	8		IC-8000-SERIES PROGRAMMABLE TIMER	03811	P8254
U6	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01698	SN74LS10N
U7	1820-1197	9	4	IC GATE TTL LS NAND QUAD 2-INP	01698	SN74LS00N
U8	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01698	SN74LS14N
U9	1820-1216	3	6	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01698	SN74LS138N
XU1	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	01380	641604-1/ 2-641604-1 TUBED
XU2	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	01380	641604-1/ 2-641604-1 TUBED

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	83572-60061	0	1	BOARD ASSY ALC	28480	83572-60061
C1	0160-0127	2	1	CAP-FXD 1uF 50 V	02010	SR835E105MAAH
C10	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C11	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C12	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C13	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C14	0160-3874	2	1	CAP-FXD 10pF 200 V	06352	FD12C0G2D100D
C15	0160-0127	2	1	CAP-FXD 1uF 50 V	02010	SR835E105MAAH
C16	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C17	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C18	0160-0570	9	1	CAP-FXD 220pF 100 V	02010	SR201C221MAAH
C2	0180-0374	3	1	CAP-FXD 10uF 20 V TA	04200	150D106X9020B2-DYS
C20	0160-0574	3	1	CAP-FXD 0.022uF 100 V	02010	SR201C223MAAH
C21	0160-0128	3	1	CAP-FXD 2.2uF 50 V	02010	SR515E225MAAH
C22	0160-3534	1	1	CAP-FXD 510pF 100 V MICA	02367	CD15FD511JO3
C23	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C24	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C26	0160-4389	6	1	CAP-FXD 100pF 200 V	02010	SR202A101JAAH
C27	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C3	0180-0374	3	1	CAP-FXD 10uF 20 V TA	04200	150D106X9020B2-DYS
C4	0180-0374	3	1	CAP-FXD 10uF 20 V TA	04200	150D106X9020B2-DYS
C5	0180-0374	3	1	CAP-FXD 10uF 20 V TA	04200	150D106X9020B2-DYS
C6	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C7	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C8	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C9	0160-3821	9	1	CAP-FXD 0.33uF 50 V	04200	1C10Y5U334M050B
CR10	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	00046	1N4150
CR11	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	00046	1N4150
CR12	1901-0535	9	1	DIODE-SCHOTTKY SM SIG	02062	50825511
CR17	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	02062	5082-5509
CR3	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
CR4	1901-0535	9	1	DIODE-SCHOTTKY SM SIG	02062	50825511
CR5	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
CR6	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
J1	1258-0124	7	1	SHUNT-PROGRAMMABLE 1 DBL PIN SET .100	05518	8136-475G1
L1	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH ±5% .166D-INX.	03273	15M103J
L2	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH ±5% .166D-INX.	03273	15M103J
L3	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH ±5% .166D-INX.	03273	15M103J
MP1				NOT ASSIGNED		
MP2	5040-6848	7	1	BOARD EXTR YELLOW	28480	5040-6848
MP3	5000-9043	6	1	PIN		
MP4	9320-5784	6		LBL-LNE-PTR .65-IN-WD X .2-IN-LG	12532	1EW10R
MP5	1251-4932	9	2	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	05518	LSG-1AG14-1
Q1	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE TO	02037	2N4391
Q15	1855-0423	5	1	TRANSISTOR MOSFET N-CHAN E-MODE TO-237 S	02883	VN10KM
Q2	1854-0295	7	1	TRANSISTOR-DUAL NPN PD=400MW	02037	
Q3	1855-0414	4	1	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE TO	02037	2N4393
Q6	1854-0295	7	1	TRANSISTOR-DUAL NPN PD=400MW	02037	
Q7	1855-0423	5	1	TRANSISTOR MOSFET N-CHAN E-MODE TO-237 S	02883	VN10KM
Q8	1855-0423	5	1	TRANSISTOR MOSFET N-CHAN E-MODE TO-237 S	02883	VN10KM
R10	0757-0416	7	1	RESISTOR 511 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R104	0698-7236	7	1	RESISTOR 1K ±1% .05W TF TC=0±100	00746	CRB20
R11	2100-2489	9	1	RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 1-TRN	03744	3329W-DM3-502
R12	0698-7257	2	1	RESISTOR 7.5K ±1% .05W TF TC=0±100	00746	CRB20
R13	0698-7258	3	1	RESISTOR 8.25K ±1% .05W TF TC=0±100	00746	CRB20
R17	0698-7253	8	1	RESISTOR 5.11K ±1% .05W TF TC=0±100	00746	CRB20
R18	0698-7268	5	1	RESISTOR 21.5K ±1% .05W TF TC=0±100	00746	CRB20
R19	0698-7260	7	1	RESISTOR 10K ±1% .05W TF TC=0±100	00746	CRB20
R20	0698-7257	2	1	RESISTOR 7.5K ±1% .05W TF TC=0±100	00746	CRB20
R21	0698-7272	1	1	RESISTOR 31.6K ±1% .05W TF TC=0±100	00746	CRB20
R22	0698-7261	8	1	RESISTOR 11K ±1% .05W TF TC=0±100	00746	CRB20
R23	0757-0464	5	1	RESISTOR 90.9K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R24	0698-7264	1	1	RESISTOR 14.7K ±1% .05W TF TC=0±100	00746	CRB20
R27	0698-7260	7	1	RESISTOR 10K ±1% .05W TF TC=0±100	00746	CRB20
R28	0698-7227	6	1	RESISTOR 422 ±1% .05W TF TC=0±100	00746	CRB20
R29	0698-6846	3	1	RESISTOR 5.42K ±0.5% .125W TF TC=0±50	00746	CRB14 OR CRB25
R3	2100-2515	2	1	RESISTOR-TRMR 200K 10% TKF SIDE-ADJ 1-TR	03744	3329W-DM3-204
R31	0837-0119	7	1	THERMISTOR TUB WITH AXL LEADS 5K-OHM	06784	3K502K
R32	0698-7259	4	1	RESISTOR 9.09K ±1% .05W TF TC=0±100	00746	CRB20
R33	0698-7269	6	1	RESISTOR 23.7K ±1% .05W TF TC=0±100	00746	CRB20
R35	0698-7237	8	1	RESISTOR 1.1K ±1% .05W TF TC=0±100	00746	CRB20
R36	0698-7236	7	1	RESISTOR 1K ±1% .05W TF TC=0±100	00746	CRB20
R37	0698-7248	1	1	RESISTOR 3.16K ±1% .05W TF TC=0±100	00746	CRB20
R38	0698-7226	7	1	RESISTOR 1K ±1% .05W TF TC=0±100	00746	CRB20

