

Service Guide

HP ESA-L1500A Spectrum Analyzer



HP Part No. E4411-90021

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Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and it's meaning before operating this instrument.

WARNING

Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

CAUTION

Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING

This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

WARNING

The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from it's power supply.

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 Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

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

LIMITATION OF WARRANTY

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

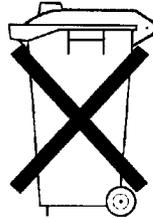
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LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR
CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT,
TORT, OR ANY OTHER LEGAL THEORY.**

Lithium Battery Disposal

When the battery on the A4 processor assembly (3 volt lithium battery, HP part number 1420-0338) is exhausted and/or ready for disposal, dispose of it according to your country's requirements. You can return the battery to your nearest Hewlett-Packard Sales and Service office for disposal, if required. Refer to "Contacting Hewlett-Packard" in Chapter 1 for a list of Hewlett-Packard Sales and Service offices.



**DO NOT THROW BATTERIES AWAY BUT
COLLECT AS SMALL CHEMICAL WASTE.**

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This chapter provides information that is useful when starting to troubleshoot a spectrum analyzer failure. It provides procedures for troubleshooting common failures and isolating problems in the spectrum analyzer. Assembly descriptions are located in Chapter 2.

Component level information containing material lists, schematics, and component location diagrams, is available separately.

Before You Start

There are four things you should do before starting to troubleshoot a failure:

- ❑ Check that you are familiar with the safety symbols marked on the instrument, and read the general safety considerations and the safety note definitions given in the front of this guide.
- ❑ The spectrum analyzer contains static sensitive components. Read the section entitled “ESD Information” on page 14 in this chapter.
- ❑ Become familiar with the organization of the troubleshooting information in this chapter.
- ❑ Read the rest of this section.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

WARNING

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.

WARNING

The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).

Replacement Assemblies

The analyzer assemblies are not repairable to the component level. The following assemblies must be replaced as an assembly.

- RF assembly
- IF assembly
- power supply
- processor assembly
- motherboard
- speaker board
- display
- display interface

Before You Start

- keypad
- GPIB assembly (Option A4H)
- RS-232 assembly (Option 1AX)
- SA I/O assembly (Option A4J)

The tracking generator assembly (Option 1DN or 1DP) consists of three boards, and is repairable to the board level.

After a Spectrum Analyzer Repair

If one or more spectrum analyzer assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to Table 5-2 on page 199 for the related adjustments and performance verification tests required for each assembly.

ESD Information**Protection from Electrostatic Discharge**

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. Figure 1-1 on page 15 shows an example of a static-safe workstation using two types of ESD protection:

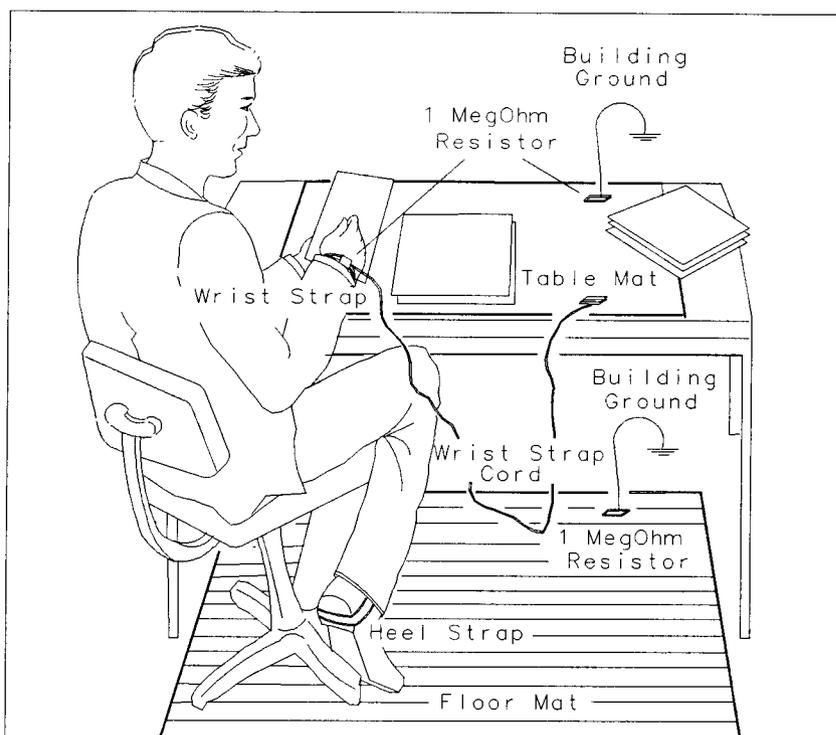
- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 M Ω of isolation from ground. Refer to Table 1-1 for information on ordering static-safe accessories.

WARNING

These techniques for a static-safe workstation should not be used when working on circuitry with a voltage potential greater than 500 volts.

Figure 1-1 Example of a Static-Safe Workstation



FORMAT46

Table 1-1 Static Safe Accessories

HP Part Number	Description
9300-0797	Set includes: 3M static control mat 0.6 m × 1.2 m (2 ft × 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169	ESD heel-strap (reusable 6 to 12 months)

Handling of Electronic Components and ESD

The possibility of unseen damage caused by ESD is present whenever components are transported, stored, or used. The risk of ESD damage can be greatly reduced by close attention to how all components are handled.

- Perform work on all components at a static-safe workstation.
- Keep static-generating materials at least one meter away from all components.

Before You Start

- Store or transport components in static-shielding containers.

CAUTION

Always handle printed circuit board assemblies by the edges. This will reduce the possibility of ESD damage to components and prevent contamination of exposed plating.

Test Equipment Usage and ESD

- Before connecting any coaxial cable to a spectrum analyzer connector for the first time each day, momentarily short the center and outer conductors of the cable together.
- Personnel should be grounded with a 1 M Ω resistor-isolated wrist-strap before touching the center pin of any connector and before removing any assembly from the spectrum analyzer.
- Be sure that all spectrum analyzers are properly earth-grounded to prevent build-up of static charge.

For Additional Information about ESD

For more information about preventing ESD damage, contact the Electrical Over Stress/Electrostatic Discharge (EOS/ESD) Association, Inc. The ESD standards developed by this agency are sanctioned by the American National Standards Institute (ANSI).

Service Equipment You Will Need

Refer to Table 1-2 for a list of the recommended test equipment needed to trouble shoot and repair the spectrum analyzer. Although Hewlett-Packard equipment is recommended, any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Table 1-2 Recommended Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model
Digital Multimeter	Input Resistance: ≥ 10 megohms Accuracy: ± 10 mV on 100 V range	HP 3458A
DVM Test Leads	For use with HP 3458A Digital Multimeter	HP 34118B
Universal Counter	Time Interval Range: 25 ms to 100 ms Single Operation Range: +2.5 Vdc to -2.5 Vdc	HP 53132 or HP 5316B
Measuring Receiver	Compatible with Power Sensors dB Relative Mode Resolution: 0.01 dB Reference Accuracy: $\pm 1.2\%$	HP 8902A
Microwave Frequency Counter	Frequency Range: 9 MHz to 7 GHz Timebase Accy (Aging): $< 5 \times 10^{-10}$ /day	HP 5352B
Oscilloscope	Bandwidth: dc to 100 MHz Vertical Scale Factor of 0.5 V to 5 V/Div	HP 54501A
Power Meter	Compatible with power sensors dB relative mode. Resolution: 0.01 dB Reference accuracy: $\pm 1.2\%$ (Option 1DP)	HP 436A

Troubleshooting the Analyzer
Service Equipment You Will Need

Equipment	Critical Specifications for Equipment Substitution	Recommended Model
Power Sensor	Frequency Range: 100 kHz to 1500 MHz Maximum SWR: 1.60 (100 kHz to 300 kHz) 1.20 (300 kHz to 1 MHz) 1.1 (1 MHz to 2.0 GHz)	HP 8482A
Power Sensor, Low Power	Frequency Range: 300 MHz Amplitude Range: -20 dBm to -70 dBm Maximum SWR: 1.1 (300 MHz)	HP8481D or HP 8484A
Power Sensor, 75 Ω	Frequency Range: 1 MHz to 1500 MHz Maximum SWR: 1.18 (600 kHz to 1500 MHz) Impedance: 75 Ω Amplitude Range: -30 dBm to +20 dBm (Option 1DP)	HP 8483A
Spectrum Analyzer, Microwave	Frequency Range: 100 kHz to 7 GHz Relative Amplitude Accuracy: 100 kHz to 1.5 GHz: $<\pm 1.8$ dB Frequency Accuracy: $<\pm 10$ kHz @ 7 GHz	HP 8566A/B
Synthesized Sweeper	Frequency Range: 10 MHz to 1.5 GHz Frequency Accuracy (CW): $\pm 0.02\%$ Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: -35 to +16 dBm	HP 8340A/B or HP 83630A
Synthesizer/Function Generator	Frequency Range: 0.1 Hz to 20 MHz Frequency Accuracy: $\pm 0.02\%$ Waveform: Triangle	HP 33120A or HP 3324A

Table 1-3 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model
Active Probe	5 Hz to 500 MHz	HP 41800A
Active Probe	300 kHz to 3 GHz	HP 85024A
Directional Bridge	Frequency Range: 0.1 to 110 MHz Directivity: >40 dB Maximum VSWR: 1.1:1 Transmission Arm Loss: 6 dB (nominal) Coupling Arm Loss: 6 dB (nominal)	HP 8721A
Minimum Loss Adapter	Frequency Range: dc to 2 GHz Insertion loss: 5.7 dB, nominal (Option 1DP)	HP 11852B
Termination, 50 Ω	Impedance: 50 Ω (nominal) Connector: Type-N (m) (2 required for Option 1DN)	HP 908A
Termination, 75 Ω	Impedance: 75 Ω (nominal) (2 required for Option 1DQ) (1 required for Option 1DP)	HP 909E Option 201

Table 1-4 Recommended Adapters

Critical Specifications for Adapter Substitution	Recommended Model
BNC (f) to dual banana plug	1251-1277
BNC (m) to BNC (m)	1250-0216
BNC (m) to BNC (m), 75 Ω (Option 1DP)	1250-1288
BNC (f) to SMB (m)	1250-1237
BNC tee (BNC f, m, f)	1250-0781
Type-N (f) to APC 3.5 (f)	1250-1745
Type-N (f) to BNC (m)	1250-1477
Type-N (m) to BNC (f), 75 Ω (Option 1DP)	1250-1535
Type-N (m) to BNC (f) (4 required)	1250-1476
Type-N (m) to BNC (m) (2 required)	1250-1473
Type-N (f), 75 Ω , to Type-N (m), 50 Ω (Option 1DP)	1250-0597
Type-N (f) to Type-N (f)	1250-1472
Type-N (m) to Type-N (m)	1250-1475

Troubleshooting the Analyzer
Service Equipment You Will Need

Critical Specifications for Adapter Substitution	Recommended Model
SMB (f) to SMB (f)	1250-0692
SMB (m) to SMB (m)	1250-0813
BNC (f) to SMB (f)	1250-1236
SMB tee (f) (m) (m)	1250-1391

Table 1-5 Recommended Cables

Critical Specifications for Cable Substitution	Recommended Model
Frequency Range: dc to 1 GHz Length: ≥122 cm (48 in) Connectors: BNC (m) both ends (<i>4 required</i>)	HP 10503A
Type-N, 62 cm (24 in)	HP 11500B/C
Type-N, 152 cm (60 in) (<i>2 required</i>)	HP 11500D
BNC, 75 Ω, 30 cm (12 in) (Option 1DP)	5062-6452
BNC, 75 Ω, 120 cm (48 in) (Option 1DP)	15525-80010
Frequency Range: dc to 310 MHz Length: 20 cm (9 in) Connectors: BNC (m) both ends	HP 10502A
Cable, Test Length: ≥91 cm (36 in) Connectors: SMB (f) to BNC (m) (<i>2 required</i>)	85680-60093

Check the Basics

A problem can often be solved by repeating the procedure you were following when the problem occurred. Before calling Hewlett-Packard or returning the spectrum analyzer for service, please make the following checks:

1. Check the line fuse.
2. Is there power at the receptacle?
3. Is the analyzer turned on? Make sure the fan is running, which indicates that the power supply is on.
4. If the display is dark or dim, press the upper brightness key in the upper left corner of the front panel. This key will not automatically repeat if held down. It must be pressed repeatedly to continue to change the brightness.
5. If the display contrast is poor, press **Display** and **Contrast** (**Contrast** is the fifth key from the top). Then change the contrast using the knob, step keys, or numeric keypad.
6. If other equipment, cables, and connectors are being used with the HP ESA-L1500A spectrum analyzer, make sure they are connected properly and operating correctly.
7. Review the procedure for the measurement being performed when the problem appeared. Are all the settings correct?
8. If the analyzer is not functioning as expected, return the analyzer to a known state by pressing the **Preset** key.

Some analyzer settings are not affected by a Preset. If you wish to reset the spectrum analyzer configuration to the state it was in when it was originally sent from the factory, press **System, More, Default Config**.

9. Is the measurement being performed, and the results that are expected, within the specifications and capabilities of the spectrum analyzer? See the "Specifications" chapter in the User's and Calibration guide for spectrum analyzer specifications.
10. In order to meet specifications, the spectrum analyzer must be aligned. Either Auto Align All must be selected (press **System, Auto Align, All**), or the analyzer must be manually aligned at least once per hour, or whenever the temperature changes more than 5° C (Press **System, Alignments, Align Now, All**). When **Auto Align All** is selected, AA appears on the left edge of the display.
11. Is the spectrum analyzer displaying an error message? If so, refer to "Error Messages" on page 24.

Check the Basics

- 12.If the necessary test equipment is available, perform the performance verification tests in the user's and calibration guide. Record all results on a Performance Verification Test Record form which follows the tests.

Problems at Instrument Power-Up

This section describes symptoms that can occur when the spectrum analyzer is first powered on.

CAUTION

Immediately unplug the spectrum analyzer from the ac power line if the unit shows any of the following symptoms:

- Smoke, arcing, or unusual noise from inside the unit.
- No response of any kind when unit is plugged into ac power mains and turned on.
- The spectrum analyzer's ac power fuse blows.
- A circuit breaker or fuse on the main ac power line opens.

These potentially serious faults must be corrected before proceeding. Refer to "Troubleshooting an Inoperative Spectrum Analyzer" on page 33.

Note that spectrum analyzers equipped with the speaker normally emit noise from the speaker at power-up. This is not a problem; adjust the volume control as desired.

The analyzer will also occasionally emit "clicking" noises. These are normal and are related to the analyzer's self alignment routines.

If the analyzer always turns on when power is applied, check the rear of the analyzer. There is an "always on" power mode switch that can be changed. Refer to the rear panel features section of the *HP ESA-L1500A User's and Calibration Guide* for information on this switch.

Error Messages

The spectrum analyzer can generate various messages that appear on its screen during operation to indicate a problem.

There are three types of messages: hardware error messages (H), user-created error messages (U), and informational messages (M).

- Hardware error messages indicate the spectrum analyzer hardware is probably broken. Additional troubleshooting should be done to verify the failure. Refer to Table 1-7 on page 32 for a list of hardware errors vs. the most likely assembly to cause the error.
- User-created error messages appear when the spectrum analyzer is used incorrectly. They are often generated during remote operation (entering programming commands using either a controller or the external keyboard).
- Informational messages provide information indicating the spectrum analyzer's progress within a specific procedure.

The messages are listed in alphabetical order on the following pages; each message is defined, and its type is indicated by an (H), (U), or (M).

ADC-2V fail Indicates a hardware failure. (H)

ADC-Gnd fail Indicates a hardware failure. (H)

ADC-time fail Indicates a hardware failure. (H)

Align IF: gain limited, may recover next alignment
Indicates that an Align Now for the IF Assembly reached a hardware limit. Perform another Align Now IF. If the message persists there may be a hardware failure. Load the default values by pressing **System, Alignments, Load Defaults** and see if the alignment process fixes the problem. (M) or (H)

Align IF: symmetry limited, may recover next alignment
Indicates that an Align Now for the IF Assembly reached a hardware limit. Perform another Align Now IF. If the message persists there may be a hardware failure. Load the default values by pressing **System, Alignments, Load Defaults** and see if the alignment process fixes the problem. (M) or (H)

Align Now All needed The instrument requires an Align Now, All. (M)

Align RF skipped 50 MHz detected Indicates that an Auto Align of the RF Assembly was not performed because of an input signal at 50 MHz that is >-25 dBm. The alignment will not work when there is too much input power at 50 MHz. The analyzer will

continue to measure properly, but automatic RF alignment will not function. To remove the message, remove the 50 MHz input signal and perform an Align Now RF. (U) or (M)

Align RF skipped No align signal Indicates that an Auto Align of the RF Assembly was not performed because the instrument's internal alignment signal was not detected or was invalid. This could be due to a problem with the accuracy or stability of the external 10 MHz reference, if one is present. Load the default values by pressing **System, Alignments, Load Defaults** and see if the alignment process fixes the problem. (U) or (H)

Alignment Needed Occurs after a 'Load Defaults' of alignment data. A complete alignment must be performed. Press **Align Now, All**. (U) or (M)

Atten auto set to 15 dB Indicates that an input signal has been detected which is of sufficient level to force the input attenuator to be auto-coupled at 15 dB. No operator intervention is required. If the signal level is reduced the attenuator will stay at 15 dB.

This overload protection occurs at an input power level of 13 dBm ± 7 dB (nominal) for 50 Ω input and 68 dBmV ± 7 dB (nominal) for the 75 Ω input, when the input attenuation is auto-coupled and set to <15 dB. To return to the original measurement setup, reduce the input signal level and press **Amplitude**. Then press **Attenuation Auto Man** twice, to toggle back to Auto. (U) or (M)

When operating remotely, the status bit should be monitored for this condition to avoid incorrect measurement results.

Cannot reach N dB points Indicates that the number of dB specified for the N dB PTS function is greater than the distance of the signal peak from the spectrum analyzer noise floor or peak threshold. (U)

CMD ERR: _ _ _ The specified programming command is not recognized by the spectrum analyzer. (U)

Configuration error: Front Panel/Display ID not recognized At power on an error was encountered identifying the Front Panel/Display assembly. (H)

Configuration error: Option ID not recognized The hardware for an option was identified in an instrument that does not support it. (H)

Configuration error: RF Assembly ID not recognized At power on an error was encountered when identifying the RF Assembly. (H)

Configuration error: RF-Source Impedance mismatch A power up check determined that the RF Assembly and optional Tracking Generator Assembly do not have the same impedance. (H) Refer to “Troubleshooting the A2 Tracking Generator (Option 1DN/1DQ)” on page 56.

Data Memory Full<data type>: _ _ _ An attempt was made to save a file of <data type> to memory, however the memory space is full. (U)

EXT REF Indicates that the frequency reference is being supplied by an external 10 MHz source. (M)

EXT Reference in use An attempt to perform a Timebase alignment with an External Reference in use. (U)

FILE NOT FOUND Indicates that the specified file could not be loaded into spectrum analyzer memory or purged from memory because the file name cannot be found. (U)

Freq corr off Indicates that the Freq Correct selection is Off. (M)

Input is internal Indicates that the 50 MHz osc selection is On. With the 50 MHz oscillator On, the input is routed through an internal signal path. (M)

INVALID AMPCOR: FREQ For the AMPCOR command, the frequency data must be entered in increasing order. See the description for the AMPCOR programming command for more information. (U)

INVALID CHECKSUM: USTATE The user-defined state does not follow the expected format. (U)

INVALID ENTER FORMAT The enter format is not valid. See the appropriate programming command description to determine the correct format. (U)

INVALID FILE NAME <file name> Indicates the specified file name is invalid. A file name is invalid if there is no file name specified or the file name is too long. See the description for the SAVE programming command for more information. (U)

Invalid flatness data: _ _ _ A power up check determined an error in the instrument’s flatness data. The 4-digit code may indicate the type of error. Refer to Table 1-6 for a description of the codes. (H)

INVALID HP-IB ADRS/OPERATION An HP-IB operation was aborted due to an incorrect address or invalid operation. Check that there is only one controller (the spectrum analyzer) connected to the printer. (U)

INVALID HP-IB OPERATION REN TRUE The HP-IB operation is not allowed. (This is usually caused by trying to print when a controller is on the interface bus with the spectrum analyzer.) To print to an

HP-IB printer from the spectrum analyzer, you must disconnect any other controllers on the HP-IB. If you are using programming commands to print, you can use an HP BASIC command instead of disconnecting the controller. See the description for the PRINT command for more information. (U)

INVALID ITEM: Indicates an invalid parameter has been used in a programming command. (U)

INVALID OUTPUT FORMAT The output format is not valid. See the appropriate programming command description to determine the correct format. (U)

INVALID RANGE: Stop < Start Indicates that the first trace element specified for a range of trace elements is larger than the ending trace element. When specifying a trace range the starting element must be less than the ending element. For example, TRA[2,300] is legal but TRA[300,2] is not. (U)

INVALID RS-232/OPERATION An RS-232 operation was aborted due to an invalid operation. (U)

INVALID START INDEX Indicates that the first trace element specified for a range of trace elements is not within the trace range of the specified trace. (U)

INVALID STOP INDEX Indicates that the ending trace element specified for a range of trace elements is not within the trace range of the specified trace. (U)

INVALID STORE DEST: _ _ _ The specified destination field is invalid. (U)

INVALID TRACE: _ _ _ The specified trace is invalid. (U)

INVALID VALUE PARAMETER: _ _ _ The specified value parameter is invalid. (U)

Marker Count Reduce SPAN Indicates the resolution bandwidth to span ratio is too small to use the frequency count function. Check the span and resolution bandwidth settings. The acceptable Span/Res BW ratio is ≤ 500 . (U)

Marker Count Widen Res BW Indicates that the current resolution bandwidth setting is too narrow to use with the marker counter function. (U)

Meas uncal The measurement is uncalibrated. Check the sweep time, span, and band width settings, or press **Auto Couple**. (U)

No points defined Indicates the specified limit line or amplitude correction function cannot be performed because no limit line segments or amplitude correction factors have been defined. (U)

Error Messages

Overload: Reduce Signal A signal has been applied to the input connector that caused the overload protection circuitry to engage. The input signal must be reduced. After the signal is reduced, press **Esc**. The change in the instrument's amplitude state will disengage the overload protection function. Overload protection engages under the following conditions: (U) or (M)

Attenuator Setting	Attenuator Coupling	Input Power Level (50 Ω)	Input Power Level (75 Ω)
≥15 dB	Auto or Man	33 dBm ±3 dB (nominal)	80 dBmV ±3 dB (nominal)
<15 dB	Man	13 dBm ±7 dB (nominal)	68 dBmV ±7 dB (nominal)

CAUTION

Exposing the analyzer to high levels of input power over a prolonged time period can damage the circuitry.

When operating remotely, the status bit should be monitored for this condition to avoid incorrect measurement results.

PARAMETER ERROR: _ _ _ The specified parameter is not recognized by the spectrum analyzer. See the appropriate programming command description to determine the correct parameters. (U)

Password required Indicates that the service function cannot be accessed without the password. (U) Refer to “Using the Internal Service-Diagnostic Routines” on page 48.

Power-up selftest failed Boot ROM checksum: Indicates a test of the bootrom produced a checksum error. (H) Refer to “Troubleshooting the A4 Processor Assembly” on page 52.

Power-up selftest failed RAM error: Indicates a test of RAM produced an error. (H) Refer to “Troubleshooting the A4 Processor Assembly” on page 52.

Power-up selftest failed Checksum: Indicates a test of the instrument ROM produced a checksum error. (H) Refer to “Troubleshooting the A4 Processor Assembly” on page 52.

Require 1 signal > PEAK EXCURSION above PEAK THRESHOLD Indicates that the N dB PTS routine cannot locate a signal that is high enough to measure. The signal must be greater than the peak excursion above the threshold level to measure. (U)

Require 3 signals > PEAK EXCURSION above PEAK THRESHOLD Indicates that the % AM routine cannot locate three signals that are high enough to measure. The signals must be greater than the peak excursion above the threshold level to measure. (U)

Require 4 signals > PEAK EXCURSION above PEAK THRESHOLD Indicates that the TOI routine cannot locate four signals that are high enough to measure. The signals must be greater than the peak excursion above the threshold level to measure. (U)

Required Option Not Installed Indicates that the function selected requires optional hardware that is not currently available. (U)

RF LO Unlocked Indicates that the local oscillator within the instrument's RF assembly is unlocked. (H)

S in the status area of the display indicates that the service request is active. Service requests are a form of informational message. More information is available in the Programmer's Guide. (M)

SAVE LOCK The spectrum analyzer's internal memory has been locked. To unlock the memory, press **Internal Lock On Off** so that Off is underlined. For remote operation, use PSTATE OFF. (U)

Signals do not fit expected % AM pattern Indicates that the % AM routine cannot perform the percent AM measurement because the on-screen signals do not have the characteristics of a carrier with two sidebands. (U)

Signals do not fit expected TOI pattern Indicates that the TOI routine cannot perform the third-order intermodulation measurement because the on-screen signals do not have the characteristics of two signals and two distortion products. (U)

Source Protected A signal has been applied to the RF OUT connector which caused the source output protection circuitry to engage. The signal must be reduced. After the signal is reduced, press the ESC key to disengage the source output protection circuitry. (U) or (M)

TABLE FULL Indicates the upper or lower table of limit lines contains the maximum number of entries allowed. Additional entries to the table are ignored. (U)

TG LO Unlocked Indicates that the local oscillator within the instrument's tracking generator assembly is unlocked. (H) Refer to "Troubleshooting the A2 Tracking Generator (Option 1DN/1DQ)" on page 56.

TG unlevelled This message can indicate the following: that the source power is set higher or lower than the spectrum analyzer can provide, that the frequency span extends beyond the specified

Error Messages

frequency range of the tracking generator, or that the calibration data for the tracking generator is incorrect. See “Stimulus-Response Measurements” in the User’s Guide for more information. (U) If this information does not help to correct the problem, refer to “Troubleshooting the A2 Tracking Generator (Option 1DN/1DQ)” on page 56.

Too many signal with valid N dB points Indicates the N dB PTS function has located two or more signals that have amplitudes within the specified dB from the signal peak. If this happens, you should decrease the span of the spectrum analyzer so that only the signal that you want to measure is displayed. (U)

Trace A is not available Indicates that trace A is in the store-blank mode and cannot be used for limit-line testing. Use **Clear Write A** or **View A** to change trace A from the store-blank mode to the clear write mode, and then turn on limit-line testing. (U)

The **Invalid Flatness Data** 4-digit error code indicates an error in the instrument's flatness data. Convert each digit in the code to the equivalent binary value and interpret them with the table below. For example, the error code 3FE1 would indicate the errors marked with the arrows had been detected in the power up check.

Table 1-6 Invalid Flatness Data Error Codes

Example Code	Equivalent Binary Value	Bit Number	Error Description
	8	15	Reserved for future use
	4	14	Reserved for future use
3 →	2	13	Error inserting the implied data for an offset correction
→	1	12	Error inserting the implied data for a reference correction
F →	8	11	Number of points exceeds remaining EEPROM size
→	4	10	Invalid band data
→	2	9	No datasets defined (Sentinal values in beginning EEPROM address)
→	1	8	EEPROM space exhausted before Dataset ID could be read
E →	8	7	Too many points encountered merging multiple datasets
→	4	6	Memory allocation error merging multiple datasets
→	2	5	Too many points for one dataset
	1	4	Frequency value outside allowable range
	8	3	Unused
	4	2	Unused
	2	1	Unused
1 →	1	0	Error determining EEPROM size

Table 1-7 lists the most probable cause for a given hardware failure. Refer to the troubleshooting section for the suspect assembly for a more thorough investigation of the problem.

Table 1-7 Hardware Error Message vs. Suspect Assembly

Hardware Error Message	Suspect Assembly
ADC-2V fail	A5 power supply
ADC-Gnd fail	A5 power supply
ADC-time fail	A4 processor
Align IF: gain limited, may recover next alignment	A3 IF or A8 RF
Align IF: symmetry limited, may recover next alignment	A3 IF or A8 RF
Align RF skipped No align signal	A8 RF or A3 IF
Configuration error: Front Panel/Display ID not recognized	A1A1 front panel interface or A4 processor
Configuration error: Option ID not recognized	check for an incorrect option board loaded
Configuration error: RF Assembly ID not recognized	A8 RF or A4 processor
Configuration error: RF-Source Impedance mismatch	A8 RF or A2 tracking generator
Invalid flatness data: _ _ _ _	A8 RF
Power-up selftest failed Boot ROM checksum	A4 processor
Power-up selftest failed RAM error	A4 processor
Power-up selftest failed Checksum	A4 processor
RF LO Unlocked	A8 RF
TG LO Unlocked	A2 tracking generator

Troubleshooting an Inoperative Spectrum Analyzer

When a spectrum analyzer appears to be dead (no display or no fan) there is often little evidence that points directly to the cause. This section provides steps and solutions to typical failure modes relating to an inoperative spectrum analyzer.

Before troubleshooting a spectrum analyzer, ensure that it has been set up correctly.

Check the Spectrum Analyzer Setup

Perform the steps in the section titled “Check the Basics” earlier in this chapter.

Initial Checks

Perform the following initial checks when first troubleshooting an inoperative spectrum analyzer.

1. Is the fan running?
 - a. If the fan is not running, refer to the section “If the Fan is Not Operating” on page 34.
 - b. If the fan is running, this indicates the power supply is functioning at least to a degree. Continue with these initial steps, and then refer to the section “Check the Power Supplies” on page 36 if no other cause is found.
2. Is the display on?
 - a. If the display is blank, Refer to the section “Check the Power Supplies” on page 36. Also verify that the firmware is good by checking the “Bootrom Self-Test Check” on page 53.
 - b. If the display is on and the fan is running, suspect one or more power supplies is being pulled down, or a defective processor assembly. In either case, the analyzer’s outer case and inner shield must be removed. Refer to Chapter 4 for removal procedures.
3. Check the power supplies.
 - a. To check the power supply voltages, refer to the section “Check the Power Supplies” on page 36.
 - b. If the supplies all measure good, suspect a defective processor, or a defective LCD or interface board.
4. Perform the following checks for the processor assembly.

