

Errata

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement business is now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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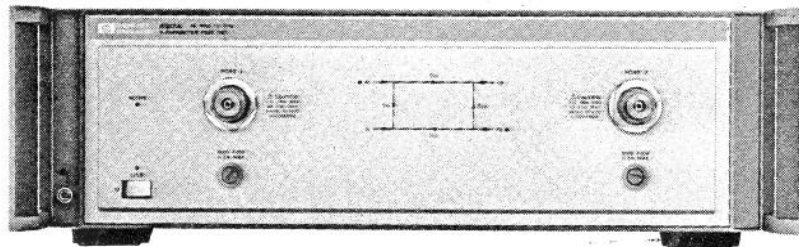
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OPERATING AND SERVICE MANUAL

HP 8517A S-PARAMETER TEST SET



 **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.

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

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

HP 8517A S-PARAMETER TEST SET

SERIAL NUMBERS

This manual applies to all HP 8517A test sets with serial number prefix 3032A and higher.

For additional information about serial numbers, refer to "Instruments Covered by Manual" in the General Information section.

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SAFETY CONSIDERATIONS

GENERAL

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

SAFETY SYMBOLS

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

Indicates hazardous voltages.

Indicates earth (ground) terminal.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed 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 auto-transformer 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 8517A S-PARAMETER TEST SET

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Chapter 1. General Information

HOW TO GET STARTED

This is the *Operating and Service Manual* for the HP 8517A S-parameter test set. This manual in conjunction with the HP 8510 network analyzer manual set provides all the information needed to properly configure your system and to make measurements.

First. Place this manual behind the tab titled "Test Sets" in the HP 8510 *Test Sets and Accessories Manual*. Read the chapters titled "General Information" and "Installation." These chapters include information on site preparation, unpacking and inspecting your instrument for damage, safety considerations, and configuring your test set to the HP 8510.

Second. Read the chapters of the *Microwave Connector Care Manual*, supplied with the HP 8510 manual set, that pertain to the care, cleaning, gaging, and connection of precision 2.4 mm devices. This information will help you make good connections and care for your precision devices. To maintain the performance of your test set and network analyzer system it is important to pay strict attention to the information provided in the *Microwave Connector Care Manual*.

Third. Read the chapter titled "Operation." This chapter will acquaint you with the front and rear panel features of your test set. Also included is information on controlling multiple test sets, using the anti-rotation clamps, and connecting devices to the test set.

The rest of the manual may be used as needed. The remaining chapters provide information on specifications, troubleshooting, replacement procedures, and parts.

VERIFYING THE TEST SET

The test set has been designed to operate specifically with the HP 8510 network analyzer.

- To check the proper operation of the test set, perform a system calibration as described in the HP 8510 *Operating and Programming Manual*. A successful calibration is an indication that the system and therefore the test set are operating properly.
- The specifications for the test set, and the system, may be determined by running the specification and performance verification software as described in the "Specification and Performance Verification" chapter in the HP 8510 *Service Manual*. Additional mechanical specifications and supplemental characteristics may be found in the "Specifications" chapter of this test set manual.
- To troubleshoot the test set, refer to the troubleshooting information in the HP 8510 *Service Manual* to determine if the test set is at fault. Then refer to the troubleshooting information in this manual to determine the faulty assembly.

ADDITIONAL EQUIPMENT REQUIRED

Additional equipment and accessories required for use with the test set are listed in Table 4-2. The table notes which items are required to verify the performance of the test set and which are required to operate it. Other equipment may be substituted if its specifications meet or exceed the specifications listed in the critical specifications column.

OPERATING AND SAFETY PRECAUTIONS

Operating



ATTENTION Static Sensitive

Handle only at Static Safe Work Stations

The assemblies in this test set are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

Otherwise, you need observe only the following normal precautions in handling and operating the test set:

Do **not** exceed the front panel operating level power input as noted:

Maximum Power Level	Test Port
+17 dBm	Port 1
+17 dBm	Port 2

Do **not** exceed +15 dBm source RF input level into the test set and under no circumstances ever apply a DC level to the source RF input of the test set.

Do **not** torque anything to the test port connector with greater than 90 N-cm (8 in-lb) of torque. The wrench supplied with your accessory kit is calibrated to 90 N-cm (8 in-lb).

Do **not** torque anything to the source RF input, on the back of your test set, with greater than 90 N-cm (8 in-lb) of torque.

Safety

The voltages in this test set warrant normal caution for operator safety. Nevertheless, service should be performed only by qualified personnel. Service strategy, troubleshooting procedures, replaceable parts, and similar information for the test set is in this manual or the HP 8510 service manual.

SPECIFICATIONS

The specifications of the test set with an HP 8510 network analyzer are defined in the "Specifications and Performance Verification" chapter of the HP 8510 manual.

CHARACTERISTICS

The performance parameters listed in the "Specifications" chapter in Table 4-1 are typical or nominal, but non-warranted characteristics of the HP 8510/8517A system.

RECOMMENDED EQUIPMENT

Item	Critical Specifications	Recommended Model	Use ¹
Network analyzer	no substitute	HP 8510B	O,P,T
Source		HP 83651A	O, P, T
Controller	no substitute	HP 9000 series 200 or 300 with 2 Mbyte RAM and HP BASIC 3.0 or higher or PCC-305 or PC-308 HP BASIC Controller with 2 Mbyte of Basic Language Processor RAM.	
Disk drive	compatible with controller		P
Multimeter	range: 0 to 50V	HP 3456A	T
Oscilloscope	50 MHz bandwidth	HP 1740A	T

1. O = operation
P = performance test
T = troubleshooting

Chapter 2. Installation

INTRODUCTION

This section explains how to install the test set. The topics covered include initial inspection, environmental considerations, positioning and connecting the test set for use, and packaging the instrument. Refer to the "Installation" chapter of the HP 8510 manual for more complete system connection and turn-on instructions.

INITIAL INSPECTION

Inspect the shipping container (including cushioning material) for damage. If it is damaged, keep it until you have checked the contents for completeness. Figure 2-1 illustrates the accessories supplied with the test set.

If the shipping container is damaged, perform the performance tests outlined in the HP 8510 manual set. If the test set fails the performance tests, or is damaged or defective, keep the shipping materials and notify both the carrier and the nearest Hewlett-Packard office. The HP office will arrange for repair or replacement of the test set without waiting for settlement of the claim. If any of the following accessories are not received with the test set, notify your nearest HP office and the missing parts will be sent to you.

ENVIRONMENTAL CONSIDERATIONS

Operation

To perform within specifications, the test sets should be operated in temperatures between 0°C and +55°C with relative humidity less than 95% (at 40°C dry bulb temperature, maximum). They may be operated at altitudes up to 4,500 meters (15,000 feet).

Storage

The test sets may be stored in temperatures from -40°C to +75°C, with relative humidity up to 90% at +65°C (maximum dry bulb temperature) and at altitudes up to 15,240 meters (50,000 feet).

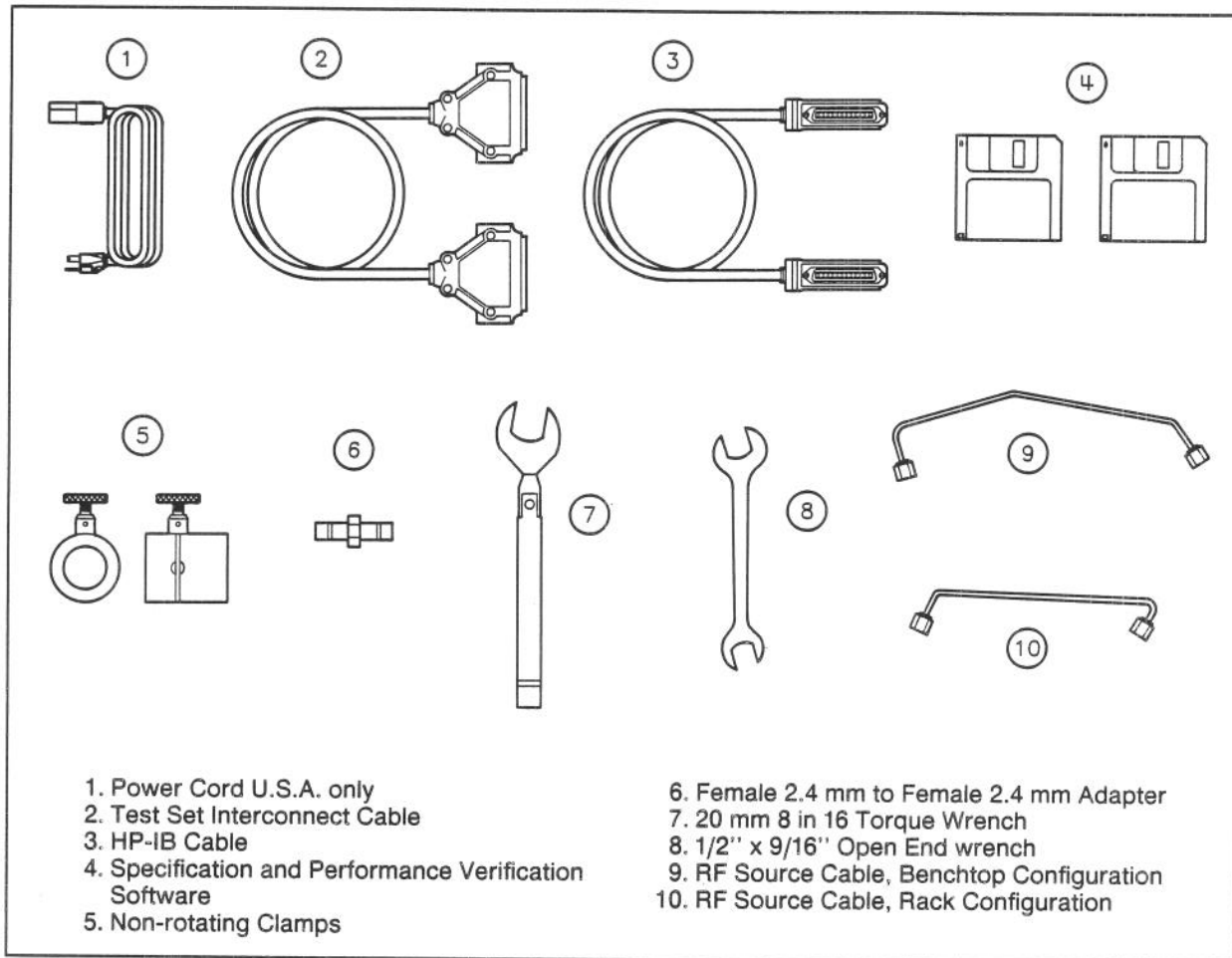


Figure 2-1. Accessories Supplied with the Test Set

STATIC-FREE WORKSTATION



ATTENTION Static Sensitive

**Handle only at Static Safe
Work Stations**

Assemblies in the test set are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

Always use an anti-static wrist strap when calibrating or verifying the test set or using the test set to measure devices. Never touch the test port center conductors

INSTALLING THE TEST SET IN A SYSTEM RACK

The recommended system rack is the HP 85043A. Instructions for rack-mounting the test set in a system configuration with the HP 8510 are provided in the "Installation" chapter of the HP 8510 on-site service manual and in the HP 85043A system rack manual.

To install the flanges to rack mount the instrument (with or without handles) in a standard 19 inch rack, refer to Figure 2-2.

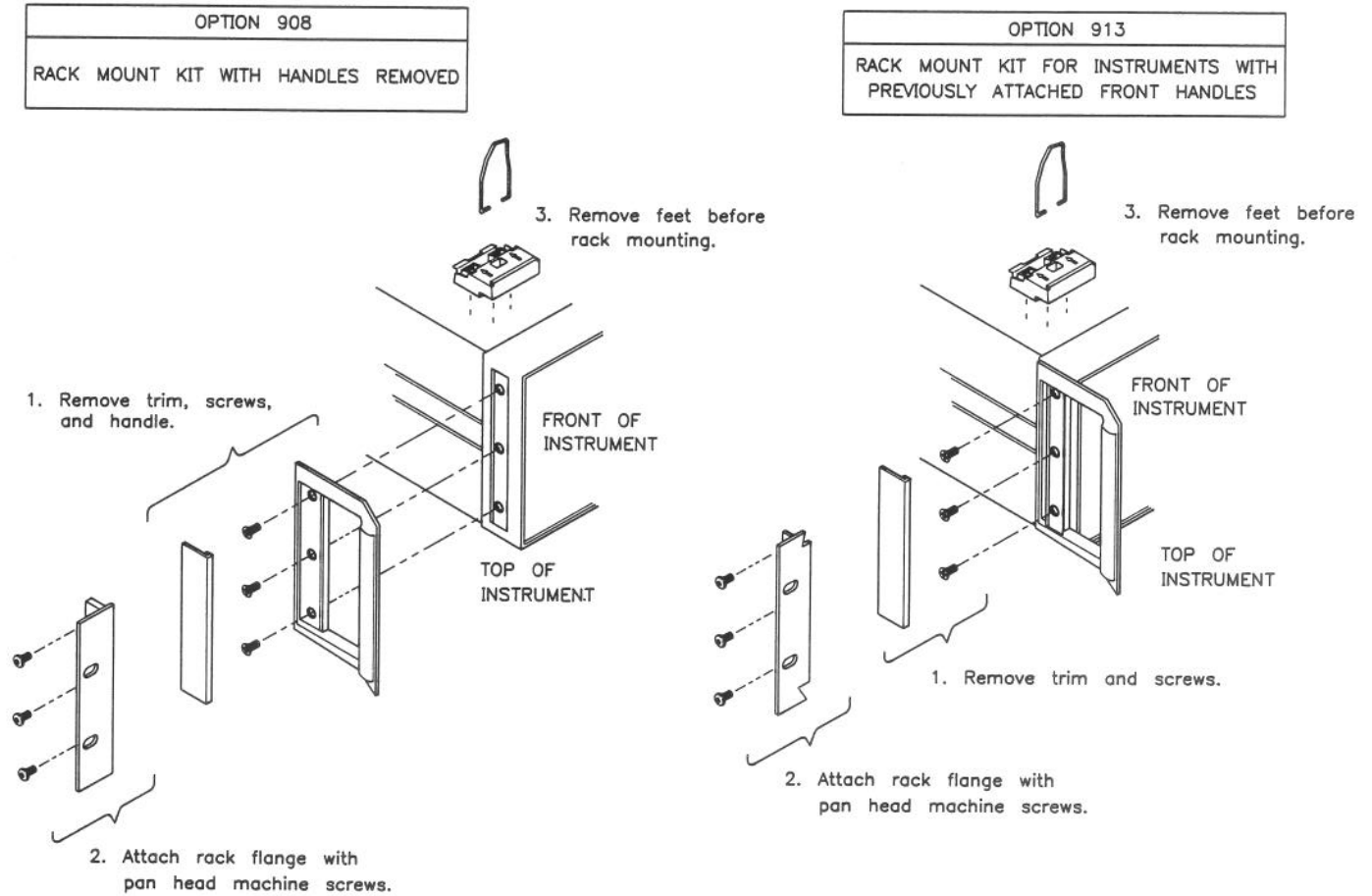


Figure 2-2. Attaching Rack-Mounting Hardware

INSTALLING THE TEST SET ON A BENCH

When installing the test set for use on a bench, place it on a grounded anti-static work surface (Figure 2-3) to lessen the chance of ESD damage. The antistatic surface should extend far enough in front of the test set to provide effective protection for the test ports and cable ends.

A grounding receptacle is provided on the test set as an alternate grounding point for your anti-static wrist-strap.

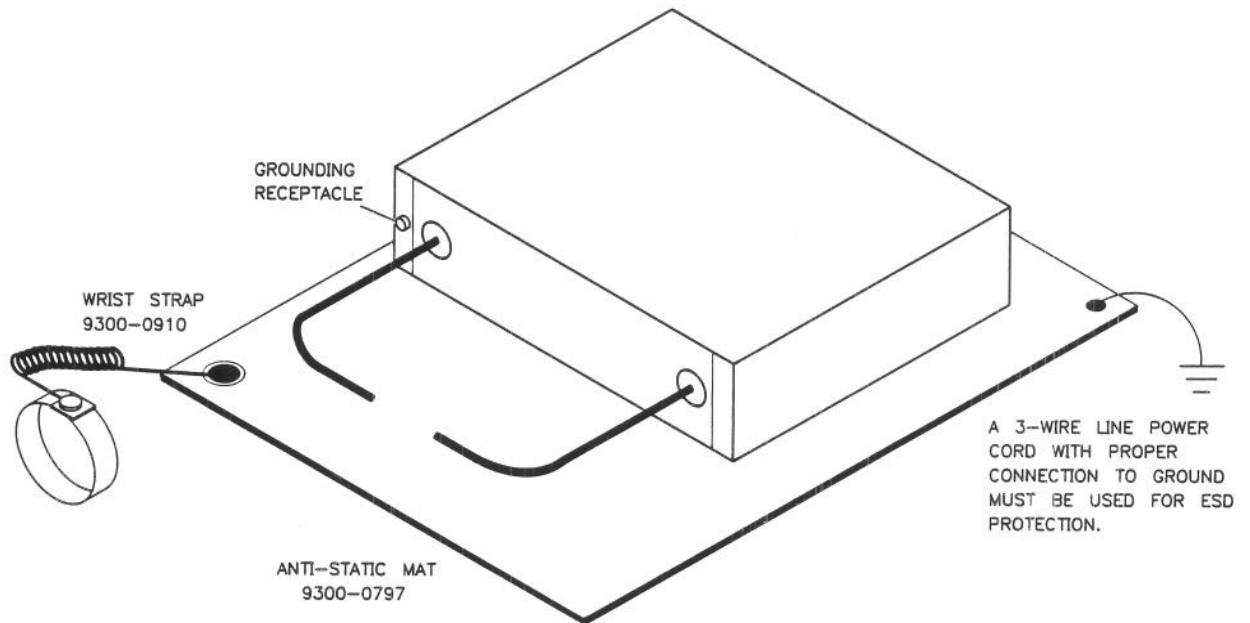


Figure 2-3. Recommended Static-Free Workstation

CONNECTING THE TEST SET IN A SYSTEM CONFIGURATION

Figure 2-4 illustrates the cable connections in a system configuration. Follow the instructions in the paragraphs below.

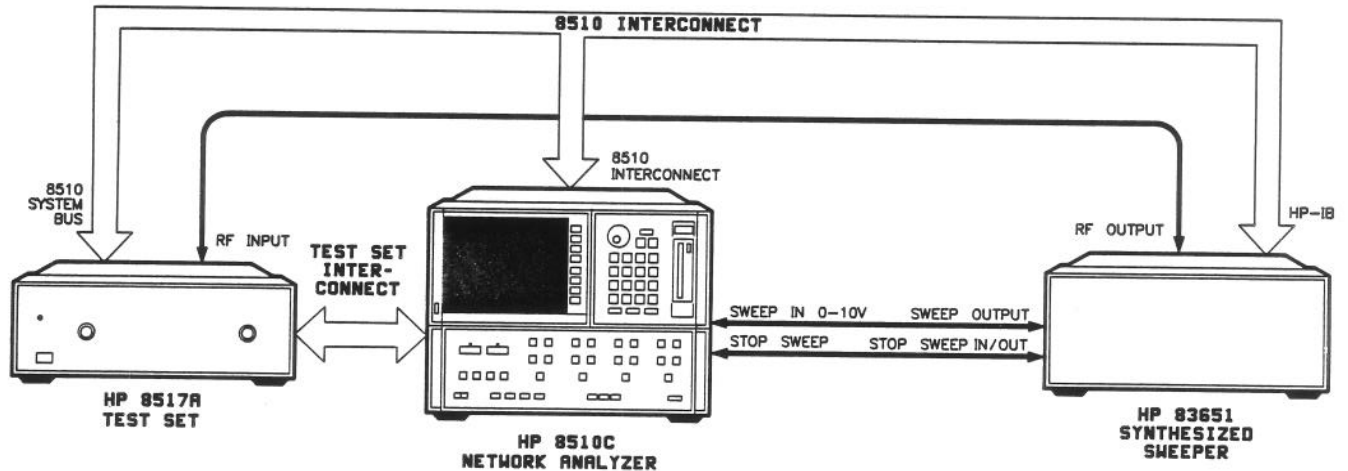


Figure 2-4. HP 8517A System Connections

Power and Control Connections

Make sure the line module is set to the correct voltage. For information on changing the voltage selection or replacing the line fuse refer to the "Troubleshooting" chapter of this manual. Connect the test set power cord to an electrical outlet

Connect the test set IF interconnect cable from the J11 TEST SET INTERCONNECT connector on the rear panel of the test set to the J1 TEST SET INTERCONNECT connector on the rear panel of the HP 85102 IF detector.

Connect the system bus cable from the test set J12 HP 8510 SYSTEM BUS connector to the HP 8510 INTERCONNECT connector of the HP 85101 display/processor. The test set IF interconnect cable and the system bus cable transmit control signals between the test set and the network analyzer.

Signal Path Connections

The IF signals from the test set are transmitted to the HP 85102 IF detector by the test set IF interconnect cable (see above).

Connect the RF output from the rear panel of the source to the RF input of the test set, using the 2.4 mm RF cable supplied with the test set.

Test Port Connectors

Ports 1 and 2 are NMD-2.4 mm connectors, and mate with precision 2.4 mm female connectors

Anti-Rotation Clamps

Use these clamps to stabilize the test port/RF cable connection. Connect the test port cables to the test ports and torque them to 72 N-cm (8 in lb). Loosen the anti-rotation clamp thumb screw sufficiently to slip the clamp over the cable and up to the front panel. The clamp end with the flats should come to rest on the flats of the test port shoulder. Finger-tighten the thumb screws to prevent further loosening or tightening of the test port/RF cable connection. More detail is given in the "Operation" chapter.

The internal O-ring (HP part number 0900-0007) is field replaceable without disassembling the anti-rotation clamp. When it no longer holds the RF cable securely, pry it out with fine tweezers or a similar tool. Insert the new O-ring by engaging one side of it in the slot of the phenolic clamp donut. Use your fingers to push the O-ring all the way into the slot.

PACKAGING

If reshipping is required, the test set should be repackaged in the original factory package. Containers and materials identical to those used by the factory are available through Hewlett-Packard offices.

Alternatively, comparable packaging materials may be used. Wrap the test set in heavy paper or anti-static plastic. If shipping to an HP office or service center, complete and attach a service tag (in the HP 8510 manual set). Use sufficient shock absorbing material on all sides of the test set to provide a thick, firm cushion and prevent movement. Seal the shipping container securely and mark it **FRAGILE**.

In any correspondence with HP, refer to the test set by full model and serial number.

Chapter 3. Operation

INTRODUCTION

This section illustrates the features and functions of the front and rear panels of the test set, and describes the multiple test set option (option 001). It explains the setup and use of one or more test sets in a system.

FRONT PANEL FEATURES

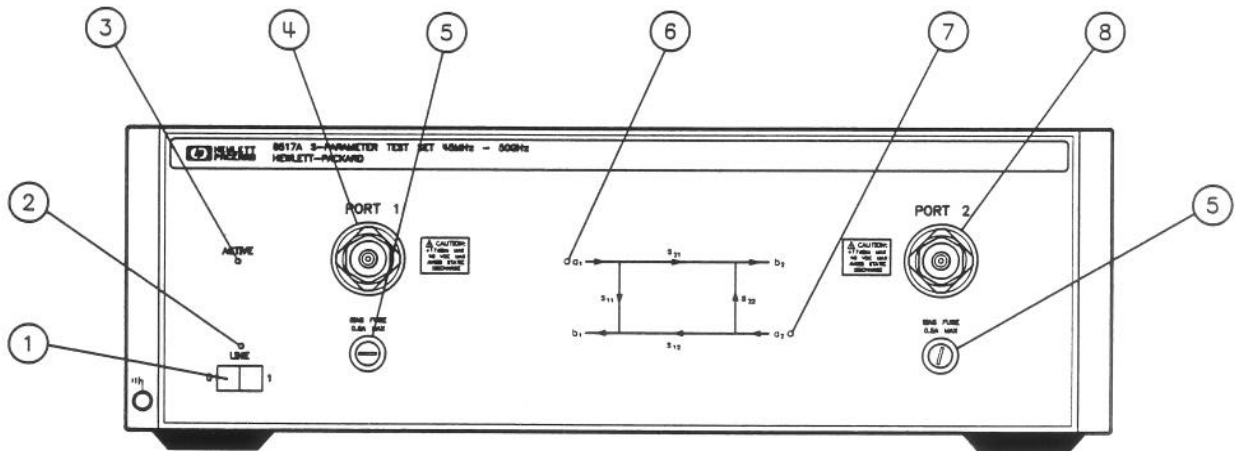


Figure 3-1. Front Panel Features of the Test Set

1. **Line Switch.** This switch turns the test set on and off. When the side of the switch labeled 0 is depressed, the test set is off; 1 is on.
2. **Line LED.** This LED goes on and off with the test set line switch.
3. **Active LED.** This LED lights about two seconds after power is turned on, following the successful conclusion of self-test. If the test set is used with other test sets (option 001) and is not addressed by the HP 8510, then this light remains off.
4. **Port 1.** This test port transmits RF energy from the source to the DUT and receives reflected or transmitted RF energy from the DUT. The reflected RF energy is coupled to a sampler within the instrument. Connections made to this input must be torqued no more than 90 N-cm (8 in-lb).

5. **Bias Fuse.** The fuses that limit bias applied to ports 1 and 2 are in these holders (see the instrument front panel or the replaceable parts list for the fuse values).
6. **a1 LED.** This LED indicates that the test set is internally switched to the S_{11} or S_{21} mode and source power is switched to port 1.
7. **a2 LED.** This LED indicates that the test set is internally switched to the S_{22} or S_{12} mode and source power is switched to port 2.
8. **Port 2.** This test port transmits RF energy from the source to the DUT and receives reflected or transmitted RF energy from the DUT.

REAR PANEL FEATURES

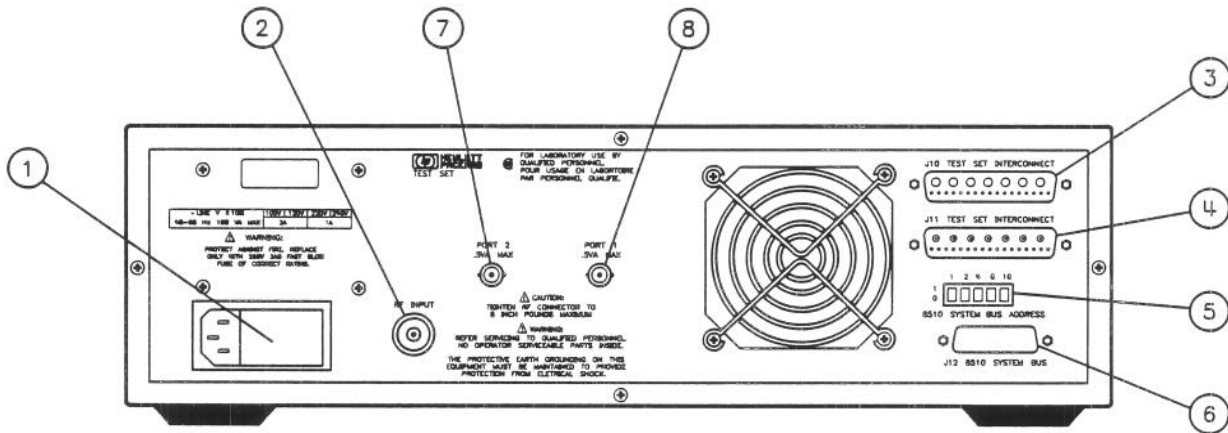


Figure 3-2. Rear Panel Features of the Test Set

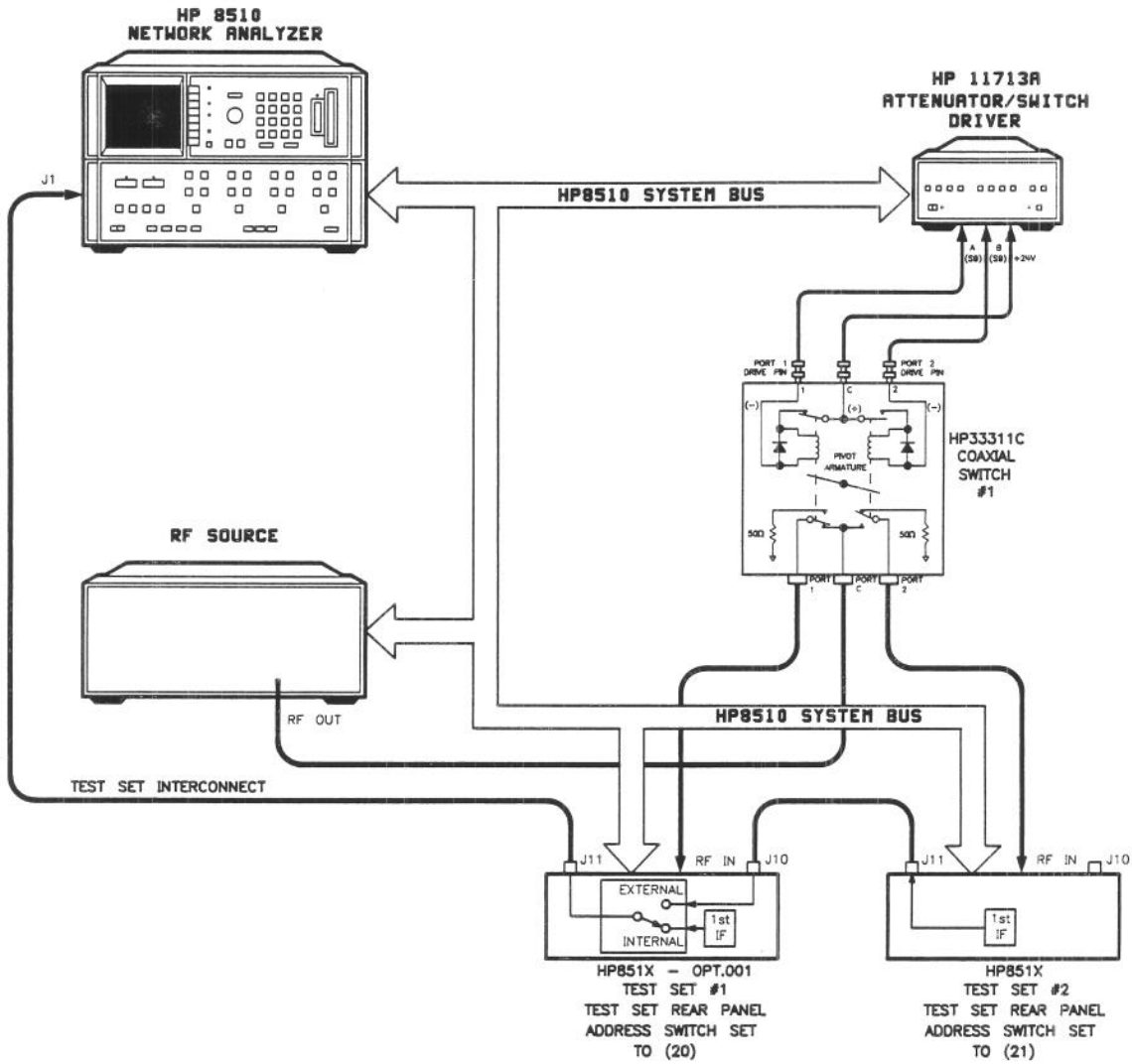
1. **Line Module.** This assembly houses the line cord connector, line fuse and line voltage selector. Pull out the right side of the line module cover to replace or change the fuse or to change the voltage selection. The voltage selector drum must be removed to rotate it to a different voltage setting. Recommended fuse values are printed on the rear panel.
2. **RF Input.** This 3.5 mm connector receives RF energy from the source. Connections made to this input must be torqued no more than 90 N-cm (8 in-lb).
3. **J10 Test Set Interconnect.** This connector is used only in test sets with option 001. It allows connecting another test set to the option 001 test set. Up to four test sets can be serially connected to the analyzer. The HP 8510 system automatically selects the IF output from the chosen test set for processing and display. Refer to "Controlling Multiple Test Sets" in this chapter for more information.

4. **J11 Test Set Interconnect.** This connector transmits the IF signal from the test set to the HP 85102 IF detector. It also transmits control signals bidirectionally.
5. **HP 8510 System Bus Address Switch.** This five-pole binary-weighted switch sets the system bus address of the test set. The binary weight of each pole is indicated on the rear panel, as are the on and off positions. Decimal twenty (off-off-on-off-on, from left to right) is the default setting.
6. **J12 8510 System Bus Connector.** This connector is used for HP-IB communications with the HP 85101 display/processor.
7. **Port 2 Bias.** This female BNC connector is used to supply bias through the center conductor of port 2 to active devices under test.
8. **Port 1 Bias.** This female BNC connector is used to supply bias through the center conductor of port 1 to active devices under test.

CONTROLLING MULTIPLE TEST SETS

Option 001 for the HP 851X-series test sets allows an HP 8510 to alternately control up to four test sets. While a measurement is proceeding on test set number 1, which is equipped with option 001, a test device can be connected to test set number 2, which does not need to be equipped with option 001. When the measurement on test set number 1 is complete, then the HP 8510 can control test set number 2.

In a standard test set, the 20 MHz IF and control signals are applied directly to J11 TEST SET INTERCONNECT, which connects to the HP 8510. Option 001 adds a set of IF switches, control switches, and the J10 TEST SET INTERCONNECT connector. This allows the selection of 20 MHz test set IF signals. As shown in Figure 3-3, test set number 1 can apply its IF to the HP 8510 or it can switch to pass the IF from test set number 2 through the J10 TEST SET INTERCONNECT to the HP 8510.



- NOTE:**
1. Not all system connections are shown.
 2. In dual source configurations, the second can be multiplexed in a similar manner. If only one dual source test set is used, the second source can be directly connected to the appropriate test set.

HP 33311C Coaxial Switch Positions with Two Test Sets

New ADDRESS of Test Set	Test Set Selected	HP 33311C Coaxial Switch Port Selected
20	1	Port 1
21	2	Port 2

Figure 3-3. RF and IF Switching with Two Test Sets

TEST SET CONNECTIONS

Set each test set rear panel address switch to the address listed in Figure 3-3 for a dual test set configuration, or Figure 3-4 if configuring more than two test sets. Use the supplied test set interconnect cable to connect test set number 1 J11 to the analyzer. Use the supplied test set interconnect cable to connect test set number 2 J11 to test set number 1 J10. You may continue to connect in series up to four test sets if the total length of all test set interconnect cables does not exceed 13 meters (about 40 feet). The last test set in the chain does not require option 001.

If the RF coaxial switch is not incorporated into the system, the RF input to the test set must be manually switched to the active test set.

INITIALIZATION AT POWER-UP

Upon power-up, the IF switches must be configured so that only one system test set is active. The following procedure shows how to make one test set active:

1. Check the active lights of all system test sets.
2. Check the analyzer's expected test set address by pressing **(LOCAL) [TEST SET]**. The display should match the address of the desired test set. If not, change the address on the analyzer.
3. If unselected test sets are active (active light on), deactivate the test set by temporarily addressing it. Then return to the desired address.

SELECTING A TEST SET

Test Set IF Switching

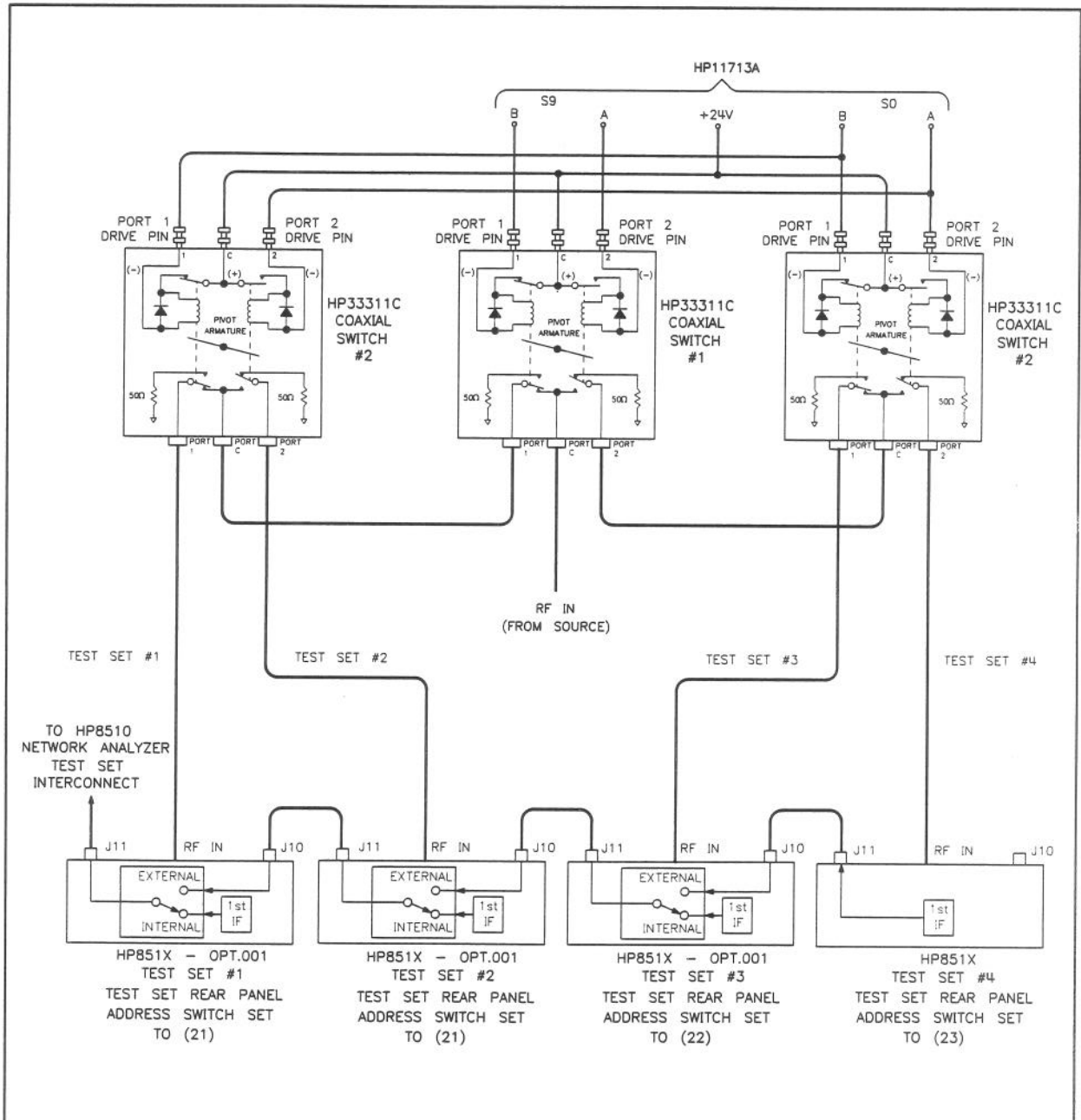
The active test set is selected by the built-in capability of the analyzer to generate an addressed command to the test set. Each time the HP 8510 **[ADDRESS of TEST SET]** function is changed (see **(LOCAL)** Menu), the analyzer switches the previously addressed test set IF to external and the newly addressed test set IF to internal. The test set front panel ACTIVE indicator shows the test set status. When the test set is active the IF signals from the test set are applied directly to J11 TEST SET INTERCONNECT. When the test set is inactive the IF signals appearing at J10 are passed through to J11 and on to the next test set or the analyzer.

Test Set Address

The address of the test set can be changed manually from the analyzer front panel by selecting the **[ADDRESS of TEST SET]** function, then entering the address of the test set and pressing **(x1)**; or it can be changed under program control using the analyzer's HP-IB ADDRTESS; command. The HP-IB address of a particular test set is set by address switches on the test set rear panel.

RF Switch Driver Commands

A related feature of the analyzer is that when the HP 8510 **[ADDRESS of TEST SET]** function is changed, a code sequence is automatically issued over the HP 8510 system bus to the device at the **[ADDRESS of RF SWITCH]**. In the recommended configuration, this device is an HP 11713A attenuator/switch driver which in turn controls one or more HP 33311C coaxial switches. As shown in Figures 3-3 and 3-4, these switches are used to select which of the test sets receives the RF output of the network analyzer source. The exact command issued depends upon the new value of the **[ADDRESS of TEST SET]** function, also shown in Figures 3-3 and 3-4.



- NOTE:**
1. Not all system connections are shown.
 2. In dual source configurations, the second can be multiplexed in a similar manner. If only one dual source test set is used, the second source can be directly connected to the appropriate test set.

HP 33311C Coaxial Switch Positions with Four Test Sets

New ADDRESS of Test Set	Test Set Selected	HP 33311C Coaxial Switch Port Selected	
		Switch #1	Switch #2
20	1	Port 1	Port 1
21	2	Port 1	Port 2
22	3	Port 2	Port 1
23	4	Port 2	Port 2

Figure 3-4. RF and IF Switching with Four Test Sets

MEASUREMENT CALIBRATION

After selecting the active test set, perform the system calibration procedure as usual. When you select a different test set, make sure that you recall the cal set that applies to **that** test set.

NOTE: Since the cal set limited instrument state does not include the number of the active test set, a cal set which does not apply to the current test set can be turned on without any HP 8510 caution messages appearing. This will cause errors in the displayed data because incorrect error coefficients are applied to the measured data.

It may be convenient to store a hardware state file and an instrument state file for each combination of test set and cal set. You may also store your hardware state file on a tape or disk for future use. To change the configuration, simply recall the appropriate hardware state file, which sets the address of test set and issues the RF switch command, and then the appropriate instrument state file which recalls the cal set.

OPERATIONAL CHECKS

To check operation of a multiple test set configuration, first connect a device with a known response at test set number 1, then press HP 8510 (LOCAL) [TEST SET], [ADDRESS of TEST SET], enter the address of test set number 1 (this would be 20), then press (x1). The test set number 1 measurement should appear. Press (DISPLAY) [DATA→MEMORY] [DISPLAY: DATA and MEMORY] to store the trace for later comparison. Now use [ADDRESS of TEST SET] to select test set number 2, then switch back to test set number 1. Observe any difference in the response between the stored trace and the result after switching back and forth between the test sets. Repeat for each of the test sets. Any difference in the data believed due to the option 001 IF switch or RF switching must be investigated: refer to the "Troubleshooting" chapter.

PERFORMANCE VERIFICATION

Standard system performance verification procedures are used to verify the operation of the option 001 test set as test set number 1. To verify the performance of another test set in the chain, select it as the active test set and proceed as usual. Refer to the HP 8510 "On-Site Service Manual" for the performance verification procedure.

CABLE AND ANTI-ROTATION CLAMP INSTALLATION

Anti-rotation clamps are used to secure the RF connections at the test ports of several Hewlett-Packard test sets. When installed, each clamp holds the large nut that secures the test set RF port connector to the front panel, and the RF cable connector or the front panel adapter mated with the port connector.

Without the clamps, the test port connections may become loose when the device under test is moved, and could invalidate calibrations and measurements.

NOTE: Although the anti-rotation clamps may be used with front panel adapters, these instructions refer to an installation using HP RF cables. Adapter installations will be similar.

1. Two anti-rotation clamps are included in the test set accessories box. Remove one from the box and loosen the thumbscrew until it is almost out of the counter-bored hole in the clamp body.

Gently push the clamp (round-hole end first) over and past the RF cable connector you will connect to the test set RF port. The rubber O-ring in the round end of the clamp will fit tightly over the connector. Wiggle the clamp if necessary to get it over the connector.

Connect the cable to the test port and tighten as specified in the cable manual. Make sure that you do not twist the cable as you attach it to the test port. Use the torque wrench supplied with your calibration kit to tighten the cable to no more than 90 N-cm (8 in-lb).

2. Important! The test set RF connector is easily loosened, so hold the RF cable throughout the rest of this procedure. Do not allow the cable to rotate.
3. See Figure 3-5. Turn the clamp so that the thumbscrew is pointing up. From there, turn the clamp to visually align the clamp flats with the flats on the test port connector nut. This will minimize rotating the connector in the next step.

NOTE: The flats may be in any orientation with respect to the front panel.

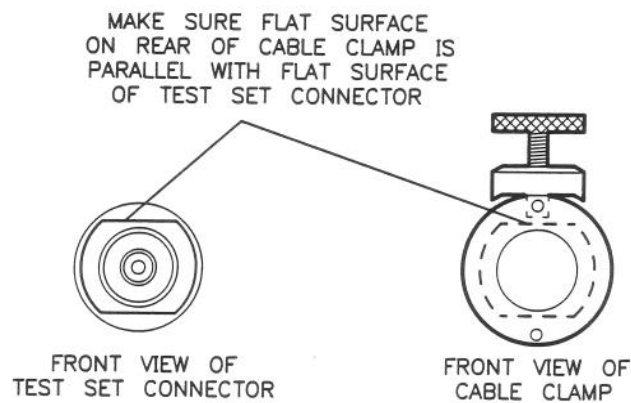


Figure 3-5. Visually Aligning Clamp and Nut Flats

- See Figure 3-6. Hold the cable with one hand, and with the other press the clamp gently and steadily while wiggling the clamp straight over the RF connector and onto the test port connector nut. The internal flats in the clamp must fit over the flats on the test port connector nut. Try not to rotate the clamp as you do this or the RF connection may be loosened.

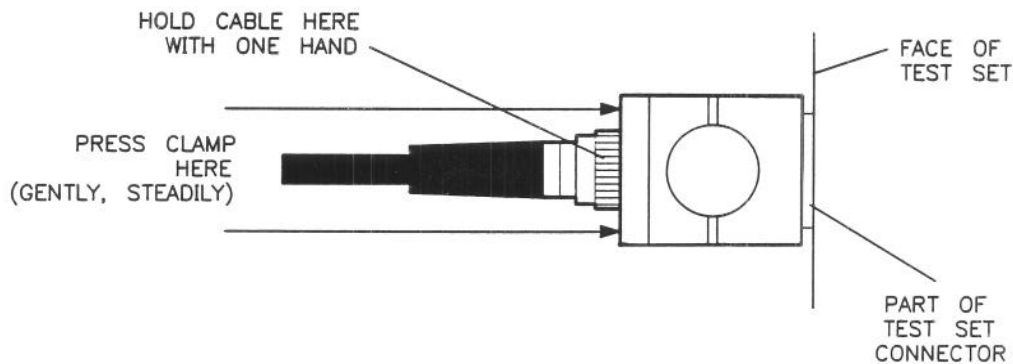


Figure 3-6. Mating the Clamp and Nut Flats

- See Figure 3-7. Make sure that the thumbscrew is aligned with the counter-sunk hole in the clamp body. Push the clamp toward the test set front panel and then tighten the thumbscrew with your fingers. The cable cannot be damaged by tightening the thumbscrew too tightly.

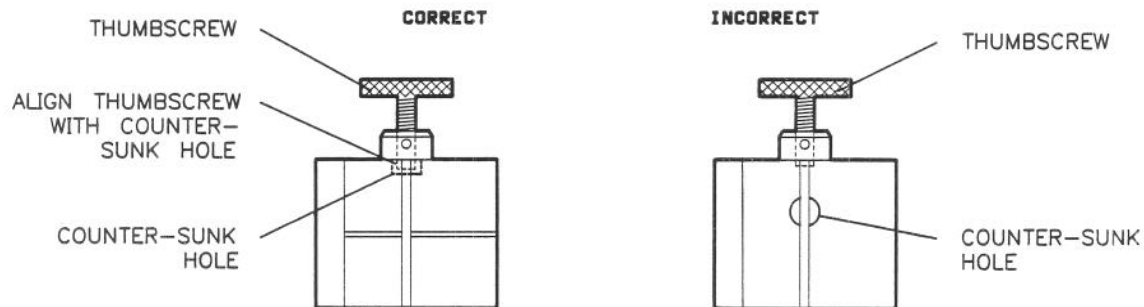


Figure 3-7. Aligning the Thumbscrew With the Counter-bored Hole

- Repeat steps 1 through 5 for the other clamp.

This completes the anti-rotation clamp installation procedure. Refer to the "Replacement Procedures" chapter for instructions to replace the internal O-ring in the anti-rotation clamp.

Chapter 4. Specifications

INTRODUCTION

Specifications describe the warranted performance of the instrument. The electrical specifications of the test set with an HP 8510 network analyzer are defined in the "Specifications" section of the HP 8510 Service Manual.

MECHANICAL SPECIFICATIONS

Table 4-1. HP 8510/8517A Mechanical Specifications

Test Ports	
Connector type:	NMD-2.4 mm
Center Pin Recession:	+0.00256 mm to +0.0127 mm +0.0001 in to +0.0005 in

NOTE: Refer to your calibration kit manual for information on how to use your gages.

SUPPLEMENTAL CHARACTERISTICS

The supplemental characteristics listed in the following tables are intended to provide information useful in applying the instrument by giving typical, but non-warranted, performance parameters.

Table 4-2. HP 8510/8517A Supplemental Characteristics

Test Ports (Front Panel)	
Connector type:	precision 2.4 mm male
Connector torque:	90 N-cm (8 in-lb) maximum
Impedance:	50 Ohms nominal
DC bias:	500 mA, 40 Vdc, maximum
Damage input level:	
Port 1:	17 dBm CW RF
Port 2:	17 dBm CW RF
Nominal operating power level:	-10 dBm \pm 5 dBm
Nominal connector nut size:	20 mm
Recommended torque:	90 N-cm (8 in-lb)
RF Connectors (Rear Panel)	
Connector type:	precision 3.5 mm female
Connection torque:	90 N-cm (8 in-lbs), maximum
Damage input level:	15 dBm. Note: this must be AC coupled.
User 1 power levels for reference channel phase lock:	
Minimum:	-45 dBm
Maximum:	-10 dBm
Nominal connector nut size:	8 mm
Recommended torque:	
	90 N-cm (8 in-lb) for precision 3.5
mm	
	56 N-cm (5 in-lb) for SMA

Table 4-3. HP 8517A Power Requirements and Physical Characteristics

Operating temperature:	0°C to 55°C
Power:	110, 120, 220 or 240 Vac \pm 10%; 47 to 66 Hz line frequency
Dimensions:	460 mm H x 133 mm W x 609 mm D (18.1 x 5.25 x 24 inches)
Weight:	15 kg (35 lb) net

Chapter 5. Test Set Troubleshooting

INTRODUCTION

The troubleshooting strategy for the HP 8517A S-parameter test set is a systematic sequence of procedures. This troubleshooting information is used after system-level troubleshooting has pinpointed the test set as the problem instrument. Use the following troubleshooting flowchart (Figure 5-2) to identify the faulty assembly. The troubleshooting flowchart is keyed to numbered, individual troubleshooting procedures. As you progress through the flowchart, perform the numbered procedure associated with each block. Block diagrams are provided at the end of this section to assist in understanding the operation of the test set.

THEORY OF OPERATION

The RF paths for port 1 and port 2 are similar. Source power, as applied to test port 1, will be the case discussed in detail, as if S_{11} and S_{21} is being measured.

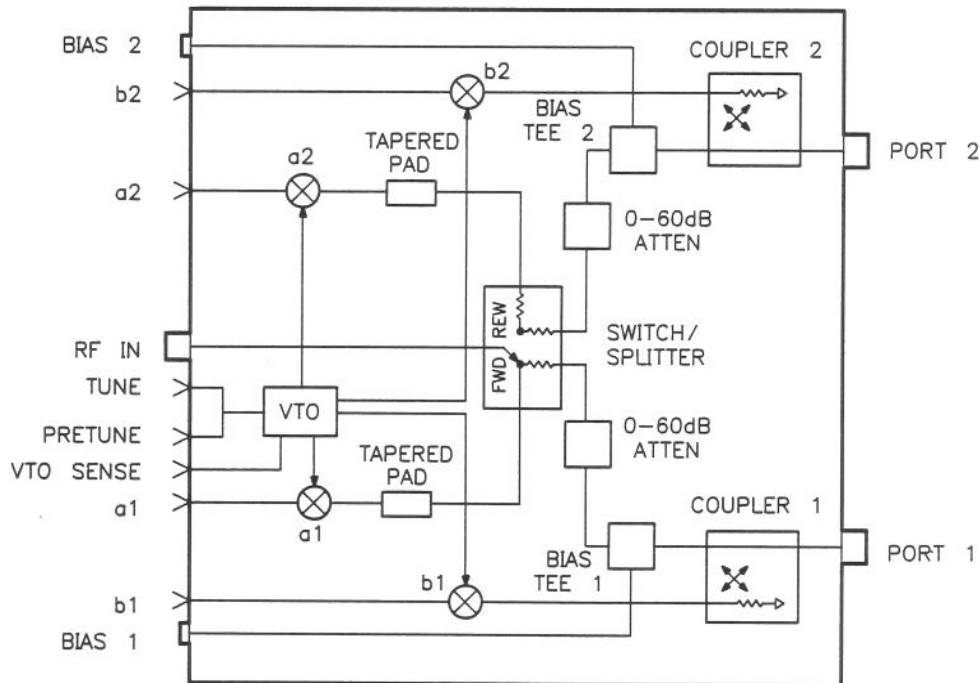


Figure 5-1. Simplified RF Block Diagram

The RF power from the source enters the test set on the rear panel. The RF is then applied to the switch/splitter where it is attenuated by approximately 7 dB. The switch/splitter is a combination of two power splitters and a solid state switch. The switch/splitter receives its control signals from the attenuator/switch driver board. The switch selects the power splitter to be used and, therefore, the test port that will receive the RF power from the source. LEDs on the front panel indicate which test port is currently active.

The **reference signal** is routed from the switch/splitter through a 20-7 dB tapered pad to compensate for the line losses. The signal is then applied to the a1 sampler assembly where it is down-converted to a 20 MHz intermediate frequency. Because the RF power is being applied to port 1, the a1 IF signal is used to phase lock the network analyzer. Had the RF power been applied to port 2, the a2 IF signal would have been used to phase lock the network analyzer.

The **test signal** is routed from the switch/splitter to a 60 dB programmable attenuator. The signal may then be attenuated in 10 dB steps or passed through without attenuation to the port 1 bias tee. A bias supply can be connected to the port 1 bias input, on the rear panel of the test set, to supply a DC voltage to the bias tee. The RF rides on this DC level and is used to bias on active devices so their S-parameters can be measured. Through the bias tee the test signal is routed to the directional coupler, where the incident RF power is applied to the device under test. The signal reflected back from the DUT is separated from the signal incident to the DUT by the port 1 coupler. This reflected signal exits the coupler and is applied to the b1 sampler where it is down-converted to a 20 MHz IF signal. The measured S_{11} is then the ratio of the two IF signals out of samplers a1 and b1. The incident signal is transmitted through the DUT, port 2 coupler and into the b2 sampler where it is down-converted to a 20 MHz IF signal so S_{21} will be measured as the ratio of IF signals from samplers a1 and b2.

The samplers can be turned on and off depending on the parameter currently being measured. This switching is controlled by a microprocessor on the HP-IB board. The default condition (test set power on with no HP-IB commands sent by the network analyzer) is for the test set to be active with the RF applied to port 1. If the test set is equipped with option 001 (test set multiplexing) it will come up inactive. That is, rather than using the internal IF of the test set, a switch is set in the test set to accept an IF from another test set.

The LO generated by the VTO/driver is phase locked to the source so that the desired VTO harmonic is 20 MHz greater than the source frequency. The phase-locked loop includes portions of the test set (VTO summing amp board, VTO/driver, and a1 sampler assembly) and the HP 8510.

The VTO summing amp board provides the control voltages that tune the VTO to the correct LO frequency. It also has an output LENDRA (Low END of Range) that is sent to the HP 85102 over the test set interconnect cable. This provides an indication to the network analyzer whether or not the VTO is in its normal operating frequency range. Should the VTO exceed its normal frequency range, the network analyzer will respond by displaying the running error message "VTO OVER RANGE."

STATIC PRECAUTIONS



ATTENTION
Static Sensitive

**Handle only at Static Safe
Work Stations**

The assemblies handled in these troubleshooting procedures are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

TROUBLESHOOTING SEQUENCE

A flowchart of the troubleshooting sequence is illustrated below. Use this flowchart and the procedures in the following pages to determine the faulty assembly.