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R39	0698-7248	1	1	RESISTOR 3.16K ±1% .05W TF TC=0±100	00746	CRB20
R4	2100-2632	4	1	RESISTOR-TRMR 100 10% TKF SIDE-ADJ 1-TRN	03744	3329W-DM3-101
R40	0698-7243	6	1	RESISTOR 1.96K ±1% .05W TF TC=0±100	00746	CRB20
R41	0698-7283	4	1	RESISTOR 90.9K ±1% .05W TF TC=0±100	00746	CRB20
R42	0698-7267	4	1	RESISTOR 19.6K ±1% .05W TF TC=0±100	00746	CRB20
R43	0698-7272	1	1	RESISTOR 31.6K ±1% .05W TF TC=0±100	00746	CRB20
R44	0698-7275	4	1	RESISTOR 42.2K ±1% .05W TF TC=0±100	00746	CRB20
R46	0698-7197	9	1	RESISTOR 23.7 ±1% .05W TF TC=0±100	00746	CRB20
R47	2100-2030	6	1	RESISTOR-TRMR 20K 10% TKF TOP-ADJ 1-TRN	03744	3329H-DM3-203
R48	0757-0421	4	1	RESISTOR 825 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R49	0698-7264	1	1	RESISTOR 14.7K ±1% .05W TF TC=0±100	00746	CRB20
R5	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R51	0698-7277	6	1	RESISTOR 51.1K ±1% .05W TF TC=0±100	00746	CRB20
R52	0698-7243	6	1	RESISTOR 1.96K ±1% .05W TF TC=0±100	00746	CRB20
R54	0698-7257	2	1	RESISTOR 7.5K ±1% .05W TF TC=0±100	00746	CRB20
R55	0698-7254	9	1	RESISTOR 5.62K ±1% .05W TF TC=0±100	00746	CRB20
R56	2100-2030	6	1	RESISTOR-TRMR 20K 10% TKF TOP-ADJ 1-TRN	03744	3329H-DM3-203
R57	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R58	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R59	2100-1986	9	1	RESISTOR-TRMR 1K 10% TKF TOP-ADJ 1-TRN	03744	3329H-DM3-102
R60	0698-7236	7	1	RESISTOR 1K ±1% .05W TF TC=0±100	00746	CRB20
R61	0698-7259	4	1	RESISTOR 9.09K ±1% .05W TF TC=0±100	00746	CRB20
R62	0698-7270	9	1	RESISTOR 26.1K ±1% .05W TF TC=0±100	00746	CRB20
R63	0757-0447	4	1	RESISTOR 16.2K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R64	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R65	0698-7260	7	1	RESISTOR 10K ±1% .05W TF TC=0±100	00746	CRB20
R66	0757-0401	0	1	RESISTOR 100 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R67	2100-2030	6	1	RESISTOR-TRMR 20K 10% TKF TOP-ADJ 1-TRN	03744	3329H-DM3-203
R68	0698-7236	7	1	RESISTOR 1K ±1% .05W TF TC=0±100	00746	CRB20
R69	0698-3440	7	1	RESISTOR 196 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R71	0698-3152	8	1	RESISTOR 3.48K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R72	0757-0279	0	1	RESISTOR 3.16K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R73	0698-7277	6	1	RESISTOR 51.1K ±1% .05W TF TC=0±100	00746	CRB20
R74	0698-7251	6	1	RESISTOR 4.22K ±1% .05W TF TC=0±100	00746	CRB20
R8	2100-0670	6	1	RESISTOR-TRMR 10K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-103
R9	2100-3749	6	1	RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 17-TRN	03744	3296X-DM3-502
R93	0698-7212	9	1	RESISTOR 100 ±1% .05W TF TC=0±100	00746	CRB20
R94	0698-7253	8	1	RESISTOR 5.11K ±1% .05W TF TC=0±100	00746	CRB20
R95	0698-7222	1	1	RESISTOR 261 ±1% .05W TF TC=0±100	00746	CRB20
TP1	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP10	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP11	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP12	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP14	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP15	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP2	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP3	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP4	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP5	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP6	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP7	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP8	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
TP9	1251-4672	4		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68000-610
U1	1826-1349	5	1	IC OP AMP GP 8-DIP-C PKG	02180	OP-02CZ
U10	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01698	SN74LS00N
U11	1826-0319	7	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	02037	LF356G
U12	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01698	SN74LS138N
U13	1820-1730	6	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01698	SN74LS273N
U14	1826-0752	2	1	D/A 12-BIT 16-CBRZ/SDR CMOS	03285	AD7542BD
U15	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P PKG	01698	LM311P
U2	1826-1186	8	1	ANALOG SWITCH 4 SPST 16 -CERDIP	02180	SW-06GQ
U3	1826-0616	7	1	IC OP AMP PRCN QUAD 14-DIP-C PKG	02180	OP-11EY
U4	1826-0610	1	1	ANALOG MULTIPLEXER 4 CHNL 16 -CERDIP	02180	MUX-24FQ
U5	1826-0319	7	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	02037	LF356G
U6	1826-0610	1	1	ANALOG MULTIPLEXER 4 CHNL 16 -CERDIP	02180	MUX-24FQ
U7	1826-0447	2	1	IC OP AMP WB TO-99 PKG	03406	LF257H
U8	1826-0021	8	1	IC OP AMP GP TO-99 PKG	03406	LM310H
U9	1826-1186	8	1	ANALOG SWITCH 4 SPST 16 -CERDIP	02180	SW-06GQ
VR1	1902-0049	2	1	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	02037	SZ30016-122RL
VR2	1902-0049	2	1	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	02037	SZ30016-122RL
VR3	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	02037	
VR4	1902-3139	7	1	DIODE-ZNR 8.25V 5% DO-35 PD=.4W	02037	
W2	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1
W3	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	83572-60073	8	1	BD ASY FM	28480	83572-60073
C1	0160-0574	3	1	CAP-FXD 0.022uF 100 V	02010	SR201C223MAAH
C10	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C12	0160-3876	4	1	CAP-FXD 47pF 200 V	02010	SR202C470MAAH
C15	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C16	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C17	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C18	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C2	0160-0572	1	1	CAP-FXD 2200pF 100 V	02010	SR201C222MAAH
C20	0160-2249	3	1	CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	01468	2RDPLX0504R7NP0
C23	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C24	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C25	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C26	0160-3874	2	1	CAP-FXD 10pF 200 V	06352	FD12C0G2D100D
C27	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C28	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C29	0180-2617	1	1	CAP-FXD 6.8uF 35 V TA	01760	202L3502-685-K0-552
C3	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C30	0180-2617	1	1	CAP-FXD 6.8uF 35 V TA	01760	202L3502-685-K0-552
C31	0180-2617	1	1	CAP-FXD 6.8uF 35 V TA	01760	202L3502-685-K0-552
C32	0180-2617	1	1	CAP-FXD 6.8uF 35 V TA	01760	202L3502-685-K0-552
C33	0180-2207	5	1	CAP-FXD 100uF 10 V TA	04200	150D107X9010R2-DYS
C34	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C35	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C36	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C37	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C38	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C39	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C4	0160-0945	2	1	CAP-FXD 910pF 100 V MICA	02367	CD15FA911JO3
C40	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C41	0160-2249	3	1	CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	01468	2RDPLX0504R7NP0
C42	0160-4801	7	1	CAP-FXD 100pF 100 V	02010	SA102A101JAAH
C5	0160-0575	4	1	CAP-FXD 0.047uF 50 V	02010	SR205C473MAAH
C6	0160-2253	9	1	CAP-FXD 6.8pF 500 V	01468	
C7	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C8	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C9	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
CR1	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR10	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	02062	5082-5509
CR2	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR3	1901-0047	8	1	DIODE-SWITCHING 20V 75MA 10NS DO-35	03406	
CR4	1901-0047	8	1	DIODE-SWITCHING 20V 75MA 10NS DO-35	03406	
CR5	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
CR6	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
CR7	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
CR8	1901-1098	1	1	DIODE-SWITCHING 1N4150 50V 200MA 4NS	00046	1N4150
CR9	1901-0535	9	1	DIODE-SCHOTTKY SM SIG	02062	50825511
K1	0490-0916	6	1	RELAY-REED 1A 500MA 100VDC 5VDC-COIL 10V	02744	R-6966-1
K2	0490-1063	6	1	RELAY-REED 2A 500MA 50VDC 5VDC-COIL 10VA	02744	RA30382051-96
L2	9100-1619	2	1	INDUCTOR RF-CH-MLD 6.8UH ±10% .166D-INX	03273	15M681K
L3	9100-1619	2	1	INDUCTOR RF-CH-MLD 6.8UH ±10% .166D-INX	03273	15M681K
L4	08503-80001	9	1			
L5	9100-1619	2	1	INDUCTOR RF-CH-MLD 6.8UH ±10% .166D-INX	03273	15M681K
L6	9100-1619	2	1	INDUCTOR RF-CH-MLD 6.8UH ±10% .166D-INX	03273	15M681K
MP1				NOT ASSIGNED		
MP2	5000-9043	6	1	PIN		
MP3	5040-6851	2	1	EXTRACTOR TAB	28480	5040-6851
MP4	4330-0145	9	6	INSULATOR-BEAD GLASS	01708	
MP5	9320-5784	6		LBL-LNE-PTR .65-IN-WD X .2-IN-LG	12532	1EW10R
MP6	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	02608	2226B
Q1	1854-0529	0	1	TRANSISTOR-DUAL NPN PD=750MW	03799	
Q2	1854-0529	0	1	TRANSISTOR-DUAL NPN PD=750MW	03799	
Q3	1854-0529	0	1	TRANSISTOR-DUAL NPN PD=750MW	03799	
Q4	1854-0529	0	1	TRANSISTOR-DUAL NPN PD=750MW	03799	
Q5	1854-1030	0	1	TRANSISTOR-DUAL NPN TO-78 PD=750MW	02037	
R1	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R10	0757-0438	3	1	RESISTOR 5.11K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R11	0698-3155	1	1	RESISTOR 4.64K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R12	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R13	0698-3446	3	1	RESISTOR 383 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R14	0757-0394	0	1	RESISTOR 51.1 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R15	0757-0394	0	1	RESISTOR 51.1 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R17	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R18	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R19	2100-3749	6	1	RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 17-TRN	03744	3296X-DM3-502
R2	0757-0200	7	1	RESISTOR 5.62K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R20	0757-0458	7	1	RESISTOR 51.1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R22	0757-0446	3	1	RESISTOR 15K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R26	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R27	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R28	0757-0382	6	1	RESISTOR 16.2 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R29	0757-0382	6	1	RESISTOR 16.2 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R3	0757-0200	7	1	RESISTOR 5.62K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R30	0757-0398	4	1	RESISTOR 75 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R31	0757-0398	4	1	RESISTOR 75 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R32	0757-0403	2	1	RESISTOR 121 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R33	0698-7280	1	1	RESISTOR 68.1K ±1% .05W TF TC=0±100	00746	CRB20
R34	2100-2574	3	1	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	03744	3329W-DM3-501
R35	0698-7280	1	1	RESISTOR 68.1K ±1% .05W TF TC=0±100	00746	CRB20
R36	2100-2574	3	1	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	03744	3329W-DM3-501
R37	0698-7280	1	1	RESISTOR 68.1K ±1% .05W TF TC=0±100	00746	CRB20
R38	2100-2574	3	1	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	03744	3329W-DM3-501
R39	0698-7280	1	1	RESISTOR 68.1K ±1% .05W TF TC=0±100	00746	CRB20
R4	0757-0200	7	1	RESISTOR 5.62K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R40	2100-2574	3	1	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 1-TRN	03744	3329W-DM3-501
R41	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R42	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R43	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R44	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R45	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R46	0757-0420	3	1	RESISTOR 750 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R47	0757-0420	3	1	RESISTOR 750 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R48	2100-3759	8	1	RESISTOR-TRMR 2K 10% TKF SIDE-ADJ 17-TRN	03744	3296X-DM3-202
R49	0698-7280	1	1	RESISTOR 68.1K ±1% .05W TF TC=0±100	00746	CRB20
R5	0757-0200	7	1	RESISTOR 5.62K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R50	2100-3750	9	1	RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-203
R51	0698-7274	3	1	RESISTOR 38.3K ±1% .05W TF TC=0±100	00746	CRB20
R52	0698-3160	8	1	RESISTOR 31.6K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R53	0757-0346	2	1	RESISTOR 10 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R54	0757-0346	2	1	RESISTOR 10 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R55	0757-0346	2	1	RESISTOR 10 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R56	0757-0346	2	1	RESISTOR 10 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R57	0757-0346	2	1	RESISTOR 10 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R58	0757-0346	2	1	RESISTOR 10 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R6	0757-0439	4	1	RESISTOR 6.81K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R7	0757-0439	4	1	RESISTOR 6.81K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R73	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R74	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R76	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R77	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R79	0757-0403	2	1	RESISTOR 121 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R8	0698-3158	4	1	RESISTOR 23.7K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R80	0698-0082	7	1	RESISTOR 464 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R9	0698-6360	6	1	RESISTOR 10K ±0.1% .125W TF TC=0±25	00746	CRB14 OR CRB25
TP1	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP10	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP11	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP2	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP3	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP4	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP5	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP6	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP7	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP8	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP9	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
U1	1810-0206	8	1	NETWORK-RES 8-SIP 10.0K OHM X 7	02483	750-81
U10	1826-0546	2	1	IC WIDEBAND AMPL VID TO-100 PKG	02910	NE592H
U11	1826-0476	7	1	ANALOG SWITCH SPDT 8 -DIP-P	01698	TL601CP
U14	1826-0557	5	1	IC OP AMP GP QUAD 14-DIP-C PKG	03406	LM348J
U16	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01698	SN74LS174N
U17	1826-0699	6	1	D/A 8-BIT 16-CBRZ/SDR CMOS	03285	AD7524AD
U18	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01698	SN74LS138N
U19	1826-0700	0	1	IC OP AMP WB 14-DIP-C PKG	03799	HA1-5195-5
U2	1810-0208	0	1	NETWORK-RES 8-SIP 68.0K OHM X 7	02483	750-81
U20	1820-0224	1	1	IC OP AMP SPCL TO-99 PKG	03406	LH0002CH
U21	1810-0366	1	1	NETWORK-RES 6-SIP 220.0 OHM X 5	02483	750-61
U3	1826-0416	5	1	ANALOG SWITCH 4 SPST 16 -CBRZ/SDR	03406	LF13331D
U4	1810-0205	7	1	NETWORK-RES 8-SIP 4.7K OHM X 7	02483	750-61
U5	1810-0321	8	1	NETWORK-RES 8-SIP 220.0K OHM X 7	02483	750-81

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
U7	1826-0092	3	1	IC OP AMP GP DUAL TO-99 PKG	02037	
U8	1826-0349	3	1	IC V RGLTR-FXD-POS 5.7/6.3V TO-39 PKG	03406	UA78M06HC
U9	1826-0558	6	1	IC V RGLTR-ADJ-NEG 1.2/37V TO-39 PKG	03406	LM337H
VR1	1902-3002	3	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	02037	
VR2	1902-3002	3	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	02037	
W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1
W10	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1
W11	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1
W4	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1
W5	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1
W6	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1
W7	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1

Table 6–3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	83572-60075	0	1	BD AY YO	28480	83572-60075
C1	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C10	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C11	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C12	0160-0572	1	1	CAP-FXD 2200pF 100 V	02010	SR201C222MAAH
C13	0160-3874	2	1	CAP-FXD 10pF 200 V	06352	FD12C0G2D100D
C14	0160-3874	2	1	CAP-FXD 10pF 200 V	06352	FD12C0G2D100D
C15	0180-2815	1	1	CAP-FXD 100uF 10 V TA	01760	202L1002-107-M6-552
C16	0180-0116	1	1	CAP-FXD 6.8uF 35 V TA	04200	150D685X9035B2-DYS
C17	0180-0116	1	1	CAP-FXD 6.8uF 35 V TA	04200	150D685X9035B2-DYS
C18	0160-0574	3	1	CAP-FXD 0.022uF 100 V	02010	SR201C223MAAH
C19	0180-2661	5	1	CAP-FXD 1uF 50 V TA	01760	221M5002-105-K3-552
C2	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C20	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C21	0180-2697	7	1	CAP-FXD 10uF 25 V TA	01760	202L2502-106-K7-552
C22	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C25	0180-2486	2	1	CAP-FXD 470uF 30 V WT-SLG-TA-ELCTLT	02995	40EW477C030M1C
C26	0180-0228	6	1	CAP-FXD 22uF 15 V TA	04200	150D226X9015B2-DYS
C27	0160-3742	3	1	CAP-FXD 1uF 50 V POLYC-MET	05176	HEW-576
C28	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C3	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C4	0160-4801	7	1	CAP-FXD 100pF 100 V	02010	SA102A101JAAH
C5	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C6	0160-4801	7	1	CAP-FXD 100pF 100 V	02010	SA102A101JAAH
C7	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C8	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C9	0160-3878	6	1	CAP-FXD 1000pF 100 V	02010	SR201C102MAAH
CR1	1901-0535	9	1	DIODE-SCHOTTKY SM SIG	02062	50825511
CR10	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR12	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	02062	5082-5509
CR2	1901-0535	9	1	DIODE-SCHOTTKY SM SIG	02062	50825511
CR3	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR4	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR5	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR6	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR7	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR8	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR9	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
K1	0490-0916	6	1	RELAY-REED 1A 500MA 100VDC 5VDC-COIL 10V	02744	R-6966-1
L1	9100-1649	8	1	INDUCTOR RF-CH-MLD 620UH ±5% .2D-INX.45	03273	19M623J
L2	9100-1649	8	1	INDUCTOR RF-CH-MLD 620UH ±5% .2D-INX.45	03273	19M623J
L3	08503-60001	9	1	COIL TOROID		
MP1				NOT ASSIGNED		
MP2	5040-6849	8	1	BD EXTR BLUE	28480	5040-6849
MP3	5000-9043	6	1	PIN		
MP4	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	02606	2226B
MP5	1200-0173	5	1	INSULATOR-XSTR DAP-GL	02210	A-10001 DAP
MP6	1200-1256	7	1	SOCKET-IC 24-CONT DIP DIP-SLDR	01380	2-641614-2
Q1	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD$EE400MW	02037	2N2907A
Q2	1853-0405	9	1	TRANSISTOR PNP SI PD$EE300MW FT$EE850MHZ	02037	2N4209
R1	0698-8484	9	1	RESISTOR 6.44K ±0.1% .1W TF TC$EE0$PP4	02995	5023Z
R10	0683-4755	8	1	RESISTOR 4.7M ±5% .25W CC TC$EE-900/$PP1100	01607	CB4755
R11	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R12	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R13	0757-0416	7	1	RESISTOR 511 ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R14	2100-3753	2	1	RESISTOR-TRMR 200K 10% TKF SIDE-ADJ 17-T	03744	3296X-DM3-204
R15	0757-0447	4	1	RESISTOR 16.2K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R16	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R17	0698-3136	8	1	RESISTOR 17.8K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R18	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R19	0757-0458	7	1	RESISTOR 51.1K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R2	0698-8484	9	1	RESISTOR 6.44K ±0.1% .1W TF TC$EE0$PP4	02995	5023Z
R20	0757-0458	7	1	RESISTOR 51.1K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R21	0698-3440	7	1	RESISTOR 196 ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R22	0698-3449	6	1	RESISTOR 28.7K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R23	0757-0438	3	1	RESISTOR 5.11K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R24	0698-3156	2	1	RESISTOR 14.7K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R25	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R26	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R27	0698-3457	6	1	RESISTOR 316K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R28	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R3	0698-8484	9	1	RESISTOR 6.44K ±0.1% .1W TF TC$EE0$PP4	02995	5023Z
R30	0698-3158	4	1	RESISTOR 23.7K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R31	0698-3453	2	1	RESISTOR 196K ±1% .125W TF TC$EE0±100	00746	CRB14 OR CRB25
R33	2100-3732	7	1	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-501