- a. Is the analyzer “clicking”? The analyzer should occasionally emit “clicking” noises. These are related to the analyzer’s self alignment routines, and indicate the processor is basically functioning. When the analyzer is cold, there will be more self alignment activity (more clicking) than when it is warm.

If you do not hear any clicks after a few minutes, suspect a defective processor assembly. Refer to the section “Troubleshooting the A4 Processor Assembly” on page 52.

- b. Are the processor assembly LEDs all out? There is a row of LEDs along the top edge of the processor assembly. These should all be off. To check their functionality, cycle the analyzer’s power. The processor LEDs should all go on for a few seconds, then go off. If one or more LEDs remains on, suspect the processor assembly is defective. Refer to the section “Bootrom Self-Test Check” on page 53.
- c. If the analyzer is clicking, and all of the processor LEDs are out, suspect a defective LCD or a defective front panel interface board. Refer to the section “Troubleshooting the LCD Display” on page 39.

If the Line Fuse Has Blown

If the line fuse has blown, perhaps a nonstandard fuse with too low a current rating was installed. If the line fuse still blows, suspect that the power supply assembly is defective.

WARNING

For continued protection against fire hazard, replace fuse only with same type and ratings, (5 A 250 V). The use of other fuses or materials is prohibited.

If the Fan is Not Operating

CAUTION

The power supply may be hot if the instrument has been operating without the fan running. Allow the instrument to cool down before troubleshooting.

1. If there is no display:
 - a. Unplug the line-power cord.
 - b. Change the switch at the rear of the analyzer so the power is always on. Refer to the rear panel features section of your user’s guide for information on this switch. This will bypass the front panel power switch.
 - c. If the fan still does not turn on, suspect a defective power supply assembly. Refer to the section “Check the Power Supplies” on page 36, to check individual supply voltages.

- d. If the fan starts, this indicates a problem with the front panel switch or the line to the power supply.
2. If there is a display:
 - a. Remove the analyzer's outer case. Refer to Chapter 4 for removal details.
 - b. Measure the fan voltage.
 - c. The fan voltage can be checked directly at the center of the fan where the wires connect. The fan normally operates on a voltage ranging from -5 to -16 Vdc depending on the fan speed needed, based on the temperature of the analyzer. As analyzer temperature increases, fan voltage should get more negative, increasing the speed of the fan.

If the correct voltage is present, suspect a defective fan.

If the voltage is not present, check the plug where the fan wires attach to the power supply board. If this looks good, suspect a defective power supply. Refer to Chapter 4 for information on how to remove the power supply.

Check the Power Supplies

The power supply voltages are checked using a digital voltmeter. The voltages measured should be within the tolerances listed in Table 1-8.

In order to measure the power supply voltages on the motherboard, it is first necessary to remove the analyzer's outer case and inner shield. Refer to Chapter 4 for removal instructions.

WARNING

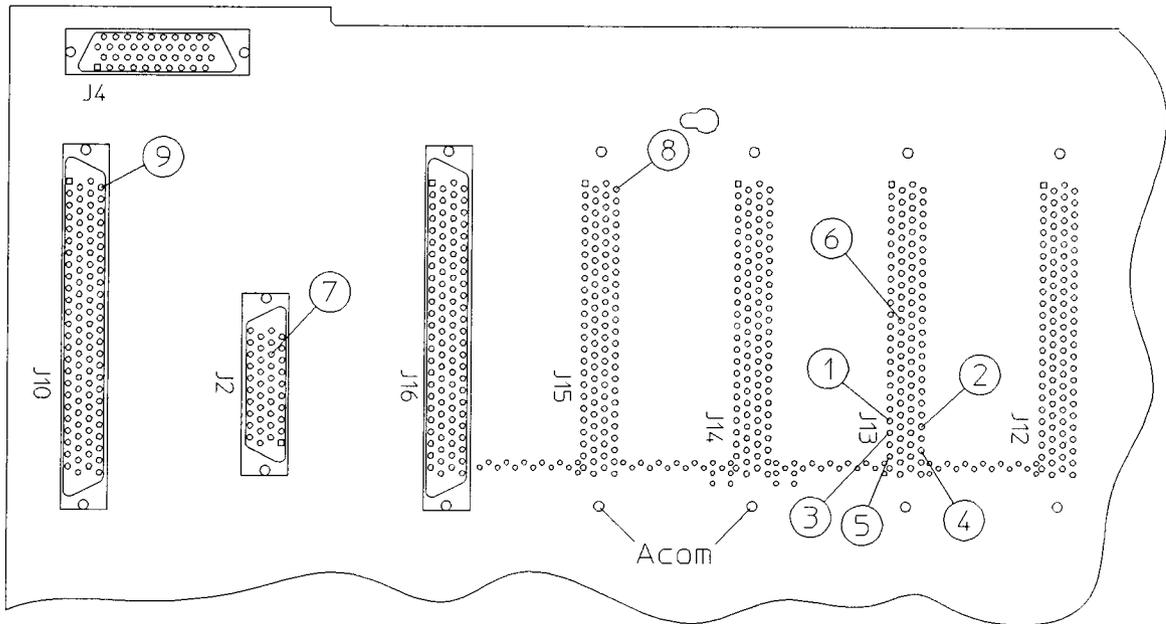
The spectrum analyzer contains potentially hazardous voltages. Refer to the safety symbols provided on the spectrum analyzer, and in the general safety instructions in this guide, before operating the unit with the cover removed. Ensure that safety instructions are strictly followed. Failure to do so can result in severe or fatal injury.

Refer to Figure 1-2 for the supply test points on the motherboard. Use any one of the points marked as "Acom" in Figure 1-2 for the ground connection.

Table 1-8
Power Supply Tolerances

Test Point	Power Supply	Specification
1	-15 V	-15.22 to -14.78 Vdc
2	-5 V	-5.07 to -4.93 Vdc
3	+5 V	+4.93 to +5.07 Vdc
4	+15 V	+14.78 to +15.22 Vdc
5	+28 V	+26.04 to +29.96 Vdc

Figure 1-2 Motherboard Test Point Locations



sl755a

Test point	Location	Description
1	A7J13 pin 41	-15 V
2	A7J13 pin 92	-5 V
3	A7J13 pin 43	+5 V
4	A7J13 pin 96	+15 V
5	A7J13 pin 47	+28 V
6	A7J13 pin 24	IF_VIDEO
7	A7J2 pin 16	IF_VIDEO
8	A7J15 pin 52	10 MHz
9	A7J10 pin 52	10 MHz

If All Low Voltage Supplies Are Dead

If all the power supplies are dead, suspect a defective A5 power supply assembly. Refer to Chapter 4 for removal instructions.

If Some Low Voltage Supplies Are Dead

If some supplies are ok while others are dead or low, it is possible that one of the assemblies in the analyzer is loading the power supply down.

Troubleshooting an Inoperative Spectrum Analyzer

In this case it is necessary to sequentially remove the assemblies, taking care to disconnect the line-power cord before removing any assembly. A logical first step would be to unplug the RF ribbon cable from the motherboard at the rear of the instrument. This disconnects the complete RF section without having to remove it from the chassis. Refer to Chapter 4 for any other assembly removal procedures.

After an assembly is disconnected or removed, plug the line-power cord back into the analyzer and remeasure the supply that was down. If it is still down, continue with the assembly removal. If the supply is now up, suspect the last assembly removed as being defective.

If All the Supplies Are Good

If all of the supplies have measured within tolerances, and the display is still blank, return to the initial check #4 on page 33.

Troubleshooting the LCD Display

Check the intensity and contrast controls on the A1A1 front panel interface board.

Intensity

1. Verify the analyzer went through a full power on sequence. Refer to the section “Troubleshooting an Inoperative Spectrum Analyzer” on page 33.
2. If the display is dark or dim, press the upper brightness key in the upper left corner of the front panel. This key will not automatically repeat if held down. It must be pressed repeatedly to continue to change the brightness.
3. If the display is dark, (not visible), connect an external VGA monitor to the rear panel VGA output connector on the analyzer. Some multisync monitors might not be able to lock to a 60 Hz sync pulse. If the video information is not present on the external VGA monitor, the most probable cause is the A4 processor board.
4. If the external VGA monitor is functioning, verify that the ribbon cables going to and from the A1A1 front panel interface board are aligned properly and plugged into their connectors. Refer to Figure 1-3.
5. If you are increasing the intensity and the analyzer screen is not changing, measure A1A1P3 pin 1 using an oscilloscope. Refer to Figure 1-3. If you measure a sinewave between 30 kHz and 100 kHz with a voltage of >300 V p-p, the most probable cause is the backlight assembly. Refer to Chapter 4 for the removal procedure.
6. If the voltage is not correct and video information is present using the external VGA monitor, the most probable cause is the A1A1 front panel interface board. Refer to Chapter 4 for the removal procedure.

Contrast

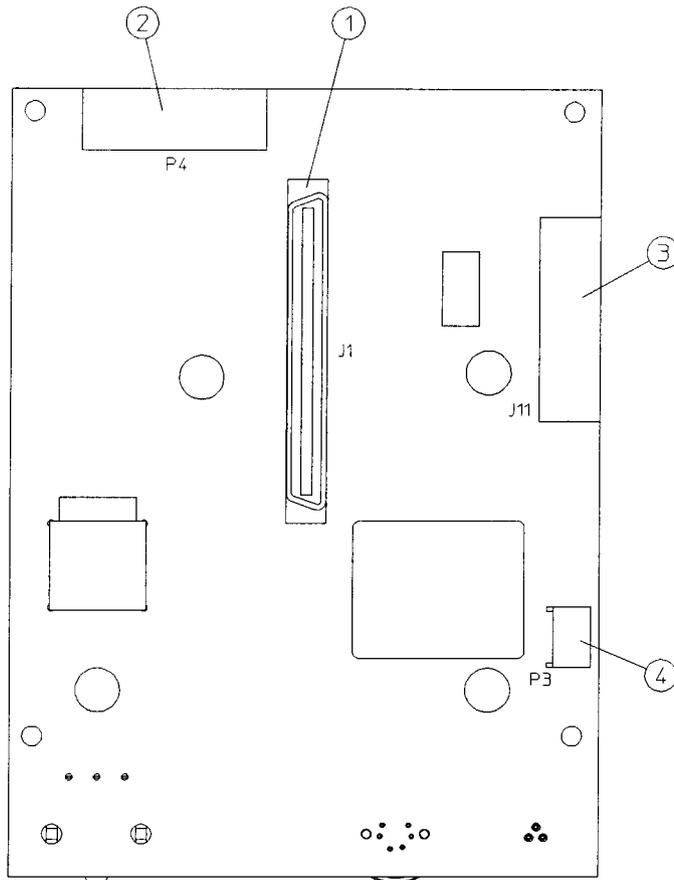
1. If the display contrast is poor, press **Display** and **Contrast** (**Contrast** is the fifth key from the top). Then change the contrast using the RPG knob, step keys, or numeric key pad.
2. If contrast is not functioning, verify that the ribbon cables going to and from the A1A1 front panel interface board are aligned properly and plugged into their connectors. Refer to Figure 1-3.

Troubleshooting the LCD Display

3. If you are adjusting contrast and the analyzer screen is not changing, measure the dc voltage at A1A1J11 pin 23 to ground. Refer to Figure 1-3. With the contrast set to 0, the dc voltage will measure 0 V. With the contrast set to 255, the DC voltage will measure approximately 3.1 V.
4. If this voltage is not changing the A1A1 front panel interface is the most probable cause. Refer to Chapter 4 for the removal procedure.
5. If the voltage is correct the LCD is the most probable cause. Refer to Chapter 4 for the removal procedure.

The display is not field-repairable, and must be replaced as an assembly. Refer to Chapter 3 for HP part number information.

Figure 1-3 A1A1 Front Panel Interface Board Connectors



sl757a

Item #	Connector	Description
1	A1A1J1	Supplies and I/O from A4 processor assembly
2	A1A1P4	Front panel key inputs
3	A1A1J11	Controls to LCD
4	A1A1P3	Intensity, or backlight control

Isolating an RF, LO, IF, or Video Problem

This section provides techniques for isolating amplitude failures along the signal path.

1. Check Detector Modes

The instrument has three detector modes known as positive peak, negative peak, and sample detector. All of these detectors are located on the A4 processor board. Normal instrument power up routes the detected video signal through the positive peak detector only. If there are no graticules, signal information, or screen annotations, refer to the section “Troubleshooting the LCD Display” on page 39. The assumption from this point on is that the graticules and annotations have come up on the screen, but the noise floor and signal information is not present.

- If no video is present on the analyzer screen switch to Sample or Negative Peak detector mode by pressing **Det/Demod**, **Detector**, and the proper softkey.
- If the video signal appears in one of these two modes, the most probable cause is the A4 processor board itself.
- If there is no video information present in any detector mode, inject a signal into the IF assembly as per step 4 on page 44. This step will produce 2 Vdc (IF_VIDEO) at the out put of the IF assembly. The 2 Vdc can be measured on the motherboard at A7J13 pin 24. If you do not measure a DC level at approximately 2 Vdc, the IF assembly is the most probable cause. Refer to Figure 1-2 on page 37.
- If you measure 2 Vdc on the output of the IF assembly but do not see a flat line at the top of the LCD, there may be a problem between the output of the IF assembly and the input to the A4 processor board. Possibly an open trace or a bent pin on the A7 motherboard.
- If you measure 2 Vdc right up to the IF_VIDEO input on the A4 processor board and still don't have a flat horizontal line near the top of the screen, the A4 processor board is the most probable cause.

2. Check Corrected vs. Uncorrected Performance Using Video Shift On/Off

If you have a frequency response failure such as a power hole or power spike, you should turn the video shift off to see if the digital correction values are having an adverse effect on the analyzer performance.

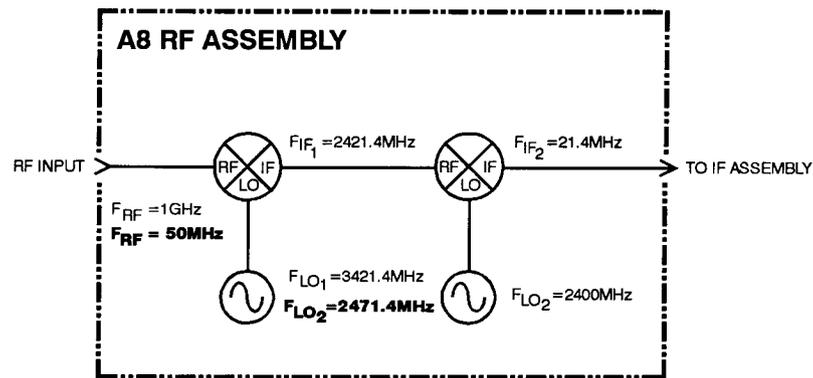
- Turn the video shift off by pressing **System**, **More**, **Service**, (Password = -2010), **Enter**, **Service**, **Video Shift On Off** (Off).

- If the power hole or spike goes away, perform the Flatness Calibration Adjustments in Chapter 5. Refer to section “Using the Internal Service-Diagnostic Routines” on page 48 for more information about the video shift function.
- If the power hole or power spike does not go away after re-adjusting the flatness calibration, the A8 RF assembly is the most probable cause.

3. Verifying the A8 RF Assembly Performance

The A8 RF assembly will down-convert the analyzer's input signal to the final I.F. of 21.4 MHz. You can troubleshoot the RF assembly by injecting a CW signal at 50 MHz to the RF input of the analyzer. The 21.4 MHz down-converted I.F. signal will be the input level minus the input attenuation. The RF assembly's frequency response will roll off by about 8 dB at 1.5 GHz. There are only two down-conversions made in this analyzer. Refer to Figure 1-4 for two examples of down conversion, one with an input frequency of 1 GHz, and one with an input frequency of 50 MHz.

Figure 1-4 Example of Down Conversion



s1759a

1. Inject a CW signal at 50 MHz at -10 dBm for $50\ \Omega$ and at $+38.76\text{ dBmV}$ for $75\ \Omega$ into the RF input of the analyzer.
2. Tune the analyzer to 50 MHz, zero span, input attenuation set to 0 dB by pressing:
 - **System, 50 MHz Osc On Off (On)**
 - **Amplitude, Attenuation, 0 dB**
 - **Span, Zero Span**
3. Turn Auto Align On/Off to off by pressing **System, Alignments, Auto Align, Off**.

4. Disconnect the flexible gray cable going into the A3 IF assembly at A3J2.
5. Connect a microwave spectrum analyzer to this flexible gray cable and measure the 21.4 MHz output from the A8 RF assembly.
 - If the A8 RF assembly is operating properly, you will measure 21.4 MHz out of the A8 RF assembly at -10 dBm on the microwave spectrum analyzer.

NOTE

If your signal amplitude is too high or too low, vary the input attenuation from 0 to 60 dB and note that for every 5 dB of attenuator change, the 21.4 MHz I.F. output signal from the A8 RF assembly should change 5 dB as well. The signal amplitude problem may be the result of a defective attenuator/switch on the R.F. assembly itself.

- If you notice a frequency response problem, visually inspect the RF input connector for mechanical integrity.
- If the analyzer has a frequency response problem, you can inject the frequency of interest, tune the analyzer to that frequency in zero span, and monitor the 21.4 MHz I.F. signal level for abnormalities on your microwave spectrum analyzer.
- If you have excessive loss through the A8 RF assembly, replace the RF assembly.

You can also use the internal 50 MHz calibrator signal by pressing **System, 50 MHz osc On Off (On)**. This is a 50 MHz signal at approximately -27 dBm for 50 Ω input or $+24.75$ dBmV for 75 Ω input that originates from the RF assembly.

4. Verifying the A3 IF Assembly Performance

NOTE

At other frequencies in zero span, the gain of the A3 IF assembly will increase, necessitating the input level to be decreased for top of screen response. If the analyzer is in full span and the 21.4 MHz. input frequency has a power level of -20 dBm, the displayed response will be the inverse of the A8 RF assembly flatness. Setting the Video Shift Off as stated in step 2 will result in a flat line. In narrow spans, the flatness correction will be done by changing the A3 IF assembly gain. In large spans, when it is not practical to change the A3 IF assembly gain as the spectrum analyzer sweeps, video shift is used for flatness correction. Some video shift will be used for flatness correction even when A3 IF assembly gains are also used, but the maximum video shift will be less than 1 dB, unless there is insufficient A3 IF assembly gain available.

1. Turn the Auto Align off by pressing **System, Alignments, Auto Align, Off**.

2. Perform an Align Now All by pressing **System, Alignments, Align Now, All**.
3. Verify the initial failure viewed on the analyzer screen is acceptable.
 - If the signal on screen appears to be correct, turn the Auto Align back on by pressing **System, Alignments, Auto Align, All** and make sure the signal remains correct.
 - If the signal is not correct press **System, Alignments, Load Defaults**. (Press this key twice for the defaults to load.)
 - If the signal is not correct with the defaults loaded proceed to the next step. Otherwise:
 - a. Perform Align Now All by pressing **System, Alignments, Align Now, All**.
 - b. Turn Auto Align back on by pressing **System, Alignments, Auto Align, All**.
 - c. Verify the analyzer performance now that the A3 IF assembly has had the defaults loaded and the auto align has been turned back on.
 - If the signal on screen is still not correct perform step 1 on page 42. Now inject a 21.4 MHz signal at -10 dBm from a synthesizer into the A3 IF assembly. With the reference level at 0 dBm., the input attenuator set to 0 dB, and CF at 50 MHz in zero span, a flat line should appear at the top of the analyzer screen.
 - If the signal is not at the top of the screen, measure A7J13 pin 24 on the motherboard with a voltmeter and verify 2 Vdc. Refer to Figure 1-2 on page 37.
 - If 2 Vdc is not present the most probable cause would be the A3 IF assembly, but first check for a bent pin on the A7J2 motherboard connector pin 16 (IF_VIDEO). Refer to Figure 1-2 on page 37.
 - If 2 Vdc is present the most probable cause is either an A7 motherboard trace problem to the A4 processor board, a bent pin on A7J7 motherboard connector, or the A4 processor board itself.

5. Horizontal Trace With No Signal or Noise Floor Present

1. Check the ADC circuitry on the A4 processor board by pressing **Preset, Frequency 50 MHz, Span, Zero Span, System, 50 MHz osc On Off (On), Amplitude -27 dBm for 50Ω or $+24.75$ dBmV for 75Ω input**. This should provide a 2 Vdc output from the A3 IF assembly.

2. Connect a voltmeter to A7J13 pin 24 on the A7 motherboard to probe the output of the A3 IF assembly. If the IF assembly is working properly the voltmeter will read approximately 2 Vdc. Refer to Figure 1-2 on page 37.

If you measure 2 Vdc at this point the most probable cause is the A4 processor board.

If you DO NOT measure 2 Vdc at this point perform step 4 on page 44 to check the integrity of the A3 IF assembly.

NOTE

It is possible that there is a bent pin (IF_VIDEO) on the A7 motherboard connectors or an open trace on the A7 motherboard itself. Follow the 2 Vdc from the output of the A3 IF assembly to the input of the A4 processor board.

6. Spectrum Analyzer Displays a Low Signal Level

A low signal level can be caused by a number of assemblies inside the spectrum analyzer.

1. Verify that this problem is not related to the detectors by performing step 1 on page 42.
2. The two most common assemblies for a low signal level would be the A8 RF assembly and the A3 IF assembly respectively. Verify the A8 RF assembly performance as per step 3 on page 43.

If step 3 measures properly, verify the A3 IF assembly performance as per step 4 on page 44.

7. Spectrum Analyzer Displays a High Noise Floor

A high noise floor is often caused by a low gain situation. When the analyzer adjusts for excessive low gain, the displayed noise level will rise too high.

1. Verify the ADC performance as per step 5 on page 45 before taking any measurements.
2. The A8 RF assembly is the most probable cause due to an over-correction during the flat ness calibration. Verify the A8 RF assembly performance as per step 3 on page 43.

If the 21.4 MHz. I.F. alignment signal from the A8 RF assembly was not getting to the A3 IF assembly the noise floor may rise. Verify the 21.4 MHz alignment signal is getting switched to the A3 IF assembly as per step 11 on page 47.

3. Verify the A3 IF assembly performance as per step 4 on page 44 if the A8 RF assembly appears to be O.K.

8. Spectrum Analyzer Signal Amplitude Appears Too High

1. Verify the A3 IF assembly performance as per step 4 on page 44.
2. Verify the A8 RF assembly performance as per step 3 on page 43.
3. Verify the A4 processor board performance as per step 5 on page 45.

9. Spectrum Analyzer Signal Is Distorted

1. Verify the A3 IF assembly performance as per step 4 on page 44.
2. Verify the A8 RF assembly performance as per step 3 on page 43.

10. Spectrum Analyzer Signal Is Off Frequency

- Verify the 10 MHz reference is adjusted properly as per the 10 MHz Reference adjustment procedure in Chapter 5.
- If the 10 MHz reference cannot be adjusted within specifications, the A8 RF assembly is the most probable cause.

11. Check the 21.4 MHz Alignment Signal

This alignment signal is generated on the A8 RF assembly and is switched in during various background alignment sequences to align the A3 IF assembly. If this signal is not present during the alignments there will be problems with analyzer gains and possibly noise floor issues as well.

1. Verify this signal by turning the analyzer on and pressing **Preset**.
2. Turn Auto Align to off by pressing **System, Alignments, Auto Align, Off**.
3. Disconnect the flexible gray cable at the input of the A3 IF assembly (A3J2).
4. Connect the female end of an SMB tee to the A3 IF assembly, one end to a calibrated spectrum analyzer using a snap on cable, and the other end to the flexible gray cable that was previously connected.
5. Press **System, Alignments, Align Now, IF**. During the Align IF you will see the 21.4 MHz. alignment signal on your microwave spectrum analyzer during most of this alignment. The power level should be approximately -55 dBm. If this signal is significantly lower, the A8 RF assembly is the most probable cause.
6. Reconnect the flexible gray cable to the input of the A3 IF assembly (A3J2).
7. After measuring the 21.4 MHz alignment signal, turn the Auto Align back on by pressing **System, Alignments, Auto Align, All**.

Using the Internal Service-Diagnostic Routines

The HP ESA-L1500A spectrum analyzer has several routines which are helpful in diagnosing faults:

- Timebase (in Alignments menu)
- Timebase (in Service Menu, password-protected)
- Video Shift On Off (in Service Menu, password-protected)
- Align Now
- Load Defaults
- Default Config

The service menu is password protected. To access this menu, press **System, More, Service**. At the password prompt, enter -2010 and press **Enter**.

Timebase (in Alignments Menu)

This function allows adjustment of the coarse and fine DACs controlling the VCXO timebase. The primary use for this function is verifying the timebase settability specification (refer to the 10 MHz reference performance test in the User's and Calibration Guide). However, it can also be used to verify proper operation of the phase locked loops (PLLs).

The coarse DAC has a resolution of approximately 9 Hz per DAC count. The fine DAC has a resolution of approximately 1.2 Hz per DAC count. Any changes made to these DACs will remain in effect until the analyzer's power is cycled (i.e., pressing Preset will not reset the DACs back to the values stored in EEROM). To change the timebase DAC values stored in EEROM, it is necessary to use the Timebase function in the Service menu.

To check proper operation of the PLLs:

1. Connect a frequency counter to the 10 MHz REF OUT of the spectrum analyzer. Set the counter for 1 Hz frequency resolution.
2. Connect a 1 GHz, -10 dBm signal to the spectrum analyzer INPUT 50 Ω
3. On the spectrum analyzer, press **Preset, Frequency, 1 GHz, Span 100 kHz**. If necessary, adjust the center frequency to place the 1 GHz signal at the center frequency.
4. On the spectrum analyzer, press **System, Alignments, Timebase, Coarse**. Note the frequency displayed on the frequency counter and the position of the signal on screen. Use the knob to change the

coarse timebase such that the signal displayed on the spectrum analyzer moves by 1 division (10 kHz). The coarse DAC value should require a change of approximately 11 counts. If the signal does not move as the coarse DAC value is changed, the PLLs are not functioning properly.

5. Note the frequency displayed on the frequency counter. If the PLLs are operating properly, the difference between this new frequency and the frequency noted in step 4 should be approximately 100 Hz. If this frequency difference is significantly greater or less than 100 Hz, the PLL is not functioning properly.

Timebase (in Service Menu)

The Timebase function in the Service menu functions the same way as the Time base function in the Alignments menu. However, with the Timebase function in the Service menu, the coarse and fine DAC values can be stored in EEROM by pressing **Save**. This function is used primarily to adjust the 10 MHz reference, but can also be used to check the PLLs as mentioned above.

Video Shift On Off

Amplitude errors in the spectrum analyzer are compensated for by adding IF gain on the A3 IF assembly, by “shifting” the digitized video signal, or by a combination of both IF gain and video shift. By turning video shift on or off, it is possible to isolate problems in analog hardware from problems caused by faults in the auto alignment routines or adjustment procedures.

IF gain is used only to compensate for frequency response (“flatness”) errors when in relatively narrow spans. In the narrow spans, a single IF gain setting can compensate for the majority of the flatness error. In wider spans, however, a single IF gain setting would not yield acceptable flatness. Therefore, in the wider spans, video shift is used to compensate for flatness errors.

When both IF gain and video shift are used, the amount of video shift is typically less than 1 dB; most of the amplitude correction is done with IF gain.

Video shift is also used to correct for log amplifier errors, especially errors more than 50 dB below the reference level. Therefore, when observing a signal in a narrow span, with the noise level more than 70 dB below the reference level, it is typical to see the signal peak change by only a few dB while the noise changes by approximately 25 dB as video shift is turned on and off.

To determine whether an anomaly (i.e., a glitch or spurious response on the trace) is caused by the analog hardware (“raw performance”) or caused by incorrect video shift being applied, proceed as follows:

1. Set up the analyzer so that the anomaly appears on the displayed trace.
2. Press **System, More, Service**. When prompted for the password, enter -2010 and press **Enter**
3. Press **Video Shift On Off (Off)**.
4. If the anomaly disappears, it was caused by an unusually high amount of video shift being applied. This could be the result of an amplitude glitch during execution of an auto alignment routine or an adjustment procedure. Perform an **Auto Align Now All**. Then, set **Video Shift On Off (On)** and check whether or not the anomaly is still present. If so, it is necessary to perform the Uncorrected Flatness and the Corrected Flatness adjustment procedures. Refer to Chapter 5.
5. If the anomaly does not disappear when Video Shift is set to Off, the hardware is at fault. The A8 RF assembly is the most likely cause.

Align Now

During normal spectrum analyzer operation, a small portion of the analog circuitry is being realigned between each sweep. In this mode ("Auto Align On"), a complete realignment occurs approximately every 10 minutes to 1 hour. Realignments are done more frequently when the analyzer is first turned on (when it is cold) and then less frequently as the analyzer warms up. Normal spectrum analyzer operation is not interrupted in this "background" mode.

Align Now halts normal spectrum analyzer operation and forces a complete realignment of the entire system (**Align Now All**) or of a piece of the system (**Align Now IF**, for example).

If any amplitude errors, bandwidth symmetry errors, or log fidelity errors occur, perform an **Align Now All**. This will take approximately 30 seconds. Most of this time is spent aligning the IF subsystem. In some cases, it may be necessary to perform **Align Now All** two or three times.

If performing **Align Now All** does not fix the problem, it may be necessary to first **Load Defaults** (see below), and then perform **Align Now All** once or twice.

