Notice

Hewlett-Packard to Agilent Technologies Transition

This documentation supports a product that previously shipped under the Hewlett-Packard company brand name. The brand name has now been changed to Agilent Technologies. The two products are functionally identical, only our name has changed. The document still includes references to Hewlett-Packard products, some of which have been transitioned to Agilent Technologies.

Agilent Technologies

Printed in USA   March 2000

Service Guide

HP 11757B Multipath Fading Simulator

Including Options 140 and 147

SERIAL NUMBERS

Attached to the rear panel of the instrument is a serial number plate. The serial number is in the form: 0000A00000. The first four digits and the letter are the serial number prefix. The last five digits are the suffix. The prefix is the same for identical instruments; it changes only when a configuration change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument.

This manual applies to instruments with serial numbers prefixed 3108A and above.

HEWLETT PACKARD

HP Part No. 11757-90033

5301 Stevens Creek Blvd., Santa Clara, California 95052
Printed in USA

By internet, phone, or fax, get assistance with all your test and measurement needs.

Table 1-1 Contacting Agilent

Online assistance: www.agilent.com/find/assist

United States (tel) 1 800 452 4844	**Latin America** (tel) (305) 269 7500 (fax) (305) 269 7599	**Canada** (tel) 1 877 894 4414 (fax) (905) 282-6495	**Europe** (tel) (+31) 20 547 2323 (fax) (+31) 20 547 2390
New Zealand (tel) 0 800 738 378 (fax) (+64) 4 495 8950	**Japan** (tel) (+81) 426 56 7832 (fax) (+81) 426 56 7840	**Australia** (tel) 1 800 629 485 (fax) (+61) 3 9210 5947	

Asia Call Center Numbers

Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People’s Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101

Safety Considerations

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I system (provided with a protective earth terminal).

Before Applying Power

Verify that the product is set to match the available line voltage and the correct fuses are installed.

Safety Earth Ground

An uninterruptable safety earth ground must be provided from the main power source to the product input wiring terminals, power cable, or supplied power cable set.

Warning

Any interruption of the protective (grounding) conductor (inside or outside the system) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection.) In addition, verify that a common ground exists between the unit under test and the system prior to energizing either unit.

Whenever it is likely that the protection has been impaired, the system must be made inoperative and be secured against any unintended operation.

If this system is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to neutral (that is, the grounded side of the mains supply.)

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

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

Capacitors inside the system's instruments might still be charged even if the system has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuses only with 250V fuses of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuse holders.

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 (see Table of Contents for page references).

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 a 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.

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), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

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

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

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

LIMITATION OF WARRANTY

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

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

EXCLUSIVE REMEDIES

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

ASSISTANCE

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

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

HP 11757B

Herstellerbescheinigung

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

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

Zusatzinformation für Mess- und Testgeräte:

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

Manufacturer's Declaration

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

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

Contents

Figures

Tables

1

General Information

Introduction

The service information for the HP 11757B Multipath Fading Simulator is separated into two binders.

The *HP 11757B Service Manual* binder provides the information needed to adjust and repair the HP 11757B to the assembly level. The *HP 11757B Component-Level Information* binder provides component- level information for the repair of individual instrument assemblies. The binder contains Component-Level Information Packets (CLIPs) for selected assemblies. Each CLIP contains component-level schematics, a component parts list, and illustrations for component location by reference designator. Each CLIP has its own HP part number which is changed whenever the HP part number for its related instrument assembly is changed. A list of all CLIP part numbers for the HP 11757B is provided in Appendix A of this manual.

Manual Organization

The service manual is divided into the following chapters:

Chapter 1, GENERAL INFORMATION, covers manual organization, module versions, and electrostatic discharge information.

Chapter 2, TROUBLESHOOTING, contains descriptions of the Multipath Fading Simulator operation, troubleshooting procedures, and error code definitions.

Chapter 3, REPLACEMENT PROCEDURES, contains instructions for the removal and replacement of all major assemblies.

Chapter 4, REPLACEABLE PARTS, contains information needed to order assemblies for the instrument.

Chapter 5, MAJOR ASSEMBLY AND CABLE LOCATIONS, contains figures identifying all major assemblies and cables.

Appendix A, contains a list of the HP part numbers for all the Component-Level Information Packets (CLIPs) that are available for the Multipath Fading Simulator.

Instruments Covered By This Manual

Attached to the rear panel of this instrument is a serial number plate. The serial number is in the form: 0000A00000. The first four digits and the letter are the serial number prefix. The last five digits are the suffix. The prefix is the same for identical instruments; it changes only when a configuration change is made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply directly to instruments having the serial number prefix(es) listed under "Serial Numbers" on the title page.

Manual Updates

An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates that the instrument is different from those documented in this manual. If manual changes are needed, the manual for this newer instrument is accompanied by a *Manual Updates* package. This package contains information that explains how to adapt this manual to the newer instrument.

To keep this manual as current as possible, Hewlett-Packard recommends that you update it periodically with the latest *Manual Updates* package. The package is identified with the manual print date and part number, both of which appear on the manual title page.*Manual Updates* package are available through Hewlett-Packard Sales and Service Offices.

Electrostatic Discharge

Electrostatic Discharge (ESD) can damage or destroy electronic components. All work performed on assemblies containing electronic components should be done ONLY at a static-safe work station. See figure 1-1.

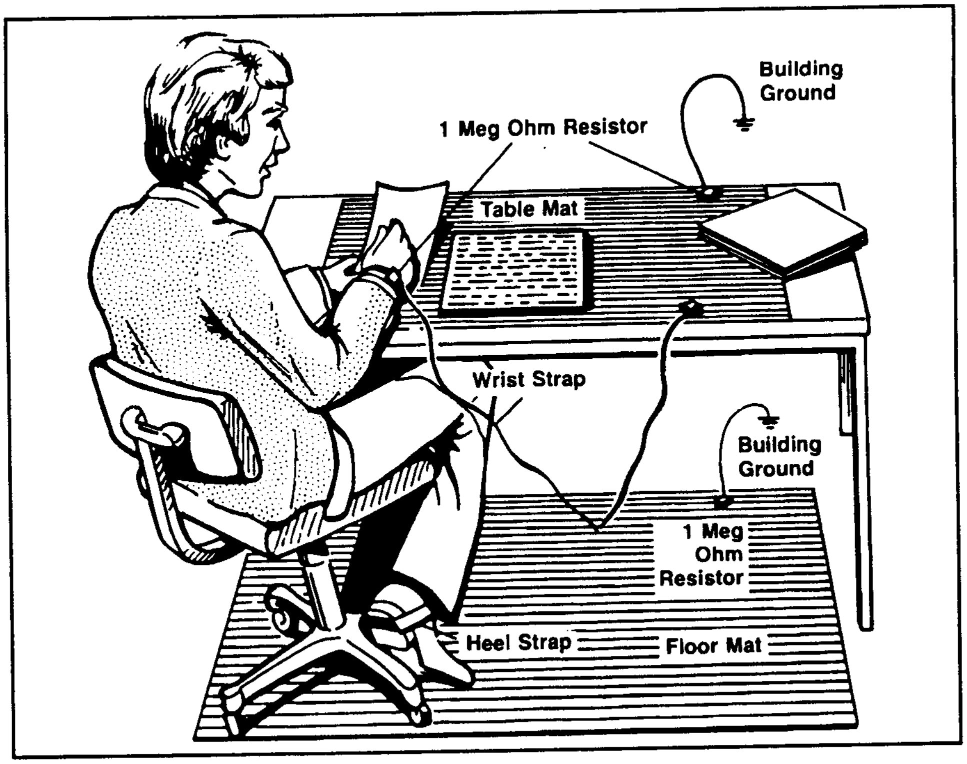

Figure 1-1. Static-Safe Workstation

PC Board Assemblies and Electronic Components

- Handle these items ONLY at a static-safe work station.
- Store or transport these items ONLY in static-shielding containers.

Caution

Do not use erasers to clean the PC board edge connector contacts. Erasers generate static electricity and remove the thin gold plating, which degrades the electrical quality of the contacts.

Do not use paper of any kind to clean the edge connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections.

Do not touch the edge connector contacts or trace surfaces. Always handle board assemblies by the edges.

Clean PC board assembly edge connector contacts with a lint- free cloth and a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. Perform this procedure only at a static-free work station.

Test Equipment

- Before connecting a coaxial cable to an instrument connector for the first time each day, momentarily ground the center and outer conductors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from the instrument.
- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.

ESD Accessories

The following static-safe accessories may be ordered from a Hewlett-Packard sales or service office:

Description	Dimensions	HP Part No.
3M Static Control Mat Ground Wire, 4.6m (15 ft) Wrist Strap and Attachment Cord	0.6m x 1.2m (2 ft x 4 ft)	9300-0797
Wrist Strap Cord	1.5m (5 ft)	9300-0980
Wrist Strap (Large)		9300-0985
Wrist Strap (Small)		9300-0986
ESD Heel Strap (*Reusable 6 to 12 Months*)		9300-1169
Shoe Ground Strap (*One-Time Use Only*)		9300-0793

The ESD accessories listed below may be ordered from:

Hewlett-Packard Company
Computer Supplies Operations
1320 Kifer Road
Sunnyvale, California 94086
Phone: (408) 738-8858

Description	Dimensions	HP Part No.
Static Control Mat Black, Hard-Surface	1.2m x 1.5m (4 ft x 5 ft)	HP 92175A
Static Control Mat Brown, Soft-Surface	2.4m x 1.2m (8 ft x 4 ft)	HP 92175B
Static Control Mat Black, Hard-Surface, Small	1.2m x 0.9m (4 ft x 3 ft)	HP 92175C
Static Control Mat, Tabletop	58cm x 76cm (23in x 30in)	92175T
Anti-Static Carpet	1.8m x 1.2m (6 ft x 4 ft)	HP 92176A (natural color) HP 92176C (russet color)
Anti-Static Carpet	2.4m x 1.2m (8 ft x 4 ft)	HP 92176B (natural color) HP 92176D (russet color)

Sales and Service Offices

Hewlett-Packard has sales and service offices around the world providing complete support for the HP 11757B Multipath Fading Simulator. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office. In any correspondence, refer to the module by its model number and any pertinent assembly partnumbers.

How to Return the Module for Service

Service Tag

If you are returning the Multipath Fading Simulator to Hewlett-Packard for servicing, please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the screen or have any other specific data on the performance of the module, please send a copy of this information with the unit.

Original Packaging

Before shipping, pack the unit in the original factory packaging materials. If the original materials were not retained, identical packaging materials are available through any Hewlett-Packard office.

Other Packaging

Caution

Module damage can result from using packaging materials other than those specified. Never use styrene pellets, in any shape, as packaging materials. They do not adequately cushion the equipment or prevent it from shifting in the carton. They also cause equipment damage by generating static electricity.

You can repackage the module with commercially available materials as follows:

1. Attach a completed service tag and any other failure information to the instrument.
2. Wrap the module in anti-static plastic to reduce the possibility of ESD damage.
3. Use a strong shipping container. A double-walled, corrugated cardboard carton with 159-kg (350-lb) bursting strength is adequate. The carton must be both large enough and strong enough to accommodate the module and at least three to four inches of packing material on all sides.
4. Securely pack the module in three to four inches of packing material to prevent it from moving around in the carton. If packing foam is not available, the best alternative is to use S.D.-240 Air Cap TM, from Sealed Air Corporation in Commerce, California, 90001. This material is a plastic sheet of $1\frac{1}{4}$-inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrap the module several times in this material to protect it and to prevent it from moving in the carton.
5. Seal the shipping container securely with strong nylon adhesive tape.
6. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to encourage careful handling.
7. Retain copies of all shipping papers.

Recommended Test Equipment

A listing of the test equipment required when making HP 11757B Basic Front Panel Checks, Performance Tests, and Adjustments is contained in the Installation and Calibration Guide (HP Part No. 11757-90030) included as a part of this binder.

Lists of test equipment required for troubleshooting the HP 11757B are provided in Chapter 2 of the Service Manual; also a part of this binder.

2

Troubleshooting

Introduction

This section will aid you in the troubleshooting and repair of the HP 11757B Multipath Fading Simulator (MFS). It contains block diagrams, theory of operation, troubleshooting procedures, and cable interconnection diagrams. Schematic diagrams, replaceable parts lists, and component locator diagrams are located in the Component Level Information manual.

A discussion of how the MFS functions is given in the section called "Multipath Fading Simulator Theory of Operation". This is an instrument level discussion of how the principle features are implemented. Detailed discussions on the individual assemblies are included in the troubleshooting procedures. Following the instrument theory of operation is a section called "Troubleshooting Techniques". This section discusses practices that are common to most of the troubleshooting procedures.

The troubleshooting process contains three levels. The first level is called "Determining the Failure Mode". The goal of this procedure is to determine if the MFS has failed and if so, what are the symptoms. This is accomplished by turning on the MFS and checking it's different features. Since certain hardware failures will exhibit multiple symptoms, this procedure is designed to determine the most significant symptom with a minimum amount of effort. It is recommended that this procedure be followed, even if symptoms have already been identified, in order to determine the most significant symptom. This procedure does not require the MFS cover to be removed.

At the end of "Determining the Failure Mode" is a chart that will tell you, once the most significant symptom has been identified, what the next step should be. For most symptoms, additional work needs to be done in order to determine which assembly has failed. This is accomplished in the second level, "Failure Modes".

"Failure Modes" are symptom specific procedures that isolate the failed assembly. The steps of these procedures that can be performed with the MFS cover still on, are listed under the heading "Before Removing the Instrument's Covers". Any steps beyond that require you to open up the instrument.

The third level in the troubleshooting process is "Assembly Verification Procedures". These procedures start with a discussion of how the assembly functions and what the significant signals are. The purpose of these procedures is to determine if an assembly has failed and needs replacing. In some cases the troubleshooting process will lead you directly from the first level to the third. Technicians with experience troubleshooting the MFS may wish to go directly to the assembly verification procedures. These procedures require that the instrument's cover be removed.

Once the instrument has been repaired, it is necessary to run the Automated Adjustment Procedures. Refer to section entitled, "Performance Tests and Adjustments" in the Installation and Calibration Manual.

Section Contents

Multipath Fading Simulator Theory of Operation

The HP 11757A Multipath Fading Simulator (MFS) is a tuneable notch filter. The notch filter can be controlled through the MFS's front panel or over HP-IB. The notch's center frequency and depth are adjustable. Flat Fade (across the frequency band) can be employed as either attenuation or gain. Notch parameters and Flat Fade can also be swept across their performance range.

In the MFS, the input signal is split into two channels, Channels 1 and 2. Channel 1 goes through a 6.3 nanosecond delay line before being recombined with Channel 2 to give the output signal. Each channel also has an attenuator and phase shifter in its path. The phase difference between the two signals causes cancellation at a particular frequency. This is how the Notch Frequency is controlled.

The relative power levels of the two channels control the depth of the notch. The Phase key, on the front panel, controls which channel has the greater signal level. In Minimum-Phase mode, Channel 2 is dominant. Channel 1 is dominant in Non-Minimum Phase mode.

Flat Fade is controlled by an attenuator that is in the signal path after the two channels have been recombined.

A sloped frequency response is also available. This is generated by placing a notch outside of the frequency band. A positive slope is created by a notch frequency below the frequency band and a negative slope is generated by a notch frequency above the frequency band. The attenuators and phase shifters are digitally controlled.

The CPU Assembly stores DAC values that correspond to the desired notch and Flat Fade parameters. During the Automated Adjustment procedure (See Installation and Calibration Manual), the DACs are set to known values and the MFS performance is measured. A table of measured data is stored in the MFS. When a value is entered, the microprocessor reviews the data table and selects the DAC settings to provide the requested value.

When a calibration is performed, via the Automated Adjustment procedure, the data can be stored in EEPROM as well as RAM. With the calibration data stored in EEPROM if the battery on the CPU assembly fails, causing loss of RAM data, the data is reloaded from the EEPROM into RAM. This ensures optimum performance of the MFS even if the RAM data is lost. It is recommended that the Automated Adjustment procedure be run annually to ensure meeting specifications.

The new EEPROM/Counter Assembly (A18 board) has several new functions that permit M-Curve Measurements to be made with the HP 11757B MFS. First, it allows measurements of Bit Error Rate (BER) to be done on an incoming error signal from a radio, or BER test set (BERT). This input can be terminated for 75 Ohm ECL, 75 Ohm TTL, or 10K Ohm TTL to match user equipment. Second, allow measurement of recovery time for a radio taken out of lock and then returned to lock (Uses an ALARM signal input [10K Ohm TTL] provided by many radios). Third, provide access to a Real Time Calendar to allow time stamping of a measurement.

The front panel PRINTER key ((SHIFT) (MEAS)) provides access to printer options. It allows selection of an external printer, internal printer or no printer (NONE, INTERNal, or EXTERNal). It also permits setting of the print mode (NONE, PRVIEW, or DATA). The internal printer is supplied 5Vdc and AGND from the A9 Distribution Assembly and a serial data input line from the A11 CPU Assembly via the A9 Distribution Assembly.

Troubleshooting Techniques

Using MFS Direct Control

The control lines in the MFS can be set to known states by the user. This is accomplished through Direct Control of the DACs and data bits that determine the state of the control lines. When troubleshooting the MFS, much can be learned about what is or is not faulty by setting the control lines to a known state and then verifying the voltage level of the line. Direct Control can be accessed via the front panel or HP-IB.

Each control line has been assigned an I Bus number. When using direct control you need to enter the I Bus number and the value that you wish to set the line to. Table 2-1 lists the I Bus numbers, Minimum and Maximum DAC values and their corresponding voltages. In these procedures we will be setting the DACs to both their maximum and minimum values and then verifying the voltages. The following steps describe the procedure for using Direct Control.

1. Press (MORE) ((SHIFT) then (PRESET/LOCAL))
2. Key in 8 or use the arrow keys to scroll to function 8, Service. Either the arrow keys or data entry keys are acceptable for selecting the More function.
3. Press (ENTER)
4. Key in or use the arrow keys to scroll to the I Bus number for the control line desired. Either the arrow keys or data entry keys are acceptable for selecting the I Bus Number. Press (ENTER)
5. Use the arrow keys to select the desired DAC Value. The data entry keys cannot be used to set the DAC Value.

Note

DO NOT PRESS (ENTER) AFTER SELECTING THE DAC VALUE

Once the DAC value has been selected, pressing (ENTER) returns the MFS control lines to the values that are appropriate for the notch parameters, Flat Fade and frequency band selected. Pressing (ENTER) takes you out of Direct Control.

The MFS block diagram (figure 2-14) shows which assemblies use which control lines. Figures 2-6 to 2-8, the Module Interconnection diagrams, show where the control lines physically connect to each module.

Table 2-1. Multipath Fading Simulator Direct Control

	Line Name	I Bus Number[1]	DAC Value for Max[2]	Voltage	DAC Value for Min	Voltage
Notch Frequency Control[3]	phi1 phi2	16 17	0 0	+13V +13V	4095 4095	-10V -10V
Notch Depth Control[4]	b1 b2	18 19	0 0	0V 0V	4095 4095	+12.5V +12.5V
Attenuation Control	a1 a2	20 21	0 0	+2V +2V	4095 4095	+12V +12V
Frequency Band Select[5]	MFSBIT1 MFSBIT2	6 7	1 1	+5V +5V	0 0	0V 0V

1 The I Bus is accessed via MORE function 8.

2 For a1, a2, b1, and b2 the Max value gives maximum attenuation.

3 phi1 – phi2 control the notch frequency.

4 |b1 – b2| control the notch depth. When b1=b2, notch depth is at maximum.

5 For the 70 MHz band both MFSBIT1 and MFSBIT2=0. For the 140 MHz band both MFSBIT1 and MFSBIT2 = 1.

MFS Impedance Levels

The MFS IF INPUT, IF OUTPUT and AUX IF OUT all have an impedance of 75 ohms. The input port of the Input Assembly (A5) and both output ports of the Output Assembly (A7) are also 75 ohms. All connections in between the MFS IF Input and IF Outputs are a nominal 50Ω. Should you measure the power at a port with an instrument of the wrong impedance, the mismatch loss will be less than 0.3 dB in most cases.

Most of the measurements made during troubleshooting are rough checks and this level of accuracy is not necessary. However, before replacing an assembly because of low output power, make sure that the power measurement was made accurately.

It is critical that the MFS IF INPUT and IF OUTPUT impedances be properly matched when performing the Automated Adjustment and Performance Verification procedures.

Service Position

When servicing the MFS, it is necessary to place the Interface (A2) and CPU (A11) assemblies in a vertical service position (see Figure 2-1) in order to access the remaining assemblies. Both boards are hinged so that they can rotate into this position.

To place the instrument in service position, proceed as follows:

1. Position the instrument with the rear panel up.

2. Remove the four large screws securing the cover to the instrument frame. (#1, Figure 3-1. Refer to Chapter 3, Replacement Procedures.)
3. Using an allen wrench, remove the four screws within the plastic standoffs. (#2, Figure 3-1.)
4. Holding the HP 11757B firmly by the front panel, remove the outer cover by sliding it off the rear of the instrument.

Caution

Do not pull on the plastic standoffs. Excessive force may damage them.

5. Remove the six screws securing the A2 Interface Assembly and the A11 CPU Assembly to the instrument frame. Raise and secure the boards in place with the plastic supports and thumb screws provided.

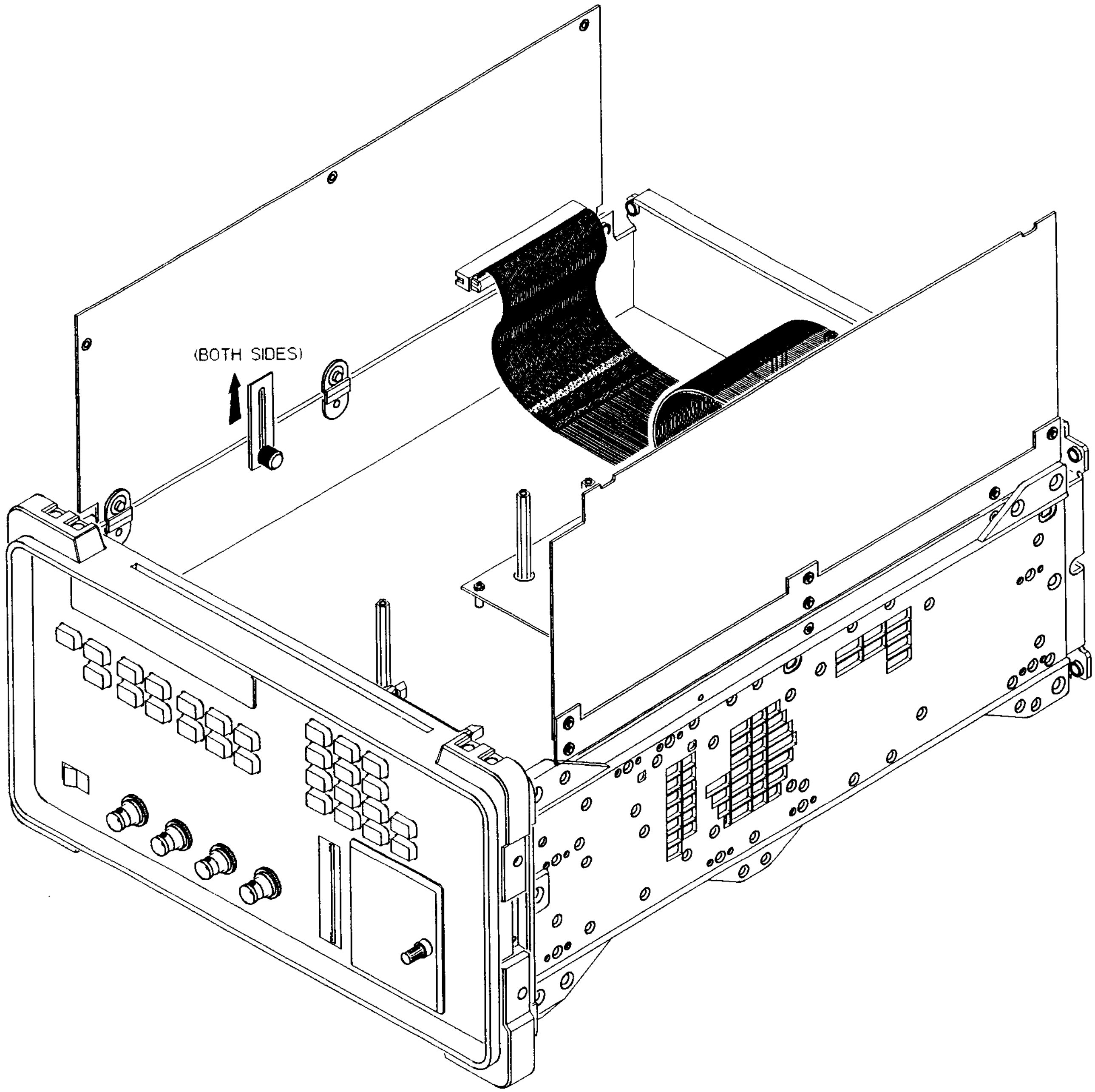

Figure 2-1. MFS Service Position

Recommended Test Equipment

A long, spring loaded test clip (HP part number 1400-0833, also known as an EZE Clip or Minigrabber) is recommended for making voltage measurements of dc and control lines connecting to the Input, Phase Shifter and Output assemblies. This device can be clipped on to the feedthru which brings the voltage into the module. Using this method, the connector does not need to be disconnected and the voltage can be measured under its normal load.

Table 2-2. Recommended Test Equipment

Item	Critical Specifications	Choices
Voltmeter	None	Any HP Voltmeter
Network Analyzer	40 to 190 MHz frequency range >50 dB Dynamic Range	HP 8753B/C
S-Parameter Test Set	Compatible with HP 8753B/C Network Analyzer	HP 85046B or equivalent
Signal Generator	40 to 190 MHz frequency range CW output mode -10 dB output power	HP 8656B
Power Meter	Compatible with 8481A Sensor	HP 437B
Power Sensor	-30 to +20 dBm	HP 8481A

In addition, the following adapters are required:

SMC to Coax BNC;	HP 1250-0832
SMC(m) to SMC(m);	HP 1250-0827
BNC(m) to N(f);	HP 1250-0077
SMB(f) to BNC(f);	HP 1250-1236
Elbow BNC(m) to BNC(f);	HP 1250-0076
75Ω BNC Barrel;	HP 1250-1287
75Ω Matching Transformers;	HP 11694A

Troubleshooting test setups are provided with the procedures as required.

Determining The Failure Mode

Note

Work through the following procedure in order to determine the instrument's failure mode. This is an important step even if you have already identified a failure, since hardware failures may show several symptoms. For instance, excessive loss in the Input Assembly Channel 2 will cause a Notch Depth failure as well as low output power. The most direct troubleshooting approach is to treat this problem as a low output power failure rather than a Notch Depth problem.

If this procedure is followed in the order presented, you do not need to complete it once a failure mode has been identified. As soon as the MFS under test fails a procedure step, proceed to table 2-3 in order to determine the proper course of action.

1. Plug in and turn on the Multipath Fading Simulator (MFS). If the display does not come on, check to see if the fan is running. If the fan is not running, there is a Power Supply problem. If this is the case, check that the line voltage selection on the rear panel is correct for the input line voltage. Check the fuse for continuity. If the problem is still present, proceed to "Verifying Power Supply Functionality".
2. If the display does not come on, but the fan is running, proceed to "Verifying CPU Assembly Functionality".
3. The turn on sequence for the MFS is as follows:
   a. Software Version (duration of 2 seconds)
   b. Instrument Model and Option numbers (2 seconds)
   c. Self Test (5 seconds)
   d. Self Test Status (2 seconds)
   e. Turn on complete, display shows the last instrument state used

   If the instrument does not execute the turn on sequence, proceed to Failure Mode "Instrument does not respond".

   If Self Test fails, proceed to Failure Mode "Self Test Fails".
4. Press (PRESET) then (ENTER). Check the display to make sure that all parameters are in their preset states. Check also to ensure that the display segments are working. If there is a problem with the display or preset states proceed to "Verifying CPU Assembly Functionality".
5. If the complaint has been with HP-IB operation only, go to Failure Mode "Does not respond to HP-IB commands".

6. Connect the equipment as shown in Figure 2-2. Preset the Network Analyzer. Press (LOCAL) on the S-Parameter Test Set.

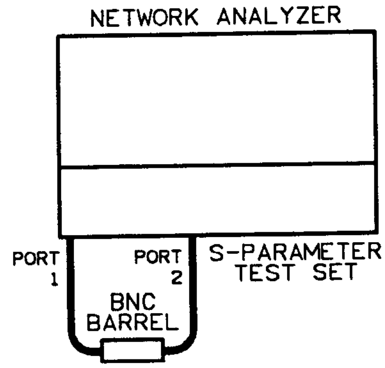

Figure 2-2. Network Analyzer Calibration Setup

Note

The equipment requires one hour warm up prior to performing the calibration.

7. On the Network Analyzer set the Start/Stop Frequencies to 40 MHz and 190 MHz. Set Measurement mode to S21, and perform a thru line calibration.
8. When calibration is completed, to check the insertion losses of the instrument, set a marker at 70 MHz for Standard or Option 147 instruments (140 MHz for Option 140) and set reference to marker. Connect the equipment as shown in Figure 2-3. The insertion loss of the MFS should be within 2 dB of the reference level. If the level is within limits, make a note of this level and continue with this procedure. If the level is not within limits, proceed to Failure Mode, "No or Low Output Power".
9. Press (PHASE). This puts the MFS into non-minimum phase. Repeat step 8.
10. If the instrument is an Option 147, Set the MFS Notch Frequency to 140 MHz. Repeat steps 8 and 9.
11. Measure the level out of the AUX IF OUT connector . This level should be within 2 dB of the levels recorded in steps 8 and 9. If the level is not within this limit, proceed to Failure Mode, "No or Low Power at the AUX IF OUT connector".
12. Set a Notch Depth of 20 dB on the MFS. Check the Network Analyzer display for a notch at 70 MHz (Standard unit) or 140 MHz (Option 140) whichever is applicable. For Option 147 check at both 70 and 140 MHz. If no notch is observed, proceed to Failure Mode, "Corrupted Calibration Data".