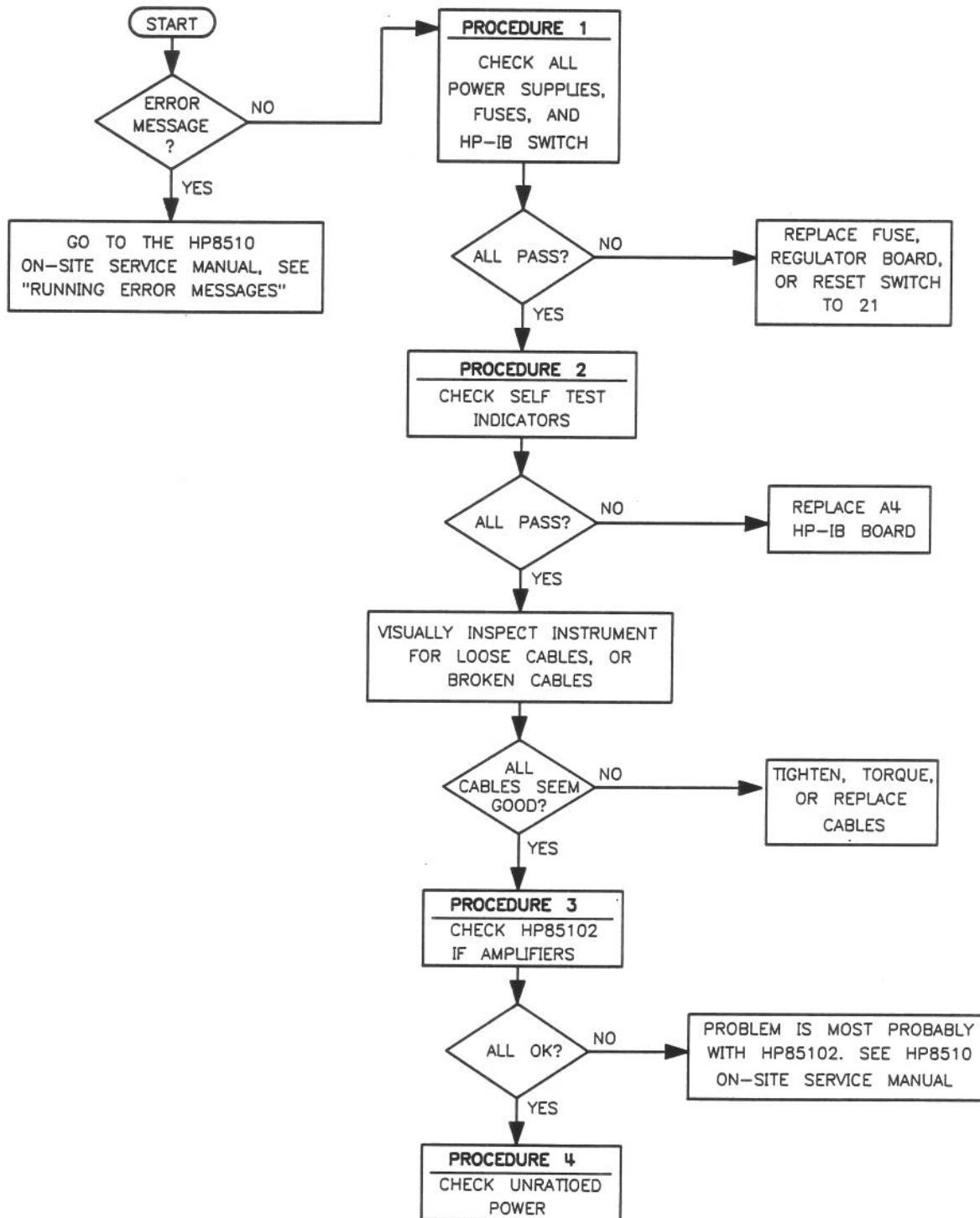


Figure 5-2. Troubleshooting Flowchart

EQUIPMENT NEEDED BUT NOT SUPPLIED

The following equipment is needed to troubleshoot your instrument. It is not supplied with the instrument.

Equipment	HP Part Number
1 point pozidriv screwdriver	8710-0899
2 point pozidriv screwdriver	8710-0900
Service adapter	85105-60210
5/16 in. torque wrench	8710-1655
Oscilloscope	HP 1740A

TROUBLESHOOTING PROCEDURES

PROCEDURE 1. A15 REGULATOR HP-IB ADDRESS SWITCHES FUSE LOCATIONS

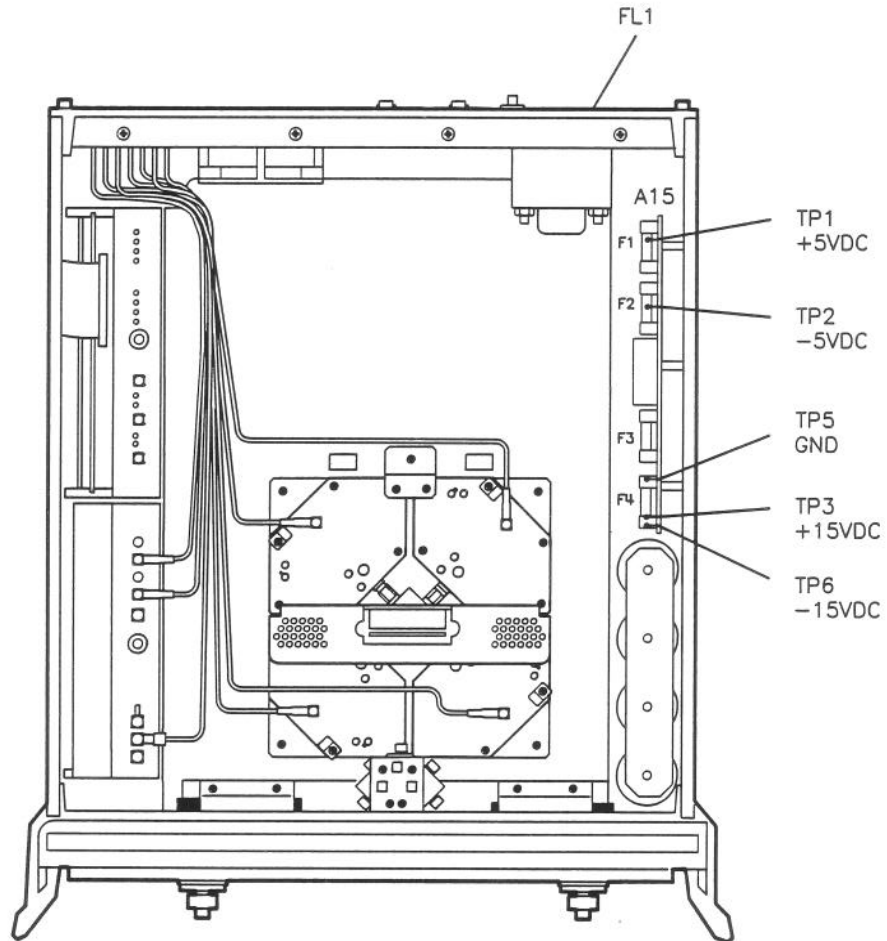


Figure 5-3. Power Supply Fuses and Test Points

A15 Primary Regulator Board Assembly

Use a digital voltmeter to check the voltages and an oscilloscope to check the ripple in Table 5-1.

Table 5-1. Power Supply Voltages

Nominal Voltage	Test Point	Voltage Range	Maximum Ripple Peak to Peak
+5.05 Vdc	A15TP1	+4.75 to +5.25	2 mv
-5.20 Vdc	A15TP2	-4.90 to -5.50	2 mv
+14.85 Vdc	A15TP3	+14.10 to +15.60	2 mv
-14.85 Vdc	A15TP6	-14.10 to -15.60	2 mv

HP-IB Address Switch

Set the switch as indicated in Figure 5-4 (the dark side of the switch is depressed). The HP-IB address switch is on the instrument rear panel. It is easy to access but need not be changed unless the error message "SYSTEM BUS ADDRESS ERROR" is displayed on the HP 8510 screen. Decimal twenty, binary 00101 (off, off, on, off, on) is the default setting.

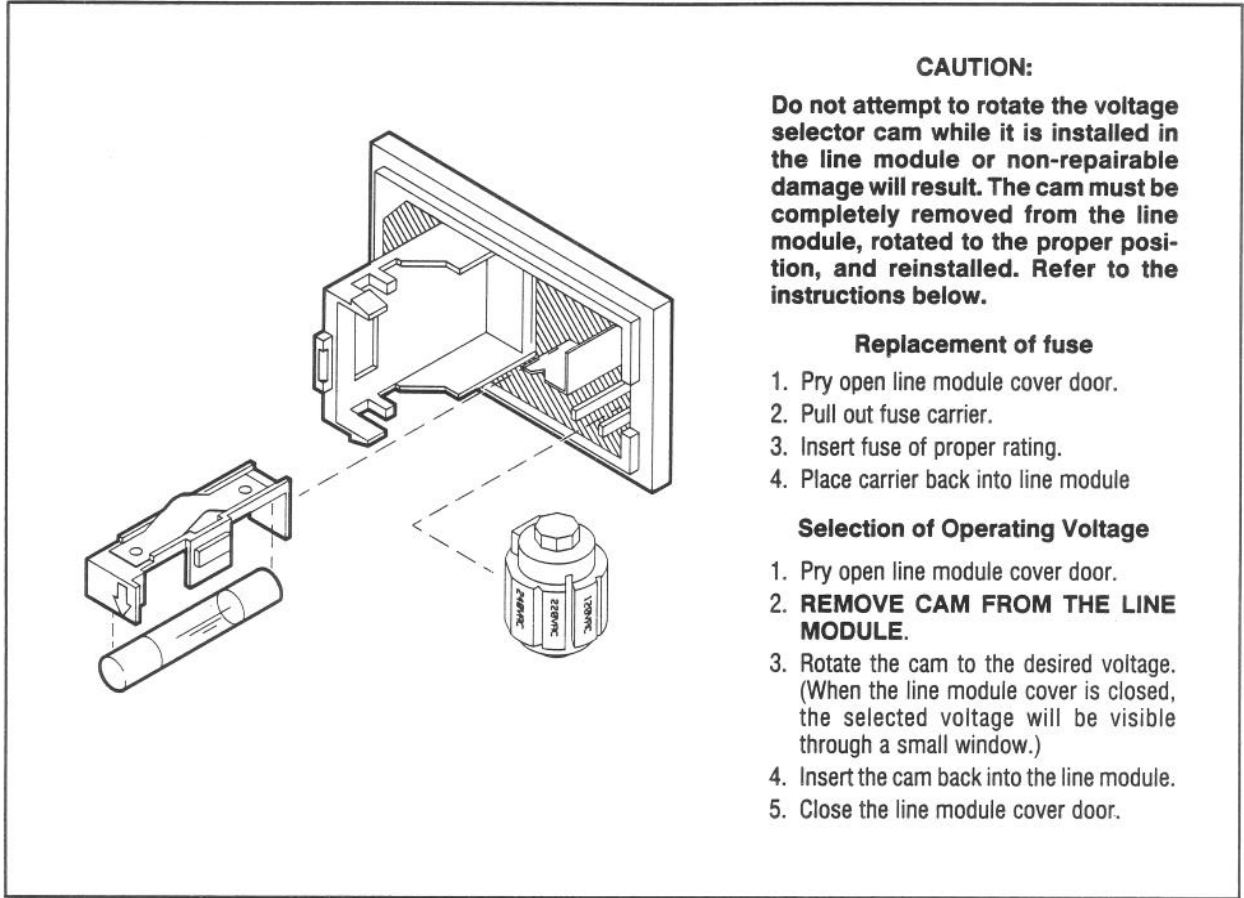


Figure 5-4. Instrument HP-IB Switch Setting

FUSES

The locations of the fuses used in the test set are illustrated in Figure 5-3. The values of these fuses and their part numbers may be found in the "Replaceable Parts" chapter.

Refer to Figure 5-5 for information on how to set the voltage selector cam and replace the line fuse.



CAUTION:

Do not attempt to rotate the voltage selector cam while it is installed in the line module or non-repairable damage will result. The cam must be completely removed from the line module, rotated to the proper position, and reinstalled. Refer to the instructions below.

Replacement of fuse

1. Pry open line module cover door.
2. Pull out fuse carrier.
3. Insert fuse of proper rating.
4. Place carrier back into line module

Selection of Operating Voltage

1. Pry open line module cover door.
2. **REMOVE CAM FROM THE LINE MODULE.**
3. Rotate the cam to the desired voltage. (When the line module cover is closed, the selected voltage will be visible through a small window.)
4. Insert the cam back into the line module.
5. Close the line module cover door.

Figure 5-5. Power Line Module

PROCEDURE 2. SELF-TEST INDICATORS

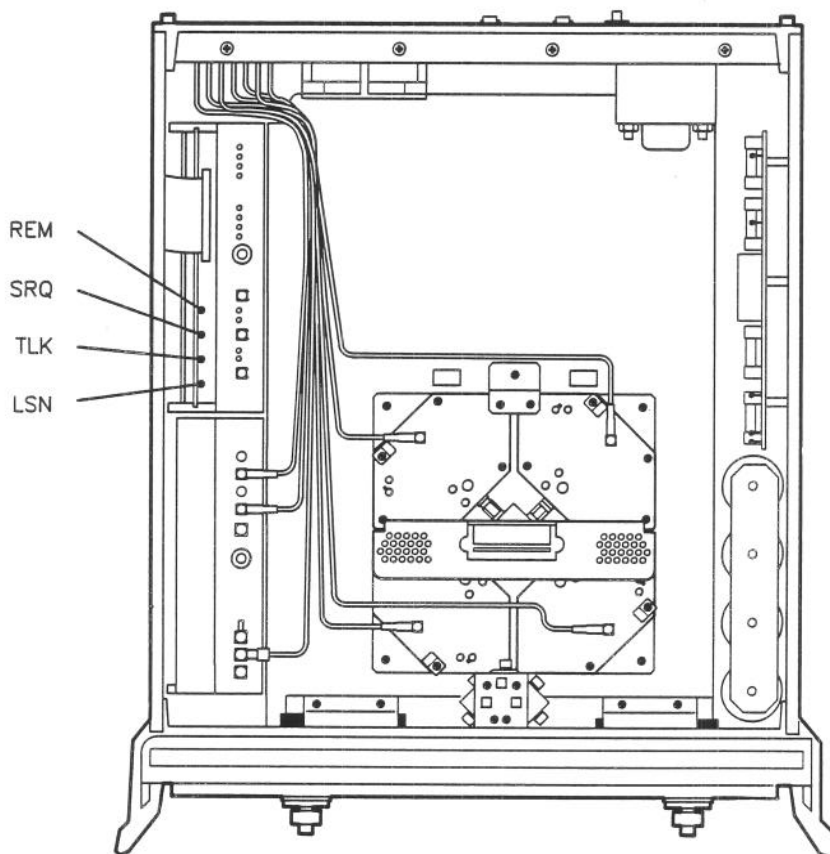


Figure 5-6. Location of Self-Test Indicators

If the ACTIVE LED on the front panel of the instrument fails to light within five seconds of power on or lights immediately, the instrument has not passed its self-test. To determine what part of the self-test has failed, note which LEDs on the A4 board are lit (Figure 5-6), as shown below:

Table 5-2. Self-Test Failure Indications

Self-Test Indication	A4 HP-IB LEDs				Time (after turn-on)
	LSN	TLK	SRQ	REM	
PWON	ON	ON	ON	ON	0 to 0.5 seconds
Fail ROM Test	OFF	ON	ON	ON	on briefly
Pass ROM Test	OFF	OFF	ON	ON	0.5 to 2.0 seconds
Fail RAM Test	OFF	OFF	OFF	ON	
Pass RAM Test	OFF	OFF	OFF	OFF	after 2 seconds

If the Self-Test Fails to Run

If the portion of memory which contains the self-test programming is faulty, the self-test will not run properly. The following conditions indicate that the HP-IB board is most probably faulty.

- all LEDs flash briefly and go off
- all LEDs flash briefly and stay on
- ACTIVE LED goes on too soon
- ACTIVE LED does not go on

PROCEDURE 3. HP 85102 IF AMPLIFIER TEST

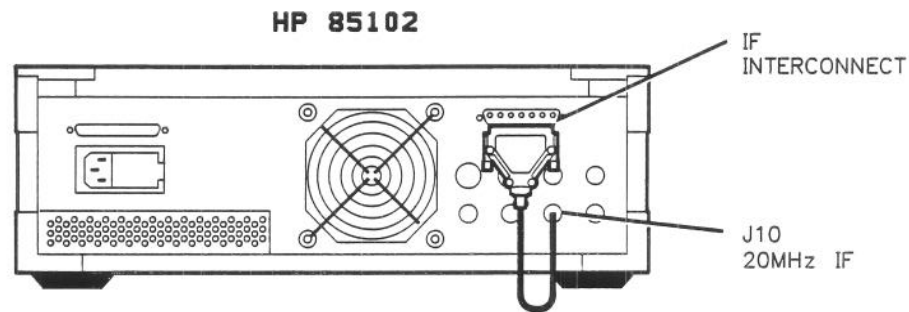


Figure 5-7. Service Adapter Connections

Using the Service Adapter

The service adapter substitutes for a test set, by connecting the 20 MHz IF signal from the HP 85102 back into the amplifier of the HP 85102. This is done to determine if a fault is in the test set or the HP 85102.

1. Connect the service adapter as shown in Figure 5-7.
2. Press **PRESET**, **MARKER**, **STIMULUS** **MENU**, **[STEP]** **PARAMETER** **MENU**. Examine each User parameter by pressing the corresponding softkey to observe the unratiod power level of the User1 through User4 channels. The traces should be flat lines, quite close to each other, as indicated by the marker value (typically about -28 ± 5 dB).

Service Adapter Conclusions

- **If all the channels look good.** The HP 85102 is working properly. The problem is most probably with the source or the test set. Refer to Procedure 4 the "Unratiod Power Tests" in this chapter.
- **If one or more channels look bad.** The problem is most probably with the HP 85102. Refer to the HP 8510 *On-Site Service Manual* for information on troubleshooting the HP 85102.

PROCEDURE 4. UNRATIOED POWER TEST

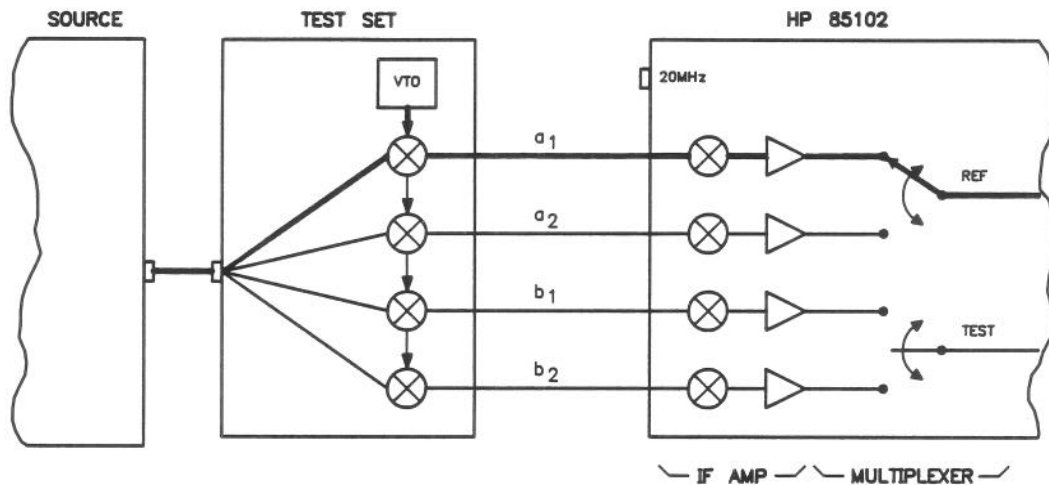


Figure 5-8. IF Signal Path

INTRODUCTION

Six RF paths in the test set are examined by observing their associated IFs (Figure 5-9). Figures 5-10 through 5-11 show which assemblies are common and which are unique in paths 1 through 6.

Determining which RF component in the test set is the most probable cause of a failure is accomplished in four steps.

1. Run the tests labeled path 1 through path 6 on the following pages.
2. Record your results in Table 5-3 for each path.
3. Compare the results you recorded in Table 5-3 with Table 5-4.
4. Investigate the most probable cause, based on the information in Table 5-4.

TESTING PATHS 1-4

1. Preset the analyzer and put the source into step mode. Press **PRESET** **STIMULUS** **MENU** **[STEP]** on the network analyzer.
2. To examine the four IFs produced by the samplers it is necessary to redefine what port and sampler the analyzer uses for phase lock.

Press **PARAMETER** **MENU** **[User3 a2]** **[REDEFINE PARAMETER]** **[DRIVE]** **[Port 2]** **[PHASE LOCK]** **[a2]** **[REDEFINE DONE]** to redefine a2.

Press **[User2 b2]** **[REDEFINE PARAMETER]** **[DRIVE]** **[Port 2]** **[PHASE LOCK]** **[a2]** **[REDEFINE DONE]** to redefine b2.

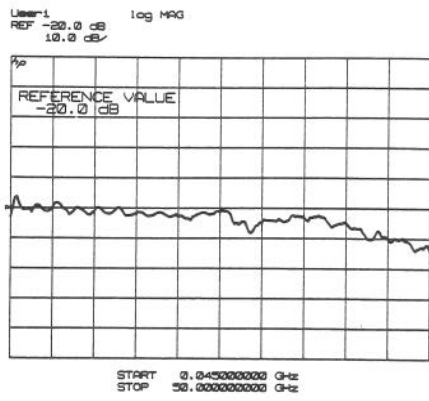
3. Connect an open (or short) to port 1 and port 2. This reflects power back to the b1 and b2 samplers through the coupler.
4. Press **[User1 a1]**, **[User2 b2]**, **[User3 a2]**, and **[User4 b1]** to check the samplers indicated. The RF signal paths are shown in Figure 5-10. Each trace should typically be similar to the examples in Figure 5-9 within ± 5 dB.

Record your results for paths 1 thru 4 (User1 through 4) in Table 5-3.

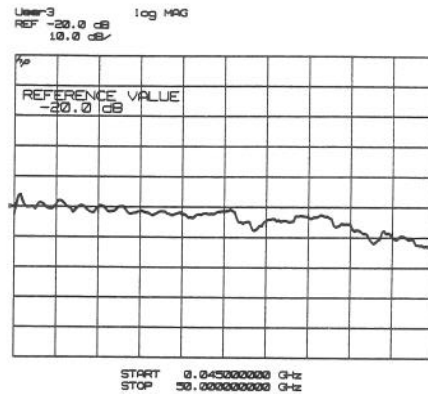
TESTING PATHS 5 AND 6

1. Connect a cable between port 1 and port 2.
2. Press **PARAMETER** **MENU** **[USER4 b1]** **[REDEFINE PARAMETER]** **[DRIVE]** **[PORT 2]** **[PHASELOCK]** **[a2]** **[REDEFINE DONE]** to observe the b1 power level trace through path 5 illustrated in Figure 5-11. Each trace should typically look like the examples in Figure 5-9 within ± 5 dB. Record your result in Table 5-3.
3. Press **PARAMETER** **MENU** **[USER2 b2]** **[REDEFINE PARAMETER]** **[DRIVE]** **[PORT 1]** **[PHASELOCK]** **[a1]** **[REDEFINE DONE]** to observe the b2 power level trace through path 6 illustrated in Figure 5-11. Each trace should typically look like the examples in Figure 5-9 within ± 5 dB. Record your result in Table 5-3.

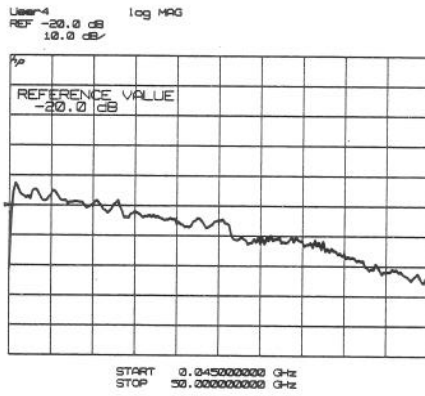
Make sure that you redefine the parameters back to the original conditions for a1, b1, a2, b2.



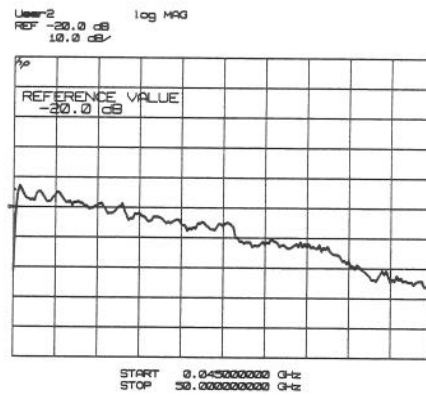
Path 1 a_1



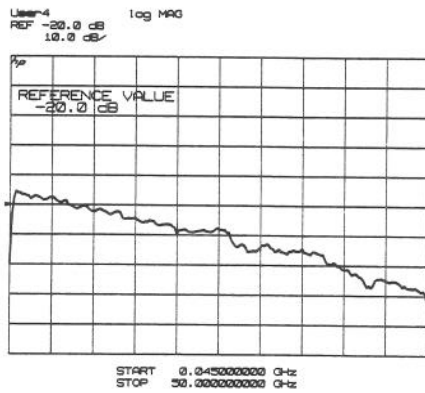
Path 2 a_2



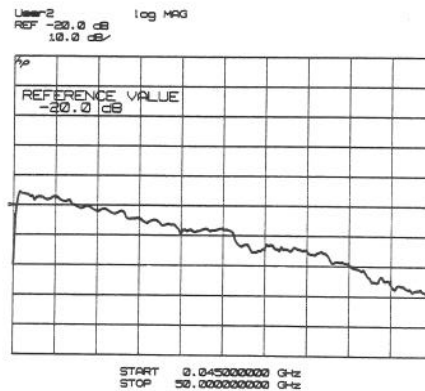
Path 3 b_1



Path 4 b_2

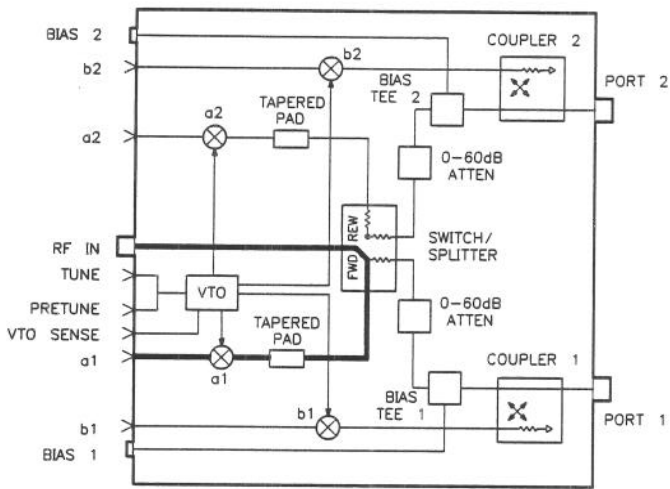


Path 5 b_1 thru

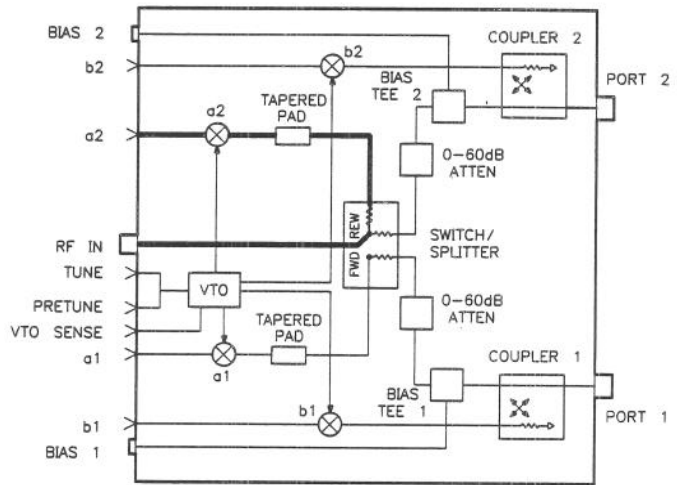


Path 6 b_2 thru

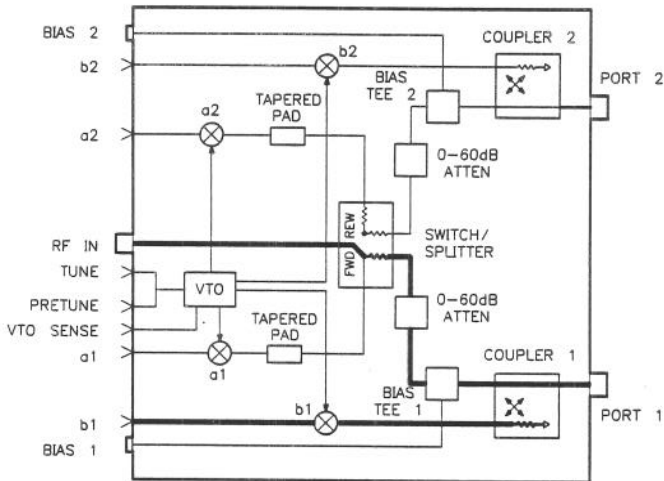
Figure 5-9. Typical Traces for Paths 1 to 6



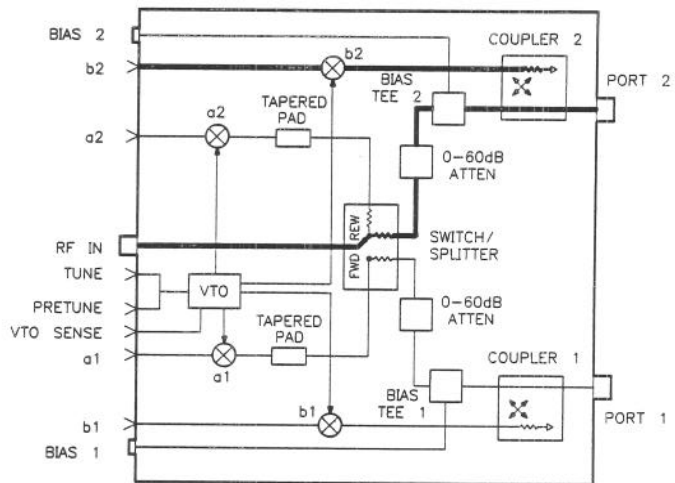
Path 1 a₁



Path 2 a₂

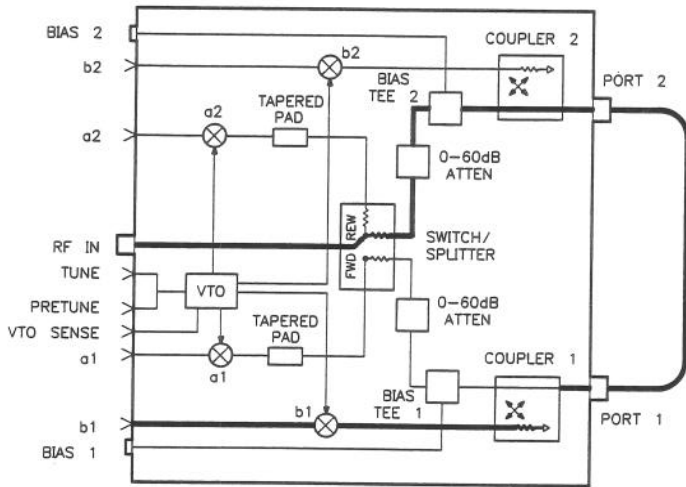


Path 3 b₁

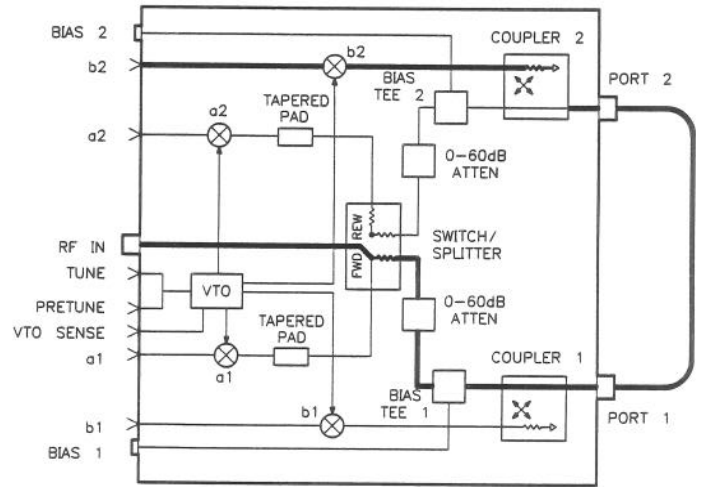


Path 4 b₂

Figure 5-10. RF Paths 1 to 4



Path 5 b_1 thru



Path 6 b_2 thru

Figure 5-11. RF Paths 5 & 6

FINDING THE FAULTY ASSEMBLY

Compare the results recorded in Table 5-3 with the matrix in Table 5-4. There are 32 possible variations. Twelve of these possibilities result in probable failures and are listed in Table 5-4.

For Example

Suppose that you have determined that paths 3 and 5 are bad and paths 1, 2, 4, and 6 are good. Refer to Table 5-4 to see that the most probable cause for the failure is the b1 sampler.

Table 5-3. Test Results of Paths 1-6

a ₁ Path 1	a ₂ Path 2	b ₁ Path 3	b ₂ Path 4	b ₁ thru Path 5	b ₂ thru Path 6

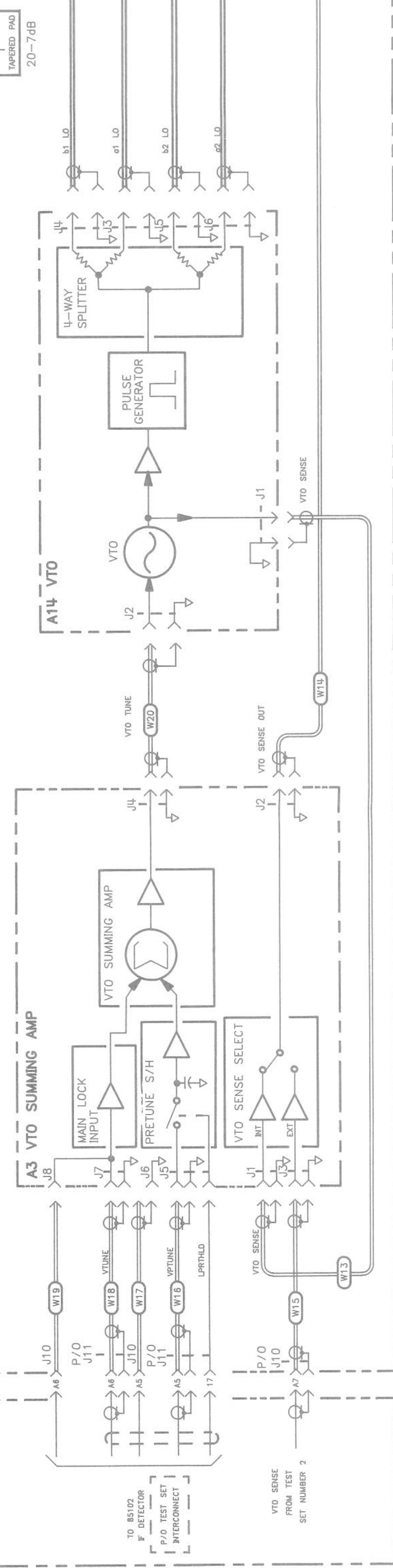
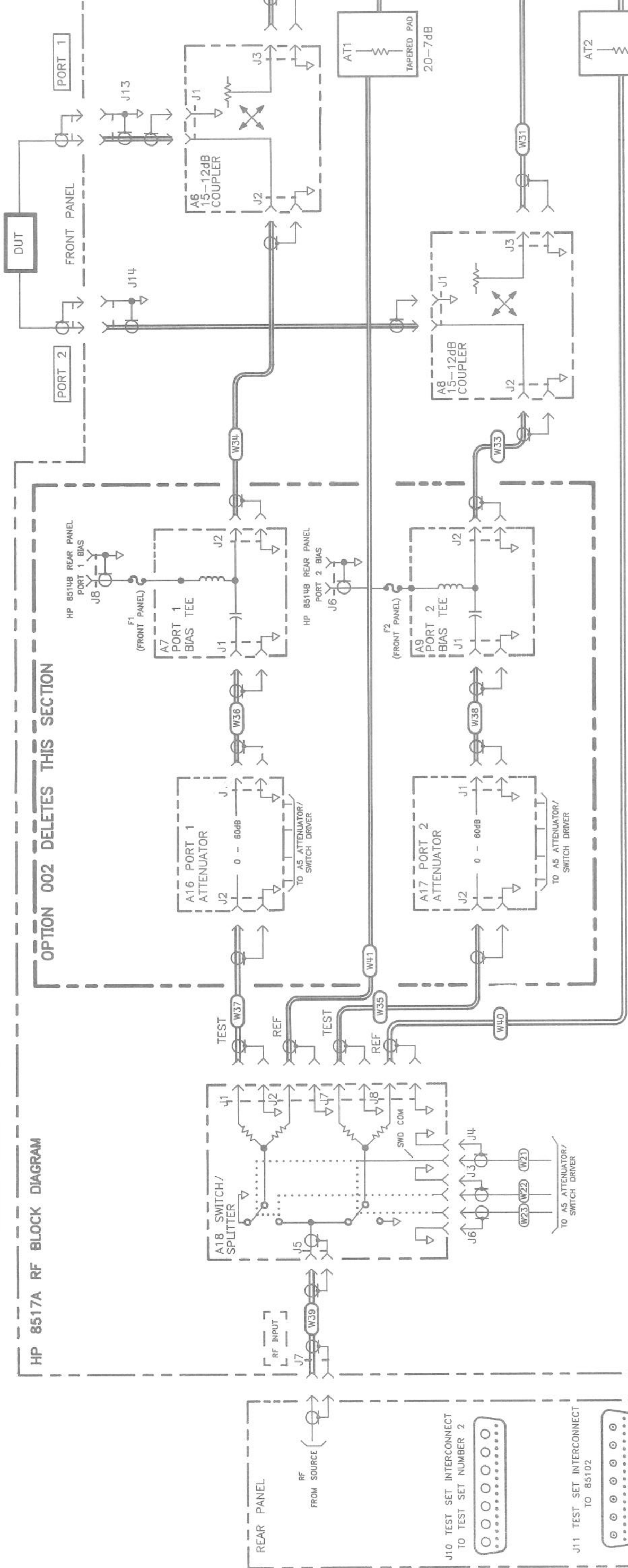
Table 5-4. Most Probable Failures

Path						Most Probable Failure
1	2	3	4	5		
—	—	—	—	—	—	Test set is not problem
B	B	B	B	B	B	Source, source cable, VTO, cables from rear panel to switch splitter
—	B	—	B	B	—	Switch splitter
B	—	B	—	—	B	Switch splitter
—	—	B	—	B	—	b ₁ sampler
B	—	—	—	—	—	a ₁ sampler
—	B	—	—	—	—	a ₂ sampler
—	—	—	B	—	B	b ₂ sampler
—	—	B	—	B	B	Port 1 connector or directional coupler
—	—	B	—	B	B	A1, T1
—	—	—	B	B	—	A2, T2
—	—	—	B	B	B	Port 2 connector or directional coupler

B = Bad
— = Good

HP 8517A RF BLOCK DIAGRAM

OPTION 002 DELETES THIS SECTION



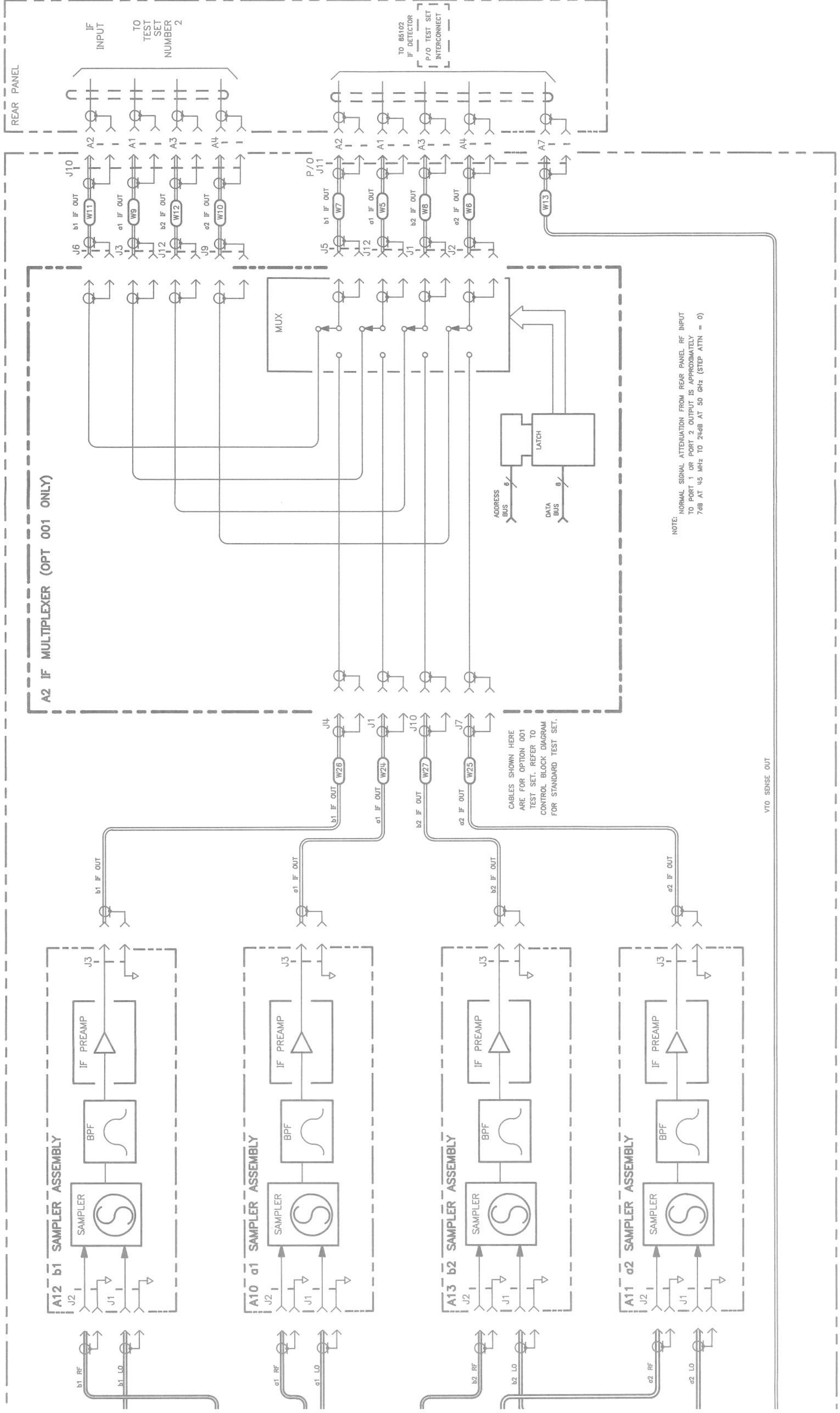
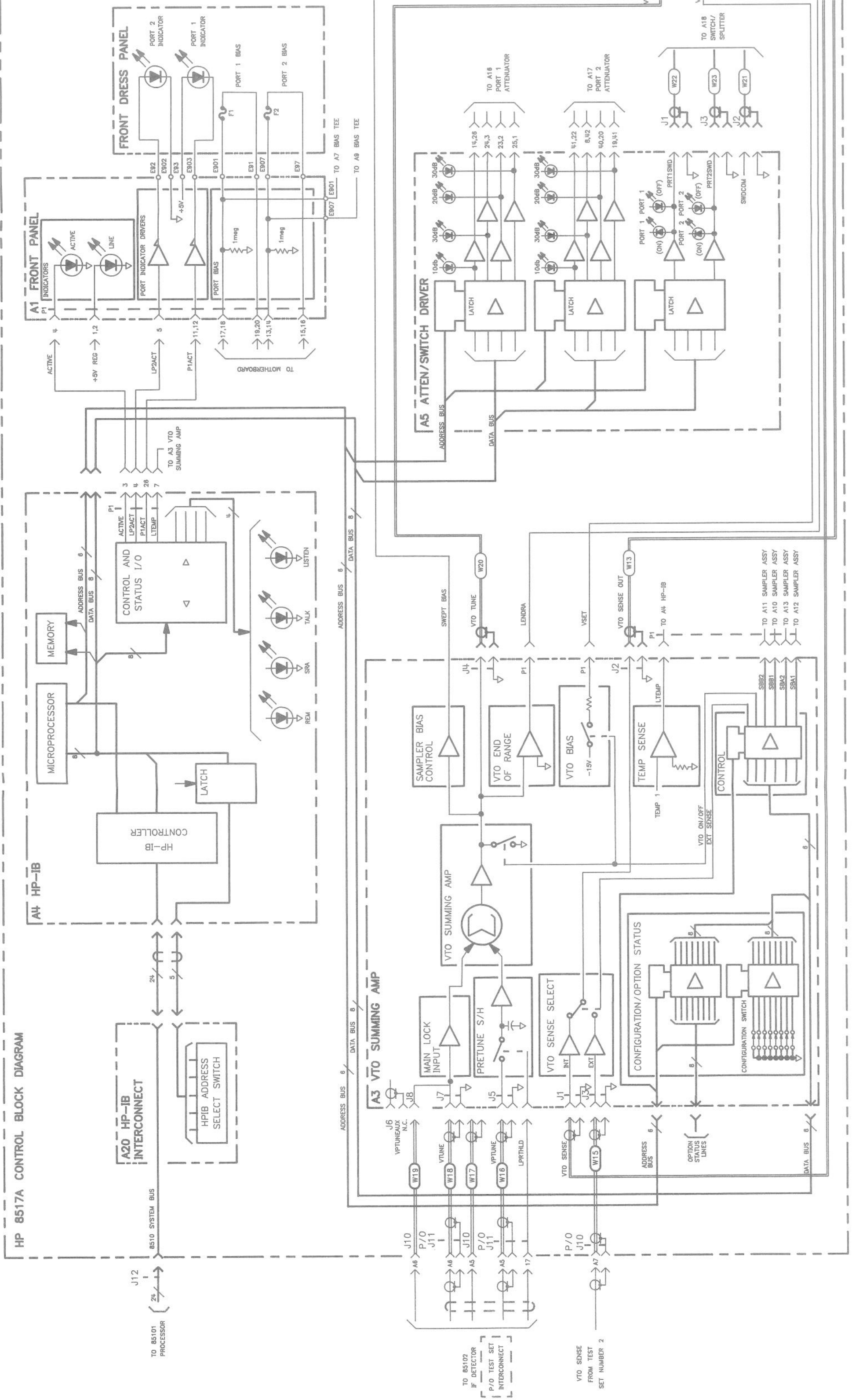


Figure 5-12. HP 8517A RF Block Diagram
Test Set Troubleshooting 5-17/5-1

HP 8517A CONTROL BLOCK DIAGRAM



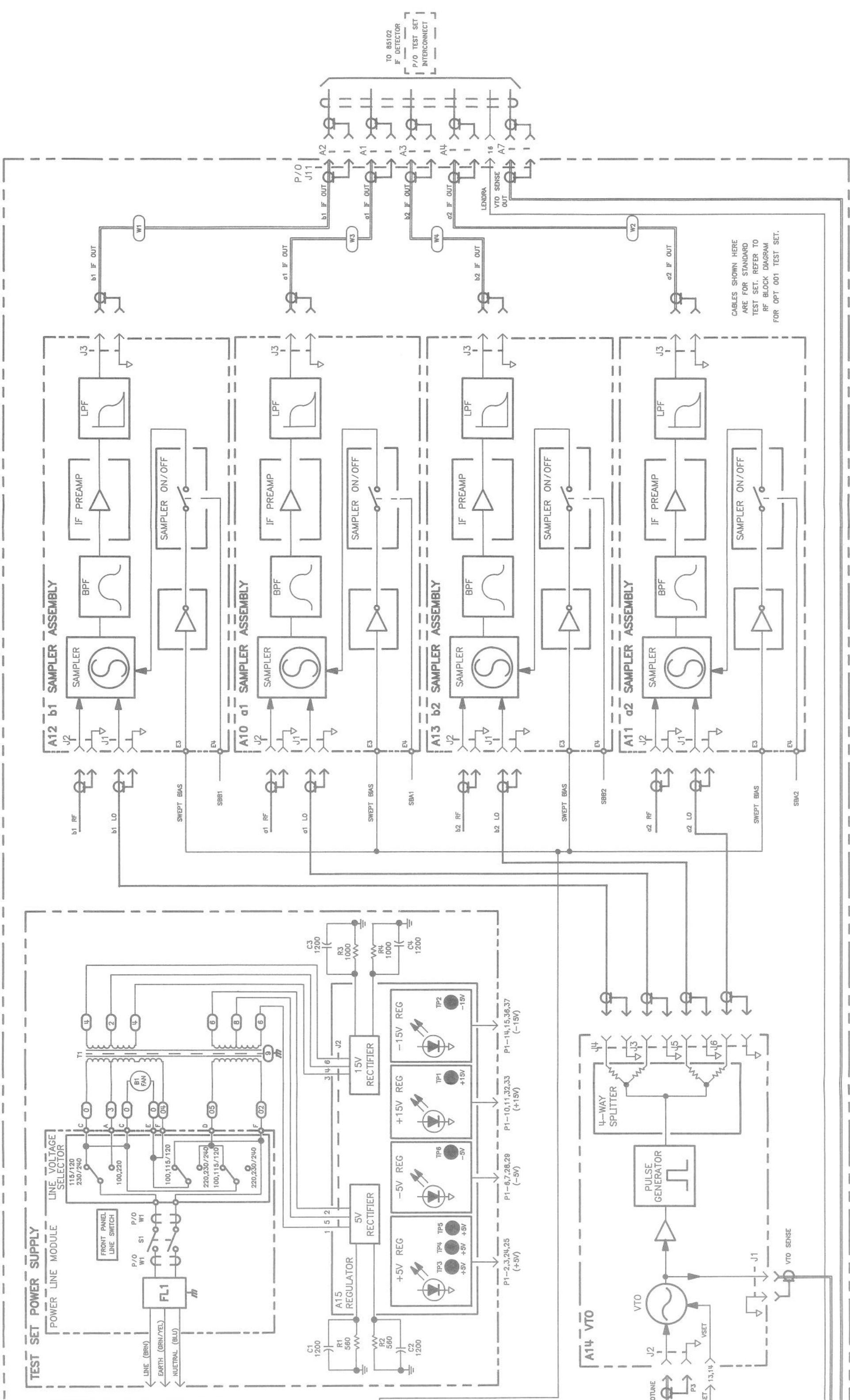
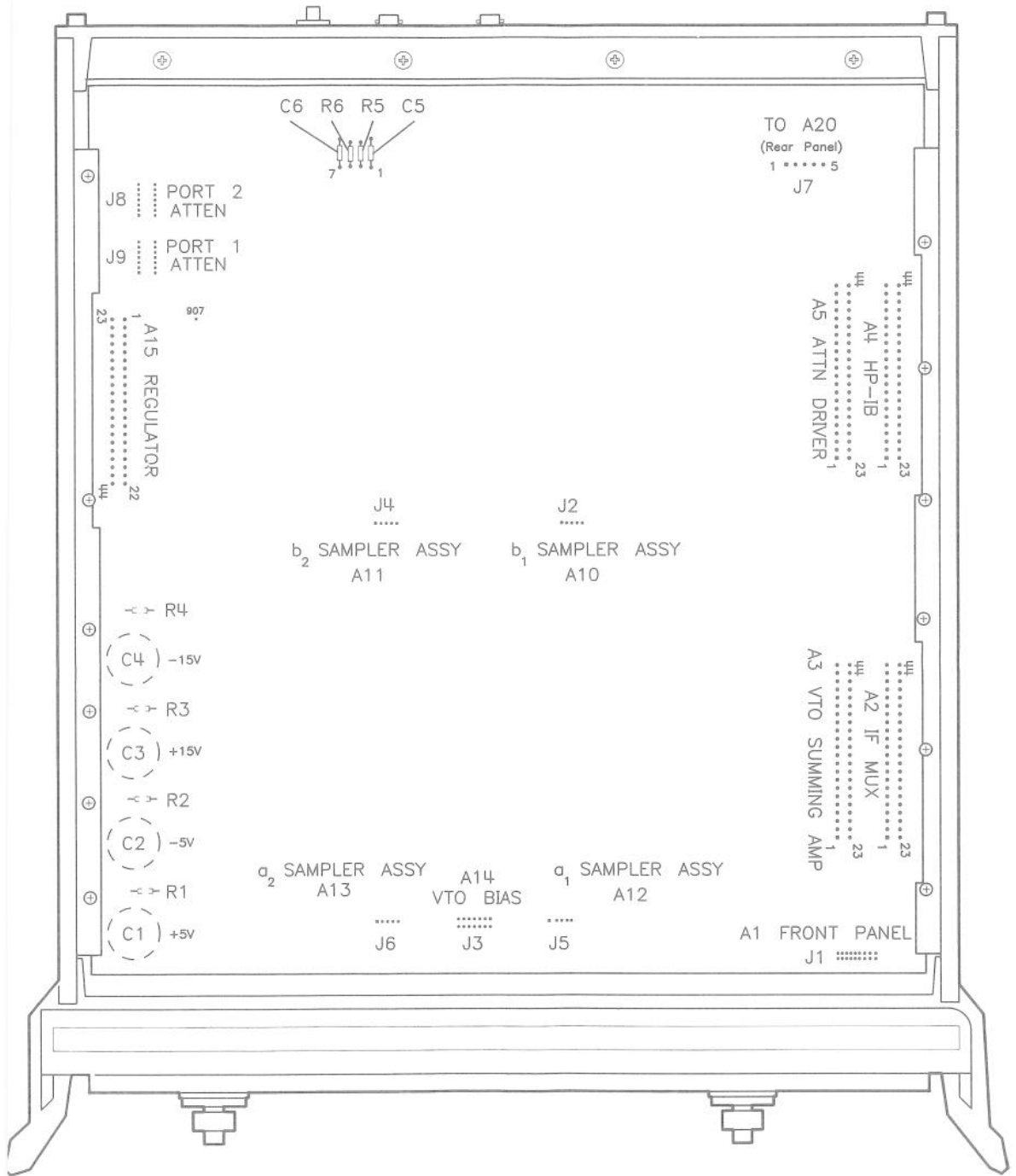


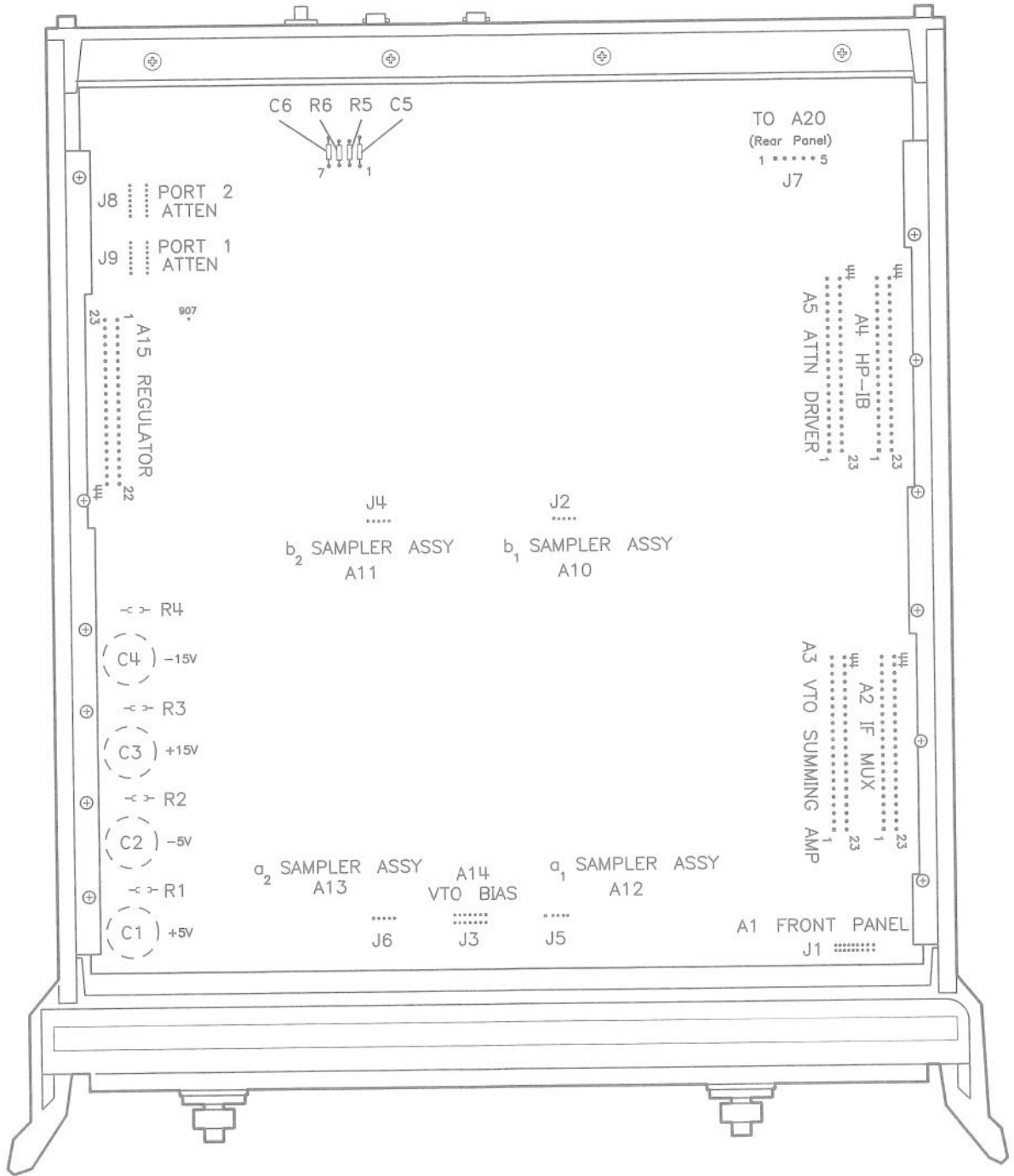
Figure 5-13. HP 8517A Control Block Diagram



Interconnect Table (1 of 2)

A3 VTO UMMING AMP	A4 HP-IB	A5 ATTN/ SWITCH	A10 SAMPLER	A11 SAMPLER	A12 SAMPLER	A13 SAMPLER	A14 VTO/ DRIVER	A15 REGULATOR	A16 STEP ATTN 1	A17 STEP ATTN 2	A20 REAR PANEL
XA3	XA4	XA5	J2	J4	J5	J6	J3	XA15	J8	J9	J7
29 8 30		29 8 30									
9 31		9 31							2 13		
									9 3 5 11		
									10 4 2	13	
										9 3 5 11	
	2	28								10 4	
15 37 16 38		15 37 16 38									
17 18 40											
11, 12, 33, 34 19 41 44	11, 12, 33, 34	11, 12, 33, 34 21	2	2	2	2	3, 4		14	14	

Table 5-5. HP 8517A Test Sets Interconnect Table (1 of 2)



Interconnect Table (2 of 2)

A3 VTO UMMING AMP	A4 HP-IB	A5 ATTN/ SWITCH	A10 SAMPLER	A11 SAMPLER	A12 SAMPLER	A13 SAMPLER	A14 VTO/ DRIVER	A15 REGULATOR	A16 STEP ATTN 1	A17 STEP ATTN 2	A20 REAR PANEL
XA3	XA4	XA5	J2	J4	J5	J6	J3	XA15	J8	J9	J7
5	27	5									2
	7	43 7									3
6		6						1			
				1	1 5	1					
			5	5		5	1				
							13, 14		6	6	
								26, 27 8, 9, 30, 31			
14, 36	14, 36						9, 10 7, 8	12, 13, 34 16, 17, 38, 39			
10, 32 13, 35	10, 32 13, 35	10, 32 13, 35	4 3	4 3	4 3	4 3	11, 12 5, 6				

Table 5-5. HP 8517A Test Sets Interconnect Table (2 of 2)

Chapter 6. Replacement Procedures

INTRODUCTION

This chapter consists of the following 14 replacement procedures:

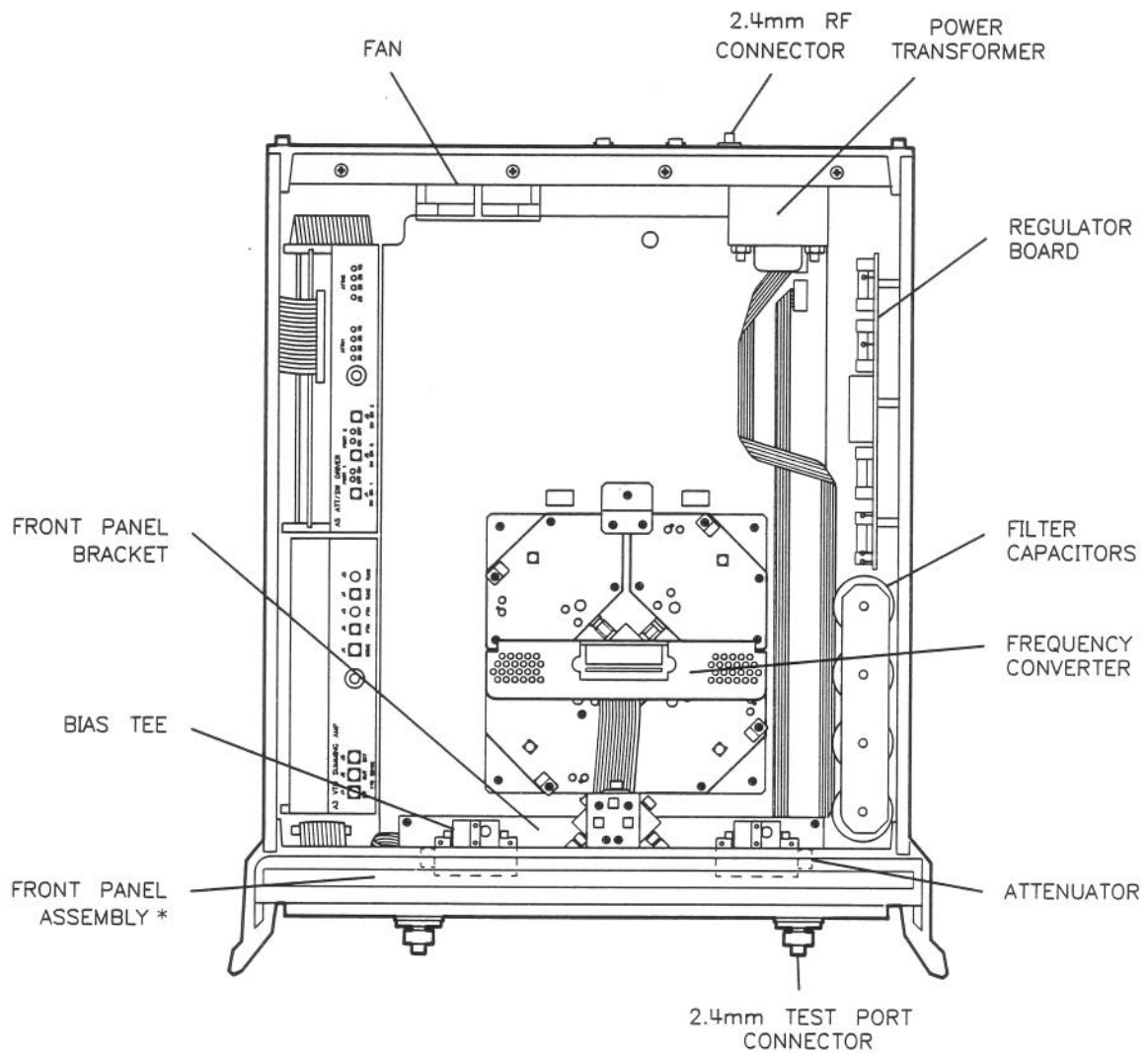
1. Switch/splitter
2. Frequency converter
3. Regulator board assembly
4. Filter capacitors
5. Rear panel 2.4 mm RF connectors
6. 2.4 mm test port connector
7. Fan
8. Power Transformer
9. Anti-rotation clamp O-ring
10. Front panel
11. Bias tee
12. Coupler
13. Attenuator
14. Front panel bracket

EQUIPMENT NEEDED BUT NOT SUPPLIED

Table 6-1 lists all the equipment needed to replace the assemblies documented in the following procedures. Use Figure 6-1 to locate the assemblies in the test set.