When performing **Align Now All** or **Align Now RF**, the presence of an external 50 MHz signal is checked. If an external 50 MHz signal > -25 dBm is detected, the RF alignment will be skipped and the message "Align RF skipped 50 MHz detected" will be displayed. If this occurs, remove the 50 MHz signal from the spectrum analyzer input and perform **Align Now All** or **Align Now RF** again.

Load Defaults

If a glitch occurs during an auto alignment routine, due to an intermittent hardware problem, for example, the correction constants calculated by the auto alignment routine will be incorrect. Performing **Align Now All** will not always allow recovery from such a failure.

Pressing **Load Defaults** loads default values for the alignment system, turns on the frequency corrections, and resets the timebase to the factory values. Once the default values for the alignment system are loaded, **Align Now All** should be able to correctly align the analyzer.

Load Defaults can also be used with **Auto Align Off** to set the analyzer hardware to a consistent, nominal condition for future troubleshooting.

Default Config

Default Config resets the spectrum analyzer to the user configuration originally set at the factory. It also performs an instrument preset. The following table shows the default user-configuration settings which result from pressing **Default Config**:

Configuration	Default Value
Analyzer address (Option A4H)	18
Baud rate (Option 1AX)	9600
Date mode	Month-day-year format
External preamp	0 dB
Internal lock	Off
Power-on	IP (Preset)
Print softkeys	On
Printer Address (Option A4H)	1
Printer port (Options A4H and 1AX)	Parallel
Time/Date display	On

Default Config can be used to return the analyzer to a known "safe" state.

If the information is not correct, perform the spectrum analyzer initialization utility in the adjustment software.

3. Turn the analyzer power off and reseal A4. Refer to Figure 4-8 on page 159. Remove the single screw (4) which secures the processor assembly (8) to the chassis. Carefully lift the processor assembly until the assembly disengages from the two mother board connectors. Carefully plug the processor assembly into the motherboard. Replace the single screw (4) to secure the processor assembly to the chassis. Turn the analyzer power on. If normal operation is not restored, continue with step 4.
4. Perform the "Bootrom Self-Test Check" as described below.
5. Perform the "Address Strobe Check" as described below.
6. If proper operation has not been restored by following the preceding steps, replace A4.

Bootrom Self-Test Check

When the spectrum analyzer is powered-on, the bootrom performs several self-tests. Before each test, the 8 LEDs along the top edge of the A4 processor assembly will light in a pattern which indicates the test to be performed. As tests succeed, the pattern will change. If a test fails, the LED pattern will remain in a state which corresponds to the test that failed. If the display is not functioning, observing the LED pattern will provide information on the status of the self tests performed.

The following table lists the LED patterns and their associated tests:

Table 1-9 Self-Tests vs. LED Pattern

Self-Test Performed	LED Pattern							
	D	D	D	D	D	D	D	D
	S	S	S	S	S	S	S	S
	1	2	3	4	5	6	7	8
Start of Test	1	1	1	1	1	1	1	1
Bootrom Flash EPROM Checksum	1	1	1	1	1	1	1	0
RAM used by Bootrom (destructive)	1	1	1	1	1	1	0	1
Remainder of RAM (non-destructive)	1	1	1	1	1	1	0	0
Main Firmware Checksum	1	1	1	1	1	0	1	0
All Tests Completed Successfully	0	0	0	0	0	0	0	0

1. Cycle the analyzer power and observe the LEDs. If all the LEDs do not light at the start of the test, the bootrom self-tests did not run. Turn the analyzer power off, remove A4 and reseal the bootrom, A4U58. Replace A4 and turn the analyzer power on. If the LEDs still do not light, replace A4.
2. If the self-test indicates a RAM failure, perform the “Clearing RAM” procedure below.
3. If the self-test indicates a main firmware checksum error, reload the firmware. Refer to the Firmware Upgrade Kit.
4. If all tests completed successfully, continue with step 4 of the initial checks for A4 processor troubleshooting.

Observing the LEDs as described above is useful if the LCD display is not functioning. If the display is functioning properly, the following error messages might appear:

Power-up selftest failed Boot ROM checksum: Indicates a test of the bootrom produced a checksum error. The A4 processor assembly is defective.

Power-up selftest failed RAM error: Indicates a test of RAM produced an error. Refer to the “Clearing RAM” procedure below.

Power-up selftest failed Checksum: Indicates a test of the analyzer’s main firm ware produced a checksum error. Reload the firmware. Refer to the Firmware Upgrade Kit.

Clearing RAM

If the power-on selftest indicates a RAM error, try clearing RAM as described below.

1. Turn spectrum analyzer power off.
2. Set switch 1 of A4S1 (switch 1 is closest to the front of spectrum analyzer) to the on (down) position.
3. Turn spectrum analyzer power on and wait 2 seconds.
4. Turn spectrum analyzer power off. Set switch 1 of A4S1 to the off (up) position.
5. Turn spectrum analyzer power on. The entire RAM has been set to 0.

Address Strobe Check

This procedure allows you to set the microprocessor so it can toggle each address line. The microprocessor will set one main address line high at a time. The main address lines, MA0 through MA23, can be monitored via pins on A4J4 and A4J5.

1. Turn the spectrum analyzer power off.

2. Remove any remote I/O assembly (Option A4H or Option 1AX).
3. Set switch 2 of A4S1 to the on (down) position.
4. Turn the spectrum analyzer power on.

CAUTION

Accidentally shorting pins on the top two rows and bottom two rows of A4J4 and A4J5 could damage the analyzer. These pins are connected to the +5V digital supply and digital ground. The +5V supply can provide enough current to damage traces on the A4 processor assembly.

5. Check the main address lines, MA0 through MA23, on A4J4 and A4J5. MA0 is the least-significant bit; MA23 is the most significant bit. Only one address line should be set high at a time. Refer to the component-level information for the A4 processor assembly for A4J4 and A4J5 pinout information.
6. The address strobe check is now complete
 - Turn the spectrum analyzer power off.
 - If an I/O assembly was removed in step 2 above, replace the assembly.
 - Set switch 2 of A4S1 to the off (up) position
 - Turn the spectrum analyzer power on.
7. If the main address lines did not toggle as described in step 5 above, the CPU is not operating. Replace A4.

Troubleshooting the A2 Tracking Generator (Option 1DN/1DQ)

The A2 tracking generator (TG) assembly (Option 1DN/1DQ), is comprised of three board assemblies: the A2A1 tracking generator control board, the A2A2 tracking generator RF board, the A2A3 tracking generator output board. The troubleshooting procedures which follow will help to isolate a failure to one of these three board assemblies.

If Output is Unleveled (TG Unleveled message displayed)

A window comparator on the A2A2 tracking generator RF board is used to monitor the ALC lines. If an unleveled condition occurs, L_UNLEVELED will be set true (low). The unleveled indicator is checked at the end of each sweep. For this reason, it is possible that the output could be unleveled during a portion of a sweep, and although the output returns to a leveled condition by the end of the sweep, TG Unleveled will be displayed at the end of the sweep.

If TG Unleveled is displayed, proceed as follows:

1. Verify that the tracking generator frequency is between 9 kHz and 1.5 GHz for 50 Ω tracking generator and between 1 MHz and 1.5 GHz for 75 Ω tracking generator. Also verify that the source amplitude setting is between 0 dBm and -70 dBm for 50 Ω and between -42.75 dBmV and -27.25 dBmV for 75 Ω .
2. Check at which frequencies the output is unleveled. Set the spectrum analyzer to zero span and step the center frequency in 50 MHz increments. Note at which frequencies the output is unleveled.
3. Check at which power levels the output is unleveled. With the spectrum analyzer in zero span, set the center frequency to 50 MHz or one of the frequencies noted in step 2. Lock the source attenuation to 0 dB by pressing **Source Amptd, Attenuation, Auto Man** (Man). Press **Source Amptd, Amptd, Step, Auto Man** (Man), **Amplitude On Off** (On), **0 dBm** and step the Source Amptd setting in 1 dB increments from 0 dBm to -15 dBm for 50 Ω input. Step the Source Amptd setting in 1 dB increments from 42.75 dBmV to 27.75 dBmV for 75 Ω input. Note at which power levels the output is unleveled. The output may be unleveled when the power level is greater than +1 dBm for 50 Ω or 43.75 dBmV for 75 Ω .
4. Perform the Tracking Generator ALC Calibration and the Tracking Generator Frequency Slope adjustments. Refer to Chapter 5.

5. Check the presence of the 10 MHz reference. Temporarily remove the A2 tracking generator assembly. Refer to Chapter 4 for removal instructions. If a 10 MHz signal is not present on A7J10 pin 52, suspect the A8 RF assembly. Refer to Figure 1-2 on page 37. Reinstall A2.
6. Check that the TG LO signal is present.
 - Set the HP ESA-L1500A to a center frequency of 50 MHz and zero span.
 - Use an active probe, such as the HP 85024A, and a microwave spectrum analyzer to probe A2A1J4. J4 is not loaded, but the holes for the jack are present; probe the center hole. One of the other four holes may be used for a ground connection.
 - Set the microwave spectrum analyzer to a center frequency of 2.5 GHz and a span of 1 GHz.
 - An LO signal of 2.45 GHz at approximately –20 dBm should be present.
 - If the LO signal is not present, or is significantly off frequency, suspect the A2A1 tracking generator control board.
 - If the LO signal is OK, suspect the A2A2 tracking generator RF board.

If the TG LO is Unlocked (TG LO Unlocked message displayed)

The TG LO is referenced to the 10 MHz reference generated on the A8 RF assembly. The TG LO resides on the A2A1 tracking generator control board.

1. Check the presence of the 10 MHz reference. Temporarily remove the A2 tracking generator assembly. Refer to Chapter 4 for removal instructions. If a 10 MHz signal is not present on A7J10 pin 52, suspect the A8 RF assembly. Refer to Figure 1-2 on page 37. Reinstall A2.
2. Check that the TG LO signal is present.
 - Set the HP ESA-L1500A to a center frequency of 50 MHz and zero span.
 - Use an active probe, such as the HP 85024A, and a microwave spectrum analyzer to probe A2A1J4. J4 is not loaded, but the holes for the jack are present; probe the center hole. One of the other four holes may be used for a ground connection.
 - Set the microwave spectrum analyzer to a center frequency of 2.5 GHz and a span of 1 GHz.

- An LO signal of 2.45 GHz at approximately -20 dBm should be present.
- If the LO signal is not present, or is significantly off frequency, suspect the A2A1 tracking generator control board.
- If the LO signal is OK, suspect the A2A1 tracking generator control board (the lock- detect circuitry is also on A2A1).

If the Tracking Generator Is Not Properly Recognized by the Firmware (Configuration error: RF-Source Impedance mismatch message displayed)

When the analyzer is powered-up, the firmware queries each board assembly for its identification information. If a board does not respond to a query, it is assumed to not be present. If the A2 tracking generator assembly does not respond to the firmware's query, the functions under the **Source Amptd** menu will not be available.

1. Check the **Show System** screen. Press **System, Show System**. Verify that "1DN 50 Ohm Tracking Generator" is displayed.
2. If the information in the **Show System** screen does not identify a tracking generator, try reseating A2 in its motherboard connector. If **Show System** still does not identify a tracking generator, suspect the A2A1 tracking generator control board.
3. If the information in the **Show System** screen identified a 75 ohm tracking generator (Option 1DQ), the A2A3 tracking generator output board might not be properly connected to A2A2J4. A2A2J4 pin 2 is normally grounded by the A2A3 tracking generator output board to identify the A2 assembly as a 50 ohm tracking generator. If A2A2J4 pin 2 is not connected, this line will be pulled high, causing the A2 assembly to be identified as a 75 ohm tracking generator.

If Flatness is Out-of-Tolerance

1. Check the Type-N output connector for damage. Replace the connector if it is damaged.
2. Perform the Tracking Generator ALC Calibration and Tracking Generator Frequency Slope adjustments. Refer to Chapter 5.
3. If the adjustments did not bring flatness within tolerance, suspect the A2A2 tracking generator RF board or the A2A3 tracking generator output board.

If Vernier Accuracy is Out-of-Tolerance

1. Perform the Tracking Generator ALC Calibration adjustment. Refer to Chapter 5.
2. If the adjustment did not bring vernier accuracy within tolerance, suspect the A2A2 tracking generator RF board.

If Harmonics and Spurious Outputs are Too High

High harmonic output levels will generally be caused by problems on the A2A2 tracking generator RF board. However, some non-harmonic spurious output levels may be caused by the TG LO on the A2A1 tracking generator control board.

1. If harmonic output levels are out-of-tolerance, suspect the A2A2 tracking generator RF board.
2. If non-harmonic output levels are out-of-tolerance, note the frequency difference between the fundamental output frequency and the spurious output. Check the LO to see it also displays a spurious output with the same frequency difference:
 - Set the HP ESA-L1500A to the center frequency used to determine the out-of-tolerance condition and zero span.
 - Use an active probe, such as the HP 85024A, and a microwave spectrum analyzer to probe A2A1J4. J4 is not loaded, but the holes for the jack are present; probe the center hole. One of the other four holes may be used for a ground connection.
 - Set the microwave spectrum analyzer to a center frequency of 2.4 GHz higher than the HP ESA-L1500A center frequency. Set the span to at least twice the frequency difference between the non-harmonic spurious output and the fundamental output.
 - An LO signal at approximately -20 dBm should be present.
 - If the LO shows a spurious response at an offset equal to the difference between the tracking generator's fundamental output and the non-harmonic spurious output, suspect the A2A1 tracking generator control board.
 - If the LO does not show a spurious response as described above, suspect the A2A2 tracking generator RF board.

If Power Sweep is Not Functioning Properly

The power sweep function is implemented on the A2A2 tracking generator RF board, but is controlled via digital signals from the A2A1 tracking generator control assembly.

1. Perform the Absolute Amplitude, Vernier, and Power Sweep Accuracy performance test in the *HP ESA-L1500A User's and Calibration Guide*.
2. If the performance test passes, suspect the A2A2 tracking generator RF board.
3. If the performance test fails, perform the Tracking Generator ALC Calibration adjustment. Refer to Chapter 5. Rerun the performance test.
4. If the performance test still fails, suspect the A2A1 tracking generator control board (digital control signals might be corrupted) or the A2A2 tracking generator RF board (the power level control DACs might not be responding properly).

If There is No Output Power

No output power can be caused not only by a failure in the mixer, output amplifier, or output attenuators, but also by one of the two synthesizers being extremely off-frequency.

1. Check the presence of the 10 MHz reference. Temporarily remove the A2 tracking generator assembly. Refer to Chapter 4 for removal instructions. If a 10 MHz signal is not present on A7J10 pin 52, suspect the A8 RF assembly. Refer to Figure 1-2 on page 37. Reinstall A2.
2. Check that the TG LO signal is present.
 - Set the HP ESA-L1500A to a center frequency of 50 MHz and zero span.
 - Use an active probe, such as the HP 85024A, and a microwave spectrum analyzer to probe A2A1J4. J4 is not loaded, but the holes for the jack are present; probe the center hole. One of the other four holes may be used for a ground connection.
 - Set the microwave spectrum analyzer to a center frequency of 2.5 GHz and a span of 1 GHz.
 - An LO signal of 2.45 GHz at approximately -20 dBm should be present.
 - If the LO signal is not present, or is significantly off frequency, suspect the A2A1 tracking generator control board.
 - If the LO signal is OK, suspect the A2A2 tracking generator RF board or the A2A3 tracking generator output board.

Contacting Hewlett-Packard

If you have a problem with your spectrum analyzer, first, check the basics. This chapter contains a checklist that will help identify some of the most common problems. If further troubleshooting is necessary, continue with the troubleshooting steps earlier in this chapter, or return the spectrum analyzer to Hewlett-Packard.

Calling HP Sales and Service Offices

Use the information in this section to obtain Hewlett-Packard sales and service offices information. Sales and service offices are located around the world to provide complete support for your spectrum analyzer. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service office listed in Table 1-10. In any correspondence or telephone conversations, refer to the spectrum analyzer by its model number and full serial number. With this information, the HP representative can quickly determine whether your unit is still within its warranty period.

Table 1-10 Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS			
Headquarters Hewlett-Packard Company 19320 Pruneridge Avenue Cupertino, CA 95014, USA (800) 752-0900	California, Northern Hewlett-Packard Co. 301 E. Evelyn Mountain View, CA 94041 (415) 694-2000	California, Southern Hewlett-Packard Co. 1421 S. Manhattan Ave. Fullerton, CA 92631 (714) 999-6700	Colorado Hewlett-Packard Co. 24 Inverness Place, East Englewood, CO 80112 (303) 649-5512
Atlanta Annex Hewlett-Packard Co. 2124 Barrett Park Drive Kennesaw, GA 30144 (404) 648-0000	Illinois Hewlett-Packard Co. 5201 Tollview Drive Rolling Meadows, IL 60008 (847) 342-2000	New Jersey Hewlett-Packard Co. 150 Green Pond Road Rockaway, NJ 07866 (201) 586-5400	Texas Hewlett-Packard Co. 930 E. Campbell Rd. Richardson, TX 75081 (214) 231-6101
EUROPEAN FIELD OPERATIONS			
Headquarters Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/Geneva Switzerland (41 22) 780.8111	France Hewlett-Packard France 1 Avenue Du Canada Zone D'Activite De Courtaboeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60	Germany Hewlett-Packard GmbH Hewlett-Packard Strasse 61352 Bad Homburg v.d.H Germany (49 6172) 16-0	Great Britain Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG41 5DZ England (44 734) 696622
INTERCON FIELD OPERATIONS			
Headquarters Hewlett-Packard Company 3495 Deer Creek Rd. Palo Alto, CA 94304-1316 (415) 857-5027	Australia Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895	Canada Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232	China China Hewlett-Packard Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888
Japan Hewlett-Packard Japan, Ltd. 1-27-15 Yabe, Sagamihara Kanagawa 229, Japan (81 427) 59-1311	Singapore Hewlett-Packard Singapore (Pte.) Ltd. 150 Beach Road #29-00 Gateway West Singapore 0718 (65) 291-9088	Taiwan Hewlett-Packard Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404	

Instrument Serial Numbers

Hewlett-Packard makes frequent improvements to its products to enhance performance, usability, or reliability. Hewlett-Packard service personnel have access to complete records of design changes to each type of instrument, based on the instrument's serial number and option designation.

Whenever you contact Hewlett-Packard about your spectrum analyzer, have the complete serial number available. This will ensure that you obtain accurate service information.

A serial number label is attached to the rear of the spectrum analyzer. This label has two instrument identification entries: the first provides the instrument's serial number and the second provides the identification number for each option built into the instrument.

The serial number has two parts: the prefix (two letters and the first four numbers), and the suffix (the last four numbers). Refer to Figure 1-6.

Figure 1-6 Example Serial Number



sz155e

The two letters identify the country in which the unit was manufactured. The four numbers of the prefix are a code identifying the date of the last major design change incorporated in your spectrum analyzer. The four digit suffix is a sequential number and, coupled with the prefix, provides a unique identification for each unit produced. Whenever you list the serial number or refer to it in obtaining information about your analyzer, be sure to use the complete number, including the full prefix and the suffix.

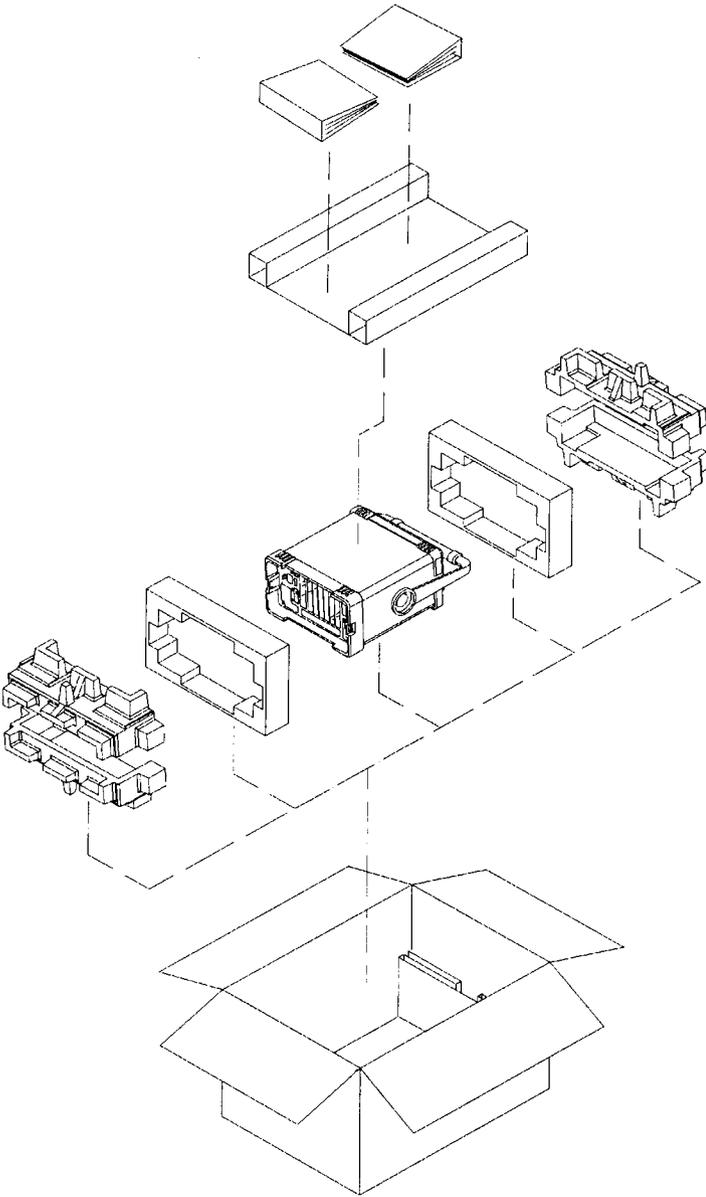
How to Return Your Analyzer for Service

Service Tag

If you are returning the spectrum analyzer to Hewlett-Packard for servicing, fill in and attach a blue service tag. Several service tags are supplied in this manual. 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 completed a Performance Test Record, or have any other specific data on the performance of the spectrum analyzer, please send a copy of this information with the unit.

Original Packaging

Before shipping, pack the unit in the original factory packaging materials if they are available. If the original materials were not retained, see "Other Packaging".



form116

Other Packaging

CAUTION

Spectrum analyzer 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 cause equipment damage by generating static electricity and by lodging in the spectrum analyzer louvers, blocking airflow.

You can repackage the instrument with commercially available materials, as follows:

1. Attach a completed service tag to the instrument.
2. If you have a front-panel cover, install it on the instrument; if not, protect the control panel with cardboard.
3. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
4. 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 spectrum analyzer. Allow at least 3 to 4 inches on all sides of the analyzer for packing material.
5. Surround the equipment with three to four inches of packing material and prevent the equipment from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation (Hayward, California, 94545). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrapping the equipment several times in this material should both protect the equipment and prevent it from moving in the carton.
6. Seal the shipping container securely with strong nylon adhesive tape.
7. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to assure careful handling.
8. Retain copies of all shipping papers.

2 **Block Diagrams**

This chapter provides information about the operation of the spectrum analyzer that is useful when first troubleshooting a spectrum analyzer failure.

The HP ESA–L1500A spectrum analyzer is a microprocessor-controlled swept receiver with a frequency range of 9 kHz to 1.5 GHz. This chapter briefly describes each of the following analyzer assemblies:

- “A8 RF Assembly” on page 69
- “A3 IF Assembly” on page 73
- “A4 Processor Assembly” on page 75
- “A5 Power Supply Assembly” on page 79
- “A1 Display/Front Panel” on page 81
- “Option 1DN and 1DQ A2 Tracking Generator” on page 82
- “Option A4J A7A1 IF/Sweep Port Assembly” on page 82

All of the assemblies listed above are connected to the serial digital interface through the motherboard connection. All data and control information, and all power supplies, are distributed through these connections. Each of these assemblies has its own individual EEPROM where serial numbers and alignment data for the board are stored.

The assemblies listed below do not have individual EEPROMs and are not connected to the serial digital interface.

- “A7 Motherboard” on page 80
- “A6 Speaker Board” on page 81
- “Option A4H A7A2 HP-IB/Parallel Assembly” on page 83
- “Option 1AX A7A3 RS-232/Parallel Assembly” on page 83

A8 RF Assembly

The A8 RF assembly performs the following major functions:

- Provides input protection
- Provides input attenuation
- Converts RF input signals to the 21.4 MHz IF
- Generates first and second local oscillator (LO) signals for down-conversion
- Uses a fractional-N phase locked loop for first LO stability
- Generates a 10 MHz reference signal
- Generates an internal 50 MHz alignment signal, and a 21.4 MHz IF alignment signal

The RF section uses a two-stage frequency conversion to convert RF signals to the 21.4 MHz final IF.

Input Connector

The input connector is mounted directly on the RF assembly. This connector can be easily replaced without disassembling the RF section. Refer to Chapter 4 for the removal procedure.

Input Protection

CAUTION

Exposing the analyzer to high levels of input power over a prolonged time period can damage the circuitry.

The spectrum analyzer input circuitry can be damaged by power levels that exceed the maximum safe input level specifications. Refer to the instrument specifications for the exact values.

Some input protection is provided by a DC blocking capacitor after the input connector. The input relay that switches between input signals and an internal 50 MHz alignment signal also functions as an overload protection switch. The relay is driven by an overload detector that has two power trip points. When the input attenuation is less than 15 dB the trip point is approximately +13 dBm (68 dBmV with Option 1DP), to protect the mixer. When the input attenuation is 15 dB or greater the trip point is set to approximately +33 dBm (76 dBmV with Option 1DP), to protect the attenuator.

During an overload condition, the input signal will still be displayed, but at a lower amplitude. This will be accompanied by a message displayed on screen informing the operator of the overload condition. Refer to the User's and Calibration Guide for your analyzer for information on how to clear the overload condition.

Attenuator

The input attenuator provides 0 to 60 dB of attenuation in 5 dB steps. Pressing **Preset** selects 10 dB attenuation.

Low-Pass Filter

The input signal passes through a 1.5 GHz low-pass filter (LPF) to eliminate unwanted signals above 1.5 GHz.

First Mixer

The first mixer converts incoming signals to a 2.4214 GHz first IF by mixing the input signal with a 2.4214 to 3.9214 GHz first local oscillator (LO). This LO is derived by tripling the output from an 800 to 1308 MHz fractional-N phase locked loop (PLL) synthesizer.

1st IF Amplifier/Filter/Attenuator

The overall gain of the front end is set by the digital to analog converter (DAC) controlled RF variable gain amplifier. The variable gain amplifier has an input LPF, input attenuator, amplifier, output attenuator, and an output LPF. The LPF's provide rejection of harmonics of the LO in order to attenuate unwanted spurious signals. The two attenuators control the approximately 30 dB of available gain. This range is used to provide an overall gain of 0 dB from the RF input to the 21.4 MHz output to the IF assembly.

Second Mixer

The second mixer converts the 2.4214 GHz first IF to a 21.4 MHz second and final IF, by mixing it with a 2.4 GHz second LO. The second LO is derived from tripling the frequency of an 800 MHz voltage controlled oscillator (VCO).

21.4 MHz Amplifier

The 21.4 MHz amplifier has 3 functions: a bandpass filter (BPF) at the input to reject signals at 10.7 MHz, an amplifier with a typical gain of 12 dB, and a PIN switch circuit to switch between the IF and the 21.4 MHz IF alignment signal that is generated by the first LO.

Frequency Reference

The 10 MHz voltage controlled crystal oscillator (VCXO) frequency reference is used to phase lock the 800 to 1308 MHz PLL first LO, and the 800 MHz PLL second LO. It is also used for synchronization with the processor assembly for the analog to digital converter (ADC).

LO

First LO

The 2.4214 to 3.9214 GHz first LO signal is derived from an 800 to 1308 MHz PLL synthesized signal that is tripled by a diode tripler/filter.

This first LO multiplier consists of three tripler/filter paths that are selected by PIN diode switches. Each path contains its own tripler/filter and the appropriate signal path is switched in based on the desired LO frequency. The three paths are identical except for the range of their bandpass filters.

The output of the tripler is bandpass filtered to remove the harmonics, and sent to the output switch. Then it is amplified with a limiting amplifier before going to the first LO amplifier to drive the input mixer.

For frequency sweeps that cross over more than one path range, the two adjacent paths are enabled simultaneously during band crossings to produce a “make- before-break” type of switching action. This action is controlled by the system processor to avoid first LO power drop outs.

The first LO generates the 21.4 MHz IF alignment signal by dividing the PLL output by 40 and bandpass filtering the divided-down signal.

Second LO

The 2.4 GHz second LO signal and the 50 MHz alignment signal are both synthesized from the 800 MHz VCO that is phase locked to the 10 MHz reference. The 2.4 GHz signal is derived by multiplying the 800 MHz signal with the use of a tripler/filter path similar to the one used to generate the first LO signal. The 50 MHz alignment signal is derived by dividing the 800 MHz signal by 16.

Interconnections to Other Assemblies

The A8 RF assembly has three external connectors, (two at the rear of the instrument and one at the front). It also has seven internal connectors, (four on the top of the board, two on the bottom, and one on the bandpass filter (BPF) cavity).

A8J10	RF Input (front external port)
A8J12	EXT REF IN - accepts an external frequency source to provide the 10 MHz, -15 to +10 dBm frequency reference used by the spectrum analyzer. (rear external port)
A8J3	21.4 MHz IF output to the A3 IF Assembly (internal)
A8J11	EXT REF OUT - provides a 10 MHz, 0 dBm minimum, time- based reference signal. (rear external port)
A8J5	1st LO VCO test port (internal)
A8J6	2nd LO VCO test port (internal)
A8J13	BPF alignment port (internal)

Unused

- A8J4 (internal)
- A8J2 (internal)
- A8J7 (internal)

A3 IF Assembly

The A3 IF assembly utilizes combined crystal and LC filters to process 21.4 MHz input signals and create a video output signal.