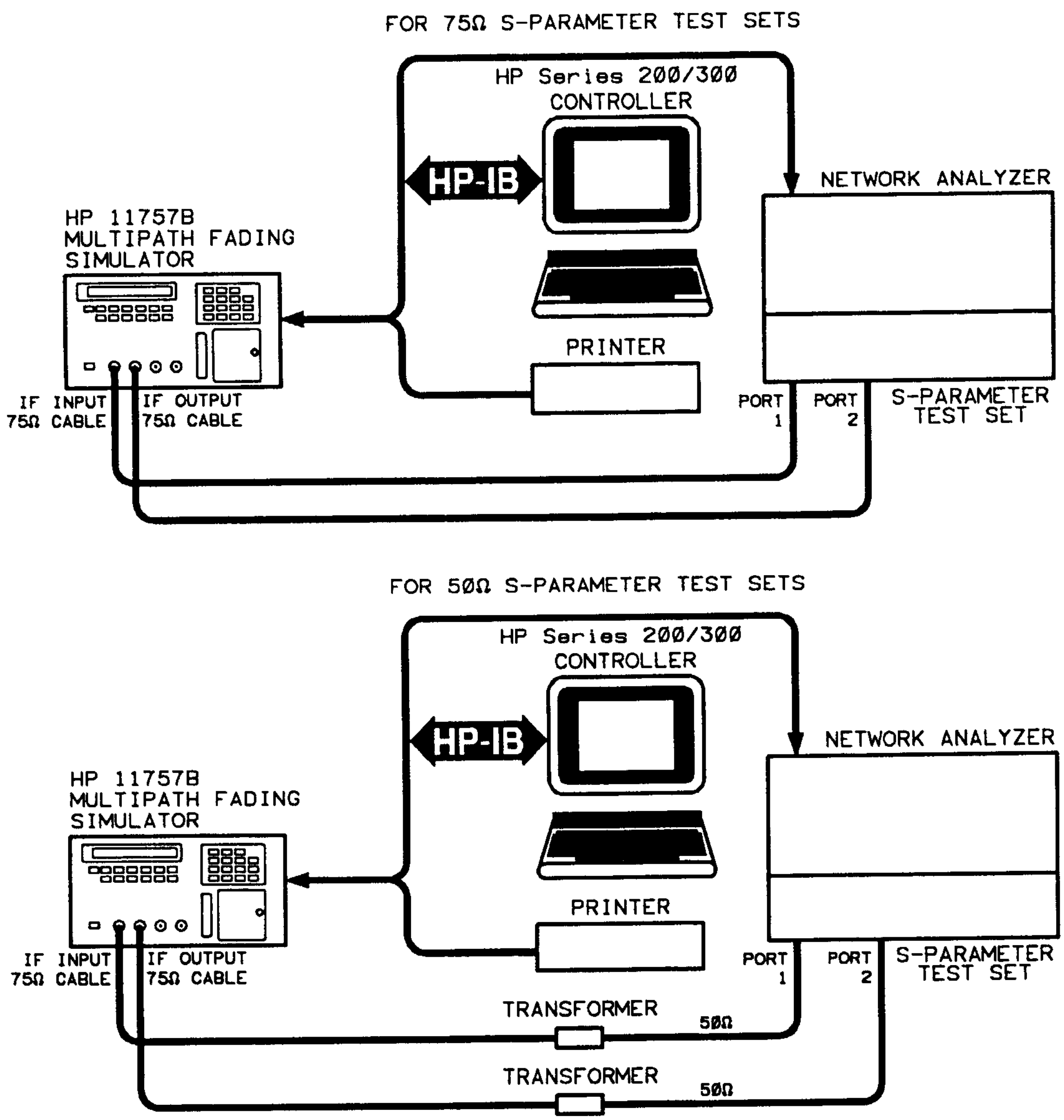

Figure 2-3. Automated Adjustment/Performance Test Setup

13. Run the Automated Performance Test Procedures. If any of the tests fail by a small margin (1.0 MHz or within 2 dB) the MFS may need to have the Automated Adjustment Procedures performed. Refer to the Installation and Calibration Manual for this procedure. Rerun the Automated Performance tests after completing the Automated Adjustment procedures.

    If the Notch Depth test fails, proceed to Failure Mode, "Incorrect Notch Depth". If the Notch Frequency test fails, proceed to Failure Mode, "Incorrect Notch Frequency". If the Attenuator Accuracy test fails, proceed to Failure Mode, "Incorrect Flat Fade".

Note If any of these tests fail see also Failure Mode, "Corrupt Calibration Data".

14. If the instrument has passed all of the above steps, the following is true:
    a. All the dc and control signals are getting to the RF assemblies and are functioning.
    b. All of the RF assemblies are meeting their attenuation/gain and phase requirements.
    c. All RF cables and connectors are acceptable.
    d. The front panel and CPU assemblies are functioning, however neither has been tested 100%, nor has the possibility of intermittent problems in either assembly been eliminated.
15. EEPROM Read/Write error messages are available for viewing over HP-IB (See Appendix A of the HP 11757B Operation and Programming Guide). If an error occurs during storing of CAL data into EEPROM, or a transfer of CAL data from EEPROM into RAM, an error number (-311) is stored in the HP-IB error queue. Executing a SYST:ERR? query will print out the error message string. Go to Failure Mode, "EEPROM R/W Errors".
16. Verify printer function using front panel keys as follows:
    a. Press (PRESET/LOCAL).
    b. Press (SHIFT), (MEAS), then (ENTER).
    c. Press the (▲) key until "DST INTERN" apprears on the front panel display. Press (ENTER) ("1 PRINT" should be shown on the display).
    d. Press (RADIO SETUP) key, then (▲) key until "RADIO DEMO" appears on display. Press (ENTER).
    e. Press (▲) key until "ON" appears, then (ENTER).
    f. Press (SHIFT), then (EXIT).
    g. Press (MEAS SETUP), then (▲) key until "6 PHASE" appears on display.
    h. Press (ENTER), then (▲) key until "BOTH" appears. Press (ENTER) and then (SHIFT) (EXIT).
    i. Press (MEAS). After the measurement the printer should print the results.
    j. If the printout is correct, the internal printer is functioning properly. If there is no printout, proceed to "Verifying Internal Printer Functionality".

If no failures have been identified, look at the particular symptom that the customer has listed and try to verify the problem.

Table 2-3. Troubleshooting Guide

Step	Discrepant Condition	Where to go If This is the First Problem Encountered
1	MFS won't turn on	"Verifying Power Supply Functionality"
2	Display won't turn on	"Verifying CPU Assembly Functionality"
3	Fails Self Test	Failure Mode "Self Test Fails"
3	Does not execute turn-on sequence	Failure Mode "Instrument Does Not Respond"
4	Wrong Display or Preset conditions	"Verifying CPU Assembly Functionality"
5	HP-IB	Failure Mode "Does not respond to HP-IB commands"
8,9,10	Output Power	Failure Mode "No or Low Output Power"
11	Auxiliary Output Power	Failure Mode "No or Low Power at the AUX IF OUT Connector"
12	Unable to set Notch Depth	Failure Mode "Corrupted Calibration Data"
13	Flat Fade	Failure Mode "Incorrect Flat Fade"
13	Notch Frequency	Failure Mode "Incorrect Notch Frequency"
13	Notch Depth	Failure Mode "Incorrect Notch Depth"
15	Memory Errors; EEPROM	Failure Mode "EEPROM R/W Errors"
16	No Printout on Internal Printer	"Verifying Printer Functionality".

Failure Modes

Note

Except where noted, this section uses the same setup as the previous section, Determining the Failure Mode.

No or Low Power Out

Conditions

Any other symptom.

Possible Causes

1. Any open transmission path, including failed amplifiers.
2. Failed attenuator or attenuator DAC.
3. Improper dc to assemblies.
4. Switch fails to switch.

Before Removing the Instrument Cover

Note

Complete this procedure in its entirety. Having more than one of the symptoms listed can help to identify the failed module in your instrument.

The measurements made in steps 2, 3 and 4 are identical to steps 9, 10 and 11, respectfully, from "Identifying the Failure Mode". Depending on the symptoms that the instrument is demonstrating, you may have or may not have made these measurements already. If you have performed them, recall the result that you obtained in order to isolate the failed assembly. If you have not performed them, do so now.

Troubleshooting Procedure

1. Set the Notch Depth to 0 dB. Enter the level of the MFS IF OUTPUT that was measured in step 8 of the "Determining the Failure Mode" procedure.

   This level is expected to be within 2 dB of the input power level. This is the output power in minimum phase mode.

2. Press (PHASE). This will set the MFS phase mode to non-minimum phase mode. Measure the power out of the MFS IF OUTPUT port. The power level should be within 2 dB of the input power level. If the power out of the MFS is acceptable in one phase mode but not in the other, then the problem is in either the Input or Phase Shifter assembly. However, if the power out is not sensitive to the phase mode, the failure must be in either the Input or Output assembly. This step has isolated the failure to two assemblies, either the Input or Phase assembly for phase

sensitive instruments or the Input or Output assemblies for non-phase sensitive instruments. Continue with this procedure.

3. If the instrument is an Option 147, set the MFS Notch Frequency to 140 MHz. Press (PHASE) to return the MFS to Minimum Phase mode. Measure the power out of the MFS IF OUTPUT connector (on the front panel). This power is expected to be within 2 dB of the input power level.

   For a model Option 147, if the power out of the MFS is insensitive to frequency band, then the problem is in either the Input or Output assembly. No new information is gained if the power problem is sensitive to frequency band.

4. Measure the power out of the rear panel AUX IF OUT port. This power level should be within 2 db of the input power level. If the power out of the AUX IF OUT is correct, but the power is low out of the front panel IF OUTPUT, then the problem is in either the Output Assembly or the cables connecting it to the front panel. If the AUX IF OUT power is incorrect, then you can assume that the cables carrying power out of the Output Assembly and the front and rear panel connectors are acceptable.

5. If the symptoms have allowed you to isolate the problem to a single module, proceed to the Verification Procedure for the module identified.

6. If more than one module is suspected, remove the instrument's cover and measure the power level out of the Input Module. This will be CH1 70 MHz and CH2 70 MHz for the standard options models and CH1 140 MHz and CH2 140 MHz for Option 140 (Refer to figure 2-4). Set the Notch Frequency to the center of the band that you wish to measure (70 MHz or 140 MHz). When in Min Phase mode, the Channel 2 signal level will be approximately 6 dB greater than the power level input to the instrumemt, and the Channel 1 signal level will be >30 dB less than the Channel 2 signal (−30 dB for example).

7. Press (PHASE). This places the MFS in Non-Min phase mode. Repeat step 6. The Channel 1 signal level will be approximately 6 dB greater than the power level input to the instrument and the Channel 2 signal level will be >30 dB less than the Channel 1 signal.

8. If the MFS fails either step 6 or step 7, proceed to "Verifying Input Assembly Functionality". If the instrument has passed both steps 6 and 7, the Input Assembly is functioning properly. Per step 2 of this procedure, the problem must be in either the Phase Shifter assembly (for phase mode sensitive instruments) or the Output Assembly (for non-phase sensitive assemblies). Proceed to the functionality verification procedure for the suspected assembly.

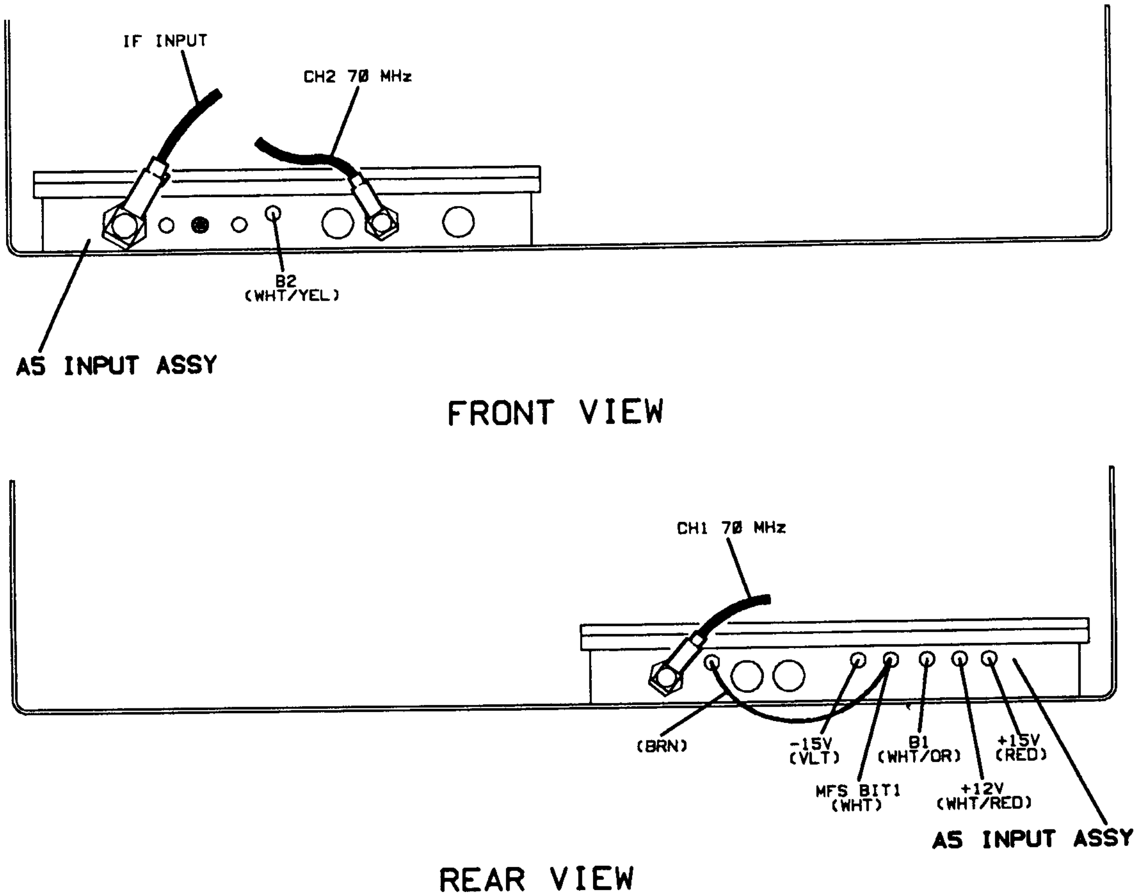

Figure 2-4. Input Assembly Connections

Incorrect Notch Frequency

Conditions

MFS output power is correct. Notch depth or flat fade may be out of spec.

Possible Causes

1. MFS needs re-calibration.
2. Faulty Phase Shifter Assembly.
3. Incorrect control signals or power supplies into the phase shifter assembly.

Before Removing the Intrument Cover

1. Proceed to the Phase Shifter Assembly verification procedure.

Incorrect Notch Depth

Conditions

The MFS output power is correct. The flat fade accuracy may be out of spec.

Possible Causes

1. MFS needs re-calibration.
2. Input assembly attenuators not functioning correctly. May be incorrect control signals or power supplies to the Input Assembly.

Before Removing the Intrument Cover

1. Proceed to the Input Assembly Functionality Verification procedure.
2. If the Input Assembly passes the verification procedure, run the Automated Adjustment procedure and recheck the notch depth.

Incorrect Flat Fade

Conditions

Power out is correct with 0 dB Flat Fade, however, the instrument fails the Flat Fade/Attenuator Accuracy Performance test.

Possible Causes

1. MFS needs re-calibration.
2. Attenuator in the output assembly is not working. May be incorrect control signals or power supplies to the Output Assembly.

Before Removing the Intrument Cover

1. Proceed to the Output Assembly verification procedure.
2. If the Output Assembly passes the verification procedure, run the Automated Adjustment procedure and recheck the flat fade.

Corrupted Calibration Data

Note

This failure is not common, but does occur and is therefore included here. The condition occurs more frequently when calibration is performed using a power splitter in place of the recommended S-Parameter Test Set.

Conditions

Self Test passes with no Checksum Errors reported, but you are unable to set a Notch Depth from the front panel.

Possible Cause

1. Corrupted calibration data stored in RAM/EEPROM memory.
2. MFS needs re-calibration.

Troubleshooting Procedure

Note

This procedure will erase all data stored in RAM.

1. Turn instrument to OFF, and place unit in Service Position.
2. Disconnect cable W25 at connector J1 on EEPROM/Counter (A18) assembly to prevent calibration data stored there from being loaded into RAM.
3. Press (◀) while turning power switch to ON. This erases all data stored in RAM, resets the CPU, and loads default data from EPROM into RAM.
4. When INIT is completed, Set a Notch Depth of 20 dB on the MFS. Check the display for a notch at 70 MHz or 140 MHz, whichever is applicable (the notch depth may be up to 3 db less than set on front panel). If a notch is observed, the calibration data stored in memory was corrupted; continue with this procedure. If no notch is observed then the problem is a hardware problem and other symptoms should be indicated.
5. Turn MFS power to OFF. Reconnect cable W25 to the A18J1 connector. Proceed to Automated Adjustment Procedures to calibrate the instrument. Run the Automated Performance Tests to check the calibration and store the calibration data in EEPROM.

No or low power at the AUX IF OUT connector.

Conditions

Front panel (IF OUTPUT) output power is correct and there are no other failure symptoms.

Possible Causes

1. Output Assembly active splitter has failed.
2. Cable or connectors from output assembly to rear panel output have attenuation.

Troubleshooting Procedure

1. Measure the power out of the Output Assembly module AUX IF OUT port. This power level should be ±2.0 dB of the front panel IF OUTPUT power. If this level is incorrect, replace the Output Assembly (A7). If the level is correct, check the cables going to the rear panel output and the AUX IF OUT connector.

Self Test Fails

Conditions

The following messages are displayed during the MFS's turn on sequence:

"SELF TEST FAILS"
"LOADING CAL DATA"

In addition, this message may be received:

"BAD CAL DATA"

Possible Causes

1. The battery has lost its charge and needs replacing.
2. Memory (RAM or EEPROM) failure.

Troubleshooting Procedure

1. There has been a failure of the battery backed RAM. The battery is on the CPU Assembly (A11), measure its voltage. If the battery voltage is greater than 3.1 volts, it still has an adequate charge. If the charge is insufficient, replace the battery.
2. If the "BAD CAL DATA" message is received, there has been an error in reading the data stored in EEPROM. The most likely cause of this symptom is a bad connection or failure in cable W25. Check the electrical continuity of this cable and ensure that it is making a good connection. If the cable is making its connections, replace the A18 assembly.
3. If the battery charge is adequate, replace the CPU Assembly (A11).

Instrument Does Not Respond

Conditions

The instrument does not execute its turn on sequence or it does not respond to both keyboard and HP-IB commands. The front panel does turn on when the instrument is turned on.

Possible Causes

1. The CPU has been placed into an invalid state.
2. CPU Assembly failure.
3. Improper dc to the CPU Assembly.

Troubleshooting Procedure

Note

Be sure of the symptoms before proceeding with this procedure. Upon completion of step 1, all data stored in the RAM will be erased.

1. Press ◀ while turning on the MFS. This will reinitialize the instrument's memory and reset the CPU. If the instrument now executes a turn on sequence, the problem may now be fixed. If the instrument did not execute a turn on sequence, or still does not respond to keyboard commands, proceed to Verifying CPU Assembly Functionality.

Does not respond to HP-IB commands

Conditions

The instrument does not respond to HP-IB commands, but it does respond to settings entered from the front panel keyboard.

Possible Causes

1. CPU Assembly (A11) failure.
2. A failure of the HP-IB connector or the cabling that connects the connector to the CPU Assembly.
3. Application error.

Before Removing the Instrument Cover

1. Set the instrument's HP-IB ADDRESS to 14 by performing the following steps:
   a. Press the (MORE) key (press (SHIFT), then (PRESET/LOCAL))
   b. Use the arrow keys to modify the blinking digit until the display reads "5 HP-IB ADRS"
   c. Press (ENTER). The MFS will display its HP-IB address.
   d. If necessary, use the arrow keys to change the HP-IB address to 14.
2. Using a controller connected to the MFS via HP-IB (SELECT CODE 7), run the following program:

```
DIM Id$[50]
OUTPUT 714;"*IDN?"
ENTER 714;Id$
PRINT Id$
END
```

3. The MFS should return the following string:

   HEWLETT-PACKARD,11757BOPTNNN,0,REVX.Y

   where NNN is the option number and X.Y is the firmware version number. Standard model units will have an option number of 000.
4. If you have received the proper response, the MFS's HP-IB capabilities are functioning properly. The problem may be with the application of HP-IB.

5. If you do not receive a response or get a response other than that which was described, either the CPU Assembly (A11) has failed, or the cabling connecting the CPU Assembly to the rear panel HP-IB connector has failed.

   The most likely failure is the CPU Assembly, however you may want to check the electrical continuity through the cable before replacing the A11 board.

EEPROM Read/Write Errors

Conditions

EEPROM Read/Write errors (-311) returned via HP-IB SYST:ERR? query.

Possible Causes

1. Loss of 5V dc to A18 EEPROM/Counter Assembly.
2. Bad connection or failure in cable W25 (A9J12 to A18J1).
3. A18 Assembly failure.

Before Removing the Instrument Cover

1. Use (MORE) mode, function 10 "SET TIME" (or 11 "SET DATE") to verify you can Read and Write to the Clock Calendar chip U13. This checks presence of 5 Vdc on the A18 Assembly, and gives an indication that cable W25 is good. These are the most likely failures on the assembly. Proceed to "Verifying EEPROM/Counter Assembly Functionality".
2. If the display shows a strange indication of the time and/or date, the internal battery in the Clock Calendar chip may have failed. Remove and replace either U13, or the A18 Assembly.

Note

This procedure does not check the EEPROM/Counter IC, U9.

Verifying Input Assembly Functionality

Theory of Operation

The A5 Input Assembly is responsible for controlling the depth of the notch and routing the input signal to the appropriate Phase Shifter Assembly. The input signal is amplified and then split into two channels, channel 1 and channel 2. The two channels can be attenuated individually. The ratio of the channel 1 to channel 2 signal levels controls the notch depth.

For a deep notch depth the two channels are nearly equal in level. A small notch depth will be generated by a large level difference in the two signals. Which signal is larger is determined by the phase mode of the instrument. In minimum phase mode, the channel 2 signal will be dominant. In non-minimum phase mode, channel 1 will be dominant. When the notch depth is 0, the dominant channel has no attenuation and the other channel has maximum attenuation.

The control lines coming into the assembly are:

b1	Channel 1 attenuation control
b2	Channel 2 attenuation control
MFS BIT 1	Channels 1 & 2 switch control

The dc inputs to this assembly are +15 volts, −15 volts and +12 volts. There are 4 outputs from this assembly. These are:

Channel 1	70 MHz and 140 MHz
Channel 2	70 MHz and 140 MHz

The outputs connect to the appropriate Phase Shifter Assembly or are terminated, depending on the option of the instrument.

When the attenuators are set to zero attenuation, this assembly provides 4 to 7 dB of gain. The attenuators have a range of approximately 30 dB.

The most likely failure modes for this assembly are inability to switch either channel between the 70 and 140 MHz outputs and improper operation of either channel's attenuator. The components that are most likely to fail are the switches and the attenuators.

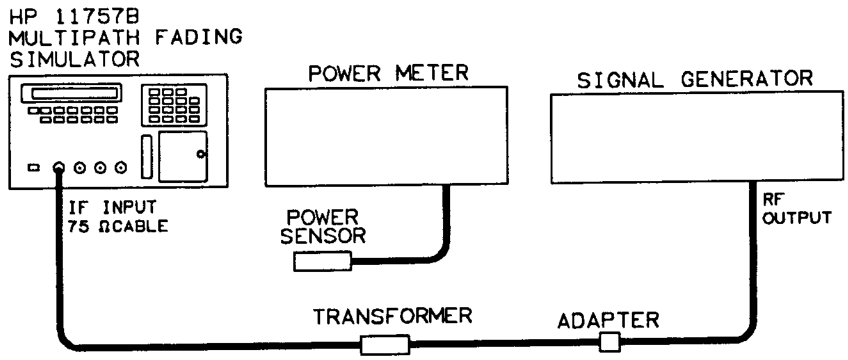

Figure 2-5. Verification Procedures Test Setup

Note

Unless otherwise indicated all assemlby verification procedures use the same test setup.

Verification Procedure

1. Measure the +15, −15 and +12 volt dc inputs to the assembly. Measure the signals at their connection to the Input Assembly (refer to figure 2-2). If the voltage on any of the lines is incorrect, disconnect the line from the Input Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow steps 1 and 2 of Verifying Distribution Assembly Functionality). If all dc input voltages are correct, proceed to the next step.

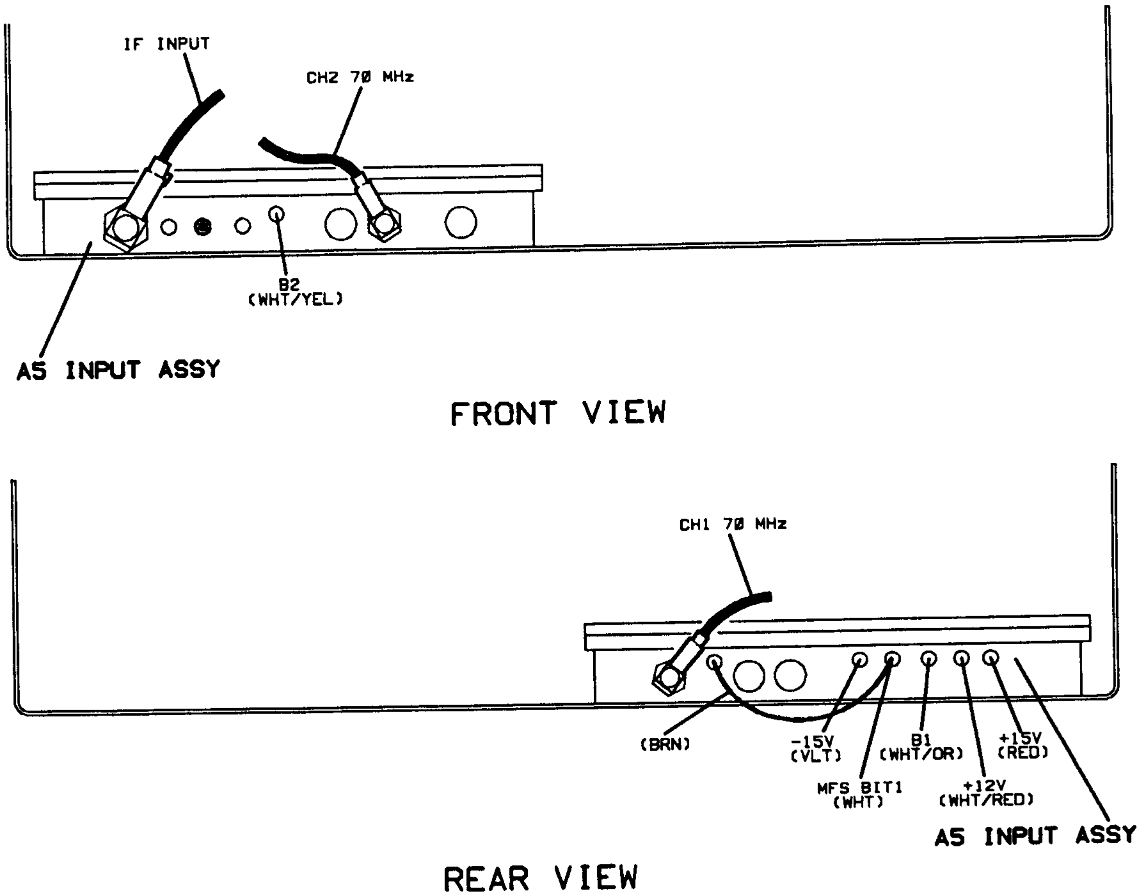

Figure 2-6. Input Assembly Connections

If the discrepant line's voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Input Assembly. If the cable is functioning properly, replace the Input Assembly. If the cable is not electrically continuous or has loss, replace the cable.

2. Measure the voltages, at the maximum and minimum settings, of the b1, b2, and MFS BIT 1 control lines. Use direct control to set the levels of the control lines (refer to the table below). Measure the signals at their connection to the Input Assembly (refer to figure 2-2). If the measured voltage is incorrect for any of the control lines, disconnect the line from the Input Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow step 3 of Verifying Distribution Assembly Functionality). If all the control line voltages are correct, proceed to the next step.

   If the discrepant control line's output voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Input Assembly. If the cable is functioning properly, replace the Input Assembly. If the cable is not electrically continuous or has loss, replace the cable.

	Line Name	I Bus Number	DAC Value for Max	Voltage	DAC Value for Min	Voltage
Notch Depth Control	b1 b2	18 19	0 0	0V 0V	4095 4095	+12.5V +12.5V
Frequency Band Select	MFSBIT1	6	+5V	0	0V	

3. Connect a 70 MHz, −10 dBm, CW signal to the MFS IF INPUT connector.

Note

For this test, it is irrelevant which option is being verified. A 70 or 140 Mhz signal will work equally well, unless you are troubleshooting a narrow bandwidth power loss. If that is the case, use an input signal that coincides with the frequency of the power loss.