Table 6-1. Equipment Needed to Replace Test Set Major Assemblies

Tools	Used For	HP Part Number
2 point Pozidriv screwdriver	all components	8710-0900
1 point Pozidriv screwdriver	all components	8710-0899
5/16 inch torque wrench, 90 N-cm (8 in-lb)	all components	8710-1765
2.9 mm gage kit	port connectors	in 85056A cal kit
anti-static mat	all components	9300-0797
wrist strap	all components	9300-1257
clip lead	C1-C4 capacitors	any supplier
needle nose pliers	couplers	any supplier
wire cutters	couplers, B1 fan	any supplier
T-10 Torx screwdriver	all components	8710-1623
T-15 Torx screwdriver	8710-1622	
9/16 inch 50 in-lb torque wrench	test parts	8710-1948
9/16 inch nut driver	connector repair	8720-0008
1/2 inch torque wrench, 280 N-cm (25 in-lb)	connector repair	8710-1581
100 ohm 20 watt resistor	C1-C4 capacitor removal	0819-0019
1 inch torque wrench, 800 N-cm (27 in-lb)	coupler removal	MTB 100 72lbinE ¹
5/16 inch open end wrench	fan replacement	any supplier
1/2 inch open-end wrench	test port connector removal RF input connector	any supplier
1. Order from Muntz Company, 1080 North 11th Street, San Jose, CA 95112		



* not visible

Figure 6-1. Assembly Location Diagram

ASSEMBLY REPLACEMENT PROCEDURES

PRELIMINARY PRECAUTIONS



ATTENTION
Static Sensitive



The assemblies handled in this procedure are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

1. To prevent electrostatic damage ground the work area and yourself.
2. Turn the test set off.
3. Disconnect the power cord.
4. Remove the top and side covers, trim strips, and handles.
5. Torque 2.4 mm connections to 90 N-cm (8 in-lb).
6. Exercise caution when handling semi-rigid coax cables. They are easily bent.
7. To install a part, reverse the appropriate procedure.

(1) SWITCH/SPLITTER

1. Remove the five semi-rigid cables and the three flexible cables from the switch/splitter. (Reposition any other cables as required to ease removal.)
2. Remove the two screws that attach the switch/splitter to the front panel mounting bracket.
3. Remove the switch/splitter from the test set.

(2) FREQUENCY CONVERTER

The frequency converter consists of a VTO (voltage-tuned oscillator) assembly and four samplers.



ATTENTION
Static Sensitive



The assemblies handled in this procedure are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

1. Remove the semi-rigid cable attached to each of the four samplers.
2. Remove the two in-line attenuators from the samplers.
3. Remove the six flexible cables from the frequency converter by gently pulling on the gold connector.
4. Remove the four frequency converter mounting plate screws and the bracket screw that fastens the frequency converter to the chassis.
5. Unplug the ribbon cable near the front panel.
6. Unplug the four harnessed (multi-colored) wire and socket assemblies.
7. Lift the frequency converter out of the test set.
8. Remove the frequency converter bracket by removing the two pozidriv screws.

(3) REGULATOR BOARD ASSEMBLY

1. Unplug the transformer socket from the regulator board.
2. Remove the three mounting screws from the top edge of the regulator board.
3. Remove the regulator board. (You may have to partially back out one of the transformer mounting screws for clearance.)

(4) FILTER CAPACITORS

1. Set the test set upright and pull the metal and plastic cover off the capacitors.
2. Turn the test set over and remove the bottom cover.
3. To discharge the capacitors, attach one end of an insulated clip lead to the chassis of the instrument and the other end of the clip lead to a 100 Ω 20 watt resistor. Use the resistor to discharge each capacitor terminal (large Pozidriv screw on the bottom side of the test set). Each capacitor has two terminals. **Discharge all capacitor terminals.** It takes approximately six seconds to discharge each capacitor..
4. To remove a capacitor, remove the corresponding pair of screws and pull the capacitor out of the test set.

(5) 2.4 MM RF INPUT CONNECTOR REPAIR

Refer to Figure 6-2 and the following text to repair a 2.4 mm connector. Refer to chapter 7 for replacement part numbers

Disassembly

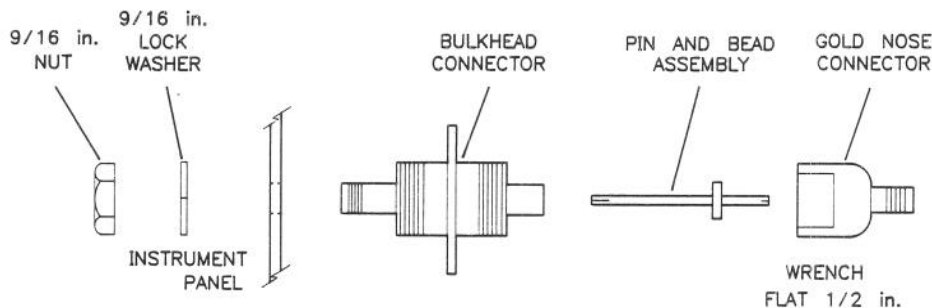


Figure 6-2. Exploded Diagram of 2.4 mm Connector

1. Remove any attached cables from the connector to be replaced.
2. Use a 1/2 inch wrench to loosen the gold nose connector.
3. Remove the pin and bead assembly from the connector. If only the pin and bead assembly needs replacing, continue with step 7.
4. From inside the test set, use a 9/16 inch nut driver to loosen the nut and remove the rest of the connector.

Assembly

5. Assemble the bulkhead connector, lock washer and nut.
6. Using the 9/16 inch nut driver, tighten the nut to 506 N-cm (45 in-lb).
7. Clean the pin and bead assembly (use the procedures described in the *Microwave Connector Care Manual*, provided with your HP 8510 manual set).
8. Insert the pin and bead assembly into the gold nose connector.
9. Attach this assembly to the bulkhead connector, and torque the bulkhead connector to 281 N-cm (25 in-lb).
10. Clean the mating surfaces with alcohol and lint-free swabs.
11. Check the pin depth of the gold nose connector. The pin depth specification is 0.0000 to +0.0030 inch.

NOTE: If the pin depth is not within specification, **do not shim** the connector. Instead, install another pin and bead assembly.

12. Reconnect the cables disconnected in step 1.

(6) 2.4 MM TEST PORT CONNECTOR

PORT 1 AND 2

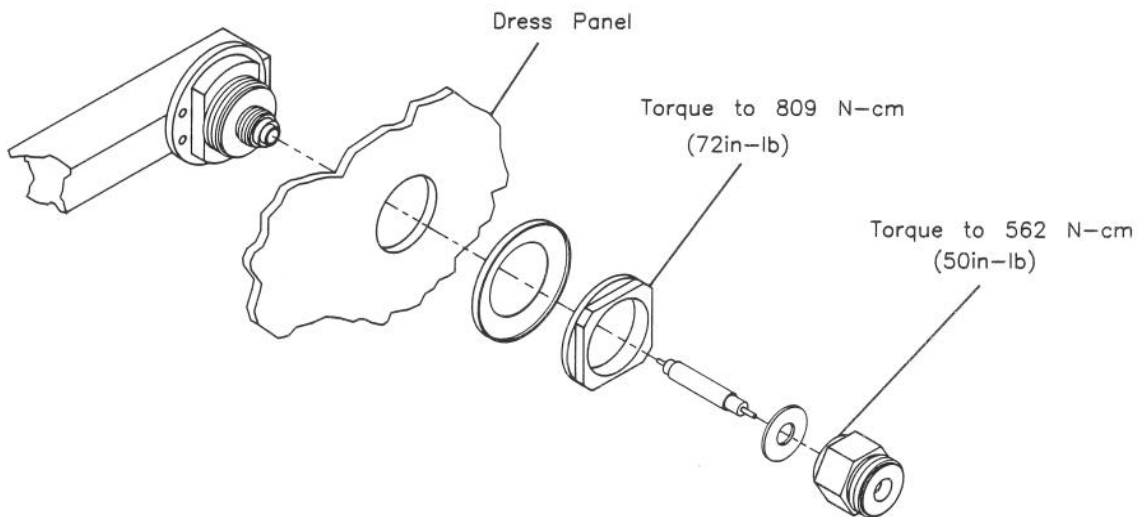


Figure 6-3. Exploded Diagram of a 2.4 mm Test Port Connector

1. Raise the rear of the test set approximately four inches and support it on a substantial object (book etc.).
2. Unscrew the test port connector nut using a 9/16 inch open end wrench.
3. Pull out the center conductor assembly and replace it with a new assembly. Do not touch either end of the new assembly.
4. Replace the test port connector nut and torque it to 562 N-cm (50 in-lb).
5. Measure the pin depth of each port using a 2.4 mm female pin-depth gage. Refer to the *Connector Care Manual* for more information on using the gage.
6. If the center pin protrudes, or if the depth is less than 0.0001 inch, remove the connector assembly and add the appropriate shim to adjust the pin depth to between 0.0001 and 0.0007 inch. When measuring the pin depth be sure to take into consideration the uncertainty of your gage.
7. If shimmed, regage the test port connector assembly.

(7) B1 FAN

WARNING

Turn the test set OFF and disconnect the power cord from the mains. Electrocutation can result if power is not removed from the test set prior to this procedure.

To replace the fan B1, you must remove the transformer (T1) so that the ends of the fan wires can be unsoldered from the line module FL1. Refer to the "Replaceable Parts" chapter of this manual for a detailed view of the fan and transformer hardware.

1. Turn the test set on its right side.
2. Using a 5/16 inch open end wrench, remove the hardline cables connected between the couplers A7 and A9 and the bulkhead connectors J2 and J5.
3. Unplug the transformer connector at J2 on the A15 regulator board.
4. Using a large Pozidriv screwdriver, remove the four screws and washers that hold the transformer onto the rear panel.
5. Using a large Pozidriv screwdriver, remove the screw that holds the transformer angle bracket to the main deck. The transformer wires soldered to the line module are short, so do not pull the transformer out too far.
6. Carefully remove the transformer from the test set and put it on the bench close to the test set.
7. Strip the heat shrink tubing off the two fan wires and unsolder the wires from the line module. Cut any cable ties holding the fan wires to nearby cables.
8. Using a small Pozidriv screwdriver, remove the screw and lockwasher that secure the green/yellow fan ground wire to the top of the rear panel frame.
9. Using a small Pozidriv screwdriver, remove the four screws that hold the fan to the rear panel; remove the fan.

(8) T1 POWER TRANSFORMER

WARNING

Turn the test set OFF and disconnect the power cord from the mains. Electrocution can result if power is not removed from the test set prior to this procedure.

1. Turn the test set on its right side.
2. Using a 5/16 inch open end wrench, remove the hardline cable connected between coupler A7 and bulkhead connector J2.
3. Unplug the transformer connector at J2 on the A15 regulator board.
4. Using a large Pozidriv screwdriver, remove the four screws and washers that hold the transformer onto the rear panel.
5. Using a large Pozidriv screwdriver, remove the screw that holds the transformer angle bracket to the main deck. The transformer wires soldered to the line module are short, so do not pull the transformer out too far.
6. Carefully remove the transformer from the test set and put it on the bench close to the test set.
7. Strip the heat shrink tubing off the transformer wires soldered to the line module, and unsolder the wires.
8. Unsolder the transformer ground wire connected to the chassis side rail.
9. Remove the transformer.
10. When you replace the transformer, refer to Figure 6-4 for the location of the wires connected to the line module.

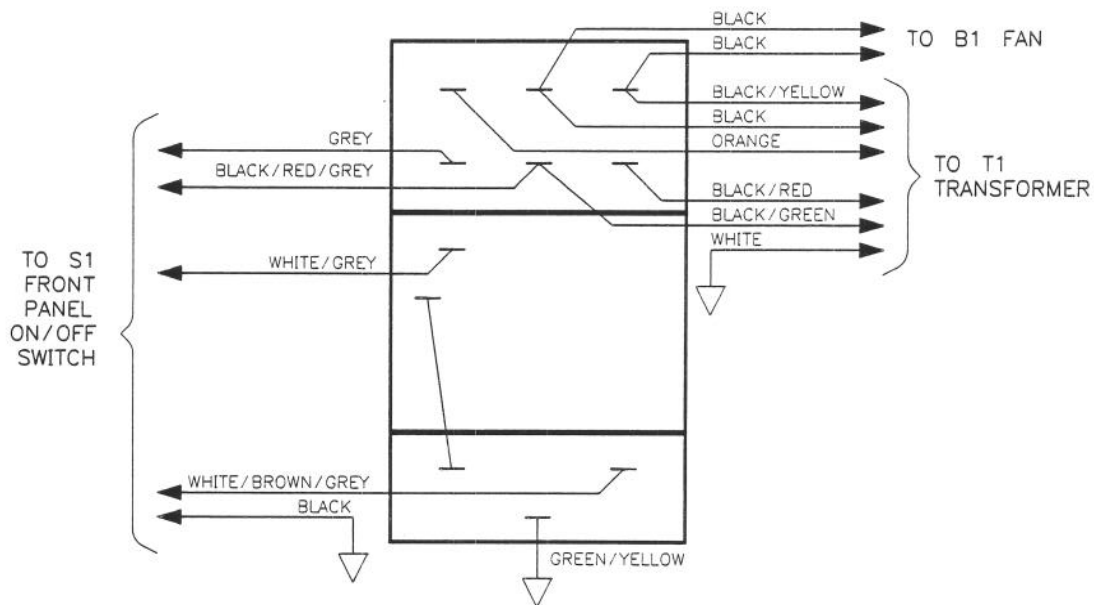


Figure 6-4. Wire Connections to Line Module FL1

(9) ANTI-ROTATION CLAMP O-RING

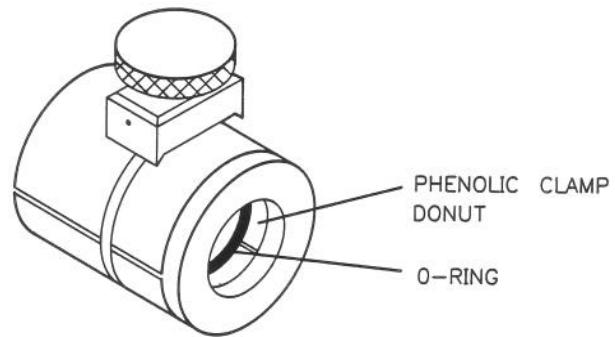


Figure 6-5. Position of the O-Ring in the Clamp

1. Pry the O-ring out of the clamp with fine tweezers or a similar tool.
2. To insert the new O-ring (HP part number 0900-0007) engage one side of it in the slot of the phenolic clamp donut.
3. Use your fingers to seat the O-ring into the rest of the slot.

(10) FRONT PANEL ASSEMBLY

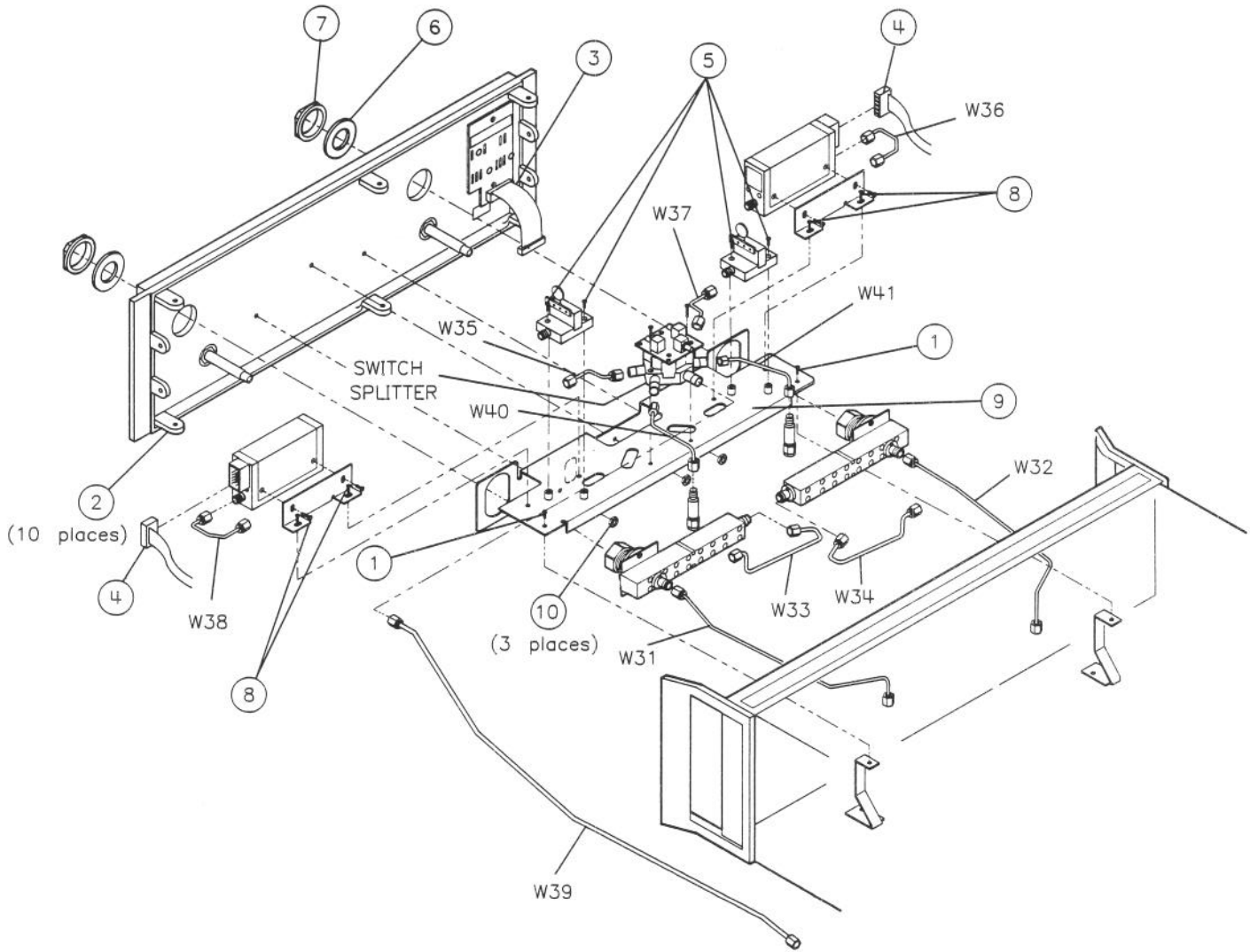


Figure 6-6. Front Panel Assembly

Refer to Figure 6-6 and the following text to remove the front panel assembly.

1. Remove the two semi-rigid cables (W40 and W41) that connect the switch splitter to the samplers.
2. Disconnect W39 from the switch splitter and move it out of the way.
3. Disconnect the three flexible RF cables connected to the switch splitter.
4. Disconnect semi-rigid cables W31 and W32 where they connect to the samplers.
5. Remove the two screws (1) that connect the front panel bracket to the Z brackets.
6. Remove the ten screws (2) that secure the front panel assembly to the front frame.
7. Unplug the ribbon cable (3).
8. Grasp the test ports and pull the front panel assembly out, tilting the top of the assembly toward yourself.
9. Unplug the ribbon cables (4).
10. Grasp the cable attached to the line switch and pull it toward the front of the instrument. This provides enough cable length for you to tilt the front panel assembly the rest of the way out of the test set frame.
11. Carefully remove the front panel assembly. Be careful not to damage the two cables (W31 and W32).
12. Lay the front panel assembly face down on the work surface.

(11) BIAS TEE

Refer to Figure 6-6 and the following text to replace the bias tees.

1. Remove the semi-rigid cables (W36 and W37 for port 1) attached to the bias tee.
2. Unsolder the wires attached to the bias tee.
3. Remove the screws (5) that secure the bias tee to the front panel bracket and remove the bias tee.

(12) TEST PORT COUPLERS

Refer to Figure 6-6 and the following text to replace the couplers.

1. Remove the front panel assembly as described in procedure 10.
2. Remove the two semi-rigid cables (W34 and W32 for port 1) attached to the coupler.
3. Remove the test port nut (7) using a 1 inch wrench.
4. Remove the test port washer (6).

(13) ATTENUATOR

Refer to Figure 6-6 and the following text to replace the attenuators.

1. Remove the front panel assembly as described in procedure 10.
2. Remove the two semi-rigid cables (W36 and W37 for port 1) attached to the attenuator.
3. Unplug the ribbon cable (4) from the attenuator.
4. Remove the two screws (8) that secure the attenuator to the attenuator bracket.

Chapter 7. Replaceable Parts

INTRODUCTION

This section contains information for ordering replaceable parts for the instrument. The replaceable parts include major assemblies, and chassis hardware, but not parts of major assemblies. Table 7-1 lists major reference designations and abbreviations used in the parts lists.

R-E (REBUILT-EXCHANGE) ASSEMBLIES COST LESS

Lower cost assemblies are available through the rebuilt-exchange program. These factory rebuilt (repaired and tested) assemblies meet all factory specifications required of a new assembly. They are offered on an exchange (trade-in) basis only. The defective assembly must be returned for credit. Figure 7-1 illustrates the rebuilt-exchange procedure. The rest of the figures provide parts information. If you have any questions, contact your HP customer engineer.

REPLACEABLE PARTS LIST

The following figures assist in locating and identifying all replaceable parts, and include corresponding lists that provide the following information:

1. Hewlett-Packard part number.
2. Part quantity as shown in the corresponding figure. There may or may not be more of the same part located elsewhere in the instrument.
3. Part description, using abbreviations in Table 7-1.

The following information is given only if a part is available from an alternate supplier (other than Hewlett-Packard).

4. A typical manufacturer of the part in a five-digit code (refer to the Manufacturers Code list in Table 7-1 for addresses).
5. The manufacturer's part number.

ORDERING INFORMATION

To order a part listed in the replaceable parts lists, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

To order a part that is not listed in the replaceable parts lists, include the instrument model number, complete instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

To Order Parts....Fast!

(800) 227-8164

Monday through Friday, 6 am to 5 pm (Pacific Standard Time)

The parts specialists have direct online access to replacement parts inventory corresponding to the replaceable parts list in this manual. There is a charge for hotline one day delivery, but four day delivery time is standard. After hours and holidays, call (415) 968-2347. This fast service applies to the United States only. Outside the United States, contact your nearest HP office.

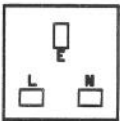

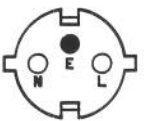


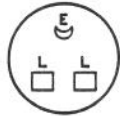
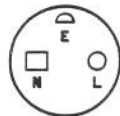
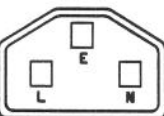
Table 7-1. Reference Designations, Abbreviations, and Manufacturers Code List

REFERENCE DESIGNATIONS			
A	Assembly	FL	Filter
CR	Diode, Diode Thyristor, Step Recovery Diode (SCR), Varactor	J	Electrical Connector (Stationary Portion), Jack
DS	Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device	MP	Miscellaneous Mechanical Part
F	Fuse	P	Electrical Connector (Movable Portion), Plug
Q	Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor	R	Resistor
S	Switch	TP	Test Point
U	Integrated Circuit	W	Cable, Transmission Path, Wire

ABBREVIATIONS			
A		H	
ADJ	Adjust, Adjustment	HD	Hand, Hard, Head, Heavy Duty
AMP	Amplifier	HEX	Hexadecimal, Hexagon, Hexagonal
ASSY	Assembly	I	
ATTN	Attenuator	ID	Identification, Inside Diameter
B		IN	Inch, Indium
BD	Board	INTL	Internal
BNC	Type of Connector	K	
C		KB	Knob
C	Capacitance, Capacitor	L	
CBL	Cable	LED	Light Emitting Diode
CHAM	Chamfer	LG	Length, Long
CPU	Central Processing Unit	LKWR	Lockwasher
D		M	
D	Deep, Depletion, Depth, Diameter, Direct Current	MACH	Machine
DB	Decibel, Double Break	MM	Millimeter
DBL	Double	MTLC	Metallic
E		N	
EXT	Extended, Extension, External, Extinguish	NEG	Negative
F		O	
F	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency	OD	Olive Drab, Outside Diameter
FL	Flash, Flat, Fluid	P	
FLTR	Filter, Floater	PAN-HD	Pan Head
G		PC	Picocoulomb, Piece, Printed Circuit
GHZ	Gigahertz	PNL	Panel
		P/O	Part of
		PN Part Number	
		R	
		R	Rear
		RFI	Radio Frequency Interference
		S	
		SAMP	Sampler
		SCR	Screw, Scrub, Silicon Controlled Rectifier
		SHFT	Shaft
		SHLDR	Shoulder
		SKT	Skirt, Socket
		SLDR	Solder
		SMB	Subminiature, B Type (Snap-On Connector)
		SST	Stainless Steel
		T	
		THD	Thread, Threaded
		THK	Thick
		V	
		VDC	Volts, Direct Current
		W	
		W	Watt, Wattage, White, Wide, Width, Wire
		X	
		XSTR	Transistor
		Y	
		YIG	Yttrium-iron-garnet
		Z	
		ZN-P	Zinc Plate

MANUFACTURERS CODE LIST			
Mfr. Code	Manufacturer Name	Address	Zip Code
00000	Any Satisfactory Supplier		
28480	Hewlett-Packard Company Corp. Hq.	Palo Alto CA	94304
55787	Gas Spring Corp.	Montgomeryville PA	18936
71400	Cooper Industries Inc.	Houston TX	77210

Table 7-2. Power Cable and Plug Part Numbers

Plug Type ¹	Cable HP Part Number ²	Plug Description ²	Cable Length (inches)	Cable Color	For Use in Country
250V 	8120-1351 8120-1703	Straight BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V 	8120-1369 8120-0696	Straight ZNSS198/ASC112 90°	79 87	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	Straight CEE7-VII 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, Republic of So. Africa, India (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	Straight NEMA5-15P 90° Straight NEMA5-15P Straight NEMA5-15P 90° Straight NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan (100V or 200V), Mexico, Philippines, Taiwan
250V 	8120-2104	Straight SEV1011.1959 24507, Type 12	79	Gray	Switzerland
250V 	8120-0698	Straight NEMA6-15P			United States, Canada
220V 	8120-1957 8120-2956	Straight DHCK 107 90°	79 79	Gray Gray	Denmark
250V 	8120-1860	Straight CEE22-VI (System Cabinet Use)			

1. E = Earth Ground; L = Line; N = Neutral

2. Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.

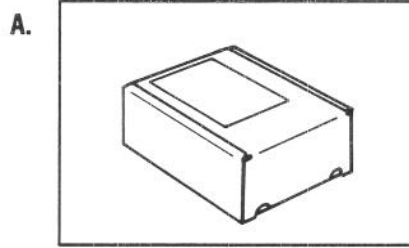
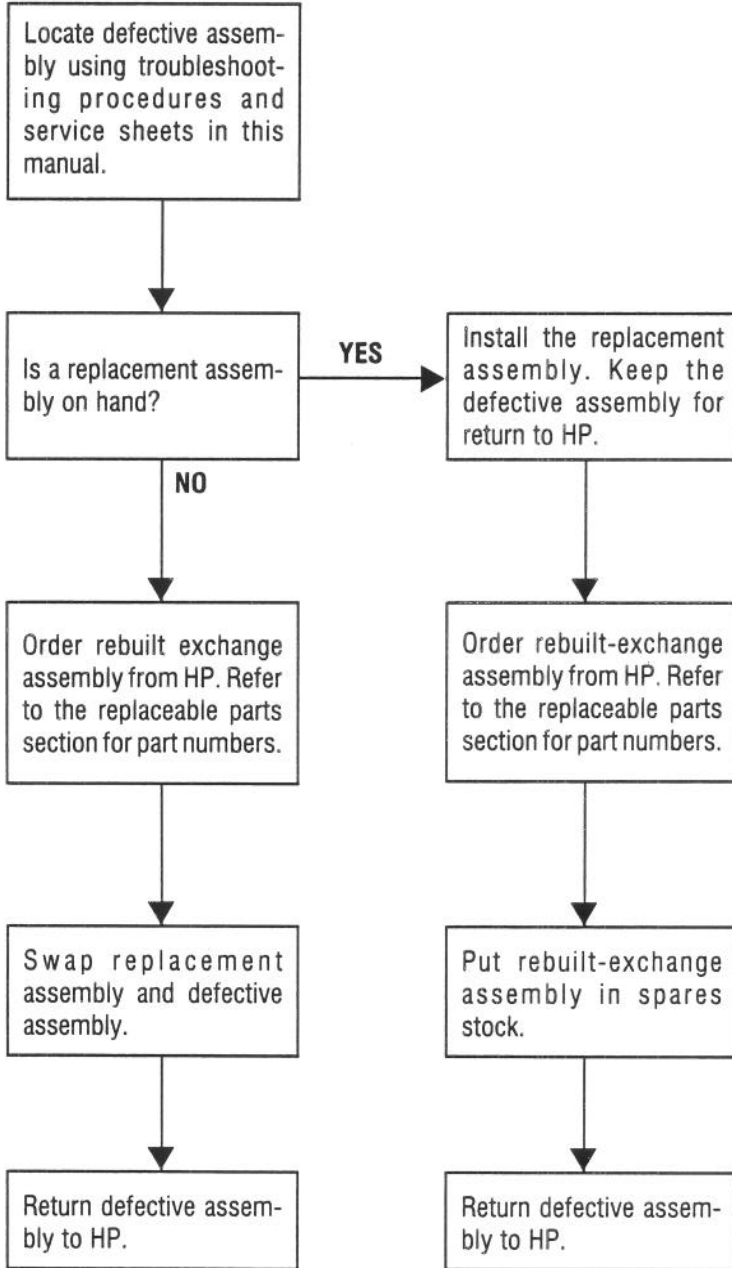
Table 7-3. Touch-up Paint

Color	Part Number	Applicable Use
Dove Grey	6010-1146	The frame around the front panel and painted portions of the front handles.
French Grey	6010-1147	The side, top and bottom covers.
Parchment Grey	6010-1148	The rack mound flanges, rack support shelves and front panels.

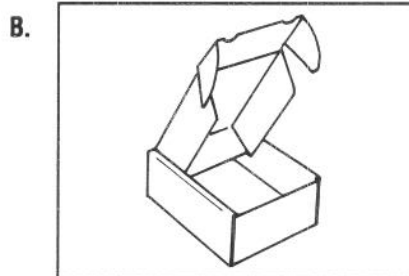
Table 7-4. Fuses

Fuses						
Fuse	Name	Location	AMP	100-120 VAC	AMP	220-250 VAC
				Part No.		Part No.
AC Line	F1	Rear Panel	2	2110-0002	1	2110-0001
+5 VDC	F1	Regulator Board	1.5	2110-0043	1.5	2110-0043
-5 VDC	F2	Regulator Board	1.0	2110-0001	1.0	2110-0001
+15 VDC	F3	Regulator Board	1.5	2110-0043	1.5	2110-0043
-15 VDC	F4	Regulator Board	1.0	2110-0001	1.0	2110-0001
Bias	Bias Fuses	Front Panel	0.5	2110-0012	0.5	2110-0012

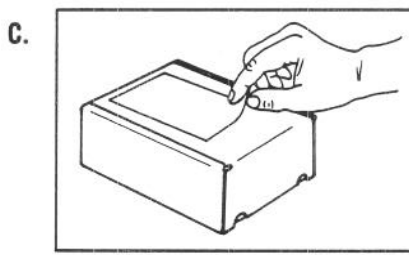
Use this fast, efficient, economical method to keep your Hewlett-Packard instrument in service.



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



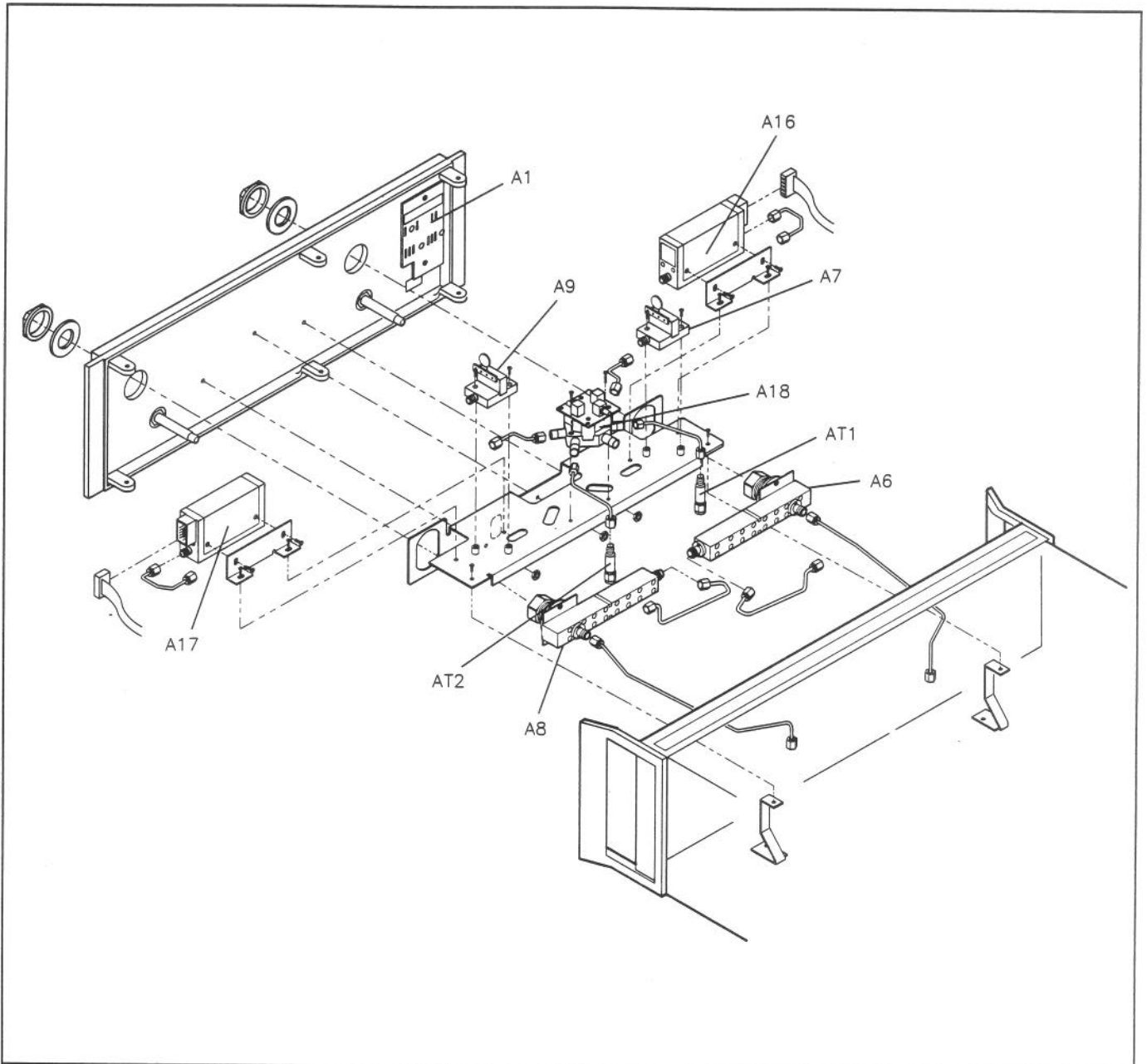
Open box carefully - it will be used to return defective assembly to HP. Complete failure report. Place it and defective assembly in box. Be sure to remove enclosed return address label.



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.

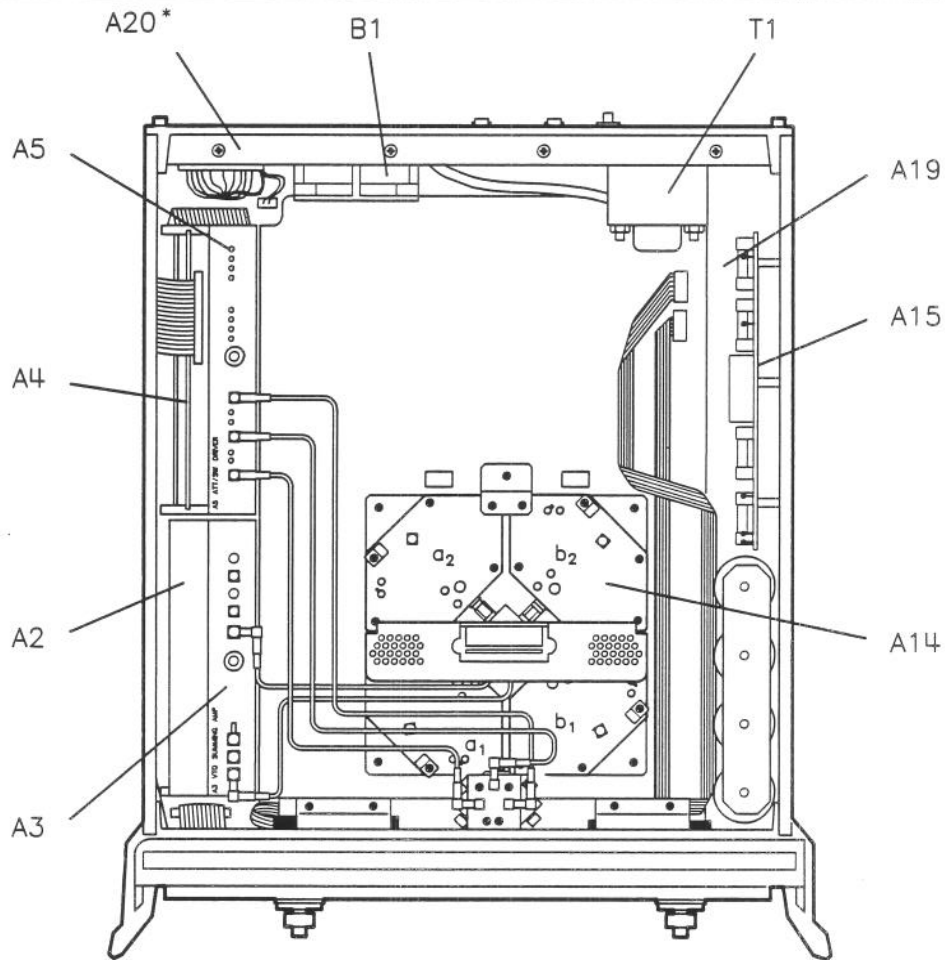
*HP pays postage on boxes mailed in U.S.A.

Figure 7-1. The Low Cost Rebuilt-Exchange Procedure



Reference Designation	HP Part Number	Qty.	Description
A1	08513-60005	1	FRONT PANEL INTERFACE BOARD ASSEMBLY
A6,A8	5086-7518	2	50 GHZ COUPLER, (NEW)
	5086-6518		50 GHZ COUPLER, (R-E)
A7,A9	5086-7484	2	BIAS TEE (NEW)
	5086-6484		BIAS TEE (R-E)
A16,A17	33325-60004	2	60 DB STEP ATTENUATOR (NEW)
	33325-69004		60 DB STEP ATTENUATOR (R-E)
A18	5086-7570	1	SWITCH SPLITTER (NEW)
	5086-6570		SWITCH SPLITTER (R-E)
AT1,AT2	08517-60026	2	20-7 DB TAPERED PAD

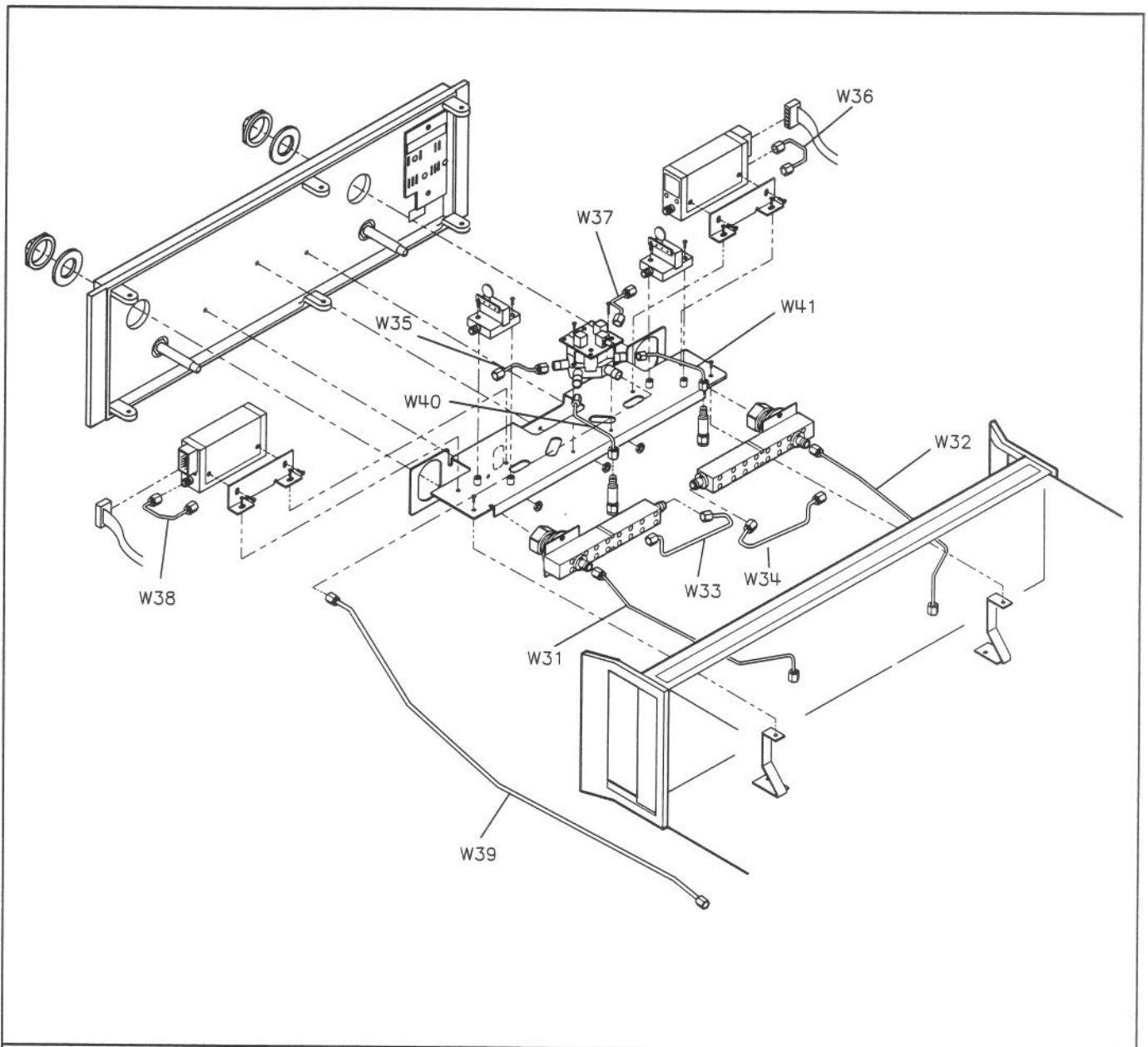
Figure 7-2. Major Assemblies (1 of 2)



* not visible

Reference Designation	HP Part Number	Qty.	Description
A2			USED FOR OPTION 001 SEE FIGURE 7-12
A3	08517-60002	1	VTO SUMMING AMPLIFIER BOARD ASSEMBLY (NEW)
	08517-69002		VTO SUMMING AMPLIFIER BOARD ASSEMBLY (R-E)
A4	08516-60029	1	HP-IB BD ASSEMBLY (NEW)
	08516-69029		HP-IB BOARD ASSEMBLY (R-E)
A5	08517-60001	1	ATTEN/SWITCH DRIVER BOARD ASSEMBLY
A14	5086-7501	1	FREQ. CONV. 50 GHZ (SAMPLERS & VTO) (NEW)
	5086-6501		FREQ. CONV. 50 GHZ (SAMPLERS & VTO) (R-E)
A15	08513-60007	1	REGULATOR BOARD ASSEMBLY
A19	08513-60001	1	MOTHERBOARD
A20	08513-60006	1	HP-IB INTERFACE BOARD ASSEMBLY
B1	08513-20031	1	FAN-TBAX 34-CFM 115V 50/60 HZ 1.5KV DIEL
T1	9100-4723	1	POWER TRANSFORMER

Figure 7-2. Major Assemblies (2 of 2)



Reference Designation	HP Part Number	Qty.	Description
W31	08517-20012	1	CABLE ASSEMBLY A8 TO A14
W32	08517-20011	1	CABLE ASSEMBLY A6 TO A14
W33	08517-20015	1	CABLE ASSEMBLY A8 TO A9
W34	08517-20016	1	CABLE ASSEMBLY A6 TO A7
W35	08517-20009	1	CABLE ASSEMBLY A17 TO A18
W36	08517-20017	1	CABLE ASSEMBLY A7 TO A16
W37	08517-20008	1	CABLE ASSEMBLY A7 TO A18
W38	08517-20007	1	CABLE ASSEMBLY A9 TO A17
W39	08517-20005	1	CABLE ASSEMBLY A18 TO REAR PANEL
W40	08517-20013	1	CABLE ASSEMBLY A18 TO AT2
W41	08517-20014	1	CABLE ASSEMBLY A18 TO AT1