The IF assembly provides the following main functions:

- Resolution bandwidth filtering
- Step gain amplification
- Log amplification
- Linear detection
- Frequency counter prescaling

Cal Attenuator

The cal attenuator has 0 to 49 dB of attenuation (in 7 dB steps) to provide gain range for the log amplifier alignment. The attenuator is switched on only as part of IF alignment, not during any normal spectrum analyzer sweeps.

21.4 MHz Bandpass Filters

The 21.4 MHz IF filters are a series of four pole, synchronously-tuned combined crystal and LC filters with adjustable gain and bypass switches.

Eight IF bandwidths, from 1 kHz to 3 MHz, can be selected in a 1, 3, 10 sequence.

The resolution bandwidths are normally coupled to the frequency span of the spectrum analyzer for an optimum ratio of span to resolution bandwidth. Sweep time is also coupled to both resolution bandwidth and span for optimum amplitude response. The resolution bandwidth, sweep time, and span can be set independently.

Log Detector

The log detector displays the input signal logarithmically due to the successive detection log amplifier that has an overall range of 85 dB.

In log mode, the default vertical amplitude units is dBm, (dB relative to a milliwatt), rather than volts. (The default vertical amplitude units is dBmV with Option 1DP.)

Linear Detector

The input signal can be displayed in a linear mode, in which the vertical deflection on the screen is directly proportional to the voltage of the input signal.

Interconnections to Other Assemblies

- A3J2 Unfiltered 21.4 MHz input on SMB cable from the A8 RF assembly at -10 dBm nominal level corresponding to a full scale (top of screen) output video level of 2 V
- Filtered 21.4 MHz output to A7A1 (option A4J) at $+10$ dBm nominal level corresponding to a full scale (top of screen) input of -10 dBm
 - Video output, nominally 0 V at bottom of screen and 2 V at top of screen
 - Frequency counter output, differential output 100 mV at 10.7 MHz

A4 Processor Assembly

The A4 processor assembly provides the following main functions:

- Main CPU processing
- Memory, including boot memory and firmware
- Video filtering
- Peak detection
- Analog to digital conversion of the video output from A3
- Real time clock
- IF counters
- Communicates with I/O assemblies
- Front panel interface
- LCD interface

Analog Section

The analog section of the processor assembly takes care of all video processing. The analog section includes the input mux, video filter, peak detector, and analog to digital conversion circuitry.

Input Muxes

There are two input multiplexers on the processor assembly. MUX A selects which signal passes through the video filters to the peak detectors. MUX B selects which signal is digitized by the analog-to-digital converter.

Video Filters

There are 10 video filter bandwidths in the video section of the processor assembly. They are simple low-pass RC filters created by switching one of 5 different capacitors and one of 2 different resistors into the system. The video filters range from 1 MHz to 30 Hz in a 1, 3, 10 sequence in 10 steps.

Peak Detectors

There are two peak detectors on the processor assembly. The positive peak detector saves the maximum value reached between measurement buckets. The negative peak detector saves the minimum value reached between measurement buckets.

Analog to Digital Converter (ADC)

The analog to digital converter on the processor assembly has a 0 to +2 V range and uses a 12 bit conversion for normal measurements. This results in a vertical resolution of approximately 0.05 dB in log mode and 0.05% of reference level in linear mode.

Temperature Sensor

The processor assembly has an on-board temperature sensor to give the firmware the ability to determine when the instrument should be realigned due to temperature changes.

Audio

There is an audio line on the motherboard that goes to the speaker assembly installed in the instrument. When a signal needs to be heard through the speaker or headphone jack, it is put onto the audio line. The processor has the ability to put two different signals onto the AUDIO line of the analyzer. The first is the AUX_VIDEO line. This is the signal going through the video filters. The second is the CPU_SOUND line. This is an output from the main CPU and can be used to make beeps for the speaker.

Real Time Clock

The real time clock uses a 32 kHz crystal to keep track of the time and date. It has battery backup from the same battery and controller as the SRAM. The real time clock and the display controller each have their own separate timers.

IF Count

The processor counts the IF divided by 2 (10.7 MHz) to determine precisely where the spectrum analyzer is tuned. This is used for the frequency counter function

Analyzer Battery Information

The spectrum analyzers use a 3 V lithium battery to enable the internal memory to retain data. The date when the battery was installed is on a label on the rear panel of the spectrum analyzer. See Figure 2-1.

The minimum life expectancy of the battery is 8 years at 25 °C. If you experience problems with the battery or the recommended time period for battery replacement has elapsed, see "Contacting Hewlett-Packard" in Chapter 1.

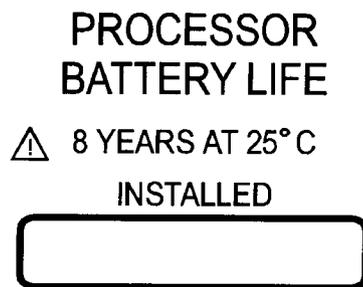
If you wish to replace the battery yourself, refer to the "BT1 Battery" replacement procedure in Chapter 4. The battery is soldered onto the spectrum analyzer processor board. If the battery goes dead or the

battery connection is broken, the real time clock stops and all data stored in RAM is lost. This data will have to be restored after the battery is replaced. Examples of this data are:

- HP-IB address (Option A4H) or RS-232 baudrate (Option 1AX)
- Current correction factors (Factory correction factors are stored on each assembly.)
- Any saved states, traces, limit lines, and Ampcor tables
- Any customized instrument settings like display contrast, etc.

After replacing the spectrum analyzer battery, write the date of battery replacement on the rear-panel label.

Figure 2-1 Rear-Panel Battery Information Label



sl737a

Interconnections to Other Assemblies

There are four connectors to the rear panel. They are:

A4J7	VGA OUTPUT - drives an external VGA compatible monitor with a signal that has 31.5 kHz horizontal, 60 Hz vertical synchronizing rate, non-interlaced.
A4J1	(service connector for downloading firmware)
A4J8	GATE TRIG/EXT TRIG IN (TTL) - accepts the positive edge of an external voltage input that triggers the spectrum analyzer internal sweep source.
A4J9	GATE/HI SWP OUT (TTL) - indicates when the spectrum analyzer is sweeping.

The front panel interface connector contains the signals and voltages for all front panel circuitry:

- Power supplies
- Rotary pulse generator (RPG) interface - There are two RPGs; one for the active function and one for volume.
- Front panel keyboard interface
- AT keyboard interface - an AT-style PC keyboard can be plugged into the front panel.
- LCD digital interface - The display controller for the processor assembly can drive an LCD (internal), and a VGA (external) CRT simultaneously.
- Front panel serial interface - used to communicate with the front panel of the instrument.
- Probe power unfiltered supply (+15 V and -15 V supplies). The -15 V supply is converted to -12.6 V on the front panel interface board for the probe power connector.

A5 Power Supply Assembly

The A5 power supply assembly can be powered by a 90 to 264 volt AC supply, or an external DC supply. It supplies the instrument with all of the supply voltages listed below. The line module, line fuse, and the DC power connector and DC fuse are all part of the power supply assembly. Refer to the parts list in Chapter 3 for the fuse types.

If the instrument loses power for more than 30 seconds, the controller can forget what power state (on or off) the operator had selected. When power is restored, the instrument will normally be off. There is a switch, accessible from the rear of the instrument, to make the instrument always come on when power is applied. This feature might be desirable if the instrument is in a rack with other instruments and the entire rack is turned on with a single switch. Also, if the instrument is operating unattended, it is desirable to have measurements continue after restoration of power.

The fan is mounted directly to the power supply assembly. The fan speed varies with internal instrument temperature; as the internal temperature increases, the fan speed also increases.

NOTE

Because of safety concerns, the power supply is not repairable.

Interconnections to Other Assemblies

- +5 V, +15 V, +28 V, -5 V, and -15 V supplies to the power supply bus
- Voltage for the fan control
- Connector at the rear panel for a DC supply input

A7 Motherboard

The A7 motherboard provides the power supply and digital bus interconnect between assemblies in the analyzer. Refer to Table 2-1 through Table 2-10 in this chapter for details on the motherboard connectors and mnemonics used.

Miscellaneous

A1 Display/Front Panel

Display

The display is an LCD monochrome flat screen with 640×480 VGA resolution. There is a connector for an external VGA display available at the rear panel.

A1A1 Front Panel Interface Board

The A1A1 front panel interface board provides the interface between the display generation circuitry on the processor assembly and the display. It also interfaces the front panel keyboard to the processor assembly. Any display-specific voltages (other than 5 V digital) are created on this board. The front panel interface board also includes the following:

- Main RPG
- Volume RPG
- Plug for external AT style PC keyboard
- Probe power (-12.6 Vdc, $+15$ Vdc, and ground)
- Circuits to digitally adjust the display
- High voltage for the display backlight

A6 Speaker Board

The speaker board has an internal speaker and a front panel earphone jack (behind the media door) to provide the capability to listen to a demodulated signal. The volume is controlled by the volume knob on the front panel.

Options

Option 1DP 75 Ω Input Impedance

Option 1DP provides a 75 Ω input impedance (1 MHz to 1.5 GHz) instead of the standard 50 Ω impedance. Spectrum analyzers with this option use cables, circuit boards, and front panels that are different from the standard units.

Option 1DN and 1DQ A2 Tracking Generator

Option 1DN (9 kHz to 1.5 GHz) and Option 1DQ (1 MHz to 1.5 GHz) provide a built-in tracking generator. This source-receiver combination makes insertion loss, frequency response, and return loss measurements. The tracking generator has a wide distortion free dynamic range, plus good sensitivity and selectivity.

Option 1DN has the standard 50 Ω output impedance. Option 1DQ has a 75 Ω out put impedance, and is available only with Option 1DP.

Option A4J A7A1 IF/Sweep Port Assembly

The A7A1 spectrum analyzer I/O assembly provides five rear panel signals:

- | | |
|--------|---|
| A7A1J6 | SWP OUT - sweep ramp output, provides a voltage ramp proportional to the sweep of the spectrum analyzer (0 V to 10 V). |
| A7A1J5 | HI SWP IN (TTL) - high sweep input, allows external sweep control. Can be grounded to stop sweeping. |
| A7A1J4 | HI SWP OUT (TTL) - high sweep output, provides the HSWP TTL signal as an output (TTL high during a sweep, TTL low during a retrace). Indicates when the spectrum analyzer is sweeping |
| A7A1J3 | AUX VIDEO OUT - auxiliary video output, provides detected video output (before the analog-to-digital conversion) proportional to vertical deflection of the trace. Output is from 0 V to 1 V. Amplitude correction factors are not applied to this signal. The output signal will be blanked occasionally during retrace by the automatic alignment routine. Select a very long sweep time to minimize this, or turn off the Auto Align All function (and use Align Now All manually to maintain calibration. Refer to the specifications chapter of the <i>HP ESA-L1500 User's and Calibration Guide</i> . |

A7A1J2 **AUX IF OUT** - auxiliary IF output. A 50 Ω , 21.4 MHz IF output that is the down-converted signal of the RF input of the spectrum analyzer. Amplitude-correction factors are not applied to this signal. This output is taken after the resolution bandwidth filters and step gains and before the log amplifier. The output signal will be blanked occasionally during retrace by the automatic alignment routine. Select a very long sweep time to minimize this, or turn off the **Auto Align All** function (and use **Align Now All** manually to maintain calibration.) Refer to the specifications chapter of the *HP ESA-L1500 User's and Calibration Guide*.

Option A4H A7A2 HP-IB/Parallel Assembly

The A7A2 HP-IB/parallel assembly provides an HP-IB port that allows you to control your spectrum analyzer from a computer that uses a Hewlett-Packard Interface Bus (HP-IB). This assembly also provides a parallel (Centronics) printer port.

Option 1AX A7A3 RS-232/Parallel Assembly

The A7A3 RS-232/parallel assembly provides an RS-232 port that allows you to control your spectrum analyzer from a computer that uses an RS-232 interface. This assembly also provides a parallel (Centronics) printer port.

Motherboard Mnemonics and Connectors

Table 2-1 **Motherboard Mnemonics**

Mnemonic	Description
10MHZ_AC	<p>This is the 10 MHz reference from the RF section to the A7A1 and processor. It is terminated in 50 Ω by the processor board. Signal: AC coupled 0.5V peak to peak</p> <p>Line Impedance: 50 Ω</p>
10MHZ_TG	<p>This is the 10 MHz reference from the RF section to the tracking generator. It is terminated in 50 Ω by the tracking generator boardL Signal: AC coupled 0.5V peak to peak</p> <p>Line Impedance: 50 Ω</p>
ACOM	Analog Common
AC_IF	<p>Analog Card IF. An uncorrected, buffered IF signal from the output of the IF assembly. Frequency: 21.4 MHz</p> <p>Line Impedance: 50 Ω</p>
AC_TRIG	(not used)
ADC_SYNC	A positive going signal that indicates when the main ADC on the video/ processor assembly has started an A/D conversion.
ANA_TST	<p>An analog signal from the RF section, tracking generator, or the analog card cage to the ADC of the video processor. When it is selected, the signal bypasses the video filter and peak detector sections.</p> <p>Line Impedance: 50 Ω</p>
AUDIO	<p>AUDIO line to internal speaker</p> <p>Line Impedance: 50 Ω</p>
AUX_VIDEO	<p>Auxiliary video: A detected video signal (0-2V) that has passed through the video filters.</p> <p>Line Impedance: 50 Ω</p>
CRD_ANLG1	(not used)
CRD_ANLG2	(not used)
CRD_ANLG3/7	(not used)
DCOM	A common ground for all digital circuitry.

Mnemonic	Description
DI_FREQ_CNT	Differential Inverted Frequency Count: 10.7 MHZ signal from IF to processor to be counted for marker count function
DN_FREQ_CNT	Differential Non-Inverted Frequency Count: 10.7 MHZ signal from IF to processor to be counted for marker count function
HPUP_AC	High = Processor Up Analog Card: This line will go high when power is applied and will go low before the supplies fully shut down.
HPUP_SYNC	(not used)
HPUP_PS	High = Processor Up Power Supply: This line will go high when power is applied and will go low before the supplies fully shut down.
HSWP_AC	High = Sweeping for analog card. A high indicates the analyzer is sweeping. (HC)
HSWP_CNTRL	High = Sweep Control: This signal provides control for the analyzer display sweep and retrace.
HWR_END_IO	High = Write_End. A signal that indicates the end of cycle for I/O card. (TTL)
H_SWEEP	High = Sweep for RF and TG. A high indicates the analyzer is sweeping. (HC)
IF_VIDEO	The detected 21.4MHz IF signal from the detector on the IF assembly to the input multiplexer of the video processor. Line Impedance: 50 Ω
IO_A(16/0)	I/O Address Lines
IO_D(15/0)	I/O Data Lines
LADDR	Low = Address, serial bus strobe for address information
LAS_IO	Low = Address strobe for I/O card. A TTL low indicates address valid
LCNTRL	Low = Control, serial bus strobe for control information
LCS_HIGH_IO	(not used)
LCS_IO	Low = Chip select for I/O card (TTL)
LDATA	Low = Data, serial bus strobe for sending data
LDS_IO	Low = Data strobe for I/O card (TTL)
LDTACK_IO	Low = Data acknowledge for I/O card
LINE_TRIG	TTL signal synchronous with AC line

Block Diagrams
Motherboard Mnemonics and Connectors

Mnemonic	Description
LI_IO0/4	Four Dedicated interrupt lines for I/O boards: LI_IO0 is for the Speaker board (J20) LI_IO1 is for Card Slot 1 (J21) LI_IO2 is for Card Slot 2 (J22)
LI_IO_SLOW	I/O Card Slow Interrupt
LLW_IO	Low = Lower write, strobe for lower 8 bits
LOE_IO	Low = output enable, strobe for reading data
LRESET_IO	Low = reset IO card (TTL)
LSRQ	Low Service Request.
L UW_IO	Low = Upper write, strobe for upper 8 bits
LWAIT_IO	Low = wait_IO card, low extends bus cycle
MB_ID3/0	(not used)
MISO	Master In Slave Out serial data
MOSI	Master Out Slave In serial data
N15	-15 volts
N5	-5 volts
P15	+15 volts
P28	+28 Volts
P5	+5 volts
P5C	+5 volts Constant
P5D	+5 volts for Digital
PS_COM	see PS_ON
PS_OFF	not used
PS_ON	PS_ON line, when connected to PS_COM the instrument will turn on
PS_ID0	Power supply ID bit
SCK	Serial clock
WLR_IO	Write Low Read
X1	(not used)
X2	(not used)

Table 2-2 Mnemonic Pin Locations

Mnemonic	A7 Motherboard Connector							
	J1	J2	J4	J6	J7	J10 and J16	J20	J21 and J22
10MHZ_AC			40		56	52 (J16 only)		
10MHZ_TG			18			52 (J10 only)		
ACOM	25-36, 75-86	6-10, 12-15, 17-19, 32-39	7, 9, 11, 13-17, 19,20, 33-35, 37-39		1, 3-7, 9-11,13-15, 17-19,21-23, 25-29,31,33, 35,37, 39-42,50,51, 53-55,57-67, 69-71,73-77, 90-92,100	1-3, 5-7, 9-11,13-15, 17-19,21-23 25-27,29,31 33, 40, 48, 51, 53-55, 57-59,61-63 65-67,69-71 73-75,77-79 90,98	42,43, 48-50,92, 93, 98, 100	1, 2, 7, 8, 51, 52, 57, 58
AC_IF		34				76		
ADC_SYNC					32	32		
ANA_TST			36		12	56		
AUDIO					8	4		
AUX_VIDEO					72	72		
DCOM	8-12, 58-62			3, 5, 7, 9, 11, 13, 15, 17,19-21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 68, 69, 81, 93		49,99	1, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39-41, 66, 78	9, 11, 13, 15, 17, 19, 21-23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 46, 50, 72, 73, 85
DI_FREQ_CNT		20			52			
DN_FREQ_CNT		40			2			
HPUP_AC		11			36	34		
HPUP_PS	2			49				
HSWP_AC					81	81 (J16 only)		
HSWP_CNTRL					80	80		
HWR_END_IO				8			38	10
H_SWEEP			8		79	81 (J10 only)		
IF_VIDEO		16			24	24		
IO_A(0)				32			16	34
IO_A(1)				80			67	84

Block Diagrams
Motherboard Mnemonics and Connectors

Mnemonic	A7 Motherboard Connector							
	J1	J2	J4	J6	J7	J10 and J16	J20	J21 and J22
IO_A(2)				30			18	32
IO_A(3)				79			68	83
IO_A(4)				78			69	82
IO_A(5)				28			20	30
IO_A(6)				77			70	81
IO_A(7)				76			71	80
IO_A(8)				26			22	28
IO_A(9)				75			72	79
IO_A(10)				74			73	78
IO_A(11)				24			24	26
IO_A(12)				73			74	77
IO_A(13)				72			75	76
IO_A(14)				22			26	24
IO_A(15)				71			76	75
IO_A(16)				70			77	74
IO_D(0)				92			55	96
IO_D(1)				91			56	95
IO_D(2)				42			6	44
IO_D(3)				90			57	94
IO_D(4)				89			58	93
IO_D(5)				40			8	42
IO_D(6)				88			59	92
IO_D(7)				87			60	91
IO_D(8)				38			10	40
IO_D(9)				86			61	90
IO_D(10)				85			62	89
IO_D(11)				36			12	38
IO_D(12)				84			63	88
IO_D(13)				83			64	87
IO_D(14)				34			14	36
IO_D(15)				82			65	86
LADDR	95	26	27		89	89		

Mnemonic	A7 Motherboard Connector							
	J1	J2	J4	J6	J7	J10 and J16	J20	J21 and J22
LAS_IO				14			32	16
LCNTRL	99	30	31		85	85		
LCS_IO				10			36	12
LDATA	97	28	29		87	87		
LDS_IO				62			84	66
LDTACK_IO							87	63
LINE_TRIG	50				38			
LI_IO0				6			91	
LI_IO1				55				59 (J21 only)
LI_IO2				54				59 (J22 only)
LI_IO3				4				
LI_IO4				53				
LI_IO_SLOW				56			90	60
LLW_IO				63			83	67
LOE_IO				60			86	64
LRESET_IO				61			85	65
LSRQ	49		12		82	82		
LUW_IO				64			82	68
LWAIT_IO				58			88	62
MISO	100	31	32		84	84		
MOSI	98	29	30		86	86		
N15	39-44 89-94	5, 25	6, 26		43, 44 93, 94	41, 91	47, 97	3, 53
N5	37-38 87-88	4, 24	5, 25		45, 95	42, 92	46, 96	4, 54
P15	17-22 67-72	2, 22	2, 22		47, 48 97, 98	45, 46 95, 96	44, 94	6, 56
P28	23, 24 73, 74		1, 21		49, 99	47, 97		
P5	13-16 63-66	3, 23	3, 23		46, 96	43, 44 93, 94	45, 95	5, 55
P5C		1, 21	4, 24					

Block Diagrams
Motherboard Mnemonics and Connectors

Mnemonic	A7 Motherboard Connector							
	J1	J2	J4	J6	J7	J10 and J16	J20	J21 and J22
P5D	3-7 53-57			44-48 94-98		50, 100	3, 4 53, 54	47, 48 97, 98
PS_COM	52			99				
PS_ON	1			50				
PS_ID0	45							
SCK	96	27	28		88	88		
WLR_IO				12			34	14

Table 2-3 A7J1 Power Supply Connector

Pin	Signal	Pin	Signal
1	PS_ON	51	PS_OFF
2	HPUP_PS	52	PS_COM
3	P5D	53	P5D
4	P5D	54	P5D
5	P5D	55	P5D
6	P5D	56	P5D
7	P5D	57	P5D
8	DCOM	58	DCOM
9	DCOM	59	DCOM
10	DCOM	60	DCOM
11	DCOM	61	DCOM
12	DCOM	62	DCOM
13	P5	63	P5
14	P5	64	P5
15	P5	65	P5
16	P5	66	P5
17	P15	67	P15
18	P15	68	P15
19	P15	69	P15
20	P15	70	P15
21	P15	71	P15
22	P15	72	P15
23	P28	73	P28
24	P28	74	P28
25	ACOM	75	ACOM
26	ACOM	76	ACOM
27	ACOM	77	ACOM
28	ACOM	78	ACOM
29	ACOM	79	ACOM
30	ACOM	80	ACOM
31	ACOM	81	ACOM
32	ACOM	82	ACOM
33	ACOM	83	ACOM
34	ACOM	84	ACOM
35	ACOM	85	ACOM
36	ACOM	86	ACOM
37	N5	87	N5
38	N5	88	N5
39	N15	89	N15
40	N15	90	N15
41	N15	91	N15
42	N15	92	N15
43	N15	93	N15
44	N15	94	N15
45	PS_ID0	95	LADDR
46		96	SCK
47	FAN	97	LDATA
48	FAN_RTN	98	MOSI
49	LSRQ	99	LCNTRL
50	LINE_TRIG	100	MISO

Table 2-4 A7J2 IF Assembly Connector

Pin	Signal	Pin	Signal
1	P5C	21	P5C
2	P15	22	P15
3	P5	23	P5
4	N5	24	N5
5	N15	25	N15
6	ACOM	26	LADDR
7	ACOM	27	SCK
8	ACOM	28	LDATA
9	ACOM	29	MOSI
10	ACOM	30	LCNTRL
11	HPUP_AC	31	MISO
12	ACOM	32	ACOM
13	ACOM	33	ACOM
14	ACOM	34	AC_IF
15	ACOM	35	ACOM
16	IF_VIDEO	36	ACOM
17	ACOM	37	ACOM
18	ACOM	38	ACOM
19	ACOM	39	ACOM
20	DI_FREQ_CNT	40	DN_FREQ_CNT

Table 2-5 A7J4 RF Connector

Pin	Signal	Pin	Signal
1	P28	21	P28
2	P15	22	P15
3	P5	23	P5
4	P5C	24	P5C
5	N5	25	N5
6	N15	26	N15
7	ACOM	27	LADDR
8	H_SWEEP	28	SCK
9	ACOM	29	LDATA
10	HPUP_SYNC	30	MOSI
11	ACOM	31	LCNTRL
12	LSRQ	32	MISO
13	ACOM	33	ACOM
14	ACOM	34	ACOM
15	ACOM	35	ACOM
16	ACOM	36	ANA_TST
17	ACOM	37	ACOM
18	10MHZ_TG	38	ACOM
19	ACOM	39	ACOM
20	ACOM	40	10MHZ_AC

Table 2-6

A7J6 Processor Digital Connector

Pin	Signal	Pin	Signal
1	MB_ID0	51	MB_ID1
2	MB_ID2	52	MB_ID3
3	DCOM	53	LI_IO4
4	LI_IO3	54	LI_IO2
5	DCOM	55	LI_IO1
6	LI_IO0	56	LI_IO_SLOW
7	DCOM	57	LCS_HIGH_IO
8	HWR_END_IO	58	LWAIT_IO
9	DCOM	59	LDTACK
10	LCS_IO	60	LOE_IO
11	DCOM	61	LRESET_IO
12	WLR_IO	62	LDS_IO
13	DCOM	63	LLW_IO
14	LAS_IO	64	LUW_IO
15	DCOM	65	SIZ0_IO
16	LEN_DTACK_IO	66	SIZ1_IO
17	DCOM	67	X2
18	X1	68	DCOM
19	DCOM	69	DCOM
20	DCOM	70	IO_A(16)
21	DCOM	71	IO_A(15)
22	IO_A(14)	72	IO_A(13)
23	DCOM	73	IO_A(12)
24	IO_A(11)	74	IO_A(10)
25	DCOM	75	IO_A(9)
26	IO_A(8)	76	IO_A(7)
27	DCOM	77	IO_A(6)
28	IO_A(5)	78	IO_A(4)
29	DCOM	79	IO_A(3)
30	IO_A(2)	80	IO_A(1)
31	DCOM	81	DCOM
32	IO_A(0)	82	IO_D(15)
33	DCOM	83	IO_D(13)
34	IO_D(14)	84	IO_D(12)
35	DCOM	85	IO_D(10)
36	IO_D(11)	86	IO_D(9)
37	DCOM	87	IO_D(7)
38	IO_D(8)	88	IO_D(6)
39	DCOM	89	IO_D(4)
40	IO_D(5)	90	IO_D(3)
41	DCOM	91	IO_D(1)
42	IO_D(2)	92	IO_D(0)
43	DCOM	93	DCOM
44	P5D	94	P5D
45	P5D	95	P5D
46	P5D	96	P5D
47	P5D	97	P5D
48	P5D	98	P5D
49	HPUP_PS	99	PS_COM
50	PS_ON	100	PS_OFF

Table 2-7 A7J7 Processor Analog Connector

Pin	Signal	Pin	Signal
1	ACOM	51	ACOM
2	DN_FREQ_CNT	52	DI_FREQ_CNT
3	ACOM	53	ACOM
4	ACOM	54	ACOM
5	ACOM	55	ACOM
6	ACOM	56	10MHZ_AC
7	ACOM	57	ACOM
8	AUDIO	58	ACOM
9	ACOM	59	ACOM
10	ACOM	60	ACOM
11	ACOM	61	ACOM
12	ANA_TST	62	ACOM
13	ACOM	63	ACOM
14	ACOM	64	ACOM
15	ACOM	65	ACOM
16	AUDIO_OUT	66	ACOM
17	ACOM	67	ACOM
18	ACOM	68	CRD_ANLG2
19	ACOM	69	ACOM
20	CRD_ANLG1	70	ACOM
21	ACOM	71	ACOM
22	ACOM	72	AUX_VIDEO
23	ACOM	73	ACOM
24	IF_VIDEO	74	ACOM
25	ACOM	75	ACOM
26	ACOM	76	ACOM
27	ACOM	77	ACOM
28	ACOM	78	GATE_AC
29	ACOM	79	H_SWEEP
30	AC_TRIG	80	HSWP_CNTRL
31	ACOM	81	HSWP_AC
32	ADC_SYNC	82	LSRQ
33	ACOM	83	NC
34	HPUP_SYNC	84	MISO
35	ACOM	85	LCNTRL
36	HPUP_AC	86	MOSI
37	ACOM	87	LDATA
38	LINE_TRIG	88	SCK
39	ACOM	89	LADDR
40	ACOM	90	ACOM
41	ACOM	91	ACOM
42	ACOM	92	ACOM
43	N15	93	N15
44	N15	94	N15
45	N5	95	N5
46	P5	96	P5
47	P15	97	P15
48	P15	98	P15
49	P28	99	P28
50	ACOM	100	ACOM

Table 2-8 A7J16 Analog Card/ J10 Tracking Generator Connector

Pin	Signal	Pin	Signal
1	ACOM	51	ACOM
2	ACOM	52	10MHz_AC/10MHz_TG
3	ACOM	53	ACOM
4	AUDIO	54	ACOM
5	ACOM	55	ACOM
6	ACOM	56	ANA_TST
7	ACOM	57	ACOM
8	CRD_ANLG7	58	ACOM
9	ACOM	59	ACOM
10	ACOM	60	CRD_ANLG6
11	ACOM	61	ACOM
12	CRD_ANLG5	62	ACOM
13	ACOM	63	ACOM
14	ACOM	64	CRD_ANLG4
15	ACOM	65	ACOM
16	CRD_ANLG3	66	ACOM
17	ACOM	67	ACOM
18	ACOM	68	CRD_ANLG2
19	ACOM	69	ACOM
20	CRD_ANLG1	70	ACOM
21	ACOM	71	ACOM
22	ACOM	72	AUX_VIDEO
23	ACOM	73	ACOM
24	IF_VIDEO	74	ACOM
25	ACOM	75	ACOM
26	ACOM	76	AC_IF
27	ACOM	77	ACOM
28	GATE_AC	78	ACOM
29	ACOM	79	ACOM
30	AC_TRIG	80	HSWP_CNTRL
31	ACOM	81	HSWP_AC/H_SWEEP
32	ADC_SYNC	82	LSRQ
33	ACOM	83	HPUP_SYNC
34	HPUP_AC	84	MISO
35	AC_ID0	85	LCNTRL
36	AC_ID1	86	MOSI
37	AC_ID2	87	LDATA
38	AC_ID3	88	SCK
39	AC_ID4	89	LADDR
40	ACOM	90	ACOM
41	N15	91	N15
42	N5	92	N5
43	P5	93	P5
44	P5	94	P5
45	P15	95	P15
46	P15	96	P15
47	P28	97	P28
48	ACOM	98	ACOM
49	DCOM	99	DCOM
50	P5D	100	P5D