4. Press the (PRESET), then the (ENTER) key.
5. Measure the power coming out of the Input Assembly's `channel 2 70 MHz` connector. (for an Option 140, measure the power out of the `channel 2 140 MHz` connector). The measured level should be approximately −6 to −3 dBm (4 to 7 dB of gain, typically). If this level is correct, continue with the procedure. If it is not correct, replace the Input Assembly (A5).

Note

Connector A5J3 (or A5J4) at the front of the Input Assembly are difficult to access. It is best to disconnect cable W12 (or W13) from the A4 (or A6) Phase Shifter Assembly and use the recommended adapters to make your measurement at the disconnected cable end.

6. Using Direct Control, set b2 to 0000. The measured level will decrease by >30 dB. If this occurs, continue with the procedure. If not, replace the Input Assembly.
7. Press the (ENTER) key. Press the (PHASE) key to set the MFS to non-minimum phase mode. The power level out of the channel 2 output should be the same as was measured in step 6. If the level is different by more than 5 dB, replace the Input Assembly.
8. **Option 147 only:** Set the notch frequency to 140 MHz and the phase mode.to minimum phase. Repeat steps 5 through 7, measuring at the `channel 2 140 MHz` connector.
9. Press the (PRESET), then the (ENTER) key.
10. Set the MFS to non-minimum phase mode.
11. Measure the power coming out of the Input Assembly's `channel 1 70 MHz` connector. (for an Option 140, measure the power at the `channel 1 140 MHz` connector). The measured level will be

approximately −6 to −3 dBm (4 to 7 dB of gain, typically). If the level is correct, continue with the procedure. If it is not correct, replace the Input Assembly.

12. Using Direct Control, set B1 to 0000. The measured level will decrease by >30 dB. If this occurs, continue with the procedure. If not, replace the Input Assembly.
13. Press the (ENTER) key. Set the MFS to minimum phase. The power level out of the channel 1 output should be the same as was measured in step 11. If the level is different by more than 5 dB, replace the Input Assembly.
14. **Option 147 only**. Set the Notch Frequency to 140 MHz and the phase mode to non-minimum phase. Repeat steps 10 through 12, measuring at the `channel 1 140 MHz` connector.

    If the Input assembly has passed this and all the previous steps, it is functioning correctly. The problem is elsewhere in the instrument.

Verifying Phase Shifter Assembly Functionality

Theory of Operation

The function of the Phase Shifter Assemblies (A4 and A6) is to generate a phase shift between the channel 1 and channel 2 signals. The absolute value of the phase difference between the two channels determines the notch frequency.

Each channel has varactor diodes, which serve as a voltage controlled phase shifter. The diodes can alter the phase of the signal by approximately 100 degrees. In addition, a 6.3 nanosecond delay is added to channel 1. This is accomplished by a coaxial delay line which is external to the Assembly. The delay line will generate a notch at 80 MHz if there is no other delay between the two channels. The delay line used for the 140 MHz Phase Shifter Assembly is the same length as the one used for the 70 MHz Phase Shifter Assembly, however, they are not interchangeable.

The two channels are combined after the phase shifters and delay line. The Assembly will have approximately 0 dB of gain. The control lines coming into this Assembly are phi 1 and phi 2, which are the control voltages for the channel 1 and channel 2 phase shifters, respectively. The dc inputs are +11 volts and −12 volts.

Two −12 volt lines come into the Assembly. They are separate cables, but they come from the same supply on the Distribution Assembly.

There are two RF inputs. Both come from the Input Assembly. There is an output and an input connection to the Delay Line. There is one RF output that connects to the Output Assembly.

A standard option model has only a 70 MHz Phase Shifter Assembly. A model option 140 has only a 140 MHz Phase Shifter Assembly. A model option 147 has both phase shifter assemblies.

The predominant failure modes for this Assembly are low gain through the Assembly and an inability to adjust phase. No components stand out as being more likely to fail than the others. In addition, this is a surface mount assembly and component replacement should only be performed by trained personnel.

Verification Procedure

This procedure will verify the functionality of either the 70 MHz or 140 MHz Phase Shifter Assemblies.

1. Measure the +11 and −12 volt dc inputs to the assembly. Measure the signals at their connection to the Phase Shifter Assembly (refer to figure 6-5). If the voltage on any of the lines is incorrect, disconnect the line from the Phase Shifter Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow steps 1 and 2 of "Verifying Distribution Assembly Functionality"). If all dc input voltages are correct, proceed to the next step.

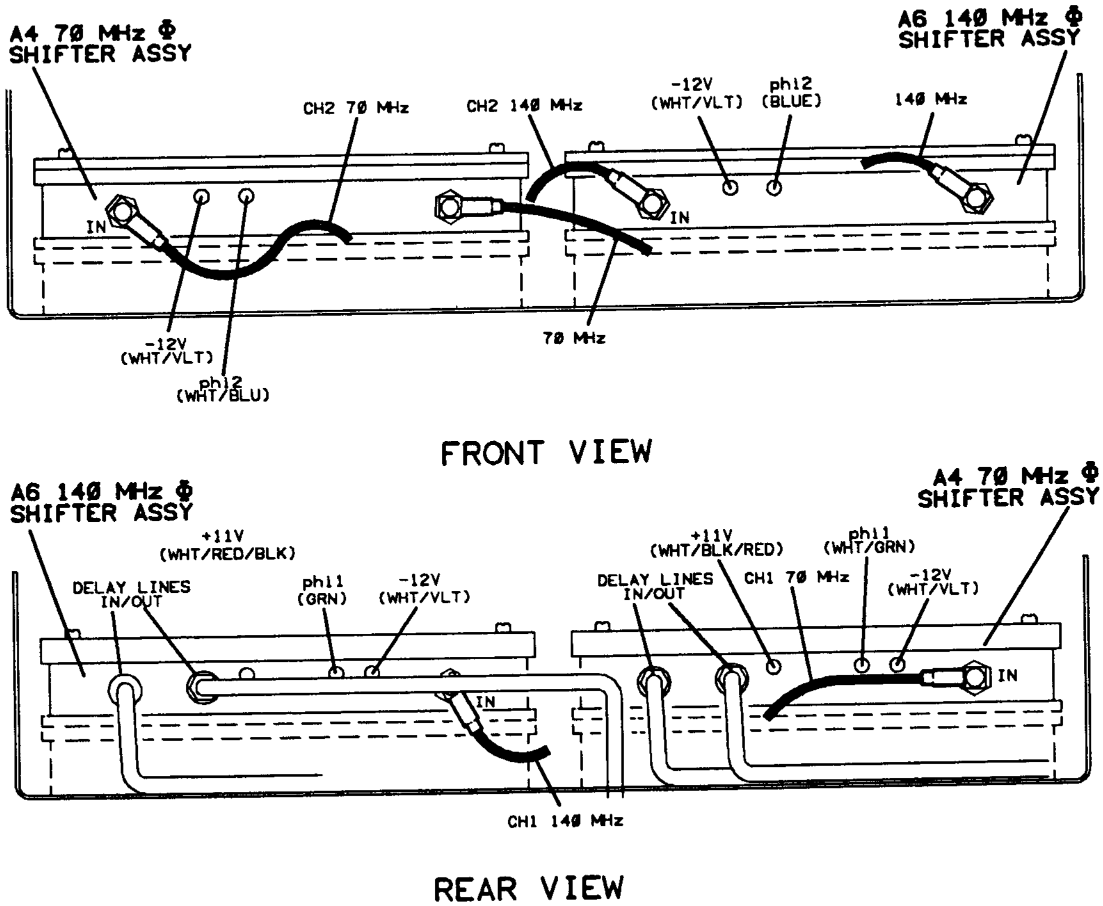

Figure 2-7. Phase Shifter Assembly Connections

If the discrepant line's voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Phase Shifter Assembly. If the cable is functioning properly, replace the Phase Shifter Assembly. If the cable is not electrically continuous or has loss, replace the cable.

2. Measure the voltages, at the maximum and minimum settings, of the phi1 and phi2 control lines. Use direct control to set the levels of the control lines (refer to the table below). Measure the signals at their connection to the Input Assembly (refer to figure 3-3). If the measured voltage is incorrect for any of the control lines, disconnect the line from the Phase Shifter Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow step 3 of "Verifying Distribution Assembly Functionality"). If all the control line voltages are correct, proceed to the next step.

   If the discrepant control line's output voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Phase Shifter Assembly. If the cable is functioning properly, replace the Phase

Shifter Assembly. If the cable is not electrically continuous or has loss, replace the cable.

	Line Name	I Bus Number	DAC Value for Max	Voltage	DAC Value for Min	Voltage
Notch Frequency Control	phi1 phi2	16 17	0 0	+13V +13V	4095 4095	-10V -10V

3. Connect a 70 MHz (or 140 MHz, depending on the Assembly being tested), −10 dBm, CW signal to the MFS IF INPUT connector.
4. Preset the MFS. Set a notch frequency at 140 MHz if you are testing the 140 MHz Phase Shifter Assembly.
5. Verify that a −5 dBm ±3 dB signal is input to the Phase Shifter assembly's channel 2 input. If this is not the case, there is a problem with the Input Assembly or the cable connecting the Input and Phase Shifter Assemblies.
6. Place the MFS in non-minimum phase mode. The power level into the Phase Shifter assembly's channel 2 input should be −35 dBm or less. If this is not the case, verify the functionality of the Input Assembly.
7. Verify that a −5 dBm, ±3 dB signal is input to the Phase Shifter assembly's channel 1 input. If this is not the case, there is a problem with the Input Assembly or the cable connecting the Input and Phase Shifter Assemblies.
8. Place the MFS in minimum phase mode. Verify that the power level into the Phase Shifter Assembly's channel 1 input is −35 dBm or less. If this is not the case, verify the functionality of the Input Assembly.
9. Set the MFS to non-minimum phase mode. Measure the power level of the signal coming out of the Phase Shifter Assembly's output connector.

Note Connector A7J2 is difficult to access. To measure the power level out of the 140 MHz Phase Shifter Assembly, it may be best to disconnect the cable (W16) connected to A6J3 and connect your own cable to A6J3. Measure the power out of the cable you supplied.

This power level should be within 4 dB of the channel 2 input power level that was measured in step 5. If this is not the case, replace the Phase Shifter Assembly. If the power level is correct, continue.

10. Set the MFS to minimum phase mode. Measure the power level of the signal coming out of the Phase Shifter Assembly's output

connector. This power level should be within 4 dB of the channel 1 input power level that was measured in step 7. If the power level is correct, go to step 13. If it is not, perform steps 11 and 12.

11. Measure the power level of the signal coming out the Delay Line input port on the Phase Shifter Assembly. This level should be −2 dB, with respect to the Phase Shifter Assemblies channel 1 input signal, as was measured in step 7.
12. Reconnect the Delay Line input connector. Check the power level of the signal coming out of the other end of the Delay Line. This signal should be within 0.5 dB of the signal measured in step 11. Tap the delay line and check to see if the power out is vibration sensitive. If there is a problem with the power coming out of the delay line, replace it. If the power out of the delay line is okay, replace the Phase Shifter Assembly.
13. If the original problem was incorrect notch frequency, then continue with this procedure. If notch frequency is not the problem, and the Phase Shifter Assembly has passed all the steps in this procedure to this point, neither the Phase Shifter Assembly nor the Delay Line contains the problem. They are both functioning as designed.
14. Run the Automated Adjustment procedure.
15. Recheck the notch frequency accuracy. If the notch frequency accuracy is still out of spec, run the manual adjustment procedure.
16. If the notch frequency is still off, replace the Phase Shifter Assembly.

Verifying Output Assembly Functionality

Theory of Operation

The Output Assembly (A7) provides flat fade to the signal going through it and splits the signal into two. One signal is routed to the front panel IF OUTPUT connector and the other to the rear panel AUX IF OUT connector. The Output Assembly takes its input from one of the Phase Shifter Assemblies, depending on the option of the instrument. A switch on the Output Assembly selects which Phase Shifter Assembly provides the signal.

The Output Assembly has two attenuators which are used to control flat fade. When these two attenuators are at their minimum attenuation setting, the MFS has gain. Total instrument gain is greater than 12 dB. When the attenuators are at maximum attenuation, the flat fade attenuates by greater than 50 dB. For 0 dB flat fade the attenuators are set somewhere between minimum and maximum attenuation. This setting is determined during the Auto-Adjustment procedure.

The control lines coming into the Output Assembly are A1 and A2, the attenuator control lines and MFS BIT 2, which controls the switch. The dc inputs to this assembly are +11, +15 and −15 volts.

There are 2 RF inputs and 2 RF outputs in the Output Assembly. The inputs come from both the 70 MHz and 140 MHz Phase Shifter Assemblies. The two outputs are identical. One goes to the front panel for the IF OUTPUT signal. The other goes to the rear panel for the AUX IF OUT.

The Output Assembly provides approximately 8 dB of gain when the attenuators are in their minimum attenuation position.

The most likely failure modes for this assembly are inability to switch frequency band and improper attenuator operation, which will result in improper flat fade. The components that are most likely to fail are the attenuators and switch.

Verification Procedure

1. Measure the +15, −15 and +11 volt dc inputs to the assembly. Measure the signals at their connection to the Output Assembly (refer to figure 3-4). If the voltage on any of the lines is incorrect, disconnect the line from the Output Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow steps 1 and 2 of "Verifying Distribution Assembly Functionality"). If all dc input voltages are correct, proceed to the next step.

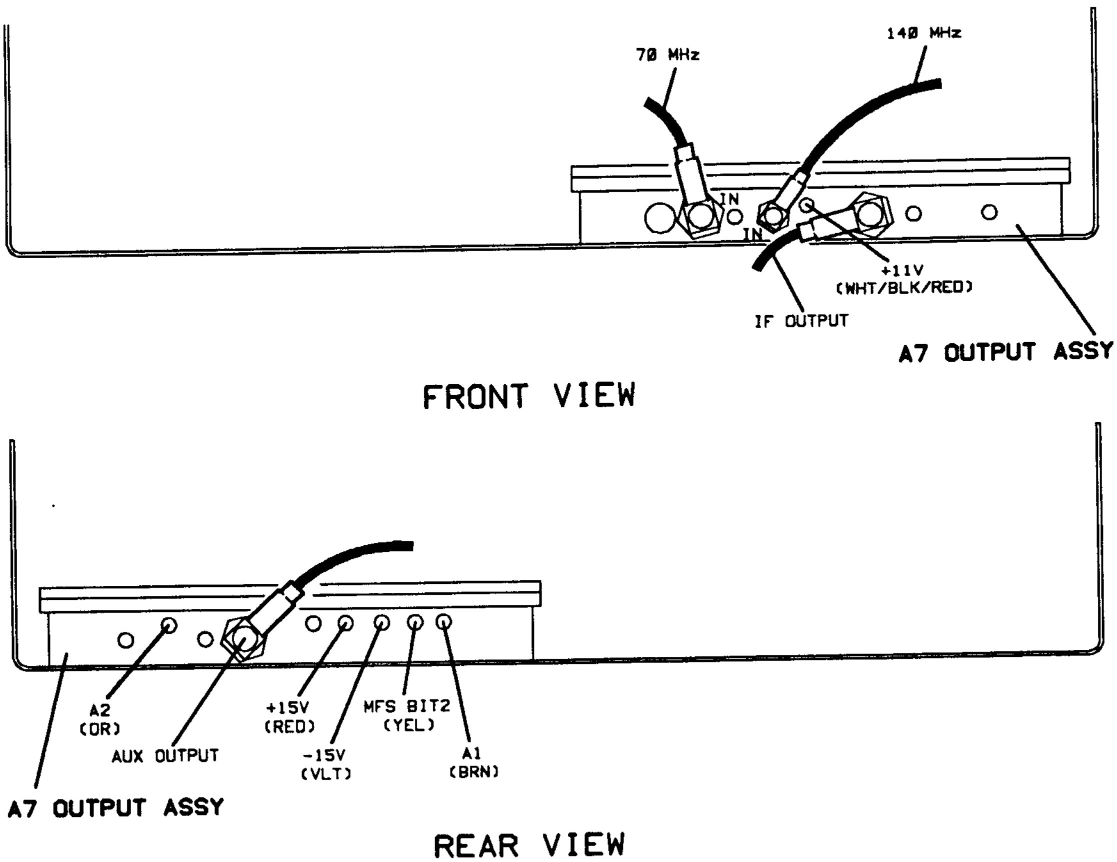

Figure 2-8. Output Assembly Connections

If the discrepant line's voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Output Assembly. If the cable is functioning properly, replace the Output Assembly. If the cable is not electrically continuous or has loss, replace the cable.

2. Measure the voltages, at the maximum and minimum settings, of the a1, a2, and MFS BIT 2 control lines. Use direct control to set the levels of the control lines (refer to the table below). Measure the signals at their connection to the Output Assembly (refer to figure 3-4). If the measured voltage is incorrect for any of the control lines, disconnect the line from the Output Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow step 3 of "Verifying Distribution Assembly Functionality"). If all the control line voltages are correct, proceed to the next step.

   If the discrepant control line's output voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Output Assembly. If the cable is functioning properly, replace the Output Assembly. If the cable is not electrically continuous or has loss, replace the cable.

	Line Name	I Bus Number	DAC Value for Max	Voltage	DAC Value for Min	Voltage
Attenuation Control	a1 a2	20 21	0 0	+2V +2V	4095 4095	+12V +12V
Frequency Band Select	MFSBIT2	7	1	+5V	0	0V

3. Connect a 70 MHz, −10 dBm, CW signal to the MFS IF INPUT connector. For this test, it is irrelevant which Option is being verified. A 70 or 140 MHz signal will work equally well, unless you are troubleshooting a narrow bandwidth power loss. If that is the case, use an input signal that coincides with the frequency of the power loss.
4. On the MFS, press (PRESET), then (ENTER).
5. Verify that there is a signal with a power level of −5 dBm ±4 dB coming out of the appropriate (70 MHz Assembly for the standard and Option 147, and 140 MHz for Assembly for Option 140) Phase Shifter Assembly.

Note

Connector A7J2 is difficult to access. To measure the power level out of the 140 MHz Phase Shifter Assembly, it may be best to disconnect the cable (W16) connected to A6J3 and connect your own cable to A6J3. Measure the power out of the cable you supplied.

Verify, for Option 147 models, that the signal level coming out of the 140 MHz Phase Shifter Assembly is >−35 dBm.

If any of the power levels measured are inadequate, the problem is not with the Output Assembly. If the levels are acceptable, continue.

6. Measure the output power out of both the A7J3 and A7J5 connectors. This level should be approximately 8 dB greater than the input to the Output Assembly. If either signal varies from this level by greater than 4 dB, change the Output Assembly. If the power out is okay, continue. Reconnect A7J3 and A7J5.
7. For Option 147, verify the signal into the Output Assembly and check the two output power levels, as was done in steps 5 and 6, at 140 MHz also. This requires setting a notch frequency of 140 MHz.
8. Set the MFS Attenuation to −12 dB. The power out of both the IF OUT connector and the AUX IF OUT should have increased by 12, ±2, dB over the 0 dB attenuation level measured in step 6. If this is not the case, replace the Output Assembly. If this level is okay, continue.

9. Set the MFS Attenuation to 50 dB (maximum attenuation). The output power coming from both the IF OUTPUT and the AUX IF OUT should have dropped by 50, ±2 dB below the level measured in step 6. If this is not the case, replace the Output Assembly. If the Assembly has passed this and all previous steps, it is functioning as designed and the problem lies elsewhere.

Verifying Interface Assembly Functionality

Theory of Operation

The A2 Interface Assembly takes digital signals from the CPU Assembly (A11) and converts them into analog voltages which are used to control the attenuators and phase shifters. The data conversion is accomplished by 12 bit DACs which sink current from an op amp through a feedback resistor.

Note that the feedback resistor is internal to the DAC and therefore, does not show up on the schematic. The feedback resistor has a value of 10K ohm. The DACs sink 1 milliamp when set to their maximum value (4095). The Interface Assembly also contains the shift registers that receive the MFS BIT 1 and MFS BIT 2 from the microprocessor. The MFS Bits are used to control the frequency band that the MFS is operating in. The control voltages and bits are routed from the Interface Assembly to the appropriate RF assembly through the Distribution Assembly. The purpose, range and I Bus Number for each control voltage and bit is described in table 3-1, "Multipath Fading Simulator Direct Control" (this table is repeated in this section). There are no RF signals in this assembly. The board has outputs to the Distribution Assembly for each of the control lines: a1, a2, b1, b2, MFS BIT 1 and MFS BIT 2. The board receives clock, data and transfer signals from the CPU Assembly. The dc inputs are +15, −15 and +5 volts, which are received from the Distribution Assembly. The Interface Assembly takes the −15 volt input and converts it to a precision −10 volt signal which is used as a voltage reference to the DACs. This reference voltage is used on this assembly only. Much of the circuitry on this board is not used in this instrument.

The components that are most likely to fail are the Voltage Reference ICs and Op Amps.

Procedure

1. Measure the +15, −15 and +5 volt dc inputs to the assembly. The dc input voltages and their test points are as follows:

Input Voltage	Test Point
+15 volts	TP29
-15 volts	TP27
+5 volts	TP22

If the voltage on any of the lines is incorrect, disconnect the line from the Interface Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow steps 1 and 2 of "Verifying Distribution Assembly Functionality"). If all dc input voltages are correct, proceed to the next step. If the discrepant line's voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Interface Assembly. If the cable is functioning properly, replace the Interface Assembly. If the cable is not electrically continuous or has loss, replace the cable.

2. Measure the voltages, at the maximum and minimum settings, of all the control lines. Use direct control to set the levels of the control lines (refer to the "Direct Control" table below). The control lines and their test points are as follows:

Control Line	Test Point
a1	TP1
a2	TP30
b1	TP6
b2	TP21
phi 1	TP12
phi 2	TP14
MFS BIT 1	TP11
MFS BIT 2	TP9

If the measured voltage is incorrect for any of the control lines, disconnect the line from the Interface Assembly and verify the line's voltage on the Distribution Assembly (A9) (follow step 3 of "Verifying Distribution Assembly Functionality"). If all the control line voltages are correct, proceed to the next step.

If the discrepant control line's output voltage is correct on the Distribution Assembly, verify the continuity of the cable connecting the Distribution Assembly to the Interface Assembly. If the cable is functioning properly, replace the Interface Assembly. If the cable is not electrically continuous or has loss, replace the cable.

Direct Control

	Line Name	I Bus Number	DAC Value for Max	Voltage	DAC Value for Min	Voltage
Notch Frequency Control	phi1 phi2	16 17	0 0	+13V +13V	4095 4095	-10V -10V
Notch Depth Control	b1 b2	18 19	0 0	0V 0V	4095 4095	+12.5V +12.5V
Attenuation Control	a1 a2	20 21	0 0	+2V +2V	4095 4095	+12V +12V
Frequency Band Select	MFSBIT1 MFSBIT2	6 7	1 1	+5V +5V	0 0	0V 0V

3. If all of the control lines are bad, the problem is probably with the CPU Assembly (A11) or the cable connecting the CPU Assembly to the Interface Assembly. If this is the case, proceed to "Verifying CPU Assembly Functionality".
4. If more than one of the analog control lines are bad, one of the −10 volt references to the Digital-to-Analog-Converters (DACs) may be the problem. The following table groups the analog control lines by their −10 volt reference.

Control Lines	Reference Test Point
b1 b2 phi 1 phi 2	U42, TP17
a1 a2	U41, TP24

If all of the control lines in either group are bad, check the appropriate −10 volt test point. If the test point is bad and the −15 volt test point (TP27) is okay, then the −10 volt reference has failed. Replace either the reference or the Interface Assembly. If the −10 volt reference is functioning, the problem is most likely with the CPU Assembly (A11).

5. If one of the analog control lines is bad, check the inputs to the operational amplifiers (op amps) that convert the lines DAC current to voltage. The two op amp inputs should be at the same

voltage. If this is not the case, the op amp has failed. When this happens replace either the op amp or the Interface Assembly.

The following is a list of the op amps and their input pin numbers for each analog control line.

Control Line	Operational Amplifier
A1	U6 pins 2, 3
A2	U6 pins 5, 6
B1	U13 pins 2, 3
B2	U13 pins 5, 6
phi 1	U20 pins 2, 3 and pins 5, 6
phi 2	U45 pins 2, 3 and pins 5, 6

6. If a control line is bad, and its Op amp is functioning the DAC may have failed. Set the control line to its maximum value and check the DAC input bits. They should all be a TTL high level. The following list gives the IC number for the DAC for each control line.

Control Line	DAC IC Number
a1	A2U5
a2	A2U25
b1	A2U12
b2	A2U32
phi 1	A2U19
phi 2	A2U39

The input pins for all the DACs, in order of least significant bit to most significant, are as follows: 15,14,13,12,11,10,9,8,7,6,5,4.

Check the DAC input bits for the minimum DAC setting, as well. In this case all input bits should be a TTL low level. If the DAC inputs are at the correct levels and the Op amps are functioning then, most likely, the DAC has failed. Replace the DAC or the Interface Assembly.

7. If the DAC inputs are not at the proper levels, either the DAC is shorting the input to ground or the Shift Registers that shift data into the DAC has failed. Either replace the Interface Assembly or refer to the schematic for further component level troubleshooting.

Verifying Distribution Assembly Functionality

Theory of Operation

The Distribution Assembly (A9) is used to route signals and voltages from one assembly to another. There are very few active components on this board, and the ones that are there are, for the most part, not used in this instrument (this board is used in other instruments). The active components used in this instrument are a +12 volt regulator, a −12 volt regulator, and a +11 volt regulator. There are several passive components that are used for DC line decoupling.

The most likely failure mechanisms for this board is failure of the U2 and U4 voltage regulators or the U5 Operational Amplifier.

Verification Procedure

1. Check the +15, −15, +5 and +12 volt DC inputs, and both the analog and digital grounds.

Input Line	J15 Pin Number
AGND	1
+15V	2
−15V	3
+12V	5
+5V	4
DGND	6

If any of these voltages are incorrect, proceed to "Verifying Power Supply Functionality".

2. Check the +12, −12 and +11 volt lines. Below is a listing of the test points that correspond to each line.

Reference Voltage Line	Test Point
+12 volts	TP 1
−12 volts	TP 2
+11 volts	TP 6

a. If both the +12V and −12V lines are bad, the problem is most likely the U4 voltage regulator. If the +12V line is bad, check U5, pins 12 and 13, these should both be at virtual ground. If this is not the case, U5 has failed.

b. If the −12V line is bad check U5, pins 9 and 10. These two pins should also be at virtual ground. Failure to meet this condition indicates a failure of U5. * If the +11V line is bad, the most likely cause is U2. R3, R7, R8 and C10 could also cause a failure on this line, and should be checked before U2 is replaced.

3. The control lines may be checked at their input and output connectors. Again, there are no test points available. The following is a listing of each control line and its input and output connector positions.

Control Line	Input Position	Output Position
a1	J10, pin 45	J1,pin4
a2	J10, pin 47	J1, pin 5
b1	J10, pin 39	J1, pin 22
b2	J10, pin 40	J1, pin 23
phi 1	J10, pin 37	J1, pins 10 and 15
phi 2	J10, pin 39	J1, pins 11 and 16
MFS BIT 1	J10, pin 44	J1, pin 24
MFS BIT 2	J10, pin 43	J1, pins 6 and 25

If the line's input is okay, but the output is not, the problem is on the Distribution assembly. If the input signal is incorrect, the problem is on the Interface Assembly (A2) or the cable connecting the Interface Assembly to the Distribution Assembly. Proceed to "Verifying Interface Assembly functionality". If the Interface Assembly is functioning, the problem is with the cable that interconnects the Interface and Distribution Assemblies (W1).

	Line Name	I Bus Number	DAC Value for Max	Voltage	DAC Value for Min	Voltage
Notch Frequency Control	phi1 phi2	16 17	0 0	+13V +13V	4095 4095	−10V −10V
Notch Depth Control	b1 b2	18 19	0 0	0V 0V	4095 4095	+12.5V +12.5V
Attenuation Control	a1 a2	20 21	0 0	+2V +2V	4095 4095	+12V +12V
Frequency Band Select	MFSBIT1 MFSBIT2	6 7	1 1	+5V +5V	0 0	0V 0V

Verifying CPU Assembly Functionality

Theory of Operation

The CPU Assembly (A11) provides the interface between the Multipath Fading Simulator (MFS) user and the analog circuits. The user's requirements are communicated to the CPU Assembly either through the MFS's front panel or through the HP-IB. The CPU Assembly determines what values the notch depth, notch frequency, and flat fade DACs need to be at in order to provide the required performance.

The main microprocessor is a 68000. It is a 16 bit microprocessor and is clocked at 16 MHz. It interfaces with five subsystems. These subsytems are listed and discussed in detail below.

Memory

The MFS utilizes memory in three forms, RAM, ROM and EEPROM. The instrument's firmware and default calibration data is stored in ROM. Present calibration data and saved instrument settings are stored in RAM. In order to protect the calibration data from accidental erasure, you can store calibration data in EEPROM upon the completion of the calibration.

There are four 1M (128k X 8) ICs of ROM, two 256k (32k X 8) ICs of RAM and 1 8k IC of EEPROM. Both the RAM and ROM ICs are located on the A11 assembly. The EEPROM ICs are located on the EEPROM Board, A18.

On instrument turn-on, a self test is run that checks the battery-backed RAM ICs. They are checked to determine if they have maintained their memory while the instrument was turned off. An additional self test can be initiated through the MORE function. A checksum test is performed on each RAM and ROM IC during this test. Should any of the ICs fail, an error code will be given that will identify the failed circuit.

Instrument Bus

The main microprocessor controls the performance of the analog assemblies by sending numeric values to each DAC that correspond to the settings selected by the operator. The DACs are located on the Interface Assembly (A2). The DAC's analog output is the control line that connects to the corresponding analog assembly.