Figure 7-3. Semi-Rigid Cables

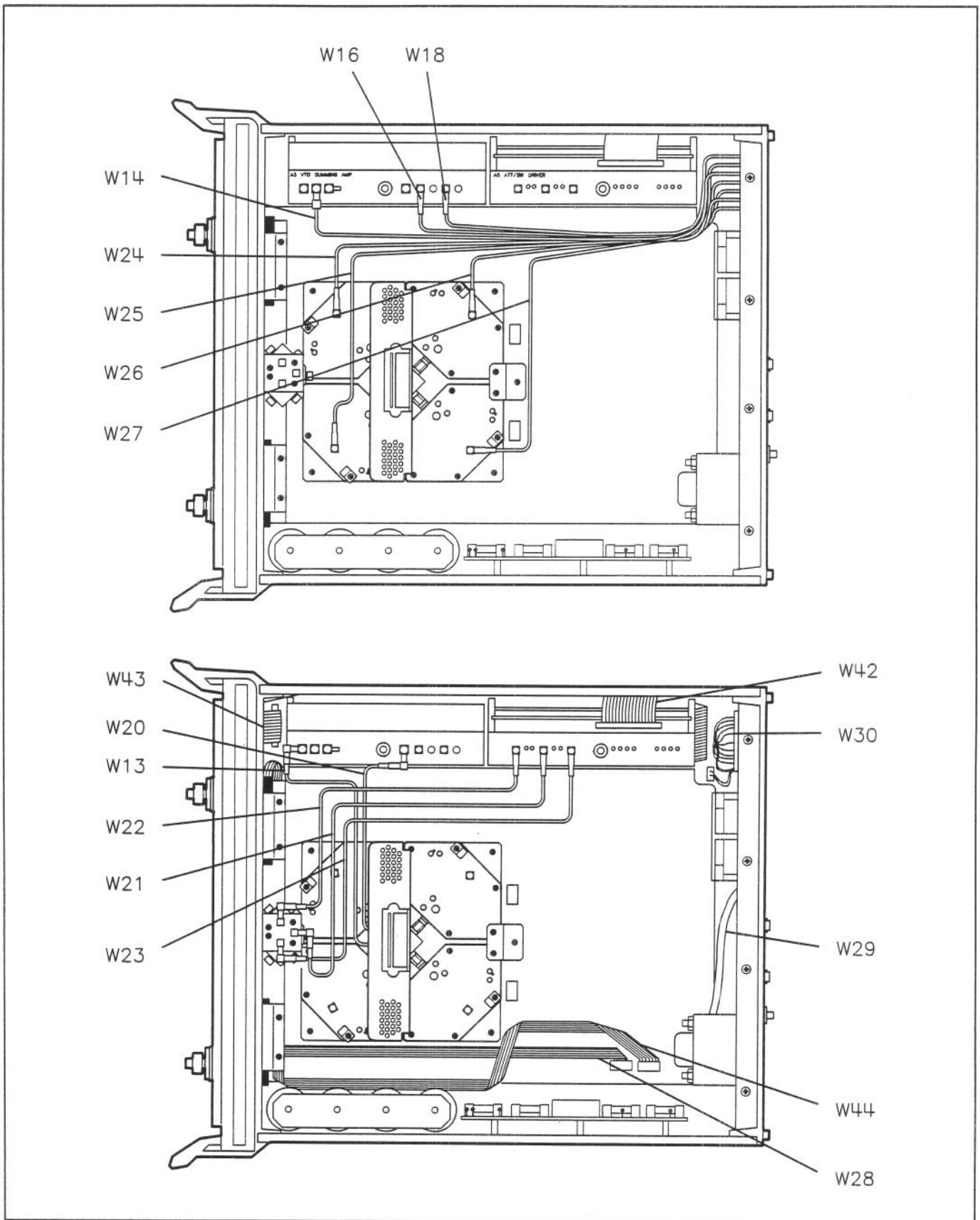
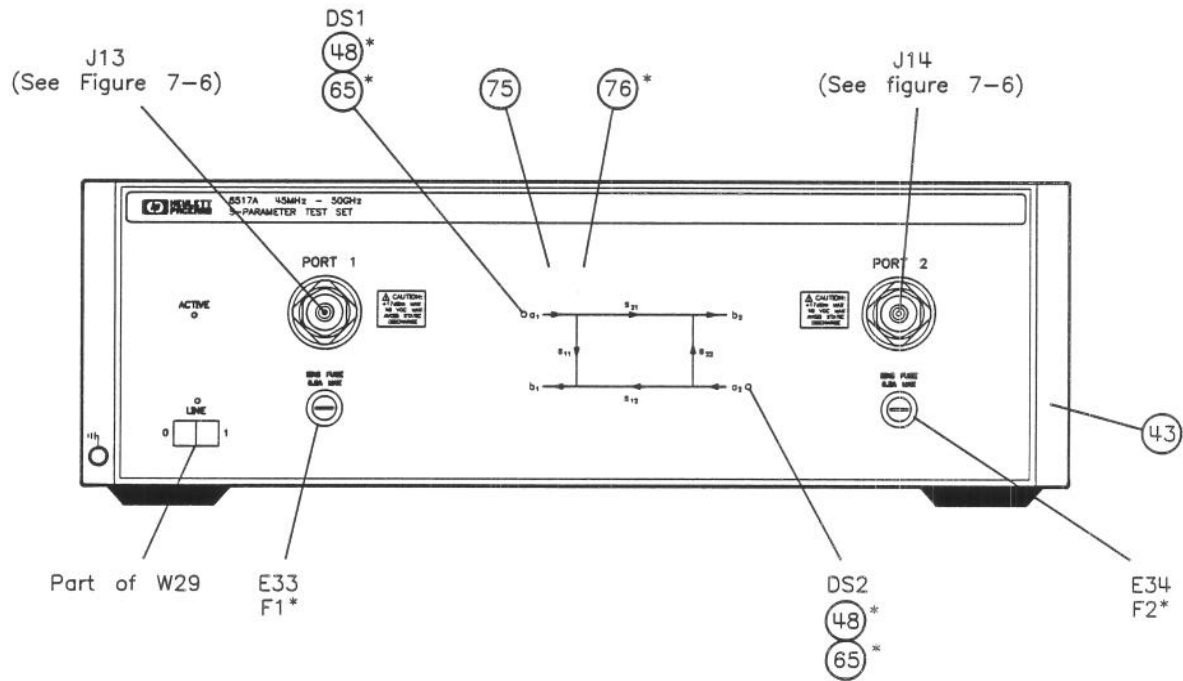


Figure 7-4. Flexible RF Cables (1 of 2)

Reference Designation	HP Part Number	Qty.	Description
W13	08513-60133	1	CABLE ASSEMBLY A3J1 TO A14J1
W14	08513-60134	1	CABLE ASSEMBLY A3J2 TO J11A7
W16	08513-60136	1	CABLE ASSEMBLY A3J5 TO J11A5
W18	08513-60138	1	CABLE ASSEMBLY A3J7 TO J11A6
W20	08513-60140	1	CABLE ASSEMBLY A3J4 TO A14J2
W21	08513-60141	1	CABLE ASSEMBLY A5J2 TO A18J4
W22	08513-60142	1	CABLE ASSEMBLY A5J1 TO A18J3
W23	08513-60143	1	CABLE ASSEMBLY A5J3 TO A18J6
W24	08513-60144	1	CABLE ASSEMBLY A12J3 TO J11A1
W25	08513-60145	1	CABLE ASSEMBLY A13J3 TO J11A4
W26	08513-60146	1	CABLE ASSEMBLY A10J3 TO J11A2
W27	08513-60147	1	CABLE ASSEMBLY A11J3 TO J11A3
W28	08517-60014	1	RIBBON CABLE ASSEMBLY A16-A19
W29	85102-60226	1	CABLE ASSEMBLY LINE SWITCH
W30	08513-60014	1	CABLE ASSEMBLY J10 TO J11
W42	08513-60036	1	CABLE ASSEMBLY A4 TO A20
W43	08513-60013	1	CABLE ASSEMBLY A1 TO A19
W44	08517-60015	1	RIBBON CABLE ASSEMBLY A17-A19

Figure 7-4. Flexible RF Cables (2 of 2)

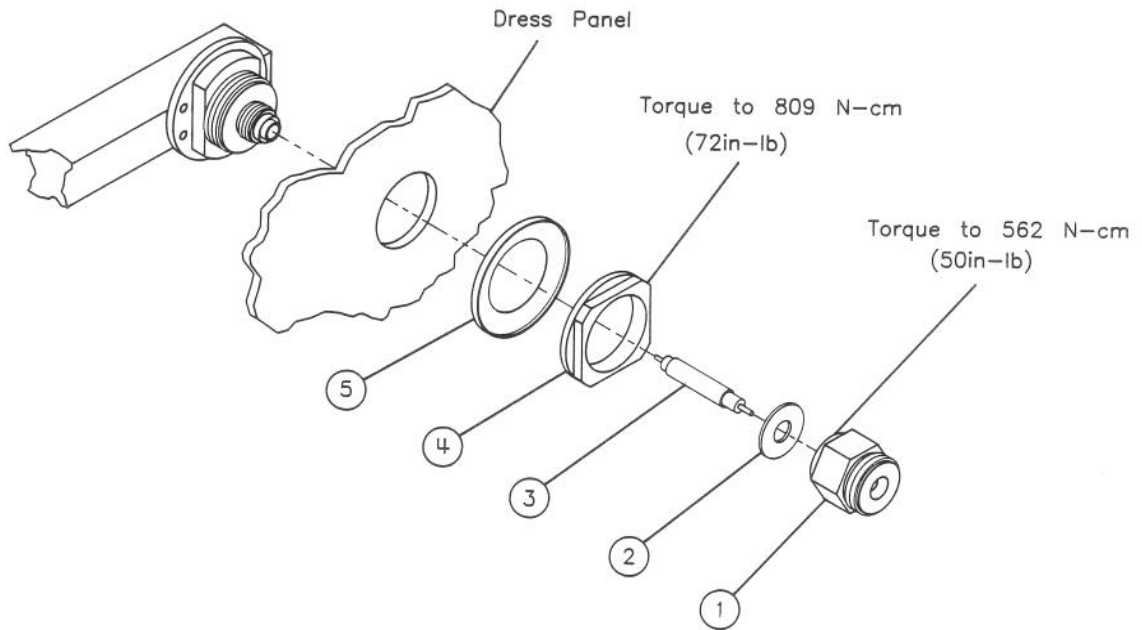


* not visible

Reference Designation	HP Part Number	Qty.	Description
DS1,DS2	1990-0858	2	LED LAMP 25MA MAX
E33,E34	2110-0797	2	FUSEHOLDER
F1,F2	2110-0012	2	FUSE .5A 250V
J13,J14			SEE FIGURE 7-6
43	5021-8747	1	FRONT BEZEL
48	1450-0615	2	RETAINER LED
65	08340-40002	2	MOUNT LED
75	08517-00002	1	FRONT DRESS PANEL
76	08517-00003	1	FRONT SUB PANEL

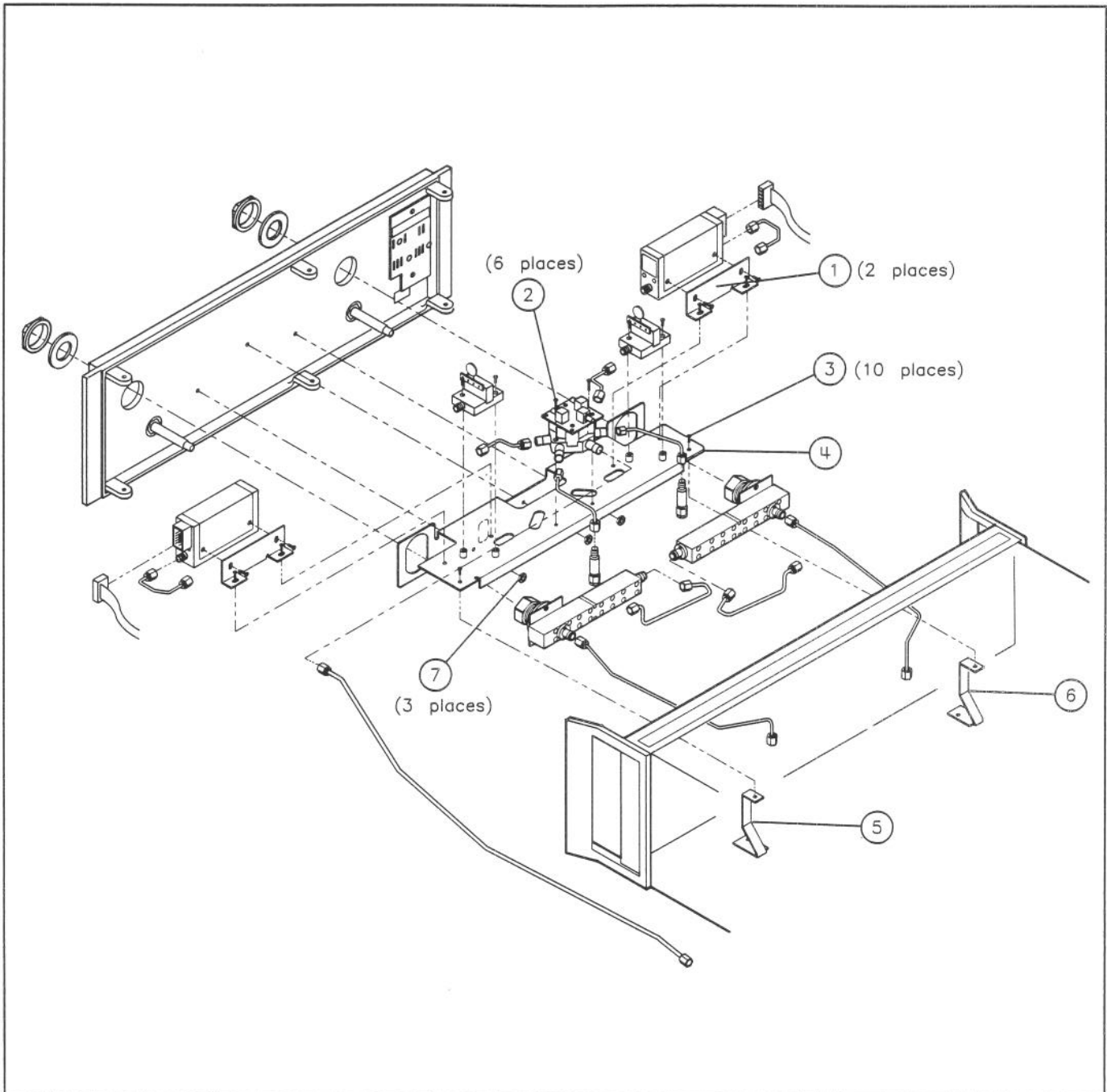
Figure 7-5. Miscellaneous Parts, Front Panel

PORT 1 AND 2



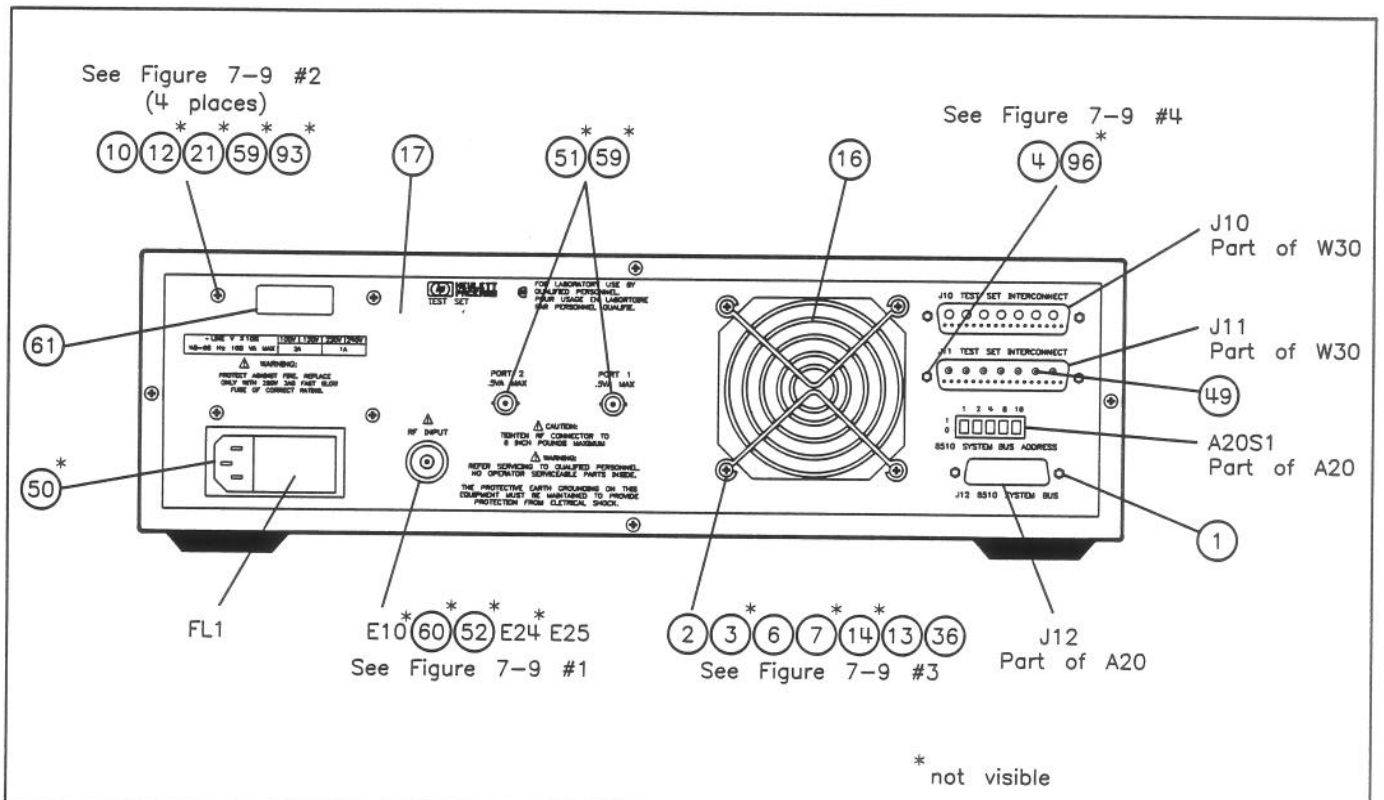
Reference Designation	HP Part Number	Qty.	Description
1	5062-7274	1	TEST PORT CONNECTOR
2	5001-3930		.0002 IN. SHIM
	5001-3904		.0005 IN. SHIM
	5001-3905		.001 IN SHIM
	5001-3906		.002 IN SHIM
3	5062-7276	1	TEST PORT CENTER CONDUCTOR
4	5021-3428	2	TEST PORT NUT
5	5021-3427	2	TEST PORT WASHER

Figure 7-6. Test Port Connectors



Reference Designation	HP Part Number	Qty.	Description
1	08517-00005	2	ATTENUATOR BRACKET
2	0515-0375	6	MACHINE SCREW
3	0515-0372	10	MACHINE SCREW
4	08517-00004	1	MOUNTING BRACKET
5	08517-00007	1	LEFT SUPPORT BRACKET
6	08517-00006	1	RIGHT SUPPORT BRACKET
7	2260-0009	3	NUT

Figure 7-7. Miscellaneous Parts Front Panel



Reference Designation	HP Part Number	Qty.	Description	Mfr Code	Mfr Part Number
E10	08513-20016	1	GOLD NOSE CONNECTOR		
E24	5061-5394	1	PIN AND BEAD ASSEMBLY		
E25	08513-20017	1	BULKHEAD CONNECTOR		
FL1	9135-0217	1	LINE MODULE-FILTERED		
J10	1251-2197	1	CONNECTOR R&P 24F		
J11	1251-2204	1	CONNECTOR R&P 24M		
1	0380-0643	2	STANDOFF-HEX .255-IN-LG 6-32 THD	00000	ORDER BY DESCRIPTION
2	0400-0010	4	GROMMET-RND .188-IN-ID .312-IN-GRV-OD		
3	0380-0926	4	THREADED INSERT-STDF 6-32 .188-IN-LG SST		
4	1251-7812	6	CONNECTOR JACKSCREW		
6	0380-0002	4	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	2510-0322	4	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK	00000	ORDER BY DESCRIPTION
10	2510-0270	4	SCREW-MACH 8-32 3.25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
12	3050-0139	12	WASHER-FL MTLC NO.8 .172-IN-ID		ORDER BY DESCRIPTION
13	3050-0152	4	WASHER-SHLDR NO.8 .172-IN-ID .438-IN-OD		
14	3050-0227	4	WASHER-FL MTLC NO.6 .149-IN-ID		
16	3160-0309	1	FINGER GUARD		
17	08517-00001	1	REAR PANEL		
21	2190-0017	4	WASHER-LK INTL NO. 10 .195-IN-ID		
36	08513-00002	1	TRANSFORMER BRACKET		
49	5021-0906	14	TEFLON CABLE SLEEVE		
50	5001-3907	2	LINE MODULE RETAINER CLIPS		
51	2190-0016	2	WASHER-LK INTL T 3/8 IN .377-IN-ID		
52	2190-0104	1	WASHER-LK INTL T 7/16 IN .439-IN-ID		
59	2950-0001	2	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
60	2950-0132	1	NUT-HEX-DBL-CHAM 7/16-28-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
61	7121-2380	1	LABEL-SERIAL NUMBER		
93	08513-20032	2	TRANSFORMER SUPPORT BRACKET		
96	0590-0663	6	NUT-HEX 4/40		

Figure 7-8. Miscellaneous Parts Rear Panel

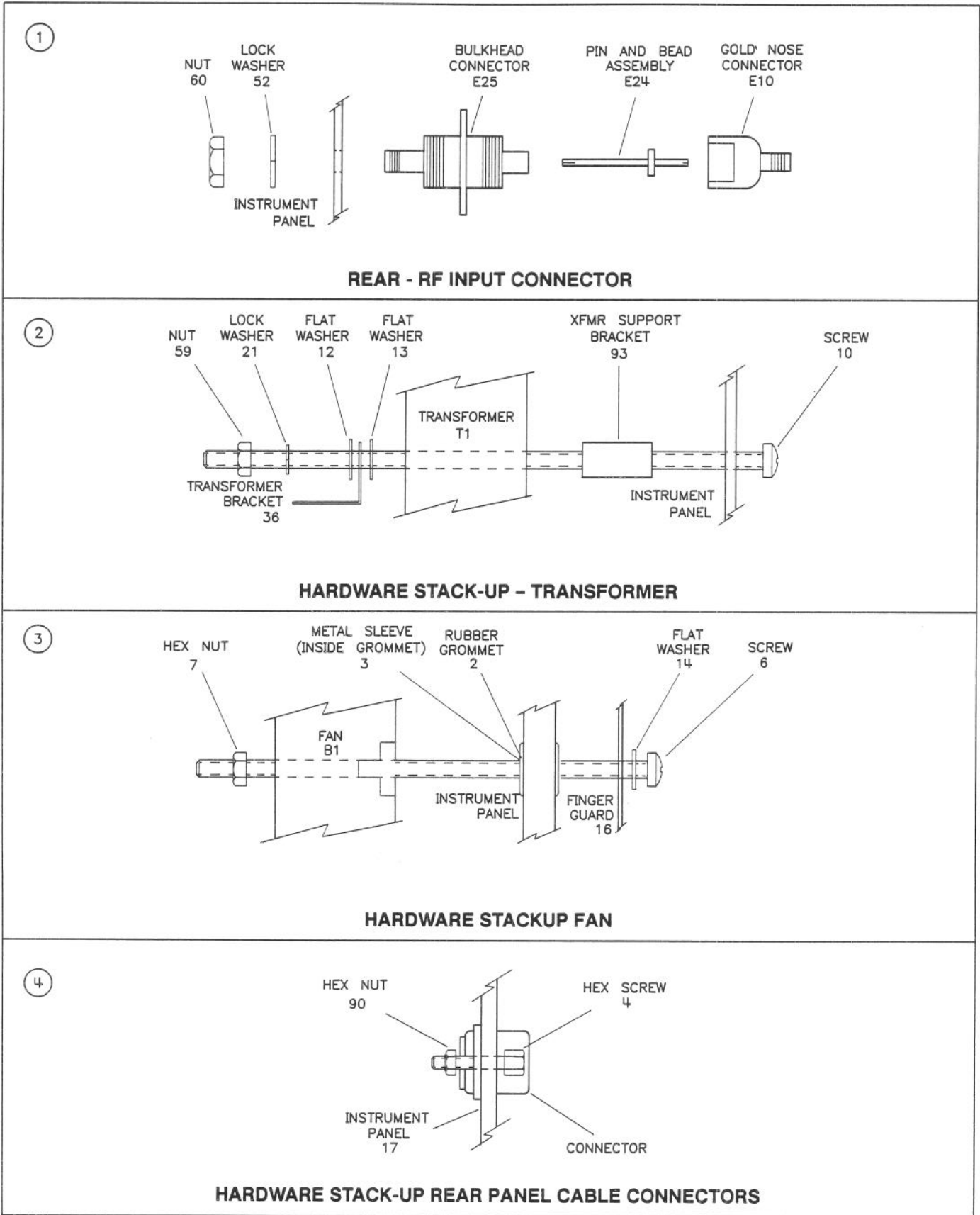
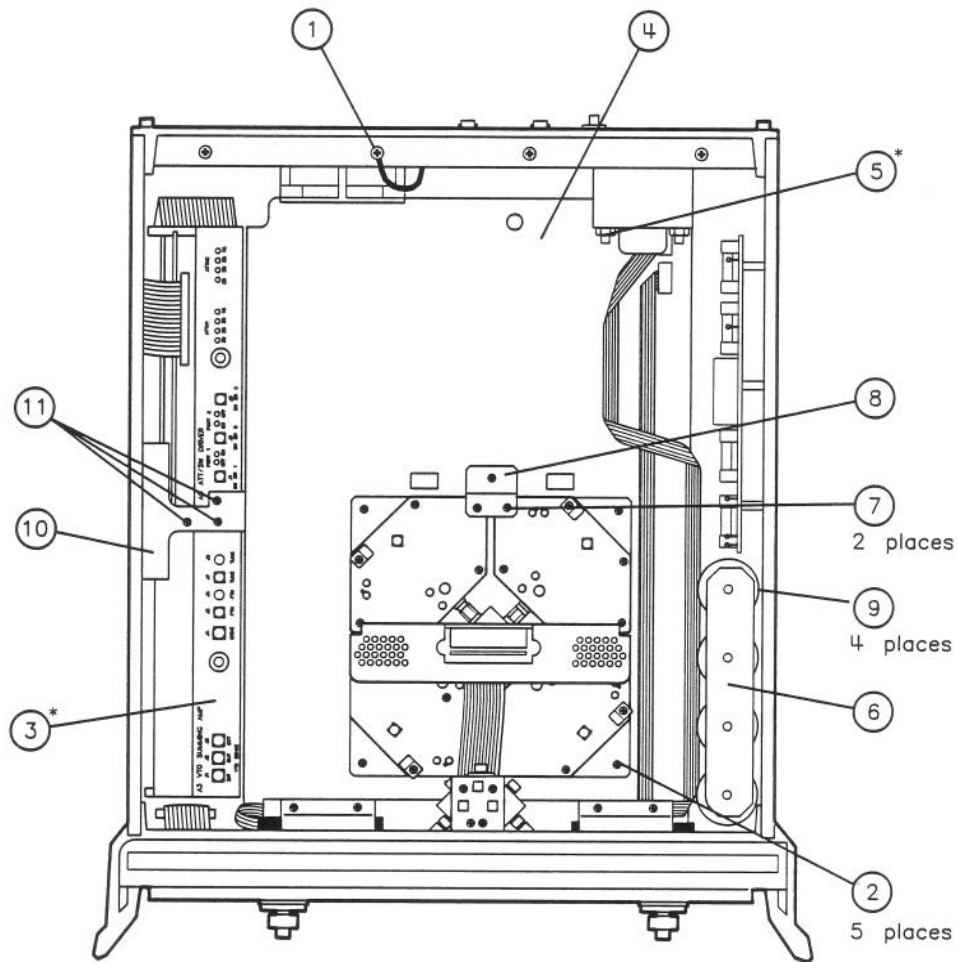


Figure 7-9. Rear Panel Miscellaneous Parts: Detailed Views



* not visible

Reference Designation	HP Part Number	Qty.	Description
1	0360-0031	1	TERMINAL CRIMP
2	2360-0115	5	MACHINE SCREW
3	08512-20005	1	RFI GASKET
4	08513-00001	1	TOP DECK
5	08513-00002	1	TRANSFORMER BRACKET
6	08513-00015	1	CAPACITOR PLATE
7	2200-0109	2	MACHINE SCREW
8	08514-00007	1	MOUNTING PLATE
9			SEE FIGURE 7-11
10	0513-00037	1	ENCLOSURE BRACKET
11	2200-0107	3	MACHINE SCREWS

Figure 7-10. Miscellaneous Parts Top Internal

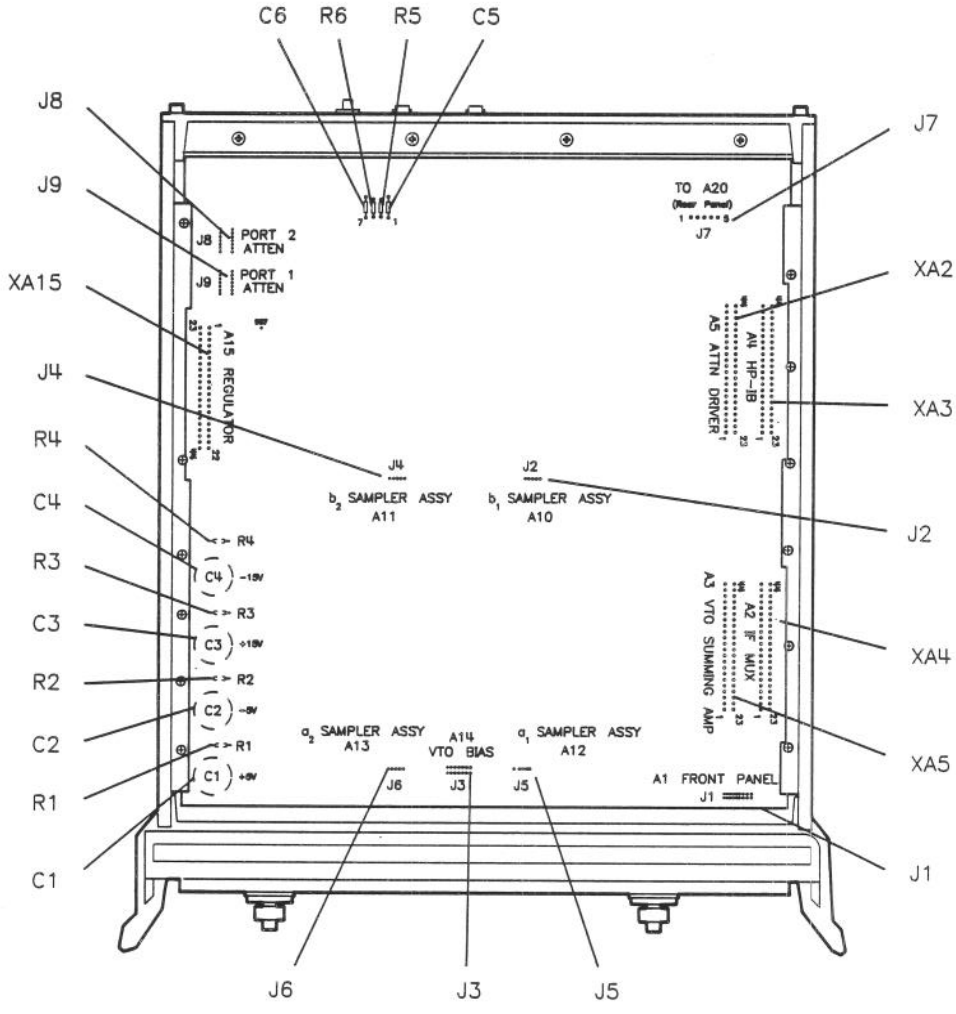


Figure 7-11. Miscellaneous Parts, Motherboard (1 of 2)

Reference Designation	HP Part Number	Qty.	Description	Mfr Code	Mfr Part Number
C1	0180-2671	4	CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	500123U030AC2A
C2	0180-2671		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	
C3	0180-2671		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	
C4	0180-2671		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	
C5-C6	0160-4834	2	CAPACITOR-FXD .047UF ±10% 100VDC CER		500123U030AC2A
J1	1251-5745		CONNECTOR 20-PIN M POST TYPE (A19J1 DOES NOT INCLUDE A19MP1 & A19MP2)		
J2	1251-6868	4	CONNECTOR 5-PIN M POST TYPE		
J3	1251-7939	1	CONN-POST TYPE .100-PIN-SPCG 14-CONT (A19J3 DOES NOT INCLUDE A19MP3)		
J4	1251-6868		CONNECTOR 5-PIN M POST TYPE		
J5	1251-6868		CONNECTOR 5-PIN M POST TYPE		
J6	1251-6868		CONNECTOR 5-PIN M POST TYPE		
J7	1251-3825	1	CONNECTOR 5-PIN M POST TYPE		
J8	1200-0508	2	SOCKET-IC 14-CONT DIP-SLDR		
J9	1200-0508		SOCKET-IC 14-CONT DIP-SLDR		
R1	0764-0015	2	RESISTOR 560 5% 2W MO TC=0±200		
R2	0764-0015		RESISTOR 560 5% 2W MO TC=0±200		
R3	0764-0016	2	RESISTOR 1K 5% 2W MO TC=0±200		
R4	0764-0016		RESISTOR 1K 5% 2W MO TC=0±200		
R5	0757-0394		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F C4-1/8-T0-51R1-F
R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0±100	24546	
XA2	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS		
XA3	1251-7882		CONNECTOR-PC EDGE 2-ROWS		
XA4	1251-7882		CONNECTOR-PC EDGE 2-ROWS		
XA5	1251-7882		CONNECTOR-PC EDGE 2-ROWS		
XA6- XA14			NOT ASSIGNED		
XA15	1251-7882		CONNECTOR-PC EDGE 2-ROWS		

Figure 7-11. Miscellaneous Parts, Motherboard (2 of 2)

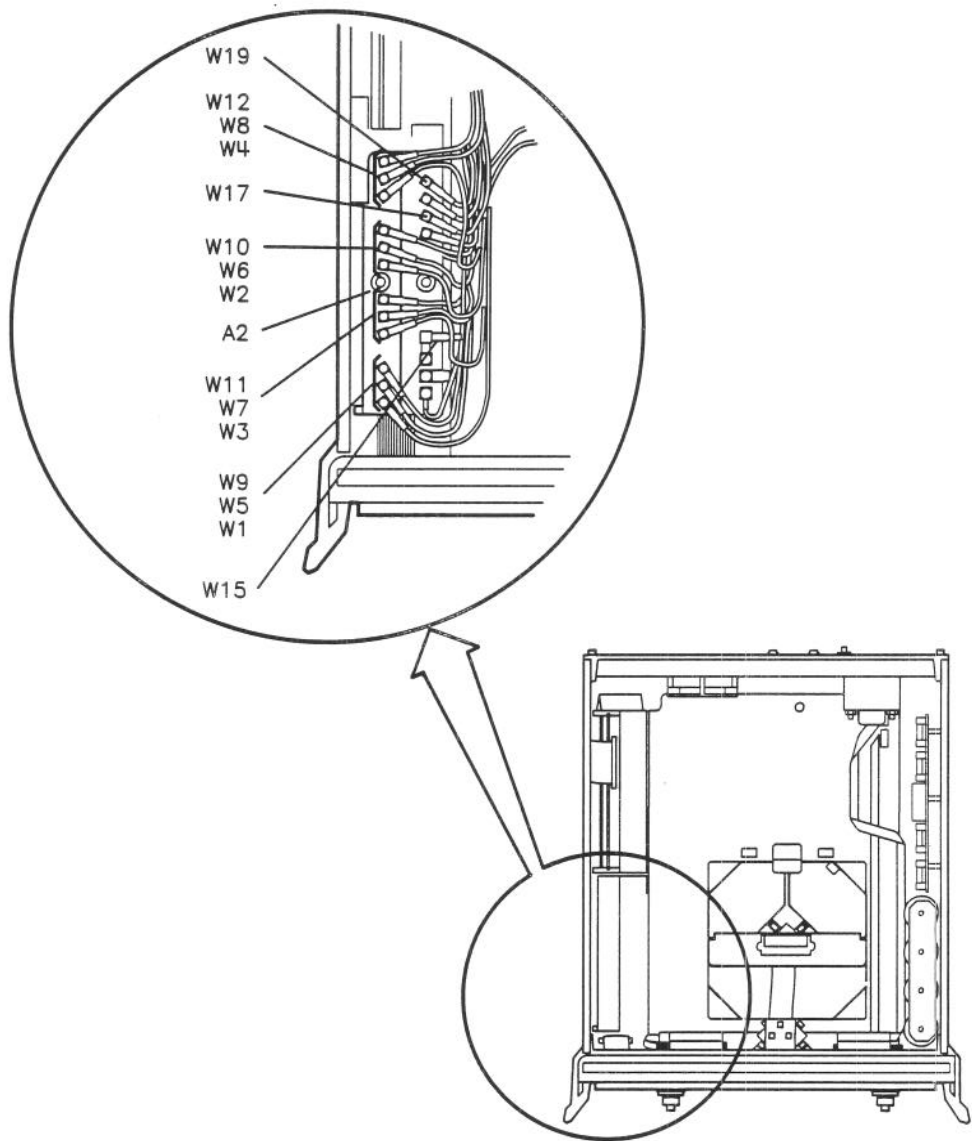
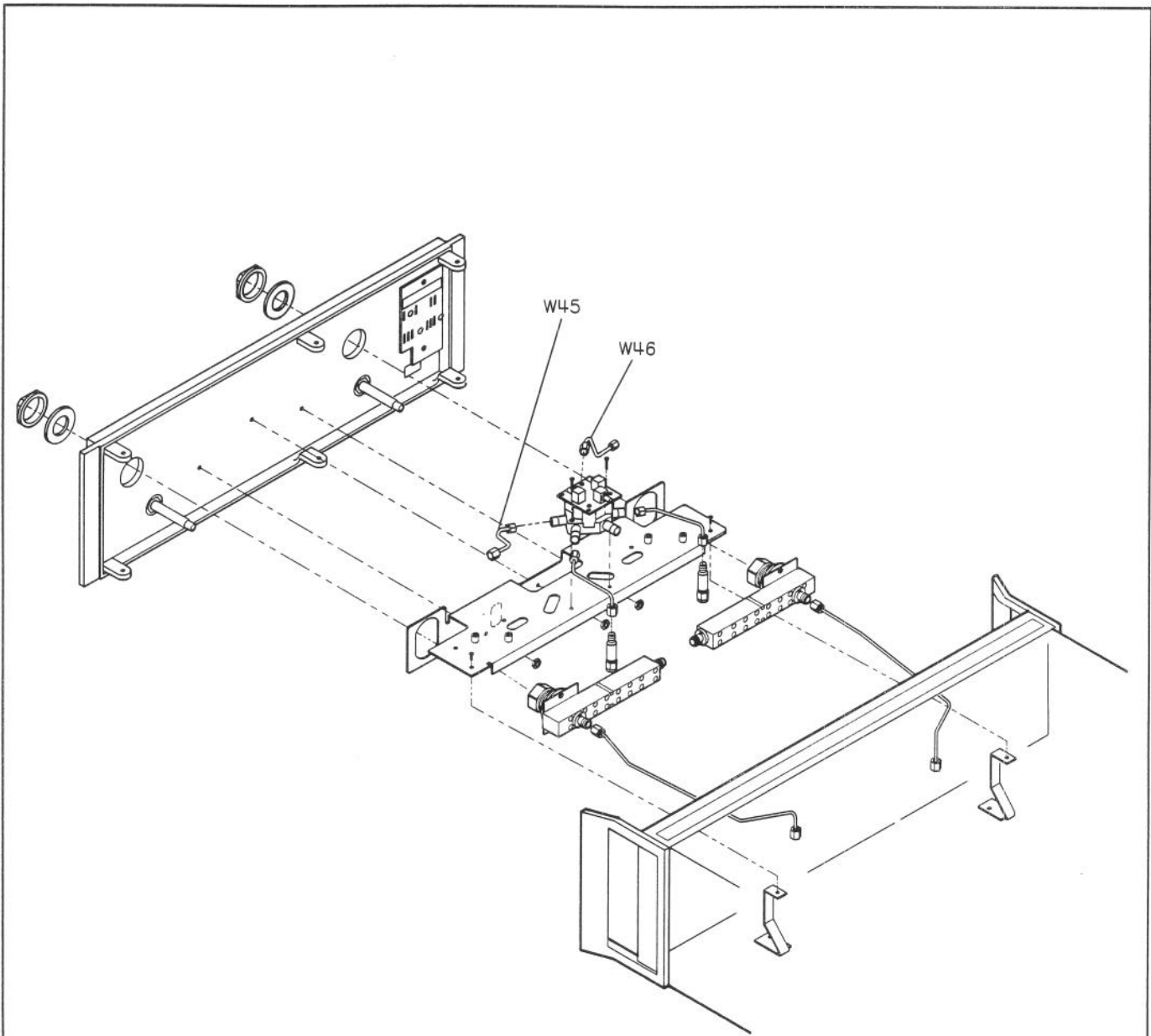


Figure 7-12. Parts Unique to Option 001 (1 of 2)

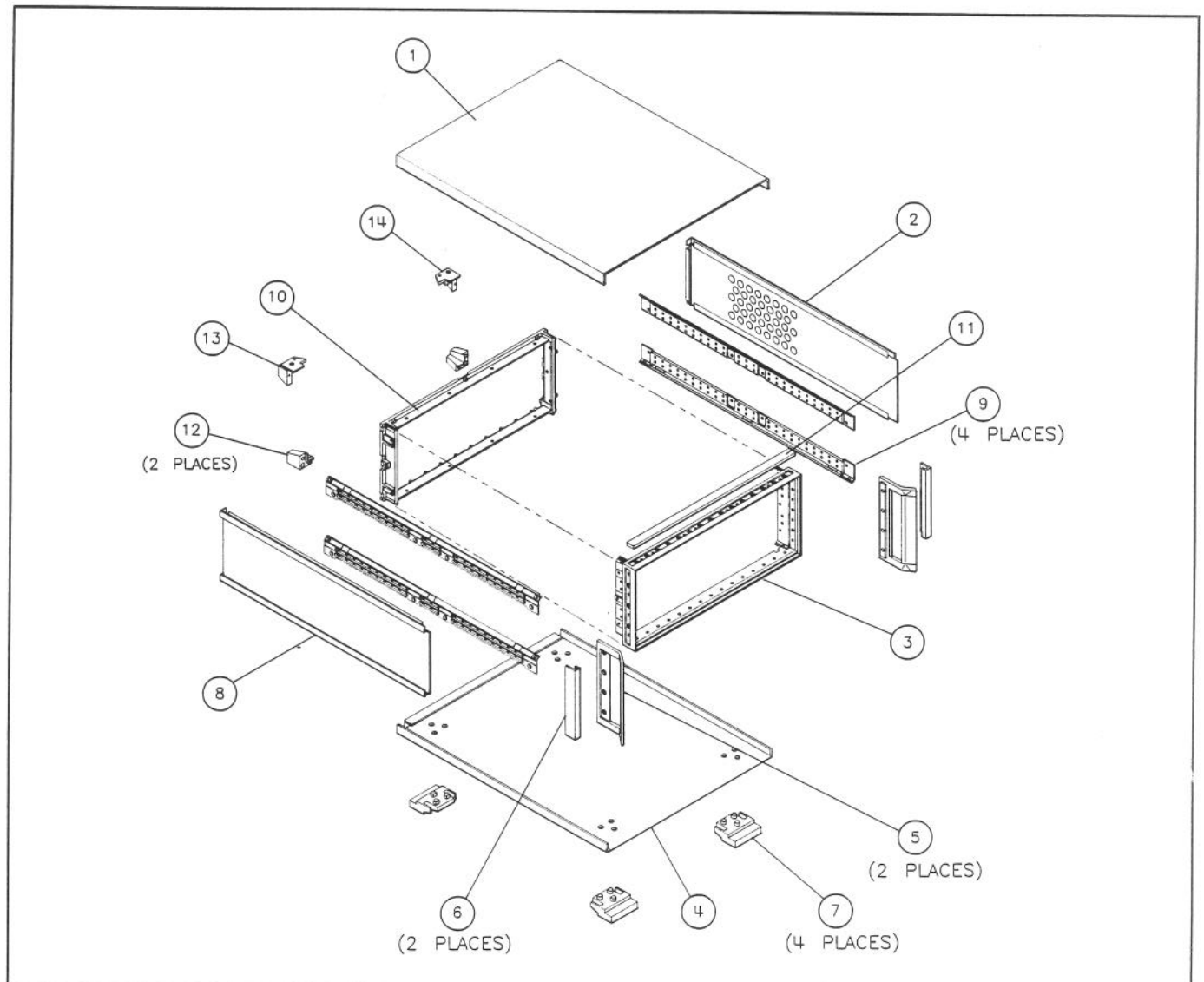
Reference Designation	HP Part Number	Qty.	Description
			PARTS UNIQUE TO OPTION 001
A2	08513-60004	1	BOARD ASSEMBLY, IF MULTIPLEXER (NEW)
A2	08513-69004	1	BOARD ASSEMBLY, IF MULTIPLEXER (REBUILT)
W1	08513-60121	1	CABLE ASSEMBLY A12J3 TO A2J1
W2	08513-60122	1	CABLE ASSEMBLY A13J3 TO A2J7
W3	08513-60123	1	CABLE ASSEMBLY A10J3 TO A2J4
W4	08513-60124	1	CABLE ASSEMBLY A11J3 TO A2J10
W5	08513-60125	1	CABLE ASSEMBLY A2J2 TO J11A1
W6	08513-60126	1	CABLE ASSEMBLY A2J8 TO J11A4
W7	08513-60127	1	CABLE ASSEMBLY A2J5 TO J11A2
W8	08513-60128	1	CABLE ASSEMBLY A2J11 TO J11A3
W9	08513-60129	1	CABLE ASSEMBLY A2J3 TO J10A1
W10	08513-60130	1	CABLE ASSEMBLY A2J9 TO J10A4
W11	08513-60131	1	CABLE ASSEMBLY A2J6 TO J10A2
W12	08513-60132	1	CABLE ASSEMBLY A2J12 TO J10A3
W13-W14			NOT UNIQUE TO OPTION 001
W15	08513-60135	1	CABLE ASSEMBLY A3J3 TO J10A7
W16			NOT UNIQUE TO OPTION 001
W17	08513-60137	1	CABLE ASSEMBLY A3J6 TO J10A5
W18			NOT UNIQUE TO OPTION 001
W19	08513-60139	1	CABLE ASSEMBLY A3J8 TO J10A6

Figure 7-12. Parts Unique to Option 001



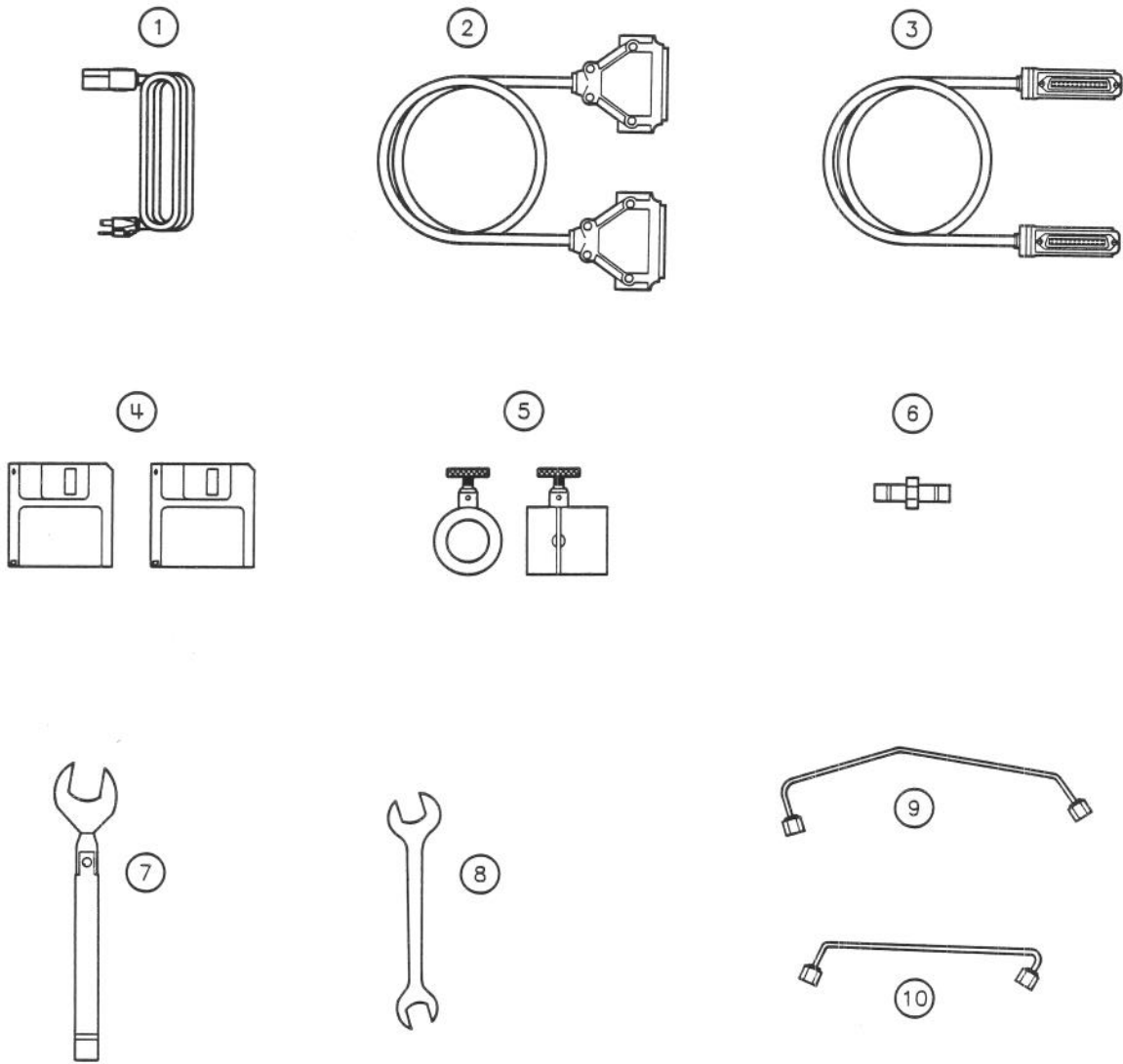
Reference Designation	HP Part Number	Qty.	Description
W45	08517-20017	1	CABLE ASSEMBLY A8 TO A18
W46	08517-20018	1	CABLE ASSEMBLY A6 TO A18

Figure 7-13. Parts Unique to Option 002



Reference Designation	HP Part Number	Qty.	Description
1	08513-00040	1	TOP COVER
2	08513-00041	1	SIDE COVER PERFORATED
3	5021-8403	1	FRONT FRAME
4	5062-3747	1	BOTTOM COVER
5	5062-3799	1	HANDLE ASSEMBLY
6	5021-8496	1	TRIM FRONT HANDLE
7	5041-8821	4	BOTTOM FOOT
8	5062-3757	1	SIDE COVER
9	5021-5837	1	18" CORNER STRUT
10	5021-5804	1	REAR FRAME
11	5041-8802	1	TRIM STRIP
12	5041-8821	2	BACK PANEL FOOT
13	5021-8538	1	LOCK FOOT
14	5021-8540	1	LOCK FOOT

Figure 7-14. Cabinet Parts



Reference Designation	HP Part Number	Qty.	Description
1	8120-1348	1	POWER CORD U.S.A.
2	08510-60106	1	INTERFACE CABLE
3	8120-3445	1	HP-IB CABLE
4	08510-10033	1	SPECIFICATION AND PERFORMANCE VERIFICATION SOFTWARE
5	08515-60003	2	TEST PORT CLAMPS
6	1250-2188	1	ADAPTER FEMALE TO FEMALE 2.4MM
7	8710-1764	1	20 MM 8 IN.-LB WRENCH
8	8710-1770	1	1/2" X 9/16" WRENCH
9	08517-20005	1	SOURCE CABLE, RACK MOUNT
10	08517-20019	1	SOURCE CABLE, BENCH CONFIGURATION

Figure 7-15. Accessories Supplied with the Test Set

Chapter 8. Performance Tests

Performance test information and procedures are located in the "Specifications and Performance Verification" chapter of the HP 8510 On-Site Service Manual. Note that the HP 8510 performance test software (supplied with the test set) is required to test the HP 8517A. Performance test results are based on the HP 8510 system, including the test set, cables, calibration kit, etcetera.

Chapter 9. Adjustments

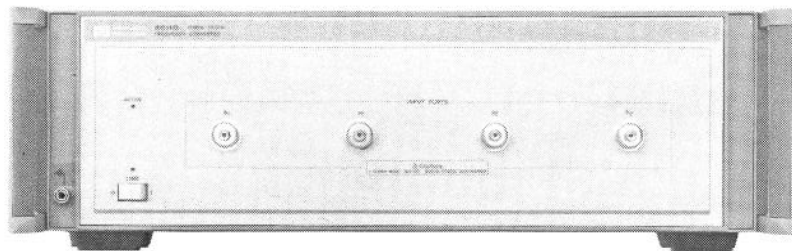
The HP 8517A has no adjustments. Specifically, no attempt should be made to adjust the samplers.

Chapter 10. Instrument History

This manual applies directly to instruments as designated on the title page.

If your instrument had a lower serial number prefix and needed additional documentation, it would be located in this section. For additional information, see "Instruments Covered by this Manual" in the "General Information" chapter of this manual.

HP 8511B FREQUENCY CONVERTER TEST SET



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 system product is warranted against defects in materials and workmanship for a period corresponding to the individual warranty periods of its component products. Computer and computer peripherals are warranted for a period of 90 days. Instruments are warranted for a period of one year. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

Warranty service for products installed by HP and certain other products designated by HP will be performed at Buyer's facility at no charge within HP service travel areas. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses. In all other areas, products must be returned to a service facility designated by HP.

For products returned to HP for warranty service, Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

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

LIMITATION OF WARRANTY

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

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OR 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.

HP 8511B FREQUENCY CONVERTER TEST SET

SERIAL NUMBERS

This manual applies directly to the HP 8511B Frequency Converter Test Set with serial number prefix 3047A and higher.

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

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MANUAL PART NO. 08511-90046

Printed: JULY 1991



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 auto-transformer 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 8511B FREQUENCY CONVERTER TEST SET

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CHAPTER 9. ADJUSTMENTS

CHAPTER 10. INSTRUMENT HISTORY

Chapter 1. General Information

HOW TO GET STARTED

This is the *Operating and Service Manual* for the HP 8511B Frequency Converter test set. This manual, in conjunction with the HP 8510 network analyzer manual set, provides all the information needed to properly configure your system and make measurements.

First. Place this manual behind the tab titled "Test Sets" in the HP 8510 *Test Sets and Accessories Manual*. Read the chapters titled "General Information" and "Installation." These chapters include information on site preparation, unpacking and inspecting your instrument for damage, safety considerations, and configuring your test set to the HP 8510.

Second. Read the chapters of the *Microwave Connector Care Manual*, supplied with the HP 8510 manual set, that pertain to the care, cleaning, gaging, and connection of precision 2.4 mm devices. This information will help you make good connections and care for your precision devices. To maintain the performance of your test set and network analyzer system it is important to pay strict attention to the information provided in the *Microwave Connector Care Manual*.

Third. Read the chapter titled "Operation." This chapter will acquaint you with the front and rear panel features of your test set. Also included is information on controlling multiple test sets, using the anti-rotation clamps, and connecting devices to the test set.

The rest of the manual may be used as needed. The remaining chapters provide information on specifications, troubleshooting, replacement procedures, and parts.

VERIFYING THE FREQUENCY CONVERTER TEST SET

The test set has been designed to operate specifically with the HP 8510 network analyzer.

- To check the proper operation of the test set, perform the Operator's Check in the "Operation" chapter of this manual.
- The specifications for the test set may be verified by running the performance test software as described in the "Performance Tests" chapter in this manual.
- To troubleshoot the test set, refer to the troubleshooting information in the HP 8510 *Service Manual* to determine if the test set is at fault. Then refer to the troubleshooting information in this manual to determine the faulty assembly.

MEASUREMENT ACCURACY

Any precision measurement is no better than the calibration of the network analyzer. As a general rule, the shorter the time between a calibration and the measurement of a device under test (DUT), the more precise the measurement will be, within the limitations of your system. For this reason Hewlett-Packard recommends that for precision measurements you recalibrate your system every few hours, or as a minimum, reverify your system calibration.

The frequency of your required calibration will depend on the temperature stability of the location of the network analyzer.

INSTRUMENTS COVERED BY THIS MANUAL

You will find a two-part serial number on the rear panel of the instrument. The first four digits and the letter are the serial number prefix. The last five digits are the sequential suffix which is unique to each test set. The contents of this manual apply directly to test sets with the same serial number prefix as the one(s) on the title page.

If the serial prefix of your test set is not listed on the title page, your instrument differs from those documented in this manual. The differences are documented in the "Instrument History" chapter.

INSTRUMENT COMPATIBILITY

The test set is compatible with all HP 8510 network analyzers, HP 8340 or 8341 synthesized sweepers, and HP 8350 sweep oscillators. HP 836XX series sources must have a frequency range that extends to 50 GHz to take full advantage of the frequency range of the HP 8511B. If your network analyzer and/or source do not fulfill the required conditions, it will be necessary to upgrade your system. Please consult your Hewlett-Packard representative for more information. It is possible to use the HP 8511B test set with an HP 834x or an HP 8350 source, to their upper frequency limit.

DESCRIPTION AND CHARACTERISTICS OF THE INSTRUMENT

The HP 8511B four channel frequency converter test set is designed to operate with all HP 8510 network analyzers. The test set provides a convenient means of customizing a test configuration for a variety of applications within the frequency range of 45 MHz to 50 GHz. In addition to configurations for measuring reflection and transmission parameters of one-port or two-port devices you can build configurations to characterize antenna parameters, radar cross sections and frequency translation devices. Figure 1-1 shows one possible measurement set-up.