Table 2-9 A7J20 Speaker Board Connector

Pin	Signal	Pin	Signal
1	DCOM	51	IO_ID0
2	IO_ID1	52	IO_ID2
3	P5D	53	P5D
4	P5D	54	P5D
5	DCOM	55	IO_D(0)
6	IO_D(2)	56	IO_D(1)
7	DCOM	57	IO_D(3)
8	IO_D(5)	58	IO_D(4)
9	DCOM	59	IO_D(6)
10	IO_D(8)	60	IO_D(7)
11	DCOM	61	IO_D(9)
12	IO_D(11)	62	IO_D(10)
13	DCOM	63	IO_D(12)
14	IO_D(14)	64	IO_D(13)
15	DCOM	65	IO_D(15)
16	IO_A(0)	66	DCOM
17	DCOM	67	IO_A(1)
18	IO_A(2)	68	IO_A(3)
19	DCOM	69	IO_A(4)
20	IO_A(5)	70	IO_A(6)
21	DCOM	71	IO_A(7)
22	IO_A(8)	72	IO_A(9)
23	DCOM	73	IO_A(10)
24	IO_A(11)	74	IO_A(12)
25	DCOM	75	IO_A(13)
26	IO_A(14)	76	IO_A(15)
27	DCOM	77	IO_A(16)
28	X1	78	DCOM
29	DCOM	79	X2
30	LEN_DTACK_IO	80	SIZ1_IO
31	DCOM	81	SIZ0_IO
32	LAS_IO	82	LUW_IO
33	DCOM	83	LLW_IO
34	WLR_IO	84	LDS_IO
35	DCOM	85	LRESET_IO
36	LCS_IO	86	LOE_IO
37	DCOM	87	LDTACK_IO
38	HWR_END_IO	88	LWAIT_IO
39	DCOM	89	LCS_HIGH_IO
40	DCOM	90	LI_IO_SLOW
41	DCOM	91	LI_IO0
42	ACOM	92	ACOM
43	ACOM	93	ACOM
44	P15	94	P15
45	P5	95	P5
46	N5	96	N5
47	N15	97	N15
48	ACOM	98	ACOM
49	ACOM	99	AUDIO_OUT
50	ACOM	100	ACOM

Table 2-10 A7J21 and A7J22 I/O Assembly Connector

Pin	Signal	Pin	Signal
1	ACOM	51	ACOM
2	ACOM	52	ACOM
3	N15	53	N15
4	N5	54	N5
5	P5	55	P5
6	P15	56	P15
7	ACOM	57	ACOM
8	ACOM	58	ACOM
9	DCOM	59	LI_IO1/2
10	HWR_END_IO	60	LI_IO_SLOW
11	DCOM	61	LCS_HIGH_IO
12	LCS_IO	62	LWAIT_IO
13	DCOM	63	LDTACK_IO
14	WLR_IO	64	LOE_IO
15	DCOM	65	LRESET_IO
16	LAS_IO	66	LDS_IO
17	DCOM	67	LLW_IO
18	LEN_DTACK_IO	68	LUW_IO
19	DCOM	69	SIZ0_IO
20	X1	70	SIZ1_IO
21	DCOM	71	X2
22	DCOM	72	DCOM
23	DCOM	73	DCOM
24	IO_A(14)	74	IO_A(16)
25	DCOM	75	IO_A(15)
26	IO_A(11)	76	IO_A(13)
27	DCOM	77	IO_A(12)
28	IO_A(8)	78	IO_A(10)
29	DCOM	79	IO_A(9)
30	IO_A(5)	80	IO_A(7)
31	DCOM	81	IO_A(6)
32	IO_A(2)	82	IO_A(4)
33	DCOM	83	IO_A(3)
34	IO_A(0)	84	IO_A(1)
35	DCOM	85	DCOM
36	IO_D(14)	86	IO_D(15)
37	DCOM	87	IO_D(13)
38	IO_D(11)	88	IO_D(12)
39	DCOM	89	IO_D(10)
40	IO_D(8)	90	IO_D(9)
41	DCOM	91	IO_D(7)
42	IO_D(5)	92	IO_D(6)
43	DCOM	93	IO_D(4)
44	IO_D(2)	94	IO_D(3)
45	DCOM	95	IO_D(1)
46	DCOM	96	IO_D(0)
47	P5D	97	P5D
48	P5D	98	P5D
49	IO_ID1	99	IO_ID2
50	DCOM	100	IO_ID0

GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS			
BASIC COMPONENT SYMBOLS			
	VARIABLE RESISTOR (WIPER MOVES TOWARD CW WHEN SHAFT IS ROTATED IN A CLOCKWISE DIRECTION)		HEAVY LINE WITH ARROWS INDICATES PATH AND DIRECTION OF MAIN SIGNAL
	THERMISTOR		HEAVY DASHED LINE WITH ARROWS INDICATES PATH AND DIRECTION OF MAIN FEEDBACK
	ELECTROLYTIC CAPACITOR		DIGITAL BUS
	CAPACITOR		LIGHT-EMITTING DIODE
	VARIABLE CAPACITOR		PIN DIODE
	FEEDTHROUGH CAPACITOR		TRIAC
	FERROUS-CORE INDUCTOR		STEP RECOVERY DIODE
	SLUG-TUNED INDUCTOR		ADJUSTABLE SHUNT REGULATOR
	RELAY (BOX OFTEN OMITTED)		TEMPERATURE-COMPENSATED VOLTAGE-REFERENCE DIODE
	(ALTERNATE RELAY)		SILICON CONTROLLED RECTIFIER (SCR)
	CRYSTAL		TRANSISTOR, PNP
	SPEAKER		TRANSISTOR, NPN
	GENERAL PURPOSE DIODE		JUNCTION-FET, N-CHANNEL
	BREAKDOWN DIODE (ZENER)		JUNCTION-FET, P-CHANNEL
	SCHOTTKY DIODE		MOS-FET, N-CHANNEL ENHANCEMENT MODE
	VARACTOR DIODE		MOS-FET, P-CHANNEL ENHANCEMENT MODE
			CIRCUIT ASSEMBLY BORDERLINE
			FUSE
			INDICATES A MECHANICAL CONNECTION
			INDICATES A SOLDERED CONNECTION
			SURFACE ACOUSTIC WAVE (SAW)
			JUMPER WIRE
			SW1 SLIDE, TOGGLE, OR ROCKER SWITCH
			FERRITE BEAD
			INDICATES SHIELDING CONDUCTOR FOR CABLES
			GROUNDING COAXIAL SHIELDING
		*	INDICATES FACTORY SELECTED COMPONENT
			SW1 PUSHBUTTON SWITCH NORMALLY CLOSED
			SW1 PUSHBUTTON SWITCH NORMALLY OPEN
			AIR-CORE TRANSFORMER
			FERROUS-CORE TRANSFORMER
			MOS-FET, N-CHANNEL DEPLETION MODE
			MOS-FET, P-CHANNEL DEPLETION MODE

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Block Diagrams

Motherboard Mnemonics and Connectors

GRAPHIC SYMBOLS USED ON SCHEMATIC AND BLOCK DIAGRAMS

BASIC COMPONENT SYMBOLS (CONTINUED)

	INDICATES A PLUG-IN CONNECTION (F) TO (M)		TEST POINT (TERMINAL PROVIDED FOR TEST PROBE CONNECTION)
	CONNECTION SYMBOL INDICATING PLUG (MOVABLE)		MEASUREMENT POINT (USED TO INDICATE A CONVENIENT POINT FOR MEASUREMENT. NO TERMINAL PROVIDED FOR TEST PROBE)
	CONNECTION SYMBOL INDICATING JACK (STATIONARY)		INDICATES WIRE OR CABLE COLOR CODE (COLOR SAME AS RESISTOR COLOR CODE. FIRST NUMBER INDICATES BASE COLOR, SECOND AND THIRD NUMBERS INDICATE COLORED STRIPES)
	MULTI-CONDUCTOR CABLE OR BJS		EARTH GROUND SYMBOL
	INDICATES A SINGLE PIN OF A PC BOARD EDGE CONNECTOR		USUALLY INSTRUMENT CHASSIS GROUND (MAY BE ACCOMPANIED BY A NUMBER OR LETTER TO SPECIFY A PARTICULAR GROUND)
	LIMITER		SCREWDRIVER ADJUSTMENT
	ENCLOSES REAR PANEL DESIGNATION		FRONT- OR REAR-PANEL CONTROL

COMMONLY USED ASSEMBLY AND CIRCUIT SYMBOLS

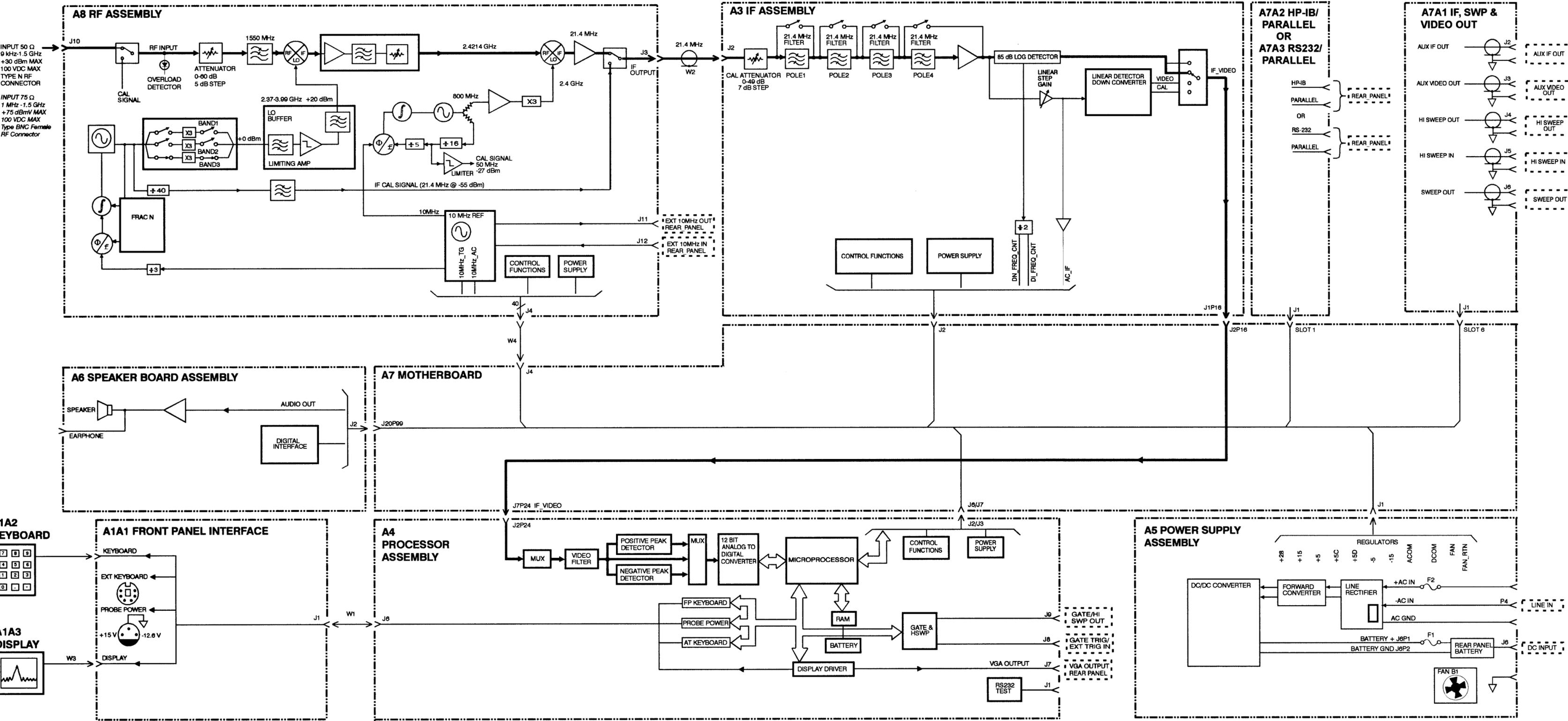
	OSCILLATOR, RPG (ROTARY PULSE GENERATOR)		PHASE-FREQUENCY DETECTOR		LOW PASS FILTER		BAND REJECT FILTER
	FAN MOTOR		SERVICE DETECTOR		HIGH PASS FILTER		ATTENUATOR (OR PAD)
	M XLR		AMPLIFIER BUFFER		BANDPASS FILTER		VARIABLE ATTENUATOR
	SAMPLER		OP AMP		TRANSMISSION LINE		

BASIC LOGIC SYMBOLS

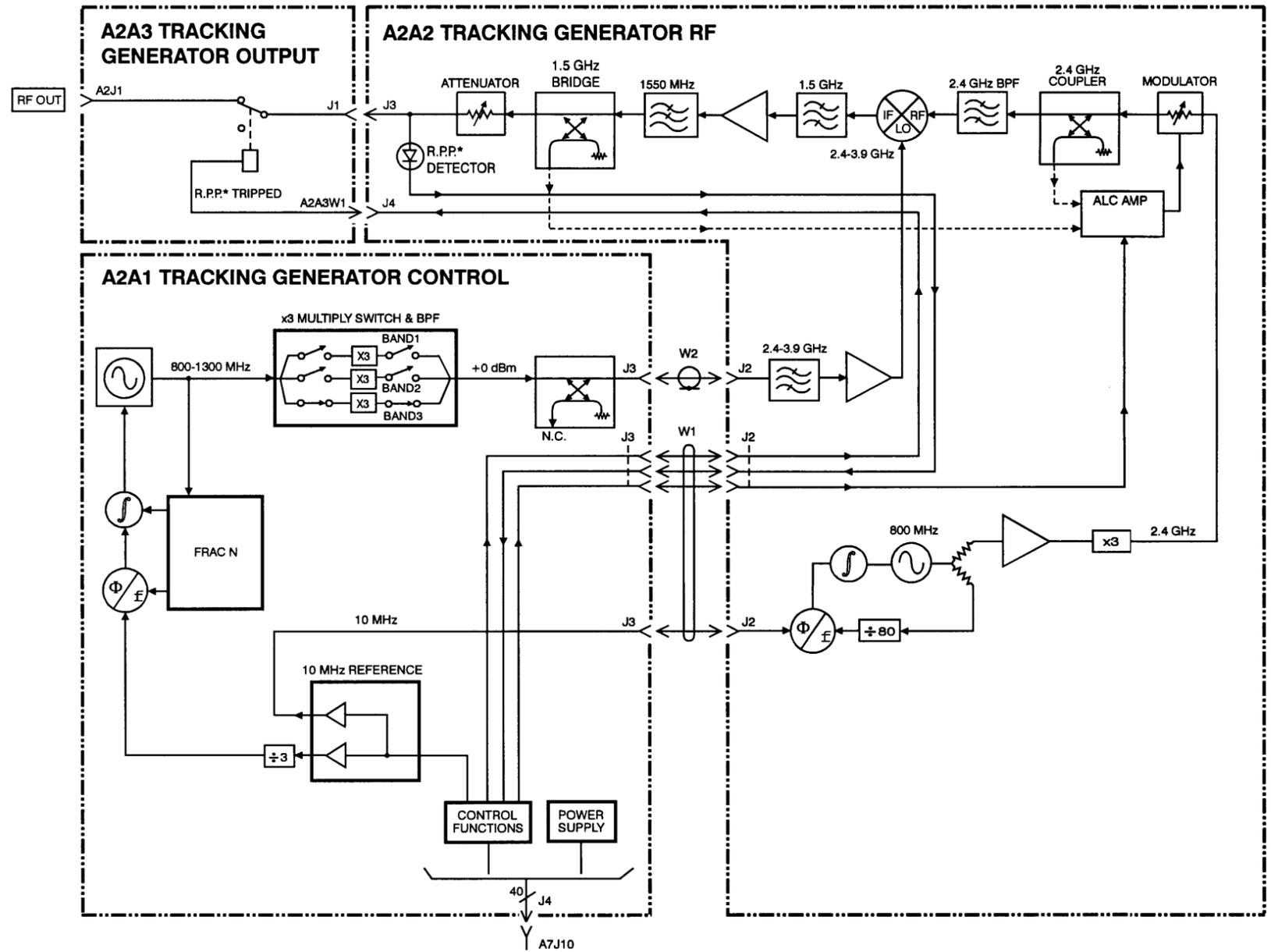
	AMPLIFIER BUFFER		3-STATE BUFFER		AND GATE		NAND GATE
	INVERTER BUFFER		SCHMITT TRIGGER		OR GATE		NOR GATE
	3-STATE INVERTER BUFFER		OPEN-COLLECTOR OUTPUTS ARE INDICATED BY THE PRESENCE OF THE OPEN-COLLECTOR SYMBOL:		EXCLUSIVE OR GATE		SAFETY SYMBOL

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ESA-L1500A OVERALL BLOCK DIAGRAM



A2 TRACKING GENERATOR ASSEMBLY



*R.P.P. = REVERSE POWER PROTECTION

3 **Parts List**

This chapter contains information for identifying and ordering replacement assemblies.

Major assembly location information is given in Chapter 4.

Component level information containing material lists, schematics, and component location diagrams, is available separately. Refer to the end of this chapter for ordering information.

The following tables and figures are also included in this chapter:

- Table 3-1 lists reference designator descriptions.
- Table 3-2 lists abbreviations used in the parts list.
- Table 3-3 lists value multipliers.
- Table 3-4 lists replacement parts.

How to Order Parts

To order an assembly or mechanical part listed in this chapter, quote the Hewlett-Packard part number and indicate the quantity required.

To order a part that is *not* listed, include the following information with the order:

- Spectrum analyzer model number
- Spectrum analyzer serial number
- Description of where the part is located, what it looks like, and its function (if known).
- Quantity needed

Parts can be ordered by addressing the order to the nearest Hewlett-Packard office. Customers within the USA can also use either the direct mail-order system, or the direct phone-order system described below. The direct phone-order system has a toll-free phone number available.

Direct Mail-Order System

Within the USA, Hewlett-Packard can supply parts through a direct mail-order system. Advantages of using the system are as follows:

- Direct ordering and shipment from Hewlett-Packard.
- No maximum or minimum on any mail order. (There is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing.)
- Prepaid transportation. (There is a small handling charge for each order.)
- No invoices.

To provide these advantages, a check or money order must accompany each order. Mail-order forms and specific ordering information are available through your local HP office.

Direct Phone-Order System

Within the USA, a phone order system is available for regular and hotline replacement parts service. A toll-free phone number is available, and Mastercard and Visa are accepted. Outside the USA, contact your local sales and service office.

Regular and Hotline Orders

The toll-free phone number, (800) 227-8164, is available Monday through Friday, 6 a.m. to 5 p.m. (Pacific time). Regular orders have a four-day delivery time. For after hours there is also a fax number available, (800) 329-4470.

Table 3-1 Reference Designations

REFERENCE DESIGNATIONS					
A	Assembly	F	Fuse	RT	Thermistor
AT	Attenuator, Isolator, Limiter, Termination	FL	Filter	S	Switch
B	Fan, Motor	HY	Circulator	T	Transformer
BT	Battery	J	Electrical Connector	TB	Terminal Board
C	Capacitor		(Stationary Portion), Jack	TC	Thermocouple
CP	Coupler	K	Relay	TP	Test Point
CR	Diode, Diode Thyristor, Step Recovery Diode, Varactor	L	Coil, Inductor	U	Integrated Circuit, Microcircuit
DC	Directional Coupler	M	Meter	V	Electron Tube
DL	Delay Line	MP	Miscellaneous Mechanical Part	VR	Breakdown Diode (Zener), Voltage Regulator
DS	Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Visible)	P	Electrical Connector (Movable Portion), Plug	W	Cable, Wire, Jumper
E	Miscellaneous Electrical Part	Q	Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor	X	Socket
		R	Resistor	Y	Crystal Unit (Piezoelectric, Quartz)
				Z	Tuned Cavity, Tuned Circuit

Table 3-2 Abbreviations

Abbreviations	
A	
A	Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ	Adjust, Adjustment
ANSI	American National Standards Institute (formerly USASI-ASA)
ASSY	Assembly
AWG	American Wire Gage
B	
BCD	Binary Coded Decimal
BD	Board, Bundle
BE-CU	Beryllium Copper
BNC	Type of Connector
BRG	Bearing, Boring
BRS	Brass
BSC	Basic
BTN	Button

Abbreviations	
C	
C	Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression
CCP	Carbon Composition Plastic
CD	Cadmium, Card, Cord
CER	Ceramic
CHAM	Chamfer
CHAR	Character, Characteristic, Charcoal
CMOS	Complementary Metal Oxide Semiconductor
CNDCT	Conducting, Conductive, Conductivity, Conductor
CONT	Contact, Continuous Control, Controller
CONV	Converter
CPRSN	Compression
CUP-PT	Cup Point
CW	Clockwise, Continuous Wave

Abbreviations	
D	
D	Deep, Depletion, Depth, Diameter, Direct Current
DA	Darlington
DAP-GL	Diallyl Phthalate Glass
DBL	Double
DCDR	Decoder
DEG	Degree
D-HOLE	D-Shaped Hole
DIA	Diameter
DIP	Dual In-Line Package
DIP-SLDR	Dip Solder
D-MODE	Depletion Mode
DO	Package Type Designation
DP	Deep, Depth, Dia- metric Pitch, Dip
DP3T	Double Pole Three Throw
DPDT	Double Pole Double Throw
DWL	Dowell
E	
E-R	E-Ring
EXT	Extended, Extension,

Abbreviations	
	External, Extinguish
F	
F	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency
FC	Carbon Film/ Composition, Edge of Cutoff Frequency, Face
FDTHRU	Feedthrough
FEM	Female
FIL-HD	Fillister Head
FL	Flash, Flat, Fluid
FLAT-PT	Flat Point
FR	Front
FREQ	Frequency
FT	Current Gain Bandwidth Product (Transition Frequency), Feet, Foot
FXD	Fixed
G	
GEN	General, Generator
GND	Ground

Parts List
How to Order Parts

Abbreviations	
GP	General Purpose, Group
H	
H	Henry, High
HDW	Hardware
HEX	Hexadecimal, Hexagon, Hexagonal
HLCL	Helical
HP	Hewlett-Packard Company, High Pass
I	
IC	Collector Current, Integrated Circuit
ID	Identification, Inside Diameter
IF	Forward Current, Intermediate Frequency
IN	Inch
INCL	Including
INT	Integral, Intensity, Internal
J	
J-FET	Junction Field

Abbreviations	
	Effect Transistor
JFET	Junction Field Effect Transistor
K	
K	Kelvin, Key, Kilo, Potassium
KNRLD	Knurled
KVDC	Kilovolts Direct Current
L	
LED	Light Emitting Diode
LG	Length, Long
LIN	Linear, Linearity
LK	Link, Lock
LKG	Leakage, Locking
LUM	Luminous
M	
M	Male, Maximum, Mega, Mil, Milli, Mode
MA	Milliampere
MACH	Machined
MAX	Maximum
MC	Molded Carbon

Abbreviations	
	Composition
MET	Metal, Metallized
MHZ	Megahertz
MINTR	Miniature
MIT	Miter
MLD	Mold, Molded
MM	Magnetized Material, Millimeter
MOM	Momentary
MTG	Mounting
MTLC	Metallic
MW	Milliwatt
N	
N	Nano, None
N-CHAN	N-Channel
NH	Nanohenry
NM	Nanometer, Nonmetallic
NO	Normally Open, Number
NOM	Nominal
NPN	Negative Positive Negative (Transistor)
NS	Nanosecond, Non-Shorting, Nose
NUM	Numeric
NYL	Nylon (Polyamide)

Abbreviations	
O	
OA	Over-All
OD	Outside Diameter
OP AMP	Operational Amplifier
OPT	Optical, Option, Optional
P	
PA	Picoampere, Power Amplifier
PAN-HD	Pan Head
PAR	Parallel, Parity
PB	Lead (Metal), Pushbutton
PC	Printed Circuit
PCB	Printed Circuit Board
P-CHAN	P-Channel
PD	Pad, Power Dissipation
PF	Picofarad, Power Factor
PKG	Package
PLSTC	Plastic
PNL	Panel
PNP	Positive Negative

Parts List
How to Order Parts

Abbreviations	
	Positive (Transistor)
POLYC	Polycarbonate
POLYE	Polyester
POT	Potentiometer
POZI	Pozidriv Recess
PREC	Precision
PRP	Purple, Purpose
PSTN	Piston
PT	Part, Point
	Pulse Time
PW	Pulse Width
Q	
Q	Figure of Merit
R	
R	Range, Red, Resistance, Resistor, Right, Ring
REF	Reference
RES	Resistance, Resistor
RF	Radio Frequency
RGD	Rigid
RND	Round
RR	Rear
RVT	Rivet, Riveted
S	

Abbreviations	
SAWR	Surface Acoustic Wave Resonator
SEG	Segment
SGL	Single
SI	Silicon, Square Inch
SL	Slide, Slow
SLT	Slot, Slotted
SMA	Subminiature, A Type (Threaded Connector)
SMB	Subminiature, B Type (Slip-on Connector)
SMC	Subminiature, C-Type (Threaded Connector)
SPCG	Spacing
SPDT	Single Pole DoubleThrow
SPST	Single Pole SingleThrow
SQ	Square
SST	Stainless Steel
STL	Steel
SUBMIN	Subminiature
SZ	Size
T	
T	Teeth,

Abbreviations	
	Temperature, Thickness, Time, Timed, Tooth, Typical
TA	Ambient Temperature,
	Tantalum
TC	Temperature Coefficient
THD	Thread, Threaded
THK	Thick
TO	Package Type Designation
TPG	Tapping
TR-HD	Truss Head
TRMR	Trimmer
TRN	Turn, Turns
TRSN	Torsion
U	
UCD	Microcandela
UF	Microfarad
UH	Microhenry
UL	Microliter, Underwriters' Laboratories, Inc.
UNHDND	Unhardened

Abbreviations	
V	
V	Variable, Violet, Volt, Voltage
VAC	Vacuum, Volts— Alternating Current
VAR	Variable
VDC	Volts— Direct Current
W	
W	Watt, Wattage, White, Wide, Width
W/SW	With Switch
WW	Wire Wound
X	
X	By (Used with Dimensions), Reactance
Y	
YIG	Yttrium-Iron-Garnet
Z	
ZNR	Zener

Table 3-3 **Multipliers**

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

Replaceable Parts

Table 3-4 Assembly Level Replaceable Parts

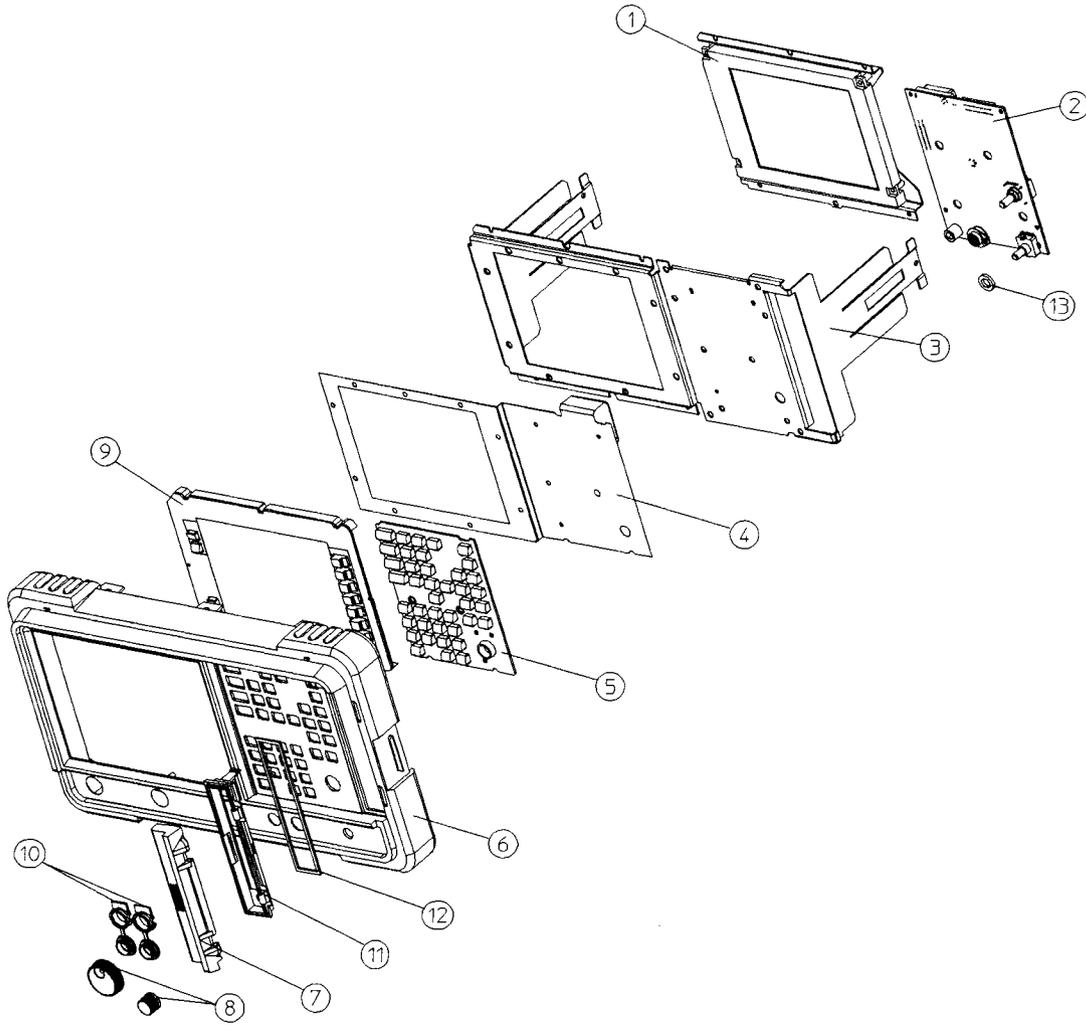
Reference Designator	Description	HP Part Number
A1A3	Front Frame Assembly (50 Ω)	E4401-60024
A1A3	Front Frame Assembly (75 Ω)	E4401-60069
A1A1	Front Panel Interface Board	E4401-60017
A1A1A1	Rotary Pulse Generator	1990-1865
A1A1A2	Volume Rotary Pulse Generator	0960-0892
A1A2	LCD Assembly	E4401-60022
A1A2L1	Display Backlight	2090-0349
A2	Tracking Generator Assembly (50 Ω)	E4401-60023
A2	Tracking Generator Assembly (75 Ω)	E4401-60065
A2A1	Tracking Generator Control Board	E4401-60003
A2A2	Tracking Generator RF Board (50 Ω)	E4401-60004
A2A2	Tracking Generator RF Board (75 Ω)	E4402-60004
A2A3	Tracking Generator Output Board (50 Ω)	E4401-60005
A2A3	Tracking Generator Output Board (75 Ω)	E4402-60005
A2W1	Cable Assy, TG (internal) (Ribbon Cable)	8120-6944
A2W2	Cable Assy, TG (internal) (Coaxial Cable)	8120-6384
A3	IF Assembly	E4401-60001
A4	Processor Assembly	E4401-60006
A4BT1	3 volt Lithium Battery	1420-0338
A5	Power Supply Assembly	E4401-60042
A5B1	Fan	3160-0866
A5MP1 - 4	Plastic Rivet	0361-1341
A5F1	Fuse (DC) 30A 32V	2110-0809
A5F2	Fuse (Line) 5A 250V	2110-0709
A6	Speaker Assembly	E4411-60002