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R34	0699-0518	6	1	RESISTOR 11.489K ±0.1% .1W TF TC=0+4	02995	5023Z
R35	0698-8489	4	1	RESISTOR 15K ±0.1% .1W TF TC=0+4	02995	5023Z
R36	0698-8489	4	1	RESISTOR 15K ±0.1% .1W TF TC=0+4	02995	5023Z
R37	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R4	0698-8484	9	1	RESISTOR 6.44K ±0.1% .1W TF TC=0+4	02995	5023Z
R5	0698-0082	7	1	RESISTOR 464 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R50	0757-0394	0	1	RESISTOR 51.1 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R51	0757-0294	9	1	RESISTOR 17.8 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R52	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R53	0698-3151	7	1	RESISTOR 2.87K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R54	0757-0405	4	1	RESISTOR 162 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R55	0811-3284	9	1	RESISTOR 150 ±5% 3W PWI TC=0±20	01854	T2B-79
R56	0757-0416	7	1	RESISTOR 511 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R57	0757-0465	6	1	RESISTOR 100K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R58	0699-0518	6	1	RESISTOR 11.489K ±0.1% .1W TF TC=0+4	02995	5023Z
R59	2100-3750	9	1	RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-203
R6	0757-0438	3	1	RESISTOR 5.11K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R60	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R61	0698-8472	5	1	RESISTOR 2.653K ±0.1% .1W TF TC=0±5	02995	5023Z
R62	0757-0180	2	1	RESISTOR 31.6 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R63	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R64	0698-6409	4	1	RESISTOR 19.68K ±0.1% .1W TF TC=0+4	02995	5023Z
R65	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R66	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R69	0698-8958	2	1	RESISTOR 511K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R7	0757-0401	0	1	RESISTOR 100 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R70	0698-7244	7	1	RESISTOR 2.15K ±1% .05W TF TC=0±100	00746	CRB20
R71	0698-7244	7	1	RESISTOR 2.15K ±1% .05W TF TC=0±100	00746	CRB20
R8	0757-0280	3	1	RESISTOR 1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R9	0698-0083	8	1	RESISTOR 1.96K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
S1	3101-0471	8	1	SWITCH-DIP RKR 10-1A 0.05A 30VDC	04990	76YY2758S
S2	3101-0471	8	1	SWITCH-DIP RKR 10-1A 0.05A 30VDC	04990	76YY2758S
TP1	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP10	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP11	0360-0535	0	1	TERMINAL-TEST POINT .330IN ABOVE	04055	
TP12	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	12355	460-2984-02-03-00
TP13	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	12355	460-2984-02-03-00
TP14	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ	12355	460-2984-02-03-00
TP2	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP3	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP4	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP5	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP6	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP7	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP8	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP9	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
U1	1810-0277	3	1	NETWORK-RES 10-SIP 2.2K OHM X 9	02483	750-101
U10	1826-1048	1	1	IC OP AMP PRCN 8-DIP-C PKG	02180	OP-07CZ
U11	1826-0752	2	1	D/A 12-BIT 16-CBRZ/SDR CMOS	03285	AD7542BD
U12	1826-1048	1	1	IC OP AMP PRCN 8-DIP-C PKG	02180	OP-07CZ
U13	1826-1048	1	1	IC OP AMP PRCN 8-DIP-C PKG	02180	OP-07CZ
U14	1826-1048	1	1	IC OP AMP PRCN 8-DIP-C PKG	02180	OP-07CZ
U15	1826-1186	8	1	ANALOG SWITCH 4 SPST 16 -CERDIP	02180	SW-06GQ
U16	1826-0758	8	1	IC MULTIPLIER ANLG TO-100 PKG	03285	AD534JH
U17	1826-0558	6	1	IC V RGLTR-ADJ-NEG 1.2/37V TO-39 PKG	03406	LM337H
U18	1826-0753	3	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	02037	MC34004BL
U19	1826-1048	1	1	IC OP AMP PRCN 8-DIP-C PKG	02180	OP-07CZ
U2	1810-0277	3	1	NETWORK-RES 10-SIP 2.2K OHM X 9	02483	750-101
U20	1826-0367	5	1	IC V RGLTR-FXD-POS 4.8/5.2V TO-39 PKG	02037	MC78M05CG
U21	1826-1048	1	1	IC OP AMP PRCN 8-DIP-C PKG	02180	OP-07CZ
U3	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01698	SN74LS244N
U4	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01698	SN74LS244N
U5	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01698	SN74LS244N
U6	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01698	SN74LS138N
U7	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01698	SN74LS174N
U8	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01698	SN74LS00N
U9	1826-0752	2	1	D/A 12-BIT 16-CBRZ/SDR CMOS	03285	AD7542BD
VR1	1902-3036	3	1	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	02037	
VR2	1902-0244	9	1	DIODE-ZNR 30V 5% PD=1W IR=5UA	02037	
VR3	1902-0625	0	1	DIODE-ZNR 1N829 6.2V 5% DO-35 PD=.25W TC	02037	1N829
VR4	1902-3036	3	1	DIODE-ZNR 3.16V 5% DO-7 PD=.4W TC=-.064%	02037	
W1	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	01339	L-2007-1

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	83572-60076	0	1	BD AY BIAS	28480	83572-60076
C1	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C11	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C12	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C13	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C2	0160-3879	7	1	CAP-FXD 0.01uF 100 V	02010	SR201C103MAAH
C22	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C23	0180-0116	1	1	CAP-FXD 6.8uF 35 V TA	04200	150D685X9035B2-DYS
C24	0180-0116	1	1	CAP-FXD 6.8uF 35 V TA	04200	150D685X9035B2-DYS
C25	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C26	0180-0474	4	1	CAP-FXD 15uF 20 V TA	01760	202L2002-156-K6-552
C27	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C28	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C3	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C4	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C5	0160-4805	1	1	CAP-FXD 47pF 100 V	02010	SA102A470JAAH
C6	0160-4805	1	1	CAP-FXD 47pF 100 V	02010	SA102A470JAAH
C7	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
C8	0160-4084	8	1	CAP-FXD 0.1uF 50 V	02010	SR215C104MAAH
CR1	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR10	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR11	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR12	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	00046	1N4150
CR13	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	02062	5082-5509
CR14	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	02062	5082-5509
CR2	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR3	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	02062	5082-5509
CR4	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	00046	1N4150
CR5	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	00046	1N4150
CR6	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	00046	1N4150
CR7	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	00046	1N4150
CR8	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
CR9	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00046	1N645
L1	9100-1641	0	1	INDUCTOR RF-CH-MLD 240UH ±5% .166D-INX.	03273	15M243J
L2	9100-1641	0	1	INDUCTOR RF-CH-MLD 240UH ±5% .166D-INX.	03273	15M243J
L3	9100-1641	0	1	INDUCTOR RF-CH-MLD 240UH ±5% .166D-INX.	03273	15M243J
L4	08503-80001	9	1	COIL TOROID		
L5	08503-80001	9	1	COIL TOROID		
MP1				NOT ASSIGNED		
MP2	5040-6853	4	1	EXTRACTOR PC BRN	28480	5040-6853
MP3	5000-9043	6	1	PIN		
MP4	83572-20018	3	2	HEAT DISSIPATOR		
MP5	0515-0372	2	4	SCREW-MACHINE ASSEMBLY M3 X 0.5 8MM-LG	01125	
MP6	0590-1095	6	4	THREADED INSERT-NUT M3 X 0.5 1.5-MM-LG	03981	KF2-M3-ZI
Q1	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	02037	2N2222A
Q11	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	02037	2N2222A
Q12	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	02037	2N2222A
Q2	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	02037	2N2907A
Q3	1854-0311	8	1	TRANSISTOR NPN 2N4240 SI TO-66 PD=35W	02037	2N4240
Q4	1853-0414	0	1	TRANSISTOR PNP 2N6423 SI TO-66 PD=35W	02037	2N6423
Q5	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	02037	2N2907A
Q6	1854-0809	9	1	TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	02037	2N2369A
Q8	1855-0555	4	1	TRANSISTOR MOSFET N-CHAN E-MODE SI	02883	VN0300L
Q9	1855-0555	4	1	TRANSISTOR MOSFET N-CHAN E-MODE SI	02883	VN0300L
R1	0698-8827	4	1	RESISTOR 1M ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R10	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R11	0757-0463	4	1	RESISTOR 82.5K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R12	2100-3611	1	1	RESISTOR-TRMR 50K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-503
R13	0698-3161	9	1	RESISTOR 38.3K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R14	0757-0440	7	1	RESISTOR 7.5K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R15	0698-3159	5	1	RESISTOR 26.1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R16	0757-0458	7	1	RESISTOR 51.1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R17	2100-3750	9	1	RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 17-TR	03744	3296X-DM3-203
R18	0757-0459	8	1	RESISTOR 56.2K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R19	0757-0459	8	1	RESISTOR 56.2K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R2	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R20	0698-3450	9	1	RESISTOR 42.2K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R21	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R22	0698-4037	0	1	RESISTOR 46.4 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R23	0698-4037	0	1	RESISTOR 46.4 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R24	0757-0440	7	1	RESISTOR 7.5K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R25	0757-0440	7	1	RESISTOR 7.5K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R26	0698-3446	3	1	RESISTOR 383 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
R28	0698-3446	3	1	RESISTOR 383 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
R29	0698-8814	9	1	RESISTOR 1.47 ±1% .125W TF TC=0±100	02995	SFR25H
R3	0757-0290	5	1	RESISTOR 6.19K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R30	0698-8814	9	1	RESISTOR 1.47 ±1% .125W TF TC=0±100	02995	SFR25H
R31	0698-0082	7	1	RESISTOR 464 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R32	0757-0419	0	1	RESISTOR 681 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R34	0698-3438	3	1	RESISTOR 147 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R35	0757-0438	3	1	RESISTOR 5.11K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R4	0698-0082	7	1	RESISTOR 464 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R41	0757-0442	9	1	RESISTOR 10K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R42	0698-0082	7	1	RESISTOR 464 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R5	0698-3452	1	1	RESISTOR 147K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R54	0698-3448	3	1	RESISTOR 383 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R55	0757-0401	0	1	RESISTOR 100 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R6	0698-3450	9	1	RESISTOR 42.2K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R66	0698-3450	9	1	RESISTOR 42.2K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R67	0698-3450	9	1	RESISTOR 42.2K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R68	0757-0401	0	1	RESISTOR 100 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R69	2100-3749	6	1	RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 17-TRN	03744	3296X-DM3-502
R7	0757-0458	7	1	RESISTOR 51.1K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R70	0698-3156	2	1	RESISTOR 14.7K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R71	2100-3749	6	1	RESISTOR-TRMR 5K 10% TKF SIDE-ADJ 17-TRN	03744	3296X-DM3-502
R72	0698-3404	3	1	RESISTOR 383 ±1% .5W TF TC=0±100	01074	H2
R74	0698-3437	2	1	RESISTOR 133 ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R8	0698-3156	2	1	RESISTOR 14.7K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
R9	0698-3156	2	1	RESISTOR 14.7K ±1% .125W TF TC=0±100	00746	CRB14 OR CRB25
TP1	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP2	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP3	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP4	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP5	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP6	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP7	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP8	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
TP9	1251-5238	0		CONN-POST TYPE .100-PIN-SPCG 10-CONT	02946	68001-610
U1	1826-0753	3	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	02037	MC34004BL
U10	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01698	SN74LS174N
U11	1810-0365	0	1	NETWORK-RES 6-SIP 2.2K OHM X 5	02483	750-61
U2	1826-0785	1	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-C	01698	TL072ACJG
U3	1820-1203	8	1	IC GATE TTL LS AND TPL 3-INP	01698	SN74LS11N
U4	1826-0371	1	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	03406	LF256H
U5	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01698	SN74LS00N
U6	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	01698	NE555P
U8	1826-1186	8	1	ANALOG SWITCH 4 SPST 16 -CERDIP	02180	SW-06GQ
U9	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01698	SN74LS138N
VR1	1902-0579	3	1	DIODE-ZNR 5.1V 5% PD=1W IR=10UA	02037	