In order to send data to a DAC, the shift registers that latch the DAC's input must be enabled. The shift registers are also located on the A2 assembly. Seven enable lines go from the A11 assembly to the A2 assembly, however only four lines are used in this product.

The data stored in EEPROM is also accessed via the instrument bus.

The following table lists the enable lines for each control line.

Control Line	Enable Line	A11J5 pin
MFSBIT 1 and 2	XFER0	18
phi1, phi2, b1, b2	XFER1	20
a1, a2	XFER3	24
EEPROM	XFER5	41

HP-IB

HP-IB communication between the main microprocessor and the user is processed by an 8291A GPIB Talker/Listener (U3). A11U4 and A11U5 provide a buffer between the HP 8291A and the rear panel HP-IB connector.

Front Panel

Communication between the main processor and the Front Panel is processed by an 8051 8 Bit Microprocessor. This microprocessor is clocked at 8 MHz. It controls the display and scans the keyboard to detect keystrokes.

Both the Keyboard Assembly (A1) and Display Assembly (A3) interface with the 8 bit microprocessor. If one is functioning but the other is not, the 8 bit microprocessor must be functioning since it interfaces with both. The problem is therefore isolated to the assembly (keyboard or display) that is not functioning. A possible exception is if the keyboard is functioning but the display is not, the problem could be with W9. If neither the display nor keyboard are functioning the problem is either with W8, the A11 assembly or the power supply.

Power Supply

The MFS's On/Off (Line) switch is connected to the instrument's power supply. When the instrument is turned on, the power supply sends a signal to the main microprocessor which initiates the turn on sequence. This signal is called PWRDWN. There is no test point available for monitoring its level. It can be checked at U20 pin 23. This line becomes a TTL high level when the CPU assembly is turned on and it remains a high level until the MFS is turned off.

The power supply also provides DC lines to the A11 assembly. The PWRDWN signal ensures that the dc lines have stabilized before the turn on sequence is initiated.

Please note that when ordering replacement assemblies, the A11 assembly does not include a battery or ROMs. These must be ordered separately.

Verification Procedure

1. Place the A11 assembly in its service position.
2. Measure the +15 (TP1), −15 (TP4) and +5 volt (TP2) dc inputs with respect to ground (TP3). If any of these voltages are incorrect, proceed to "Verifying Power Supply Functionality"
3. If the display has not turned on, check the PWRDWN line (U20 pin 23). It should be a TTL high level. If this is the case, proceed to step 4 of this procedure. If it is not a TTL high level, disconnect W2 (J6) from the Distribution Assembly (A9) and measure the voltage on J6 pin 50 on the A9 board. This level should also be a TTL high level. If J6 pin 50 is a high level, the A11 assembly is pulling this line low and not allowing the microprocessor to turn on. If this is the case, the A11 assembly needs to be replaced or repaired. If J6 pin 50 is low, with W2 disconnected, there been a failure of the Power Supply Assembly (A12) and it needs to be replaced.
4. If the display does not turn on and PWRDWN is a TTL high level, check to see if the MFS responds to commands entered from the keyboard. Connect a 70 MHz, −10 dBm CW signal to the MFS IF IN connector. Press [PRESET], then [ENTER]. Measure and record the power coming out of the IF OUT connector. Set the attenuation to 10 dB (press [ATTEN], 10, then [ENTER]). Remeasure the power out of the IF OUT connector. If the power level has dropped 10 dB (±2dB) from the previous measurement, the Display Assembly (A3) has failed and needs replacing. If the MFS does not respond to commands entered from the keyboard, continue.
5. Press [◄] while turning on the MFS. This will reinitialize the instrument's memory and reset the CPU. If there is no change to the display, replace the A11 assembly. If the display turns on and the instrument executes a turn on sequence, the problem may now be fixed. Repeat step 4 to see if the MFS now responds to keyboard commands. If the instrument does not respond to keyboard commands, continue with this procedure.
6. If the display is functioning or partially functioning, initiate a self test. Activate [MORE] ([SHIFT], then [PRESET/LOCAL]). Use the arrow keys to scroll to "8 SELF TEST", then press [ENTER]. The MFS should display "SELFTESTING*". If it doesn't, replace the A11 assembly.
7. The self test will take about 10 seconds. Upon completion the display will read "TEST: PASS" for a successful test. If this is the result proceed to step 10.
8. If the test has failed the display will read "TEST:FAIL XXX" where XXX is a weighted sum that indicates which tests have failed. Use the following chart to determine which component has failed. Each test performed during the MFS Self Test is assigned a weight. The weights of all the failed tests are summed and the sum is displayed with the "TEST:FAIL" message.

Error Condition	Weight	Corresponding Part
ROM 0U CHECK SUM BAD	1	A11U7
ROM 0L CHECK SUM BAD	2	A11U24
ROM 1U CHECK SUM BAD	4	A11U8
ROM 1L CHECK SUM BAD	8	A11U25
BATTERY BACKED RAM 0U FAILED	16	A11U9
BATTERY BACKED RAM 0L FAILED	32	A11U26
RAM 0U FAILED	64	A11U9
RAM 0L FAILED	128	A11U26

9. If the battery-backed RAM has failed, measure the battery's voltage. The battery is on the CPU Assembly (A11). If the battery's voltage is greater than 3.1 volts, it still has an adequate charge. If the charge is insufficient, replace the battery. If the charge is adequate, continue with this procedure.
10. If any segments of the display do not light, replace the Display Assembly (A3).
11. Use an oscilloscope to verify that the CLK (U23 pin 30) and DOUT (U23 pin 31) signal levels are changing. These signals are only active when data is being sent to an analog assembly. Run a Fade Event (press (SHIFT), (▶), then (ENTER)) while making the measurement to ensure that there will be signals on both lines. Both signals are TTL levels. The CLK line should be a 100 kHz square wave. If there are no CLK or DOUT signals present, replace the A11 assembly.
12. If the A11 assembly passes these checks, most likely the problem lies elsewhere.

Verifying Power Supply Functionality

Theory of Operation

The power supply (A12) is a switching design and can supply a maximum of 100 watts. It provides output lines of the following voltages, +12, +15, −15 and +5.2.

The supply has two ground lines, an analog ground and a digital ground. Although they are tied together at the power supply, there will be small differences in potential between the two grounds if measured elsewhere in the instrument. The potential difference should be less than .2 volts.

In general, the analog ground should be used when measuring analog signals and any DC power supply line except for the +5 volt line. The +5.2 volt line should be measured relative to the digital ground. However, if you use the wrong ground line you will add an inaccuracy to your measurement of less than .2 volts.

There are LEDs that show the status of each line in the power supply on the underside of the power supply. These LEDs are lit when the line is active and off when the line is inactive, giving a quick, visual check on the status of the power supplies. The LEDs provide a rough check and do not ensure that the line is meeting specifications.

If the +5.2 volt line is shorted to the digital ground, all of the LEDs will be off, the fan will stop turning and the instrument will be completely off. This condition will exist until the short is removed and the on/off switch is cycled, resetting the instrument. If any other supplies are shorted to either ground line, the LED for that supply line will be off but all the other LEDs will be on and the instrument will be powered up. This is true when the +5 volt line is shorted to the Analog ground, as well.

The supply must source a minimum current in order to turn on. A 31.6 ohm, 25 watt load resistor is connected from the −15 volt line to ground in order to guarantee sufficient current for all possible loads. If the cable that connects the load resistor, W5, is disconnected, the power supply turns off and will not turn back on until the cable is reconnected and the front panel power switch is cycled.

The fan is supplied by +12 volts, directly from the power supply, although the fan line is separate from the +12 volt power supply line. If measured unloaded, this line may measure 17.5 volts. The front panel On/Off switch turns the power supply on by grounding a control line. In the off state the control line is an open circuit.

Verification Procedure

1. Verify that the line voltage selection on the rear panel is correct for the input line voltage. Check the fuse for continuity and replace it if necessary.
2. If none of the Power Supply LEDs light when the instrument is switched on, there may be a problem with the front panel On/Off switch or its wiring. If any of the LEDs light, proceed to the next step.

   Ground TP3 on the Distribution Assembly (A9). This will bypass the front panel switch. If the LEDs turn on, the problem is not with the power supply.
3. If the fan does not turn when the MFS is on, measure the voltage at J7 on the Distribution Assembly (A9). This voltage will read about +17.5 volts unloaded and +12 volts loaded. If the voltage is correct, replace the fan. If it is not, replace the power supply.
4. Turn off the MFS and disconnect the following cables from the A9 Distribution Assembly; W1, W3, W7, and W25. This will disconnect all loads from the power supply except the 31.6Ω load resistor.
5. Turn the MFS on and measure each supply line at their A9 Distribution Assembly (A9) test points (J15). The tolerances for the supply lines are as follows:

Supply Line	Tolerance
+15V	± .5 volts
−15V	± 1.0 volts
+12	± .75 volts
+5.2	± .2 volts

   If any of the supply lines are not to specification, or if the line is in spec but the LED is not on, the power supply needs replacement.

Caution Be sure to turn the MFS off before reconnecting the cables, as damage can occur if the instrument is on.

6. If a supply line is active when unloaded (step 5) but inactive when loaded, the most likely cause of the problem is in the assembly that is loading the power supply, however the power supply itself can also be the cause.

   To determine the cause, reconnect the three cables, then disconnect them one at a time and check to see if the supply becomes active when a particular assembly has been disconnected.

   The cables and the assembly that they deliver power to are as follows:

   W1 Interface Assembly

W3	CPU Assembly
W7	Input, Phase Shifter and Output Assemblies
W25	EEPROM/Counter Assembly

If the supply line doesn't become active during this procedure the problem is most likely with the power supply assembly and it should be replaced.

7. If the supply line becomes active when one cable has been disconnected, check the corresponding assembly for a short or low impedance path between the supply line and ground. If the problem is on that assembly, not the power supply, replace the assembly.
8. If the supply becomes active when W7 is disconnected, the problem could be on several assemblies.

   If the +15 volt line is inactive, first check the +11 volt regulator and the +12 and −12 volt references on the Distribution Assembly with W7 disconnected (see Verifying Distribution Assembly Functionality).

   The next step, for any of the supply lines, is to reconnect W7 and disconnect the supply line cables to the Input, Phase Shifter and Output Assemblies. Since the +11, +12 and −12 volt lines come from the +15 volt line, you must disconnect each of these when troubleshooting the +15 volt line. Reconnect each cable that was disconnected, one at a time, and see which cable/assembly brings the supply line inactive, in order to determine which assembly is causing the problem.

   When an assembly has been isolated, check for shorts or a low impedance path from the supply line to ground. If this is the case, replace the assembly.

Verifying EEPROM/Counter Assembly Functionality

Theory of Operation

The A18 EEPROM/Counter assembly has three major functional sections. These are:

1. The EEPROM Control Count/Time LCA (Logic Controlled Array.
2. The Event and Alarm input signal processing circuitry.
3. The High Power Option circuitry (if installed).

EEPROM Control Count/Time LCA

The functions of this array are:

1. EEPROM Read/Write. The part contains a 32-bit double buffered register to perform the function of setting up control data and address lines for the EEPROM. The first of these registers is a serial shift register. The serial register is loaded using the SHIFT CHAIN (SDI, SCLCK) of the MFS, and the second register is parallel loaded when XFER5 is strobed low.
2. Clock, Calendar Read/Write. The part contains another double buffered register, similar to the one discussed above, that is used to set up the read/write, data, and address for the Clock, Calendar chip. This chip has an internal battery to prevent loss of stored data.
3. EEPROM/Counter Status Register. A third double buffered register used to hold status of this part.
4. Counter/Timer Functions. There is a 32-bit, 20 MHz, timer inside the part, as well as a 16-bit 40 MHz event counter. The timer can be used to gate the event counter so as to measure the number of events in a certain period of time. The events counter can conversely be used to gate the timer so that the amount of time for a fixed number of events can be found.

Event/Alarm Circuitry

Functions are:

1. Provide termination for the incoming error EVENT signal. The incoming signal can be terminated to 75Ω ECL, 75Ω TTL, or 10KΩ TTL. After processing, the signal is routed to the EEPROM to be counted.
2. The Alarm input signal is processed and the resultant signal is sent to the EEPROM to be measured.
3. The board has three voltage regulators to supply the voltages required by the Event/Alarm circuitry.

High Power Option

Parts are loaded only if option is ordered.

Board Input Signals

The following two inputs come from the front panel of the instrument (except option 001 units).

1. EVENT INPUT A18-J7. This is a high speed signal from a radio or BER test set. The signal can be either ECL/75Ω (default), TTL/75Ω, or TTL/10kΩ and can have a minimum pulse width of 2.5ns for ECL or 10ns for TTL. This input is used during M-Curve measurements.
2. ALARM INPUT A18-J6. A TTL 10kΩ signal from a radio, that indicates the radio under test is out of lock. The signal may be set for polarity. The default setting is positive. This input is used during Recovery Time Measurement.

The following inputs come from the Distribution Board (A9) via cable W25 and connector A18-J1.

1. DATA J1-1. TTL signal. This is the serial data line for the EEPROM Shift Chain. It is common to all shift chains and comes from the CPU Assembly (A11).
2. CLK J1-2. TTL signal. This is the serial clock line used to clock individual bits into the EEPROM Shift Chain. This input also comes from the CPU Assembly (A11).
3. XFER5 J1-4. TTL signal. This a low true strobe used to put the contents of the Shift Chain into a parallel register for use by the EEPROM, Calendar, Status, Timer, or Counters of this board.
4. INT J1-5. For any readbacks from the Calendar, Status, Timer, or Counters of this board, the XFER5 strobe will atomatically transfer the measurement data into the Serial Chain. The contents of the register is then read into the processor (CPU) via serial clocks and the output data bits on the INT line.
5. Supply voltages from the power supply. +15V, -15V, +5V and ACOM, DCOM analog and digital grounds are routed to the assembly via cable W25. See block diagram for J1 pin numbers.

Note

Connectors J2 thru J5 are reserved for the High Power Option. Connectors J8 thru J15 are for factory use only.

The most likely failures on this board are a defective cable W25 and loss of +/-15V or +5V supplies to the board.

Verification Procedure

1. Place the instrument in the service position.
2. Turn power Switch to ON and observe the green LED (DS1).

Note

DS1 is located beneath the large ribbon cable W1 going to the A2 Assembly.

If the LED is blinking, it indicates that U9 has powered up and also indicates its modes. When board is in a mode that permits access to the EEPROM the LED blinks at a 1 Hz rate. When the board is in the mode that the Calendar and Event Counter/Timer functions can be accessed the LED will blink more rapidly 3 times in a row and repeat the sequence at a 1 Hz rate. If the LED is not blinking continue with this procedure.

3. Measure the +5V (TP8) with respect to ground (TP9). If the voltage is correct, the A18 assembly is defective. If the voltage is not correct, check the voltage at A9J15 pin 4 (+5V) and pin 6 (DGND). If the voltage is correct at A9J15, the problem is cable W25 or its connections. If the voltage at A9J15 is not correct, proceed to "Verifying Power Supply Functionality".
4. Measure the +5A voltage (TP3) with respect to analog ground (use A9J15 pin 1 for convenience). If the voltage is correct, go to next step. If the voltage is not correct, check the +15V input at cable W25 pins 5, 16. If the +15V input is correct, the A18 assembly is defective. If the input voltage to the board is not correct, measure the voltage at A9J15 pin2. If the voltage at A9J15 is correct, cable W25 or its connections are defective. If the +15V is not present at A9J15, go to "Verifying Power Supply Functionality".
5. Measure the -2V (TP2) with respect to analog ground. If correct, go to next step. If incorrect, measure the -15V input to the board at cable W25 pin 8. If the input voltage is correct, either U2 and/or U4 and associated circuitry are defective. Refer to the schematic diagram for further troubleshooting or replace the A18 assembly. If the -15V input to the board is not correct, measure the voltage at A9J15 pin 3. If the voltage at A9J15 is correct, cable W25 or its connections are defective. If the -15V is not present at A9J15, go to "Verifying Power Supply Functionality".
6. Ensure that all cables are connected and turn the instrument power switch to on.
7. Press the [RADIO SETUP] key, then press the [▲] until "1 ERROR TERM" is displayed. Press [ENTER] amd use [▲] until "TTL 10kΩ" is displayed, and press [ENTER]. You should hear relays K1 and K2 switching. If the latching of the relays is heard, continue to next step. If an audible "click" is not heard, the A18 assembly may be defective.

8. At the front panel, press (PRESET/LOCAL). This returns the termination of the EVENT error signal to the default setting "ECL 75Ω". Again you should hear the relays switching.
9. If the A18 Assembly has passed all of the above checks, most likely the problem lies elsewhere.

Verifying Internal Printer Functionality

Theory of Operation

The internal printer (not installed in Option 001 instruments) is mounted on the front panel below the main deck. It uses thermal paper, HP Part No. 9270-1299 (see Installation and Calibration Manual for detailed loading of the paper roll). To use this printer you must select the internal printer option.

The internal printer is supplied 5 Vdc and AGND from A9J8 on the Distribution Board assembly. Serial data input to the printer is tapped off of cable W2 (from CPU A11 to A9 Assy) and routed to J3 on the Printer Interface Board. This is a 3-wire cable (Green, blue, violet) to the printer. The green wire is the signal input line, the blue and violet wires provide mechanical stability.

Note

The printer serial data line signal originates from U2 pin 12 (labelled CMRES on A11, CPU Assembly schematic).

As shown on Figure 2-9, there is a pushbutton switch (paper feed), a slide switch (print contrast), and a two-position ON/OFF switch located on the Printer Interface Board assembly. Pressing this momentary pushbutton switch (S2) while applying power to the instrument will self test the printer.

A malfunction in the internal printer will necessitate the removal and replacement of both the Printer Interface Board assembly (HP Part No. 11757-60050), and the Printhead Cable Assembly (HP Part No. 11757-60040).

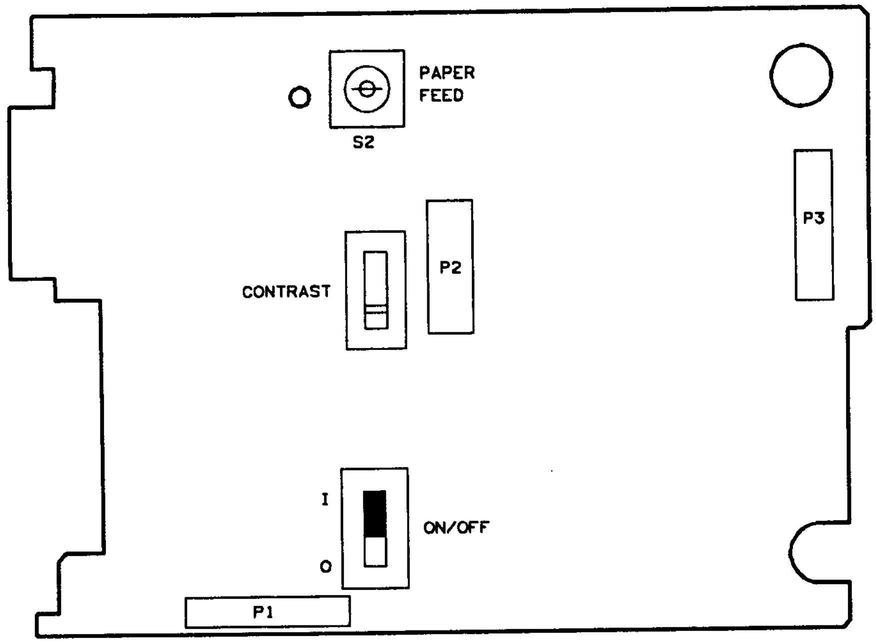

Figure 2-9. Printer Interface Board Assembly

Verification Procedure

1. Remove cover from instrument. Verify the printer board on/off switch is in the ON position (see Figure 2-9), and that there is paper on the roll.
2. Hold down switch S2 (Paper Feed) on Printer Interface Board while turning instrument power switch to ON. Printer should print out a self test of all characters. If printout is correct the printer is functioning properly.
3. If there is no printout, verify 5Vdc is present at P2 (White connector, Red wire=5V and Black wire=AGND). If voltage is correct, replace printer interface board and printhead cable A.
4. If 5Vdc is not present on the board check the voltage at A9J8. If correct replace printhead cable A and printer interface board. If voltage is not correct at A9J8, go to "Verifying Power Supply Functionality".