Parts List
Replaceable Parts

Reference Designator	Description	HP Part Number
A7	Motherboard	E4411-60001
A7A1	SA I/O Assembly	E4401-60011
A7A2	HP-IB Assembly	E4401-60013
A7A3	RS-232 Assembly	E4401-60014
A8	RF Assembly (50 Ω)	E4401-60002
A8	RF Assembly (75 Ω)	E4402-60002
A8	RF Exchange Assembly (50 Ω)	E4401-69002
A8	RF Exchange Assembly (75 Ω)	E4402-69002
A8MP15	Input Connector Cover	E4401-00021
W1	Cable Assy, Processor to Front Panel (Ribbon Cable)	8120-6919
W2	Cable Assy, RF Assy to IF Assy (Coaxial Cable)	8120-6153
W3	Cable Assy, Front Panel Interface to Display (Ribbon Cable)	8120-6945
W4	Cable Assy, RF to Motherboard (Ribbon Cable)	8120-6943
A2J1 A8J10	Type-N Connector T.G. RF Output Connector (50 Ω) RF Input Connector (50 Ω)	1250-2514
A2J1 A8J10	BNC Connector T.G. RF Output Connector (75 Ω) RF Input Connector (75 Ω)	1250-2792
A2MP1 A8MP24	Gasket - Type-N T.G. RF Output Connector (50 Ω) RF Input Connector (50 Ω)	E4401-20043
A2MP1 A8MP24	Gasket - BNC T.G. RF Output Connector (75 Ω) RF Input Connector (75 Ω)	E4401-20024
	Gasket - Volume RPG	E4401-20044
	Gasket - Rear EMI	E4401-00009
	Handle Assembly	E4401-40001
	Front Panel Connector Cover	E4401-40006
	Vibration Support	E4401-40016
	Media Bezel	E4401-40013

Reference Designator	Description	HP Part Number
	Media Bezel Gasket	E4401-20035
	LCD Lens/Keypad Assembly (50 Ω)	E4401-60041
	LCD Lens/Keypad Assembly (75 Ω)	E4401-60068
	Dress Cover	E4401-00001
	Rear Frame	E4401-20021
	Chassis	E4401-00005
	Chassis Cover (Inner Shield)	E4401-00008
	Rear Blank Panels	E4401-00010
	Subpanel	E4401-00002
	Flex Circuit	E4401-20010
	Main Keypad	E4411-40002
	Front Frame	E4401-20020
	Media Door	E4401-40004
	Volume and RPG Knobs	0370-3230 (volume) E4401-40005 (RPG)
	TG RF Shield	E4401-20030
	TG Control Shield	E4401-20031
	TG Center Shield	E4401-20032

Figure 3-1 **Front Panel Parts**

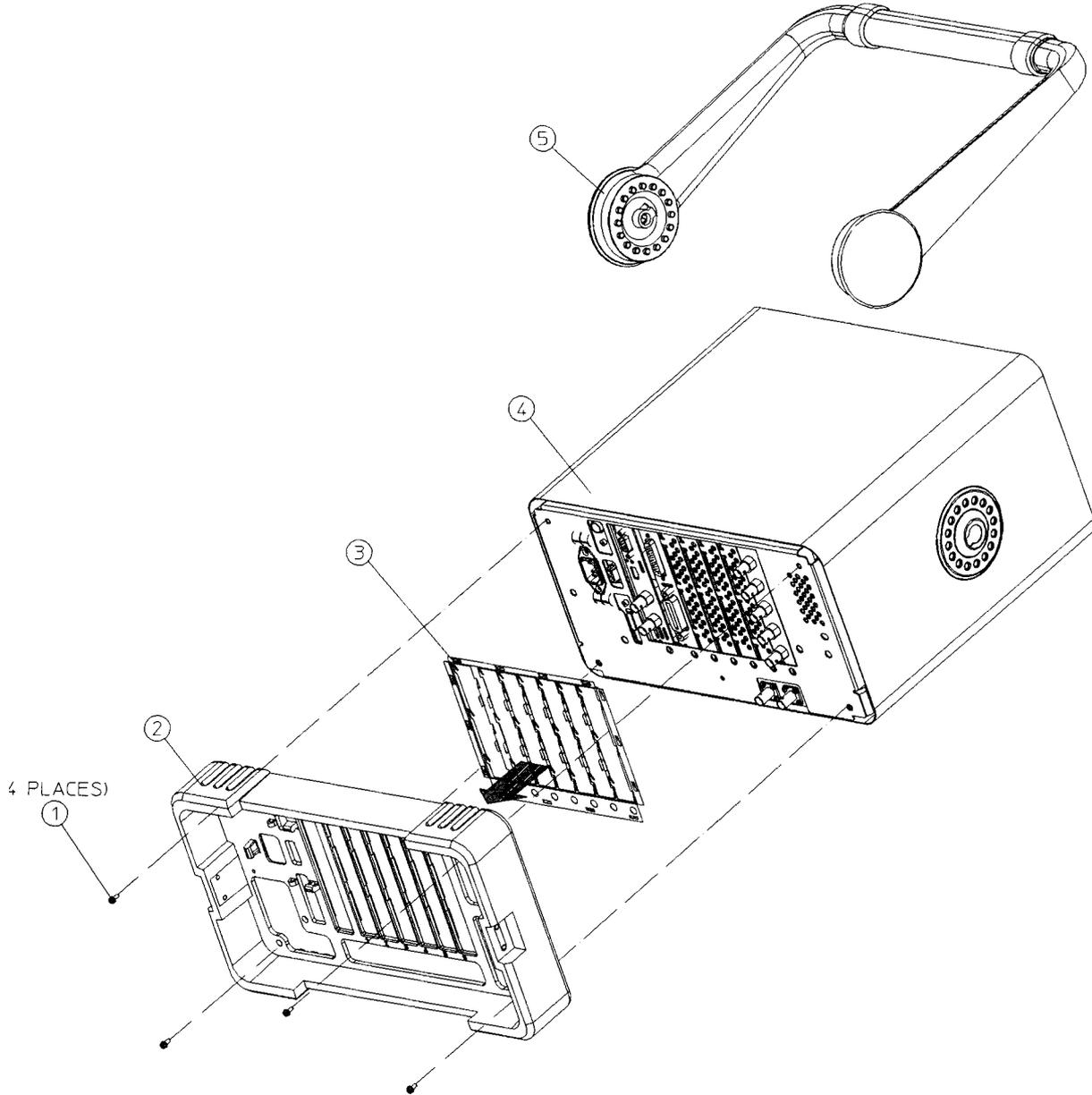


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Item	Description	HP Part Number
1	LCD Assembly	E4401-60022
2	Front Panel Interface Board	E4401-60017
3	Subpanel	E4401-00002
4	Flex Circuit	E4401-20010
5	Main Keypad	E4411-40002
6	Front Frame	E4401-20020
7	Media Door	E4401-40004
8	Volume and RPG Knobs	0370-3230 (volume) E4401-40005 (RPG)
9	LCD Lens/Keypad Assembly (50 Ω)	E4401-60041
	LCD Lens/Keypad Assembly (75 Ω)	E4401-60068
10	Front Panel Connector Cover	E4401-40006
11	Media Bezel	E4401-40013
12	Media Bezel Gasket	E4401-20035
13	Gasket - Volume RPG	E4401-20044

Hardware

Figure 3-2 **Rear Frame Hardware**

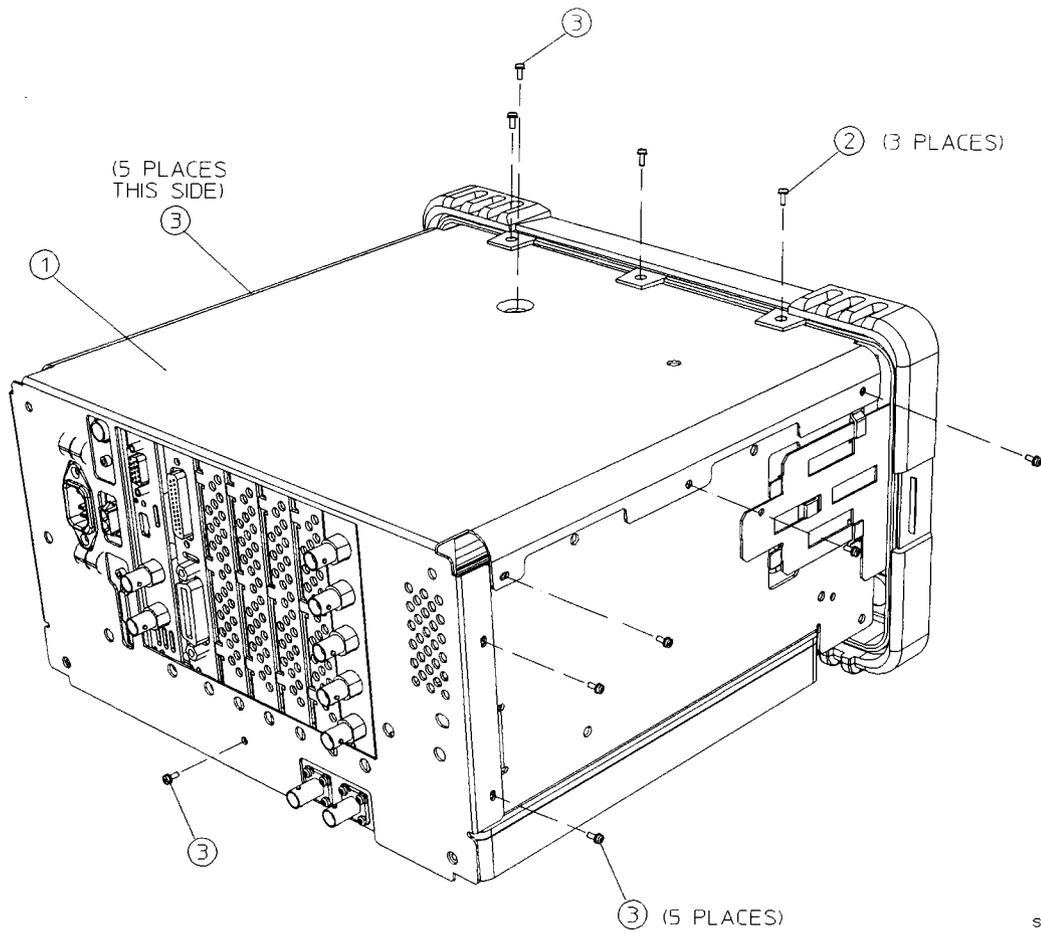


sl77a

Table 3-5 Rear Frame Hardware

Item	Description	HP Part Number
1	Screw - M4 X 12 mm (Crest Washer-Pan Head-Torx)	0515-0382
2	Rear Frame	E4401-20021
3	Gasket - Rear EMI	E4401-00009
4	Dress Cover	E4401-00001
5	Handle Assembly	E4401-40001

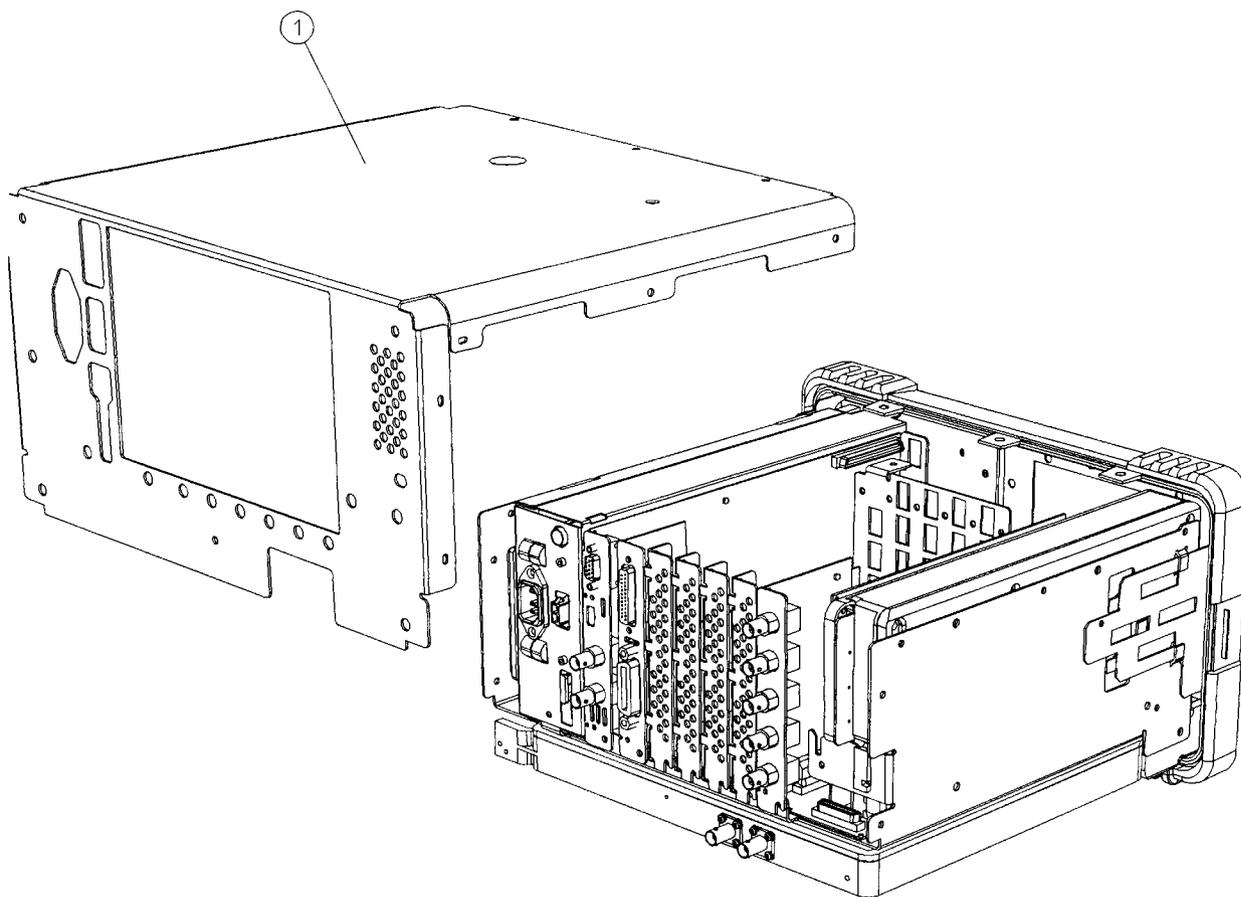
Figure 3-3 Inner Shield Hardware



sl739c

Item	Description	HP Part Number
1	Chassis Cover (Inner Shield)	E4401-00008
2	Screw - M3 X 8 mm (Flat Head-Torx)	0515-1102
3	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372

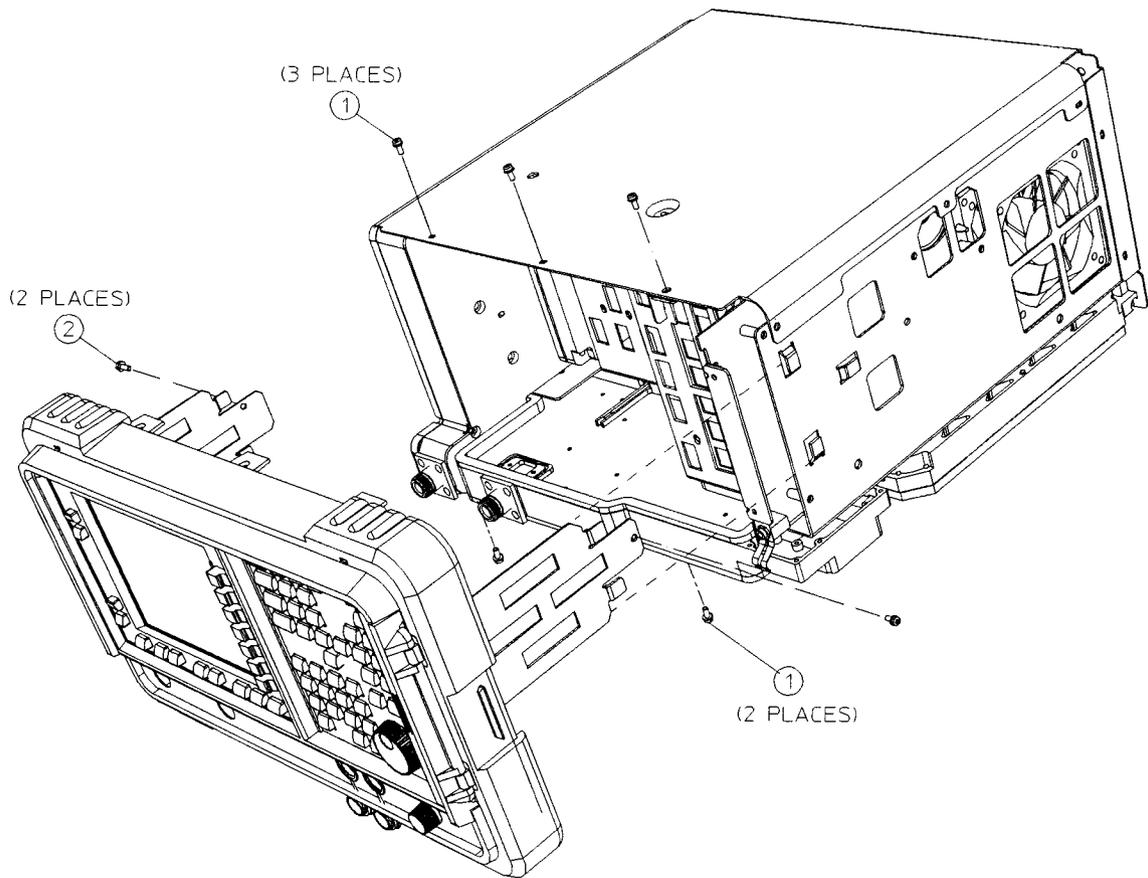
Figure 3-4 Inner Shield



sl732a

Item	Description	HP Part Number
1	Chassis Cover (Inner Shield)	E4401-00008

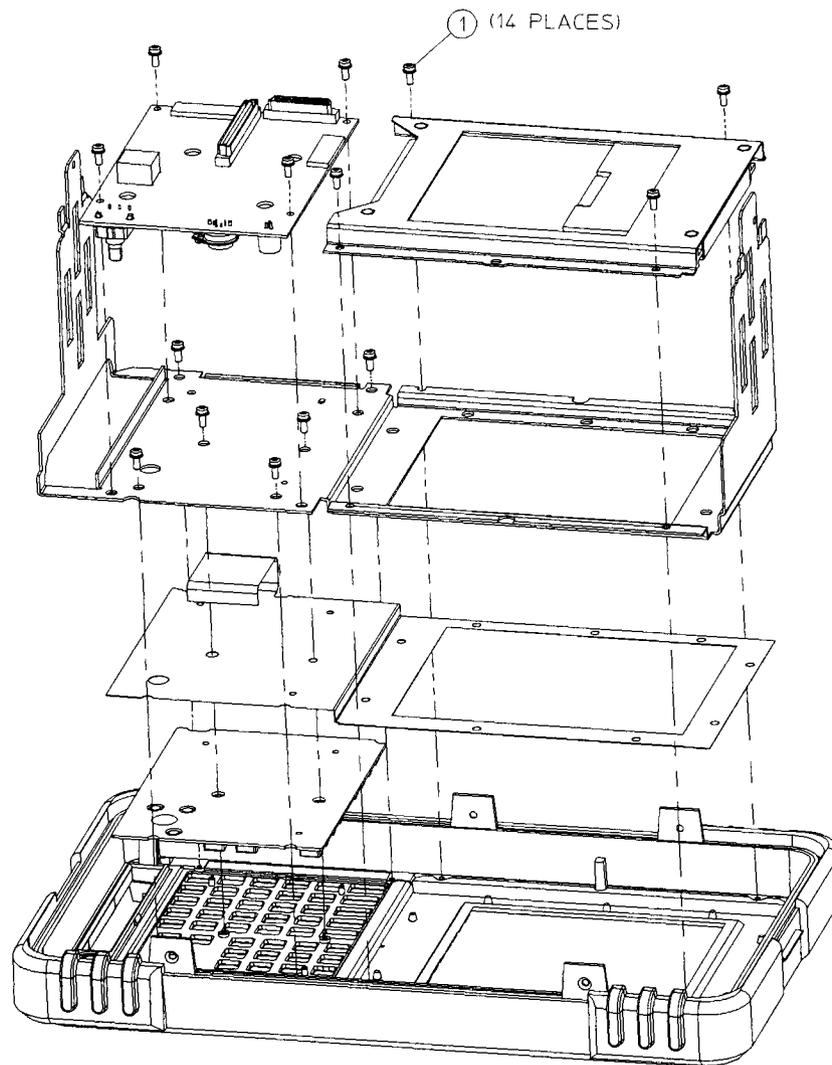
Figure 3-5 Front Frame Hardware



sl710a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Flat Head-Torx)	0515-1102
2	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372

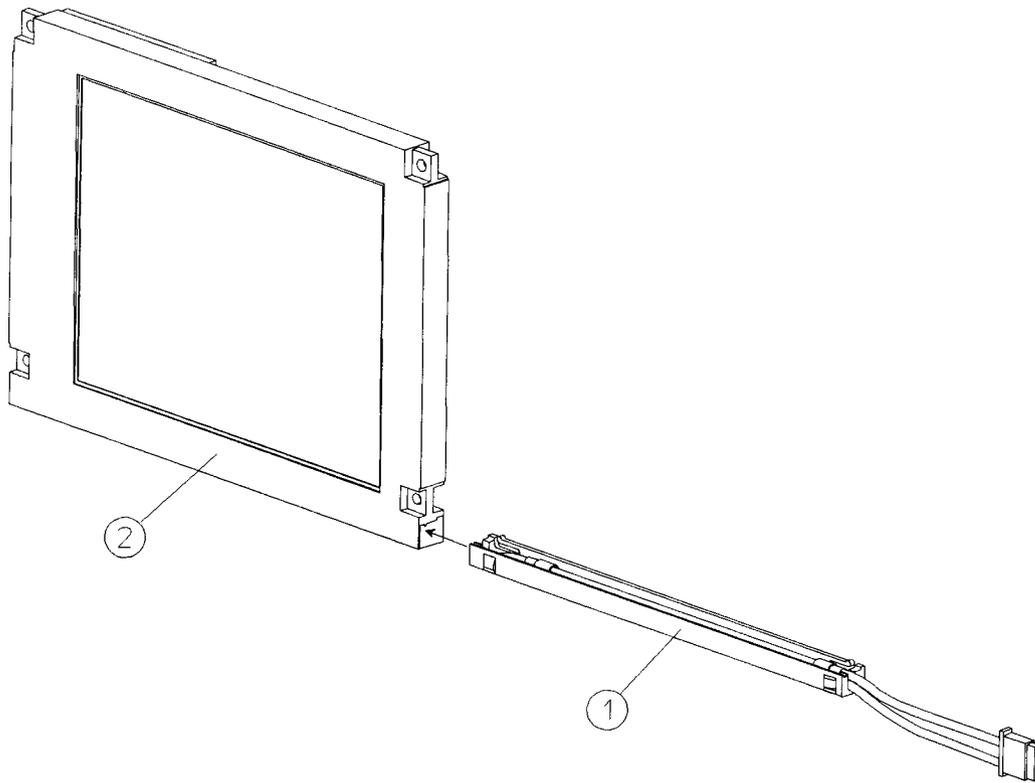
Figure 3-6 Front Panel Hardware



sl748a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372

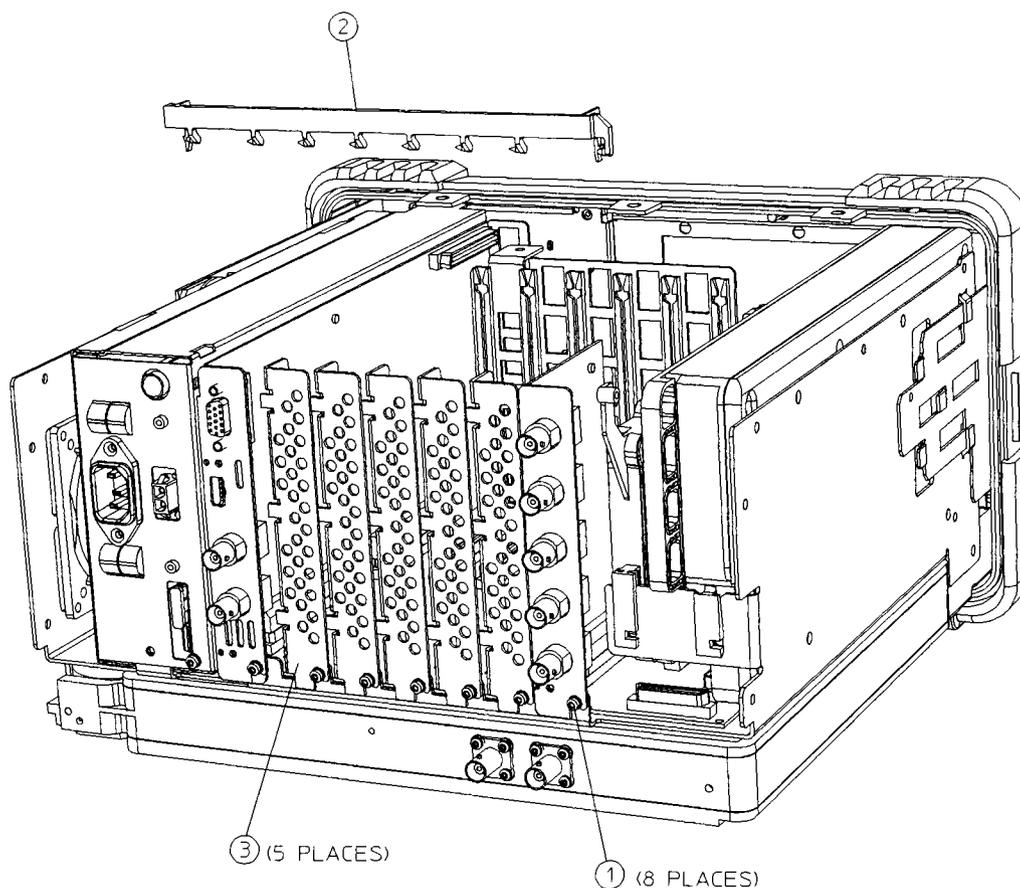
Figure 3-7 **Display**



sl735a

Item	Description	HP Part Number
1	Display Backlight	2090-0349
2	LCD Assembly	E4401-60022