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8	**83572-60001**	**8**	**1**	**BD ASSY MOTHER**	**28480**	**83572-60001**
CR1	1901-0033	2	1	DIODE-GEN PRP 180V 200MA DO-35	00048	1N645
F1	2110-0333	9	1	FUSE 1.5A 125V NTD BI	02805	GMW 1-1/2
J1	1252-0392	9	1	CONN-POST TYPE .100-PIN-SPCG 26-CONT	04726	3593-6003
J10	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	02788	5162-5021-09
J11	1251-7856	2	1	CONN-POST TYPE .100-PIN-SPCG 8-CONT	01380	3-87515-5
J12	1251-7854	0	1	CONN-POST TYPE .100-PIN-SPCG 6-CONT	01380	103168-1
J2	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	02788	5162-5021-09
J3	1252-0392	9	1	CONN-POST TYPE .100-PIN-SPCG 26-CONT	04726	3593-6003
J4	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	02788	5162-5021-09
J5	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	02788	5162-5021-09
J6	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	02788	5162-5021-09
J7	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	02788	5162-5021-09
J8	1251-6343	0	1	CONN-POST TYPE .100-PIN-SPCG 18-CONT	01380	103168-7
J9	1250-0257	1	1	CONNECTOR-RF SMB M PC 50-OHM	02788	5162-5021-09
MP1				NOT ASSIGNED		
MP2	1251-2313	6	6	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	01380	3-332070-5
MP3	0380-0884	4	4	STANDOFF-RVT-ON .156-IN-LG 4-40-THD	02121	
R2	0811-1080	9	1	RESISTOR 2.2 ±5% 3W PWI TC=0±50	01854	T2B-79
R3	0811-1082	1	1	RESISTOR 4.7 ±5% 3W PWI TC=0±50	01854	T2B-79
R5	0698-8812	7	1	RESISTOR 1 ±1% .125W TF TC=0±100	02995	SFR25H
VR1	1902-0244	9	1	DIODE-ZNR 30V 5% PD=1W IR=5UA	02037	
VR2	1902-0554	4	1	DIODE-ZNR 10V 5% PD=1W IR=10UA	02037	
XA3	1251-1365	6	1	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	03394	220-626-03
XA4	1251-1365	6	1	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	03394	220-626-03
XA5	1251-1365	6	1	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	03394	220-626-03
XA6	1251-1365	6	1	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	03394	220-626-03
XA7	1251-1365	6	1	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	03394	220-626-03

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9	83572-60005	2	1	**MODULATOR AND CABLE ASSEMBLY (INCLUDES W7 CABLE ASSY-MOD/MOTHERBOARD)**	28480	83572-60005
A10	0955-0172	2	1	**MICROWAVE SWITCH, R-BAND (OPT 006)**	28480	0955-0172
				MAJOR ASSEMBLIES, MECHANICAL PARTS AND ATTACHING HARDWARE		
AT1	0960-0658	0	1	ISOLATOR 26.5 TO 40 GHZ	28480	0960-0658
CR1	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
CR3	R422A	4	1	WAVEGUIDE DETECTOR (OPT 001)	28480	R422A
DC1	83572-60071	2	1	DIRECTIONAL COUPLER-10 DB (OPT 001)	28480	83572-60071
J1	1250-0118	3	2	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM (ALC INPUT)	28480	1250-0118
J2	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM PULSE IN (OPT. 006)	28480	1250-0118
MP1	83572-20004	7	1	WAVEGUIDE MOUNT-FRONT PANEL	28480	83572-20004
MP2	4040-1695	1	1	WINDOW-DISPLAY .125-IN-THK	28480	4040-1695
MP3	0370-3023	8	1	KNOB RND .75-IN (JADE GRAY)	28480	0370-3023
MP4	5041-1925	3	1	KEY CAP-POWER SWEEP	28480	5041-1925
MP5	5041-1924	2	1	KEY CAP-POWER LEVEL	28480	5041-1924
MP6	5041-1926	4	1	KEY CAP-SLOPE	28480	5041-1926
MP7	5041-0285	6	2	KEY CAP-LIGHT	28480	5041-0285
MP8	5041-0318	6	3	KEY CAP-LIGHT	28480	5041-0318
M9	83572-00010	4	1	FRONT PANEL DRESS	28480	83572-00010
MP10	83572-20009	2	1	FRONT PANEL-MACHINE	28480	83572-20009
MP11	5040-0345	7	2	INSULATOR-CONNECTOR	28480	5040-0345
MP12	83525-20040	4	1	LATCH	28480	83525-20040
	5021-3770	8	1	LATCH STANDOFF	28480	5021-3770
MP13	83525-20033	5	2	LATCH SCREW	28480	83525-20033
MP14	83570-00006	5	1	REAR PANEL	28480	83570-00006
MP15	0050-2032	9	1	CASTING-ALUM (REAR PANEL)	28480	0050-2032
MP16				NOT ASSIGNED		
MP17	6960-0003	5	1	PLUG-HOLE DOME-HD FOR .75-D-HOLED STL	28480	6960-0003
MP18	11869-20020	4	1	ALIGNMENT PIN-CONNECTOR	28480	11869-20020
MP19	83572-20015	0	1	HEAT SINK-RIGHT SIDE	28480	83572-20015
MP20	83572-20012	7	1	RIGHT-ANGLED MOUNTING BRACKET	28480	83572-20012
MP21				NOT ASSIGNED		
MP2				NOT ASSIGNED		
MP23	83572-20005	8	1	HEAT SINK-OSCILLATOR BASE	28480	83572-20005
MP24				NOT ASSIGNED		
MP25	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	28480	1200-0043
MP26	1200-0399	7	1	HEAT SINK-TRANSISTOR	28480	1200-0399
MP27	83570-00005	4	1	COVER-SCREEN BOX	28480	83570-00005
MP28	83570-00008	7	1	BRACKET-SUPPORT	28480	83570-00008
MP29	83572-20010	5	1	STRUT-RIGHT HAND (UPPER)	28480	83572-20010
MP30	83572-20011	6	1	STRUT-RIGHT HAND (LOWER)	28480	83572-20011
MP31	83572-20019	4	1	STRUT-LEFT HAND (UPPER)	28480	83572-20019
MP32	83572-20013	8	1	STRUT-LEFT HAND (LOWER)	28480	83572-20013
MP33	83570-20015	8	2	SHIELD	28480	83570-20015
MP34	83570-20024	9	4	SPACER-ROUND	28480	83570-20024
MP35				NOT ASSIGNED		
MP36	3030-0007	5	2	SCREW-SET 4-40 .125-IN-LG SMALL CUP-PT	28480	3030-0007
Q1	1855-0484	8	1	TRANSISTOR	28480	1855-0484
Q2				NOT ASSIGNED		
R1	0811-2606	7	1	RESISTOR 16 1% 25W PW TC=0±30	28480	0811-2606
R2	0811-3336	2	1	RESISTOR 100 3% 25W PW TC=0±30	28480	0811-3336
W1	83572-20022	9	1	WAVEGUIDE, FRONT PANEL	28480	83572-20022
W2	8170-0071	4	1	WAVEGUIDE-STRAIGHT, 26.5 TO 40 GHZ	28480	8170-0071
W3	8170-0070	3	2	WAVEGUIDE-BEND, 26.5 TO 40 GHZ	28480	8170-0070
W4				NOT ASSIGNED		
W5	83570-60009	4	1	CABLE ASSEMBLY-RIBBON (FRONT PANEL)	28480	83570-60009
W6	83570-60017	4	1	CABLE ASSEMBLY-COAX, EXT DETECTOR	28480	83570-60017
W7	83572-60010	9	1	CABLE ASSEMBLY-MOD/MOTHERBOARD, P/O A9	28480	83572-60010
W8	83572-60012	1	1	CABLE ASSEMBLY-OSC/MOTHERBOARD, P/O A2	28480	83572-60012
W9	83572-60013	2	1	CABLE ASSEMBLY-OSC/FM, P/O A2	28480	83572-60013
W10	83570-60061	8	1	CABLE ASSEMBLY-DIGITAL INTERFACE	28480	83570-60061
W11	83570-60012	9	1	CABLE ASSEMBLY-COAX AM INPUT	28480	83570-60012
W12	83570-60013	0	1	CABLE ASSEMBLY-COAX FM INPUT	28480	83570-60013
W13	83570-60014	1	1	CABLE ASSEMBLY-COAX, TUNING VOLTAGE	28480	83570-60014
W14	83570-60010	7	1	CABLE ASSEMBLY-POWER SUPPLY	28480	83570-60010
W15	83572-60011	0	1	CABLE ASSEMBLY-PIN SW/MTHRBD (OPT 006)	28480	83572-60011
W16	83572-60016	5	1	CABLE ASSEMBLY-COAX, PULSE IN (OPT 006)	28480	83572-60016
W17	11170A	6	1	CABLE ASSEMBLY-BNC (OPT 001)	28480	11170A