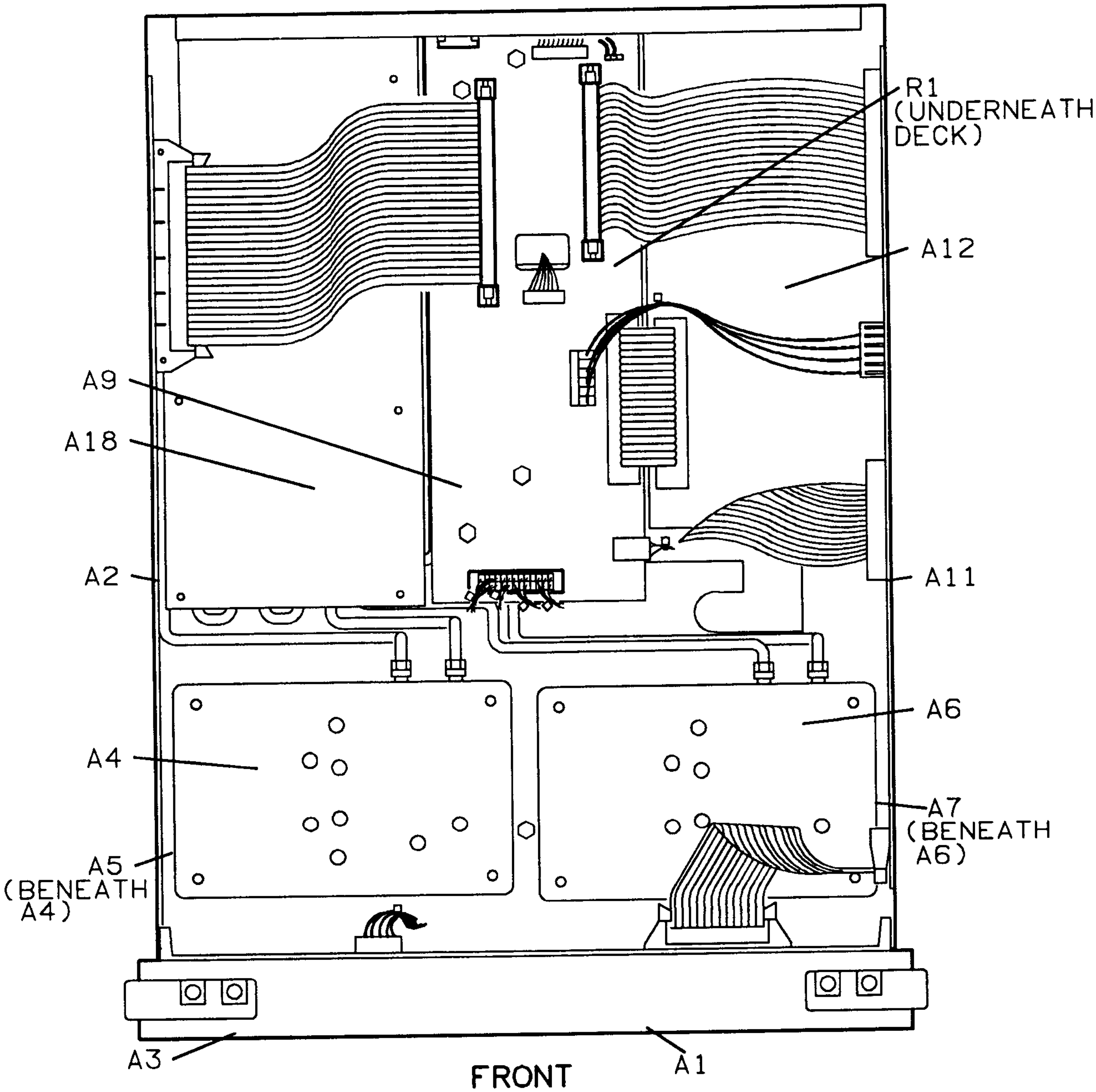

Figure 2-10. Major Assembly Locations

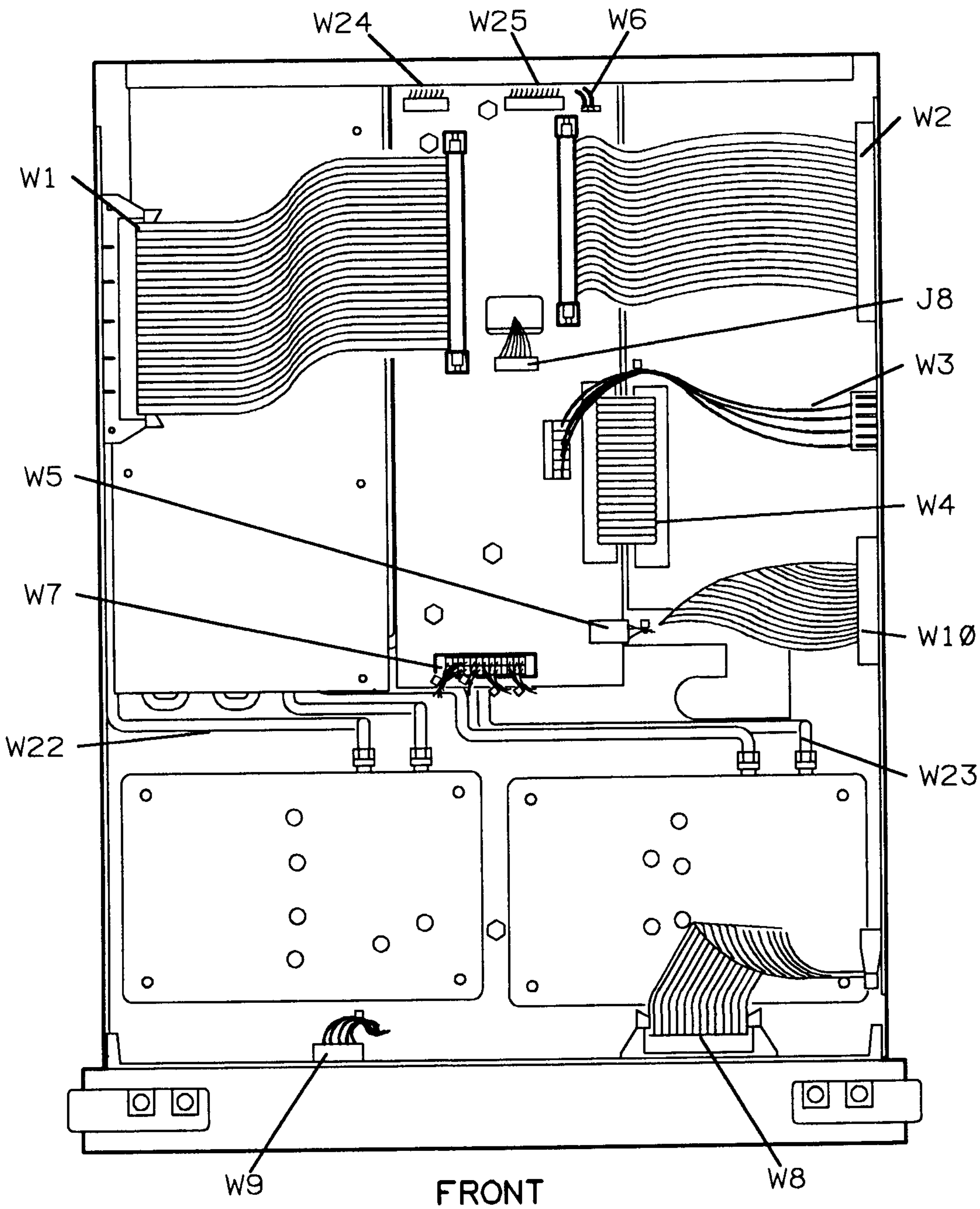

Figure 2-11. Cable Locations

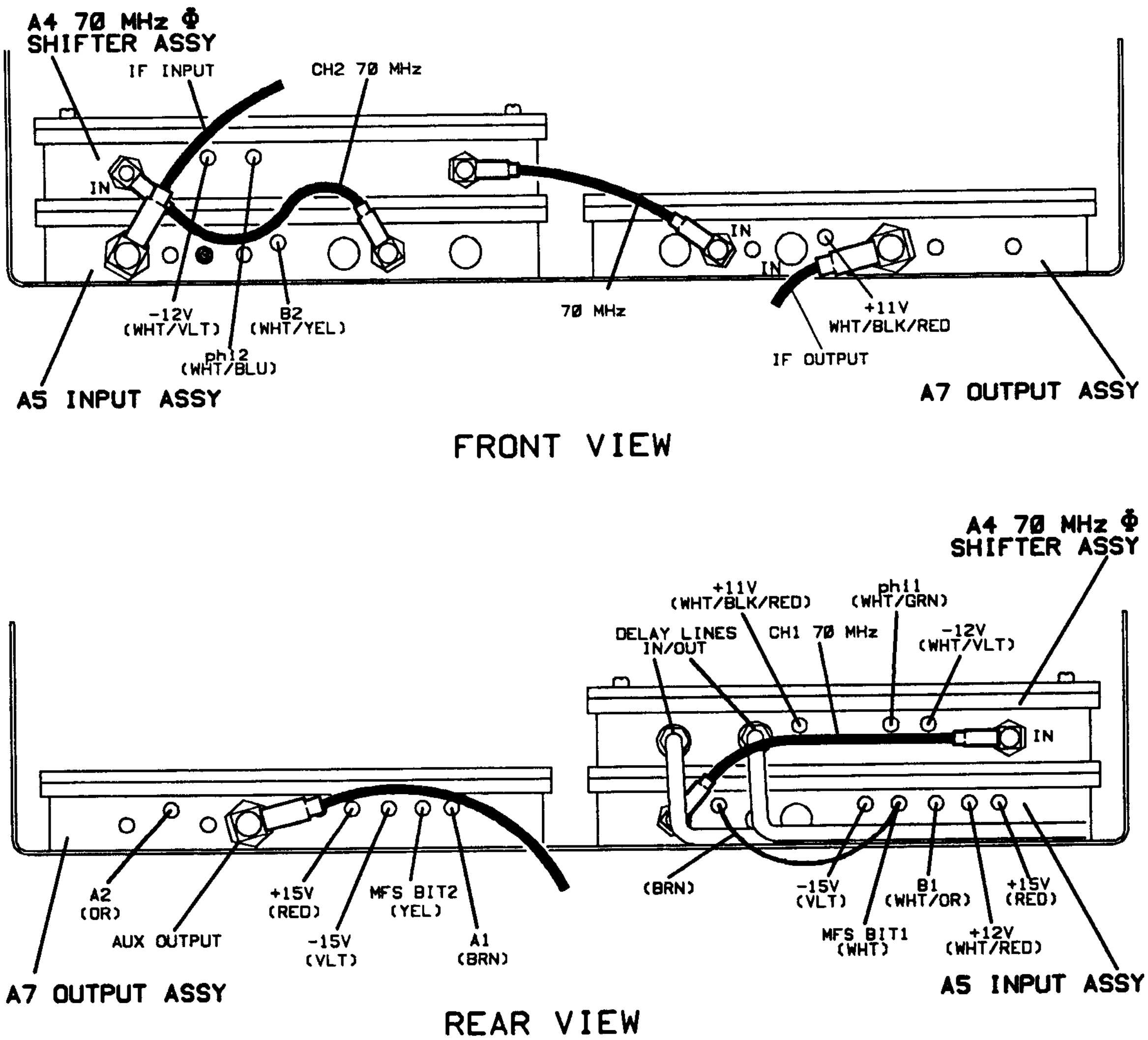

Figure 2-12. Module Interconnections, Standard Model

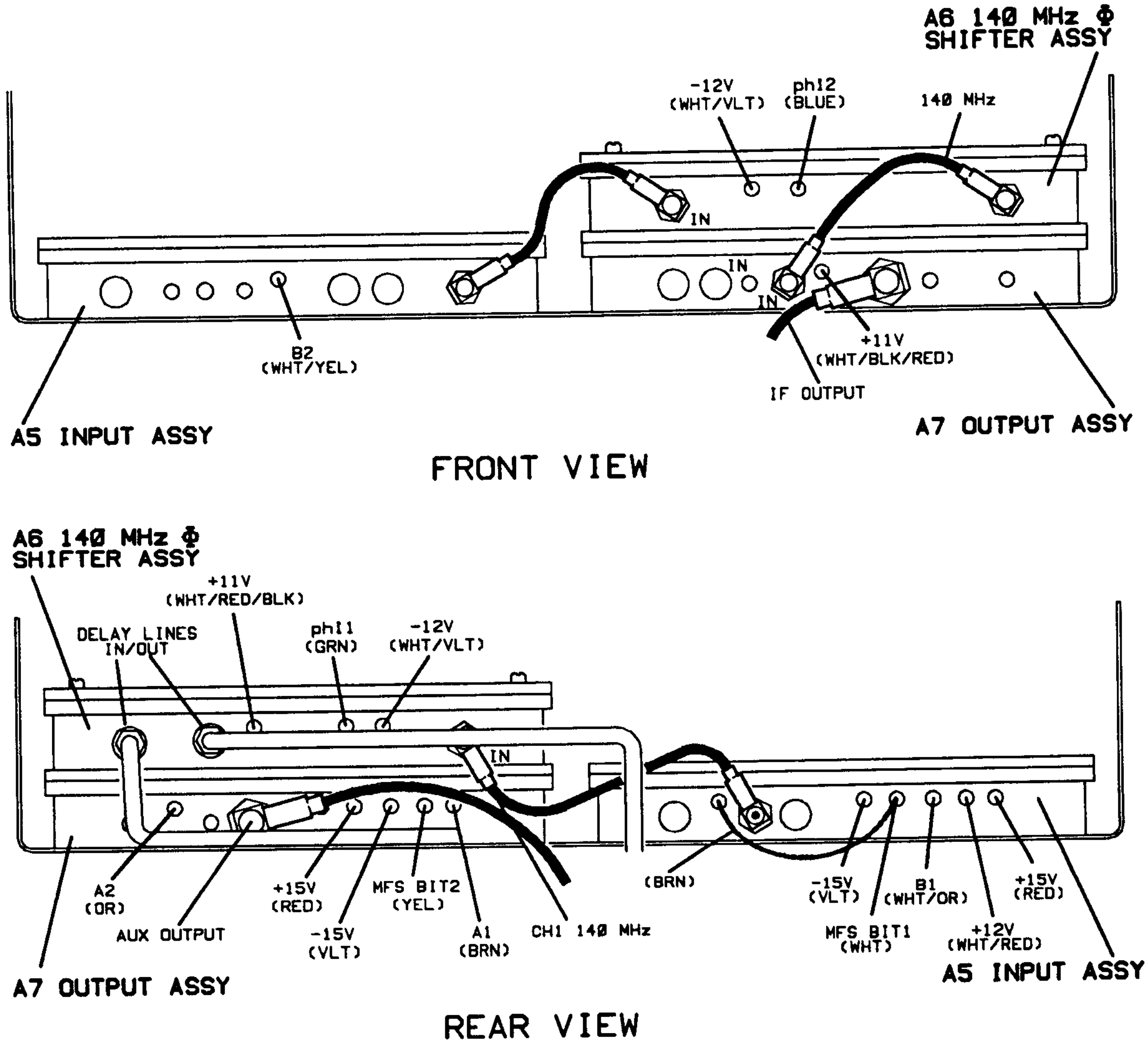

Figure 2-13. Module Interconnections, Option 140

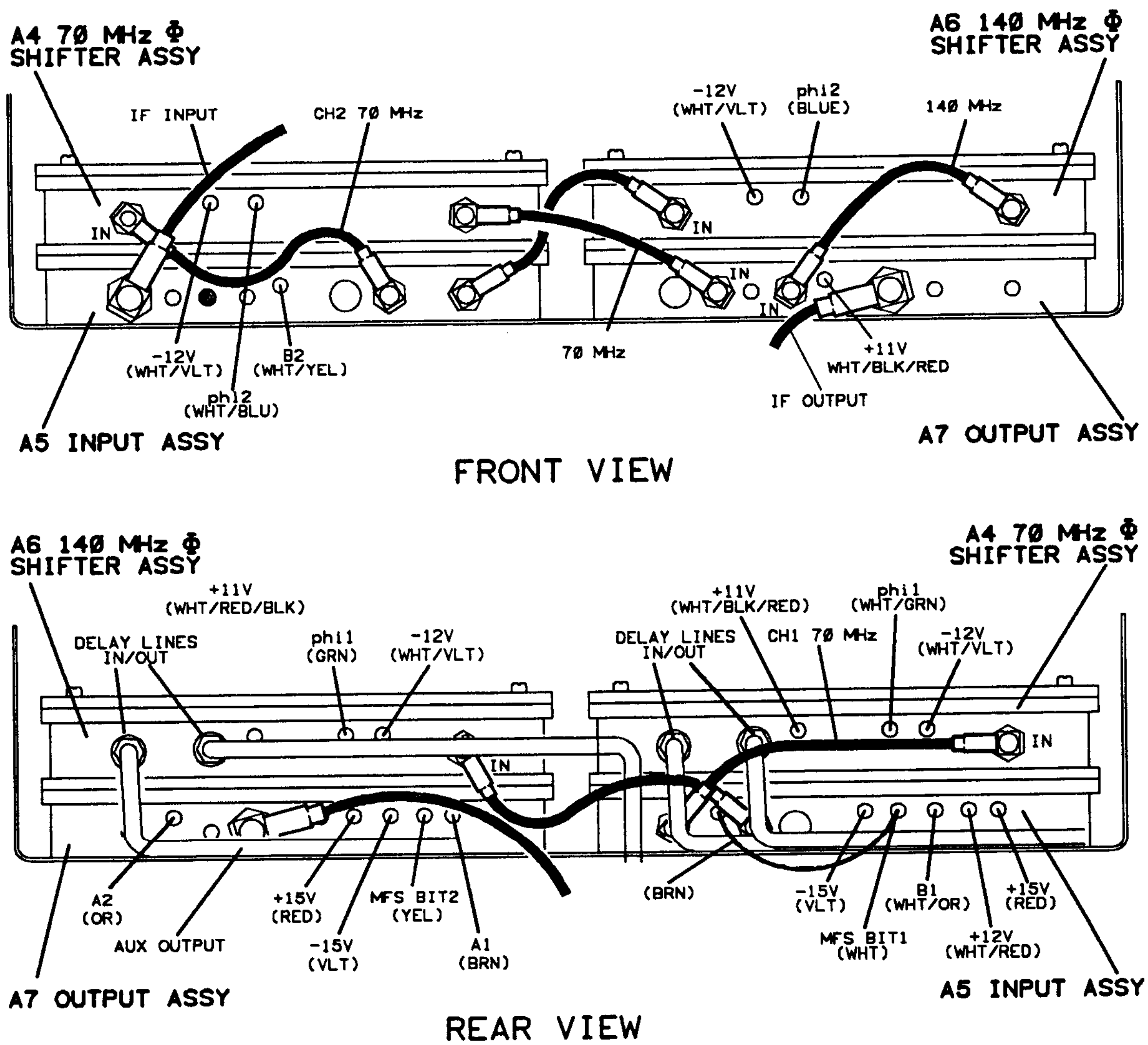

Figure 2-14. Module Interconnections, Option 147

3

Replacement Procedures

Introduction

Warning

Before beginning any disassembly procedure, be sure that the line (Mains) voltage is disconnected. Voltages exist that can cause personal injury.

This chapter contains procedures for removal and replacement of the following major assemblies in the HP 11757B Multipath Fading Simulator.

- Outer Cover
- Front Panel Assembly
- A1 Keyboard Assembly
- A12 Power Supply Assembly
- A4 Phase Shifter Assembly
- A6 Phase Shifter Assembly
- A5 Input Assembly
- A7 Output Assembly
- A11 CPU Assembly
- A2 Interface Assembly
- A18 EEPROM/Counter Assembly
- Internal Printer Assembly

Caution

The assemblies discussed in these procedures contain components that can be damaged or destroyed by electrostatic discharge. These procedures should be implemented only at a static-safe work station. Refer to "Electrostatic Discharge" in Chapter 1, "General Information".

References

Block Diagram	Service Sheet BD1
Cable and Assembly Locations	Figures 5-1 through 5-5

Outer Cover Removal

Refer to figure 3-1.

1. Position instrument with rear panel up.
2. Remove the four large screws securing the cover to the instrument frame. (#1, figure 3-1).
3. Using an Allen wrench, remove the four screws within the plastic standoffs. (#2, figure 3-1).

4. Holding the HP 11757B firmly by the front panel, remove the outer cover by sliding it off the rear of the instrument.

Caution

Do **not** pull on the plastic standoffs. Excessive force may damage them.

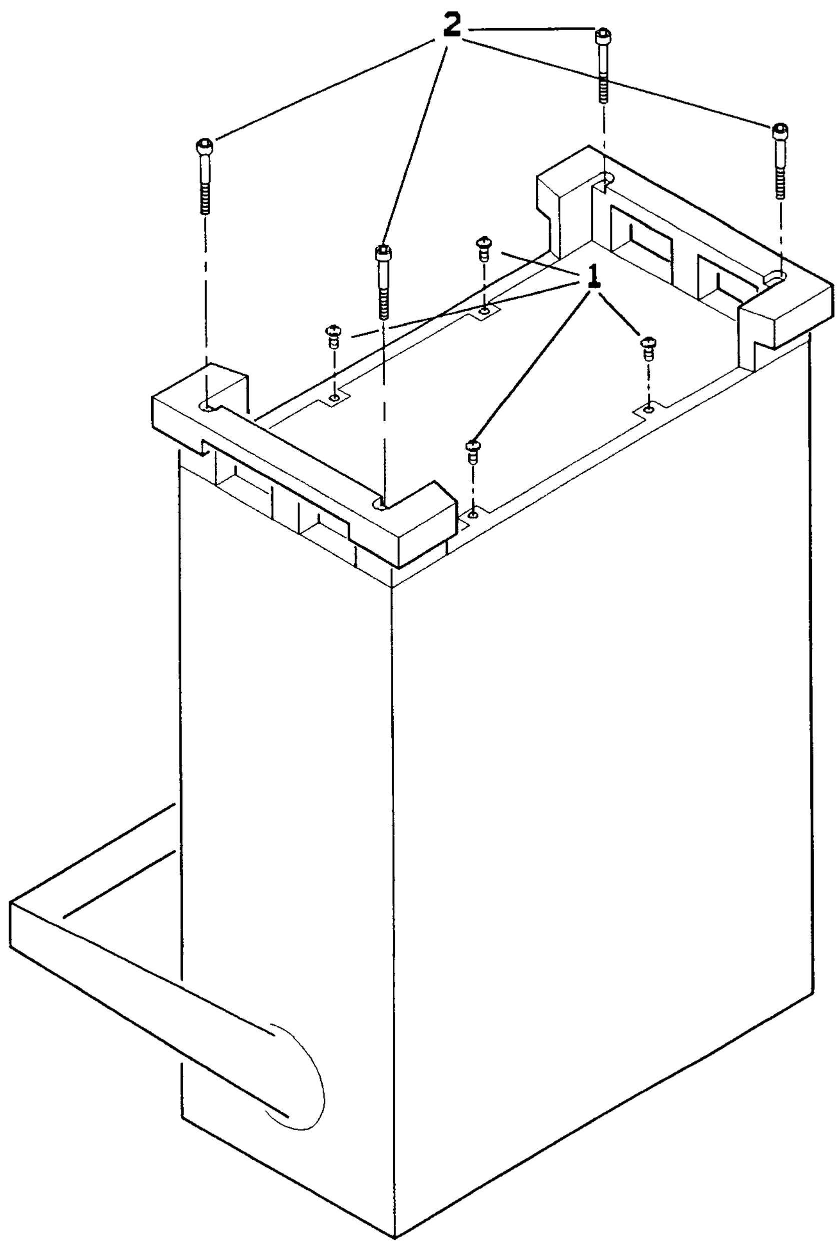

Figure 3-1. Outer Cover Removal

Front Panel Removal

1. Remove the HP 11757B outer cover as described in the "Outer Cover Removal" procedure.
2. Put the instrument in the Service Position.
3. *Refer to figure 5-2, Cable Locations*. Disconnect W8 from the front panel assembly at A1J1.
4. Disconnect the LINE switch cable (White/Green/Violet wire) from the A9 Distribution Assembly at A9J16.
5. Disconnect the Printhead Cable A (Red +5V and Black AGND wires) from the A9 Distribution Assembly at A9J8.
6. *Refer to figure 5-3, Module Interconnections*. Disconnect W11, the IF INPUT cable, from the A5 Input Assembly. Disconnect W20, the IF OUTPUT cable, from the A7 Output Assembly.
7. Disconnect the EVENT INPUT cable (W16) from the A18 EEPROM/Counter Assembly at A18J7 (not used on Option 001).
8. Disconnect the ALARM INPUT cable (W21) from the A18 EEPROM/Counter Assembly at A18J6 (not used on Option 001).
9. Remove the six screws securing the front panel to the instrument frame. (#3, figure 3-2).
10. Carefully separate the front panel from the frame.

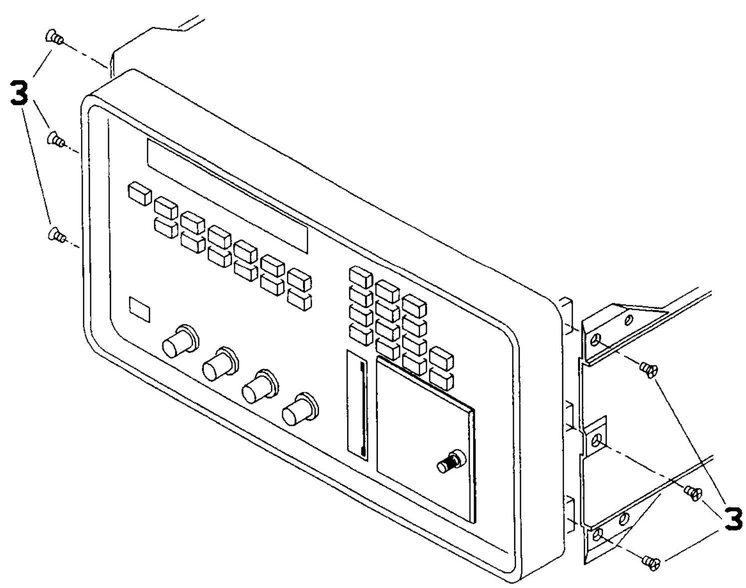

Figure 3-2. Front Panel Removal

A1 Keyboard Removal

Refer to figure 3-3.

1. Remove the front panel as described in the previous procedure.
2. Disconnect W9 at A1J2.
3. Remove the nine screws and washers securing the A1 Keyboard Assembly to the key spacers. (#1 and #2, figure 3-3).
4. Carefully remove the Keyboard Assembly from the key spacers.
5. Remove the six nuts and washers securing the key spacers to the front panel. (#3 and #4, figure 3-3).

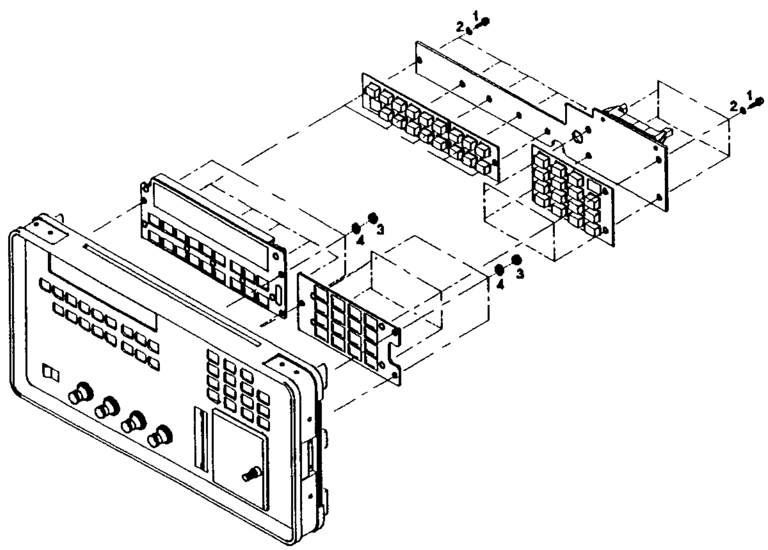

Figure 3-3. A1 Keyboard Removal

A12 Power Supply Assembly Removal

Refer to figure 3-4.

1. Remove the HP 11757B outer cover as described in the "Outer Cover Removal" procedure.
2. Put the instrument in the Service Position.
3. *Refer to figure 5-2.* Disconnect W4 from the A9 Distribution Assembly at A9J4.
4. Disconnect W5 from the A9 Distribution Assembly at A9J16.
5. Place the HP 11757B on its side with the power supply at the top and the underside of the instrument facing you.
6. Remove the four screws holding the power supply to the frame. (#5, figure 3-4).
7. Carefully slide the Power Supply forward until the line voltage socket is clear of the rear panel.
8. Carefully remove the power supply from the frame through the underside of the instrument.

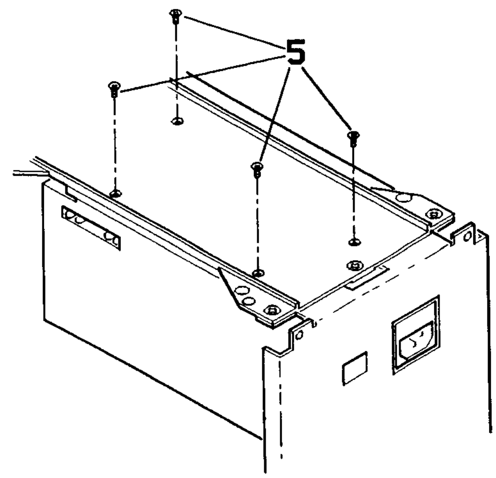

Figure 3-4. A12 Power Supply Removal

Note

For the following procedures, refer to figures 5-3 through 5-5 (in chapter 5) to ensure proper cable and assembly locations.

A4 Phase Shifter Removal (Std and Option 147)

1. Remove the HP 11757B outer cover as described in the "Outer Cover Removal" procedure.
2. Put the instrument in the Service Position.
3. Refer to figure 3-5. Disconnect the W7 cables from the feedthru capacitors on the A4 Phase Shifter Assembly.
4. Disconnect delay line W22.
5. Disconnect W12, the CH1 70 MHz cable, W14, the CH2 70 MHz cable, and W17, the 70 MHz cable.
6. Remove the four screws that secure the A4 Assembly to the instrument frame. (#6, figure 3-5).
7. Carefully remove the A4 Assembly from the instrument.

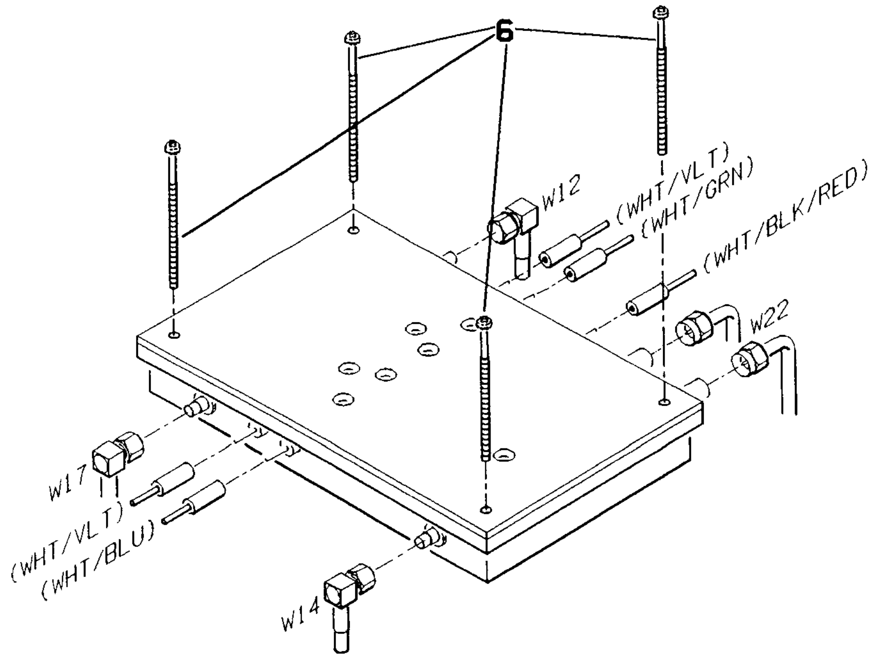

Figure 3-5. A4 Phase Shifter Assembly Removal

A6 Phase Shifter Removal (Option 140 & 147)

1. Remove the HP 11757B outer cover as described in the Outer Cover Removal procedure.
2. Put the instrument in the Service Position.
3. Refer to figure 3-6. Disconnect the W7 cables from the feedthru capacitors on the A6 Phase Shifter Assembly.
4. Disconnect delay line W23.
5. Disconnect W13, the CH1 140 MHz cable, W15, the CH2 140 MHz cable, and W18, the 140 MHz cable.
6. Remove the four screws that secure the A6 Assembly to the instrument frame. (#7, figure 3-6).
7. Carefully remove the A6 Assembly from the instrument.

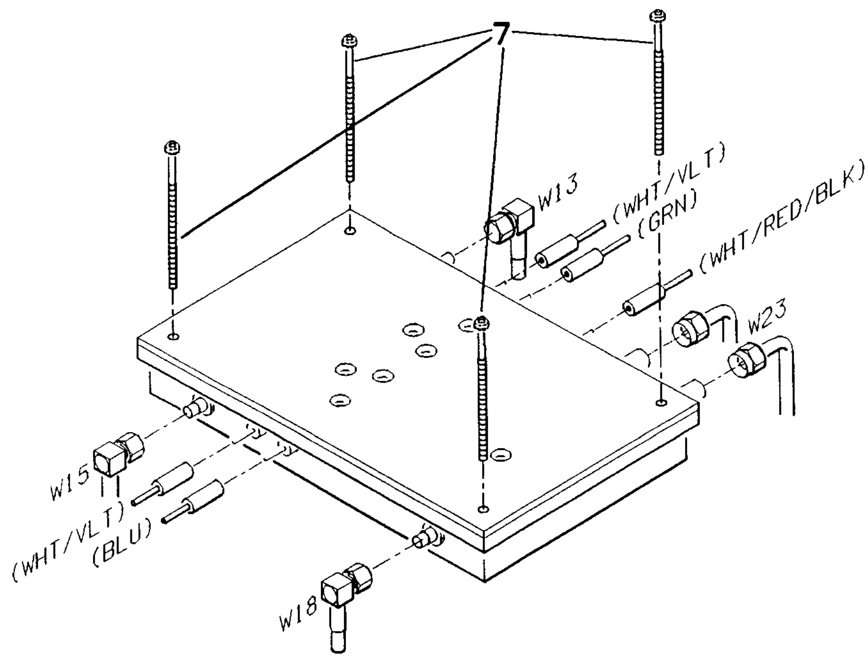

Figure 3-7. A6 Phase Shifter Assembly Removal

A5 Input Assembly Removal

If the HP 11757B is a Standard or Option 147 configuration, remove the A4 Phase Shifter Assembly as described above.

1. Refer to figure 3-7. Disconnect the W7 cables from the feedthru capacitors on the A5 Input Assembly.
2. Disconnect the signal output cables:
   a. **Standard configuration**: disconnect W12 (CH1 70 MHz) and W14 (CH2 70 MHz).
   b. **Option 140**: disconnect W13 (CH1 140 MHz) and W15 (CH2 140 MHz).
   c. **Option 147**: disconnect W12 - W15.
3. Disconnect W11, the IF INPUT cable.
4. If the HP 11757B is an Option 140 configuration, remove the four screws that secure the A5 Input Assembly to the instrument frame. (#8, figure 3-7).

Note

If the HP 11757Bis a Standard or Option 147 configuration, these screws will have been removed when the A4 Phase Shifter Assembly was removed.

5. Carefully remove the A5 Input Assembly from the instrument.

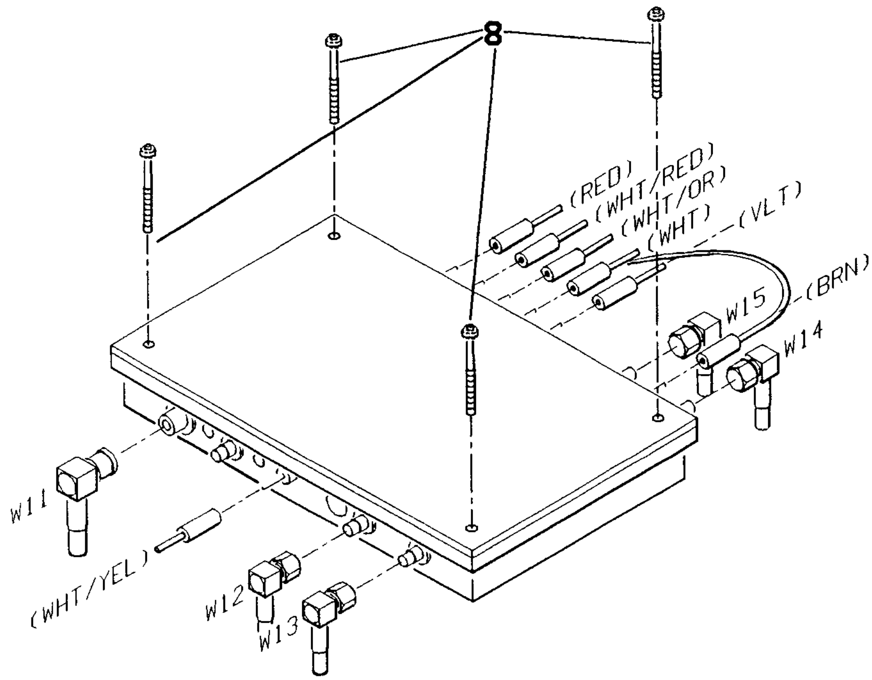

Figure 3-7. A5 Input Assembly Removal

A7 Output Assembly Removal

If the HP 11757B is an Option 140 or 147 configuration, remove the A6 Phase Shifter Assembly as described above.

1. Refer to figure 3-8. Disconnect the W7 cables from the feedthru capacitors on the A7 Output Assembly.
2. Disconnect the signal input cables:
   a. **Standard configuration**: disconnect W17 (70 MHz).
   b. **Option 140**: disconnect W18 (140 MHz).
   c. **Option 147**: disconnect both W17 and W18.
3. Disconnect W20, the IF OUTPUT cable.
4. Disconnect W19, the AUX IF OUT cable.
5. If the HP 11757B is a standard configuration, remove the four screws that secure the A7 Output Assembly to the instrument frame. (#9, figure 3-8).

Note

If the HP 11757B is an Option 140 or 147 configuration, these screws will have been removed when the A6 Phase Shifter Assembly was removed.