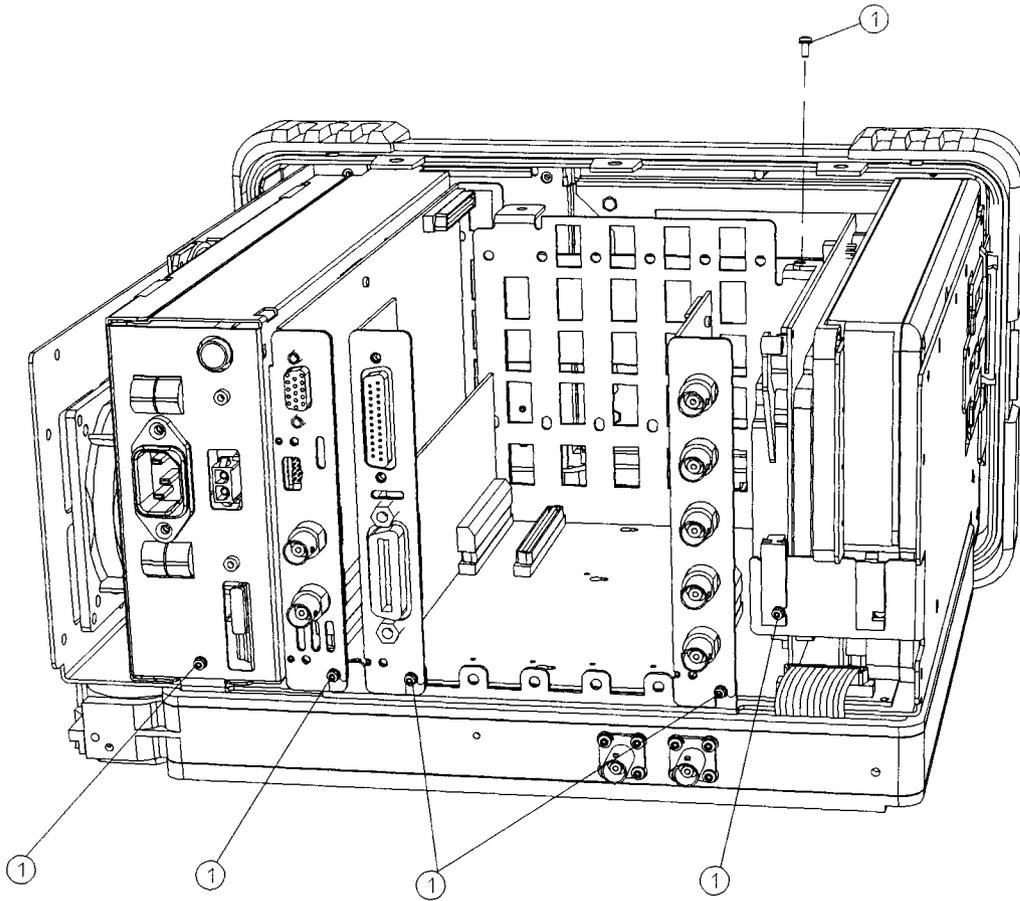
Figure 3-8 Rear Hardware



si751a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372
2	Vibration Support	E4401-40016
3	Rear Blank Panels	E4401-00010

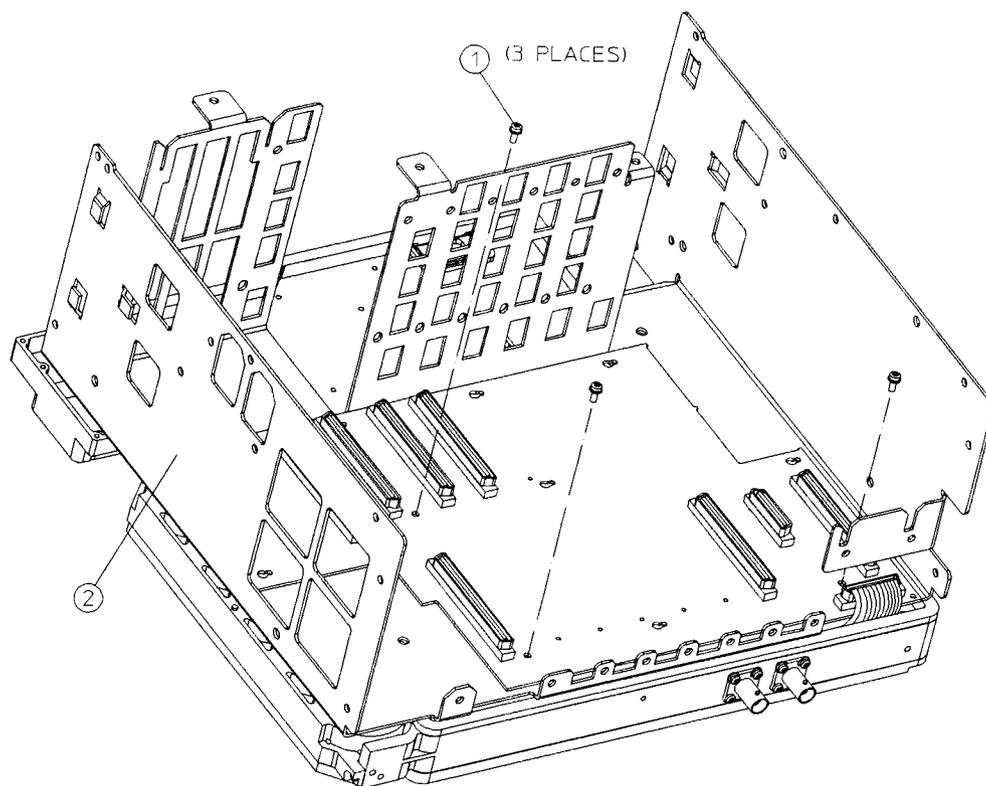
Figure 3-9 **Assembly Hardware**



s1713a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372

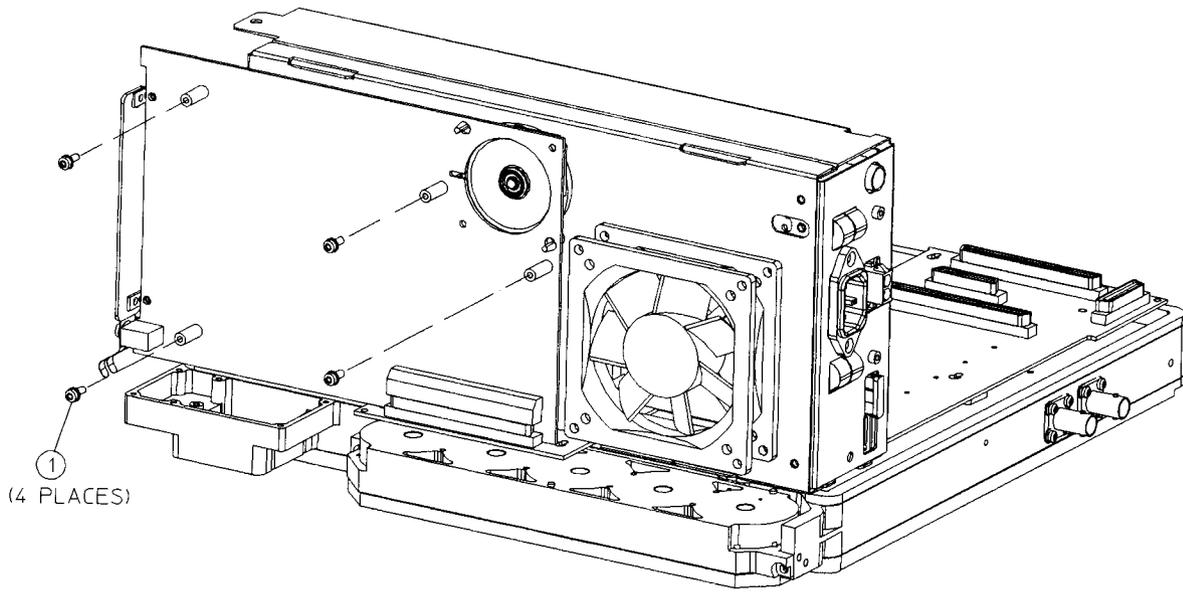
Figure 3-10 Motherboard Hardware



s1716a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372
2	Chassis	E4401-00005

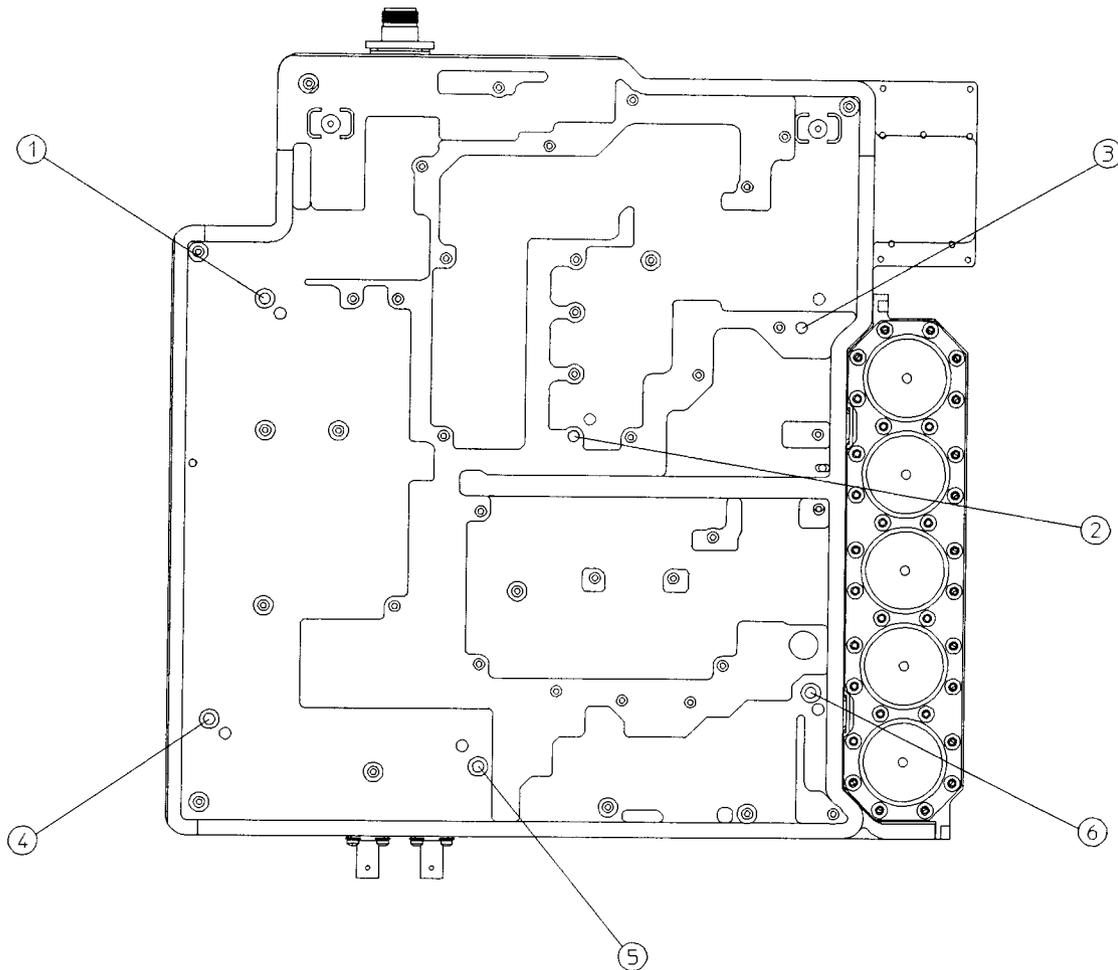
Figure 3-11 Speaker Board Hardware



sl718a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372

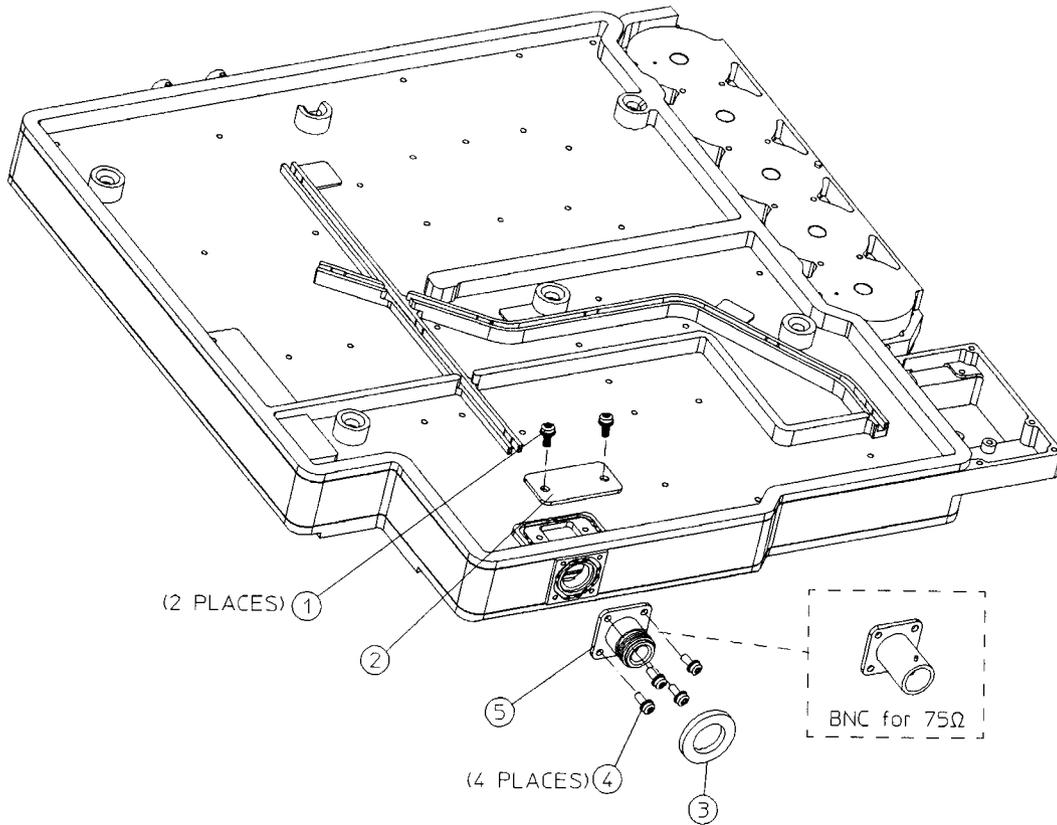
Figure 3-12 RF Assembly Hardware



s1712a

Item	Description	HP Part Number
1-6	Screw - M3 X 25 mm (Crest Washer-Pan Head-Torx)	0515-0667

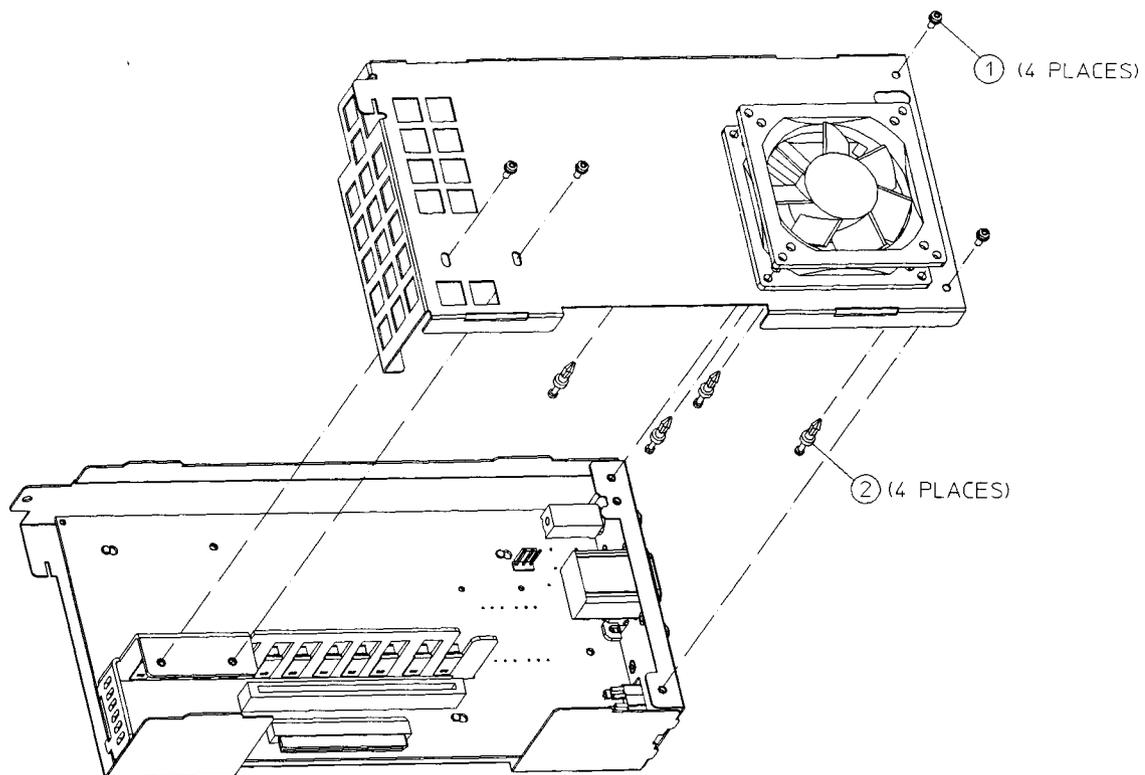
Figure 3-13 RF Input Connector Hardware



sn74a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372
2	Input Connector Cover	E4401-00021
3	Gasket, Type-N (shown) (50 Ω)	E4401-20043
	Gasket, BNC (75 Ω)	E4401-20024
4	Screw - M2.5 X 8 mm (Flat Head-Torx)	0515-2487
5	Connector, Type-N (shown) (50 Ω)	1250-2514
	Connector, BNC (75Ω)	1250-2792

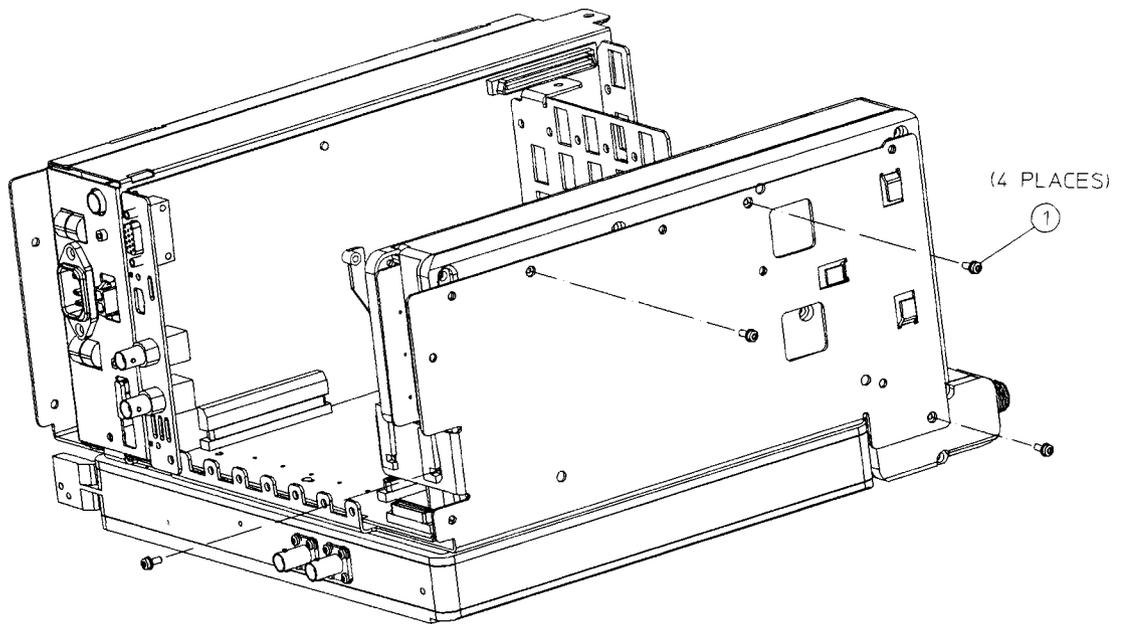
Figure 3-14 Power Supply Hardware



sl724a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372
2	Plastic Rivet	0361-1341

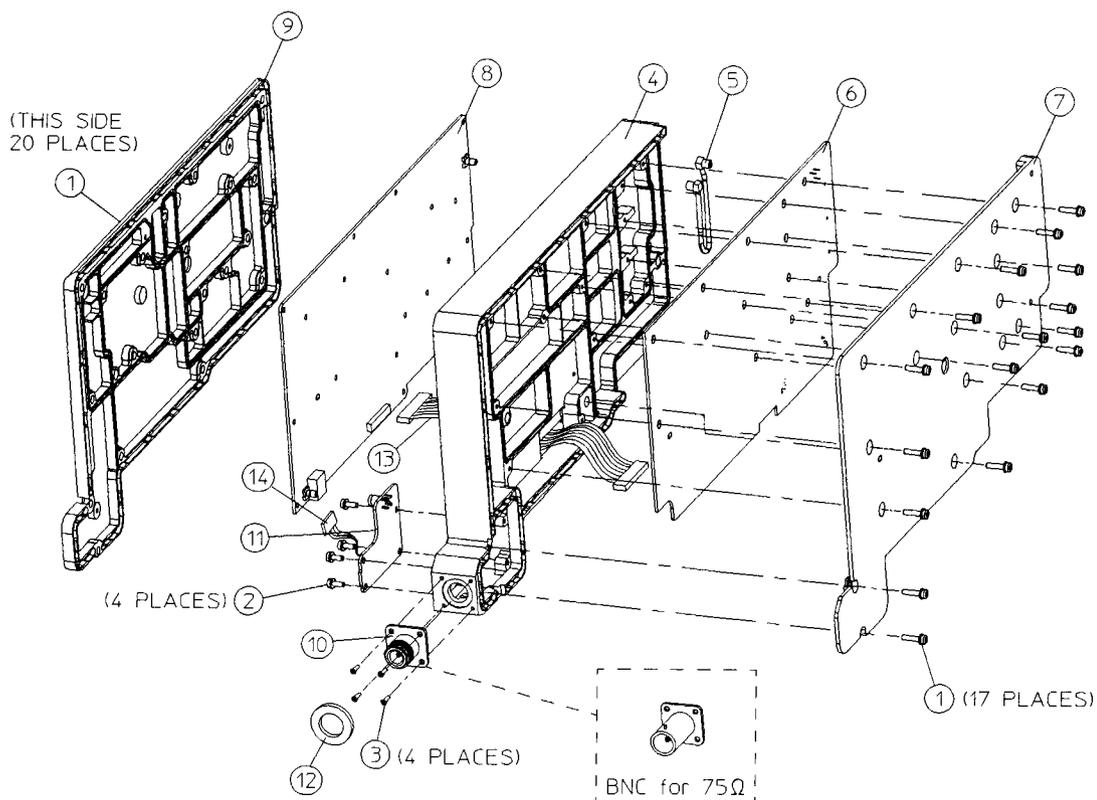
Figure 3-15 **Tracking Generator Hardware**



sl715a

Item	Description	HP Part Number
1	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372

Figure 3-16 Tracking Generator Assembly Hardware



sn75a

Item	Description	HP Part Number
1	Screw - M3 X 12 mm (Crest Washer-Pan Head-Torx)	0515-0664
2	Screw - M3 X 8 mm (Crest Washer-Pan Head-Torx)	0515-0372
3	Screw - M2.5 X 8 mm (Flat Head-Torx)	0515-2487
4	TG Center Shield	E4401-20032
5	Cable Assy, TG (internal) (Coaxial Cable)	8120-6384
6	Tracking Generator Control Board	E4401-60003
7	TG Control Shield	E4401-20031
8	Tracking Generator RF Board (50 Ω)	E4401-60004
	Tracking Generator RF Board (75 Ω)	E4402-60004

Parts List
Hardware

Item	Description	HP Part Number
9	TG RF Shield	E4401-20030
10	Connector, Type-N (shown) (50 Ω)	1250-2514
	Connector, BNC (75 Ω)	1250-2792
11	Tracking Generator Output Board (50 Ω)	E4401-60005
	Tracking Generator Output Board (75 Ω)	E4402-60005
12	Gasket, Type-N (shown) (50 Ω)	E4401-20043
	Gasket, BNC (75 Ω)	E4401-20024
13	Cable Assy, TG (internal) (Ribbon Cable)	8120-6944

CLIP part numbers (CLIP matrix)

Component Level Information Packets

Component level information is available for selected instrument assemblies. The information for each selected assembly is provided in the form of Component Level Information Packets (CLIPs).

A CLIP packet consists of a parts list, component location diagram, and schematic diagram relating to a unique instrument assembly. An HP part number is assigned to each CLIP packet. When an instrument assembly part number changes, a new CLIP is generated.

Ordering CLIPs

For ordering convenience, current CLIPs for a specific instrument are combined into Component Level Information binders. The current set of CLIPs contains information supporting the current instrument assemblies, plus a packet containing general CLIP information.

A complete set of CLIPs can be obtained by ordering the part number:
E4411-90005

Updated or replacement CLIPs may be ordered through your local Hewlett-Packard Sales or Service office using the CLIP part number provided in Table 3-6.

Parts List
CLIP part numbers (CLIP matrix)

Table 3-6 CLIP Part Numbers

Assembly	Assembly Part Number	CLIP Part Number	Instrument Serial Prefix
A1A1 Front Panel Interface Board	E4401-60017	E4401-90029	US3645-US3723*
A2A1 T.G. Control Assembly	E4401-60003	E4401-90030	US3645-US3723*
A2A2 T.G. RF Assembly (50 Ω)	E4401-60004	E4401-90031	US3645-US3723*
A2A2 T.G. RF Assembly (75 Ω)	E4402-60004	E4402-90003	US3645-US3723*
A2A3 T.G. Output Assembly (50 Ω)	E4401-60005	E4401-90032	US3645-US3723*
A2A3 T.G. Output Assembly (75 Ω)	E4402-60005	E4402-90001	US3645-US3723*
A3 IF Assembly	E4401-60001	E4401-90033	US3645
	E4401-60072	E4401-90046	US3723*
A4 Processor Assembly	E4401-60006	E4401-90034	US3645-US3723*
A6 Speaker Assembly	E4411-60002	E4411-90006	US3645-US3723*
A7A1 SA I/O Assembly	E4401-60011	E4401-90023	US3645-US3723*
A7A2 HP-IB Assembly	E4401-60013	E4401-90025	US3645-US3723*
A7A3 RS-232 Assembly	E4401-60014	E4401-90026	US3645-US3723*
A8 RF Assembly (50 Ω)	E4401-60002	E4401-90036	US3645-US3723
	E4401-60076	E4401-90048†	US3726*
A8 RF Assembly (75 Ω)	E4402-60002	E4402-90002	US3645-US3723*
<p>* Denotes the current version of the board assembly.</p> <p>† Denotes refurbished board assemblies are available. Refurbished board assembly part numbers have 9 as the second digit of the suffix. For example, E4401-69002 is the refurbished part number for board assembly E4401-60002.</p>			

4 Replacing Assemblies

The procedures in this chapter describe the location, removal and replacement of major assemblies in the spectrum analyzer. Refer to Chapter 3, "Parts List," for part numbers, assembly descriptions, and ordering information.

Numbers in parentheses, for example (1), indicate numerical callouts on the figures.

Before You Start

Before starting to disassemble the instrument:

- ❑ Check that you are familiar with the safety symbols marked on the instrument, and read the general safety considerations and the safety note definitions given in the front of this guide.
- ❑ The spectrum analyzer contains static sensitive components. Read the section entitled “ESD Information” in Chapter 1.

WARNING

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.

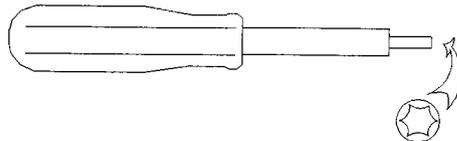
WARNING

The spectrum analyzer contains potentially hazardous voltages. Refer to the safety symbols on the spectrum analyzer and the general safety considerations at the beginning of this service guide before operating the unit with the cover removed. Failure to heed the safety precautions can result in severe or fatal injury.

Service tools you will need

Figure 4-1

TORX Tool

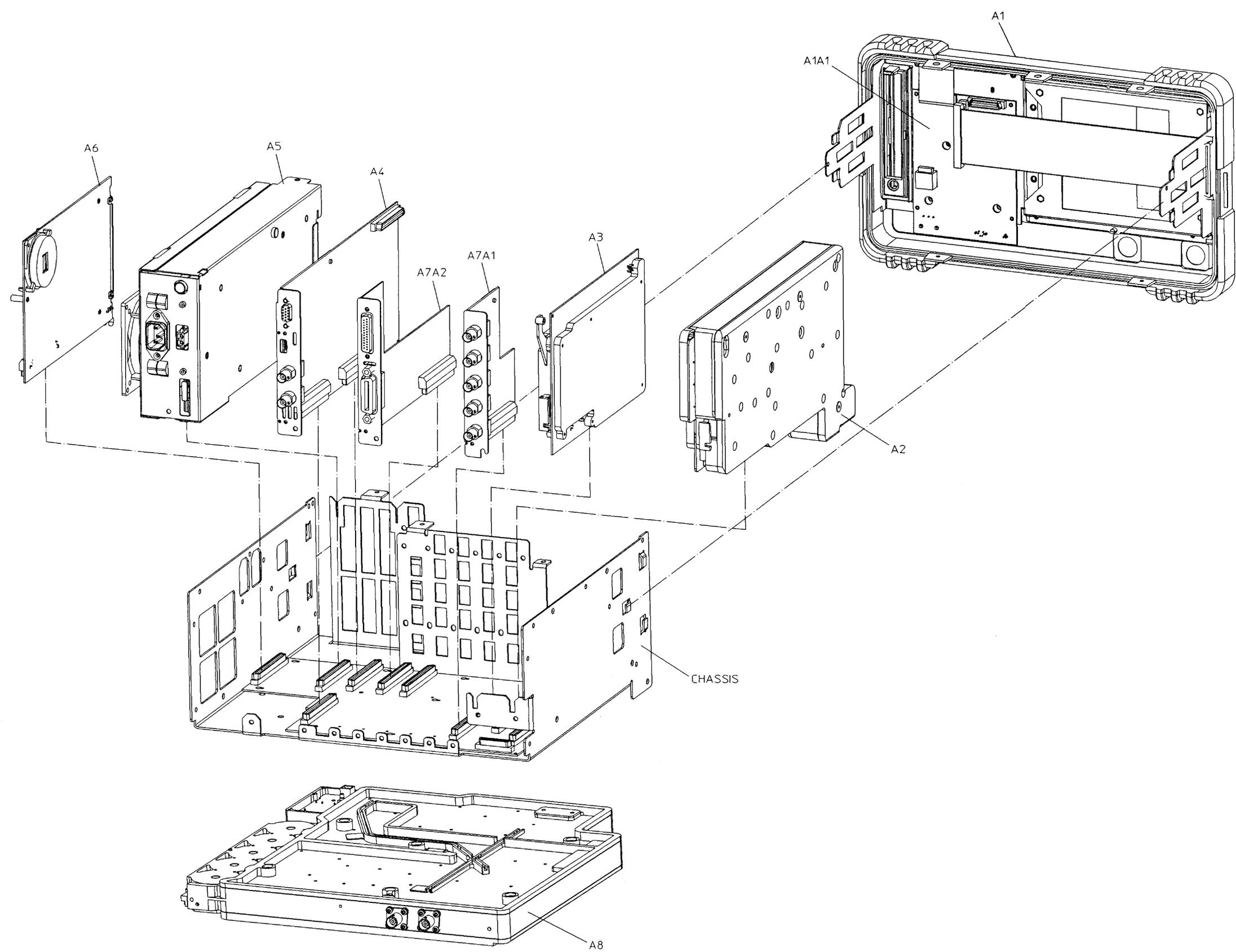


s1736a

Description	HP Part Number
TORX Hand Driver - Size T8	8710-1614
TORX Hand Driver - Size T10	8710-1623
TORX Hand Driver - Size T15	8710-1622

After a spectrum analyzer repair

If one or more spectrum analyzer assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.