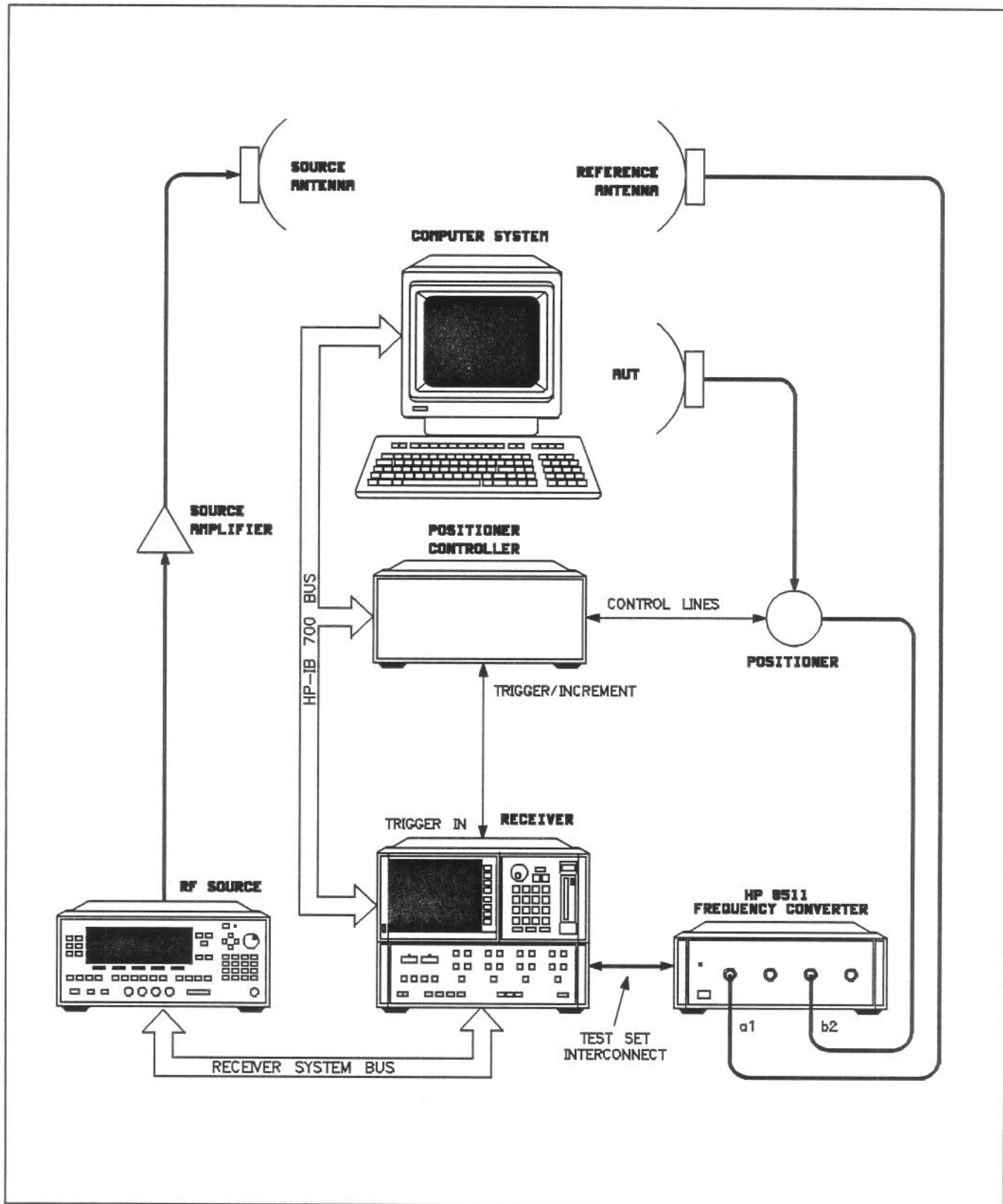


Figure 1-1. Measurement Set-up

OPTIONS

Option 001. This option adds IF switching capability to allow up to four test sets to be connected to the HP 8510 at the same time. The test set in use is selected from the network analyzer. The 20 MHz IF signal is transmitted from the standard test set through the option 001 test set(s) to the network analyzer. IF switching is performed automatically by the option 001 test set(s), without reconnections. For more information see “Controlling Multiple Test Sets” in the “Operation” chapter of this manual.

Option 908. This option supplies the parts required to rack mount the test set with handles removed. Refer to the “Installation” chapter of this manual for additional information.

Option 910. This option provides a duplicate manual.

Option 913. This option supplies the parts required to rack mount the test set with handles attached. Refer to the “Installation” chapter of this manual for additional information.

SERVICE AND SUPPORT PRODUCTS

A variety of service and support products are available. These products cover repair, calibration, and verification. Consult your local Hewlett-Packard customer engineer for details. The instrument includes a one year on-site service warranty. In the event of failure Hewlett-Packard will provide service for the system. Note that system installation is not included.

Option W30, three year customer return repair coverage, adds to the product warranty to provide a total of three years of customer return to Hewlett-Packard repair service.

Option W31, three year on-site repair coverage, adds to the product warranty to provide a total of three years of next day on-site repair service.

Option 1BN, adds a MIL-STD 45662A Certificate of Calibration to the instrument. Must be ordered when the instrument is ordered.

Option 1BP, adds a MIL-STD 45662A Certificate of Calibration and the corresponding calibration data to the instrument. Must be ordered when the instrument is ordered.

ACCESSORIES

Accessories Supplied

The accessories supplied with the test set, including part numbers, are listed in the “Installation” and “Replaceable Parts” chapters of this manual.

Accessories Available

NOTE: Additional HP 8510 system accessory information is located in the HP 8510 manual set.

Calibration and Verification Kits

Hewlett-Packard offers several calibration and verification kits. Suitable for use with 2.4 mm interfaces, they are listed below.

HP 85056A 2.4 mm Calibration Kit. Contains open and short circuits, fixed and sliding loads (2), 2.4 mm to 2.4 mm adapters, 2.4 mm connector tools and gauges.

HP 85057S 2.4 mm Verification Kit. Contains precision airline, mismatched airline, 20 and 40 dB attenuators with NIST (National Institute of Standards and Technology) traceable data and uncertainties.

OPERATING AND SAFETY PRECAUTIONS

Operating



ATTENTION Static Sensitive Handle only at Static Safe Work Stations

The assemblies in this test set are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

Otherwise, you need observe only the following normal precautions in handling and operating the test set:

Do **not** exceed the front panel operating level power input as noted:

Maximum Power Level	Test Port
+ 13 dBm	a ₁ , a ₂ , b ₁ , b ₂

Do **not** apply a DC level to the front panel input of the test set.

Do **not** torque anything to the test port connector with greater than 90 N-cm (8 in-lb) of torque.

Safety

The voltages in this test set warrant normal caution for operator safety. Nevertheless, service should be performed only by qualified personnel. Service strategy, troubleshooting procedures, replaceable parts, and similar information for the test set is in this manual or the HP 8510 service manual.

SPECIFICATIONS

The specifications of the test set with an HP 8510 network analyzer are listed in the “Specifications” chapter of this manual.

CHARACTERISTICS

The performance parameters listed in the “Specifications” chapter as characteristics are typical or nominal, but non-warranted characteristics of the HP 8510/8511B system.

RECOMMENDED EQUIPMENT

Additional equipment and accessories required for use with the test set are listed in tables in the “Performance Tests” chapter of this manual. The tables note which items are required to verify the performance of the test set and which are required to operate it. Other equipment may be substituted if its specifications meet or exceed the specifications listed in the critical specifications column. This equipment is also listed in the following table.

Item	Critical Specification	Recommended Model	Use ¹
Network Analyzer	no substitute	HP 8510 (any 8360 model)	O, P, T
Source		HP 83651A, HP 8340/41, HP 8350	O, P, T
Controller	no substitute	HP 9000 series 200 or 300 with 2 Mbyte RAM and HP BASIC 3.0 or higher or PCC-305 or PC-308 HP BASIC Controller with 2 Mbyte of Basic Language Processor RAM	
Disk drive	compatible with controller		P
Multimeter	range: 0 to 50V	HP 3456A	T
Oscilloscope	50 MHz bandwidth	HP 1740A	T
Power Splitter	45 MHz to 50 GHz	HP 11667C	P, T
Power Meter	no substitute	436, 437, 438	P
Power Sensor	no substitute	HP 8487A	P
2.4 mm Adapter	2.4 mm (f) to 2.4 mm (f)	HP 11900B	P, T
6 dB Attenuator (2)	2.4 mm DC to 50 GHz	HP 3340D Opt. 020	P, T
20 dB Attenuator	2.4 mm DC to 50 GHz	HP 33340D Opt. 020	P, T
50 Ohm Fixed Load	2.4 mm (male)	HP 85138A	P, T
50 Ohm Fixed Load	2.4 mm (female)	HP 85138B	P, T
RF Cable	2.4 mm (m) semi-rigid	08511-20031	P, T
Semi-rigid coax test cable (2)	no substitute	08511-20025	P, T

1. O = operation
 P = performance test
 T = troubleshooting

Chapter 2. Installation

INTRODUCTION

This section explains how to install the test set. The topics covered include initial inspection, environmental considerations, positioning and connecting the test set for use, and packaging the instrument. Refer to the "Installation" chapter of the HP 8510 manual for more complete system connection and turn-on instructions.

INITIAL INSPECTION

Inspect the shipping container (including cushioning material) for damage. If it is damaged, keep it until you have checked the contents for completeness. Figure 2-1 illustrates the accessories supplied with the test set.

If the shipping container is damaged, perform the performance tests. If the test set fails the performance tests, or is damaged or defective, keep the shipping materials and notify both the carrier and the nearest Hewlett-Packard office. The HP office will arrange for repair or replacement of the test set without waiting for settlement of the claim. If any of the following accessories are not received with the test set, notify your nearest HP office and the missing parts will be sent to you.

ENVIRONMENTAL CONSIDERATIONS

Operation

To perform within specifications, the test sets should be operated in temperatures between 0°C and +55°C with relative humidity less than 95% (at 40°C dry bulb temperature, maximum). They may be operated at altitudes up to 4,500 meters (15,000 feet).

Storage

The test sets may be stored in temperatures from -40°C to +75°C, with relative humidity up to 90% at +65°(maximum dry bulb temperature) and at altitudes up to 15,240 meters (50,000 feet).

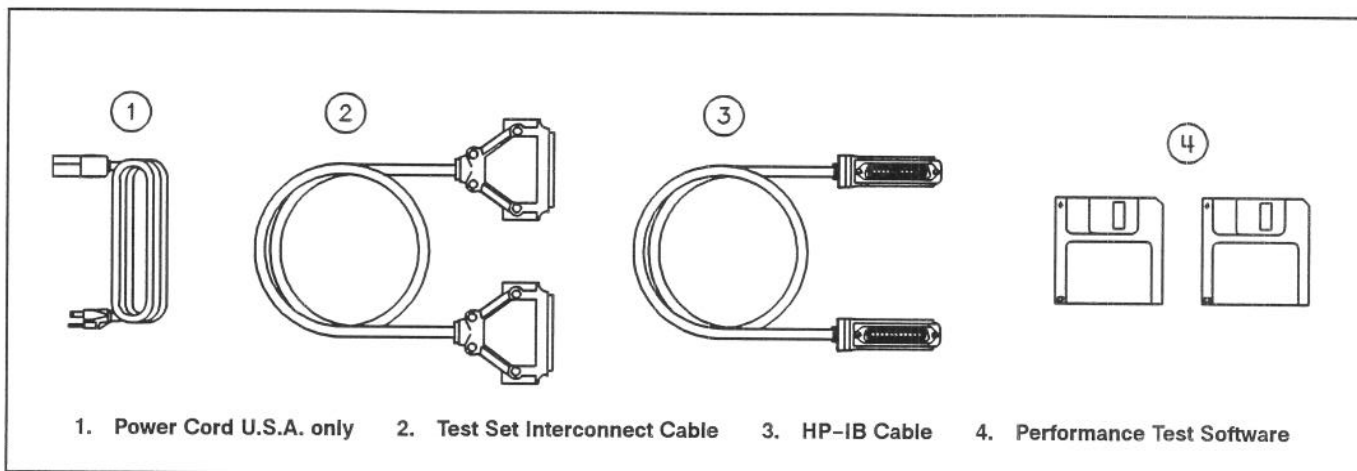


Figure 2-1. Accessories Supplied with the Test Set

STATIC-FREE WORKSTATION



ATTENTION
Static Sensitive
Handle only at Static Safe
Work Stations

Assemblies in the test set are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

Always use an anti-static wrist strap when calibrating or verifying the test set or using the test set to measure devices. Never touch the test port center conductors.

INSTALLING THE TEST SET IN A SYSTEM RACK

The recommended system rack is the HP 85043A. Instructions for rack-mounting the test set in a system configuration with the HP 8510 are provided in the "Installation" chapter of the HP 8510 on-site service manual and in the HP 85043A system rack manual.

To install the flanges to rack mount the instrument (with or without handles) in a standard 19 inch rack, refer to Figure 2-2.

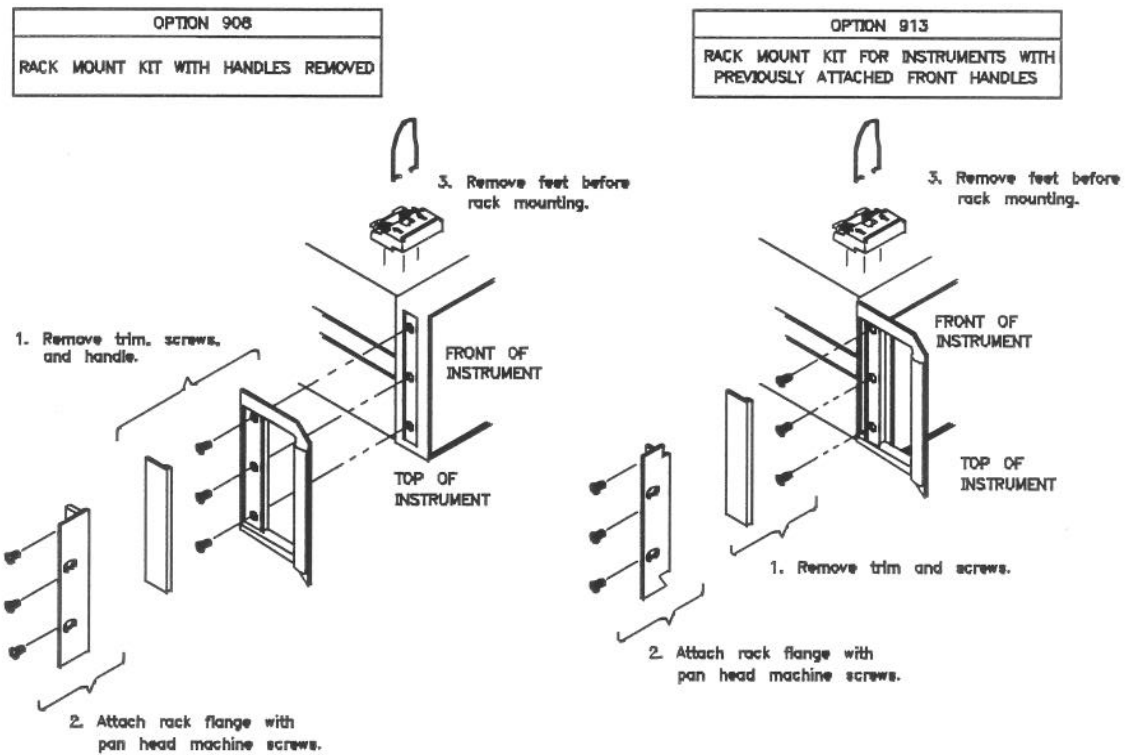


Figure 2-2. Attaching Rack-Mounting Hardware

INSTALLING THE TEST SET ON A BENCH

When installing the test set for use on a bench, place it on a grounded anti-static work surface (Figure 2-3) to lessen the chance of ESD damage. The antistatic surface should extend far enough in front of the test set to provide effective protection for the test ports and cable ends.

A grounding receptacle is provided on the test set as an alternate grounding point for your anti-static wrist-strap.

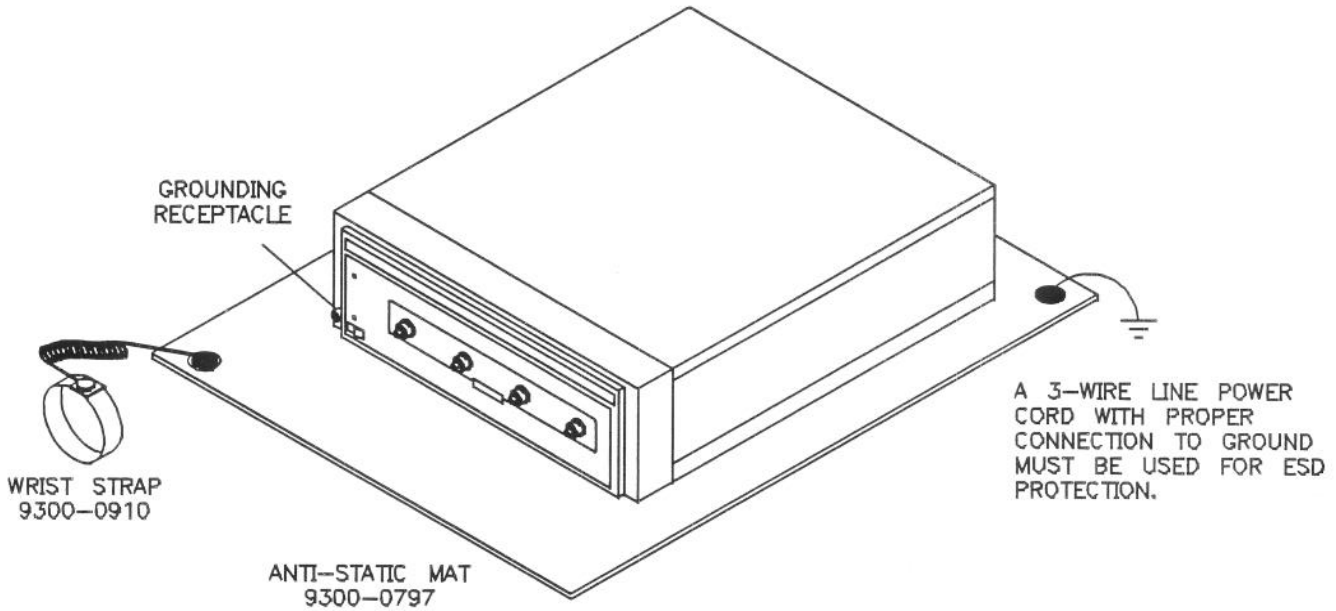


Figure 2-3. Recommended Static-Free Workstation

CONNECTING THE TEST SET IN A SYSTEM CONFIGURATION

Figure 2-4 illustrates the cable connections in a system configuration. Follow the instructions in the following paragraphs.

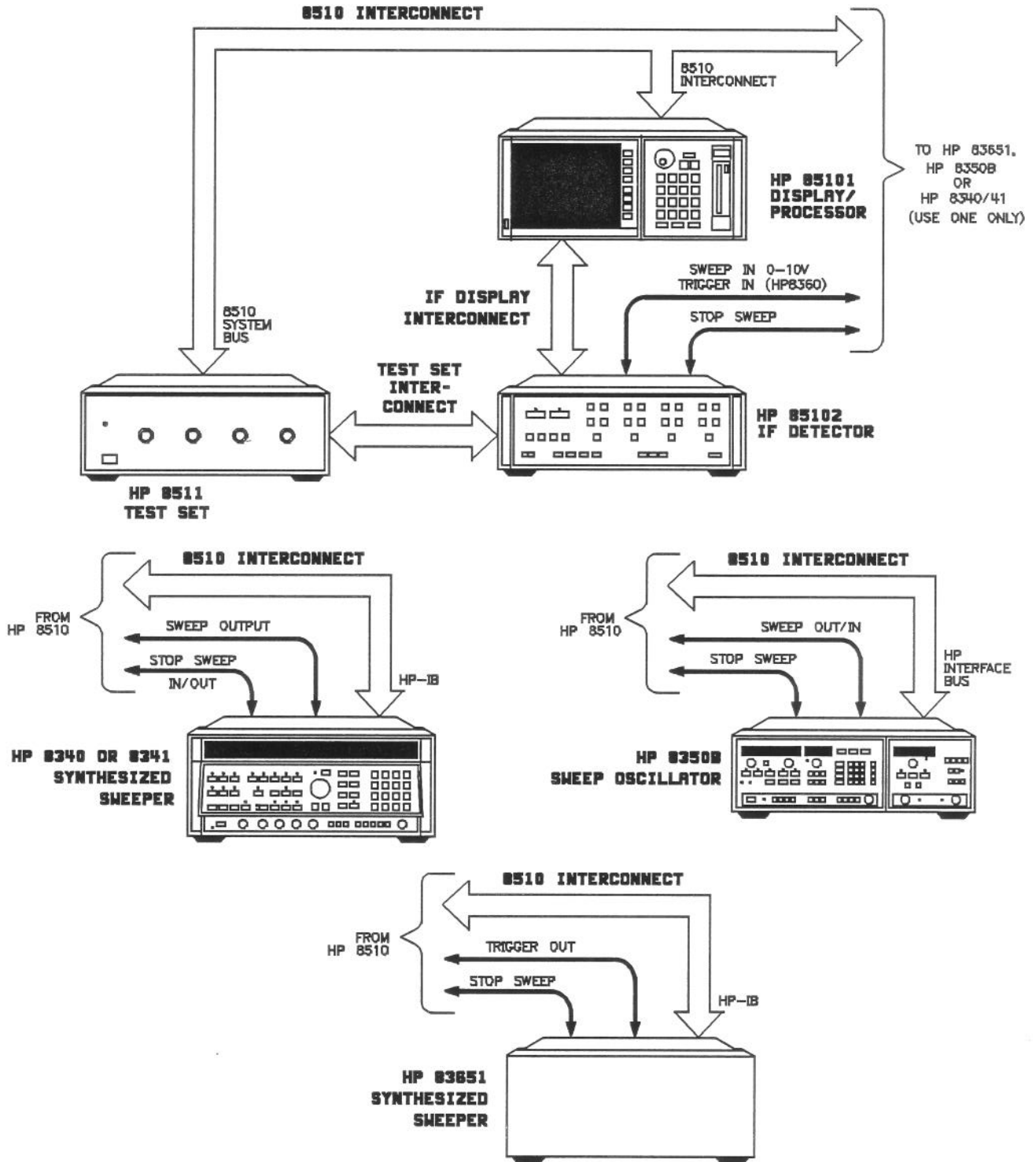


Figure 2-4. System Connections

Power and Control Connections

Make sure the line module is set to the correct voltage. For information on changing the voltage selection or replacing the line fuse refer to the “Troubleshooting” chapter of this manual. Connect the test set power cord to an electrical outlet

Connect the test set IF interconnect cable from the J11 TEST SET INTERCONNECT connector on the rear panel of the test set to the J1 TEST SET INTERCONNECT connector on the rear panel of the HP 85102 IF detector.

Connect the system bus cable from the test set J12 HP 8510 SYSTEM BUS connector to the HP 8510 INTERCONNECT connector of the HP 85101 display/processor. The test set IF interconnect cable and the system bus cable transmit control signals between the test set and the network analyzer.

Signal Path Connections

The IF signals from the test set are transmitted to the HP 85102 IF detector by the test set IF interconnect cable (see above).

Test Port Connectors

Ports a₁, a₂, b₁, and b₂ are precision 2.4 mm female connectors and mate with 2.4 mm male connectors

PACKAGING

If reshipping is required, the test set should be repackaged in the original factory package. Containers and materials identical to those used by the factory are available through Hewlett-Packard offices.

Alternatively, comparable packaging materials may be used. Wrap the test set in heavy paper or anti-static plastic. If shipping to an HP office or service center, complete and attach a service tag (in the HP 8510 manual set). Use sufficient shock absorbing material on all sides of the test set to provide a thick, firm cushion and prevent movement. Seal the shipping container securely and mark it **FRAGILE**.

In any correspondence with HP, refer to the test set by full model and serial number.

INTRODUCTION

This section illustrates the features and functions of the front and rear panels of the test set, and describes the multiple test set option (option 001). It explains the setup and use of one or more test sets in a system.

FRONT PANEL FEATURES

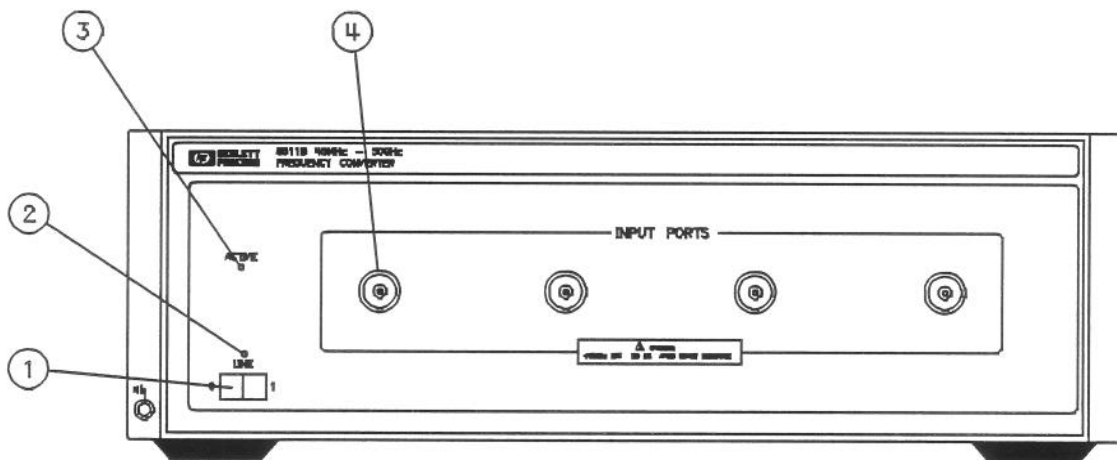


Figure 3-1. Front Panel Features of the Test Set

1. **Line Switch.** This switch turns the test set on and off. When the side of the switch labeled 0 is depressed, the test set is off; 1 is on.
2. **Line LED.** This LED goes on and off with the test set line switch.
3. **Active LED.** This LED lights about two seconds after power is turned on, following the successful conclusion of self-test. If the test set is used with other test sets (option 001) and is not addressed by the HP 8510, then this light remains off.
4. **Input ports b_1 , a_1 , a_2 , and b_2 .** These input ports transmit RF energy to the samplers within the instrument. a_1 or a_2 must be used for system phaselock. These ports are precision 2.4 mm connectors and all connections must be torqued no more than 90 N-cm (8 in-lb).

REAR PANEL FEATURES

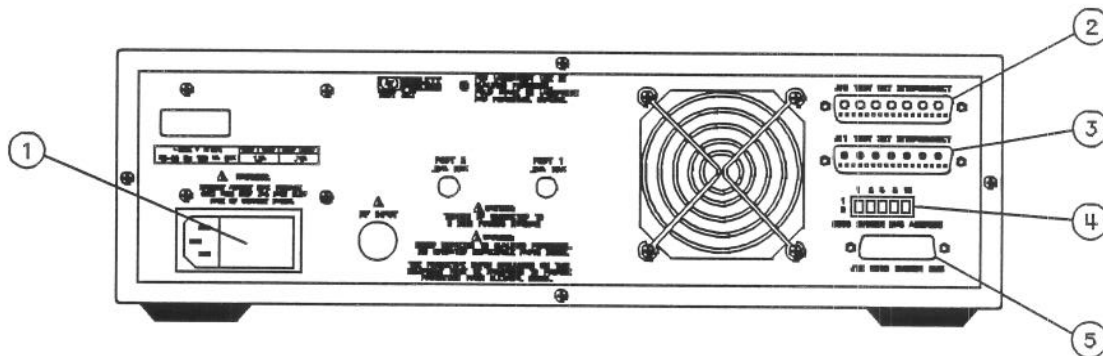


Figure 3-2. Rear Panel Features of the Test Set

1. **Line Module.** This assembly houses the line cord connector, line fuse and line voltage selector. Pull out the right side of the line module cover to replace or change the fuse or to change the voltage selection. The voltage selector drum must be removed to rotate it to a different voltage setting. Recommended fuse values are printed on the rear panel.
2. **J10 Test Set Interconnect.** This connector is used only in test sets with option 001. It allows connecting another test set to the option 001 test set. Up to four test sets can be serially connected to the analyzer. The HP 8510 system automatically selects the IF output from the chosen test set for processing and display. Refer to "Controlling Multiple Test Sets" in this chapter for more information.
3. **J11 Test Set Interconnect.** This connector transmits the IF signal from the test set to the HP 85102 IF detector. It also transmits control signals bidirectionally.
4. **HP 8510 System Bus Address Switch.** This five-pole binary-weighted switch sets the system bus address of the test set. The binary weight of each pole is indicated on the rear panel, as are the on and off positions. Decimal twenty (off-off-on-off-on, from left to right) is the default setting.
5. **J12 8510 System Bus Connector.** This connector is used for HP-IB communications with the HP 85101 display/processor.

OPERATOR'S CHECK

The purpose of this check is to confirm that the HP 8511B functions properly as part of an HP 8510 system. The performance tests are documented in the "Performance Tests" section of this manual.

NOTE: This procedure must be performed with a properly configured and operational HP 8510 system.

EQUIPMENT

Network analyzer system	HP 8510A/B/C
Semi-rigid cables (2)	08511-20025*
Power splitter	HP 11667C*

*supplied with HP 8511B service kit (part number 08511-60016).

PROCEDURE

Plug in and turn on the frequency converter. The line LED should light immediately and the active LED should light in about two seconds. Those indications mean that the instrument has passed its self-test. In case of difficulty, refer to "Troubleshooting" in this manual or contact your local HP Service office.

Turn on the source and then the HP 8510.

1. Press **[RECALL] [MORE] [FACTORY PRESET]** on the HP 85102 to preset the HP 8510C, or **[PRE-SET]** on the HP 8510A/B.
 - a. HP 8340/41 and 83651 systems: press **STIMULUS [MENU] [STEP]** on the HP 85102 to put the source in step mode.
 - b. HP 8350B systems: press **STIMULUS [MENU] [SWEEP TIME]** and then use the entry keys to set the sweep time to 200 ms. In narrow band systems, the power level in the frequency band generated should match the level shown in Figure 3-5 for a given frequency.
2. Reduce the source power by pressing **Stimulus [MENU], Power [MENU] [POWER SOURCE 1] [-10] [x1]**.

NOTE: All of the observed traces should decrease from -15 ± 5 dB at 45 MHz to -35 ± 5 dB at 50.0 GHz. Refer to Figure 3-4.

a1 and b1 Test

- Loosely connect the RF source cable to the power splitter as shown in Figure 3-3 below. Connect the other end of the RF source cable to the output of the source. Rotate the semi-rigid cables to the required position for connection to ports a1 and b1. Tighten all connections.

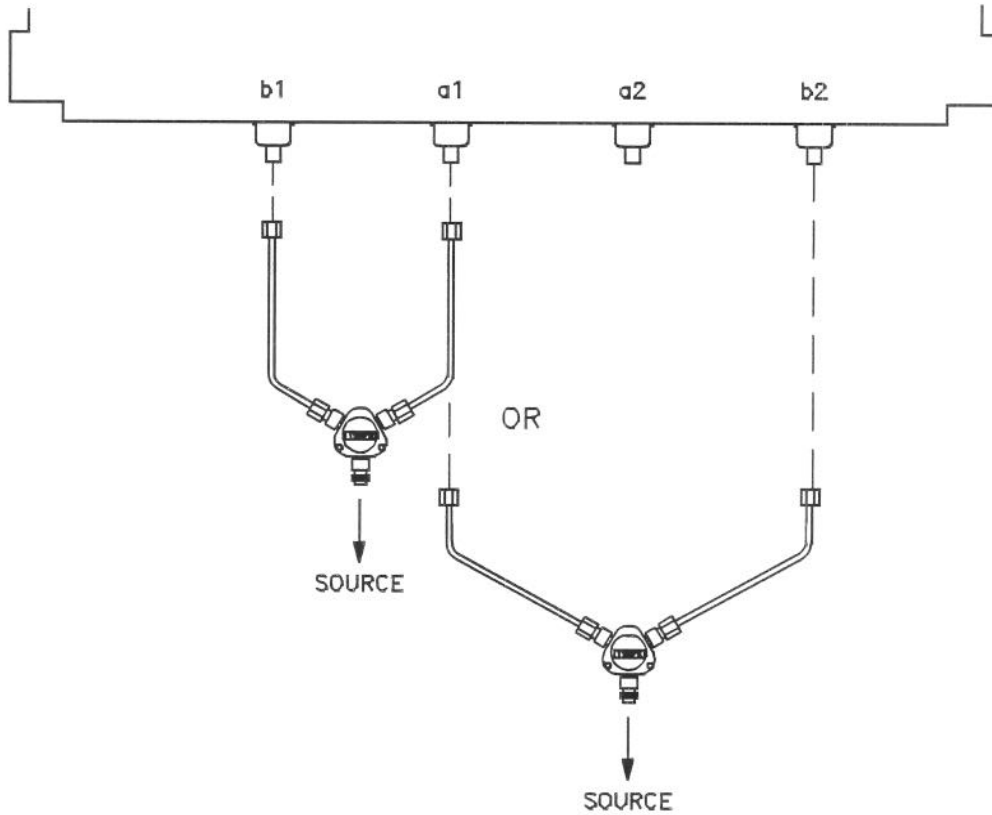


Figure 3-3. Hardware Configuration for Operator's Check

- Press **PARAMETER [MENU] [User 1 a1]** to observe the a1 power level trace.

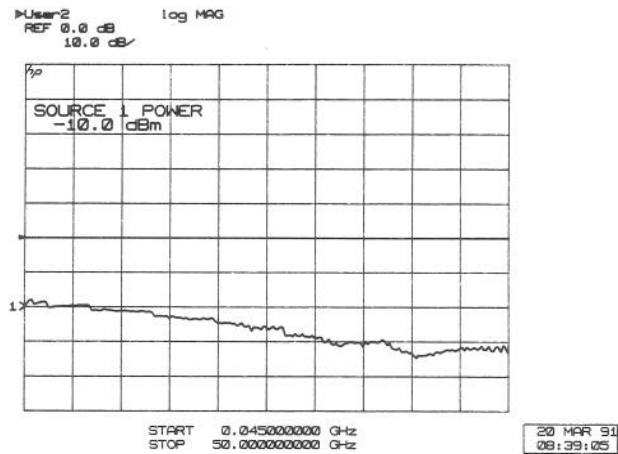


Figure 3-4. Typical Operator's Check CRT Trace

- Press **[User 4 b1]** to observe the b1 power level trace.

a2 and b2 Test

- Reconnect the semi-rigid cables (as in step 2) to ports a2 and b2. Disregard the running error message "Caution: NO IF FOUND".
- Press **[User 3 a2] [REDEFINE PARAMETER] [PHASE LOCK] [a2] [REDEFINE DONE]** to observe the a2 power level trace.
- Press **[User 2 b2] [REDEFINE PARAMETER] [PHASE LOCK] [a2][REDEFINE DONE]** to see the b2 trace.
- If any of the traces are not within the limits noted above, check all of the connections and repeat the above procedure.

CONTROLLING MULTIPLE TEST SETS

Option 001 for the HP 851X-series test sets allows an HP 8510 to alternately control up to four test sets. While a measurement is proceeding on test set number 1, which is equipped with option 001, a test device can be connected to test set number 2, which does not need to be equipped with option 001. When the measurement on test set number 1 is complete, the HP 8510 can control test set number 2.

In a standard test set, the 20 MHz IF and control signals are applied directly to J11 TEST SET INTERCONNECT, which connects to the HP 8510. Option 001 adds a set of IF switches, control switches, and the J10 TEST SET INTERCONNECT connector. This allows the selection of 20 MHz test set IF signals. As shown in Figure 3-6, test set number 1 can apply its IF to the HP 8510 or it can switch to pass the IF from test set number 2 through the J10 TEST SET INTERCONNECT to the HP 8510.

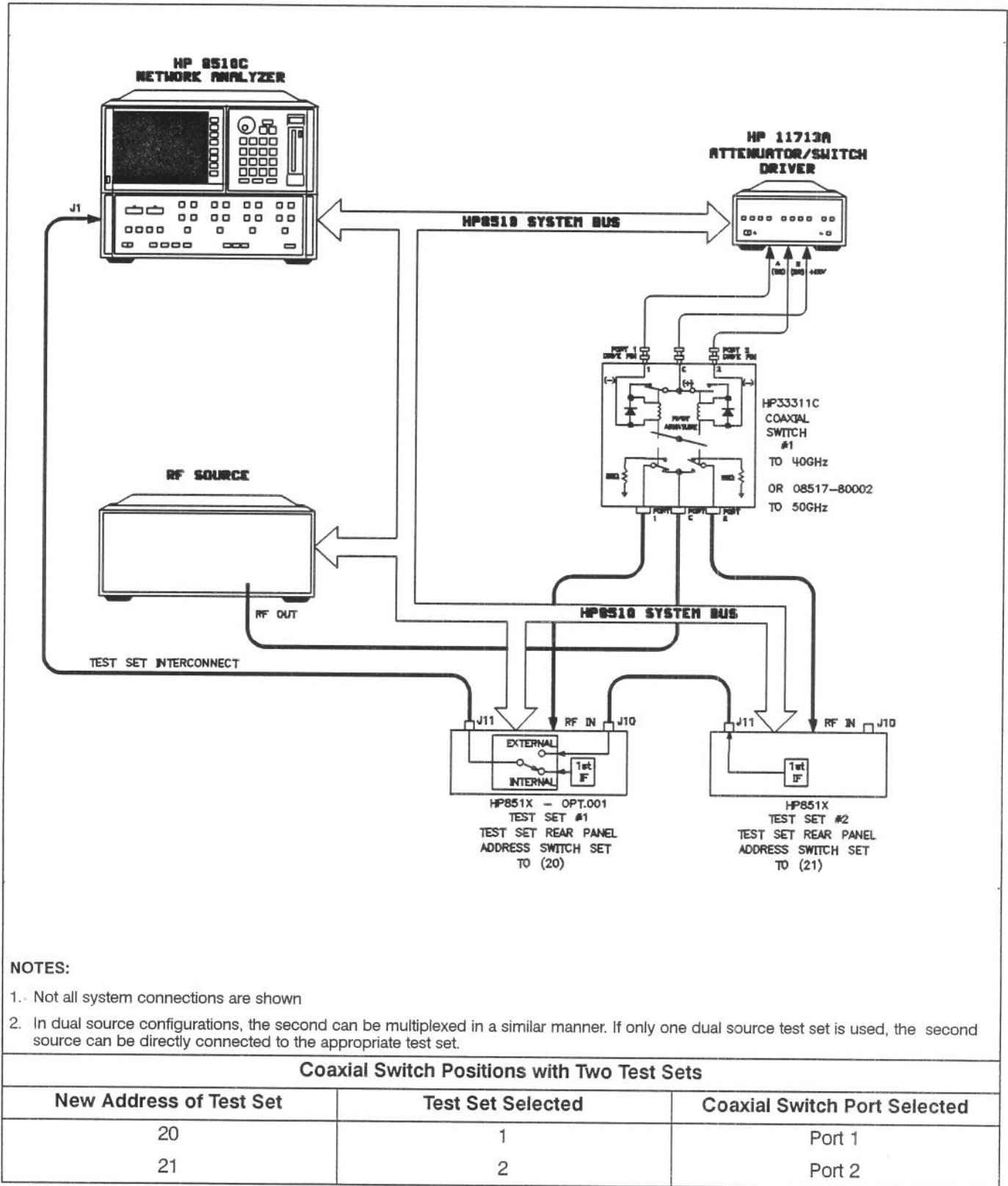


Figure 3-5. RF and IF Switching with Two Test Sets

TEST SET CONNECTIONS

Set each test set rear panel address switch to the address listed in Figure 3-5 for a dual test set configuration, or Figure 3-6 if configuring more than two test sets. Use the supplied test set interconnect cable to connect test set number 1 J11 to the analyzer. Use the supplied test set interconnect cable to connect test set number 2 J11 to test set number 1 J10. You may continue to connect in series up to four test sets if the total length of all test set interconnect cables does not exceed 13 meters (about 40 feet). The last test set in the chain does not require option 001.

If the RF coaxial switch is not incorporated into the system, the RF input to the test set must be manually switched to the active test set.

INITIALIZATION AT POWER-UP

Upon power-up, the IF switches must be configured so that only one system test set is active. The following procedure shows how to make one test set active:

1. Check the active lights of all system test sets.
2. Check the analyzer's expected test set address by pressing **[LOCAL] [TEST SET]**. The display should match the address of the desired test set. If not, change the address on the analyzer.
3. If unselected test sets are active (active light on), deactivate the test set by temporarily addressing it. Then return to the desired address.

SELECTING A TEST SET

Test Set IF Switching

The active test set is selected by the built-in capability of the analyzer to generate an addressed command to the test set. Each time the HP 8510 **[ADDRESS of TEST SET]** function is changed (see **[LOCAL] Menu**), the analyzer switches the previously addressed test set IF to external and the newly addressed test set IF to internal. The test set front panel ACTIVE indicator shows the test set status. When the test set is active the IF signals from the test set are applied directly to J11 TEST SET INTERCONNECT. When the test set is inactive the IF signals appearing at J10 are passed through to J11 and on to the next test set or the analyzer.

Test Set Address

The address of the active test set can be changed manually from the analyzer front panel by selecting the **[ADDRESS of TEST SET]** function, then entering the address of the test set and pressing **[x1]**; or it can be changed under program control using the analyzer's HP-IB ADDRTESS; command. The HP-IB address of a particular test set is set by address switches on the test set rear panel.

RF Switch Driver Commands

A related feature of the analyzer is that when the HP 8510 **[ADDRESS of TEST SET]** function is changed, a code sequence is automatically issued over the HP 8510 system bus to the device at the **[ADDRESS of RF SWITCH]**. In the recommended configuration, this device is an HP 11713A attenuator/switch driver which in turn controls one or more coaxial switches. As shown in Figures 3-5 and 3-6, these switches are used to select which of the test sets receives the RF output of the network analyzer source. The exact command issued depends upon the new value of the **[ADDRESS of TEST SET]** function, also shown in Figures 3-5 and 3-6.

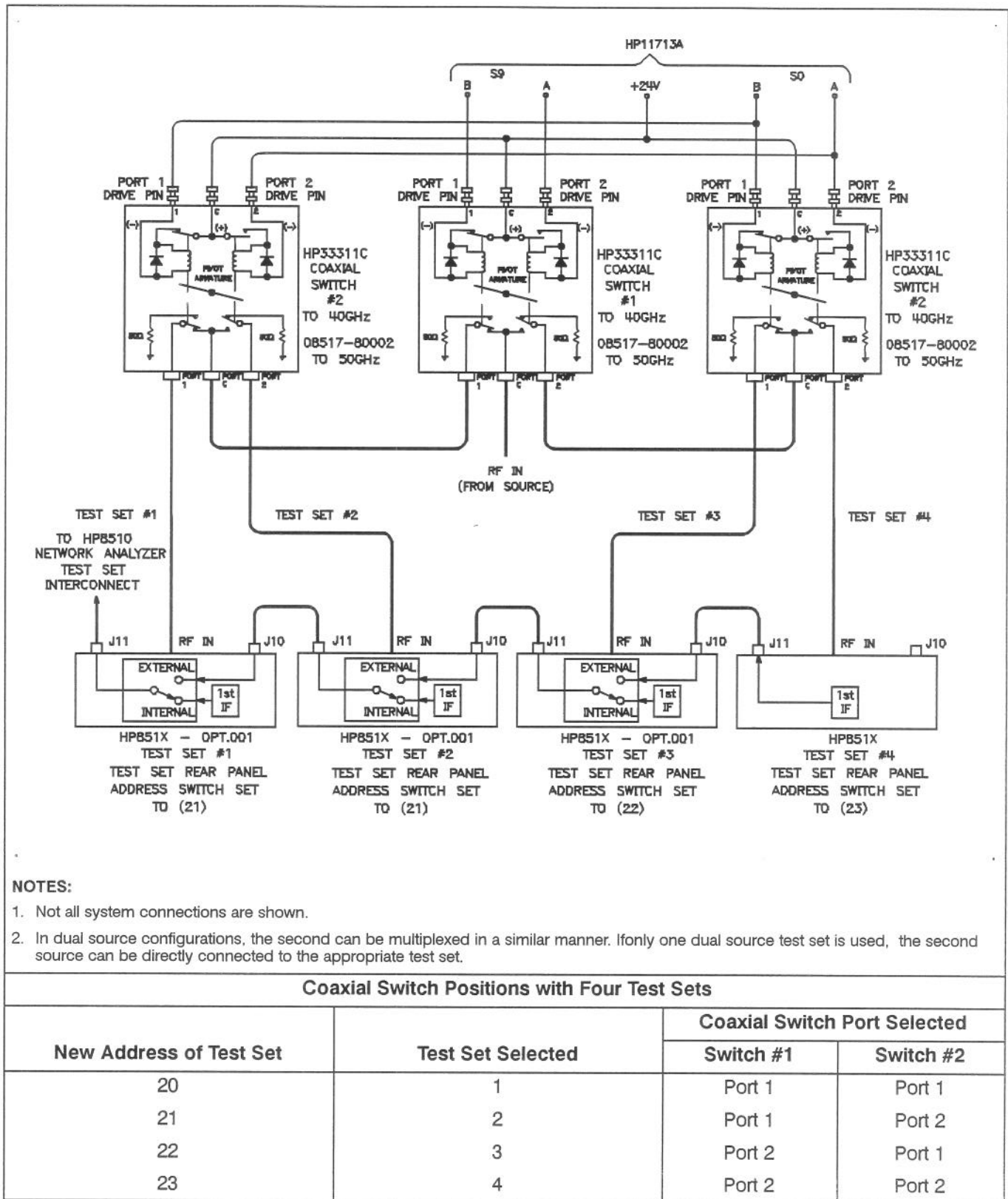


Figure 3-6. RF and IF Switching with Four Test Sets

MEASUREMENT CALIBRATION

After selecting the active test set, perform the system calibration procedure as usual. When you select a different test set, make sure that you recall the cal set that applies to **that** test set.

NOTE: Since the cal set limited instrument state does not include the number of the active test set, a cal set which does not apply to the current test set can be turned on without any HP 8510 caution messages appearing. This will cause errors in the displayed data because incorrect error coefficients are applied to the measured data.

It may be convenient to store a hardware state file and an instrument state file for each combination of test set and cal set. You may also store your hardware state file on a tape or disk for future use. To change the configuration, simply recall the appropriate hardware state file, which sets the address of test set and issues the RF switch command, and then the appropriate instrument state file which recalls the cal set.

OPERATIONAL CHECKS

To check operation of a multiple test set configuration, first connect a device with a known response at test set number 1, then press HP 8510 **[LOCAL] [TEST SET], [ADDRESS of TEST SET]**, enter the address of test set number 1 (this would be 20), then press **[x1]**. The test set number 1 measurement should appear. Press **[DISPLAY] [DATA→MEMORY] [DISPLAY: DATA and MEMORY]** to store the trace for later comparison. Now use **[ADDRESS of TEST SET]** to select test set number 2, then switch back to test set number 1. Observe any difference in the response between the stored trace and the result after switching back and forth between the test sets. Repeat for each of the test sets. Any difference in the data believed due to the option 001 IF switch or RF switching must be investigated; refer to the "Troubleshooting" chapter.

PERFORMANCE VERIFICATION

Standard system performance verification procedures are used to verify the operation of the option 001 test set as test set number 1. To verify the performance of a test set other than an HP 8511 in the chain, select it as the active test set and proceed as usual. Refer to the HP 8510 "On-Site Service Manual" for the performance verification procedure.

Chapter 4. Specifications

INTRODUCTION

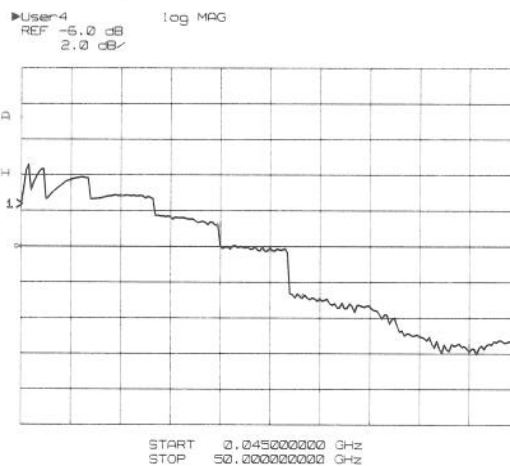
Specifications and characteristics differ as defined in the following table. Both are based on certain operating conditions. Those conditions are defined in the paragraph titled *Specification Assumptions*, which follows.

Specifications describe the warranted performance of the instrument. To verify the specifications, refer to “Performance Tests” chapter of this manual.

Table 4-1. HP 8510/8511B Specifications

Parameter	0.045 to 8 GHz	8 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Frequency Response Tracking				
Magnitude (ripple)¹	± 1.5 dB	± 1.5 dB	± 1.5 dB	± 1.5 dB
Phase (ripple)	± 75 degrees	± 75 degrees	± 75 degrees	± 75 degrees
Magnitude slope ²	± 0.055 dB/GHz	± 0.055 dB/GHz	± 0.055 dB/GHz	± 0.055 dB/GHz
Crosstalk³	-85 dB	-85 dB	-75 dB	-70 dB
High Level Noise⁴				
Magnitude (ratio)	0.006 dB rms	0.009 dB rms	0.040 dB rms	0.060 dB rms
Phase (ratio)	0.08 degrees rms	0.145 degrees rms	0.245 degrees rms	0.400 degrees rms
Low Level Noise⁵	-100 dBm	-102 dBm	-102 dBm	-102 dBm
Conversion Gain⁶	-4 dB to 1 dB	-6 dB to -1 dB	-13 dB to -3 dB	-15 dB to -5 dB
Compression (0.1 dB point)⁷	-10 dBm	-10 dBm	-15 dBm	-20 dBm
Input Port⁸				
Impedance Match (return loss) (all 4 ports)	≥ 17dB	≥ 15dB	≥ 9dB	≥ 7dB

1. Deviation from a least-squares-straight-line fit, excluding noise and slope. Ratio measurement of any two ports.
2. Slope of least-squares-straight-line fit over full frequency range.
3. Uncorrected port to port crosstalk with averaging factor of 1024.
4. Trace noise, sweep to sweep variation.
5. Low level noise measured with 50 ohm load at port, and calculated as the mean value of a 101 point trace with IF averaging set at one. Low level noise varies with averaging factory; 10 log (average factor).
6. See example below.



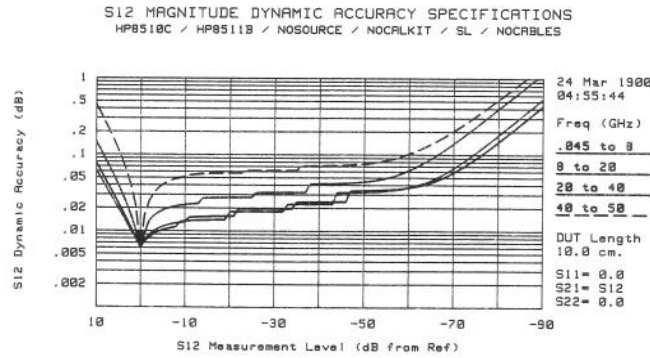
7. Do not exceed -5 dBm input to sampler for proper phase lock operation.
8. Tested with sampler in non-conducting state. When diodes are turned on by the LO pulse they present a short circuit across the sampler input port. This may affect the measured data.

Characteristics provide information useful in applying the instrument by giving typical, but non-warranted, performance parameters.

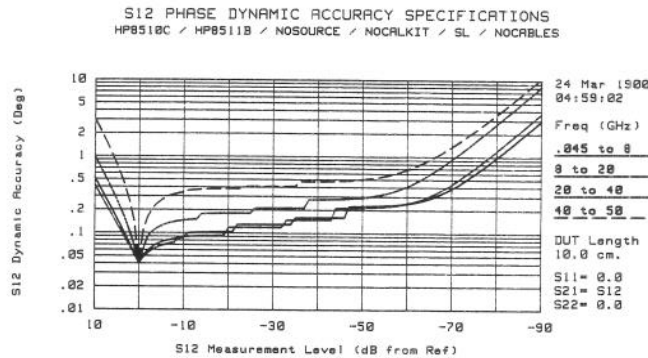
Table 4-2. HP 8510/HP8511B Characteristics (1 of 2)

Parameter	0.045 to 8 GHz	8 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Dynamic Range¹ all inputs	110 dB (-10 to -120 dBm)	112 dB (-10 to -122 dBm)	107 dB (-15 to -122 dBm)	102 dB (-20 to -122 dBm)
Accuracy Enhanced Crosstalk² -115 dB	-115 dB	-113 dB	-110 dB	-105 dB
Typical Drift (typical)	Magnitude $0.001 \times V \text{ } ^\circ\text{C}$, Linear Phase $(0.01 + 0.01 f(\text{GHz}) \times V \text{ } ^\circ\text{C})$, degrees			
Input Ports Connector type: precision 2.4 mm female Impedance: 50 ohms nominal Damage level: +13 dBm (20 mW) CWRP input ³ Port input power for phase lock:				
	Frequency	Minimum	Maximum	
	0.045 to 8 GHz	-41 dBm	-5 dBm	
	8 to 20 GHz	-39 dBm	-5 dBm	
	20 to 26.5 GHz	-32 dBm	-5 dBm	
	40 to 50 GHz	-30 dBm	-5 dBm	

Dynamic Accuracy: The following plots illustrate worst case magnitude and phase uncertainty due to IF residuals and detector inaccuracies.⁴



Magnitude



Phase⁵

Table 4-2. HP 8510/HP8511B Characteristics (2 of 2)

Source of System Dynamic Accuracy Errors: The factors affecting dynamic accuracy listed below are primarily a function of the IF/detector. Compression though, is primarily a function of the sampler/mixer circuitry. In order to measure these values, some of the system cables must be disconnected to gain access to the individual instruments.		
IF Amplifier Gain Accuracy	IF Amplifier Power Range (dBm)⁶	Maximum Gain Error (dB)
	-10 to -34	0
	-34 to -46	±0.005
	-46 to -58	±0.010
	-58 to -70	±0.015
	≤ 70	±0.025
Detector Circularity Error: ±0.003 dB peak		
IF Residuals: -140 dBm ⁶		
IF Linearity: ±0.003 dB		
Incremental Phase Accuracy (Phase versus Phase) at Measurement Reference: ±0.001 degrees/degree, not to exceed 0.02 degrees peak.		
Operating Temperature: 0°C to 55°C		
Power: 110, 120, 220 or 240 ±10% Vac; 47 to 66 Hz line frequency		
Dimensions: 460 mm x 133 mm x 609 mm (18.1 x 5.25 x 24 inches)		
Weight: 13 kg (29 lb) net; 17 kg (38 lb) shipping		
<ol style="list-style-type: none"> 1. Determined by 0.1 dB compression level and system low level peak noise. Low level peak noise measured with 50 ohm load at port and 1024 averaging factor. Noise floor varies with averaging factor. (10 log averaging factor). Low level noise is calculated from low level noise + 10.4 dB. 2. Effective crosstalk with isolation, calibration, excludes noise. 3. Do not exceed -5 dBm input to sampler for proper phase lock operation. 4. Excludes uncertainty due to noise, frequency response, directivity, port matches and connector repeatability. 5. Phase detector accuracy is better than 0.02 degrees, useful for measurements where only phase changes. 6. Measured at the IF Input to the HP 8510, not at the test set test ports. 		

Specification Assumptions

The specifications of the HP 8511B require that the following operating conditions are met:

- All system instruments have reached stable operating temperature.
- RF source: HP 83651A. Other sources recommended in the HP 8511B Performance Test procedures may be used for verification within the frequency limits of those sources. When used with another recommended source, the performance specifications may differ from those for the HP 8510/8511/83651A configuration. The performance test software will display and print the limits for the chosen configuration.
- Performance verification temperature: 23 ± 3°C.
- RF source power levels as follows:

Test	Power at Input Level (dBm)		
	0.045 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Compression, Crosstalk	-10	-15	-20
Conversion Gain, Tracking, High Level Noise	-15	-20	-25

Recommended Test Equipment

The following test equipment is required when troubleshooting, operating, and performance testing the HP 8511B.