6. Carefully remove the A7 Output Assembly from the instrument.

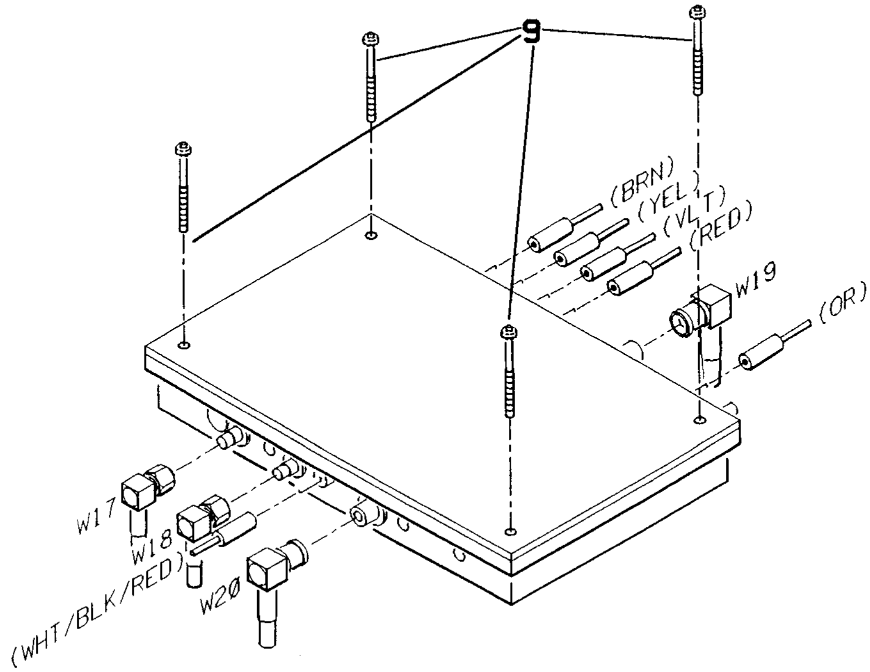

Figure 3-8. A7 Output Assembly Removal

A11 CPU Assembly Removal

1. Remove the HP 11757B outer cover as described in the "Outer Cover Removal" procedure.
2. Remove the 3 screws that secure the top of the A11 CPU Assembly to the frame (#10, figure 3-9).
3. Raise the A11 CPU board and secure it into place using the thumbscrew provided.
4. Disconnect ribbon cable W8 at A11J2.
5. Disconnect cable W10 at A11J3.
6. Disconnect cable W3 at A11J4.
7. Disconnect ribbon cable W2 at A11J5.
8. Remove the 3 screws that attach the A11 CPU Assembly to the spacer (#11, figure 3-9).
9. Carefully remove the CPU Assembly from the instrument.

Notes

1. The replacement A11 CPU Assembly, (HP part number 08782-60002), comes without the battery (BT1) and the programmed EPROMs (A11U7, U8, U24, and U25). If another CPU Assembly is ordered, it is necessary to also order another battery (HP part number 1420-0338).

   The programmed EPROMs may be either transferred from the old board to the new board, or may be ordered new. If ordered, see table 4-3, "Replaceable Parts", for the HP part number.

2. The A11 CPU Assembly has a set of dip switches on it that determine the Option setting. When the CPU Assembly arrives from the factory, the switches are set to "0000". The switches need to be set according to the Option of the instrument into which it is going to be placed. The procedure below details how to set the switches.

Option Selection

1. Check the rear panel serial tag to determine the option of the HP 11757B (Std., Opt. 140, or Opt. 147).
2. Locate switch A11S1 on the A11 CPU Assembly. (Near A11Y1, the crystal oscillator).
3. Remove the pink plastic protective cover that is over the switches.
4. Locate the numbers on the switch (1—4) to determine the number of each individual switch.
5. Set the switches according to the HP 11757B option using table 3-1 below as a guide.

Table 3-1. A11 CPU Assembly Switch Settings

HP 11757B Option	Switch Settings Down=ON
	1 2 3 4
Std	D U U U
Opt 140	D U U U
Opt 147	D U U U

6. To set the configuration into memory, set the line switch to ON and send one of the following HP-IB basic messages:

OUTPUT 714; "DIAG:OPT 17000000" (STD)
OUTPUT 714; "DIAG:OPT 17140000" (Opt 140)
OUTPUT 714; "DIAG:OPT 17147000" (Opt 147)

Note

There must be a space inserted between "DIAG:OPT and the numbers 17XXXXXX" in these messages.

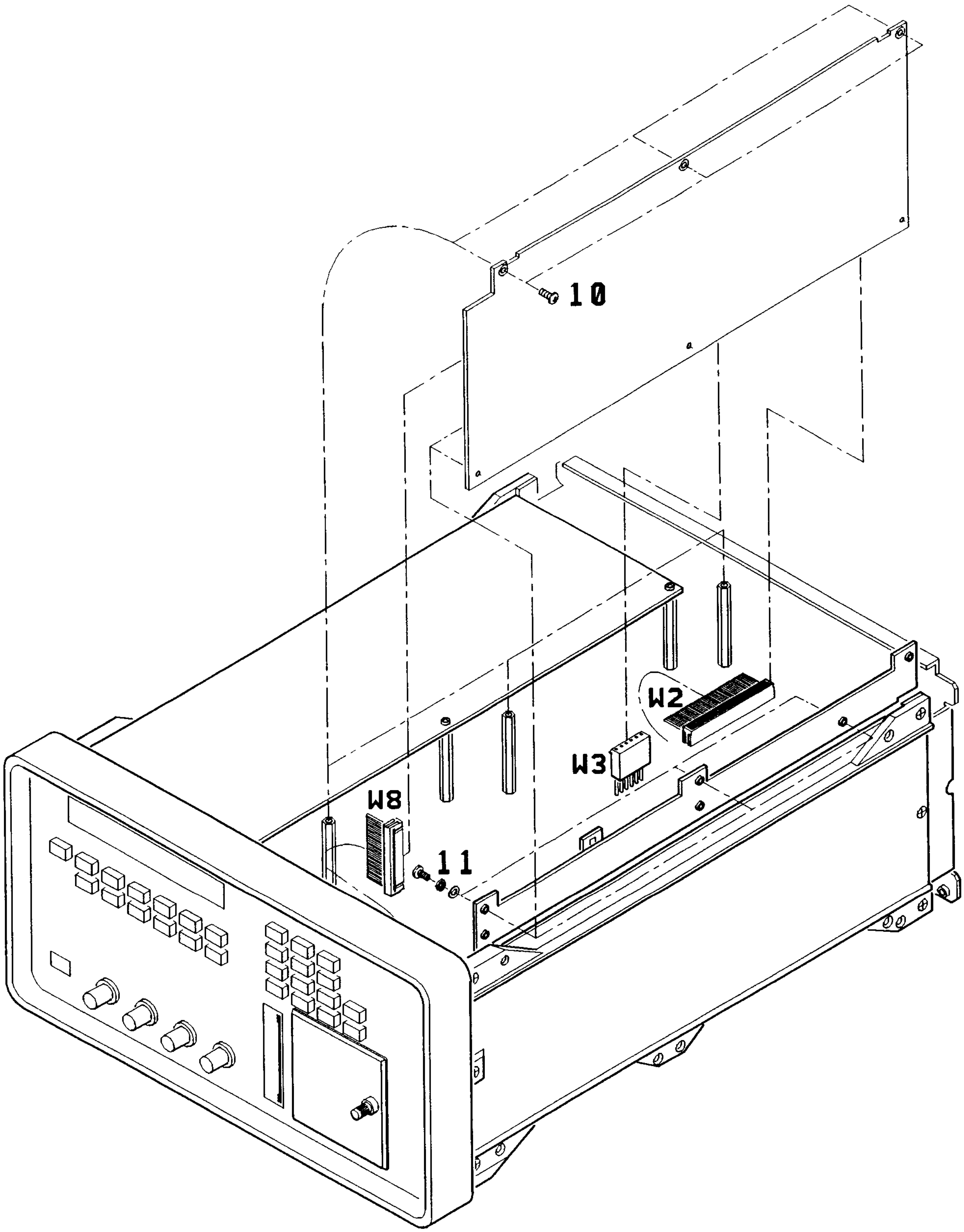

Figure 3-9. A11 CPU Assembly Removal

A2 Interface Assembly Removal

1. Remove the HP 11757B outer cover as described in the "Outer Cover Removal" procedure.
2. Put the instrument in the Service Position.
3. Disconnect ribbon Cable W1 at A2J1.
4. Remove the 3 screws that attach the A2 Interface Assembly to the molded hinges.
5. Carefully remove the Interface Assembly from the instrument.

A18 EEPROM/Counter Assembly Removal

1. Remove the HP 11757B outer cover as described in the "Outer Cover Removal" procedure.
2. Put the instrument in the Service Position.
3. Disconnect ribbon cable W1 at A2J1.
4. Disconnect ribbon Cable W25 from A18J1.
5. Disconnect EVENT INPUT cable from A18J7.
6. Disconnect ALARM INPUT cable from A18J6.
7. Remove the six screws attaching the A18 Assembly to the main deck.
8. Carefully remove the EEPROM/Counter Assembly from the instrument.

Printer Interface and Cable Removal

1. Remove the HP 11757B outer cover as described in the "Outer Cover Removal" procedure.
2. Remove the front panel as described in the "Front Panel Removal" procedure
3. *Refer to figure 3-10, Printer Interface and Cable Removal.* Disconnect the cable at the white connector (#1, figure 3-10). Disconnect flex cable at J1 (#2. fig 3-10).
4. Remove two screws (#3, fig 3-10) attaching the printhead to the front panel. Carefully remove the cable assembly from the instrument.
5. Remove the three screws (#4, fig 3-10) attaching the Interface board to the chassis. Lift the assembly free of the chassis.

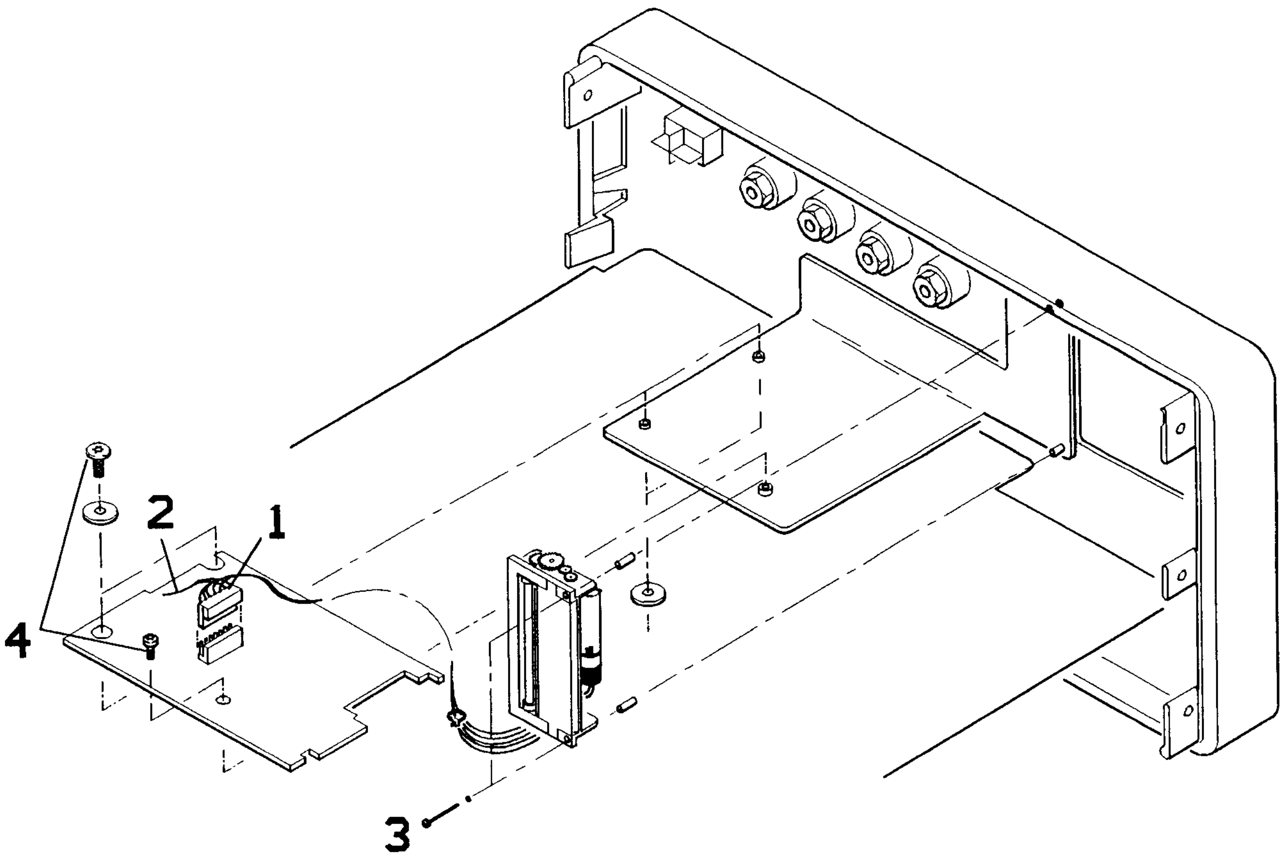

Figure 3-10. Printer Interface and Cable Removal

4

Replaceable Parts

Introduction

This chapter contains information for identifying and order-ing replacement assemblies and mechanical parts for the HP 11757B Multipath Fading Simulator (MFS). Major assembly and cable location information is given in chapter 5.

The parts lists, schematic diagrams, and component-location diagrams for the HP 11757B board assemblies are available separately in the *HP 11757B Component-Level Information Packets.*

Assembly-Level Replaceable Parts Table Format

Table 4-2 lists the following information for each major assembly and for each major mechanical and electrical part that is not part of a major assembly:

1. Assembly reference designation.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Description of the assembly.

Illustrated Parts Breakdown

Figures 4-1 through 4-8 are Illustrated Parts Breakdowns (IPBs) of the HP 11757B. Each IPB contains an exploded illustration of a section of the instrument along with a listing of the parts that are identified in each figure.

The following information is listed for each part:

1. Item number of each indicated part in the figure.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Description of the part.
5. Manufacturer's part number.

Factory Selected Parts (*)

Parts marked with an asterisk (*) are factory selected parts. The value listed in the parts list is the nominal value.

Parts List Updating (Manual Updates Package)

Production changes to instruments made after the publication date of this manual are accompanied by a change in the serial number prefix. Changes to the parts list are recorded by serial number prefix in a *Manual Updates* package that is available from Hewlett-Packard. Complimentary copies of the *Manual Updates* package are available from Hewlett-Packard.

Ordering Information

To order a part listed in the replaceable parts table, include the Hewlett-Packard part number (along with the check digit), and the quantity required. Address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, description and function of the part, and the

number of parts required. Address the order to the nearest Hewlett-Packard office.

Note

Within the USA, it is better to order directly from the HP Parts Center in Mountain View, California. Ask your nearest HP office for information and forms for the "Direct Mail Order System".

Table 4-1. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A .... assembly
AT ...... attenuator; isolator; termination
B .... fan; motor
BT .... battery
C .... capacitor
CP .... coupler
CR .... diode; diode thyristor; varactor
DC .... directional coupler
DL .... delay line
DS .... annunciator; signaling device (audible or visual); lamp; LED
E miscellaneous electrical part
F .... fuse
FL .... filter
H .... hardware
HY .... circulator
J .... electrical connector (stationary portion); jack
K .... relay
L .... coil; inductor
M .... meter
MP . miscellaneous mechanical part
P electrical connector (movable portion); plug
Q ..... transistor; SCR; triode thyristor
R .... resistor
RT .... thermistor
S .... switch
T .... transformer
TB .... terminal board
TC .... thermocouple
TP .... test point
U .... integrated circuit; microcircuit
V .... electron tube
VR .... voltage regulator; breakdown diode
W ... cable; transmission path; wire
X .... socket
Y crystal unit (piezoelectric or quartz)
Z .. tuned cavity; tuned circuit

ABBREVIATIONS

A .... ampere
ac .... alternating current
ACCESS .... accessory
ADJ .... adjustment
A/D .... analog-to-digital
AF .... audio frequency
AFC .... automatic frequency control
AGC .. automatic gain control
AL .... aluminum
ALC .. automatic level control
AM .... amplitude modulation
AMPL .... amplifier
APC . automatic phase control
ASSY .... assembly
AUX .... auxiliary
avg .... average
AWG ... American wire gauge
BAL .... balance
BCD ... binary coded decimal
BD .... board
BE CU ..... beryllium copper
BFO . beat frequency oscillator
BH .... binder head
BKDN .... breakdown
BP .... bandpass
BPF .... bandpass filter
BRS .... brass
BWO backward-wave oscillator
CAL .... calibrate
ccw .... counterclockwise
CER .... ceramic
CHAN .... channel
cm .... centimeter
CMO ..... cabinet mount only
COAX .... coaxial
COEF .... coefficient
COM .... common
COMP .... composition
COMPL .... complete
CONN .... connector
CP .... cadmium plate
CRT .... cathode-ray tube
CTL complementary transistor logic
CW .... continuous wave
cw .... clockwise
cm .... centimetre
D/A .... digital-to-analog
dB .... decibel
dBm decibel referred to 1 mW
dc .... direct current
deg ...... degree (temperature interval or difference)
... ° ... degree (plane angle)
°C degree Celsius (centigrade)
°F .... degree Fahrenheit
°K .... degree Kelvin
DEPC ...... deposited carbon
DET .... detector
diam .... diameter
DIA .. diameter (used in Parts List)
DIFF AMPL ...... differential amplifier
div .... division
DPDT .... double-pole, double-throw
DR .... drive
DSB .... double sideband
DTL .... diode transistor logic
DVM .... digital voltmeter
ECL .... emitter coupled logic
EMF ..... electromotive force
EDP electronic data processing
ELECT .... electrolytic
ENCAP .... encapsulated
EXT .... external
F .... farad
FET .... field-effect transistor
F/F .... flip-flop
FH .... flat head
FIL H .... fillister head
FM .... frequency modulation
FP .... front panel
FREQ .... frequency
FXD .... fixed
g .... gram
GE .... germanium
GHz .... gigahertz
GL .... glass
GRD .... ground(ed)
H .... henry
h .... hour
HET .... heterodyne
HEX .... hexagonal
HD .... head
HDW .... hardware
HF .... high frequency
HG .... mercury
HI .... high
HP .... Hewlett-Packard
HPF .... high-pass filter
HR .. hour (used in Parts List)
HV .... high voltage
Hz .... Hertz
IC .... integrated circuit
ID .... inside diameter
IF .... intermediate frequency
IMPG .... impregnated
in .... inch
INCD .... inncandescent
INCL .... include(s)
INP .... input
INS .... insulation
INT .... internal
kg .... kilogram
kHz .... kilohertz
kΩ .... kilohm
kV .... kilovolt
lb .... pound
LC .... inductance-capacitance
LED ..... light-emitting diode
LF .... low frequency
LG .... long
LH .... left hand
LIM .... limit
LIN linear taper (used in Parts List)
lin .... linear
LK WASH .... lock washer
LO .... low; local oscillator
LOG .. logarithmic taper (used in Parts List)
log .... logrithm(ic)
LPF .... low pass filter
LV .... low voltage
m .... metre (distance)
mA .... millampere
MAX .... maximum
MΩ .... megohm
MEG meg (10^6) (used in Parts List)
MET FLM .... metal film
MET OX ...... metallic oxide
MF .... medium frequency; microfarad (used in Parts List)
MFR .... manufacturer
mg .... milligram
MHz .... megahertz
mH .... millihenry
mho .... mho
MIN .... minimum
min .... minute (time)
... ′ ... minute (plane angle)
MINAT .... miniature
mm .... millimetre
MOD .... modulator
MOM .... momentary
MOS .... metal-oxide semiconductor
ms .... millisecond
MTG .... mounting
MTR meter (indicating device)
mV .... millivolt
mVac .... millivolt, ac
mVdc .... millivolt, dc
mVpk .... millivolt, peak
mVp-p . millivolt, peak-to-peak
mVrms .... millivolt, rms
mW .... milliwatt
MUX .... multiplex
MY .... mylar
μA .... microampere
μF .... microfarad
μH .... microhenry
μmho .... micromho
μs .... microsecond
μV .... microvolt
μVac .... microvolt, ac
μVdc .... microvolt, dc
μVpk .... microvolt, peak
μVp-p microvolt, peak-to-peak
μVrms .... microvolt, rms
μW .... microwatt

NOTE

All abbreviations in the Parts List appear in uppercase.

Table 5-1. Reference Designations and Abbreviations (2 of 2)

ABBREVIATIONS (cont'd)

nA .... nanoampere
NC .... no connection
N/C .... normally closed
NE .... neon
NEG .... negative
nF .... nanofarad
NI PL .... nickel plate
N/O .... normally open
NOM .... nominal
NORM .... normal
NPN negative-positive-negative
NPO .... negative-positive zero .... (zero temperature coefficient)
NRFR .. not recommended for field replacement
NSR .... not separately replaceable
ns .... nanosecond
nW .... nanowatt
OBD .... order by description
OD .... outside diameter
OH .... oval head
OP AMPL .... operational amplifier
OPT .... option
OSC .... oscillator
OX .... oxide
oz .... ounce
Ω .... ohm
P ... peak (used in Parts List)
PAM .... pulse-amplitude modulation
PC .... printed circuit
PCM .. pulse-code modulation; pulse-count modulation
PDM .... pulse-duration modulation
pF .... picofarad
PH BRZ .... phosphor bronze
PHL .... Phillips
PIN .... positive-intrinsic-negative
PIV ..... peak inverse voltage
pk .... peak
PL .... phase lock
PLO .... phase lock oscillator
PM .... phase modulation
PNP positive-negative-positive
P/O .... part of
POLY .... polystyrene
PORC .... porcelain
POS positive; position(s) (used in Parts List)
POSN .... position
POT .... potentiometer
p-p .... peak-to-peak
PP peak-to-peak (used in Parts List)
PPM .... pulse-position modulation
PREAMPL ...... preamplifier
PRF pulse-repetition frequency
PRR .... pulse repetition rate
ps .... picosecond
PT .... point
PTM .. pulse-time modulation
PWM . pulse-width modulation
PWV ... peak working voltage
RC .... resistance-capacitance
RECT .... rectifier
REF .... reference
REG .... regulated
REPL .... replaceable
RF .... radio frequency
RFI .... radio frequency interference
RH ... round head; right hand
RLC ... resistance-inductance-capacitance
RMO .... rack mount only
rms .... root-mean-square
RND .... round
RAM .. random-access memory
ROM ...... read-only memory
R&P .... rack and panel
RWV . reverse working voltage
S .... scattering parameter
s .... second (time)
... " ... second (plane angle)
S-B .... slow-blow (fuse) (used in Parts List)
SCR silicon controlled rectifier; screw
SE .... selenium
SECT .... sections
SEMICON ..... semiconductor
SHF .... super-high frequency
SI .... silicon
SIL .... silver
SL .... slide
SNR ..... signal-to-noise ratio
SPDT .... single-pole, double-throw
SPG .... spring
SR .... split ring
SPST single-pole, single-throw
SSB .... single sideband
SST .... stainless steel
STL .... steel
SQ .... square
SWR ..... standing-wave ratio
SYNC .... synchronize
T ..... timed (slow-blow fuse)
TA .... tantalum
TC temperature compensating
TD .... time delay
TERM .... terminal
TFT ...... thin-film transistor
TGL .... toggle
THD .... thread
THRU .... through
TI .... titanium
TOL .... tolerance
TRIM .... trimmer
TSTR .... transistor
TTL transistor-transistor logic
TV .... television
TVI .... television interference
TWT .... traveling wave tube
U .... micro (10^{-6}) (used in Parts List)
UF . microfarad (used in Parts List)
UHF .... ultra-high frequency
UNREG .... unregulated
V .... volt
VA .... voltampere
Vac .... volts, ac
VAR .... variable
VCO .... voltage-controlled oscillator
Vdc .... volts, dc
VDCW ..... volts, dc, working (used in Parts List)
V(F) .... volts, filtered
VFO ...... variable-frequency oscillator
VHF ..... very-high frequency
Vpk .... volts, peak
Vp-p ..... volts, peak-to-peak
Vrms .... volts, rms
VSWR . voltage standing-wave ratio
VTO . voltage-tuned oscillator
VTVM vacuum-tube voltmeter
V(X) .... volts, switched
W .... watt
W/ .... with
WIV .. working inverse voltage
WW .... wirewound
W/O .... without
YIG ...... yttrium-iron-garnet
Z_o ... characteristic impedance

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

NOTE

All abbreviations in the Parts List appear in uppercase.

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
A1	11757-60037	0	1	KEYBOARD A1 AY	28480	11757-60037
A2	11757-60004	3	1	INTFC BD AY	28480	11757-60004
A3	00437-60015	6	1	DISPLAY BD AY	28480	00437-60015
A4	11757-60007	4	1	MFS 70MHZ BD AY (STD, & OPT 147)	28480	11757-60007
A5	11757-60012	3	1	MFS INPUT AY MODULE	28480	11757-60012
	11757-60006	5	1	PC BOARD FOR A5 MODULE	28480	11757-60006
A6	11757-60008	5	1	MFS 140MHZ BD AY (OPT 140, OPT 147)	28480	11757-60008
A7	11757-60009	6	1	MFS OUTPUT BD AY	28480	11757-60009
A9	11758-60030	2	1	DISTRIBUT BD AY	28480	11758-60030
A11	08782-60036	5	1	PROCESSOR BD AY	28480	08782-60036
A11BT1	1420-0338	0	1	BR 2/3A BATTERY	08712	BR2/3AE25P
A11U7	11758-80016	1	1	EPROM PROGRAMMED (OPT 001 ONLY)	28480	11758-80016
	11758-80020		1	EPROM PROGRAMMED (STD, OPT 140, 147)	28480	11758-80020
A11U8	11758-80017	2	1	EPROM PROGRAMMED (OPT 001 ONLY)	28480	11758-80017
	11758-80021		1	EPROM PROGRAMMED (STD, OPT 140, 147)	28480	11758-80021
A11U24	11758-80018	5	1	EPROM PROGRAMMED (OPT 001 ONLY)	28480	11758-80018
	11758-8822		1	EPROM PROGRAMMED (STD, OPT 140, 147)	28480	11758-80022
A11U25	11758-80019	6	1	EPROM PROGRAMMED (OPT 001 ONLY)	28480	11758-80019
	11758-80023		1	EPROM PROGRAMMED (SD, OPT 140, 147)	28480	11758-80023
A12	0950-1977	7	1	POWER SUPPLY AY	12666	10-0060
A18	11757-60038	1	1	EEPROM/COUNTER BD AY	28480	11757-60038
W1	11757-60005	4	1	SYS INFC CBL AY	28480	11757-60005
W2	11757-60016	7	1	PROCESSOR CBL AY	28480	11757-60016
W3	11757-60017	8	1	PROC PWR CBL AY	28480	11757-60017
W4	11757-60003	2	1	PWR SPLY CBL AY	28480	11757-60003
W5				NOT SEPARATELY REPLACEABLE P/O R1		
W6				NOT SEPARATELY REPLACEABLE		
W7	11757-60022	5	1	MFS POWER/CONTROL CABLE AY	28480	11757-60022
W8	11757-60002	1	1	FRONT PNL CBL AY	28480	11757-60002
W9	00437-60023	6	1	DISPLAY CABLE	28480	00437-60023
W10	08780-60046	5	1	CBL AY HPIB	28480	08780-60046
W11	11757-60018	9	2	IF INPUT CBL AY, 75 OHM	28480	11757-60019
W12	08780-60079	4	4	CH2 70 MHZ CBL AY, STD, OPT 147	28480	08780-60079
W13	08780-60079	4		CH2 140 MHZ CBL AY, OPT 140, 147	28480	08780-60079
W14	08780-60079	4		CH1 70 MHZ CBL AY, STD, OPT 147	28480	08780-60079
W15	08780-60079	4		CH1 140 MHZ CBL AY, OPT 140, 147	28480	08780-60079
W16	11757-60019	0	3	EVENT INPUT CBL AY, 75 OHM	28480	11757-60019
W17	08780-60080	4	2	70 MHZ CBL AY, STD, OPT 147	28480	08780-60080
W18	08780-60080	4		140 MHZ CBL AY, OPT 140, 147	28480	08780-60080
W19	11757-60019	0		AUX IF OUT CBL AY, 75 OHM	28480	11757-60019
W20	11757-60018	9		IF OUTPUT CBL AY, 75 OHM	28480	11757-60018
W21	11757-60019	0		ALARM INPUT CBL AY, 5 OHM		
W22	11757-20012	9	1	DLY LINE 70MHZ	28480	11757-20012
W23	11757-20013	0	1	DLY LINE 140MHZ	28480	11757-20013
W24	11758-60006	6	1	AUX INTFC CBL AY	28480	11758-60006
W25	11758-60031	6	1	EPROM CBL AY	26480	11758-60031