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
1	0340-0148	9	4	INSULATOR-FLG-BSHG NYLON	28480	0340-0148
2	0360-0355	2	1	TERMINAL-SLDR LUG PL-MTG FOR-#5-SCR	28480	0360-0355
3	0360-1190	5	1	TERMINAL-SLDR LUG PL-MTG FOR-#3/8-5CR	28480	0360-1190
4	0360-1632	0	1	TERMINAL-SLDR LUG LX-MTG FOR-#3/8-5CR	28480	0360-1632
5	0360-0089	9	2	TERMINAL-SLDR LUG PL-MTG FOR-#4-5CR	28480	0360-0089
6	0510-0089	8	1	RETAINER-RING BSC EXT .188-IN-DIA BE-CU	28480	0510-0089
7	0510-1148	2	4	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
8	0624-0099	1	24	SCREW-TPG 4-40 .375-IN-LG PAN-HD-POZI	28480	0624-0099
9	0624-0268	6	15	SCREW-TPG 4-24 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
10	1400-1095	6	4	CLIP-FASTENER .400 X .300 X .090 HI; BE	28480	1400-1095
11	1460-1851	8	1	WIREFORM MUW BLK OXD	28480	1460-1851
12	1480-0337	5	1	PIN-ROLL .094-IN-DIA .188-IN-LG STL	28480	1480-0337
13	2190-0016	3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
14	2190-0030	1	24	WASHER-LK HLCL NO. 4 .11S-IN-ID	28480	2190-0030
15	2190-0067	4	1	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
16	2200-0105	4	8	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
17	2200-0107	6	4	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
18	2200-0113	4	2	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
19	2260-0009	3	4	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
20	2360-0113	2	10	SCREW-MACH 6-32 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
21	2360-0115	4	14	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
22	2360-0117	6	2	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
23	2360-0127	8	4	SCREW-MACH 6-32 .875-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
24	2360-0129	0	4	SCREW-MACH 6-32 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
25				NOT ASSIGNED		
26	2360-0210	0	2	SCREW-MACH 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
27	2360-0333	8	24	SCREW-MACH 6-32 .25-IN-LG 100 DEG	28480	2360-0333
28	2950-0001	8	2	NUT-NEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
29	2950-0004	1	1	NUT-NEX-DBL-CHAM 1/4-20-THD .188-IN-THK	00000	ORDER BY DESCRIPTION
30	3030-0956	8	8	SCREW-SKT HD CAP 4-40 .375-IN-LG SST	00000	ORDER BY DESCRIPTION
31	3030-0947	2	2	SCREW-SET 1-72 .094-IN-LG SMALL CUP PT	28480	3030-0947
32	3050-0003	3	1	WASHER-FL NM NO. 6 .141-IN-ID .375-IN-OD	28480	3050-0003
33	3050-0227	3	4	WASHER-FL MTLC NO. 6 .149-IN-ID	28480	3050-0227
34	3030-0349	8	16	SCREW-SKT HD CAP 4-40 .312-IN-LG SST	00000	ORDER BY DESCRIPTION
35	3030-0003	3	1	SCREW-SET 4-40 .125-IN-LG SMALL CUP-PT	33400	3030-0007
				OPTION 001		
CR3	R422A	4	1	WAVEGUIDE DETECTOR	28480	R422A
DC1	83572-60071	2	1	DIRECTIONAL COUPLER - 10 DB	28480	83572-60071
W17	11170A	6	1	CABLE-BNC 1-FT.	28480	11170A
	3030-0209	9	6	SCREW-SKT HD CAP 4-40 .5-IN-LG ALY STL	28480	3030-0209
				OPTION 006		
A10	0955-0172	2	1	MICROWAVE SWITCH R-BAND DELETE W2	28480	0955-0172
J2	1250-0118	3	1	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
W15	83572-60011	0	1	CABLE ASSEMBLY-PIN SW/MOTNERBOARD	28480	83572-60011
W16	83572-60016	5	1	CABLE ASSEMBLY-PULSE IN	28480	83572-60016

Section 7. Manual Backdating

INTRODUCTION

This section of the manual can contain backdating information required to adapt the manual to apply to earlier versions or configurations of the instrument. There are no earlier versions of the HP 83572C (instruments having a serial number prefix lower than the one listed on the title page), so there is no backdating information. The information in this manual applies directly to HP 83572C RF Plug-ins that have the serial number prefixes listed on the title page.

Section 8. Service

INTRODUCTION

This section provides instructions for troubleshooting and repairing the HP 83572C 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 HP 8350A/B/HP 83572C 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.

SCHEMATIC DIAGRAM NOTES

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

MNEMONICS

Table 8-9 lists alphabetically and defines all plug-in 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.

SERVICE AIDS

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 HP 8350 Sweep Oscillator for troubleshooting. These service aids are recommended for convenience in servicing the plug-in.

Table 8-1. Service Information Index

BASIC COMPONENT SYMBOLOGY

R, L, C — Resistance is in ohms, inductance is in microhenries, capacitance is in microfarads, unless otherwise noted.

P/O — Part of.

Indicates a factory selected component.

Panel Control.

Screwdriver adjustment.

Encloses front panel designation.

Encloses rear panel designation.

Circuit assembly borderline.

Other assembly borderline.

Heavy line with arrows indicates path and direction of main signal.

Indicates path and direction of main feedback.

Earth ground symbol.

Assembly ground. May be accompanied by a number or letter to specify a particular ground.

Chassis ground.

n — Represents n number of transmission paths.

Test Point: Terminal provided for test probe.

Pin Edge Connector output of PC board.

Indicates wire or cable color code. Color code same as resistor color code. First number indicates base color, second and third numbers indicate colored stripes.

Indicates shielding conductor for cables.

Indicates a plug-in connection.

Indicates a soldered or mechanical connection.

Connection symbol indicating a male connection.

Connection symbol indicating a female connection.

Resistor.

Variable Resistor.

General purpose diode.

Step recovery diode.

Schottky diode.

Breakdown Diode: Zener

Light-Emitting Diode.

SCR (Silicon Controlled Rectifier).

FET: Field Effect Transistor (N-channel).

FET: Field Effect Transistor-Guarded gate- (N channel).

Dual Transistor.

Transistor NPN

Transistor PNP

Electrolytic Capacitor.

Toroid: Magnetic core inductor.

Operational Amplifier.

Fuse

Pushbutton Switch.

Toggle Switch.

Thermal Switch.

Summing Point.

Oscillator; RPG (Rotary Pulse Generator).

Fan, Motor.

Toroidal Transformer

LOGIC SYMBOLOGY

AND Gate

OR Gate

NAND Gate

NOR Gate

Exclusive OR Gate

Buffer/Amplifier

Inverter

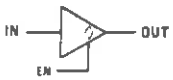
Negation symbol. Line is active low.

Indicated edge-sensitive input.

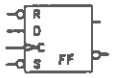
Figure 8-1. Schematic Diagram Notes (1 of 3)

INTEGRATED CIRCUIT SYMBOLOGY

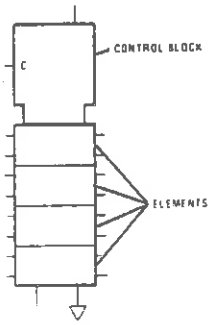
Schmitt Trigger: The gate of the Schmitt Trigger switches at different points for positive - and negative-going signals. The difference between the positive and negative thresholds is defined as hysteresis voltage.



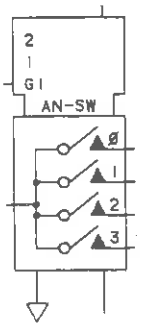
3-State Buffer: Three States:
Enable (EN) Input low: High impedence output.
Enable input high: Output = 0 or
Output = 1



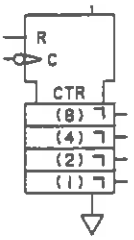
Data Flip-Flop: Set (S) and Reset (R) are asynchronous controls. Active S sets the noninverting output high and the inverting output (○—) low; active R resets both outputs. When S and R are both inactive, the outputs remain latched in the last state. An active clock (—▷) enables the D input, at which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



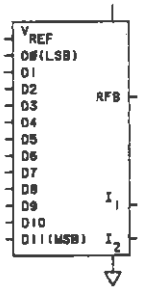
Control Block: All controlling inputs (gates, clocks, inhibits, etc.) connect to the control block.
Elements: Can be one or more of any logic function (flip-flop, counter, gate, RAM, etc.). Data inputs are on the left side of element, data outputs on the right.



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



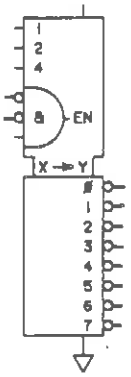
Counter: Binary-weighted registers count on the falling edge of each clock pulse. Active (high) R clears all registers.



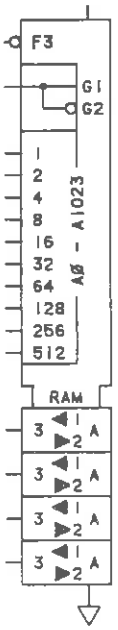
Digital to Analog Converter (DAC): Provides a scaled current output (I_1), the product of V_{REF} and the fractional binary input:

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

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)

LINE LABEL ABBREVIATIONS

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

FUNCTION LABEL ABBREVIATIONS

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

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

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

TROUBLESHOOTING

CAUTION

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

Troubleshooting is generally divided into two maintenance levels in this manual. The first level isolates the problem to a circuit or assembly. "Self-test" together with the Overall Block Diagram and Troubleshooting hints, helps to isolate the problem source to a particular assembly.

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.

SELF-TEST

HP 8350 software provides microprocessor and operator-initiated checks. These checks verify the proper functioning of the majority of the HP 8350 and plug-in digital circuitry and a portion of the analog devices.

Whenever the HP 8350 is powered ON, or the front panel **[INSTR PRESET]** push-button is pressed, instrument SELF-TEST is initiated. Instrument SELF-TEST checks a number of circuits in both the HP 8350 and the plug-in. If a failure in the plug-in is detected during SELF-TEST, error code E001 will be displayed. Table 8-2 lists other error codes associated with the plug-in.

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.

OPERATOR-INITIATED TESTS

The HP 8350 microprocessor services several operator-initiated tests of the plug-in 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.

Table 8-2. Error Codes Associated with 83572C

Error Code	Circuit Tested
E001	Addresses plug-in ROM and reads Check Sum back to HP 8350.
E050	Erroneous Front Panel Pushbutton Flag.
E051	Erroneous Front Panel Pushbutton Code received by HP 8350 Microprocessor.
E052	Checks for Timer failure in A3.
E053	Checks PIA circuits in A3.
NOTE: Error codes E050 through E099 are reserved for RF plug-ins, however, not all are used.	

Access to most of the plug-in digital circuitry can be achieved through local programming.

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:

NOTE: Before addressing a plug-in component, determine whether or not the HP 8350 microprocessor can READ or WRITE to that particular device. The majority of plug-in 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.

HEXADECIMAL

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

Table 8-3. Operator Initiated Self-Test Routines Available

Data Entry	Test	Assembly*	Test Point for Waveform
[SHIFT] [50]	Power Level DAC	A4	A4TP2
[SHIFT] [51]	Power Sweep DAC	A5	A5TP8
[SHIFT] [52]	Scale/Offset DACs	A6	A6TP2, A6TP11
[SHIFT] [53]	Address Decoder; checks major address decoder lines	A3	A3U6, A3U7,A3U9, A3U13
[SHIFT] [54]	Address Decoder; checks individual board address decoders	A4, A5, A6, A7	Address Decoders
[SHIFT] [55]	Interrupt Control	A3	A3U4-38