Table 4-2. Recommended Test Equipment

Item	Critical Specifications	Recommended Model (or part Number)	Use ¹
Network analyzer	no substitute	HP 8510A/B	O, P, T
Controller	no substitute	HP 9000 series 200/300 (with 1 Mbyte memory)	P
Disk drive	compatible with controller		P
Multimeter	range: 0 to 50V	HP 3456A	T
Oscilloscope	50 MHz bandwidth	HP 1740A	T
Semi-rigid cables			T, P
Power splitter	45 MHz to 50 GHz	HP 11667C	P, T
Power meter		HP 436A, 437A, 438A	P
Power sensor	no substitute	HP 8487A	P
2.4 mm Coax cables (2)	no substitute	08511-20031	P, T
2.4 mm (f) to 2.4mm (f) adapter	no substitute	1250-2186	P
20 dB Fixed Attenuator	No substitute	HP 33340D opt. 020 ²	P
RF Cable	2.4 (m) semi-rigid 2 in long	08511-20031A	P, T
6 dB Fixed Attenuator (2)	no substitute	HP 33340D opt. 006	P
2.4 mm 50 ohm load (m)	no substitute	HP 85148A	P
2.4 mm 50 ohm load (f)	no substitute	HP 85138B	P
1. O = operation P = performance test T = troubleshooting 2. Supplied in the HP 8511B Service Kit (part number 08511-60016)			

Chapter 5. Test Set Troubleshooting

INTRODUCTION

The troubleshooting strategy for the HP 8511B frequency converter test set is a systematic sequence of procedures. This troubleshooting information is used after system-level troubleshooting has pinpointed the test set as the problem instrument. Use the following troubleshooting flowchart (Figure 5-2) to identify the faulty assembly. The troubleshooting flowchart is keyed to numbered, individual troubleshooting procedures. As you progress through the flowchart, perform the numbered procedure associated with each block. Block diagrams are provided at the end of this section to assist in understanding the operation of the test set.

THEORY OF OPERATION

The RF section of a HP 8511B frequency converter test set consists of a voltage tuned oscillator (VTO), a four-way power splitter and four samplers. The frequency converter operates within the frequency range of 45 MHz to 50 GHz. Two reference (a1 and a2), and two test (b1 and b2) channels accept RF input via front panel bulkhead connectors.

The VTO/driver produces a harmonic that is 20 MHz away from the RF source frequency. The samplers use either the fundamental or a harmonic of the LO with the reference and test RF signals to develop a 20 MHz IF. The IF signals are then routed to the HP 85102 via a rear panel connector on the test set.

The LO, generated by the VTO/driver, is phase locked to the source. The phase lock loop includes the following portions of; the A3 VTO summing amplifier board, A14 VTO/driver, A12 a1 reference sampler assembly, A13 a2 reference sampler assembly and the HP 8510 network analyzer.

A microprocessor on the A4 HP-IB board controls the samplers, which may be switched either on or off, depending on the parameter being measured. The default condition is for all four samplers to be on. This insures that the test set will be usable in the event of a failure of the A4 HP-IB board or a failure in the communication between the test set and the HP 8510 display/prosessor.

The HP 85102 IF detector controls the VTO/driver via the VTO summing amplifier board. A control voltage is input to the VTO to tune to the correct LO frequency.

The VTO summing amplifier board has an output called LENDRA (Low=END of RAnge) that is sent to the HP 85102 IF detector over the test set interconnect cable. This indicates to the HP 85101 display prossessor whether or not the VTO is outside of its normal operating frequency range. Should the VTO exceed its normal operating range, the network analyzer will respond by displaying the running error message, "VTO OVER-RANGE." This message willnot be seen in the HP 8510C. It has been replaced by "PRETUNE FAILED."

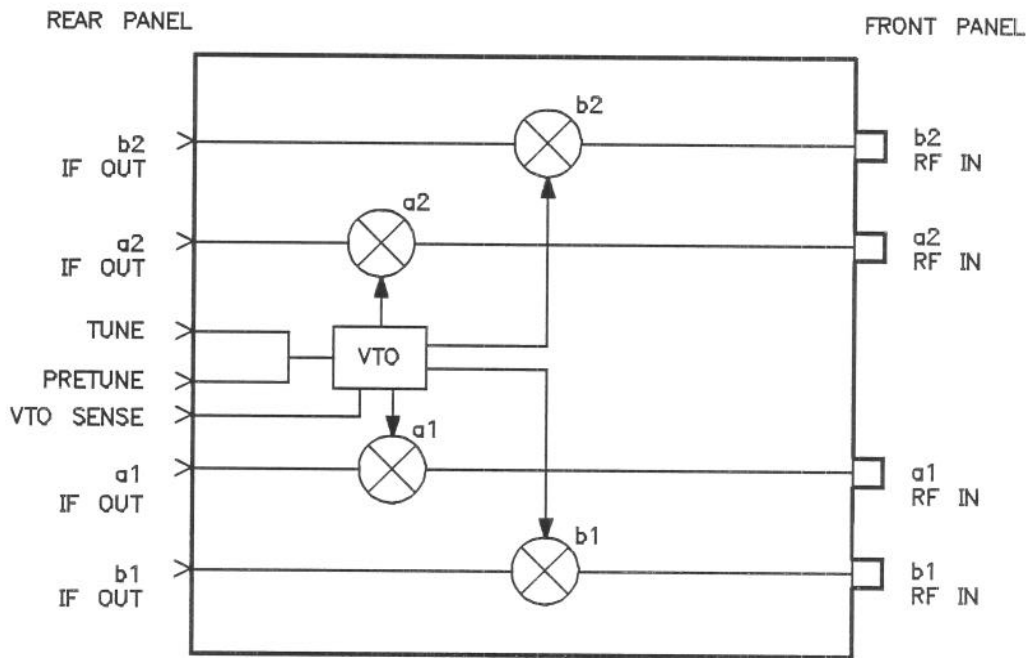


Figure 5-1. Simplified RF Block Diagram

STATIC PRECAUTIONS



ATTENTION
Static Sensitive
Handle only at Static Safe
Work Stations

The assemblies in these troubleshooting procedures are very sensitive to damage by static electricity, particularly the samplers. They may not function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

EQUIPMENT NEEDED BUT NOT SUPPLIED

The following equipment is needed to troubleshoot your instrument. It is not supplied with the instrument.

1 point pozidriv screwdriver	8710-0899
2 point pozidriv screwdriver	8710-0900
Service adapter	85105-60210
5/16 in. torque wrench	8710-1655
Oscilloscope	HP 1740A

TROUBLESHOOTING SEQUENCE

Use this flowchart and the following procedures to determine the faulty assembly.

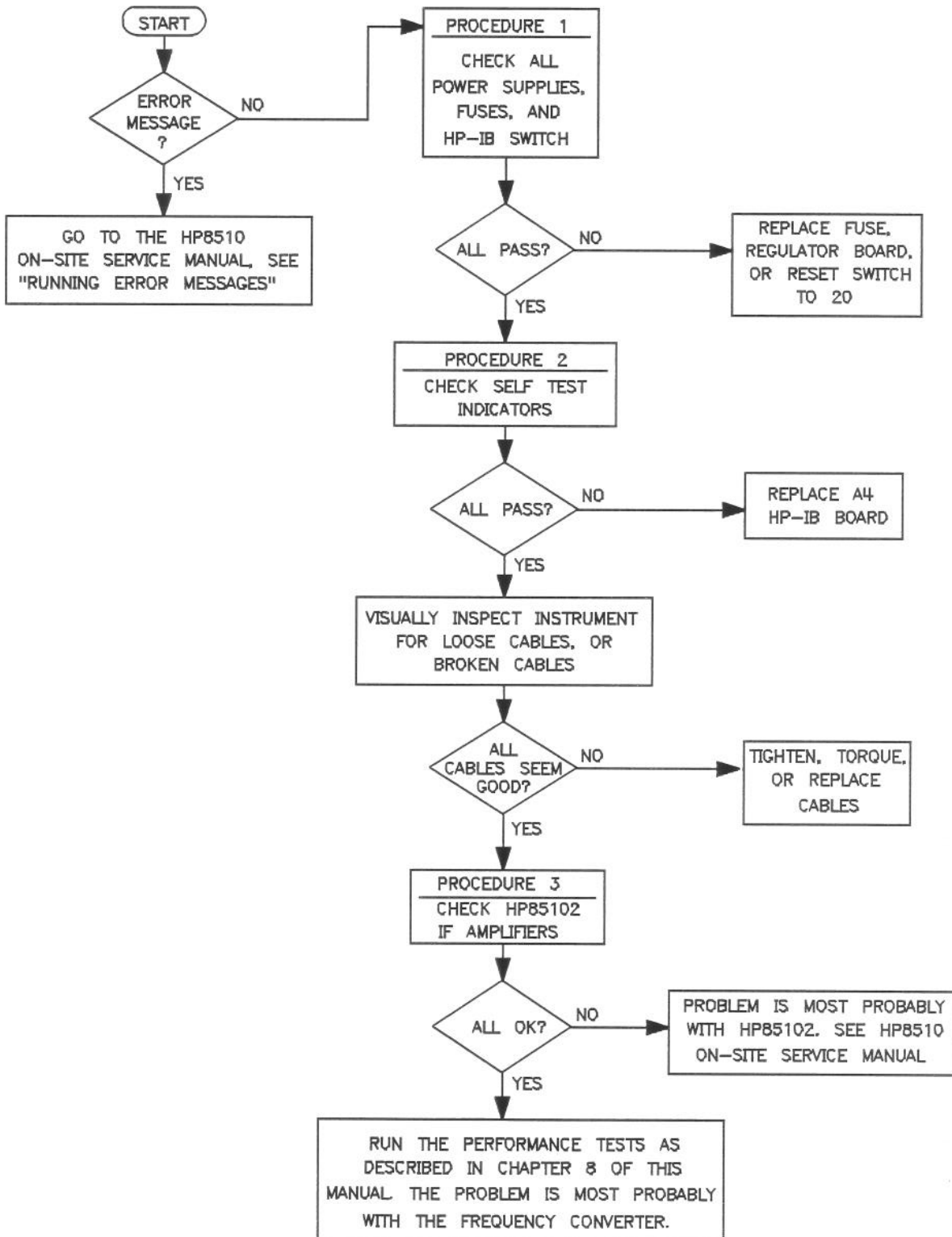


Figure 5-2. Troubleshooting Flowchart

TROUBLESHOOTING PROCEDURES

PROCEDURE 1. A15 REGULATOR HP-IB ADDRESS SWITCHES FUSE LOCATIONS

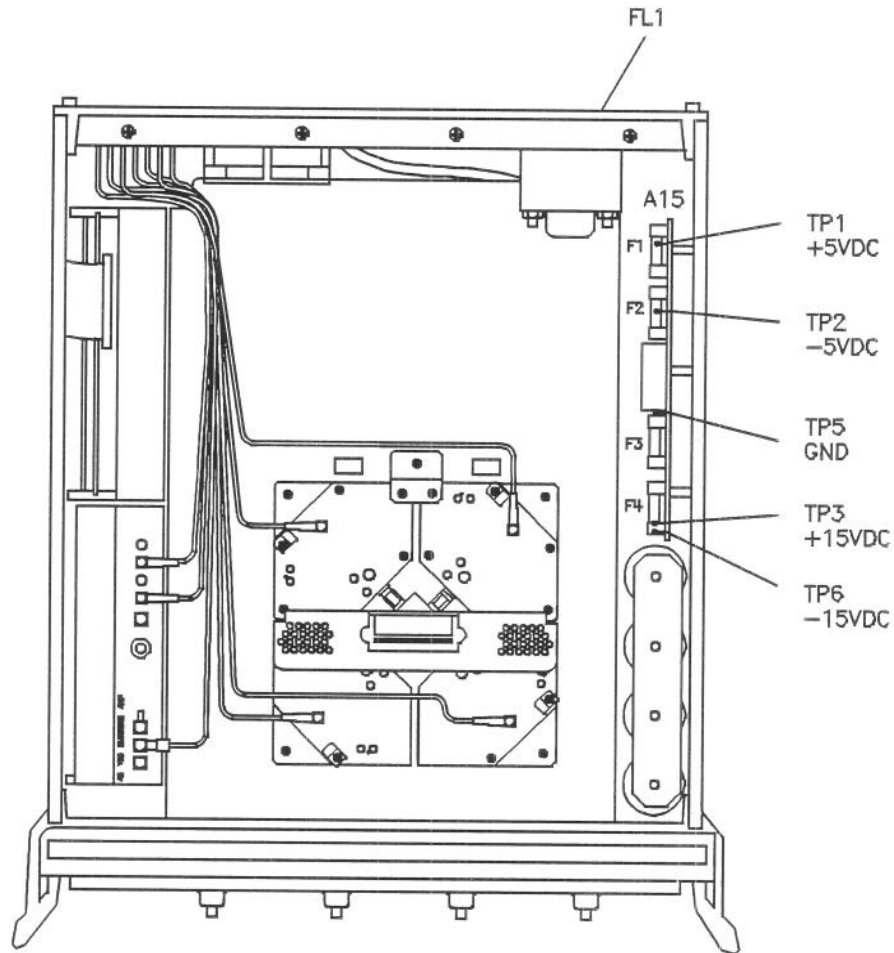


Figure 5-3. Power Supply Fuses and Test Points

A15 Primary Regulator Board Assembly

Use a digital voltmeter to check the voltages and an oscilloscope to check the ripple in Table 5-1.

Nominal Voltage	Test Point	Voltage Range	Maximum Ripple
+ 5.05 Vdc	A15TP1	+ 4.75 to + 5.25	2 mv
- 5.20 Vdc	A15TP2	- 4.90 to - 5.50	2 mv
+ 14.85 Vdc	A15TP3	+ 14.10 to + 15.60	2 mv
- 14.85 Vdc	A15TP6	- 14.10 to - 15.60	2 mv

HP-IB Address Switch

Set the switch as indicated in Figure 5-4 (the dark side of the switch is depressed). The HP-IB address switch is on the instrument rear panel. It is easy to access but need not be changed unless the error message "SYSTEM BUS ADDRESS ERROR" is displayed on the HP 8510 screen. Decimal twenty, binary 00101 (off, off, on, off, on) is the default setting.

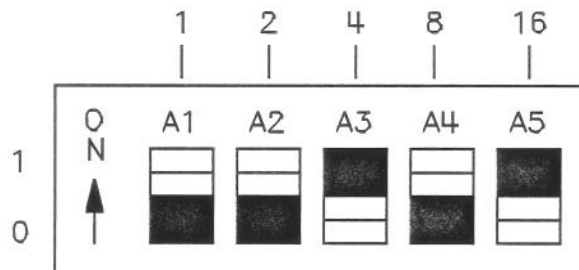
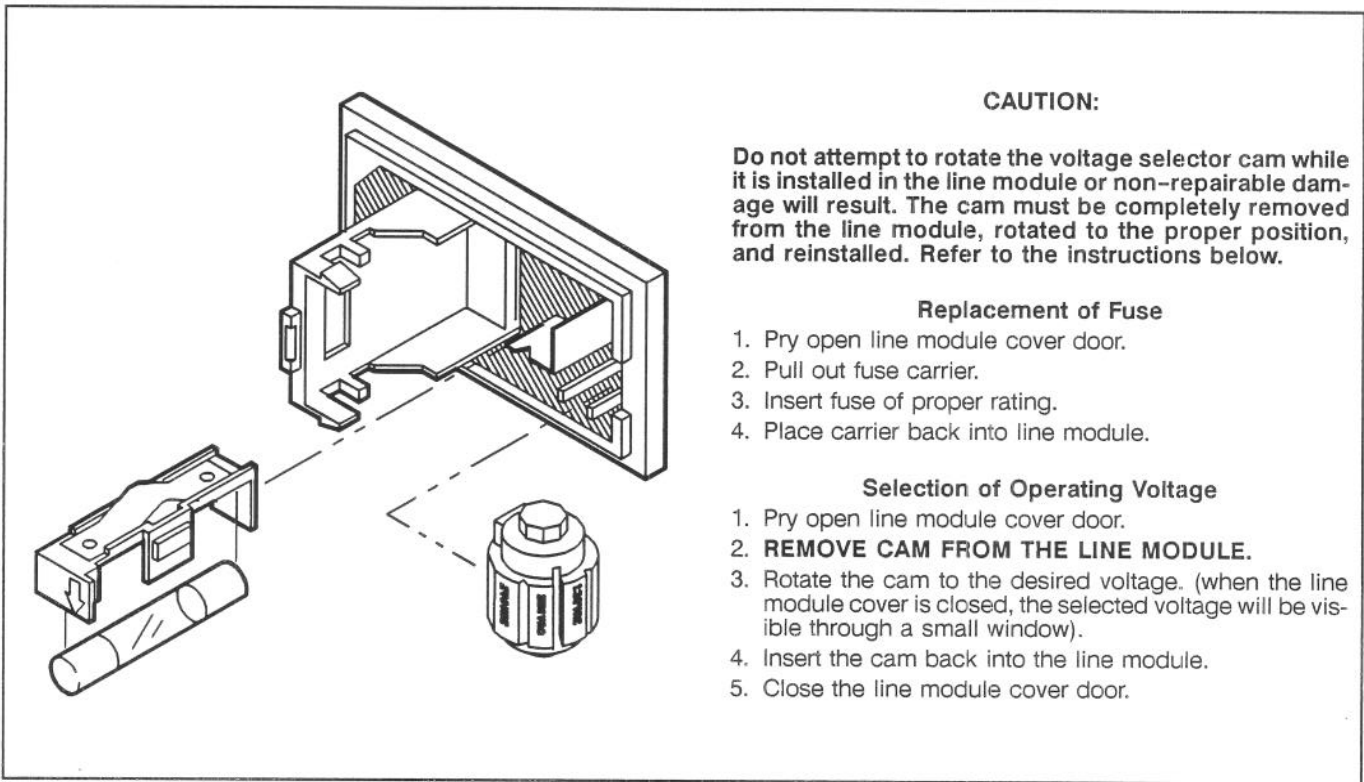


Figure 5-4. Instrument HP-IB Switch Setting

FUSES

The locations of the fuses used in the test set are illustrated in Figure 5-3. The values of these fuses and their part numbers may be found in the "Replaceable Parts" chapter.

Refer to Figure 5-5 for information on how to set the voltage selector cam and replace the line fuse.



CAUTION:

Do not attempt to rotate the voltage selector cam while it is installed in the line module or non-repairable damage will result. The cam must be completely removed from the line module, rotated to the proper position, and reinstalled. Refer to the instructions below.

Replacement of Fuse

1. Pry open line module cover door.
2. Pull out fuse carrier.
3. Insert fuse of proper rating.
4. Place carrier back into line module.

Selection of Operating Voltage

1. Pry open line module cover door.
2. **REMOVE CAM FROM THE LINE MODULE.**
3. Rotate the cam to the desired voltage. (when the line module cover is closed, the selected voltage will be visible through a small window).
4. Insert the cam back into the line module.
5. Close the line module cover door.

Figure 5-5. Power Line Module

PROCEDURE 2. SELF-TEST INDICATORS

If the ACTIVE LED on the front panel of the instrument fails to light within five seconds of power on or lights immediately, the instrument has not passed its self-test. To determine what part of the self-test has failed, note which LEDs on the A4 board are lit (Figure 5-6), as shown below:

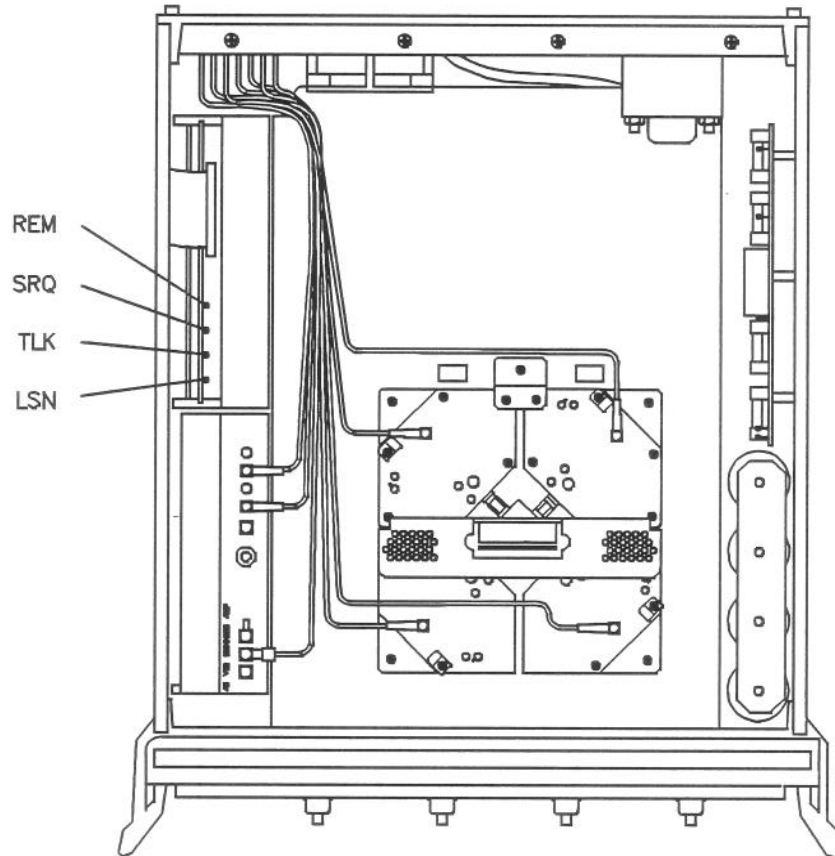


Figure 5-6. Location of Self-Test Indicators

Self-Test Indication	A4 HP-IB LEDs				Time (after turn-on)
	LSN	TLK	SRQ	REM	
PWON	ON	ON	ON	ON	0 to 0.5 seconds
Start ROM Test	OFF	ON	ON	ON	on briefly
Pass ROM Test	OFF	OFF	ON	ON	0.5 to 2.0 seconds
Start RAM Test	OFF	OFF	OFF	ON	
Pass RAM Test	OFF	OFF	OFF	OFF	after 2 seconds

If the Self-Test Fails to Run

If the portion of memory which contains the self-test programming is faulty, the self-test will not run properly. The following conditions indicate that the HP-IB board is most probably faulty.

- all LEDs flash briefly and go off
- all LEDs flash briefly and stay on
- ACTIVE LED goes on too soon
- ACTIVE LED does not go on

PROCEDURE 3. HP 85102 IF AMPLIFIER TEST

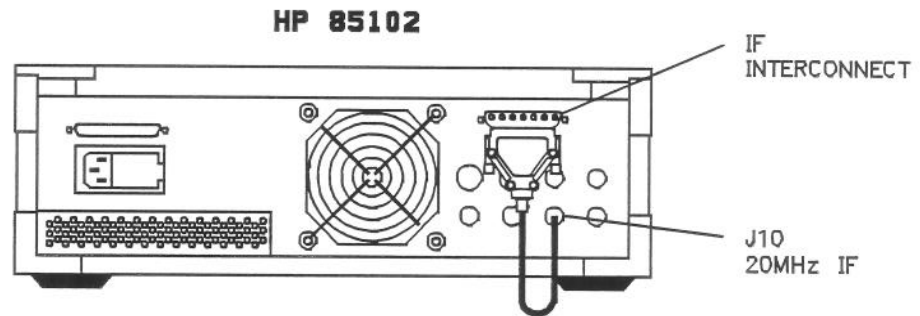


Figure 5-7. Service Adapter Connections

Using the Service Adapter

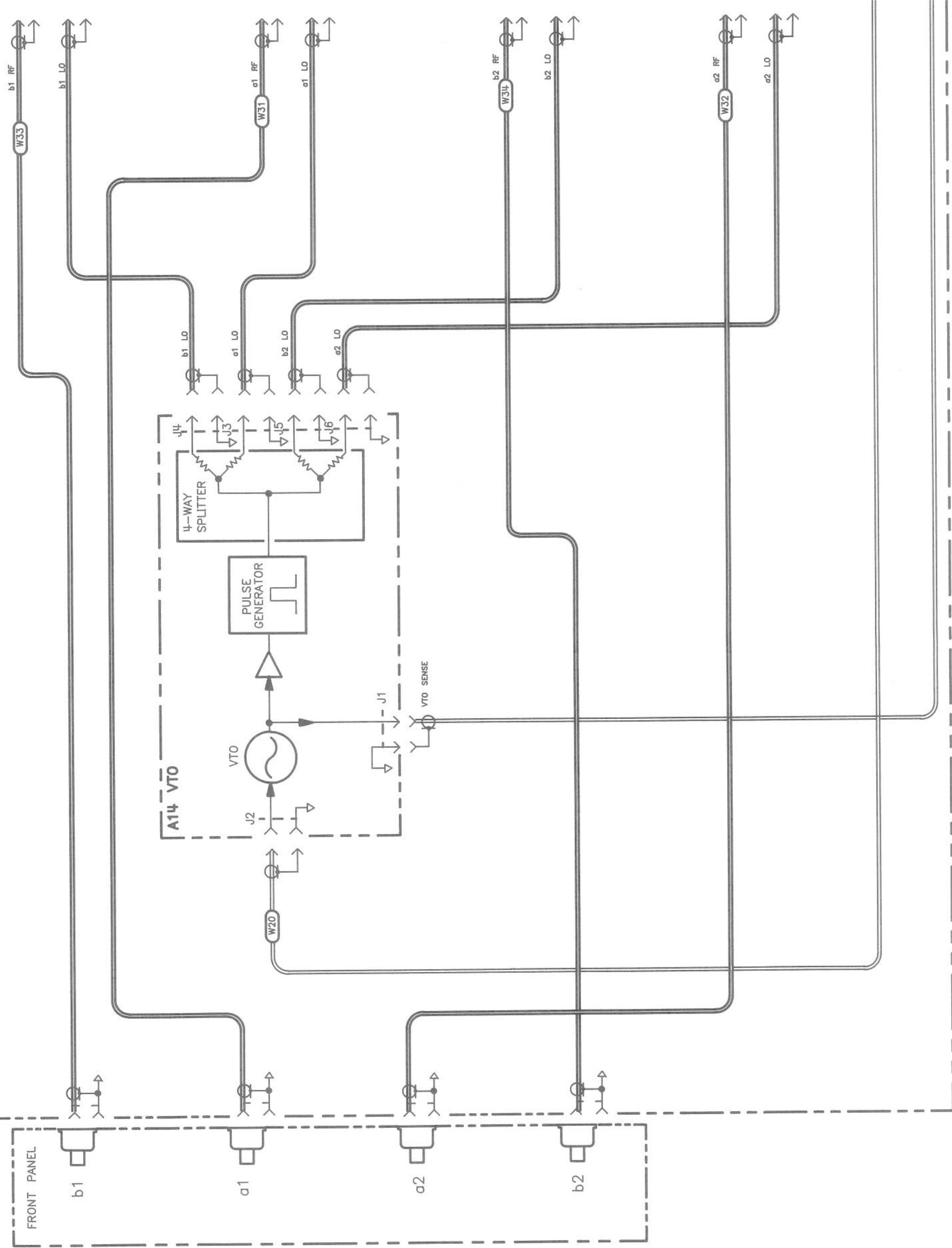
The service adapter (part number 85102-60210) substitutes for a test set, by connecting the 20 MHz IF signal from the HP 85102 back into the amplifier of the HP 85102. This is done to determine if a fault is in the test set or the HP 85102.

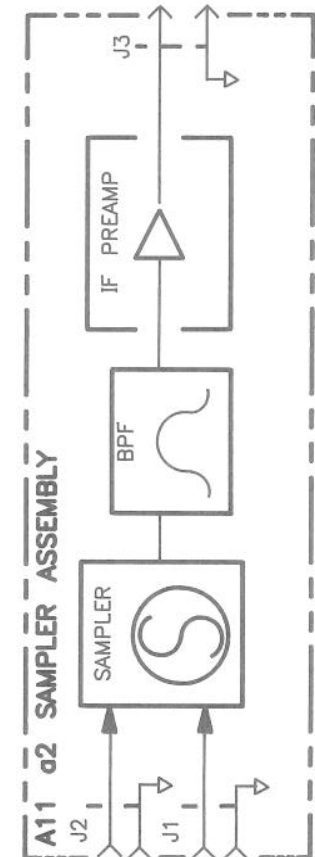
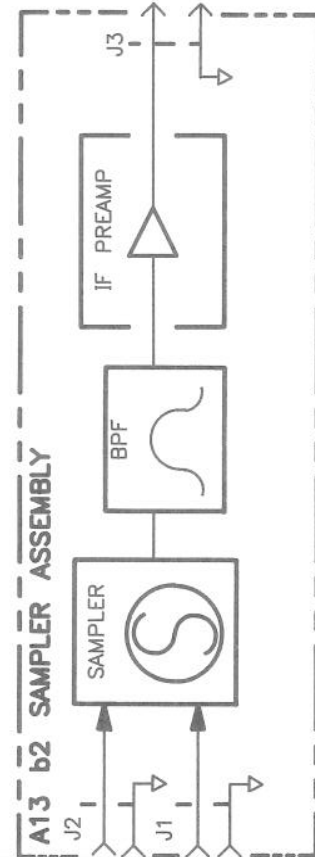
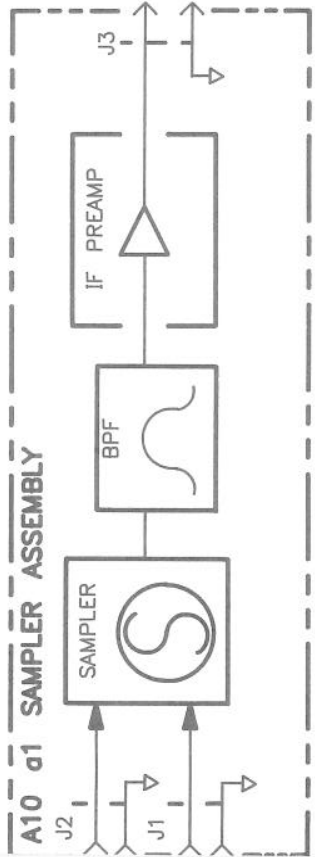
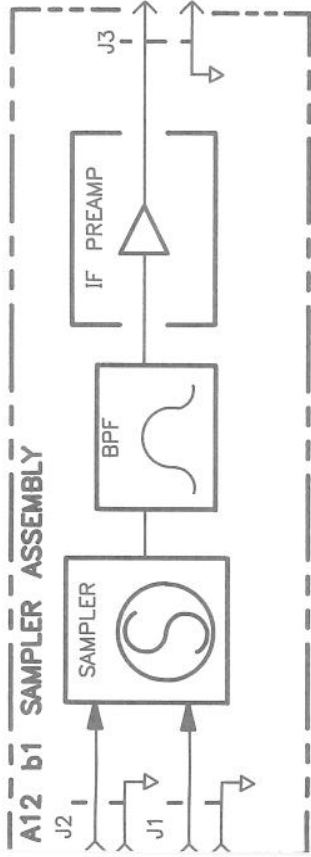
1. Connect the service adapter as shown in Figure 5-7.
2. Press **[RECALL] [MORE] [FACTORY PRESET] [MARKER]**, STIMULUS **[MENU]**, **[STEP] PARAMETER [MENU]**. Examine each User parameter by pressing the corresponding softkey to observe the unratiod power level of the User1 through User4 channels. The traces should be flat lines, quite close to each other, as indicated by the marker value (typically about -28 ± 5 dB).

Service Adapter Conclusions

- **If all the channels look good.** The HP 85102 is working properly. The problem is most probably with the source or the test set. Refer to Chapter 8 of this manual.
- **If one or more channels look bad.** The problem is most probably with the HP 85102. Refer to the HP 8510 *On-Site Service Manual* for information on troubleshooting the HP 85102.

HP 8511B RF BLOCK DIAGRAM





b1 IF OUT

a1 IF OUT

b2 IF OUT

a2 IF OUT

W3
W1

W4
W2

CABLES SHOWN HERE
ARE FOR OPTION 001
TEST SET. REFER TO
CONTROL BLOCK DIAGRAM
FOR STANDARD TEST SET.

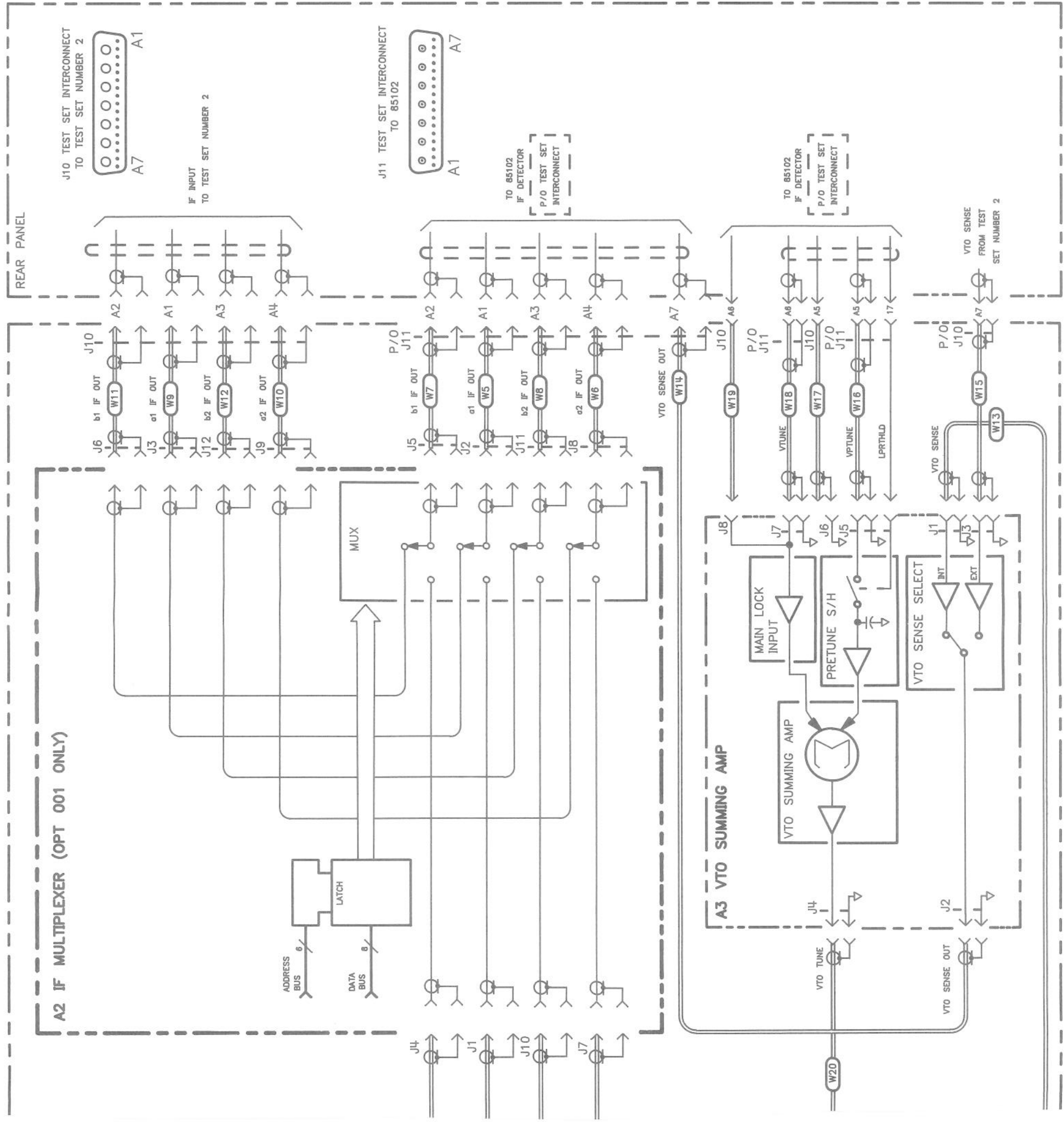
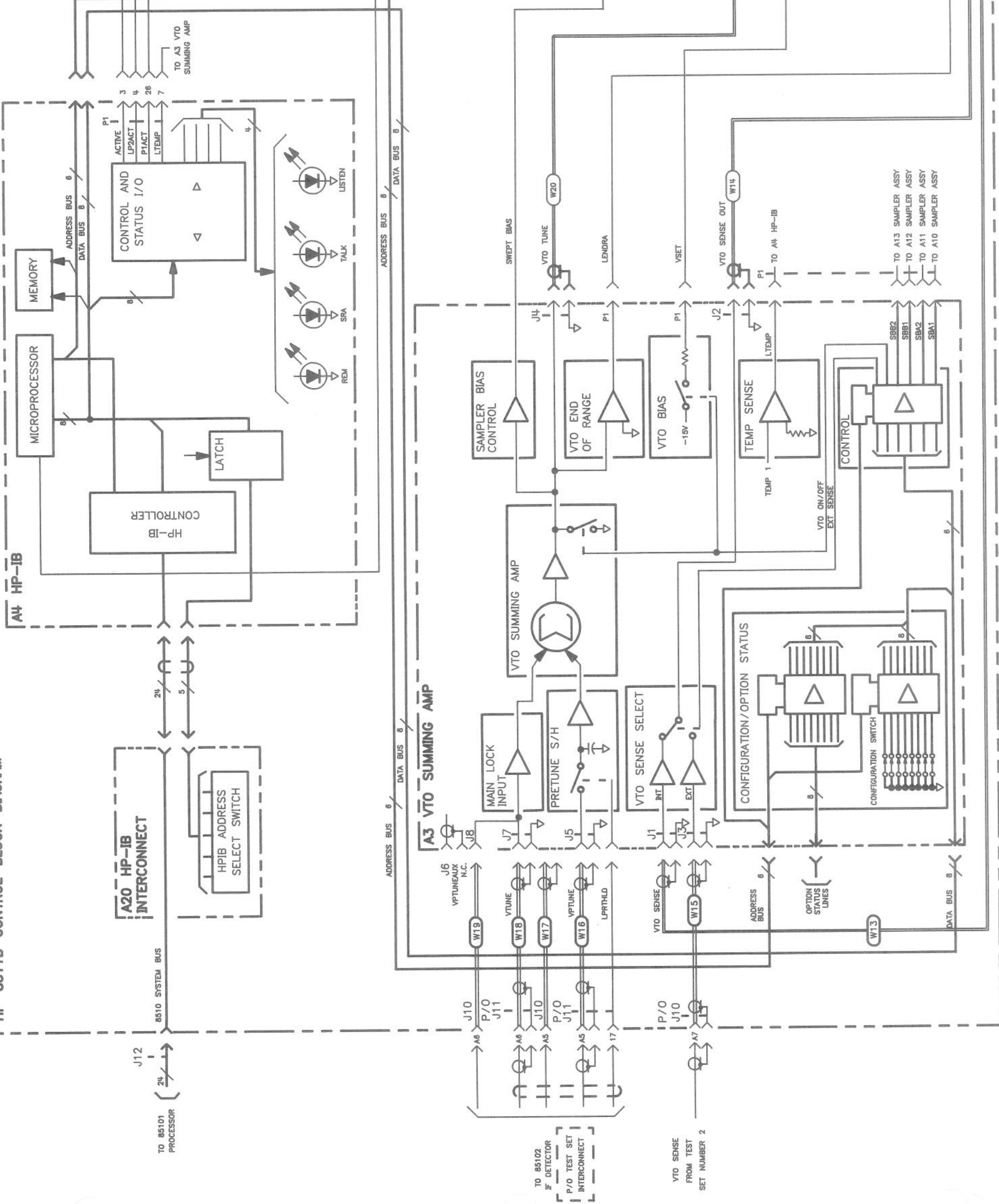
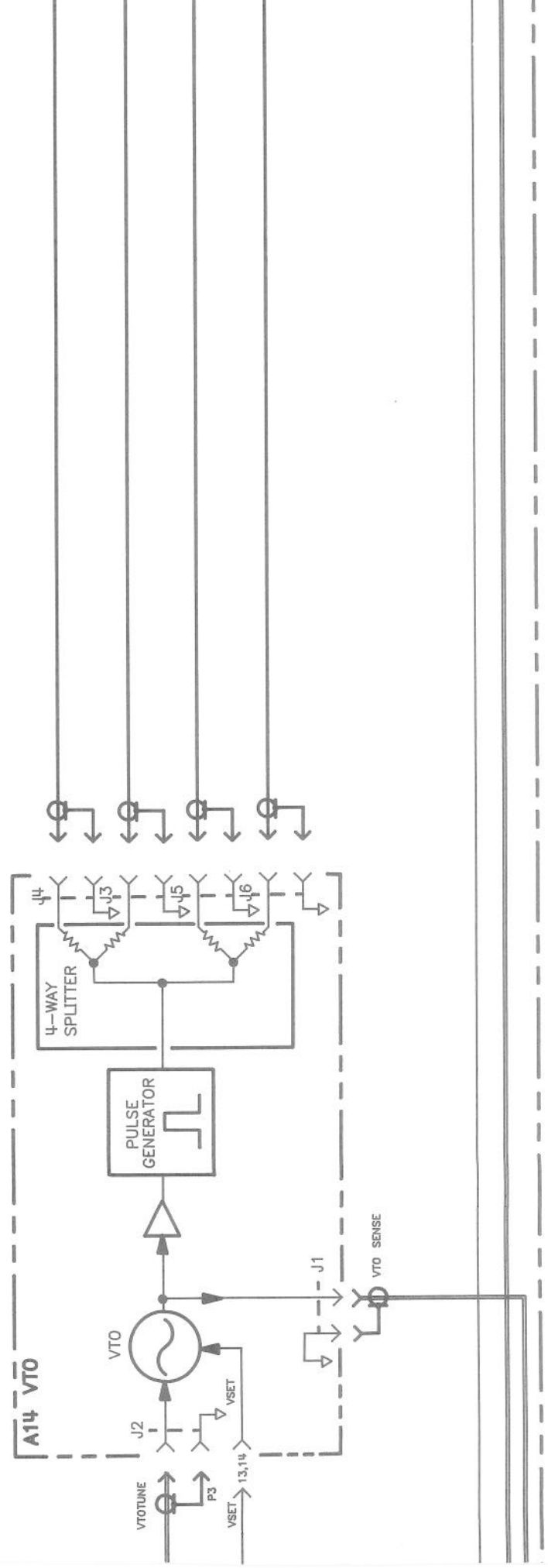
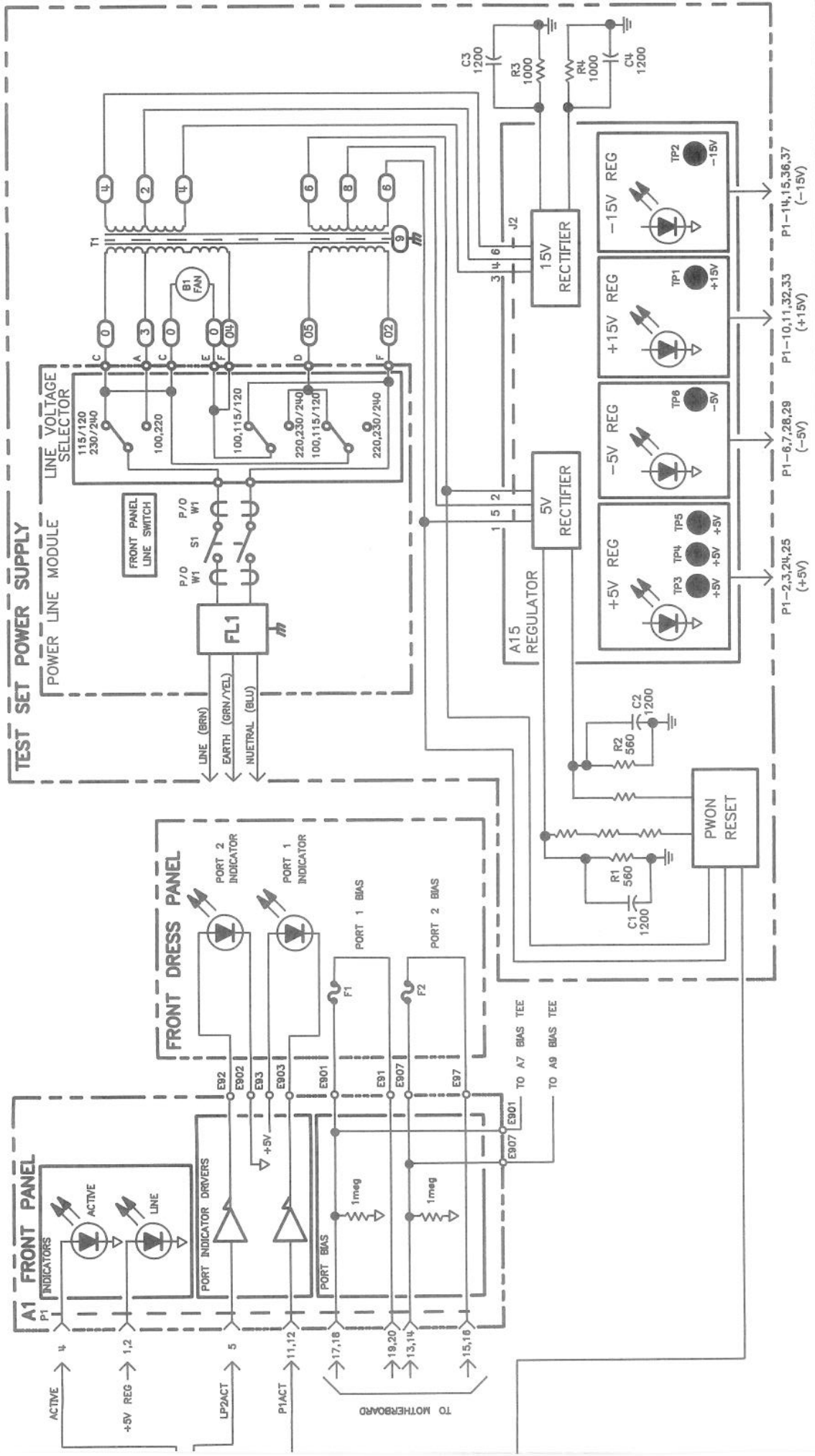


Figure 5-8. HP 8511B RF Block Diagram 5-11/5-12

HP 8511B CONTROL BLOCK DIAGRAM





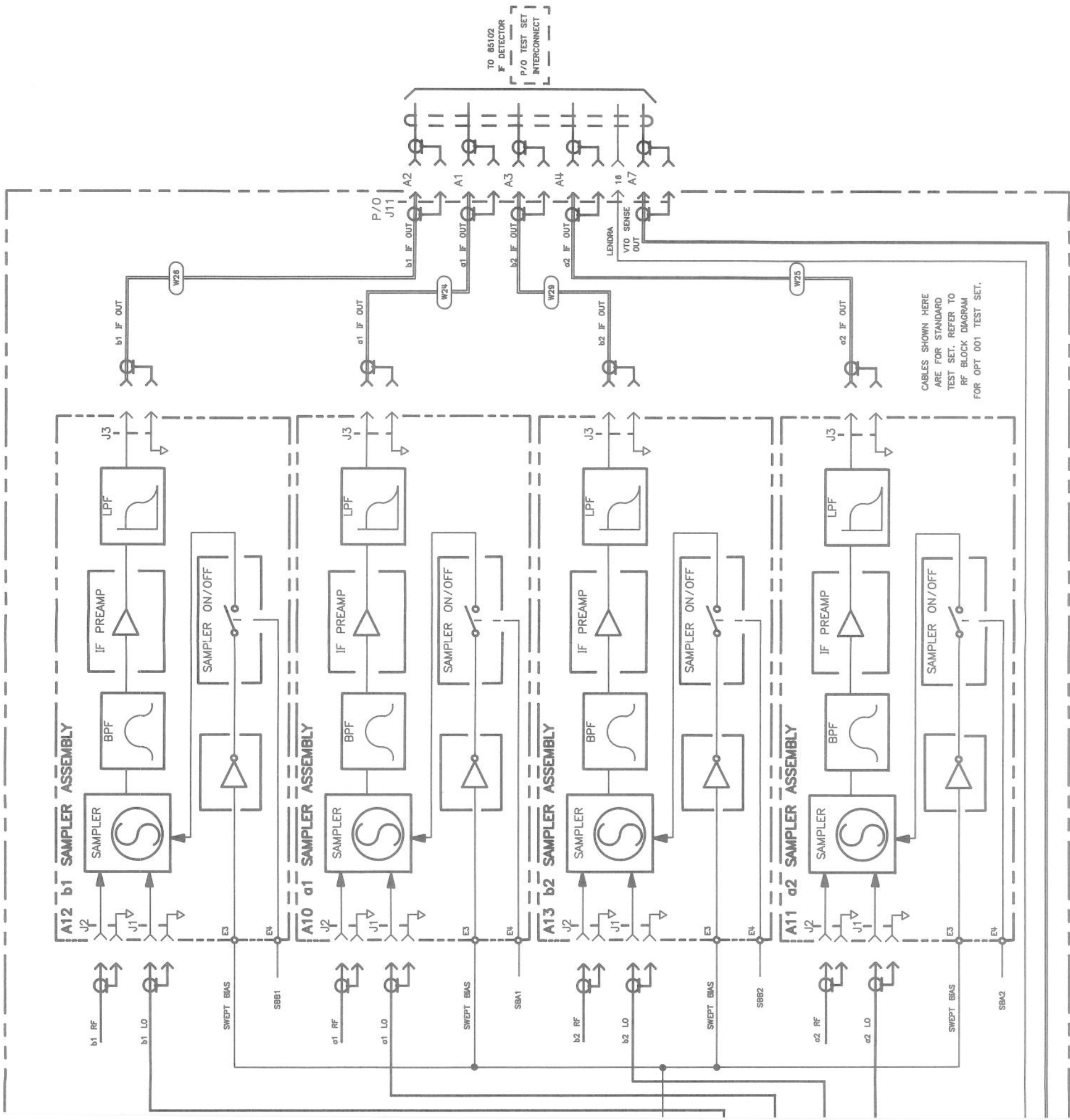
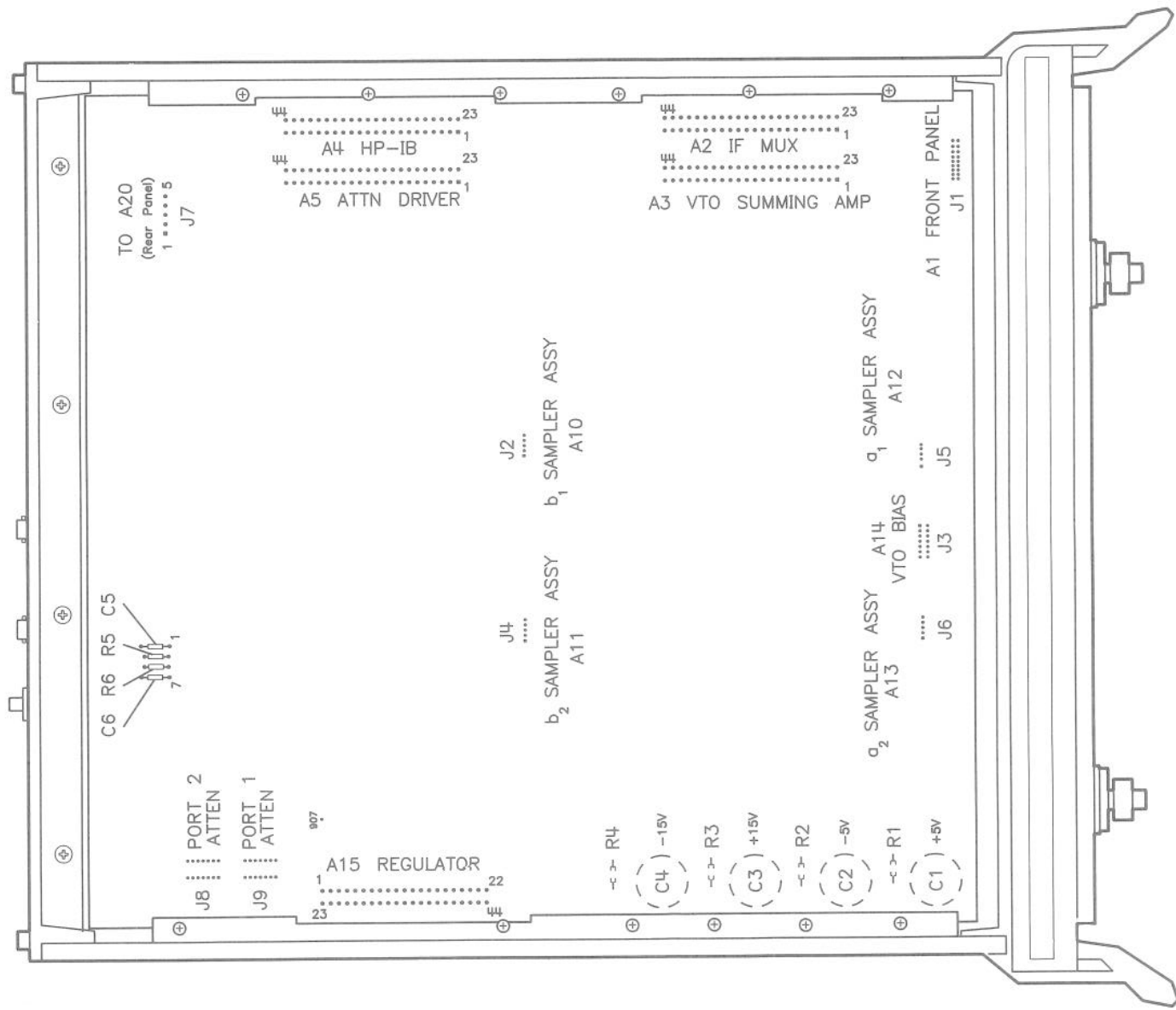


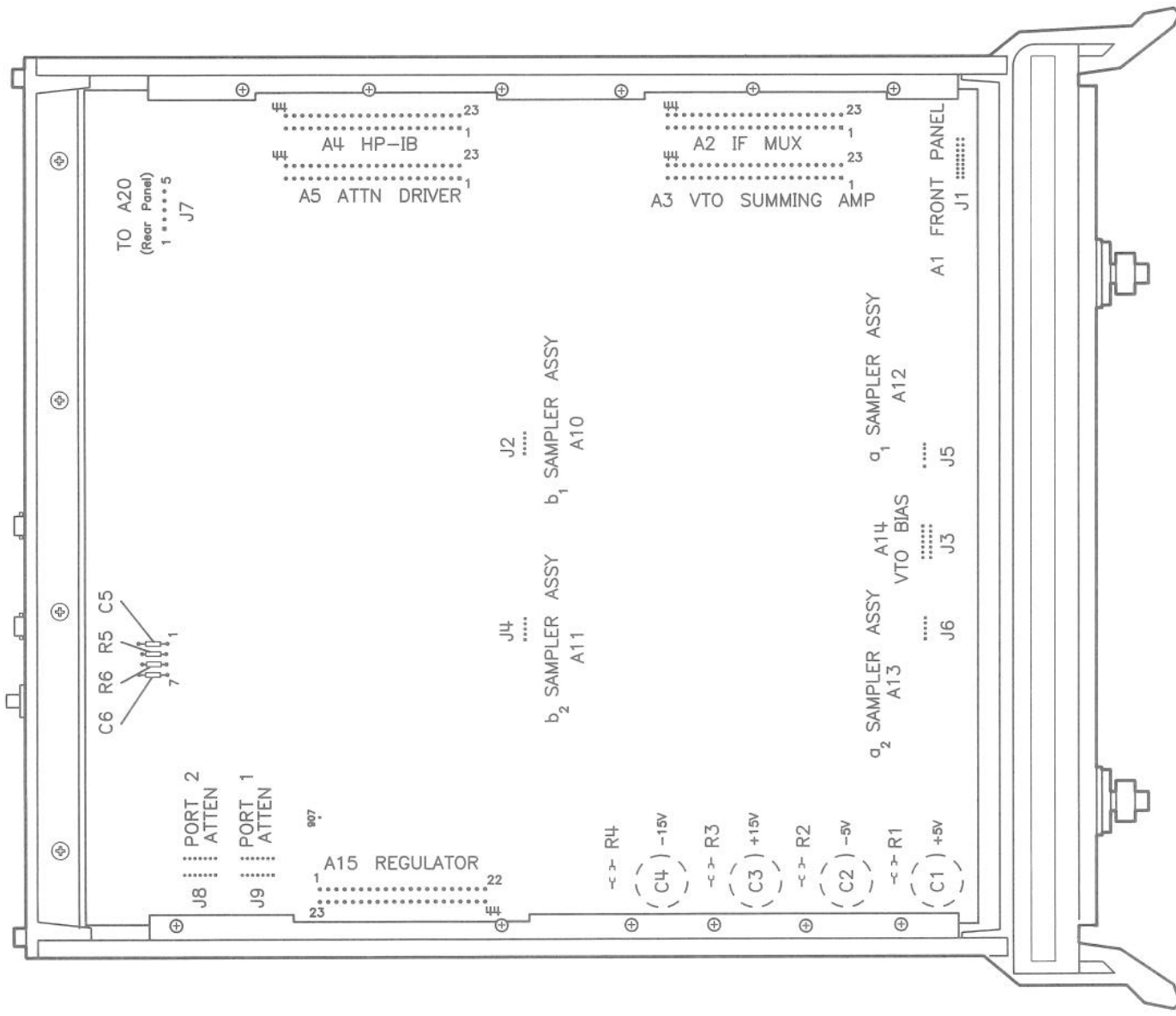
Figure 5-9. HP 8511B Control Block Diagram
5-13/5-14

Test Sets Interconnect Table (1 of 2)

MINEMONIC	DESCRIPTION	SIGNAL ENTERS MOTHERBOARD (CONNECTOR/PIN)	SIGNAL ENTERS (ASSEMBLY) →	SIGNAL EXITS MOTHERBOARD (CONNECTOR) →	A1 FRONT PANEL	A2 IF MULTIPLEXER	A3 VTO SUMMING AMP	A4 HP-IB	A5 ATTN/ SWITCH	A10 SAMPLER	A11 SAMPLER	A12 SAMPLER	A13 SAMPLER	A14 VTO/ DRIVER	A15 REGULATOR	A16 STEP ATTN 1	A17 STEP ATTN 2	A20 REAR PANEL
					J1	XA2	XA3	XA4	XA5	J2	J4	J5	J6	J3	XA15	J8	J9	J7
ACTIVE	Active LED Indicator	XA4-3			4													
AB0	Address Bus Bit 0	XA4-29			29				29									
AB1	Address Bus Bit 1	XA4-8			8				8									
AB2	Address Bus Bit 2	XA4-30			30				30									
AB3	Address Bus Bit 3	XA4-9			9				9									
AB4	Address Bus Bit 4	XA4-31			31				31									
A1S11	Attenuator 1 Section 1 In	XA5-4														2		
A1S10	Attenuator 1 Section 1 Out	XA5-26														13		
A1S21	Attenuator 1 Section 2 In	XA5-24														9		
A1S20	Attenuator 1 Section 2 Out	XA5-3														3		
A1S31	Attenuator 1 Section 3 In	XA5-23														5		
A1S30	Attenuator 1 Section 3 Out	XA5-2														11		
A1S41	Attenuator 1 Section 4 In	XA5-25														10		
A1S40	Attenuator 1 Section 4 Out	XA5-1														4		
A2S11	Attenuator 2 Section 1 In	XA5-44														2		
A2S10	Attenuator 2 Section 1 Out	XA5-22															13	
A2S21	Attenuator 2 Section 2 In	XA5-18														9		
A2S20	Attenuator 2 Section 2 Out	XA5-42														3		
A2S31	Attenuator 2 Section 3 In	XA5-40														5		
A2S30	Attenuator 2 Section 3 Out	XA5-20														11		
A2S41	Attenuator 2 Section 4 In	XA5-19														10		
A2S40	Attenuator 2 Section 4 Out	XA5-41														4		
BNMINT	Buffered Non-Maskable Interrupt	XA4-28			28				28									
BSRQ	Buffered Service Request	XA4-2						2										
DB0	Data Bus Bit 0	XA4-15			15				15									
DB1	Data Bus Bit 1	XA4-37			37				37									
DB2	Data Bus Bit 2	XA4-16			16				16									
DB3	Data Bus Bit 3	XA4-38			38				38									
DB4	Data Bus Bit 4	XA4-17			17				17									
DB5	Data Bus Bit 5	XA4-39			39				39									
DB6	Data Bus Bit 6	XA4-18			18				18									
DB7	Data Bus Bit 7	XA4-40			40				40									
GND	Chassis Ground	XA15-18-23, 40-44			3, 5				11, 12, 33, 34	2	2	2	2	3, 4		14	14	
LAP1	Low = Port 1 Attenuator Present	J8-1																
LAP2	Low = Port 2 Attenuator Present	J9-1																
LATDRVP	Low = Attenuator Switch/Driver Present	XA5-43							21									

Motherboard Pin Numbers





Test Sets Interconnect Table (2 of 2)

MNEMONIC	DESCRIPTION	SIGNAL ENTERS MOTHERBOARD (CONNECTOR/PIN)	SIGNAL ENTERS (ASSEMBLY) →	A1 FRONT PANEL	A2 IF MULTIPLEXER	A3 VTO SUMMING AMP	A4 HP-IB	A5 ATTN/ SWITCH	A10 SAMPLER	A11 SAMPLER	A12 SAMPLER	A13 SAMPLER	A14 VTO/ DRIVER	A15 REGULATOR	A16 STEP ATTN 1	A17 STEP ATTN 2	A20 REAR PANEL	
LBIOS LBUFWR LENDRA LOPTP	Low = Buffered I/O Strobe Low = Buffered Write Low = End of Range Low = Option Present	XA4-5 XA4-27 XA3-43 XA2-20	SIGNAL EXITS MOTHERBOARD (CONNECTOR) →	J1	XA2	XA3	XA4	XA5	J2	J4	J5	J6	J3	XA15	J8	J9	J7	
LPRTHLD LP2ACT LSWDRVP LTEMP	Low = Return Hold Low = Port 2 Active Low = Sweep Driver Present Low = Over Temperature	J11-17 XA4-4 XA3-21 XA3-7	Motherboard Pin Numbers	6	5 20	5	27	5									2	
PWON P1ACT P1BIASIN P1BIASOUT	Power On Port 1 Active Port 1 Bias Voltage In Port 1 Bias Voltage Out	XA4-6 XA4-26 J8 (Rear Panel) Port 1 (Front Panel)		19, 20 17, 18	6	6	6		6					1				
P2BIASIN P2BIASOUT SWEPTBIAS SBA1	Port 2 Bias Voltage In Port 2 Bias Voltage Out Swept Bias A1 Sampler On/Off	J6 (Rear Panel) Port 2 (Front Panel) XA3-24 XA3-4		15, 16 13, 14							1	1 5	1					
SBA2 SBB1 SBB2 TEMP2	A2 Sampler On/Off B1 Sampler On/Off B2 Sampler On/Off Analog Temperature Sensor	XA3-26 XA3-3 XA3-25 XA3-1								5	5		5					
VSET +5VA +5VCAP -5VCAP	VTO Set Voltage +5 Volts to Attenuators +5 Volts Unregulated to Input Filter Capacitor -5 Volts Unregulated to Input Filter Capacitor	XA3-2 XA5-17, 39 XA15-45 XA15-8, 9, 30, 31												13, 14	26, 27 8, 9, 30, 31	6	6	
+15VCAP -15VCAP +5VREG -5VREG	+15 Volts Unregulated to Input Filter Capacitor -15 Volts Unregulated to Input Filter Capacitor +5 Volts Regulated Supply -5 Volts Regulated Supply	XA15-12, 13, 34, 35 XA15-16, 17, 38, 39 XA15-2, 3, 24, 25 XA15-6, 7, 28, 29			1, 2	14, 36	14, 36	14, 36						9, 10 7, 8	12, 13, 34 16, 17, 38, 39			
+15VREG -15VREG	+15 Volts Regulated Supply -15 Volts Regulated Supply	XA15-10, 11, 32, 33 XA15-14, 15, 36, 37			7, 8	10, 32 13, 35	10, 32 13, 35	10, 32 13, 35	10, 32 13, 35	4 3	4 3	4 3	4 3	11, 12 5, 6				

Chapter 6. Replacement Procedures

INTRODUCTION

This chapter consists of the following replacement procedures:

1. Frequency converter
2. Regulator board assembly
3. Filter capacitors
4. 2.4 mm RF connectors
5. Fan
6. Power Transformer

EQUIPMENT NEEDED BUT NOT SUPPLIED

Table 6-1 lists all the equipment needed to replace the assemblies documented in the following procedures. Use Figure 6-1 to locate the assemblies in the test set.