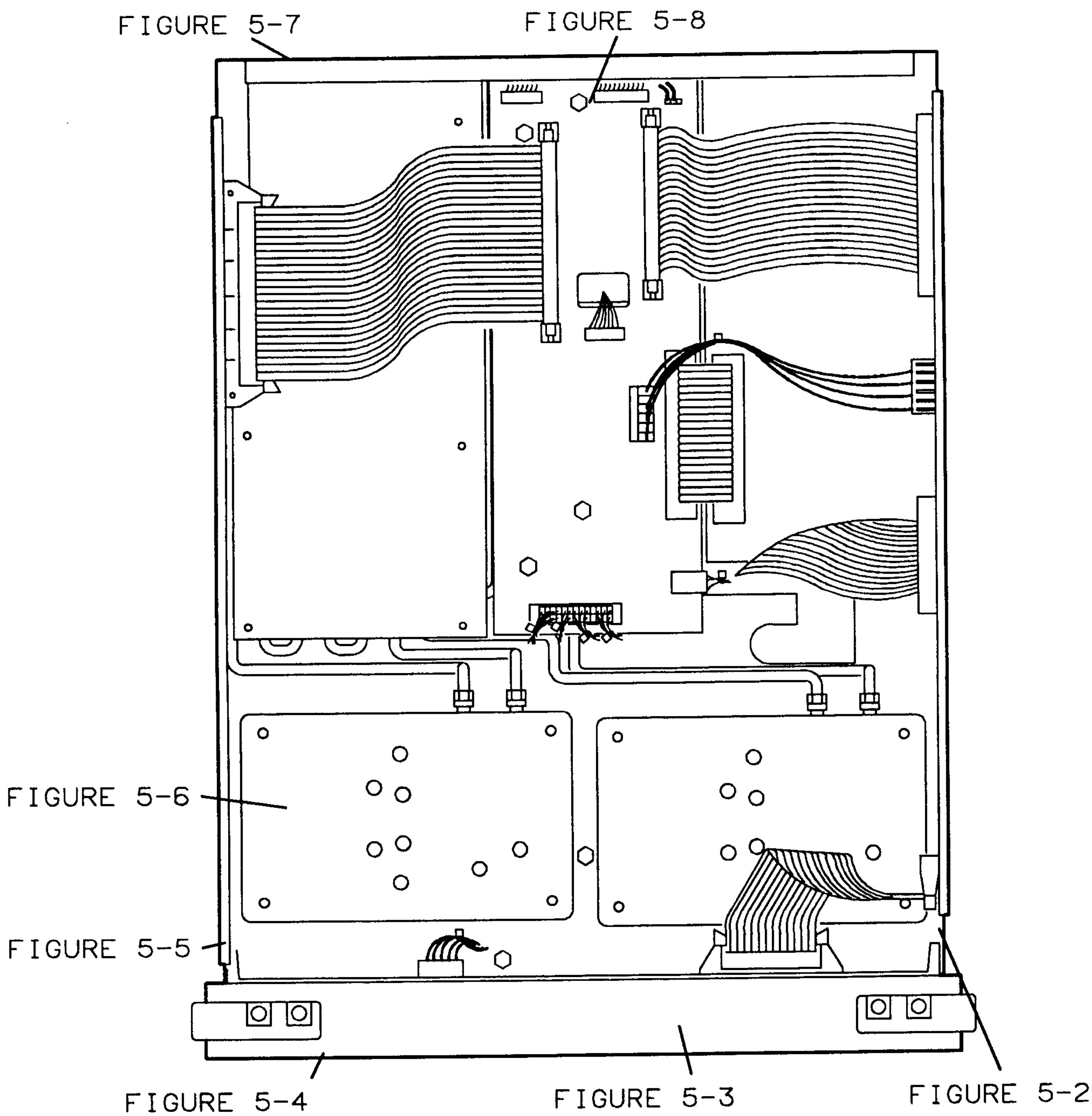

Figure 4-1. Illustrated Parts Breakdown Locations

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
FIGURE 4-2						
1	08590-60112	6	1	COVER AY	28480	08590-60112
2	P/O #1	8	4		28480	P/O #1
3	0515-0433		4	SCREW-MACH M4 X 0.7	28480	0515-0433

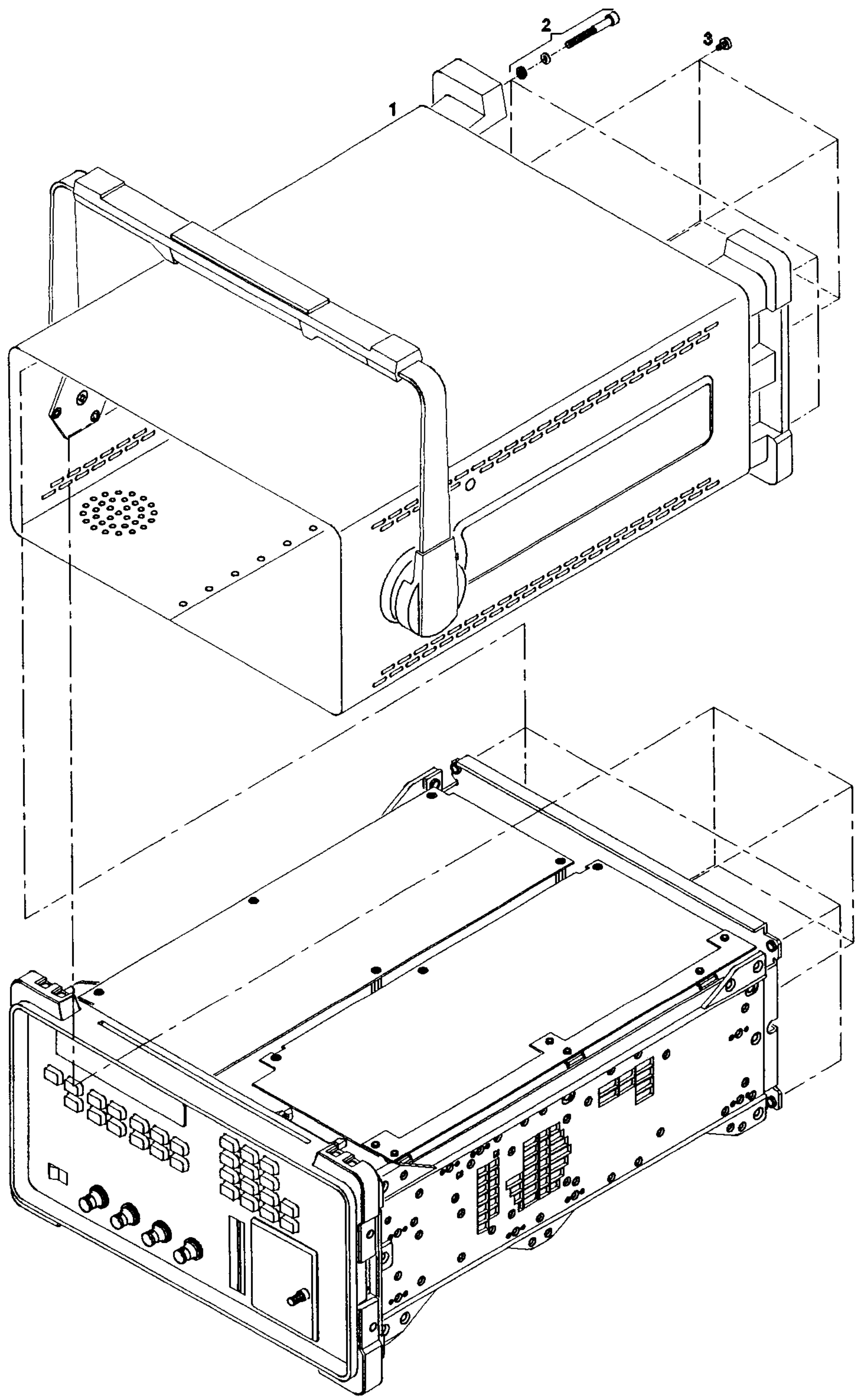

Figure 4-2. Cabinet Parts Illustrated Parts Breakdown

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
FIGURE 4-3						
1	0515-0372		8	SCREW-MACH	28480	0515-0372
2	5062-4806	9	1	KIT-BUMPER (SET OF FOUR)	28480	5062-4806
3	0515-2043		6	SCREW-MACH	28480	0515-2043

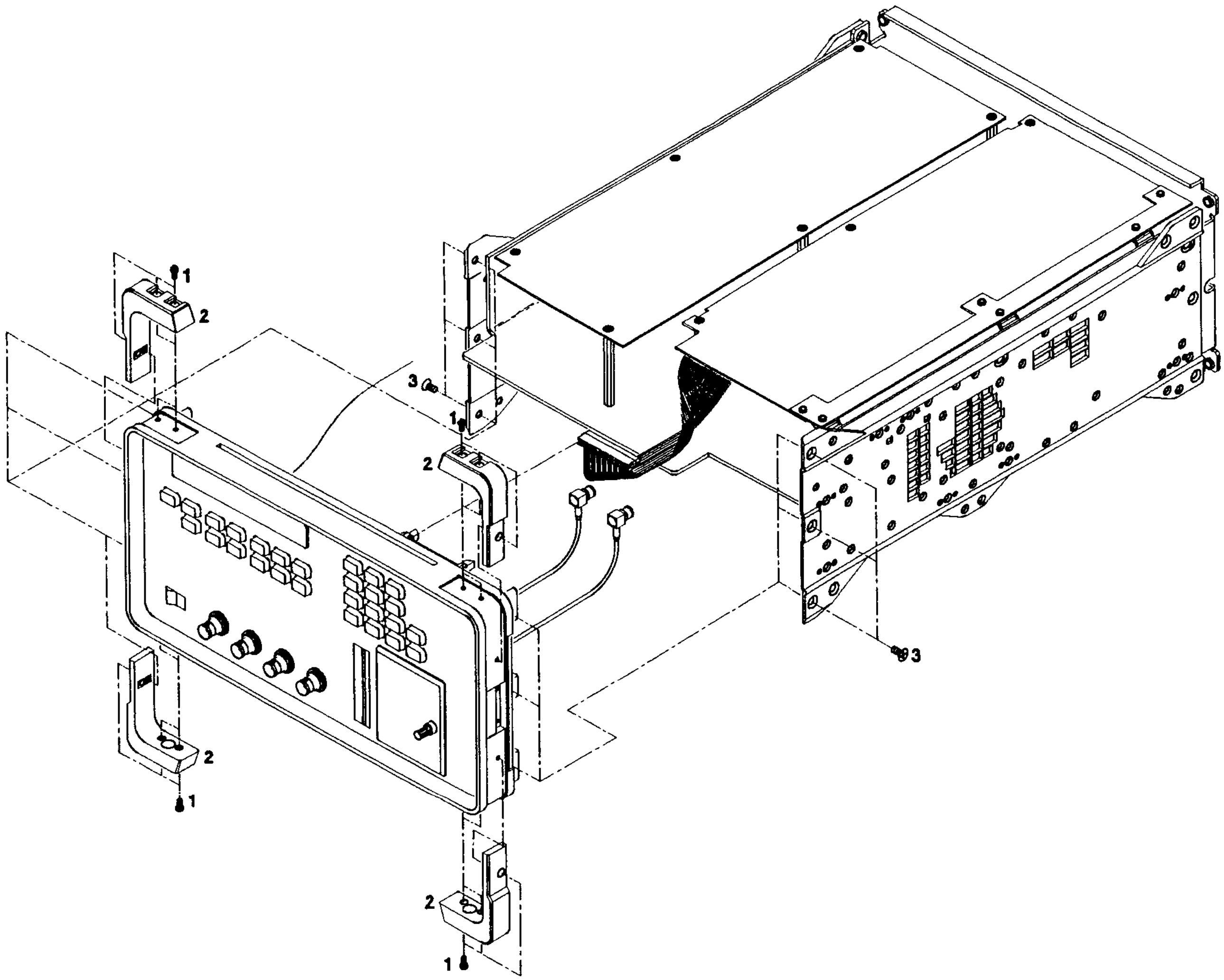

Figure 4-3. Front Panel Removal Illustrated Parts Breakdown

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
FIG 4-4						
	11757-60054			NO MCURVE FRONT AY (OPTION 001 ONLY)	28480	11757-60054
	11757-60046			FRONT AY (STD, OPT 140, 147)		
1	11757-00021		1	FRONT PANEL (OPT 001 ONLY)	28480	11757-00021
	11757-00024		1	FRONT PANEL (STD, OPT 140, 147)	28480	11757-00024
2	0590-1649	6	4	NUT-KNRLD-R 15/32-32-THD .08-IN-THK	00000	ORDER BY DESCRIPTION
3	5040-5448	1	1	WINDOW	28480	5040-5448
4	00437-60015	6	1	DISPLAY BOARD ASSEMBLY	28480	00437-60015
5	3050-0891	7	10	WASHER-FL MTLC	28480	3050-0891
6	0515-0430	3	11	SCREW-MACH	28480	0515-0430
7	11757-20020		1	FRAME-FRONT	28480	11757-20020
8				NOT ASSIGNED		
9	11757-60045	2	1	LINE SWITCH ASSEMBLY	28480	11757-60045
10	2190-0586	2	15	WASHER-LK HLCL 4.0 4.1-MM-ID 7.6-MM-OD	28480	2190-0586
11	0535-0006	1	14	NUT-HEX DBL-CHAM M4 X 0.7 3.8MM-THK	00000	ORDER BY DESCRIPTION
12	11757-60037	0	1	KEYBOARD A1 AY	28480	11757-60001
13	0515-0374		2	SCREW-MACH	28480	0515-0430
14	11757-60042		1	DISPLAY CABLE	28480	11757-60042
15	11757-00016	1	1	KEY SPACER 1	28480	11757-00016
16	11757-00017	2	1	KEY SPACER 2	28480	11757-00017
17	11757-40001	8	1	KEYPAD 1	28480	11757-40001
18	11757-40002	9	1	NUMERIC KEYPAD	28480	11757-40002
19	11757-40003	0	1	KEYPAD 3	28480	11757-40003
20	03789-40001	9	1	PAPER HOLDER (EXCEPT OPT 001)	28480	03789-40001
21	11757-20021		1	PAPER CARRIER	28480	11757-20021
22	11757-20022		2	BUSHING (EXCEPT OPT 0010	28480	11757-20022
23	11757-60040	7	1	PRINTHEAD CABLE AY (EXCEPT OPT 001)	28480	11757-60040
24	11757-60050	9	1	PRT INTERFACE BD (EXCEPT OPT 001)TS	28480	11757-60050
25	2190-0654		2	WASHER-LK HLCL		
26	0515-0974		2	SCREW-MACH M2 X 0.4		
27	2190-0320		4	WASHER-FL NM		
28	0515-0386		2	SCREW-MACH M5 X 0.8		
29	11757-00018	3	1	PRINTER BRACKET	28480	11757-00018
30	37721-40002		1	PAPER TEAR		
31	11757-20003		1	SPACER PC	28480	11757-20003
32	0515-1103		1	SCREW-FLHD		
33	0515-0886		1	SCREW-MACH		
34	9270-1299		1	PAPER-THERMAL		
35	1390-0676		1	FASTENER LATCH		

Printer
controller
11757-60046 Front Assy

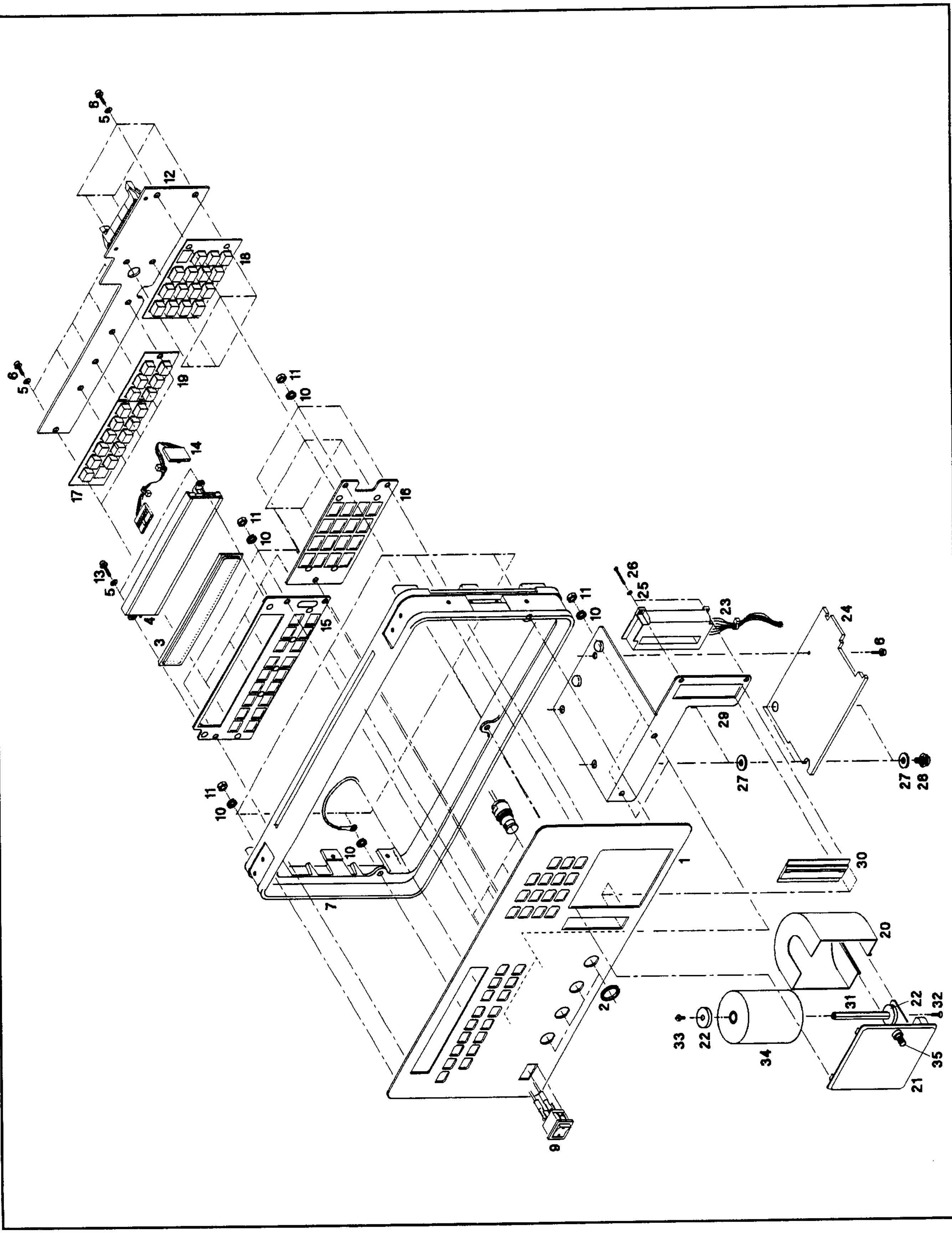

Figure 4-4. Front Panel Illustrated Parts Breakdown

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
FIGURE 4-5						
1	11757-20017	4	2	HINGE BRACKET	28480	11757-20017
2	3050-0891	7	2	WASHER-FL MTLC 3.0 3.3-MM-ID 6.85-MM-OD	28480	3050-0891
3	2190-0584	0	8	WASHER-LK HLCL 3.0 3.1-MM-ID 6.2-MM-OD	28480	2190-0584
4	11757-20016	3	2	THUMB SCREW	28480	11757-20016
5	0515-0886	3	15	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	00000	ORDER BY DESCRIPTION
6	3050-0227	3	6	HINGE-MOLDED	80120	AN960C-6
7	11757-60004	3	1	INTFC BD AY	28480	11757-60004
8	08782-60002	5	1	PROCESSOR BD AY	28480	08782-60002
9	11757-00004	7	1	BRACKET PROC	28480	11757-00004

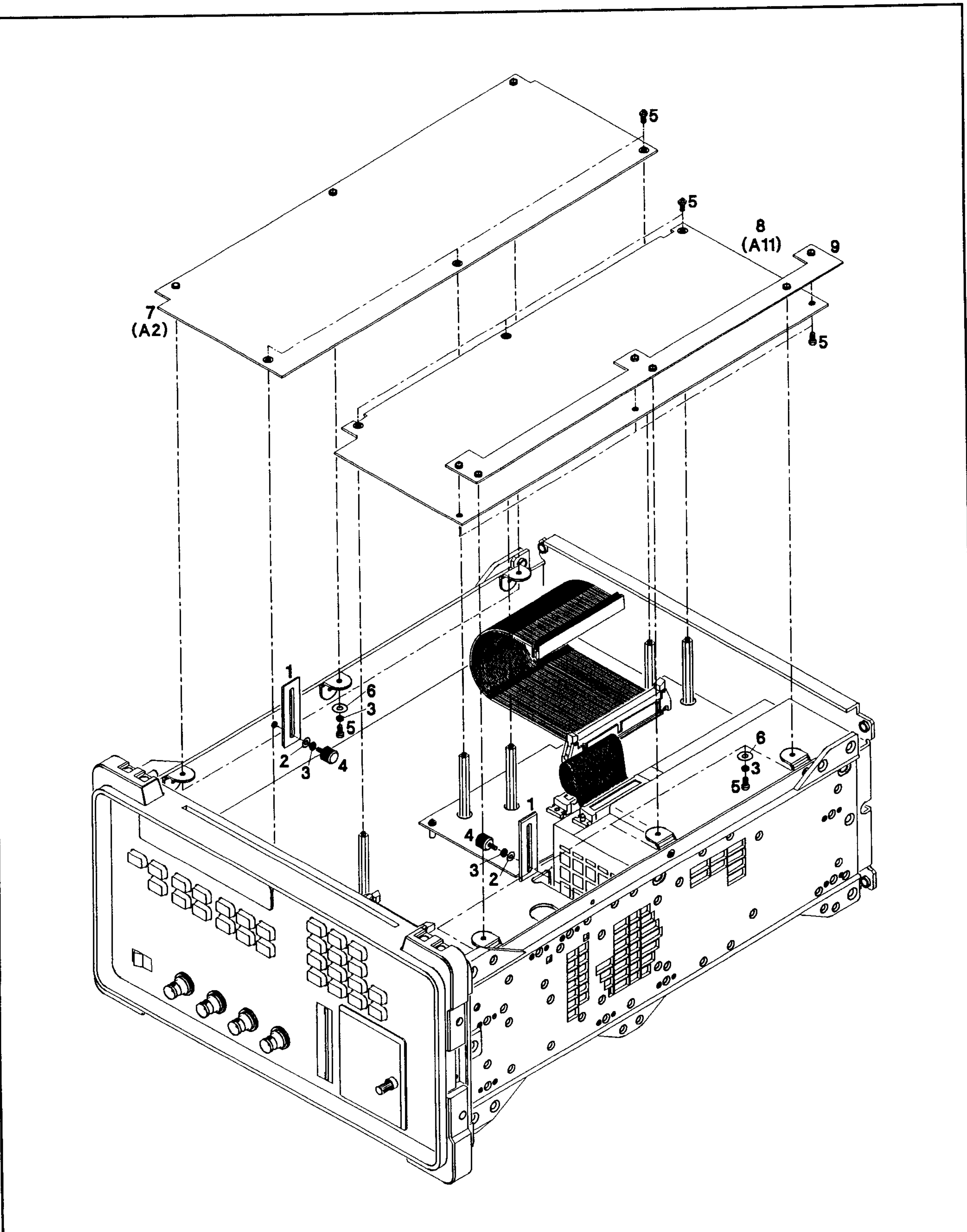

Figure 4-5. Circuit Board Illustrated Parts Breakdown

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
FIGURE 4-6						
1	11757-60012	3	1	MFS INPUT AY	28480	11757-60012
2	11757-60009	6	1	MFS OUTPUT AY	28480	11757-60009
3	86792-00006	9	2	CKT HOUSING CVR	28480	86792-00006
4	11757-60007	4	1	MFS 70MHZ AY	28480	11757-60007
5	11757-60008	5	1	MFS 140MHZ AY	28480	11757-60008
6	11757-00006	9	2		28480	11757-00006
7	0515-1060	7	8	SCREW-MACH M3 X 0.5 25MM-LG PAN-HD	00000	ORDER BY DESCRIPTION
7	0515-1466	7	8	SCREW-MACHINE ASSEMBLY M3 X 0.5 50MM-LG	00000	ORDER BY DESCRIPTION
8	11757-20012	9	1	DLY LINE 70MHZ	28480	11757-20012
9	11757-20013	0	1	DLY LINE 140MHZ	28480	11757-20013
10	0515-0886	3	1	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	00000	ORDER BY DESCRIPTION
11	1400-0054	5	1	CLAMP-CABLE .078-DIA .375-WD STL	79963	139

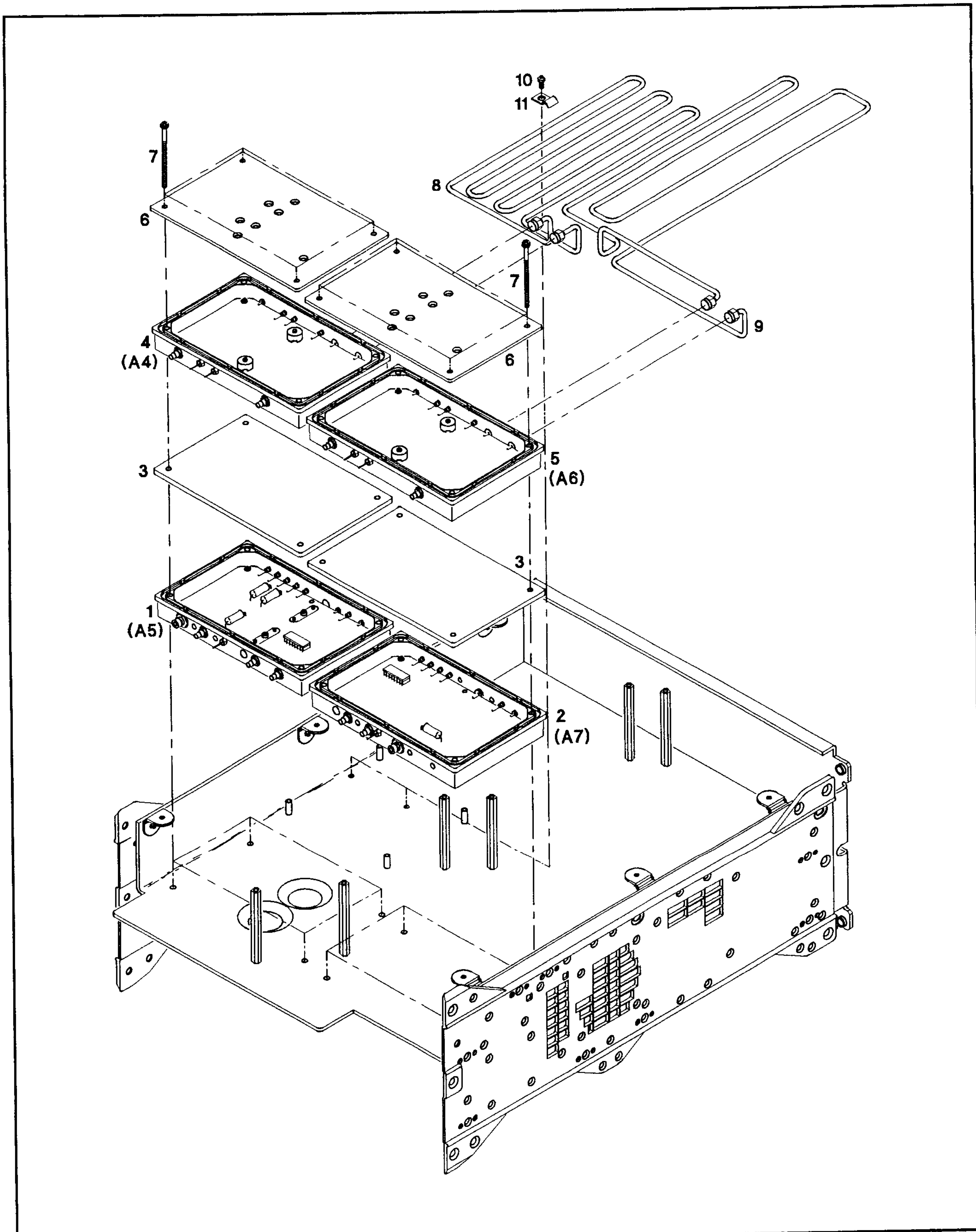

Figure 4-6. Modules and Delay Lines Illustrated Parts Breakdown

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
FIGURE 4-7						
1	0515-1715	1	4	SCREW-MACH M3 X 0.5 40MM-LG PAN-HD	00000	ORDER BY DESCRIPTION
2	2190-0645	0	4	WASHER-LK HLCL 3.0 3.1-MM-ID 6.2-MM-OD	28480	2190-0645
3	3050-0891	7	4	WASHER-FL MTLC 3.0 3.3-MM-ID 6.85-MM-OD	28480	3050-0891
4	3160-0309	5	1	FINGER GUARD	06660	9480-2-4039-1
5	08590-60026	1	1	FAN	28480	08590-60026
6	0380-1900	7	4	SPACER-RND .688-IN-LG .166-IN-ID	28480	0380-1900
7	11757-20005	0	1	SPACER FAN	28480	11757-20005
8	6960-0016	0	1	PLUG-HOLE TR-HD FOR .125-D-HOLE NYL	02768	207-080501-01-0101
9	6960-0002	4	1	PLUG-HOLE TR-HD FOR .5-D-HOLE STL	71785	SS-48152-K1110
10	0590-1649	6	1	NUT-KNRLD-R 15/32-32-THD .08-IN-THK	00000	ORDER BY DESCRIPTION
11	0515-1946	9	1	SCREW-MACH M3 X 0.5 6MM-LG 90-DEG-FLH-HD	00000	ORDER BY DESCRIPTION
12	1252-0553	4	2	SCREW LOCK KIT-SUBMIN D CONN	00779	207719-3
13	11757-60019	9	1	75OHM L CBL AY	28480	11757-60019
14	0515-0430		3	SCREW-MACH	28480	0515-0430
15	0590-0076	1	2	NUT-HEX-PLSTC LKG 4-40-THD .143-IN-THK	00000	ORDER BY DESCRIPTION
16	08780-60046	5	1	CABLE AY HPIB	28480	08780-60046
17	1251-7002	0	2	SCREW KIT-AMP CHAMP CONN	05791	LT4283
18	0515-2043		6	SCREW-MACH	28480	0515-2043
19	11758-00011	6	1	REAR PANEL	28480	11758-00011