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

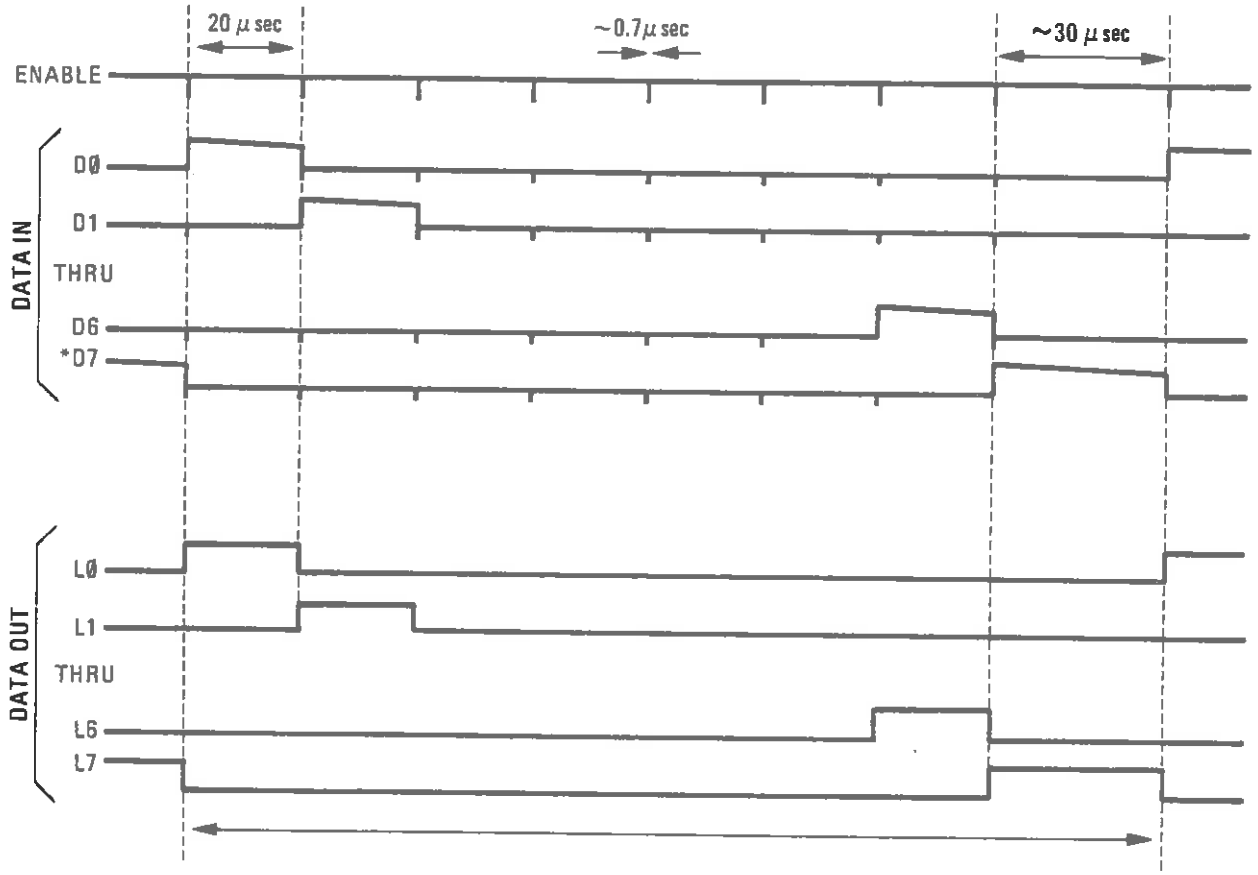


Figure 8-2. Hex Data Rotation Write-Bit Pattern

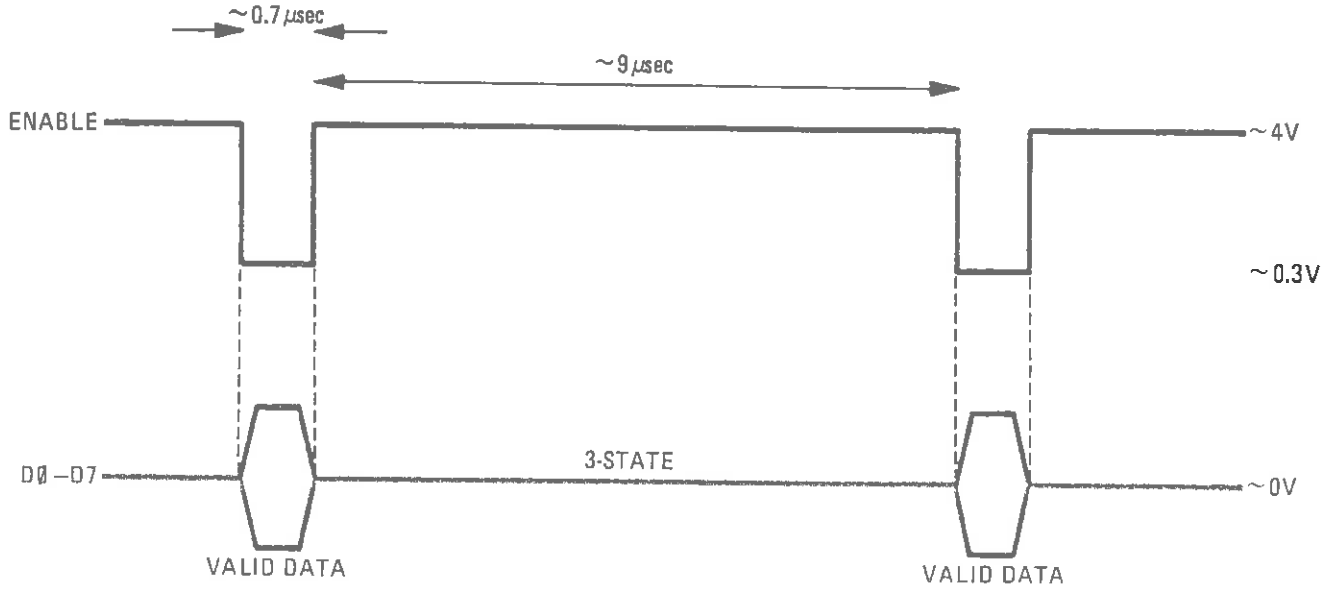


Figure 8-3. Hex Addressed Fast Read-Timing Diagram

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

When the HP 8350 is in the Hex Data WRITE mode (refer to "Operator Initiated Tests" in this section), 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.

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

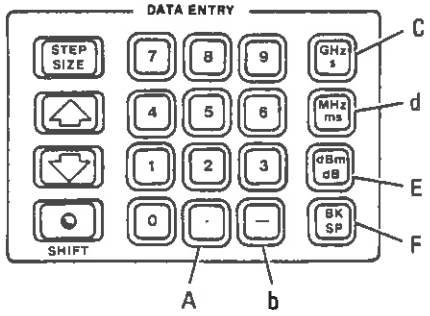


Figure 8-4. Hex Entry Keys

RECOMMENDED TEST EQUIPMENT

Test equipment required to maintain the plug-in is listed in section 1. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

Module Exchange Program

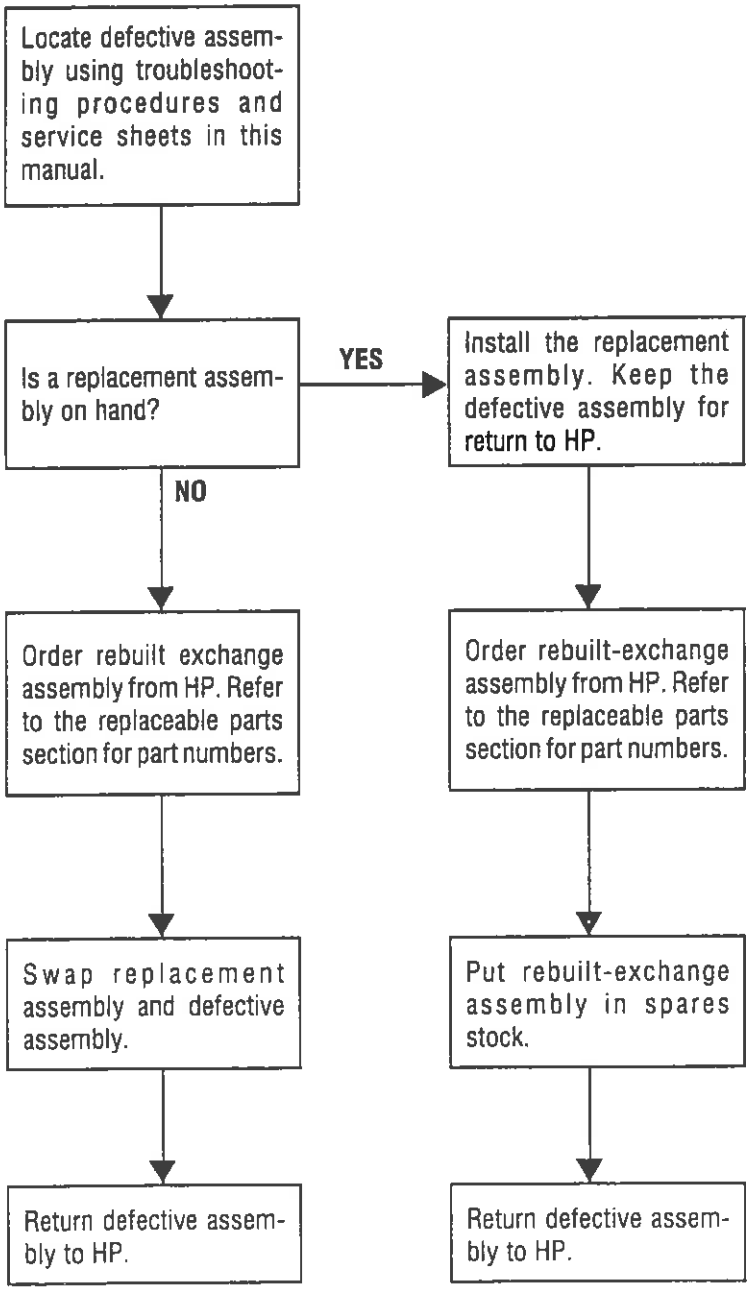
This instrument may be quickly repaired by replacing a defective module with a restored-exchange module. To support the module repair concept, Hewlett-Packard has set up a module exchange program.

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.

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.

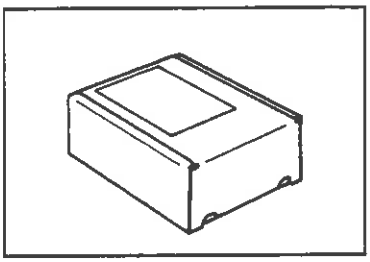
The Hewlett-Packard module exchange program allows you to obtain a fully tested and guaranteed restored-exchange module at a reduced price. (The reduced price is contingent upon return of the defective module to Hewlett-Packard.) Assemblies available for module exchange are listed in Table 6-1.

Use this fast, efficient, economical method to keep your Hewlett-Packard instrument in service.



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

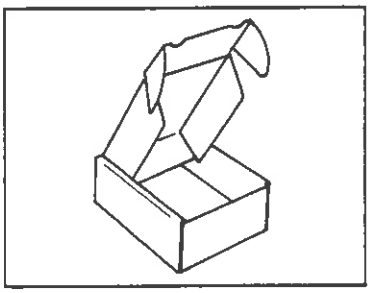
A.



Rebuilt-exchange assemblies are shipped individually in boxes like this. In addition to the circuit assembly, the box contains:

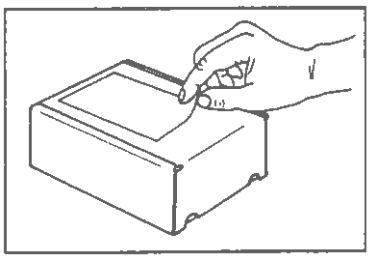
Exchange assembly failure report
Return address label

B.



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

C.



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

Figure 8-5. Module Exchange Procedure

Replacing YIG Oscillator A2 or YO Driver A6

Each YIG Oscillator requires a unique set of twelve resistors to be installed in YO Driver A6. If A6 is replaced, twelve resistors (A6R38 to A6R49) must be removed from the old board and installed on the new board. Also, if YIG Oscillator A2 is replaced, the twelve new resistors shipped with the oscillator must be installed on A6 in place of the old resistors. (In some cases, some of the A6 resistors may be deleted, depending on the drive requirements of the individual oscillator).

Rear Panel Connector Replacement

To remove the rear panel connector P1 from the rear panel casting, connector P2 must first be loosened.

When reassembling rear panel connectors P1 and P2 into the casting, alignment is very critical to ensure proper interface with the mating HP 8350 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.

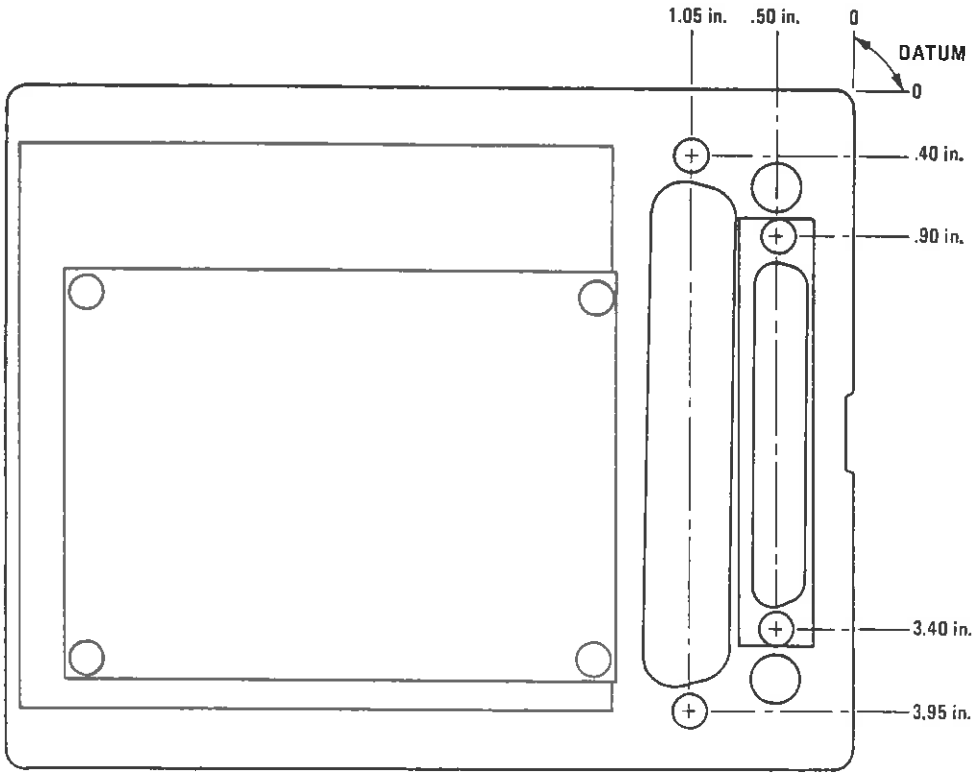


Figure 8-6. Rear Panel Connector Alignment Diagram

AFTER-SERVICE PRODUCT SAFETY CHECKS

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.