Table 6-1. Equipment Needed to Replace Test Set Major Assemblies

Tools	Used For	HP Part Number
2 point Pozidriv screwdriver	all components	8710-0900
1 point Pozidriv screwdriver38	all components	8710-0899
5/16 inch torque wrench, 90 N-cm (8 in-lb)	all components	8710-1765
2.4 mm gage kit	port connectors	in 85056A cal kit
anti-static mat	all components	9300-0797
wrist strap	all components	9300-1257
clip lead	C1-C4 capacitors	any supplier
wire cutters	B1 fan	any supplier
T-10 Torx screwdriver	all components	8710-1623
T-15 Torx screwdriver	8710-1622	
9/16 inch nut driver	connector repair	8720-0008
1/2 inch torque wrench, 280 N-cm (25 in-lb)	connector repair	8710-1581
100 ohm 20 watt resistor	C1-C4 capacitor removal	0819-0019
5/16 inch open end wrench	fan replacement	any supplier
1/2 inch open-end wrench	RF input connector	any supplier

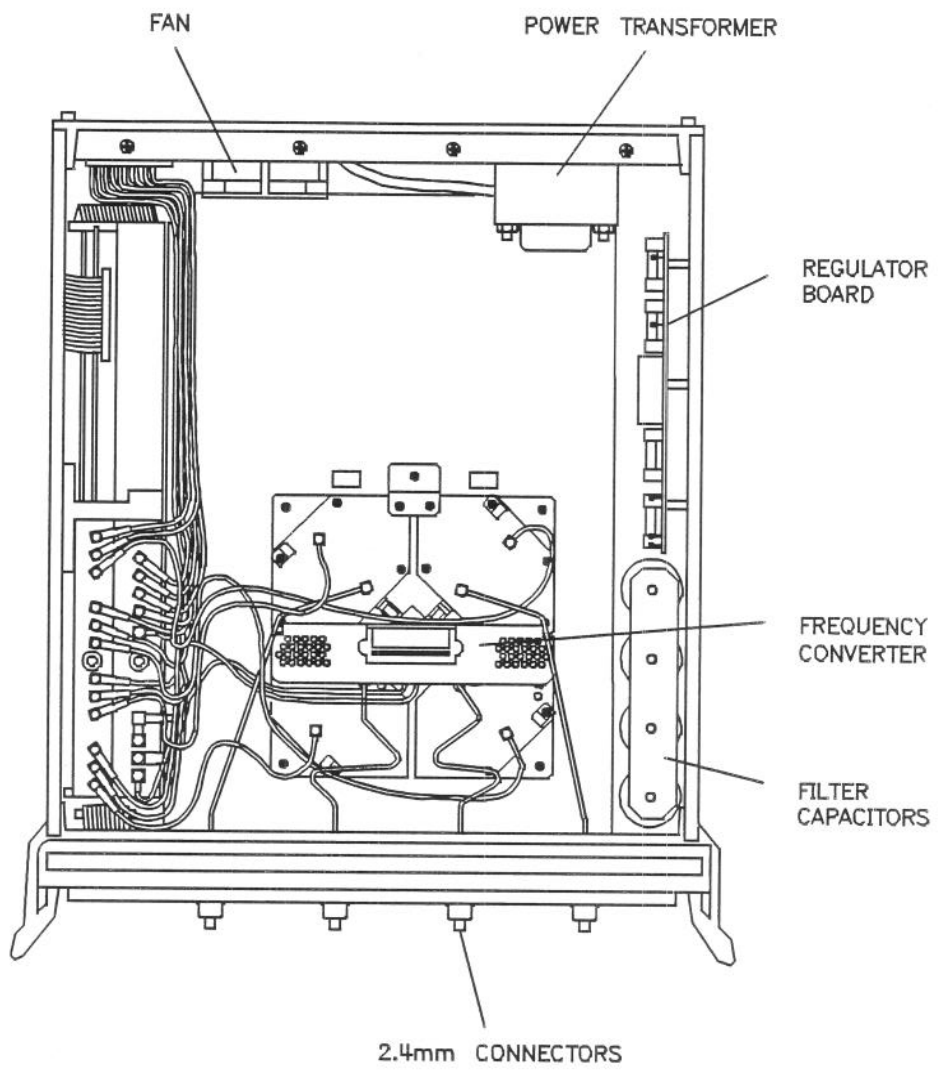


Figure 6-1. Assembly Location Diagram

ASSEMBLY REPLACEMENT PROCEDURES

PRELIMINARY PRECAUTIONS



ATTENTION **Static Sensitive** **Handle only at Static Safe** **Work Stations**

The assemblies handled in this procedure are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

1. To prevent electrostatic damage ground the work area and yourself.
2. Turn the test set off.
3. Disconnect the power cord.
4. Remove the top and side covers, trim strips, and handles.
5. Torque 2.4 mm connections to 90 N-cm (8 in-lb).
6. Exercise caution when handling semi-rigid coax cables. They are easily bent.
7. To install a part, reverse the appropriate procedure.

(1) FREQUENCY CONVERTER

The frequency converter consists of a VTO (voltage-tuned oscillator) assembly and four samplers.

1. Remove the semi-rigid cable attached to each of the four samplers.
2. Remove the two in-line attenuators from the samplers.
3. Remove the six flexible cables from the frequency converter by gently pulling on the gold connector.
4. Remove the four frequency converter mounting plate screws and the bracket screw that fastens the frequency converter to the chassis.
5. Unplug the ribbon cable near the front panel.
6. Unplug the four harnessed (multi-colored) wire and socket assemblies.
7. Lift the frequency converter out of the test set.
8. Remove the frequency converter bracket by removing the two pozidriv screws.

(2) REGULATOR BOARD ASSEMBLY

1. Unplug the transformer socket from the regulator board.
2. Remove the three mounting screws from the top edge of the regulator board.
3. Remove the regulator board. (You may have to partially back out one of the transformer mounting screws for clearance.)

(3) FILTER CAPACITORS

1. Set the test set upright and pull the metal and plastic cover off the capacitors.
2. Turn the test set over and remove the bottom cover.
3. To discharge the capacitors, attach one end of an insulated clip lead to the chassis of the instrument and the other end of the clip lead to a 100 Ω 20 watt resistor. Use the resistor to discharge each capacitor terminal (large Pozidriv screw on the bottom side of the test set). Each capacitor has two terminals. **Discharge all capacitor terminals.** It takes approximately six seconds to discharge each capacitor..
4. To remove a capacitor, remove the corresponding pair of screws and pull the capacitor out of the test set.

(4) 2.4 mm RF CONNECTOR REPAIR

Refer to Figure 6-2 and the following text to repair a 2.4 mm connector. Refer to chapter 7 for replacement part numbers

Disassembly

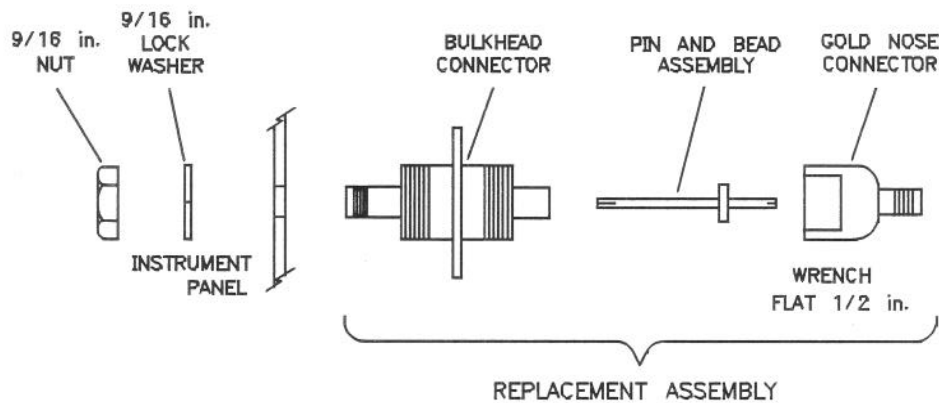


Figure 6-2. Exploded Diagram of 2.4 mm Connector

1. Remove any attached cables from the connector to be replaced.
2. From inside the test set, use a 9/16 inch nut driver to loosen the nut and remove the connector.

Assembly

3. Assemble the bulkhead connector, lock washer and nut.
4. Using the 9/16 inch nut driver, tighten the nut to 506 N-cm (45 in-lb).
5. Attach the assembly to the bulkhead connector. Torque to 281 N-cm (25 in-lb).
6. Clean the mating surfaces with alcohol and lint-free swabs.
7. Check the pin depth of the gold nose connector. The pin depth specification is 0.0000 to +0.0030 inch.
8. Reconnect the cables disconnected in step 1.

(5) B1 FAN

WARNING

Turn the test set OFF and disconnect the power cord from the mains. Electrocutation can result if power is not removed from the test set prior to this procedure.

To replace the fan B1, you must remove the transformer (T1) so that the ends of the fan wires can be unsoldered from the line module FL1. Refer to the "Replaceable Parts" chapter of this manual for a detailed view of the fan and transformer hardware.

1. Turn the test set on its right side.
2. Unplug the transformer connector at J2 on the A15 regulator board.
3. Using a large Pozidriv screwdriver, remove the four screws and washers that hold the transformer onto the rear panel.
4. Using a large Pozidriv screwdriver, remove the screw that holds the transformer angle bracket to the main deck. The transformer wires soldered to the line module are short, so do not pull the transformer out too far.
5. Carefully remove the transformer from the test set and put it on the bench close to the test set.
6. Strip the heat shrink tubing off the two fan wires and unsolder the wires from the line module. Cut any cable ties holding the fan wires to nearby cables.
7. Using a small Pozidriv screwdriver, remove the screw and lockwasher that secure the green/yellow fan ground wire to the top of the rear panel frame.
8. Using a small Pozidriv screwdriver, remove the four screws that hold the fan to the rear panel; remove the fan.

(6) T1 POWER TRANSFORMER

WARNING

Turn the test set OFF and disconnect the power cord from the mains. Electrocutation can result if power is not removed from the test set prior to this procedure.

1. Turn the test set on its right side.
2. Unplug the transformer connector at J2 on the A15 regulator board.
3. Using a large Pozidriv screwdriver, remove the four screws and washers that hold the transformer onto the rear panel.
4. Using a large Pozidriv screwdriver, remove the screw that holds the transformer angle bracket to the main deck. The transformer wires soldered to the line module are short, so do not pull the transformer out too far.
5. Carefully remove the transformer from the test set and put it on the bench close to the test set.
6. Strip the heat shrink tubing off the transformer wires soldered to the line module, and unsolder the wires.
7. Unsolder the transformer ground wire connected to the chassis side rail.
8. Remove the transformer.
9. When you replace the transformer, refer to Figure 6-3 for the location of the wires connected to the line module.

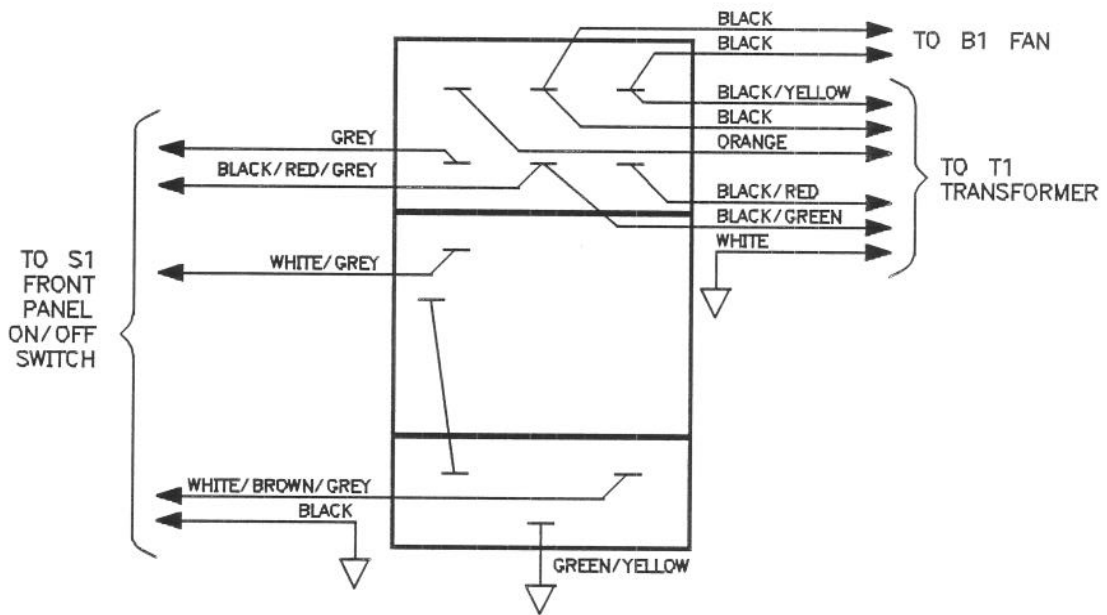


Figure 6-3. Wire Connections to Line Module FL1

Chapter 7. Replaceable Parts

INTRODUCTION

This section contains information for ordering replaceable parts for the instrument. The replaceable parts include major assemblies, and chassis hardware, but not parts of major assemblies. Table 7-1 lists major reference designations, abbreviations, and addresses of manufacturers.

R-E (REBUILT-EXCHANGE) ASSEMBLIES COST LESS

Lower cost assemblies are available through the rebuilt-exchange program. Factory rebuilt (repaired and tested) assemblies meet all factory specifications required of a new assembly. They are offered on an exchange (trade-in) basis only. The defective assembly must be returned for credit. Figure 7-1 illustrates the rebuilt-exchange procedure. If you have any questions, contact your HP customer engineer.

REPLACEABLE PARTS LIST

The following figures assist in locating and identifying all replaceable parts, and include corresponding lists that provide the following information:

1. Hewlett-Packard part number.
2. Part quantity. There may be more of the same part located elsewhere in the instrument.
3. Part description, using abbreviations in Table 7-1.

The following information is given only if a part is available from an alternate supplier.

4. A typical manufacturer of the part in a five-digit code.
5. The manufacturer's part number.

ORDERING INFORMATION

To order a listed part, quote the HP part number, quantity required, and send the order to the nearest Hewlett-Packard office.

To order a part that is not listed, include the instrument model number, complete serial number, description and function of the part, and quantity required. Send the order to the nearest Hewlett-Packard office.

To Order Parts....Fast!

(800) 227-8164

Monday through Friday, 6 am to 5 pm (Pacific Standard Time)

The parts specialists have online access to replacement parts. There is a charge for hotline one day delivery, but four day delivery time is standard. After hours and holidays, call (415) 968-2347. This service applies to the United States only. Outside the United States, contact your nearest HP office.

Table 7-1. Reference Designations, Abbreviations, and Manufacturers Code List

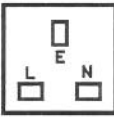




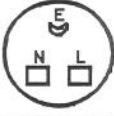
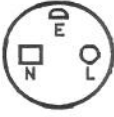
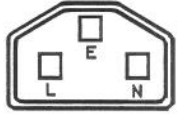
A	Assembly	FL	Filter	Q	Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
CR	Diode, Diode Thyristor Step Recovery Diode(SCR), Varactor	J ...	Electrical Connector (Stationary Portion), Jack	R	Resistor
DS	Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device	MP ..	Miscellaneous Mechanical Part	S	Switch
F	Fuse	P	Electrical Connector (Movable Portion), Plug	TP	Test Point
				U	Integrated Circuit
				W ..	Cable, Transmission Path, Wire

REFERENCE DESIGNATIONS		ABBREVIATIONS	
A		H	
ADJ	Adjust, Adjustment	HD	Hand, Hard, Head Heavy Duty
AMP	Amplifier	HEX	Hexadecimal, Hexagon Hexagonal
ASSY	Assembly		
ATTN	Attenuator	I	
		ID ...	Identification, Inside Diameter
B		IN	Inch, Indium
BD	Board	INTL	Internal
BNC	Type of Connector		
		K	
C		KB	Knob
C	Capacitance, Capacitor		
CBL	Cable	L	
CHAM	Chamfer	LED	Light Emitting Diode
CPU	Central Processing Unit	LG	Length, Long
		LKWR	Lockwasher
D			
D	Deep, Depletion, Depth, Diameter, Direct Current	M	
DB	Decibel, Double Break	MACH	Machine
DBL	Double	MM	Millimeter
		MTLC	Metallic
E			
EXT	Extended, Extension, External, Extinguish	N	
		NEG	Negative
F			
F	Fahrenheit, Farad, Female Film (Resistor), Fixed, Flange Flint., Fluorine, Frequency	O	
FL	Flash, Flat, Fluid	OD ..	Olive Drab, Outside Diameter
FLTR	Filter, Floater		
		P	
G		PAN-HD	Pan Head
GHZ	Gigahertz	PC	Picocoulomb, Piece Printed Circuit
		PNL	Panel
		P/O	Part of
		PN	Part Number

ABBREVIATIONS		REFERENCE DESIGNATIONS	
R		S	
R	Rear	SAMP	Sampler, SCR Screw, Scrub Silicon Controlled Rectifier
RFI ..	Radio Frequency Interference		
		SHFT	Shaft
S		SHLDR	Shoulder
		SKT	Skirt, Socket
		SLDR	Solder
		SMB	Subminiature, B Type (Snap-On Connector)
		SST	Stainless Steel
T			
THD	Thread, Threaded		
THK	Thick	V	
		VDC	Volts, Direct Current
V			
		W	
		W	Watt, Wattage, White, Wide, Width, Wire
X			
XSTR	Transistor		
Y			
YIG	Yttrium-iron-garnet	Z	
		ZN-P	Zinc Plate

MANUFACTURERS CODE LIST	
Mfr Code	
00000	Any Satisfactory Supplier
28480	Hewlett-Packard Company Corp. Hq., Palo Alto, CA 94304
55787	Gas Spring Corp., Mongtomeryville, PA 18936
71400	Cooper Industries, Houston, TX 77210

Table 7-2. Power Cable and Plug Part Numbers

PLUG TYPE ¹	CABLE HP PART NUMBER ²	PLUG DESCRIPTION ²	CABLE LENGTH (inches)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V 	8120-1369 8120-0696	Straight ZNSS198/ASC112 90°	79 87	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	Straight CEE7-VII 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, Republic of So. Africa, India (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	Straight NEMA5-15P 90° Straight NEMA5-15P Straight NEMA5-15P 90° Straight NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan, (100V or 200V), Mexico, Philippines, Taiwan
250V 	8120-2104	Straight SEV1011.1959 24507, Type 12	79	Gray	Switzerland
250V 	8120-0698	Straight NEMA6-15P			United States, Canada
220V 	8120-1957 8120-2956	Straight DHCK 107 90°	79 79	Gray Gray	Denmark
250V 	8120-1860	Straight CEE22-VI (System Cabinet Use)			

1. E = Earth Ground; L = Line; N = Neutral.

2. Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.

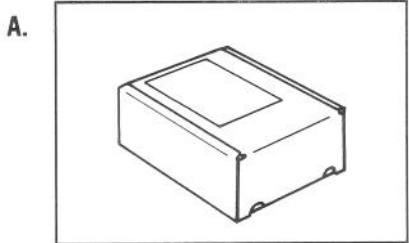
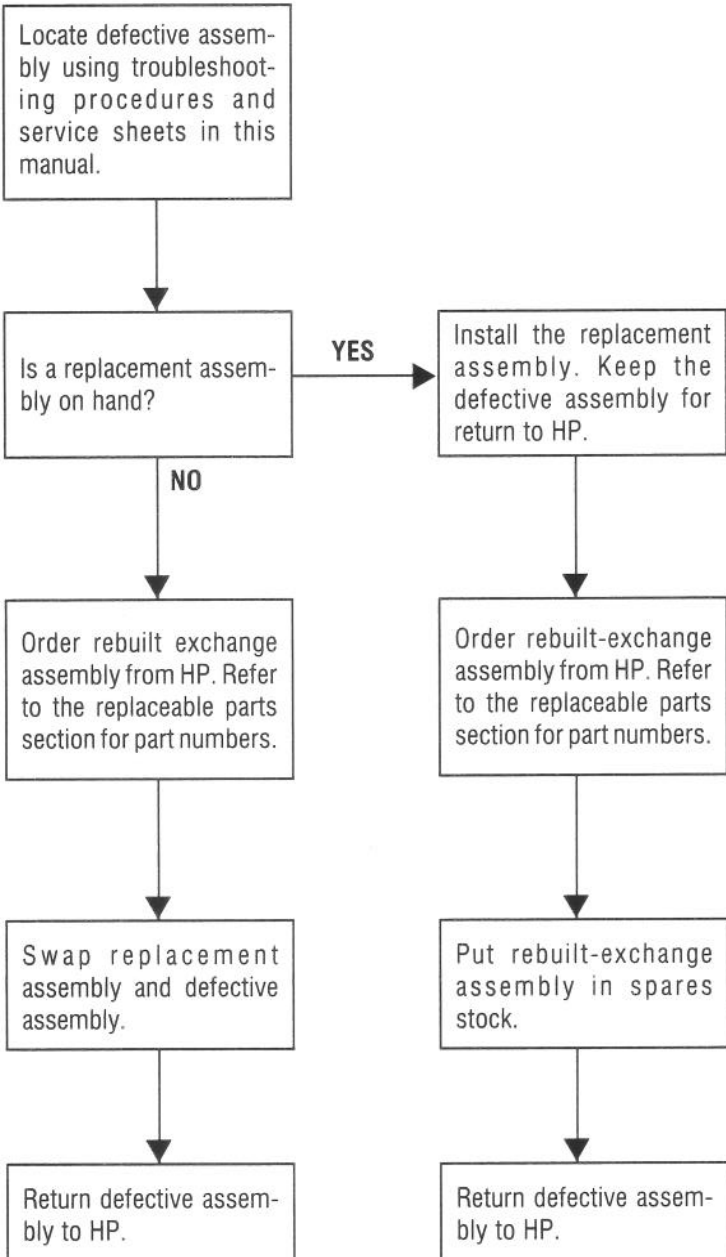
Table 7-3. Touch-up Paint

Color	Part Number	Applicable Use
Dove Gray	6010-1146	The frame around the front panel and painted portions of the front handles.
French Gray	6010-1147	The side, top and bottom covers
Parchment Gray	6010-1148	The rack mount flanges, rack support shelves and front panels.

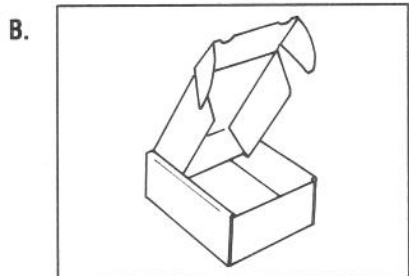
Table 7-4. Fuses

Fuse	Name	Location	AMP	100-120VAC	AMP	220-250 VAC
				Part No.		Part No.
AC Line	F1	Rear Panel	2	2110-0002	1	2110-0001
+ 5 VDC	F1	Regulator Board	1.5	2110-0043	1.5	2110-0043
-5 VDC	F2	Regulator Board	1.0	2110-0001	1.0	2110-0001
+ 15 VDC	F3	Regulator Board	1.5	2110-0043	1.5	2110-0043
-15 VDC	F4	Regulator Board	1.0	2110-0001	1.0	2110-0001
Bias	Bias Fuses	Front Panel	0.5	2110-0012	0.5	2110-0012

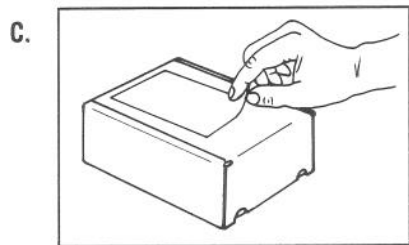
Use this fast, efficient, economical method to keep your Hewlett-Packard instrument in service.



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



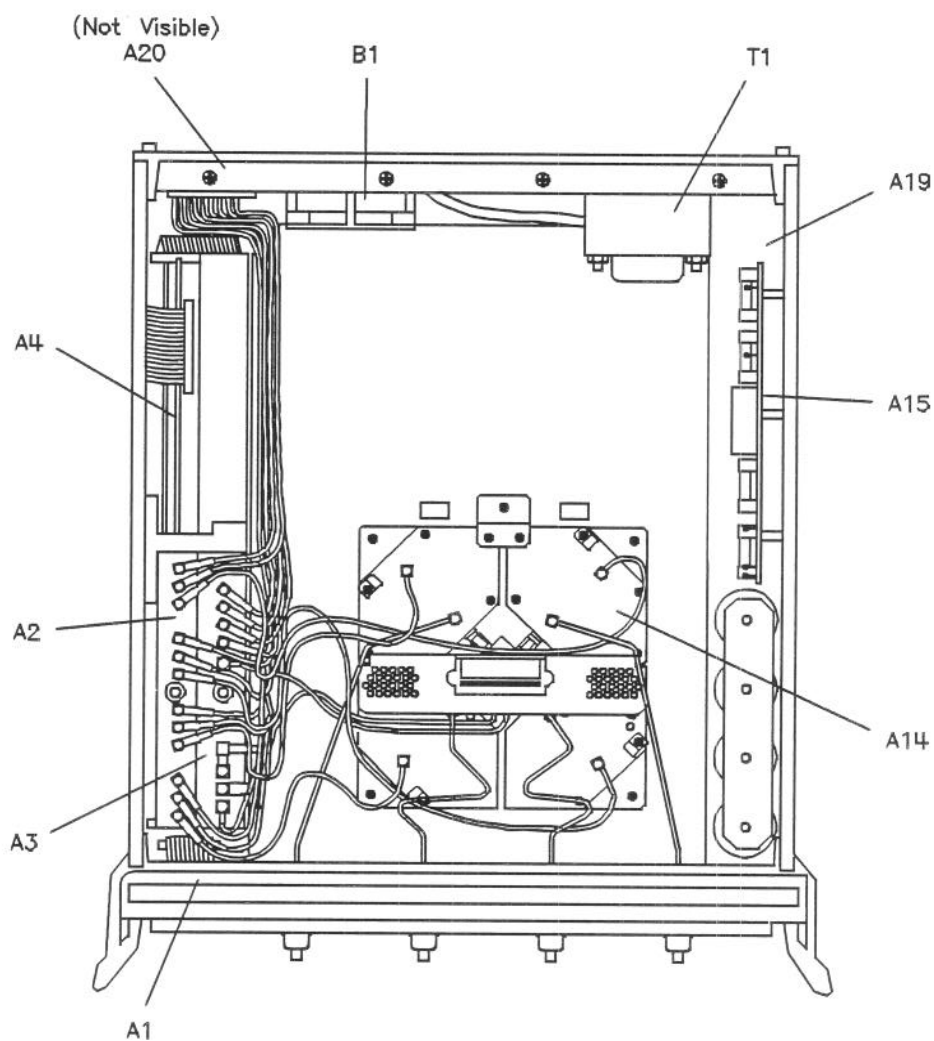
Open box carefully - it will be used to return defective assembly to HP. Complete failure report. Place it and defective assembly in box. Be sure to remove enclosed return address label.



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.

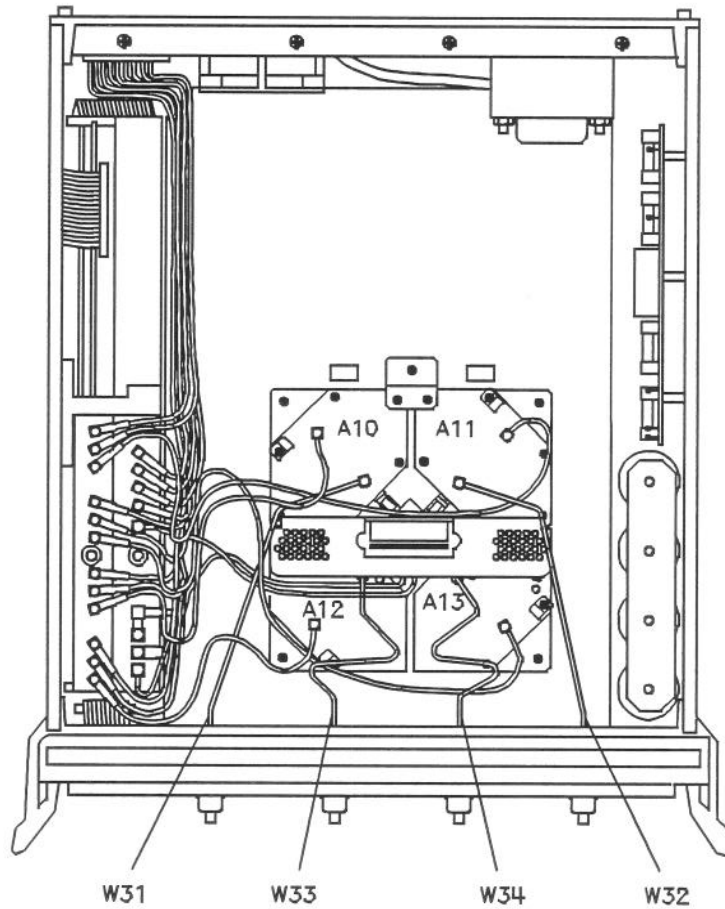
*HP pays postage on boxes mailed in U.S.A.

Figure 7-1. The Low Cost Rebuilt-Exchange Procedure



Reference Designation	HP Part Number	Qty.	Description
A1	08513-60005	1	FRONT PANEL INTERFACE BOARD ASSEMBLY
A2			USED FOR OPTION 001 SEE FIGURE 7-12
A3	08517-60002	1	VTO SUMMING AMPLIFIER BOARD ASSEMBLY (NEW)
	08517-69002		VTO SUMMING AMPLIFIER BOARD ASSEMBLY (R-E)
A4	08516-60029	1	HP-IB BD ASSEMBLY (NEW)
	08516-69029		HP-IB BOARD ASSEMBLY (R-E)
A14	5086-7501	1	FREQ. CONV. 50 GHZ (SAMPLERS & VTO) (NEW)
	5086-6501		FREQ. CONV. 50 GHZ (SAMPLERS & VTO) (R-E)
A15	08513-60007	1	REGULATOR BOARD ASSEMBLY
A19	08513-60001	1	MOTHERBOARD
A20	08513-60006	1	HP-IB INTERFACE BOARD ASSEMBLY
B1	08513-20031	1	FAN-TBAX 34-CFM 115V 50/60 HZ 1.5KV DIEI
T1	9100-4723	1	POWER TRANSFORMER

Figure 7-2. Major Assemblies



TOP VIEW

Reference Designation	HP Part Number	Qty.	Description
W31	08511-20021	1	CABLE ASSEMBLY A10 TO FRONT PANEL
W32	08511-20024	1	CABLE ASSEMBLY A11 TO FRONT PANEL
W33	08511-20022	1	CABLE ASSEMBLY A12 TO FRONT PANEL
W34	08511-20023	1	CABLE ASSEMBLY A13 TO FRONT PANEL

Figure 7-3. Semi-Rigid Cables

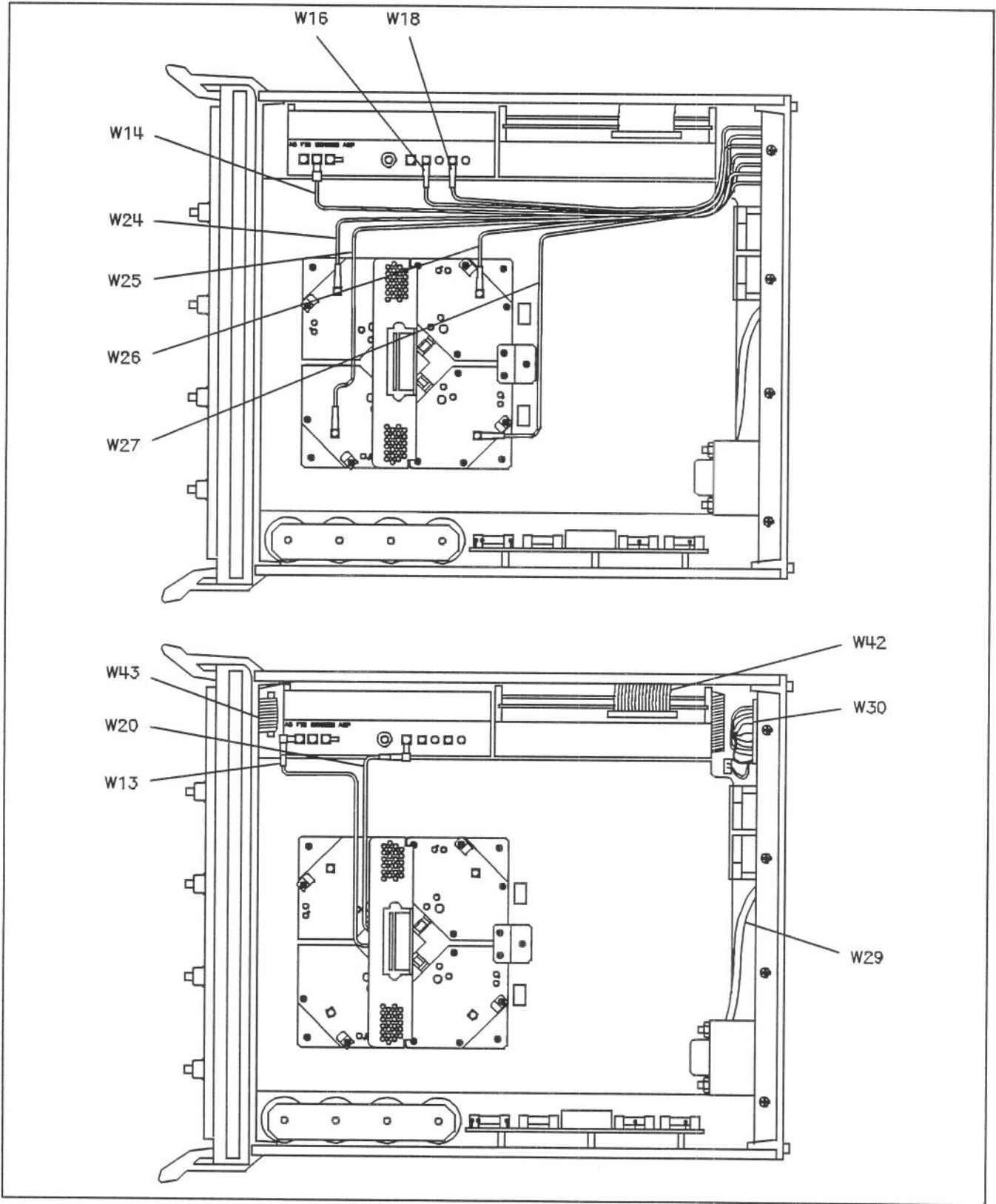
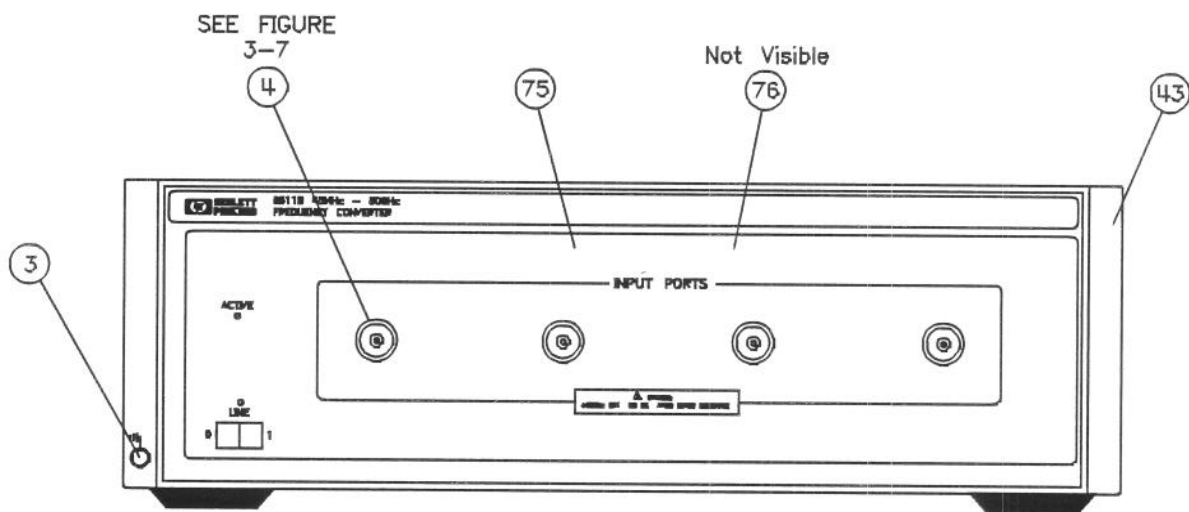


Figure 7-4. Flexible RF Cables (1 of 2)

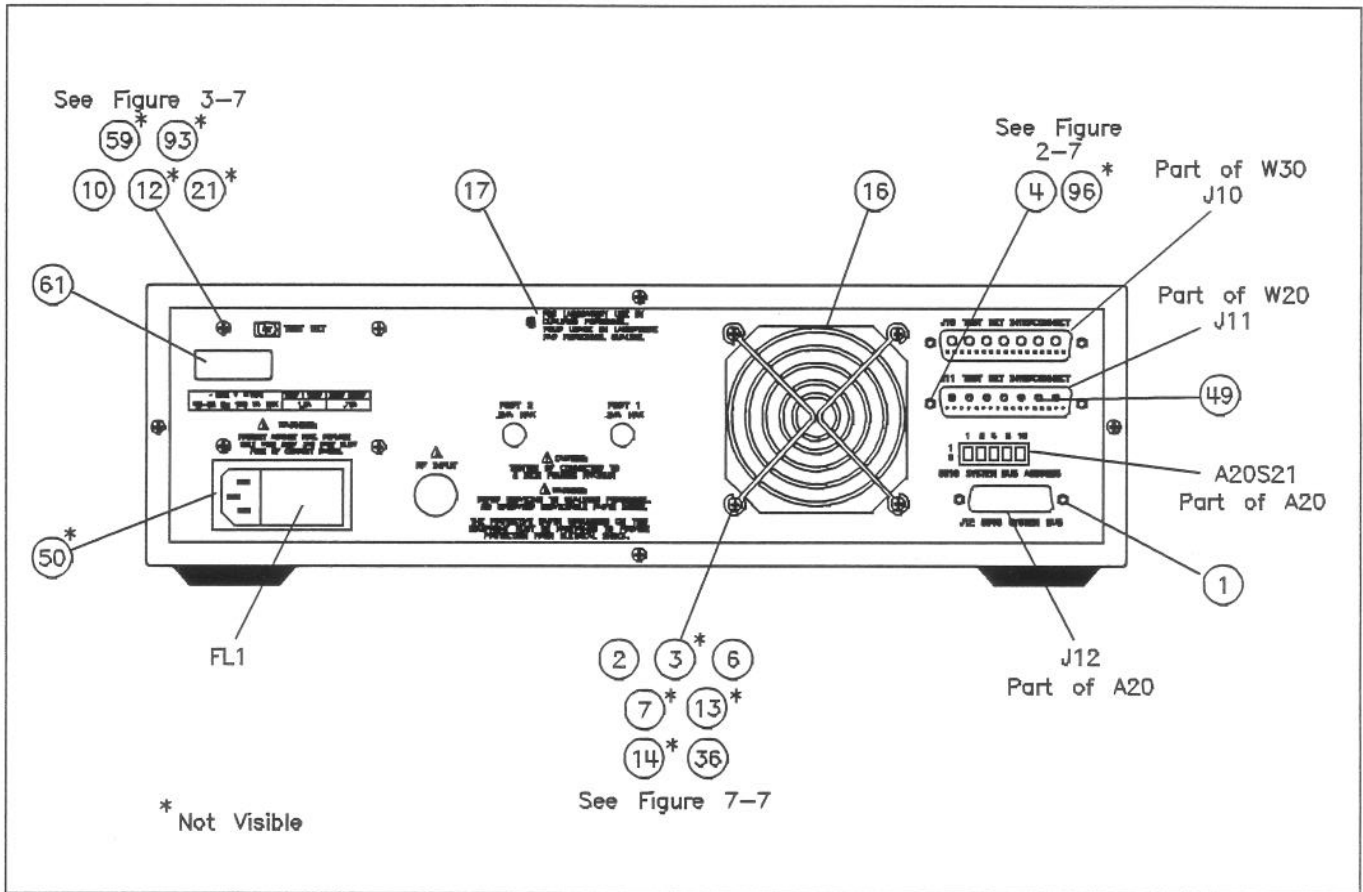
Reference Designation	HP Part Number	Qty.	Description
W13	08513-60133	1	CABLE ASSEMBLY A3J1 TO A14J1
W14	08513-60134	1	CABLE ASSEMBLY A3J2 TO J11A7
W16	08513-60136	1	CABLE ASSEMBLY A3J5 TO J11A5
W18	08513-60138	1	CABLE ASSEMBLY A3J7 TO J11A6
W20	08513-60140	1	CABLE ASSEMBLY A3J4 TO A14J2
W24	08513-60144	1	CABLE ASSEMBLY A12J3 TO J11A1
W25	08513-60145	1	CABLE ASSEMBLY A13J3 TO J11A4
W26	08513-60146	1	CABLE ASSEMBLY A10J3 TO J11A2
W27	08513-60147	1	CABLE ASSEMBLY A11J3 TO J11A3
W29	85102-60226	1	CABLE ASSEMBLY LINE SWITCH
W30	08513-60014	1	CABLE ASSEMBLY J10 TO J11
W42	08513-60036	1	CABLE ASSEMBLY A4 TO A20
W43	08513-60013	1	CABLE ASSEMBLY A1 TO A19

Figure 7-4. Flexible RF Cables (2 of 2)



Reference Designation	HP Part Number	Qty.	Description
3	1510-0038	1	BINDER POST ASSEMBLY
4	5062-7243	4	PORT CONNECTOR ASSEMBLY
43	5021-8747	1	FRONT BEZEL
75	08511-00015	1	FRONT DRESS PANEL
76	08517-00002	1	FRONT SUB PANEL

Figure 7-5. Miscellaneous Parts, Front Panel



Reference Designation	HP Part Number	Qty.	Description
FL1	9135-0217	1	LINE MODULE-FILTERED
J10	1251-2197	1	CONNECTOR R&P 24F
J11	1251-2204	1	CONNECTOR R&P 24M
1	0380-0643	2	STANDOFF-HEX .255-IN-LG 6-32 THD
2	0400-0010	4	GROMMET-RND .188-IN-ID .312-IN-GRV-OD
3	0380-0926	4	THREADED INSERT-STDF 6-32 .188-IN-LG SST
4	1251-7812	6	CONNECTOR JACKSCREW
6	0380-0002	4	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI
7	2510-0322	4	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK
10	2510-0270	4	SCREW-MACH 8-32 3.25-IN-LG PAN-HD-POZI
12	3050-0139	12	WASHER-FL MTLC NO.8 .172-IN-ID
13	3050-0152	4	WASHER-SHLDR NO.8 .172-IN-ID .438-IN-OD
14	3050-0227	4	WASHER-FL MTLC NO.6 .149-IN-ID
16	3160-0309	1	FINGER GUARD
17	08517-00001	1	REAR PANEL
21	2190-0017	4	WASHER-LK INTL NO. 10 .195-IN-ID
36	08513-00002	1	TRANSFORMER BRACKET
49	5021-0906	14	TEFLON CABLE SLEEVE
50	5001-3907	2	LINE MODULE RETAINER CLIPS
61	7121-2380	1	LABEL-SERIAL NUMBER
93	08513-20032	2	TRANSFORMER SUPPORT BRACKET
96	0590-0663	6	NUT-HEX 4/40

Figure 7-6. Miscellaneous Parts Rear Panel

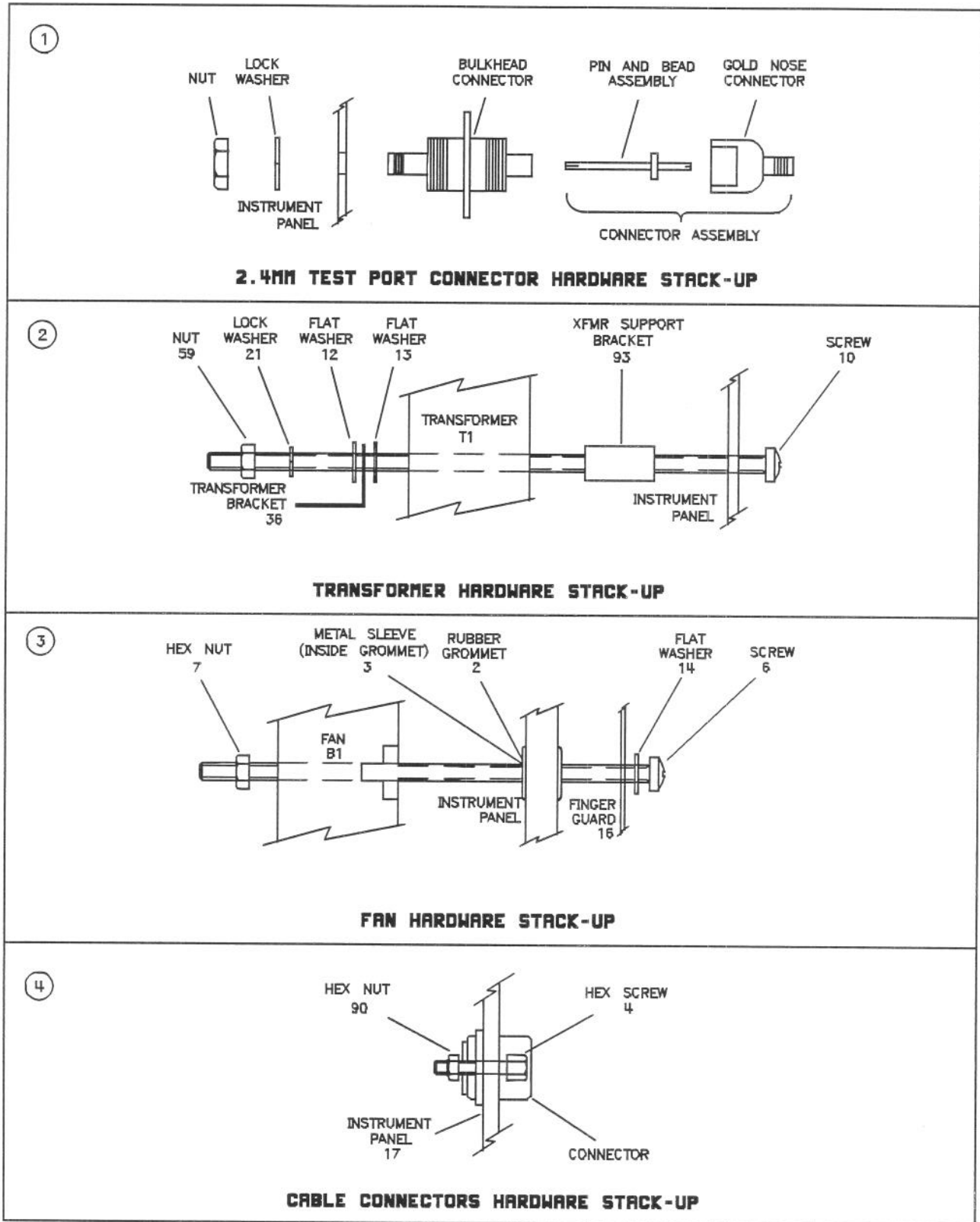
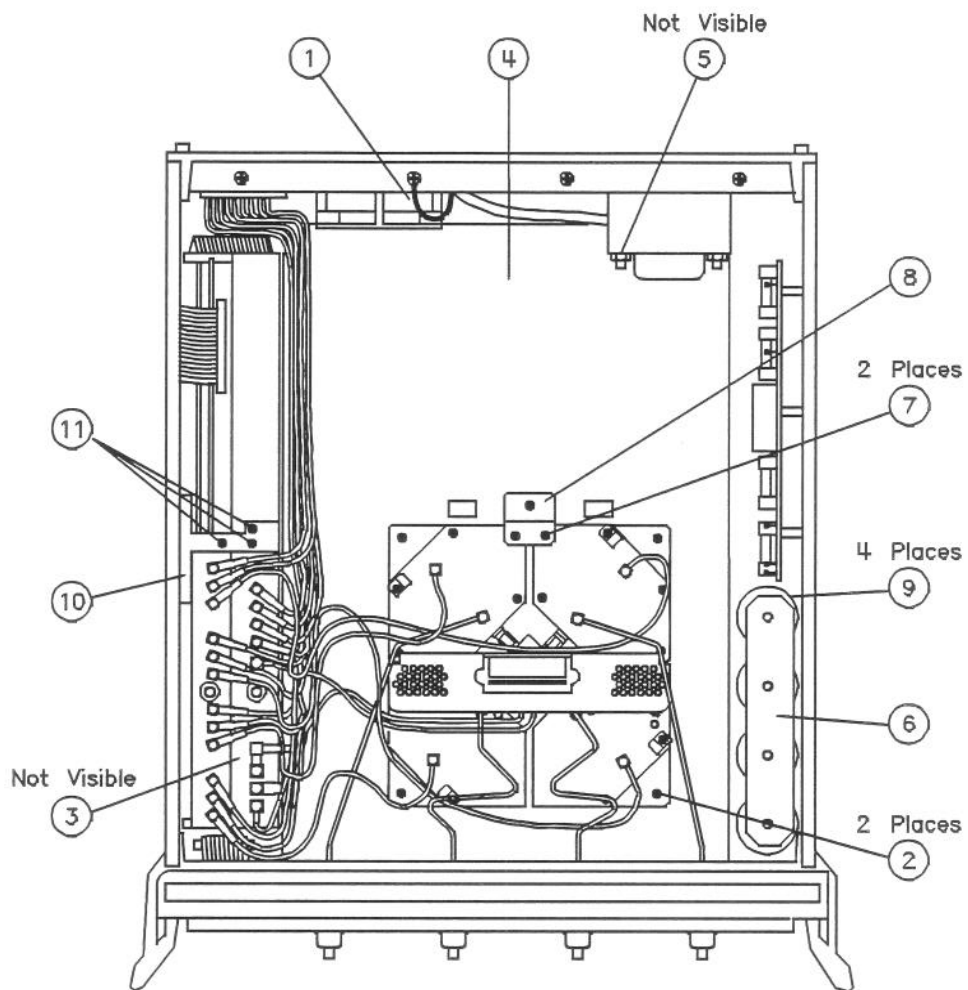