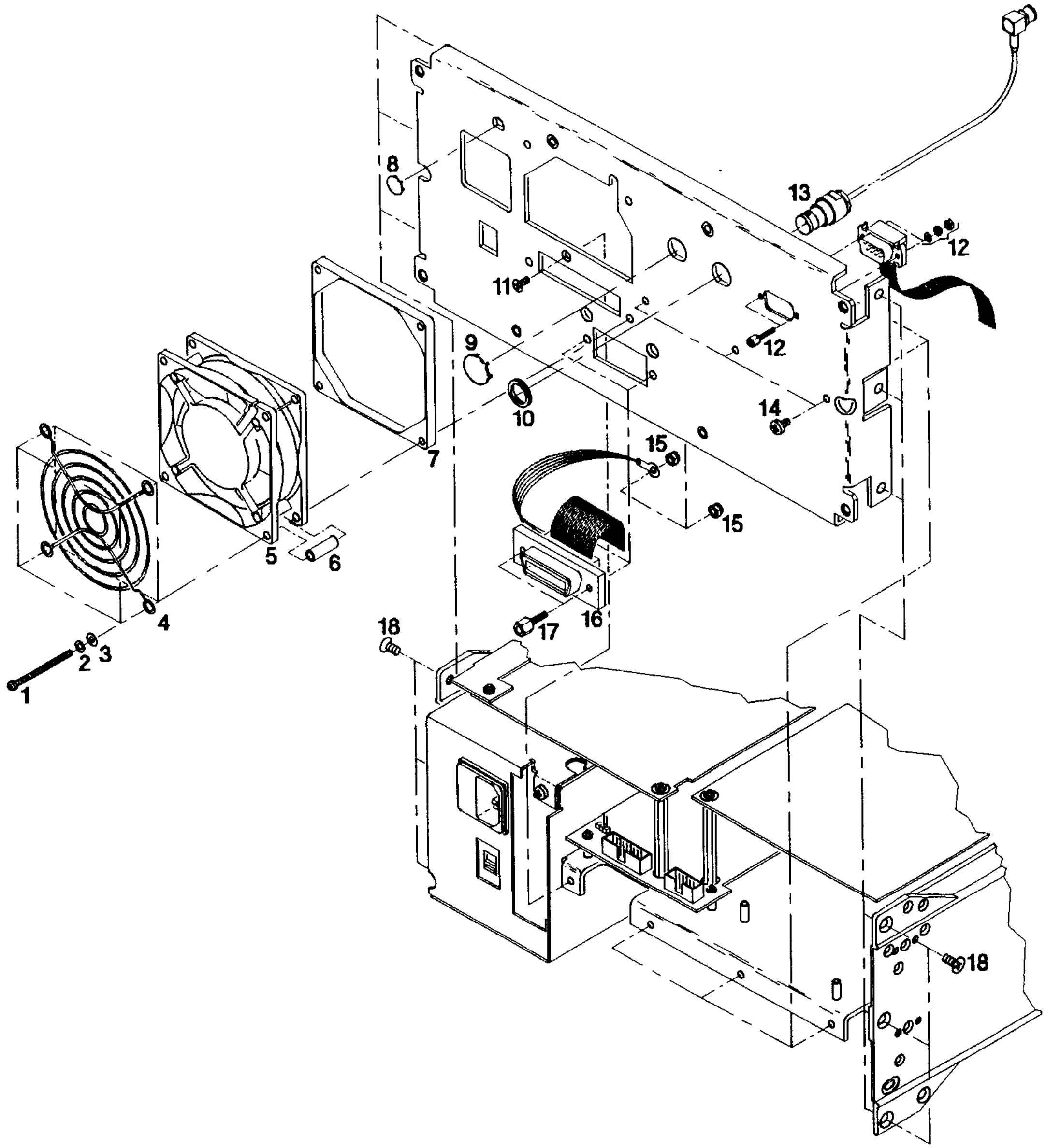

Figure 4-7. Rear Panel Illustrated Parts Breakdown

Table 4-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Manufacturer Part Number
FIGURE 4-8						
1	0515-1946		4	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	28480	0515-1946
2	08590-20019	8	2	FRAME-SIDE	28480	08590-20019
3	0515-0430		4	SCREW-MACH	28480	0515-0430
4	11757-00005	8	1	SPACER PWR SPLY	28480	11757-00005
5	0950-1977	7	1	PWR-SPLY; POWER-100W; NO.-OF-OUTPUTS-4	12666	10-0060
6	0515-1146	0	6	SCREW-MACHINE ASSEMBLY M3 X 0.5 6MM-LG	00000	ORDER BY DESCRIPTION
7	0515-0890	9	11	SCREW-MACH M3 X 0.5 6MM-LG 90-DEG-FLH-HD	00000	ORDER BY DESCRIPTION
8	11757-20003	8	6	SPACER PC	28480	11757-20003
9	11757-00002	5	1	DECK-MAIN	28480	11757-00002
10	0515-0891	0	6	SCREW-MACH M3.5 X 0.6 10MM-LG	00000	ORDER BY DESCRIPTION
11	11757-60011	2	1	DISTRIBUT BD AY	28480	11757-60011
12	0515-1430	5	6	SCREW-MACH M3 X 0.5 8MM-LG 90-DEG-FLH-HD	00000	ORDER BY DESCRIPTION
13	5040-1497	2	6	HINGE MOLDED	28480	5040-1497
14	3050-0227	3	6	WASHER-FL MTLC NO. 6 .149-IN-ID	80120	AN960C-6
15	2190-0584	0	6	WASHER-LK HLCL 3.0 3.1-MM-ID 6.2-MM-OD	28480	2190-0584
16	0535-0004	9	6	NUT-HEX DBL-CHAM M3 X 0.5 2.9MM-THK	00000	ORDER BY DESCRIPTION
17	11757-60025	8	1	POWER RES AY	28480	11757-60025
18	0515-0430		2	SCREW-MACH	28480	0515-0430

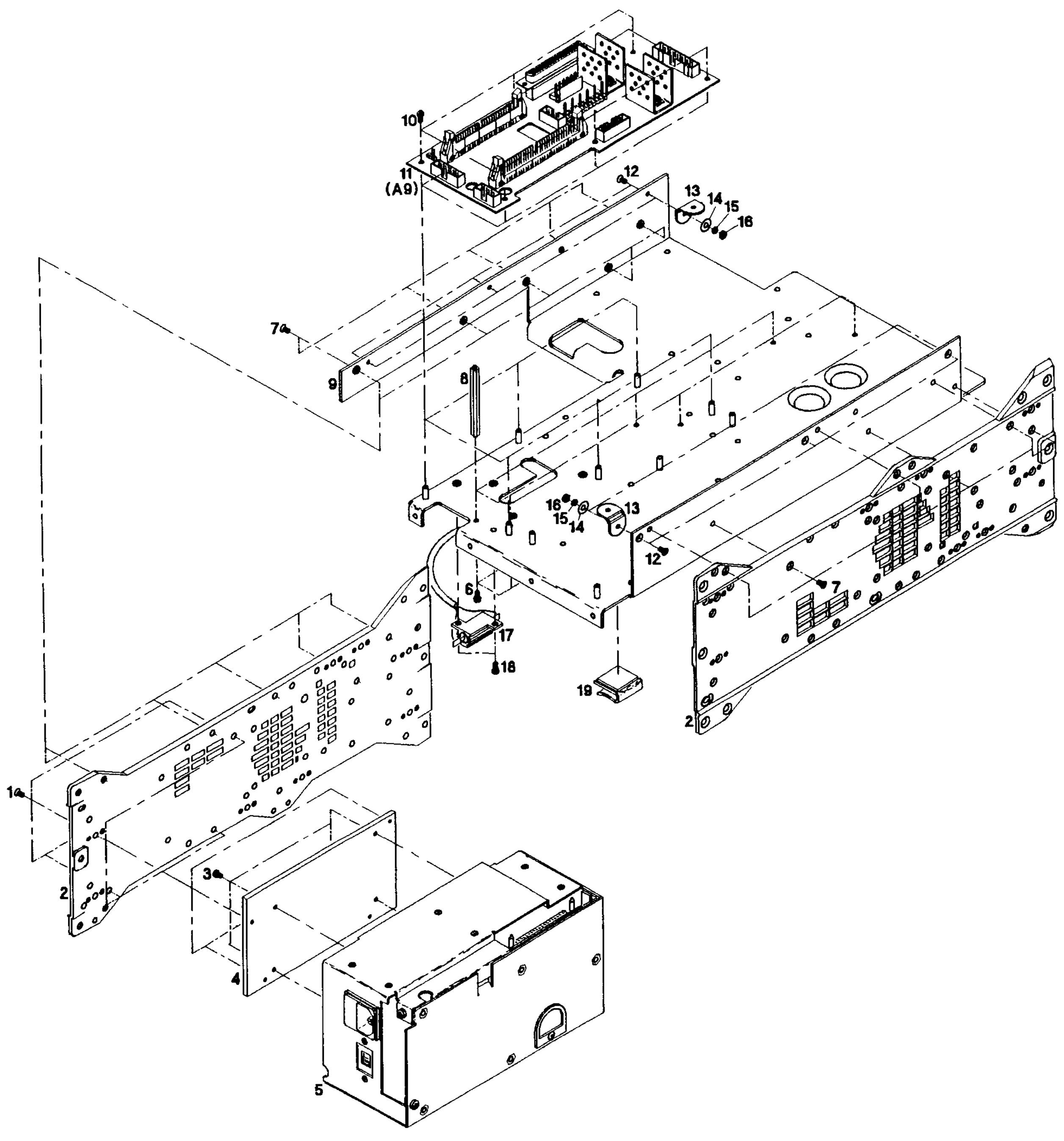

Figure 4-8. Chassis Parts Illustrated Parts Breakdown

5

Major Assembly and Cable Locations

Introduction

The various assemblies and cables of the HP 17757B instrument are illustrated in this chapter. Refer to Chapter 4, "Replaceable Parts", for part numbers, assembly descriptions, and ordering information.

Contents

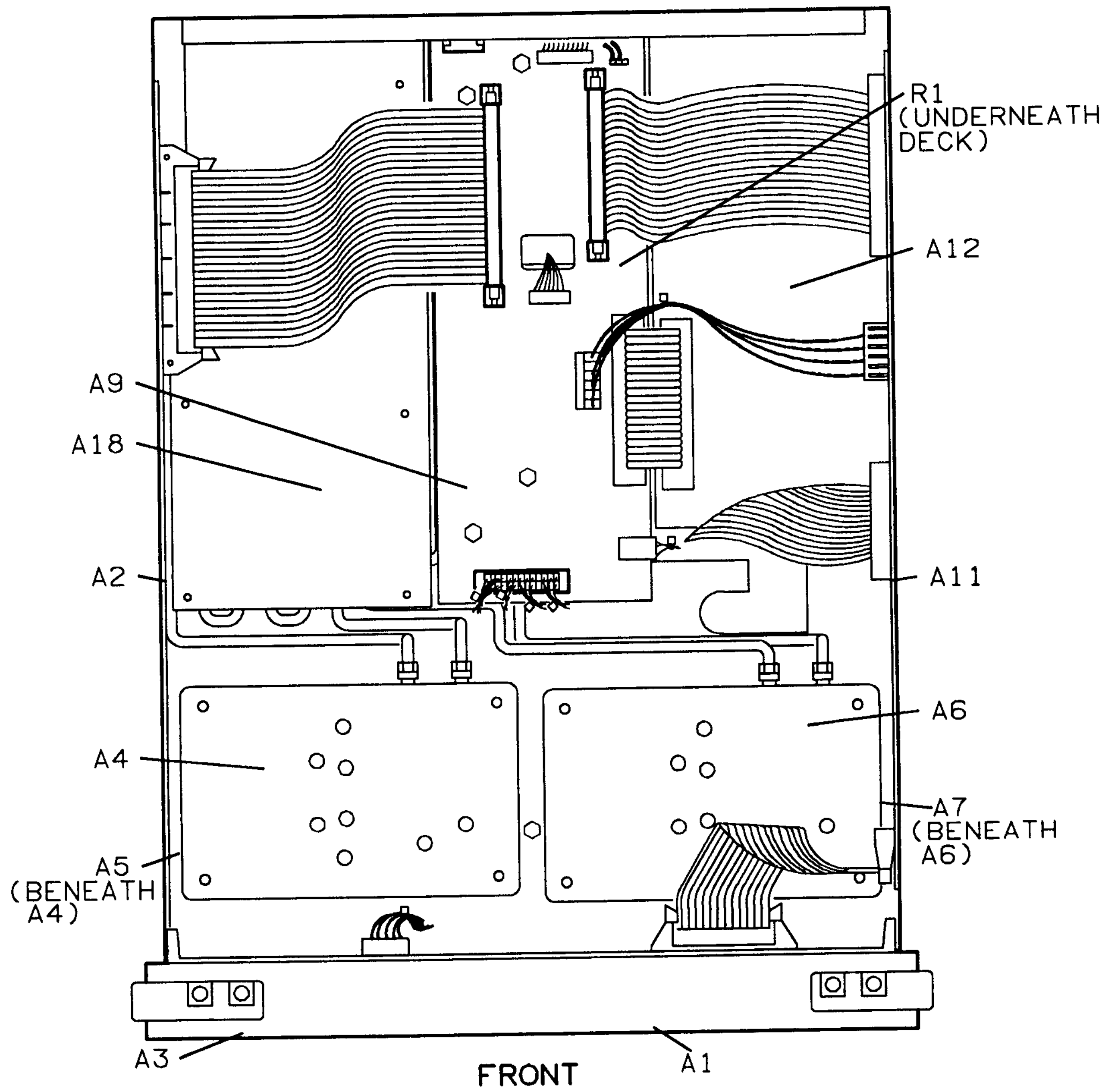

Figure 5-1. Major Assembly Locations

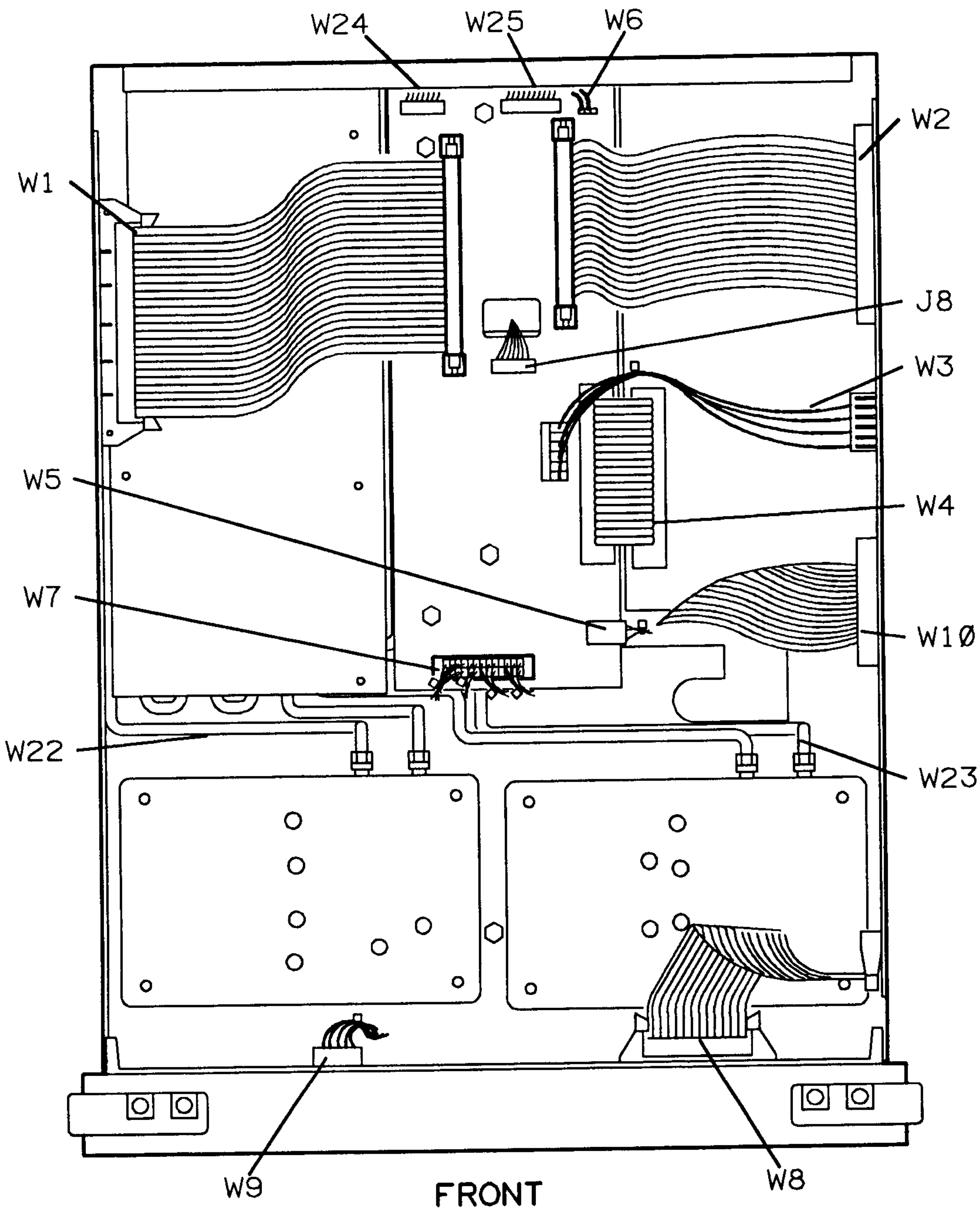

Figure 5-2. Cable Locations

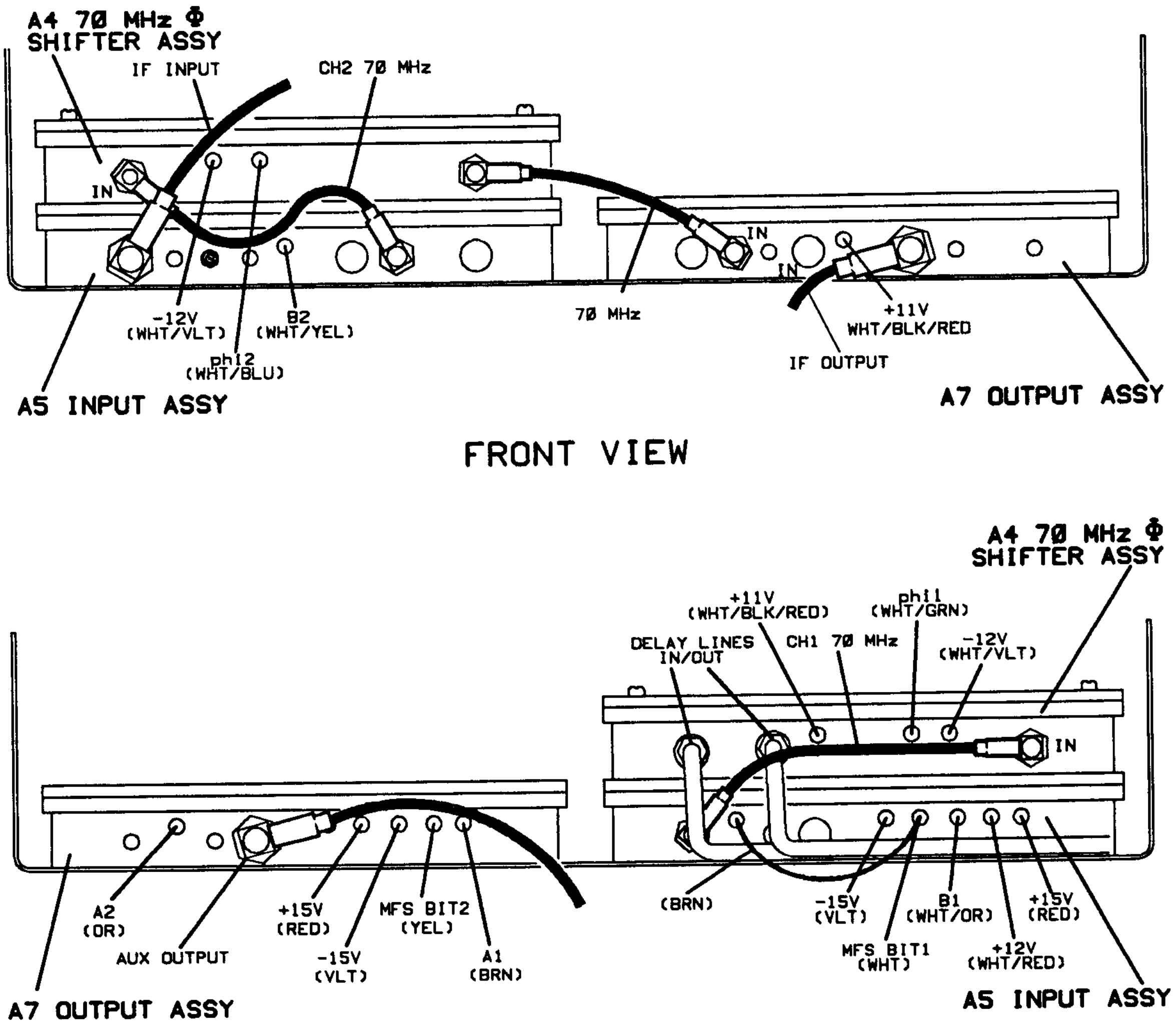

Figure 5-3. Module Interconnections, Standard Model

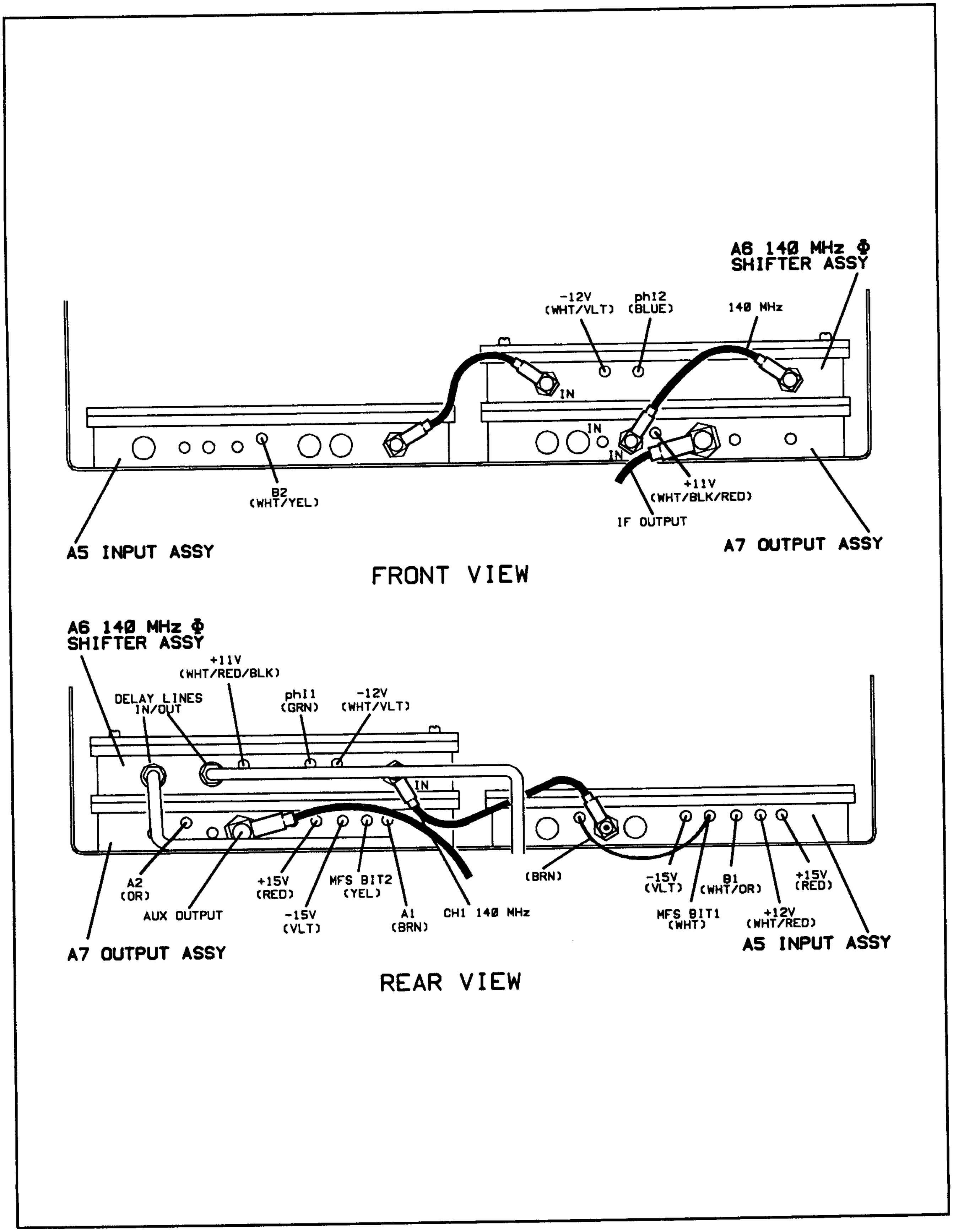

Figure 5-4. Module Interconnections, Option 140

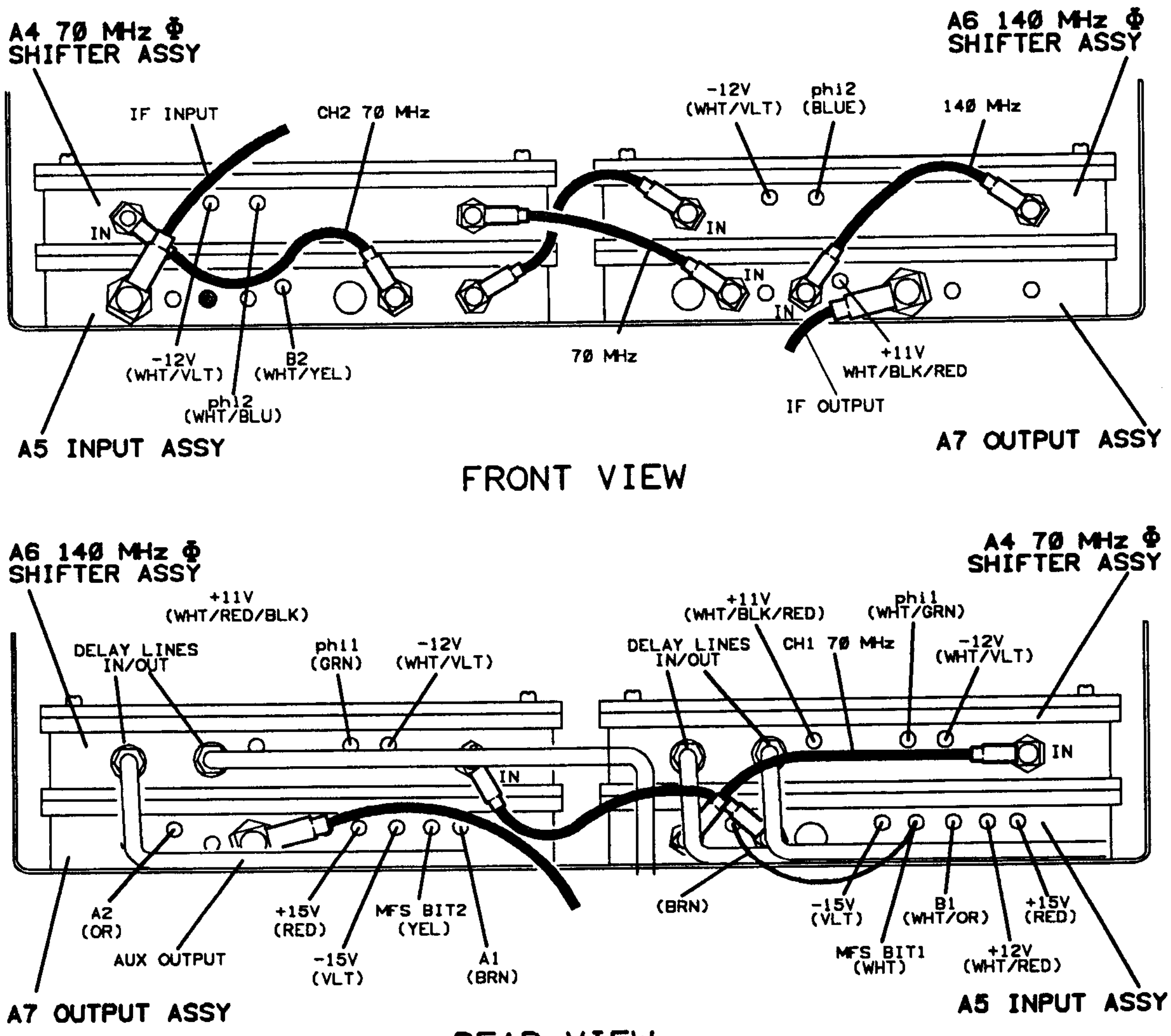

Figure 5-5. Module Interconnections, Option 147

A

Component Level Information Manual

Component-level information is available for selected HP 11757B instrument assemblies. The information for each repairable assembly is provided in the form of a Component-Level Information Manual (CLIM). Table A-1 lists the assemblies that are included in the CLIM.

Tabbed sections are provided for each major assembly. Each tabbed section contains the parts list, component location diagram, and schematic for the specified assembly.

A complete CLIM can be obtained by ordering the HP 11757B Component-Level Information Manual, HP part number 11757-90041.

Table A-1. HP 11757B Board Assembly and Serial Number Cross-Reference

Assembly	Instrument Serial Prefix	Board Assembly Part Number
A1 Keyboard	3108A and above	11757-60037
A2 Interface	3108A and above	11757-60004
A4 70 MHz Phase Shifter	3108A and above	11757-60007
A5 Input	3108A and above	11757-60006
A6 140 MHz Phase Shifter	3108A and above	11757-60008
A7 Output	3108A and above	11757-60009
A9 Distribution	3108A and above	11758-60030
A11 CPU	3108A and above	08782-60036
A18 EEPROM/Counter	3108A and above	11757-60038