HP 83572C RF PLUG-IN FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

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

FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

The plug-in, used with the HP 8350 Sweep Oscillator, covers the 26.5 to 40.0 GHz frequency range with +7 dBm of unleveled RF power (Option 001: +6 dBm). External detectors or power meters can be used to level the RF power. Furthermore, the plug-in can sweep power proportional to either frequency or sweep (Option 001).

The plug-in can be divided 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 plug-in is digitally controlled by the HP 8350 microprocessor. It must be emphasized that nearly all functions are commanded by the HP 8350; very few activities take place without microprocessor intervention.

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

Frequency Control

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

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

Delay compensation circuits are updated for the start of the next sweep by the Retrace Strobe, LRTS, which is sent from the HP 8350 mainframe.

Power Leveling (ALC); Option 001 or Option 001/006

When used in conjunction with an external coupler and detector (included with the Option 001, or 001/006), the Power Control circuits determine the RF output power level, and ensure that the power is constant across the sweep. A feedback loop detects the RF power level, compares it with a reference voltage, and adjusts the ferrite modulator in the RF path to correct for amplitude errors.

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

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

RF Section

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

The YIG Oscillator (YO) is the tunable source, covering a frequency range of 26.5 to 40 GHz. The YO output passes through an isolator, AT1, a PIN switch, A10 (Option 006 only), and a ferrite modulator, A9, before exiting from the front panel.

A directional coupler/detector is included in Option 001 and Option 001/006 units. The coupler/detector and plug-in are calibrated together.

A PIN switch suitable for pulse or square wave modulation is included in Option 006 units.

DETAILED BLOCK DIAGRAM DESCRIPTION

DIGITAL CONTROL/FRONT PANEL

A3 Digital Interface

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

The Buffer receives the digital control data (including timing), and address signals from the HP 8350 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 HP 8350, 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; four 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 HP 8350 microprocessor while executing routines dedicated to the plug-in. Two address decoding lines, plus twelve address lines, select the byte of data to be sent back to the HP 8350.

The Configuration Switch/Interrupt Control circuits serve a dual purpose. The Configuration Switch encodes information about the plug-in (including frequency range, power, etc.) options used, and certain user-defined parameters. During **[INSTR PRESET]** and power-on, the switch positions are read by the HP 8350 microprocessor, then used to display the correct frequencies, options, power, and other parameters which vary from plug-in to plug-in.

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 HP 8350 can read information from the Al Front Panel and A6 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.

A1 Front Panel

The A1 Front Panel assembly is primarily responsible for displaying the status and power level of the RF plug-in, and transmitting pushbutton and RPG commands back to the HP 8350 Sweep Oscillator for processing. Front panel analog adjustments are also processed on this assembly.

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

The Annunciator Interface stores data to drive the LED Annunciators which display the status of various functions.

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

FREQUENCY CONTROL

The Frequency Control section of the plug-in is responsible for determining the actual RF output frequency. Based on the tuning voltage (VTUNE) and digital data, the correct current is developed to tune the A2 YIG Oscillator. Frequency modulation is also processed in these circuits.

A6 YO Driver Assembly

The A6 YO Driver assembly scales and offsets the tuning voltage from the HP 8350 Sweep Oscillator, converting it into a current for controlling the A2 YIG Oscillator frequency.

The tuning voltage, VTUNE, is buffered and inverted (becoming −VTUNE) before being scaled, offset and summed with various correction signals to produce the tuning current for the A2 YIG Oscillator.

The 0 to −10V −VTUNE ramp is scaled and offset relative to the 26.5 to 40 GHz bandwidth. The Scaling and Offset DACs are also used to compensate for small differences in oscillator sensitivities. The amount of scaling and offset can be set by the Frequency Cal switches. At power-on or Instrument Preset, the status of the Cal switches is read by the HP 8350 and stored in RAM. This information is then used along with frequency range information to program the DACs.

The −10V Ref generates a stable reference supply voltage used as a reference on the A6 YO Driver, A4 ALC, and A7 Bias assemblies.

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

The summing junction adds together the scaled tuning voltage, offset, and offset compensation. The delay compensation and kick pulse from the A6 YO Driver assembly and LO FREQ FM from the A5 FM Driver assembly (both described below) are also added. The result is the YO DRIVE V, a signal proportional to the YO frequency.

The remainder of the A6 circuits, together with several chassis/motherboard components, convert the YO DRIVE V to a current to control the YO frequency. The final current drive transistor, Q1, is controlled by the A6 assembly. The current through this transistor, and hence the YO, generates a proportional voltage across the Reference Resistor, R1, 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 will also require changing.

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

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

A7 Bias

The Oscillator Bias section produces the bias voltage needed to activate the A2 YIG Oscillator. This voltage is typically +6 to +3 Vdc. When the RF is turned off via front panel controls, the A7 Bias Assembly converts data bus information to a H RF ON signal. This signal is used to remove bias from the YO, eliminating oscillations, and also drives the PIN switch (Option 006).

The Frequency Tracking Amplifier monitors the tuning ramp −VTUNE, a voltage proportional to the YO's frequency. Its output tracks the RF output frequency, and is used in the ALC flatness adjust circuit on the A5 board.

The Pulse Mod Drive circuitry provides a bias to the PIN switch (Option 006) which varies with frequency. L PULSE is also generated. This signal is used to trigger the sample and hold circuitry on the A4 board. The modulator driver incorporates a limiter and amplifier-driver to drive the A9 Ferrite modulator. The unleveled logic circuitry controls the unleveled indicating LED. U6 is used for pulse stretching to make the LED's light visible during pulse modulation.

A5 FM Driver

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

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

ALC/POWER CONTROL

The A4 ALC assembly and parts of the A5 FM Driver assembly are responsible for power level control. With option 001, power leveling is accomplished by detecting the output RF power level, comparing it to a fixed reference voltage, and biasing the RF modulator to correct for power errors. This results in constant RF power level across the entire sweep. In the UNLVLD power mode, the absolute RF power is digitally controlled, and can be set between +7 and −23 dBm using the front panel RPG and "CAL" knobs. In this mode, displayed power is not calibrated to actual RF output power. Instruments with Option 001 use an external leveling loop to achieve power control from +6 to −4 dBm. The power sweep and power slope functions are obtained by adding a scaled voltage ramp offset to the reference power level.

A4 ALC Assembly

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

The reference, or desired, power level is established digitally by a 12-bit DAC, scaling the −10V REF from the A6 assembly. This establishes a voltage proportional to the desired output level in dBm. The External AM signal from the HP 8350 Sweep Oscillator, and the PWR/SWP COMP signal from the A5 FM Driver assembly (described below), are summed in to produce PWR REF. With option 001 (in the **[SHIFT] [DET]** mode), a correction voltage from the A5 board is also summed in which compensates for frequency and amplitude variations of the external coupler and detector.

The second summing junction adds External Cal, an offset voltage from the front panel used to calibrate absolute power when external leveling is used. However, "External Cal" (screwdriver adjust on the front panel) is disabled in **[SHIFT] [DET]**. 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 shut off the RF power during RF Blanking, without saturating any other components in the path. This boosted error signal is applied to the Modulator Driver on the A7 Bias assembly which provides the current drive needed to control the ferrite modulator in the RF path. A circuit on the A4 assembly monitors the input to the modulator driver, sends a signal to the unleveled logic amplifier which in turn lights a front panel UNLEVELED LED if this voltage exceeds the normal range for leveled power.

A7 Bias Assembly

Pulse Modulation Logic on the A7 assembly monitors several signals and issues controls to the modulator drive circuitry, the PIN switch (A10, option 006), and the ALC sample and hold circuitry to modulate the output power. This circuit receives the SQ MOD (Squarewave Modulation), L RFM (Low=RF Marker), and L RFB (Low=RF Blank) signals from the HP 8350. The Ext Pulse signal from the rear panel BNC (option 006) is also summed in. In addition, this circuit receives the H RF ON signal from the data bus. Whenever any of these signals become active inputs, the L PULSE line goes low, forcing the ALC circuit into the HOLD mode and biasing the PIN switch (option 006 only) on. Additionally, when the L RFB line goes low, the ferrite modulator is biased to its high loss state.

A5 FM Driver

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

The ALC Compensation is a four-breakpoint, adjustable slope network which compensates for fixed frequency-dependent nonlinearities in the RF path, typically the couplers and detectors. Its input is FREQ TRK V, a voltage exactly proportional to frequency. This signal drives an array of four transistors whose outputs are summed together to yield the ALC compensation signal. The gain of each transistor, and the voltage at which that transistor begins to conduct, are adjustable. A ninth adjustment adds the FREQ TRK V directly. In this way, a complicated compensation function, approximated by five straight lines, is produced. For option 001 models, the ALC Compensation is factory adjusted. It is activated by **[SHIFT] [DET].**

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

RF Section

The RF Section includes the microcircuits that produce the actual RF output power. These components include A2, AT1, A9, and A10 (Option 006).

The A2 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is the frequency-controllable microwave source for the plug-in, ranging from 26.5 to 40 GHz. The YO's frequency is determined by the current flowing through large electromagnetic coils inside, supplied by the A6 assembly. Due to the response-time limitations of the main coils, a smaller coil with a much higher frequency response, but limited range, is used to modulate the output frequency.

AT1 is a 26.5 – 40 GHz Isolator providing isolation between the YO and the modulator to prevent frequency pulling on the oscillator.

The A9 Ferrite Modulator is used for manual and ALC power control.

The A10 PIN switch (Option 006) offers both pulse and squarewave modulation capability, and RF amplitude markers. A10 has a 20 dB (typically 26 dB) ON-OFF ratio.

OVERALL TROUBLESHOOTING

The purpose of this troubleshooting information is to provide an aid in isolating a problem in the plug-in to a specific assembly.

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 HP 8350 used with the plug-in is calibrated and functionally operating.

A failure in the plug-in 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 or A3 assemblies, or with the RF plug-in/HP 8350 interface.
- Frequency Control – Frequency control problems include frequency inaccuracy, and sweep control problems. If the HP 8350 VTUNE output and power supplies are verified, the problem is most likely on the A5 or A6 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 A6 Yig Oscillator Driver Assembly.
- Power Control – Typical problems are no RF Output and inability to level the power. The problem is most likely with the A4, A5, A7, or RF Section. If the trouble is limited to power sweep and slope control, the problem is most likely with the Power Sweep DAC on the A5 assembly.
- RF Path – Problems associated with high-frequency microcircuits include no RF power, low power and no power control. For power problems, refer first to the A4 ALC Troubleshooting before suspecting the RF components.

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

- Sweep Mode related – Is the problem only for swept modes of operation, or does it also exist in CW operation? If the problem still exists in CW operation, troubleshoot in this mode (it is easier to check waveforms and voltages in CW operation).
- Control related – Try different methods of entering data (i.e. RPG, data entry keys, or increment/decrement keys). If the problem is related to a specific control, troubleshoot that control and its respective circuits. If the problem is related to a specific type of control (e.g. pushbuttons), refer to the A1 section 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 A6 assembly.

Error Codes

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

Error Code E001. Error code E001 indicates that the HP 8350 microprocessor is unable to properly read plug-in ROM. Initial checks should be made to verify proper mating of rear panel connectors with the HP 8350. Also check cable connections to the A3 Digital Interface and ensure A3 is properly installed. For specific troubleshooting information, refer to the A3 troubleshooting later in this section.

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

Error Code E051. Error code E051 indicates that an invalid keycode is received by the HP 8350 microprocessor. Refer to the A1 troubleshooting for 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 troubleshooting later in this section for further information.

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 troubleshooting for further information.

Table 8-5. HP 83572C Error Codes

Error Code	Function Tested	Operator Initiated Test	Troubleshooting Hints
E001	8350A/B / 83572C		Check the RF plug-in connections and cable connections to A3. Do Hex DataWrite to front panel and Hex Data Readof 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 troubleshooting for further information.
E052	Interval Timer	SHIFT 55	See A3 troubleshooting for further information.
E053	PIA	SHIFT 55	See A3 troubleshooting for further information.