Figure 7-7. Rear Panel Miscellaneous Parts: Detailed Views



Reference Designation	HP Part Number	Qty.	Description
1	0360-0031	1	TERMINAL CRIMP
2	2360-0115	5	MACHINE SCREW
3	08512-20005	1	RFI GASKET
4	08513-00001	1	TOP DECK
5	08513-00002	1	TRANSFORMER BRACKET
6	08513-00015	1	CAPACITOR PLATE
7	2200-0109	2	MACHINE SCREW
8	08514-00007	1	MOUNTING PLATE
9			SEE FIGURE 7-11
10	0513-00037	1	ENCLOSURE BRACKET
11	2200-0107	3	MACHINE SCREWS

Figure 7-8. Miscellaneous Parts Top Internal

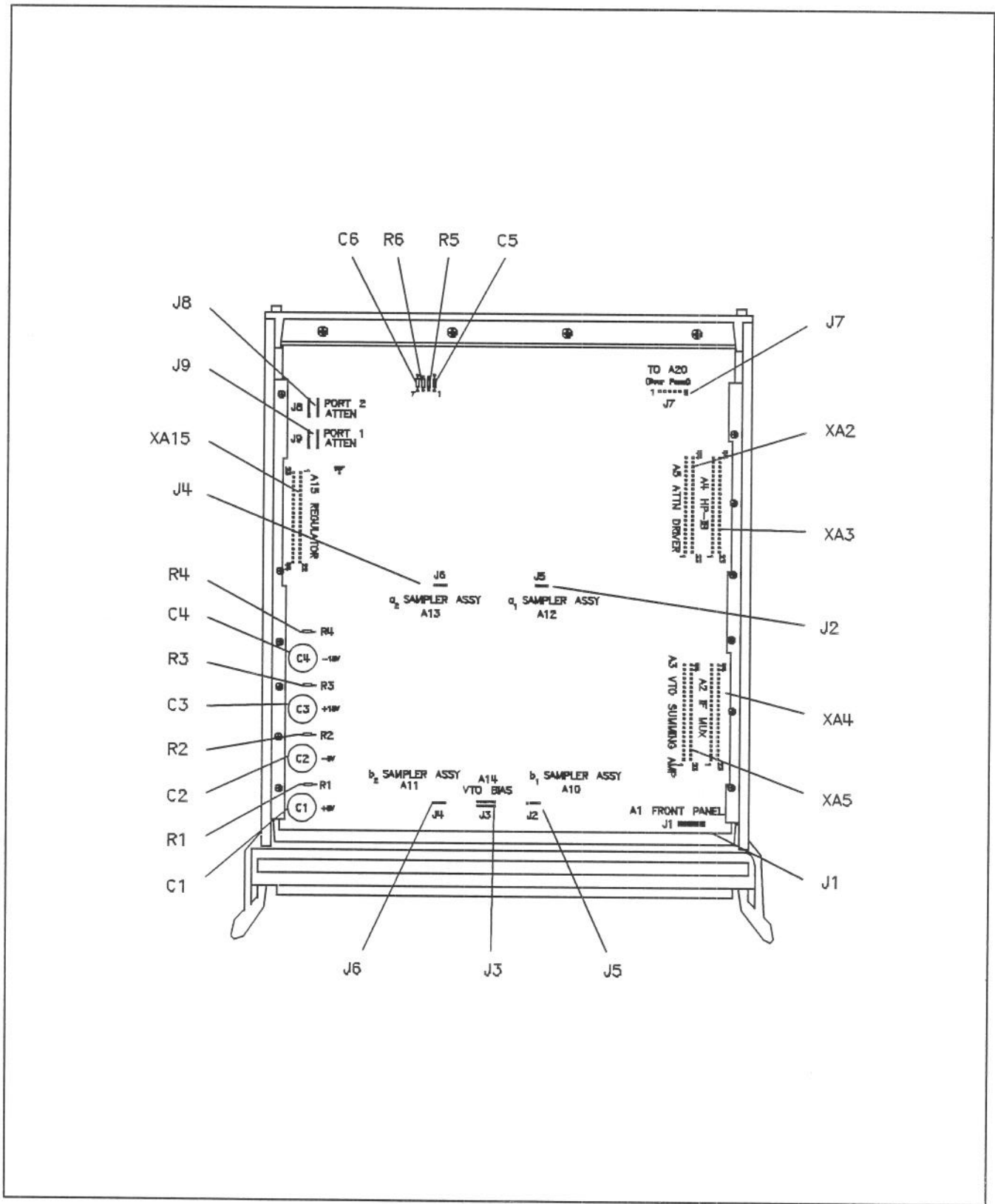


Figure 7-9. Miscellaneous Parts, Motherboard (1 of 2)

Reference Designation	HP Part Number	Qty.	Description	Mrf Code	Mfr Part Number
C1	0180-2671	4	CAPACITOR-FXD .012F +75-10% 30 VDC AL	00853	500123U030AC2A
C2	0180-2671		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	500123U03AC2A
C3	0180-2671		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	500123U03AC2A
C4	0180-2671		CAPACITOR-FXD .012F+75-10% 30VDC AL	00853	500123U03AC2A
C5-C6	0160-4834	2	CAPACITOR-FXD .047UF ± 10% 100 VDC CER		
J1	1251-5745		CONNECTOR 20-PIN M POST TYPE (A19J1 DOES NOT INCLUDE A19MP1 & A19MP2)		
J2	1251-6868	4	CONNECTOR 5-PIN POST TYPE		
J3	1251-7939	1	CONN-POST TYPE .100-PIN-SPCG 14-CONT (A19J3 DOES NOT INCLUDE A19MP3)		
J4	1251-6868		CONNECTOR 5-PIN M POST TYPE		
J5	1251-6868		CONNECTOR 5-PIN M POST TYPE		
J6	1251-6868		CONNECTOR 5-PIN M POST TYPE		
J7	1251-3825	1	CONNECTOR 5-PIN M POST TYPE		
J8	1200-0508	2	SOCKET-IC 14-CONT DIP-SLDR		
J9	1200-0508		SOCKET-IC-14-CONT DIP-SLDR		
R1	0764-0015	2	RESISTOR 560 5% 2W MO TC=0±200		
R2	0764-0015		RESISTOR 560 5% 2W MO TC=0±200		
R3	0764-0016	2	RESISTOR 1K 5% 2W MO TC=0 ±200		
R4	0764-0016	2	RESISTOR 1K 5% 2W MO TC=0 ±200		
R5	0757-0394		RESISTOR 51.1 1% .125W F TC=0 ±100	24546	C4-1/8-TO-51R1-F
R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0 ±100	24546	C4-1/8-TO-51R1-F
XA2	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS		
XA3	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS		
XA4	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS		
XA5	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS		
XA6-XA14			NOT ASSIGNED		
XA15	1251-7882		CONNECTOR-PC EDGE 2-ROWS		

Figure 7-9. Miscellaneous Parts, Motherboard (2 of 2)

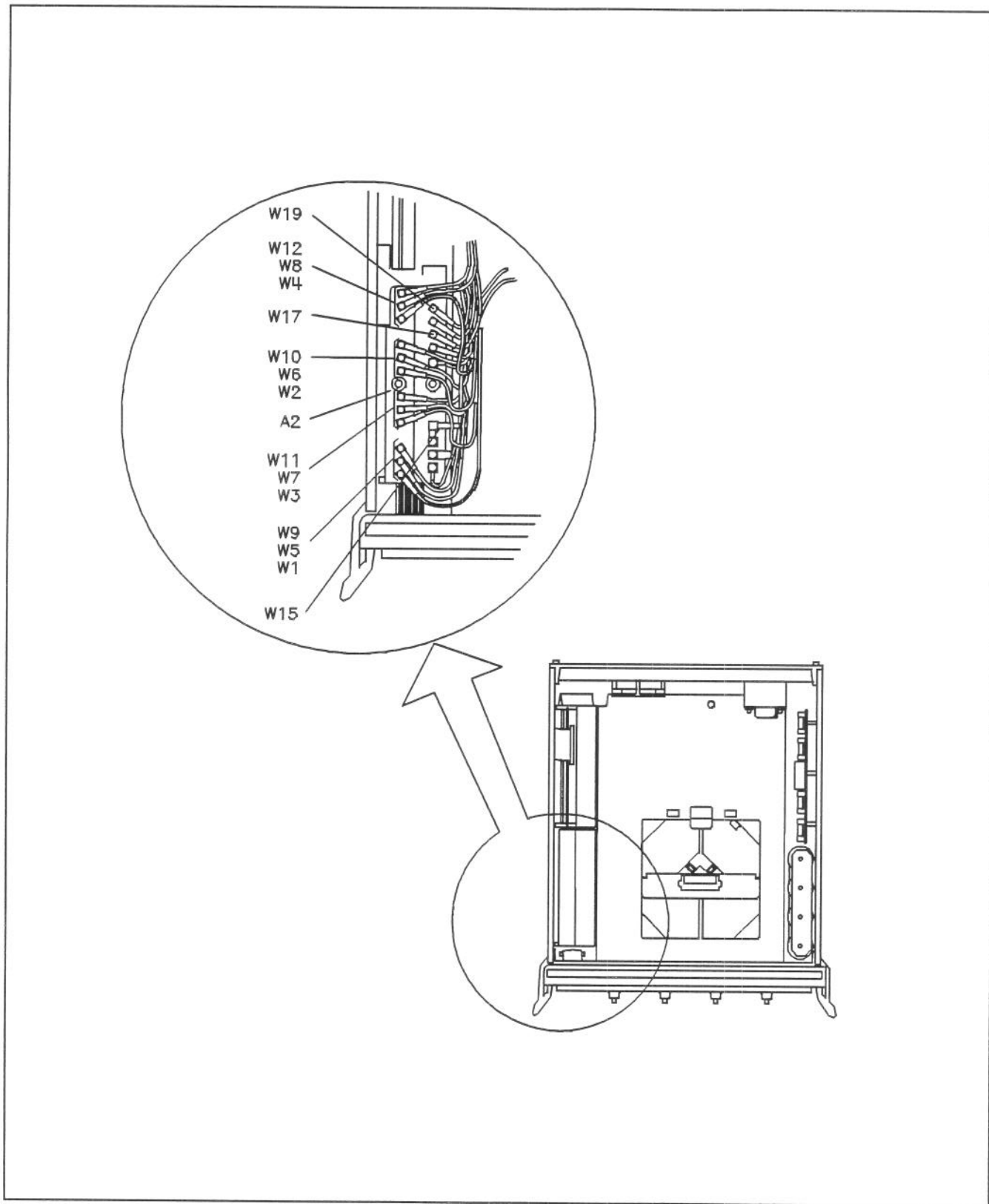
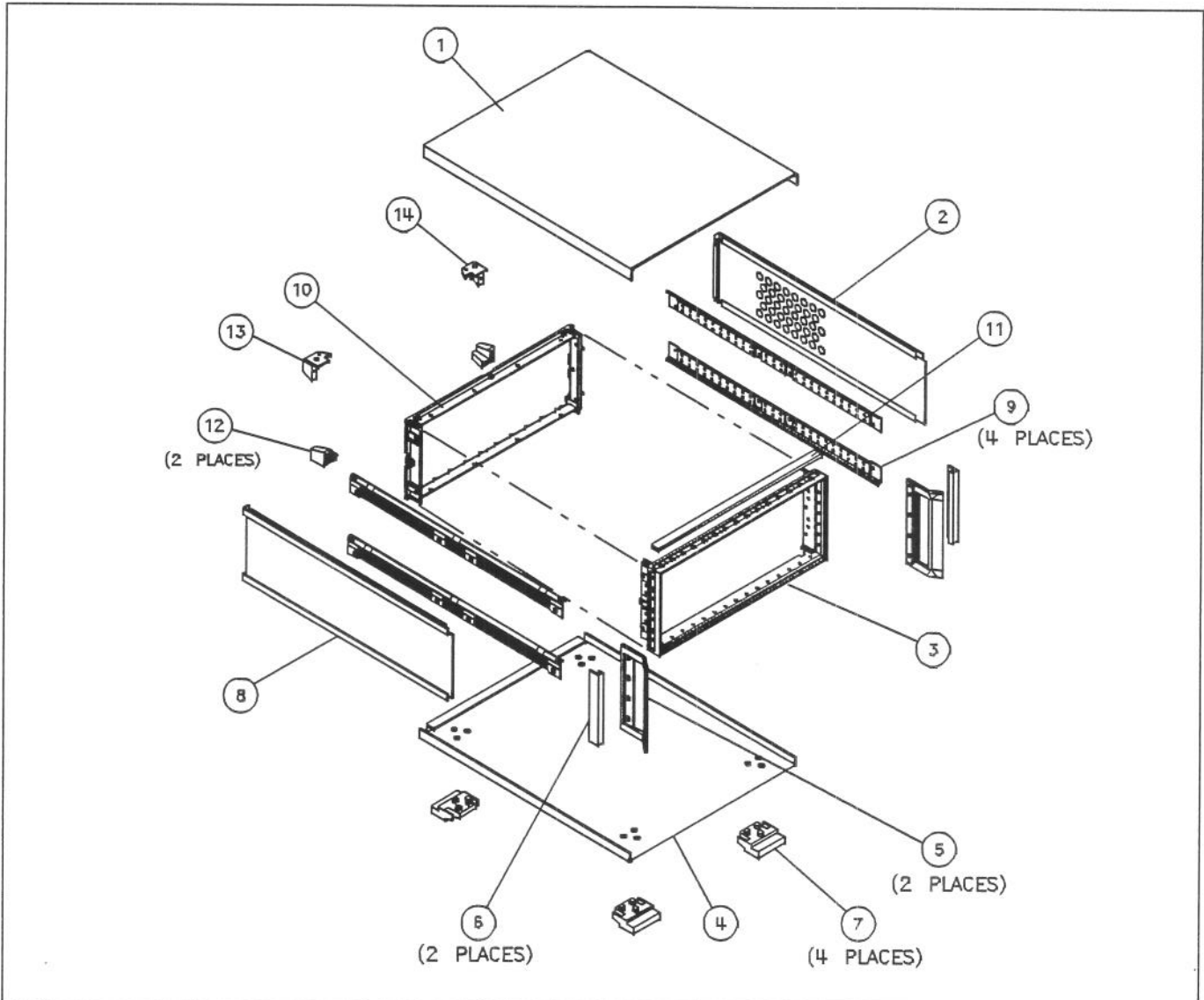


Figure 7-10. Parts Unique to Option 001 (1 of 2)

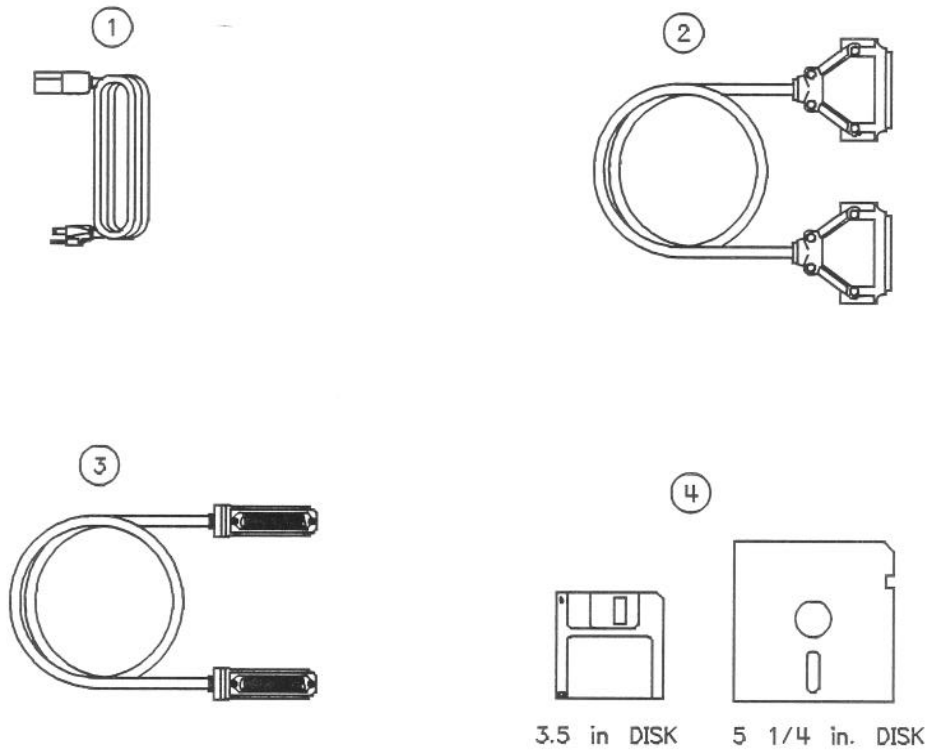
Reference Designation	HP Part Number	Qty.	Description
A2	08513-60004	1	BOARD ASSEMBLY, IF MULTIPLEXER (NEW)
A2	08513-69004	1	BOARD ASSEMBLY, IF MULTIPLEXER (REBUILT)
W1	08513-60121	1	CABLE ASSEMBLY A12J3 TO A2J1
W2	08513-60122	1	CABLE ASSEMBLY A13J3 TO A2J7
W3	08513-60123	1	CABLE ASSEMBLY A10J3 TO A2J4
W4	08513-60124	1	CABLE ASSEMBLY A11J3 TO A2J10
W5	08513-60125	1	CABLE ASSEMBLY A2J2 TO J11A1
W6	08513-60126	1	CABLE ASSEMBLY A2J8 TO J11A4
W7	08513-60127	1	CABLE ASSEMBLY A2J5 TO J11A2
W8	08513-60128	1	CABLE ASSEMBLY A2J11 TO J11A3
W9	08513-60129	1	CABLE ASSEMBLY A2J3 TO J10A1
W10	08513-60130	1	CABLE ASSEMBLY A2J9 TO J10A4
W11	08513-60131	1	CABLE ASSEMBLY A2J6 TO J10A2
W12	08513-60132	1	CABLE ASSEMBLY A2J12 TO J10A3
W13-W14			NOT UNIQUE TO OPTION 001
W15	08513-60135	1	CABLE ASSEMBLY A3J3 TO J10A7
W16			NOT UNIQUE TO OPTION 001
W17	08513-60137	1	CABLE ASSEMBLY A3J6 TO J10A5
W18			NOT UNIQUE TO OPTION 001
W19	08513-60139	1	CABLE ASSEMBLY A3J8 TO J10A6
W45	08517-20017	1	CABLE ASSEMBLY A8 TO A18
W46	08517-20018	1	CABLE ASSEMBLY A6 TO A18

Figure 7-10. Parts Unique to Option 001 (2 of 2)



Reference Designation	HP Part Number	Qty.	Description
1	08513-00040	1	TOP COVER
2	08513-00041	1	SIDE COVER PERFORATED
3	5021-8403	1	FRONT FRAME
4	5062-3747	1	BOTTOM COVER
5	5062-3799	1	HANDLE ASSEMBLY
6	5021-8496	1	TRIM FRONT HANDLE
7	5041-8821	4	BOTTOM FOOT
8	5062-3757	1	SIDE COVER
9	5021-5837	1	18" CORNER STRUT
10	5021-5804	1	REAR FRAME
11	5041-8802	1	TRIM STRIP
12	5041-8821	2	BACK PANEL FOOT
13	5021-8538	1	LOCK FOOT
14	5021-8540	1	LOCK FOOT

Figure 7-11. Cabinet Parts



Reference Designation	HP Part Number	Qty.	Description
1	8120-1348	1	POWER CORD U.S.A.
2	08510-60106	1	INTERFACE CABLE
3	8120-3445	1	HP-IB CABLE
4	08510-10035	2	PERFORMANCE TEST SOFTWARE

Figure 7-12. Accessories Supplied with the Test Set

Chapter 8. Performance Tests

INTRODUCTION

The semi-automated HP 8511B Performance Verification procedure is the method for performance testing an HP 8511B as part of an HP 8510 system. These sources may be used:

- HP 8360 series sources
- HP 8340A or 8340B
- HP 8341A or 8341B
- HP 8350B (with one of the following plug-ins):
- HP 83522A, 83525A, 83525B,
- HP 83540A, 83540B, 83545A, 83570A,
- HP 83590A, 83592A, 83592B, 83592C,
- HP 83594A, 83595A, 83596A, 83597A, 83599A

VERIFYING YOUR HP 8511B

1. Have all the right equipment before beginning. Refer to Table 1, "Required Equipment."
2. Be sure that your HP 200 or 300 series controller is properly loaded with the correct BASIC operating system and the necessary drivers and language extensions. Use the following section, "Controllers and BASIC," if you need help.
3. Refer to the *Configuration* diagram and the *Splitter/Cables* diagram to make the proper connections.
4. Power up the HP 8510 system and run the program as follows:

Insert the performance verification disk in the drive and type *LOAD "PERF8511B"*

Press **[RETURN]**, **[EXECUTE]**, or **[ENTER]**.

When the program is loaded, run it by pressing **[RUN]** on your controller or by typing *RUN* and then pressing **[RETURN]**, **[EXECUTE]**, or **[ENTER]**.

Typically if an error is displayed now, it means that a driver or language extension (or combination) has not been loaded (see Step 2 above).

5. When the system is correctly configured and the program is running, the program title banner will appear on the controller CRT. Refer to "HP 8511B Performance Verification Procedure" for details on the program menu selections.

REQUIRED EQUIPMENT

The equipment listed in the following tables is required to test the performance of the HP 8511B.

Table 8-1. Instruments

Instrument	Critical Specification	Model Number
Network Analyzer	No substitute	HP 8510
Controller	No substitute	HP 900 series 200/300
Power Meter	Range: -70 to +44 dBm	HP 436A, 437A or 438A
Power Sensor	Frequency range: 50 MHz to 50 GHz	HP 8487A
S-parameter test set (optional)	No substitute	HP 8517A

Table 8-2. HP 8511B Service Kit (part number 08511-60016)

Equipment	Critical Specification	Model Number
Power Splitter	D.C. to 50 GHz	HP 11667C
Adapter	2.4 mm (f) to 2.4 mm (f)	HP 11900B
6 dB Attenuators (2)	2.4 mm 50 MHz to 50 GHz	HP 33340D opt 006
20 dB Attenuator	2.4 mm 50 MHz to 50 GHz	HP 33340D opt 020
50 Ohm Fixed Load	2.4 mm (m) D.C. to 50 GHz	HP 85138A
50 Ohm Fixed Load	2.4 mm (f) D.C. to 50 GHz	HP 85138B
Coax Test Cables (2)	2.4 mm (m) Semi-rigid	08511-20025
RF Cable	2.4 mm (m) Semi-rigid 2 ft. long	08511-20031

CONTROLLERS AND BASIC

The software can be run on most HP series 200 or 300 controllers with a BASIC 3.0 operating system or higher and the BIN (binary) drivers and language extensions specified below. Follow the instructions below to load BASIC 3.0 or higher and BIN files. Refer to your BASIC manual set for detailed instructions about your system.

Loading BASIC and BIN Files

With the controller OFF, insert the BASIC system disk into the default drive and turn the controller ON. For 200 series HP 9836A controllers, the right hand drive is usually the default drive. For other 200 and 300 series controllers, the left hand drive is usually the default drive. When BASIC has finished loading, remove the disk.

Load the first driver by inserting the drivers disk and typing `LOAD BIN "DISC"`

When the binary file named disk has finished loading, press **[RETURN]** or **[EXECUTE]**.

Load the second driver by typing `LOAD BIN "HPIB"`

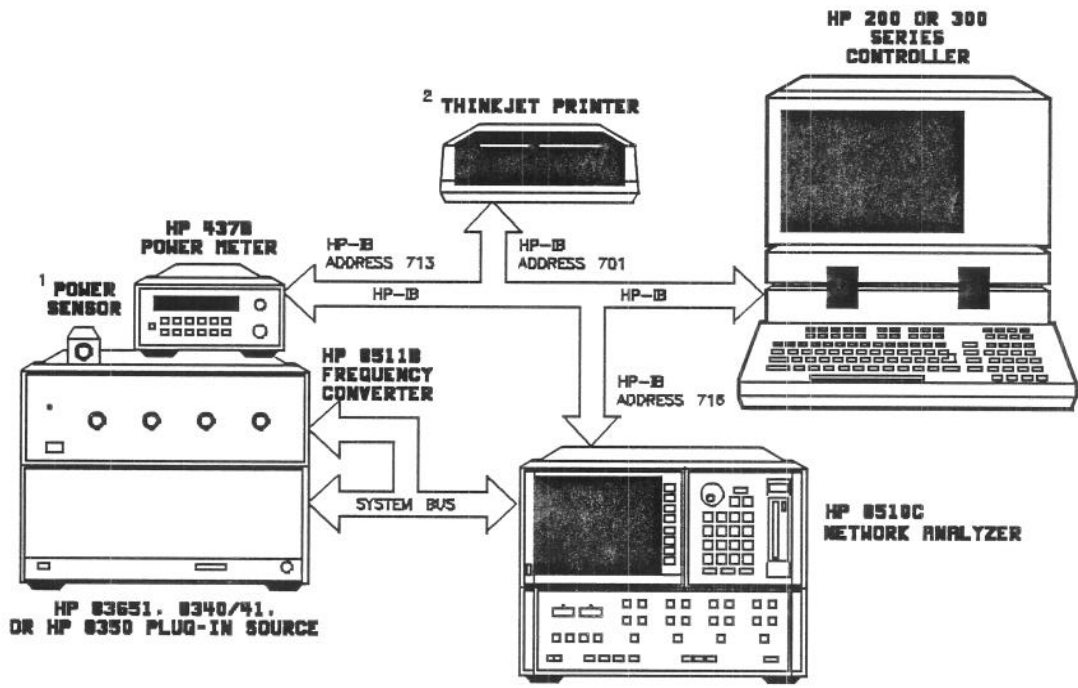
When it has finished loading, press **[RETURN]** or **[EXECUTE]**. Remove the drivers disk.

Insert the extensions disk and load the following extensions in similar fashion. Type LOAD BIN "EXTENSION FILENAME" and press **[RETURN]** or **[EXECUTE]** for each extension file. The extension file names are:

CLOCK
GRAPH
ERR
IO
KBD
MAT
MS.

If you have any of the following system configurations, you must load additional drivers or extensions or both as shown below.

Configuration	Driver	Extension
SRM	DCOMM	SRM
HP 9885 drive	HP9885	
CS80 disk drives (such as HP 9122, 9133D, 9134D, 7908, 7911)	CS80	



1. POWER SENSOR IS PLACED ON TOP OF HP 8511A SO THAT ITS CONNECTOR IS FLUSH WITH HP 8511A FRONT PANEL PORTS.
2. PRINTER CAN BE CONNECTED TO HP-IB OR SYSTEM BUS.

Figure 8-1. Configuration Diagram

NOTE: This is a suggested bench configuration for verification purposes only. If an HP 8350B source is used, raise the rear of the HP 8511B to provide adequate ventilation of the source. The HP 8350B is not as deep as the test set and will not normally support the test set by its rear feet.

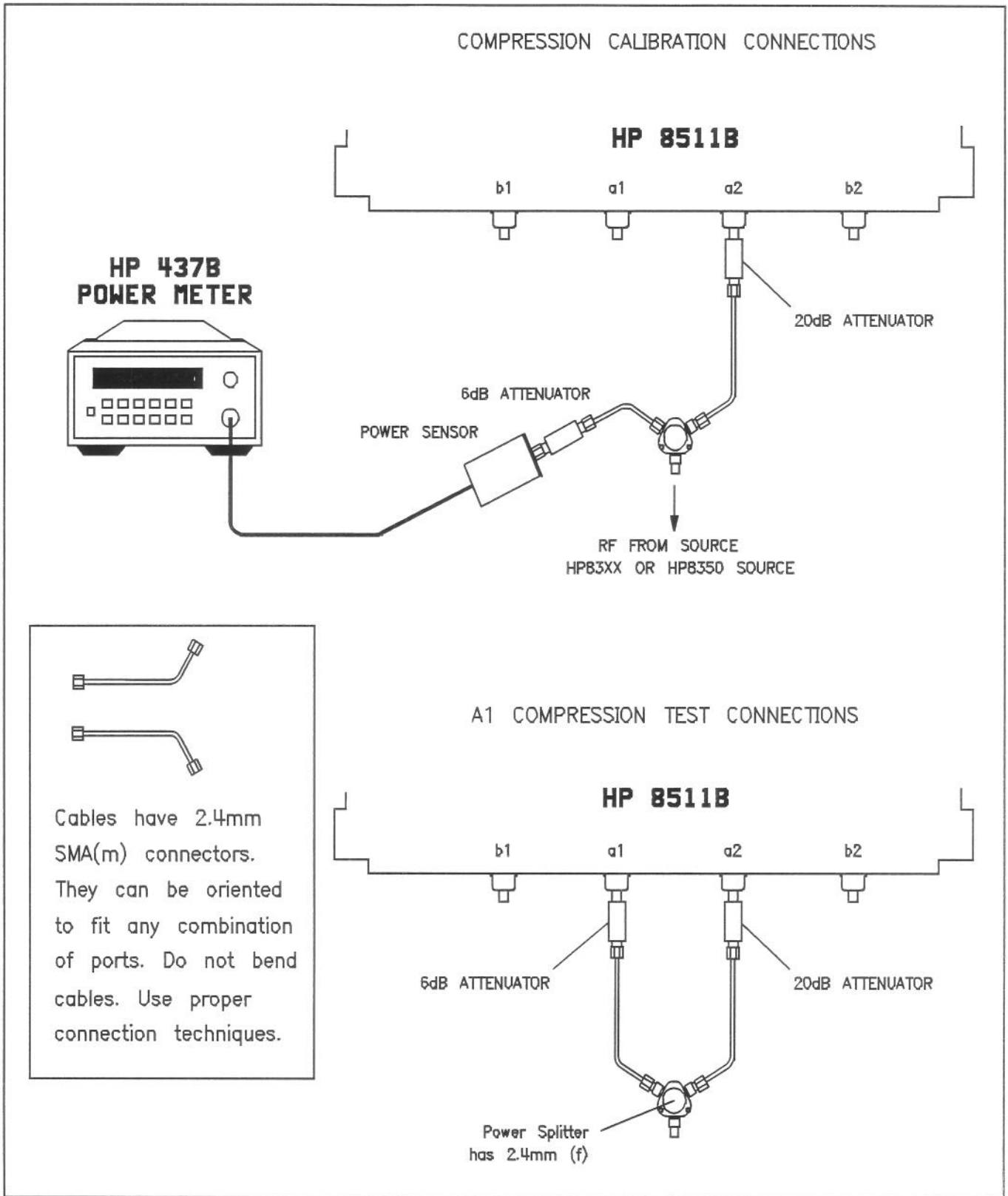


Figure 8-2. Splitter/Cables Diagram

HP 8511B PERFORMANCE VERIFICATION PROCEDURE

This procedure includes a brief description of the tests which constitute the performance verification, a summary of the softkey functions and the procedure itself.

Brief Description of the Tests

The following paragraphs briefly describe the individual tests of the performance verification procedure. Refer to “Detailed Description of the Tests” at the end of this section for additional information.

Compression. This test measures the error in a ratio measurement due to compression of the sampler output at high input power levels.

Crosstalk. This test measures signal leakage between ports.

Conversion Gain. This test measures the maximum and minimum signal gain (or loss) of the RF to IF down conversion.

Low-Level Noise. This test measures the rms noise level of the trace data when the port is terminated with a 50 ohm load.

Tracking. This test indicates how closely the output of two samplers track (match) given identical input signals.

High-Level Noise. This test measures the rms noise magnitude and phase ripple on the trace data.

Port Return Loss. This optional test measures the return loss (S11) of each of the four test ports of the test set.

Softkey Summary

[HELP]. Press this key for instructions or further information about the current test or menu. This key appears throughout the test menus and does not disrupt the test sequence.

[ABORT]. Press this key to stop the current test or menu and return to the last menu or the test menu. (It will take effect at the end of a sweep but not when the program is executing a sweep.)

[RESTART]. Press this key to view the current connection diagram and restart a single test without returning to the test menu. This softkey will appear after a test has been made.

[RECALIB]. Press this key when a test fails due to a faulty or suspect calibration. This function erases the results of the current test.

[REMEAS]. Press this key to repeat a measurement with the same setup and calibration (without viewing the current connection diagram or returning to the test menu. This softkey appears following tests and calibrations.

[I/O MENU]. This softkey displays a menu with the following softkeys and program features:

- Print – prints to printer on HP-IB or System Bus.
- File – saves data to or loads data from disk.
- Equip – displays equipment list.
- Sys Info – records system serial numbers.
- MAINmenu – returns to main menu.
- END_prog – exits the program.

Data Storage

Use the **[FILE]** softkey in the I/O menu to save data on a separate data disk. This feature enables you to return to an incomplete test and continue the test where left off.

You can exit the program any time by pressing **[END_prog]** (in the I/O menu). However, **[END_prog]** **erases calibration data** from the program disk unless it has been previously saved.

RUNNING THE SOFTWARE PROGRAM

The appearance of the program title banner on the controller CRT indicates that the hardware is properly configured and the software is running properly.

The program title banner looks similar to this:

HP 8510/HP 8511B PERFORMANCE VERIFICATION

HP part number and copyright notice.

Accompanying text with a list of compatible

HP 8350 source plug-ins and synthesizers.

If this screen is not now visible, check these items:

Configuration okay? (see Configuration Diagram)

BASIC and extensions loaded okay? (see *Controllers and BASIC*)

Individual instruments okay? (run self-tests, refer to troubleshooting information in the *HP 8510 On-site Service Manual*)

During these procedures, either disregard the HP 8510 beeper sound and accompanying error message or turn off the beeper. To turn off the beeper on a HP 8510 system, press **[SYSTEM] [BEEPER OFF]**.

Use the controller softkeys as defined by the program when making program selections. For example, when prompted to press **[CONTINUE]**, press the softkey f5 or k5 not the keyboard "Continue" key.

With the title banner displayed, press the program softkey **[CONTINUE]**. At the prompt, if you want to see the equipment list, press **[YES]**; if not, press **[NO]**. Use the **[More]** softkey to view (and **[Again]** to review) the equipment list. When you are finished, press **[Done]** to see the softkey definition menu. Then press **[Config]** to see the System Configuration menu shown below:

System Configuration

Display/Processor: HP 85101x

IF/Detector: HP 85102x

Source: HP 83xxx

Plug-In: HP 835xxx

Power meter: HP 43xx

Return loss test set (optional): HP 851xx

Printer connected to: xxxx

Toggle each softkey until the information displayed represents your system. Note that the identification of the source (or plug-in, if applicable) determines the frequency range of the performance verification. Press **[Done]** when all of the displayed information is correct.

The system information menu, shown below, will appear. Use the **[NEXT]** and **[PREVIOUS]** softkeys to move the cursor and the controller keyboard to enter as much information as you want for your records. This information can be printed using the I/O menu of this program. System information is saved to the data disk when the measurement data is saved. When saved, this information can also be printed after verification. Otherwise it will be erased as soon as another program is run or the controller is turned off.

HP 8510/8511B Performance Tests

System information:	Date
Temperature	C:
Humidity	%:
HP 85101	S/N:
HP 85102	S/N:
HP 8511B	S/N:
Power Meter	S/N:
Power Splitter	S/N:
HP Source	S/N:
HP Plug-In	S/N:

NOTE:

To reenter this menu, press **[Sys_Info]** anytime the I/O menu is displayed. To leave this menu, press **[DONE]** after you have entered as much of the above information as you need.

The program will ask you to calibrate the power meter. Turn on the power meter line switch (no other front panel set up is necessary because it is under HP-IB control). Calibrate the power meter and power sensor by using the power meter POWER REF OUTPUT as explained in the power meter manual.

The Main menu will appear on the CRT. This menu, as shown below, enables you to select and perform any of the six tests, display additional instructions with the [HELP] key or access the I/O menu. Press [MAINmenu] to access this menu as needed.

HP 8510/8511B PERFORMANCE VERIFICATION

Source: HP 83xx, etc.

Compress:	Compression & Crosstalk tests
ConvGain:	Conversion Gain tests
Tracking:	Tracking tests
High-Lev:	High-Level Noise tests
Low-Lev:	Low-Level Noise tests
Port RL:	Port Return Loss tests (optional)
Help:	Testing instructions
I/O menu:	Print to printer or save to disk a summary of test data.

Press a program softkey to choose the test you wish to perform. You can perform the tests in any order but may find it more efficient to perform them in the order listed. The first five tests are standard. The sixth, Port Return Loss, is optional and requires an HP 8517A test set.

PERFORMING THE VERIFICATION PROCEDURE

Introduction

The instructions which follow augment the screen prompts of the program. They are step-by-step instructions intended for novice operators. The screen prompts are sufficient for technicians familiar with the HP 8510 system. Refer to this supplemental information or not, as appropriate.

With the Main menu displayed on the controller CRT, read the instructions for each test below and follow the steps carefully. If an error message repeatedly appears during any part of the procedure, or if the program will not continue as the instructions indicate, you may have to rerun the program from the beginning. But this should only be done if no other program softkey can provide a solution.

SAVE/LOAD NOTE: To stop the verification at any time and save the tests you have completed, or to recall those same tests later, refer to the *Save/Load Instructions* immediately following the last test described in this section.

Compression and Crosstalk Test Procedure

1. Press [Compress] to display the Compression and Crosstalk menu. It defaults to the b₁ port compression and crosstalk tests, but that setting can be changed. Press [Port]. The port selected changes the combination of crosstalk tests listed below it. Press [Port] until it returns to b₁.

2. Press **[b₁ compr]** to begin. The program will search through the controller memory for compression calibration data. If data which matches the current hardware setup is found, the program will load that data and set up for the compression test (see step 3).

Otherwise the program will display the following:

A Compression calibration is required.

CAL: Perform Compression calibration

LOAD: Load Compression calibration from disc

Select a softkey

Press **[CAL]** and continue with step 3 to perform the calibration.

Press **[LOAD]** to display the following menu and load calibration data from disk.

Default data drive is:

:xxx

Press RETURN or ENTER if okay.

If not okay then enter

the MASS STORAGE UNIT SPECIFIER

of the disk drive used for data storage.

The default data drive will be the drive from which the program was loaded. If you want to load the calibration data from another drive, enter the MSIS of that drive. Otherwise, press **[RETURN]** or **[ENTER]** on the controller keyboard.

NOTE: Error messages may result from using the wrong or no disk, not having a calibration on the disk, or specifying the wrong drive.

The source (and plug-in) and test frequency range of the current hardware must match the hardware which was used for the calibration stored on disk. If so, continue with step 3. If not, this menu will appear:

Test conditions changed by the Compression calibration

	FROM	TO
Source:	HP 83xx	HP 83yy
Plug-in:	HP 83zz	HP 83ww
Test frequency range:	nn-mm GHz	
Is this okay? (NO = undo)		

In the example above, the controller loaded a compression calibration from the disk. Then it compared the current hardware (listed under FROM) to the record of the hardware used previously (TO column). The information did not match. But for the calibration to aid the performance test, it must match. So the answer to the question, "Is this okay?", is NO.

The solution is to match the two columns before continuing. Current setup data (FROM column) is entered by using the System Configuration menu or by loading data from a disk with the I/O menu. First make sure the FROM information represents your hardware setup. Then either match the TO data to the FROM data or perform a calibration. The TO data can be corrected by loading the appropriate calibration data, if available, from (another) disk.

3. The program will require power sensor cal factors. Enter the factors listed on the side of the power sensor.

The power meter sensor should not be connected to RF power at this time. Unless the program prompts "Power meter doesn't respond," assume the power meter's address is correctly set to 13 (see power meter manual) and the instrument is on the HP-IB bus (refer to the HP 8510 installation information).

4. Press **[Continue]** to automatically zero the power meter. This automatically prompts you to enter in Cal factors.

If the meter does not zero, confirm that the power sensor is not connected to RF power. Press the **[TRY AGAIN]** softkey. If necessary, start over by loading and running the program from the beginning.

5. When the meter is zeroed, the program will display the same setup except that, now, the power meter sensor is connected to the pad/cable/splitter. Connect the Compression CAL setup as shown on the CRT and in the Compress Calibration Connections diagram (part of the Splitter/Cables Diagram).

Press **[CONTINUE]** to set reference levels for each frequency data point. The program will take approximately 5-6 minutes to do this. The information will be displayed on the controller CRT.

After the last frequency point, the program will query whether you want to save the data on disk. This is the only time that the calibration can be saved. You should save a calibration only if you intend to use it within 24 hours. Place a blank initialized disk in the drive and press **[YES]**. The program will automatically load and name the file after you have identified the drive you are going to use. Otherwise, press **[NO]**.

6. When the CRT displays the b1 Compression setup, connect the hardware exactly as shown. Remember that the program performs the following tests using the results of the calibration for accuracy enhancement. But the calibration will be degraded by excess connections and disconnections. As much as possible, disconnect the set-ups at the test port/attenuator interface; do not disconnect the attenuators or switch the semi-rigid cables unless unavoidable.
7. Press **[CONTINUE]** for the program to perform the b1 Compression test. The measured compression (dB) at each frequency point will be displayed on the controller CRT. When the test is finished, the results will be displayed similar to this:

B1 Compression

PARAMETER	LIMIT		UNITS	MEAS.	PASS FAIL
	MIN	MAX.			
Compr. @-10 dBm @.045-20 GHz	0	0.1	dB	.012	Pass
Compr. @-15 dBm @20-40 GHz	0	0.1	dB	.027	Pass
Compr. @-20 dBm @40-50 GHz	0	0.1	dB	.019	Pass

Here, the PASS/FAIL column indicates that the HP 8511B has passed the b1 compression test in the three frequency ranges required for the source used in this example. In tests with sources which do not exceed 20 GHz, only one frequency range will be displayed.

8. If the test result was pass, go to step 9. If the test result was fail, press one of the other softkeys. Press **[REMEAS]** to repeat the measurement. If it fails again, press **[RESTART]** to return to the setup display and check all connections, addresses and so forth before restarting the b1 compression test. Or press **[RECALIB]** to erase the current calibration and prepare to perform another if the test still fails.
9. Press **[CONTINUE]** to begin the b1 crosstalk tests by displaying the b1 Compression/Crosstalk test menu. The word PASS in the Pass/Fail column indicates that the b1 Compression test has passed.

Press **[b1 x a1]** (and choose an averaging factor if using an HP 8350 source). Press **[Done]** and the b1 x a1 crosstalk setup will be displayed. Connect the hardware exactly as shown. Notice that you will need to use the two 50 ohm terminations).

10. Press **[CONTINUE]** to perform the b1 x a1 crosstalk measurement. The number of sweeps the program will take for the measurement varies: for HP 8350B-based systems the number is averaging-factor-plus-one sweeps; for synthesizers, one sweep.
11. When the b1 x a1 Crosstalk test is complete, the results will be displayed on a menu similar to this:

a1 -> b1 Crosstalk

PARAMETER	LIMIT		UNITS	MEAS.	PASS FAIL
	MIN	MAX.			
Crosstalk @.045-8 GHz	-130	-85	dB	-90.09	Pass
Averaging = xx					

The measurement result displayed is the worst case measurement, -90.09 in the example above. The measurement passed.

If your instrument did not pass, press the appropriate softkey to remeasure, restart, or recalibrate.

12. Press **[CONTINUE]** to display the a1 Compression/Crosstalk menu and the status of the test. As indicated by the CRT, only two tests remain undone: b1 x a2 and b1 x b2.

13. Complete the two remaining crosstalk tests in the same manner that you completed the b1 x a1 test. Refer to the preceding paragraphs if the procedure remains unclear.
14. When the test set has passed all of the b1 Compression/Crosstalk tests, test the next port, a1. Press **[PORT]** until the Compression/Crosstalk test menu shows that *Port is set to : a1*. Then press **[a1 Compr]** and complete that test in the same manner that you completed the b1 Compression test.
15. When the test set has passed the a1 Compression test, select the Crosstalk tests for a1 by pressing the appropriate softkeys.
16. Complete the a1 Crosstalk tests in the same manner that you completed the b1 Crosstalk tests. If necessary, refer to the steps above and substitute a1 for b1 as you proceed.
17. Perform the Compression/Crosstalk tests for both of the untested ports: a2 and b2. The end result should be a *Pass* indication on each Compression/Crosstalk menu (Ports: a1, a2, b1, b2). When the test set has passed all of the Compression/Crosstalk tests, press **[MAINmenu]** to access the main test menu. You should see a *Pass* message on the main test menu.

Conversion Gain Test Procedure

NOTE: The following instructions are less detailed than those of the Compression/Crosstalk test. If you desire greater guidance, use the **[HELP]** key and refer to the preceding documentation. Additional information is in the *Detailed Description of the Tests* at the end of this section.

1. Press **[ConvGain]** to begin this test. You must calibrate specifically for this test, so press **[CAL]**. If you have performed this calibration within the last 24 hours and have saved it on a data disk, you may load it from the disk rather than repeating the calibration. Go to step 6 if you do not need to perform a calibration.
2. Make the connections as shown in the CRT test setup. Be sure to identify one cable as #1 and #2. They must be connected as shown.
3. Press **[Continue]** to enable the HP 8510 to take several sweeps.
4. When the CRT displays another test setup for a1 power level, make the connections exactly as shown.
5. Press **[Continue]** to perform the calibration. It will take several minutes because data must be taken at each frequency point. When completed, save it on the data disk by pressing **[YES]** or continue without saving it by pressing **[NO]**.
6. The program will now display the b1 conversion gain setup. Make the connections exactly as shown. You will probably have to loosen all of the connections to adjust the orientation of the two semi-rigid cables. Retorque all loosened connections.
7. Press **[Continue]** to perform the test. If the test passes, press **[Continue]**. Perform the remaining conversion gain tests as prompted. The result should be that all tests have passed as indicated on the menu display.

If the test fails, recalibrate and/or remeasure, after checking all connections.

Tracking Test Procedure

1. Select **[Tracking]** from the Main menu. Since the program uses data taken in the conversion gain tests, no connections are necessary.
2. Press **[Continue]** to test the b1/a1 tracking. The test will be completed quickly and the results will be displayed.
3. Complete the remaining Tracking tests in the same manner.

High-Level Noise Test Procedure

NOTE: Perform these tests in the order presented.

1. Select **[High-Lev]** from the Main menu for the program to initialize the HP 8510 and display a test setup. Make the connections exactly as shown and press **[Continue]**. The tests are ratios between port pairs: b1/a1, b2/a1, a2/a1, b1/a2, b2/a2.
2. Perform the tests as prompted.

Low-Level Noise Test Procedure

1. Select **[Low-Lev]** from the Main menu for the program to initialize the HP 8510 and display a prompt to normalize the a1 power level.
2. Make all connections exactly as shown, then press **[Continue]**.
3. When these tests are complete and have passed, the HP 8511B Frequency Converter can be considered verified. The sixth test, port reflection, is optional. It requires an HP 8517A test set as part of the system. If you have one of those test sets, perform the Port Return Loss test by selecting it from the Main menu.

After the Test is Over

When you are done with the testing, decide whether you want a printed or disk copy of the results and the system information. If you do, access the I/O menu and press **[PRINT]** or **[FILE]** as desired. Make sure that the printer is properly connected, turned on and loaded with paper. The disk drive must be correctly specified, with a data (not the program) disk inserted.

To exit the program, simply remove the disk and turn off the power to the instruments. Or press **[END_prog]** in the I/O menu.

Port Return Loss Test Procedure (optional)

NOTE: An HP 8517A test set is required for this test.

1. Disconnect the HP 8511B from the HP-IB, Test Set IF Interconnect, and RF source signal. Leave it connected to line power.
2. Place the HP 8517A test set on top of the HP 8511B. Connect the HP 8517A test set in the system by connecting the HP-IB, Test Set IF Interconnect, RF source power and line power to it.
3. Turn on the HP 8511B and treat it like a device under test. You will use the HP 8517A test set to make S11 measurements of each port on the HP 8511B.
4. Press **[Port RL]** in the Main menu to perform the Port Return Loss test.
5. Follow the instructions and the test setup drawings exactly as shown. The program will prompt you to perform a calibration using devices in the 2.4 mm calibration kit with the HP 8517A test set in the system. Perform the calibration at the end of the cable and take care to avoid overly sharp cable bends (defined in cable manual). Then measure the return loss of each port on the HP 8511B.

SAVE/LOAD INSTRUCTIONS

NOTE: Calibrations and normalizations are not automatically saved by the various performance test procedures. They must be saved on a data disk immediately after they are performed. When the program queries about saving calibration data, follow the display prompts to do so.

However, as long as the controller stays ON or until another program is run, calibrations, normalizations, system information and test results will remain in the controller memory.

Use the following procedures to save and load both test results and the current system information.

How To Save Test Results

1. Insert an initialized blank (data) disk in the drive.
2. While in the Main menu, press **[I/O Menu] [File]** to begin the save process.
3. Enter the mass storage unit specifier (MSUS) of the data disk drive and press the keyboard **[RETURN]** or **[ENTER]** key to enter the File menu.
4. Press the **[Save]** softkey, type in a name for the file and press the keyboard **[RETURN]** or **[ENTER]** key. The controller will save the test results and system information onto disk.
5. Remove the disk and properly store it.

How To Load Test Results to Continue Testing or Print-Out Data

NOTE: The file must have been saved (copied) by the procedure above.

1. Insert the data disk in the drive.
2. Access the Main menu and press **[I/O Menu] [File]** to begin the load process.
3. Enter the mass storage unit specifier of the data disk drive and press the keyboard **[RETURN]** or **[ENTER]** key to enter the File menu.
4. Press **[LOAD]** , type in a name for the file and press **[RETURN]** or **[ENTER]**. The program will load the test results and system information into the controller from the data disk.
5. Press **[DONE]** to return to the I/O menu.
6. To print out a copy of the data just loaded, press **[PRINT]**. Only the printer, disk and controller need be connected and turned on to make a print-out.
7. To continue testing an instrument, press **[MAINmenu]** to reenter the test selection menu. Select one of the tests with a softkey. Connect the devices as shown in the configuration diagram and prompts and proceed with the test.

Other File Menu Functions

In addition to save and load capabilities, the File menu can catalog and purge files. The File menu is shown below.

HP 8510/8511B PERFORMANCE VERIFICATION

Source: HP 83xx

Select the desired disk functions:

CAT	:	CATALOG of files.
LOAD	:	LOAD from a data file.
SAVE	:	SAVE to a data file.
PURGE	:	PURGE to a data file.
DONE	:	Return to I/O menu.

DETAILED DESCRIPTION OF THE TESTS

Compression

This test measures the error in a ratio measurement due to compression of the sampler output at high input power levels. Each port is tested over the test frequency range. Data is taken at 25 frequency points for two sampler input power levels. For example, at a given frequency under 20 GHz, -15 dBm sampler input power is applied. The test sampler output is ratioed to the reference sampler output and the trace data is put into memory. Then the divide function is used to normalize the trace data to 1. That is, it is divided by itself to provide a flat trace. Next, the input level is increased to -10 dBm and the test port is again ratioed to the reference port. At this point, the data taken at -10 dBm is compared (using the math divide function) to the -15 dBm ratio that is in memory. This comparison should result in no more than a 0.1 dB change for any of the 25 measured frequency points. The program will display the greatest amount (or worst case) of measured compression and it will also indicate pass or fail for each port tested.

Crosstalk

This test measures the signal leakage from one port to another port where one port (sampler) has a high level input signal and the other port is terminated with a 50 ohm load. Either the a1 or a2 sampler is used to phase lock the system. With -15 dBm input, the reference sampler is measured and that data is sent to memory. Then the test sampler terminated with a 50 ohm load and measured while power is applied to the reference sampler. The test sampler data is then compared to the reference data in memory to determine its relative level. Each sampler is tested in combination with the other three — a total of 12 tests. 200 data points are taken over the test frequency range. The program will display the results (worst case) for each combination of ports. It will also indicate pass or fail for each combination tested.

Conversion Gain

Each port is tested for both maximum and minimum conversion gain. Because there is amplification in the signal path, there can be either loss or gain after the RF is down-converted by the network analyzer. Input power is monitored with the power meter to determine the input level prior to sampling. The sampled RF signal is then compared to the monitored input level and displayed by the HP 8510 after all of the down conversion processes. The result is a relative signal level that may have some loss or gain. Two hundred data points are taken over the range of the source and the results (worst case) are displayed with a pass or fail indication.

Low-Level Noise

Low-level noise is the rms noise level of the trace data when the port is terminated with a 50 ohm load. Each port (sampler) is tested at up to four different frequencies to determine the rms noise level. Test port sampler power is measured by the HP 8510 with a fixed 50 ohm load attached to the specific port. The noise floor is measured by taking the log equivalent of the averaged standard deviations of the real and imaginary parts. The worst case results are displayed in dBm along with the minimum and maximum limits and the pass or fail indication.

Tracking

Tracking measures how well the output of one sampler tracks with the output of another sampler when they have identical input signals. Six pairs are measured at 200 frequencies over the test frequency range. For each pair of ports, there are three tests; 1) Magnitude Slope (dB/GHz), 2) Ripple p-p magnitude (in dB p-p), and 3) Ripple p-p phase (in degree p-p). The three measured delta values (difference between port pairs) are displayed (worst case) along with the minimum and maximum limits and the pass or fail indication.

High-Level Noise

High level noise measures the rms noise magnitude and phase ripple on the trace data. The trace data is the ratio of two ports driven by a high power level. Five port pairs are measured at up to three frequency points to determine the phase and magnitude ratios between the two ports. The minimum and maximum limits along with the worst case measurement are displayed for each of the frequency points. A pass or fail indication is also displayed.

Port Return Loss

This optional test uses an HP 8517A test set to measure the return loss (S11) of each port on the HP 8511B. The HP 8511B has line power applied, but no RF, HP-IB, or any other connections. The HP 8517A test set is calibrated using the prompts in the program: 1-port cal using a short, open, fixed load, and sliding load, or broadband load. After calibration, the HP 8511B ports are measured and the S11 data (plotted) is displayed. A pass or fail indication for each port is also displayed.

Chapter 9. Adjustments

The HP 8511B has no adjustments. Specifically, no attempt should be made to adjust the samplers.

Chapter 10. Instrument History

This manual applies directly to instruments as designated on the title page.

If your instrument had a lower serial number prefix and needed additional documentation, it would be located in this section. For additional information, see “Instruments Covered by this Manual” in the “General Information” chapter of this manual.