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 HP 8350 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 A1 troubleshooting. For digital control problems, refer to the A3 Digital Interface troubleshooting, and check the address, data, and control line outputs of the A3 assembly.

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

Frequency Control

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

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

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

Frequency Accuracy Problem. Check the YO DRIVE V signal against the waveform shown in figure 8-38. If the frequency appears to be offset, check the Frequency Cal Switches.

Swept Frequency Accuracy Problem. A frequency accuracy problem that occurs only during swept frequency modes is typically a delay compensation problem. Refer to the A6 Yig Oscillator Driver assembly for further troubleshooting.

Power Control

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

- No RF Output Power

  Refer to the section 'No RF Power' in the A4 Troubleshooting section.

- Low Output Power

  Refer to the A4 Troubleshooting section.

RF Section

RF Section problems are usually indicated by no RF Power or low RF power. Refer to the Power Control section of the troubleshooting information.

A1 FRONT PANEL CIRCUIT DESCRIPTION

GENERAL

The A1 Front Panel assembly provides communication between the instrument and the user. Keyboard and RPG commands are transmitted to the HP 8350 microprocessor for appropriate action. The numerical power level and plug-in status information is displayed on Front Panel LEDs. External ALC power calibration is performed by a Front Panel adjustment and sent to the ALC assembly.

KEYBOARD
Push Button Switch Matrix F
Keyboard/Display Interface 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 HP 8350 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 D
Keyboard/Display Interface A
Power Display Driver C

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 HP 8350.

LED ANNUNCIATOR LATCH
LED Annunciators E
LED Annunciator Latch B

Octal latches U8 and U9 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).

RPG (Rotary Pulse Generator) H
External Leveled Power Calibration Control G

The RPG provides control as selected by the keys below it (Power Sweep, Power Level, 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 HP 8350'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. CAL also controls RF power output in the UNLVLD PWR mode along with the front panel RPG.

A1 TROUBLESHOOTING

NOTE: The entire plug-in depends on the A3 Digital Interface assembly for control, address, and data signals. Before troubleshooting the A1 assembly, verify proper functioning of A3. See Overall Troubleshooting for verification procedures.

Visually inspect the cabling inside the plug-in for damage or loose connections. Check that the large ribbon cable connections (W10, P1 and P2) are properly seated over the correct pins on Motherboard A8J3 and A3 Digital Interface A3J1. Check that W5 ribbon cable connections are securely seated over A8J1 and A1J1.

Check power supplies to the front panel: +5V at A8XA3, pins 6 and 7. Then check continuity between these points and A8J1, pin 2.

Error Codes

Error codes E050 and E051 indicate a communication problem between the Front Panel assembly and the HP 8350 microprocessor. Code implications and further troubleshooting hints are discussed later, under the subheading "Keyboard".

Digital Display

The plug-in display can be directly commanded by the HP 8350 microprocessor using Hex Data Write (see "Operator-Initiated Tests," earlier in this section, 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 a defective flip-flop. Press HP 8350 **[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.

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 USC to the A3 Digital Interface assembly.

Then, check DIG1 through DIG4 lines for sequential low pulses. 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. Trace any problems back to U6.

To check for burned out display LEDs, make the key entry previously outlined, 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 "Operator-Initiated Tests" 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 indicators (dBm, dB/GHz, and dB/SWP), and UNLEVELED annunciator.

Use Hex Data Write as follows, to check annunciator control capability. Press HP 8350 **[CW]** and enter:

[SHIFT] [0] [0]	Hex Data mode
[2] [dBm dB] [0] [0]	Address location 2E00 (U9)
[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 (U8).

If these tests fail, remove the front panel assembly to expose the A1 assembly. Use Hex Data Rotation Write as follows:

[SHIFT] [0] [0]	Hex Data mode
[2] [dBm dB] [0] [0]	Address location 2E00 (U9)
[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, A7U6 on the Bias Assembly Board, which is disabled during retrace. Check that A7U6, pin 3, is high during forward sweep (approximately 4 Vdc), and low during retrace. The UNLEVELED light should be lit in the **[UNLVLD PWR]** mode and in the **[DET]** mode when the available power is insufficient for leveling to the desired reference level (typically several dB beyond specified maximum leveled power).

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 HP 8350 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 A1U6 (accessible at A1J1-25). 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 A1U6. 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 A1U6 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 8-6.

Table 8-6. 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
UNLVLD PWR	82	3	1
DET	80	3	2
MTR	81	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 A1U6.

No keycode is defined for Row 0 at Column 1 of Column 3. A problem in this area of the matrix may result in Error Code E051.

If this test indicates further troubleshooting, remove the front panel to make A1 accessible while connections between the front panel, plug-in, and mainframe are still intact. If the numerical display is blank, check power supplies on A1. Check U6, pin 3, for the 200 kHz SCAN CLK signal. If it is missing, trace the problem back through U5C to the A3 Digital Interface assembly.

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

[SHIFT] [0] [0]	Hex Data mode
[2] [MHz ms] [8] [0]	Address location 2d00 (U6)
[M4]	Hex Data Rotation Write

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

Check the COL0 through COL3 lines for sequential low pulses, as shown in Figure 8-10.

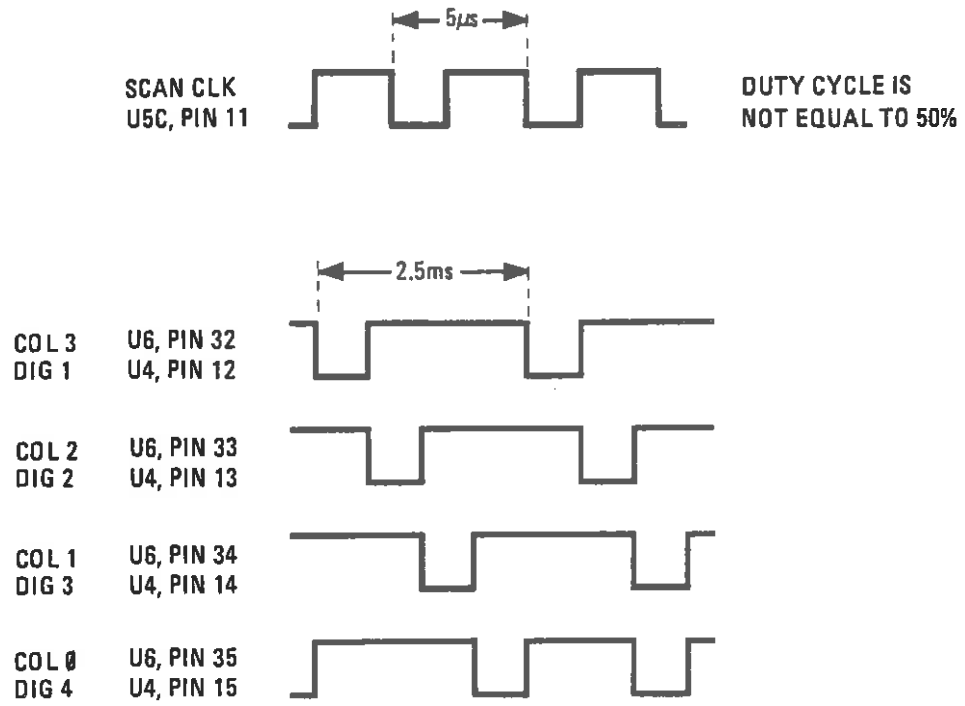


Figure 8-10. Column Strobing

If the patterns are absent, but the 200 kHz clock is present, the problem is probably U6. Ensure that problems in U5C or the A1 assembly are not tying the lines down.

If the column strobes are present, probe both the column and row lines 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, troubleshoot the keyboard matrix (Block F) 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 HP 8350 A1 Front Panel 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 HP 8350.

If the plug-in RPG appears to be dead, remove the bottom cover of the HP 8350 and probe A8J1, pins 6 and 8. Check for the waveforms shown in Figure 8-11, while slowly rotating the RPG. If the signals are present, trace the PIRPGA and PIRPGB lines through the HP 8350 to the mainframe A1 assembly. Refer to HP 8350 A1 Service Sheet for more information.

If the signals are absent in the plug-in, check for the +5V at A8J1, 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 8-11. If they are absent, check that the output leads aren't shorted to ground. If not, replace the RPG.

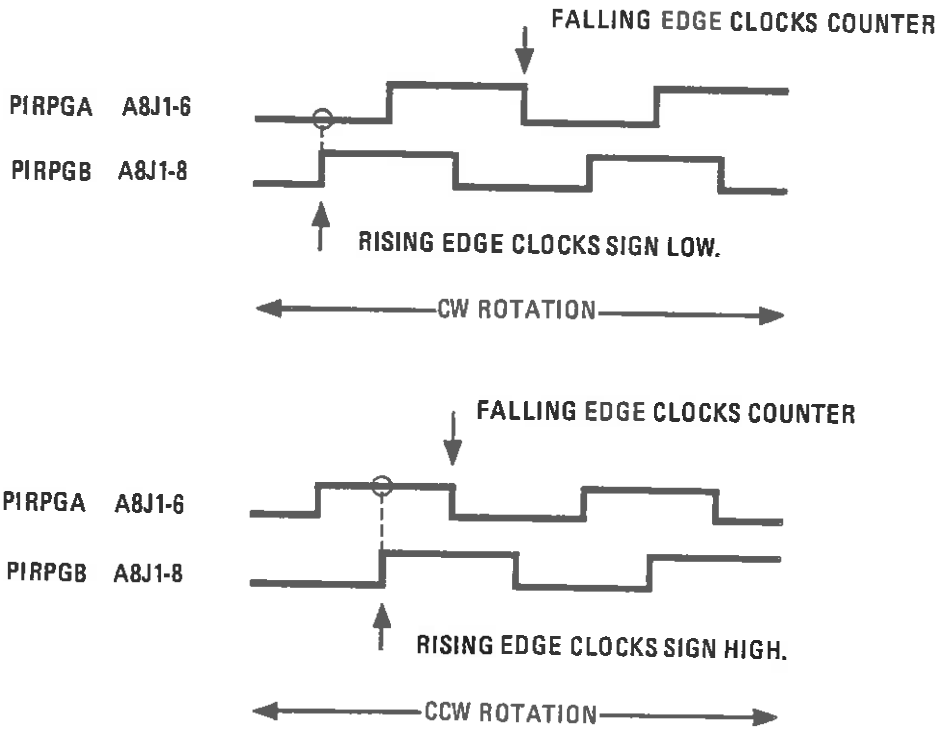


Figure 8-11. RPG Pulse Trains

Analog Circuitry

The EXT/MTR ALC CAL offset is generated by potentiometer A1R1 with the wiper running between +10 Vdc and −10 Vdc. If the signal is absent, check for the +10V and −10V supplies. If the offset voltage still cannot be produced, replace R1.

Table 8-7. A1P1 Pin-Outs

A1P1

PIN	SIGNAL	I/O	TO/FROM	BLOCK
1 23	L FP2 SCAN CLK	IN IN	A3P1-37 A3P1-38	A A
2 24	+5V L FP4	IN IN	A3P1-6,7 A3P1-26	I B
3 25	L FP1 FLAG	IN OUT	A3P1-15 A3P1-42	A A
4 26	PWON GND DIG	IN	P2-25	A I
5 27	BD0	IN	A3P1-31	A,B
6 28	PIRPGA	OUT	P2-60	H
7 29	BD1	IN	A3P1-9	A,B
8 30	PIRPGB	OUT	P2-61	H
9 31	BD2	IN	A3P1-32	A,B
10 32	UNLVLD	IN	A7P1-6	E
11 33	BD3	IN	A3P1-10	A,B
12 34	EXT CAL	OUT	A4P1-24, A7P1-24	G
13 35	BD4	IN	A3P1-35	A,B
14 36	+10V	IN	P1-8	I
15 37	BD5	IN	A3P1-13	A,B
16 38	−10V	IN	P1-13	I
17 39	BD6	IN	A3P1-36	A,B
18 40				
19 41	BD7	IN	A3P1-14	A,B
20 42	L FP3	IN	A3P1-16	B
21 43				
22 44	BA0	IN	A3P1-33	A