Removal and Replacement Procedures in this Chapter

Instrument Outer Case on page 148

Inner Shield on page 151

A1 Front Frame Assembly on page 153

A8 RF Assembly on page 157

A8J10 Input Connector on page 161

A5 Power Supply on page 163

A5B1 Fan on page 166

A2 Tracking Generator Assembly on page 169

Tracking Generator Boards on page 170

Tracking Generator RF Output Connector on page 173

A3 IF Assembly on page 174

A4 Processor Assembly on page 175

BT1 Battery on page 176

A6 Speaker Assembly on page 178

I/O Assemblies on page 180

A7 Motherboard Assembly on page 182

Front Frame Subassemblies on page 185

A1A2 Display on page 185

A1A1 Front Panel Interface Board on page 187

Front Panel RPG on page 188

Keypad/Flex Circuit on page 188

Lens/Keypad Assembly on page 190

Display Backlight on page 190

Media Door/Bezel on page 191

Instrument Outer Case

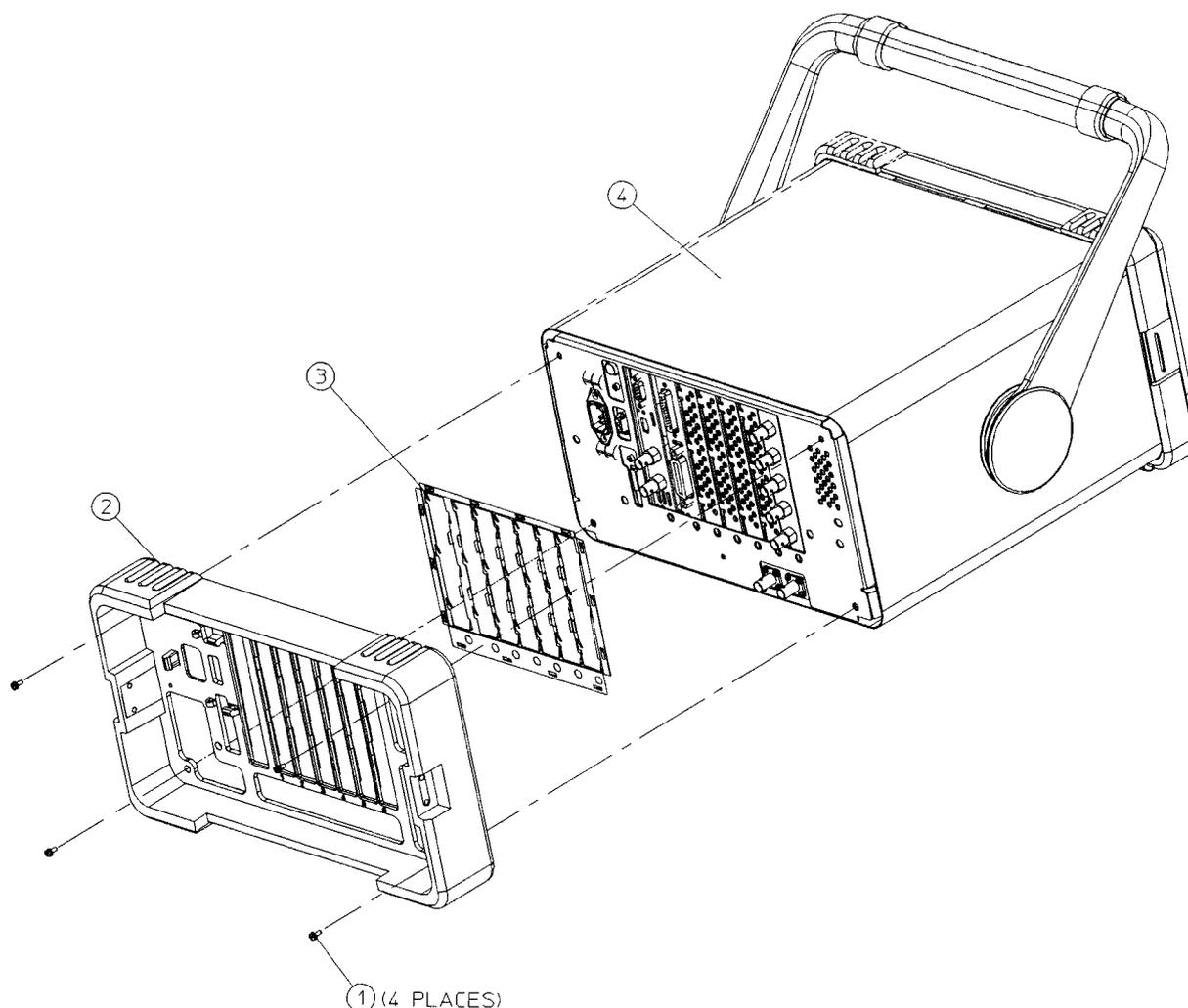
Removal

1. Disconnect the spectrum analyzer from ac power.
2. Carefully place the analyzer on the work surface with the front frame facing down.
3. Remove the four screws **(1)** that hold the rear frame **(2)** and outer case **(4)** in place. Refer to Figure 4-2.
4. Pull the instrument outer case and rear frame off towards the rear of the instrument.

CAUTION

The rear EMI contact grid **(3)** that clips onto the rear panel can come loose. Note the correct position to reattach. Refer to Figure 4-2.

Figure 4-2 **Outer Case, Rear Frame Removal**



sl753a

Replacement

1. Disconnect the spectrum analyzer from ac power.
2. Carefully place the spectrum analyzer on the work surface with the front frame facing down.
3. Replace the instrument outer case by matching the grill on the side of the case to the fan on the A5 power supply assembly.

CAUTION

The rear EMI contact grid (3) that clips onto the rear panel can come loose. When replacing the outer case, make sure the gasket is in the correct position. Refer to Figure 4-2.

4. Fit the leading edge of the case completely into the slot on the back of the front frame assembly.

Replacing Assemblies
Instrument Outer Case

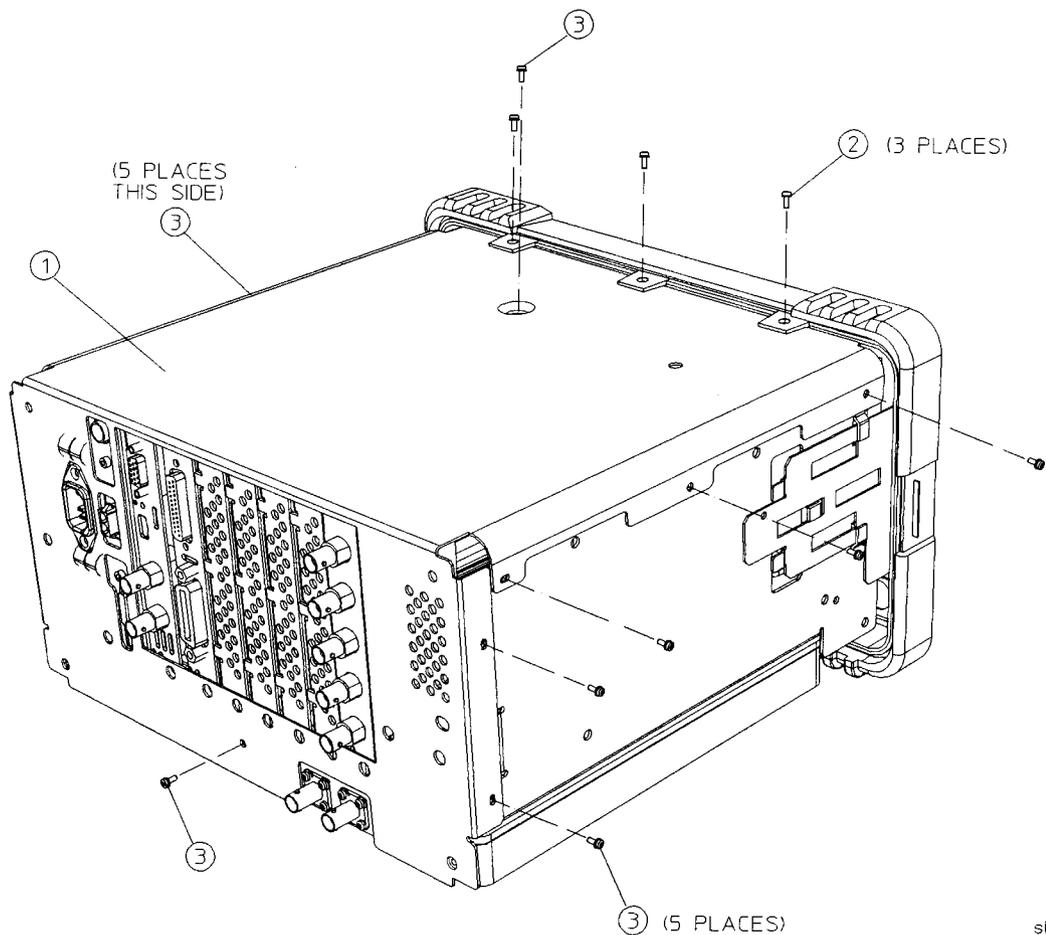
5. Replace the rear frame assembly (2) using the four screws (1) to fasten the rear frame to the instrument. Torque to 21 inch pounds.

Inner Shield

Removal

1. If you haven't already done so, remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Remove the 15 screws (2) and (3) attaching the inner shield (1) to the chassis. Refer to Figure 4-3.
3. The inner shield can now be removed from the chassis. Refer to Figure 4-4.

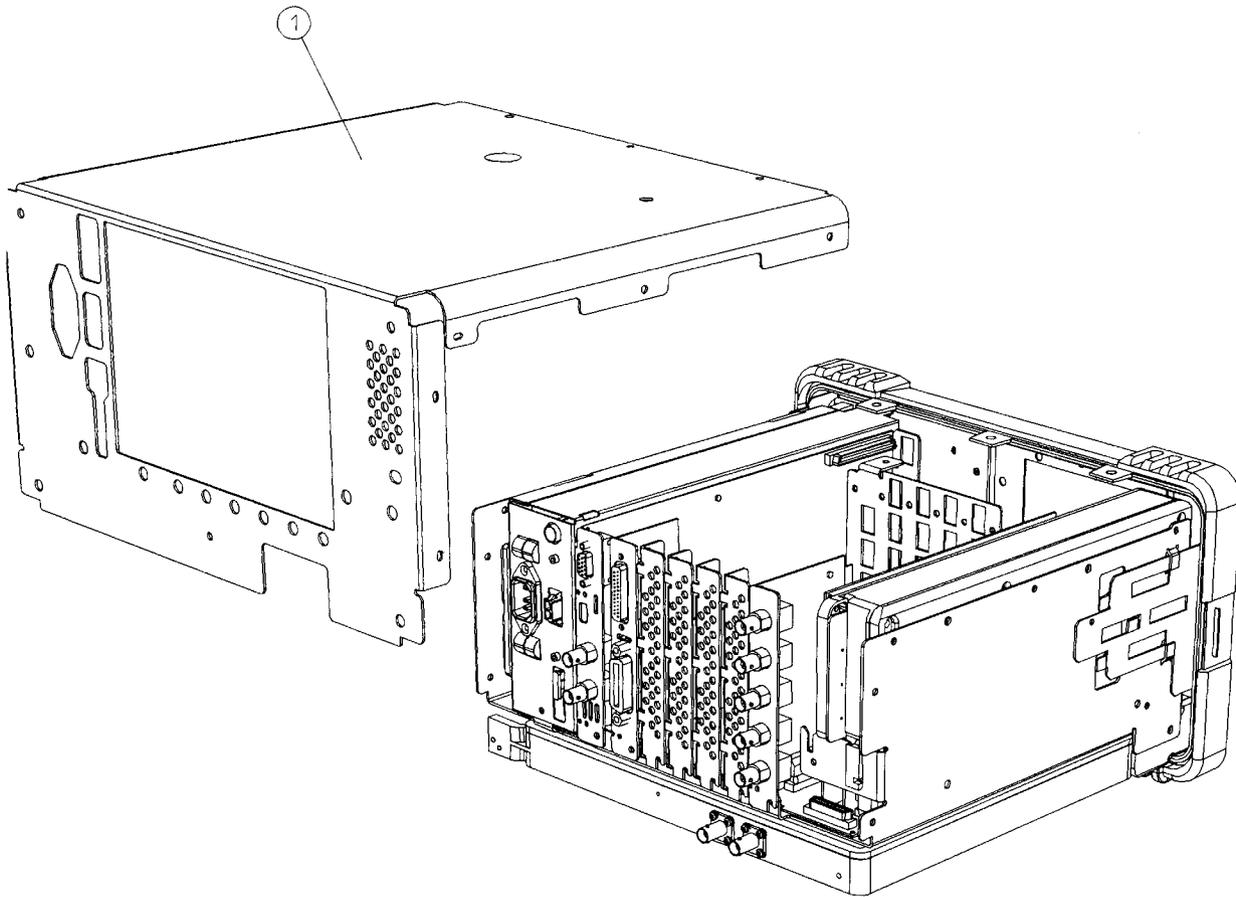
Figure 4-3 Inner Shield Removal



sl739a

Figure 4-4

Inner Shield



sl732a

Replacement

1. Carefully position the inner shield (1) on the instrument as shown in Figure 4-3.
2. Replace the 15 screws (2) and (3) shown. Torque to 9 inch pounds.
3. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.

A1 Front Frame Assembly

CAUTION

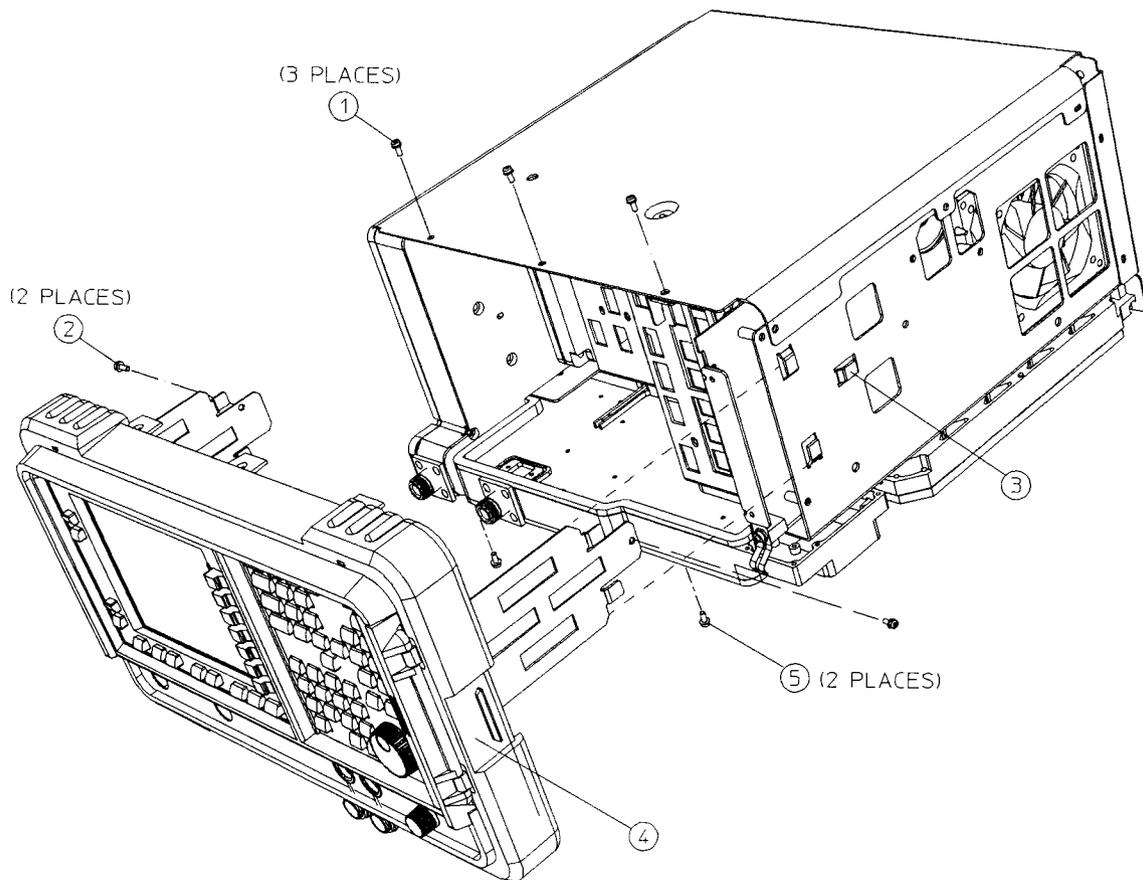
Use ESD precautions when performing this replacement procedure.

Extension

The A1 front frame assembly can be extended from the instrument without detaching any connections.

1. Remove the instrument outer case. Refer to the “Instrument Outer Case” removal procedure.
2. With the instrument still on its face, remove the two screws **(5)** on the bottom side of the instrument that secure the front frame to the RF assembly. Refer to Figure 4-5.
3. Place the instrument with the top side facing up and remove the remaining three screws **(1)** that secure the front frame to the inner shield. Remove the two screws **(2)** that secure the front frame subpanel to the chassis. Refer to Figure 4-5.
4. Slide the front frame **(4)** forward until it catches on the tabs **(3)** on the sides of the chassis.

Figure 4-5 **A1 Front Frame Assembly Removal**



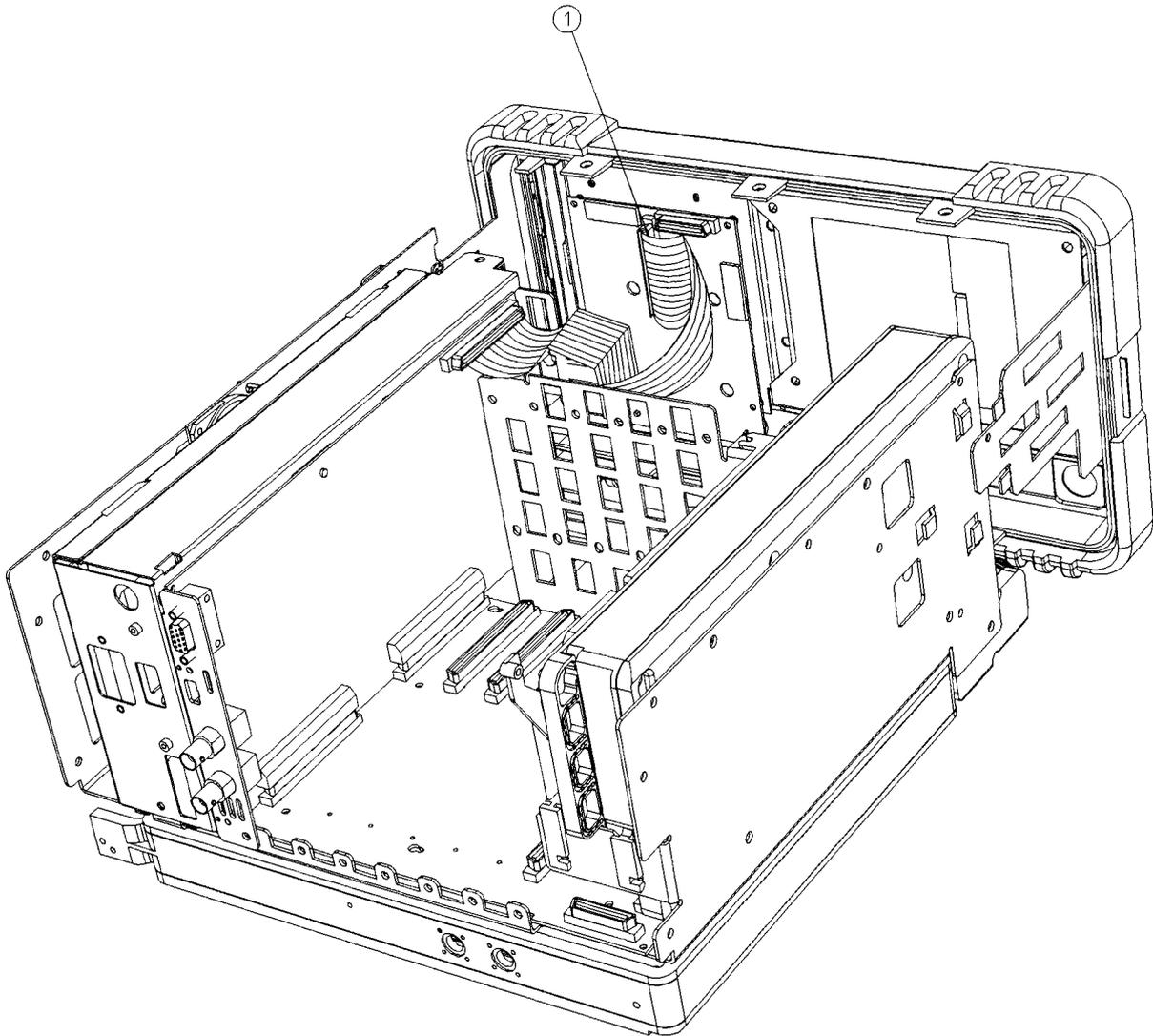
sl738c

Removal

To completely remove the A1 front frame assembly (4), complete the “Extension” procedure, then continue with the following steps:

1. Disconnect the ribbon cable (1) from the A1A1 front panel interface board. Refer to Figure 4-6.
2. Carefully pull the sides of the front frame subpanel away from the chassis and over the tabs on the chassis.
3. Slide the front frame forward to disengage from the chassis assembly.

Figure 4-6 **Front Frame Ribbon Cable**



sl711a

Replacement

1. Align the A1 front frame subpanel rails with the chassis as shown in Figure 4-5.
2. Connect the ribbon cable (1) to the front frame assembly. Refer to Figure 4-6.
3. Carefully slide the front frame toward the chassis, assuring the ribbon cable is not pinched between assemblies, and the RF input connector lines up correctly with the opening in the front frame.

NOTE

Make sure the water seal is still in place around the input connector (and around the A2 tracking generator connector if the instrument is an option 1DN) before reinstalling the front frame assembly.

4. Replace the seven screws that secure the front frame to the chassis. Refer to Figure 4-5. Torque to 9 inch pounds.
5. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
6. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

A8 RF Assembly

CAUTION

Use ESD precautions when performing this replacement procedure.

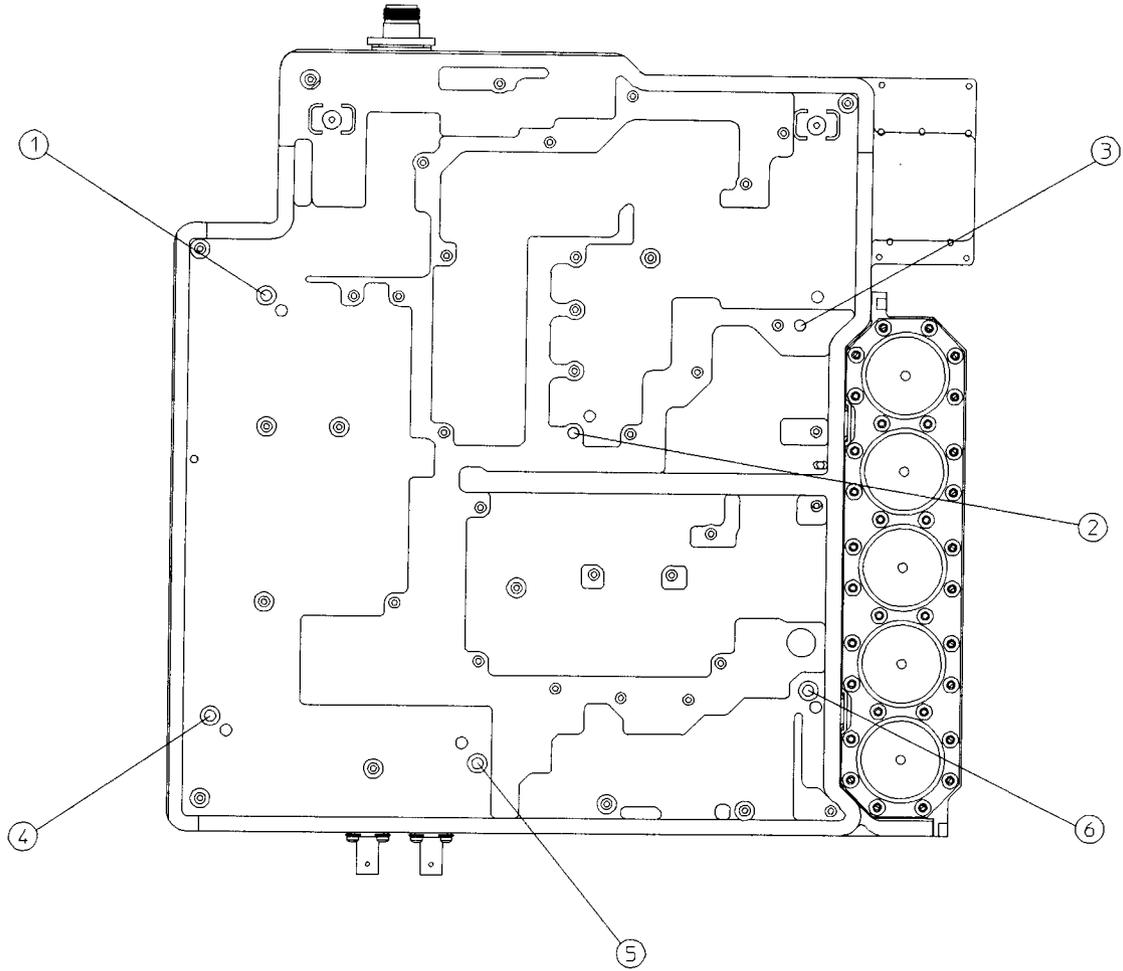
NOTE

The RF assembly is not field serviceable. Please do not remove the shields (other than the input connector cover).

Removal

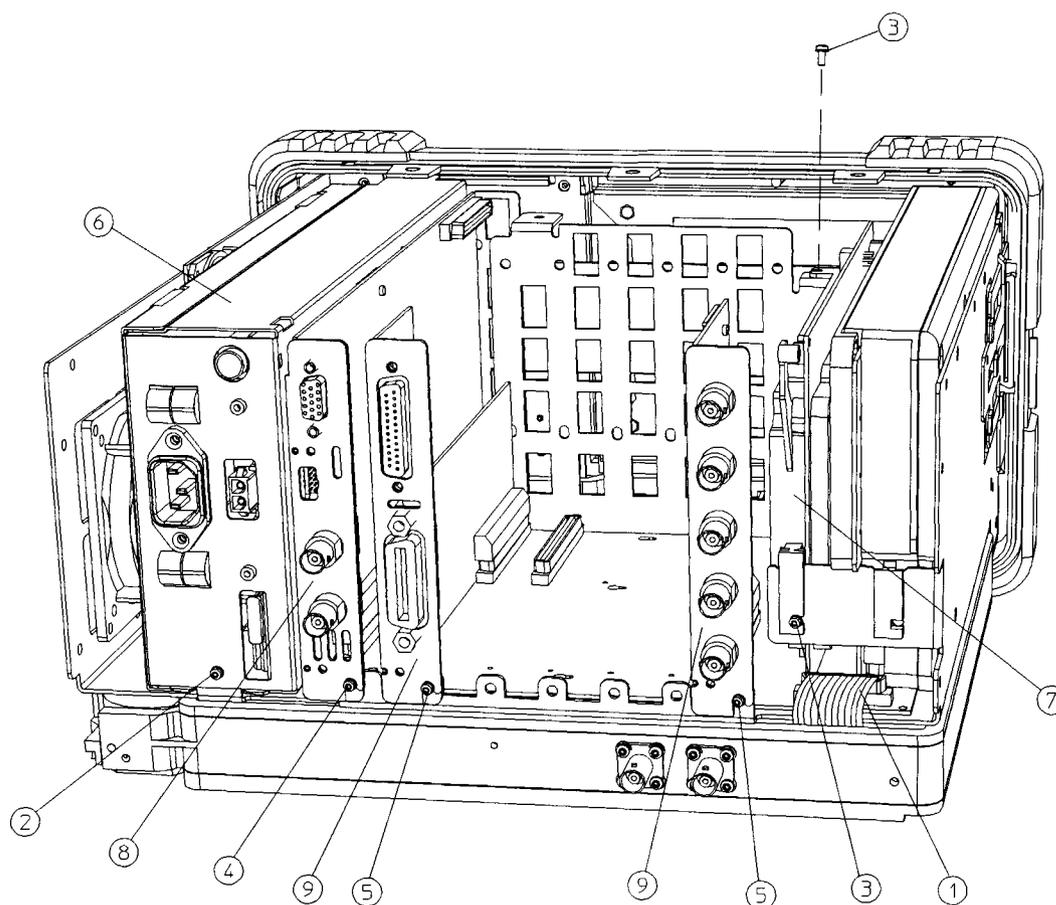
1. Remove the instrument outer case. Refer to the “Instrument Outer Case” removal procedure.
2. Extend the A1 Front Frame assembly. Refer to the “A1 Front Frame Assembly” extension procedure.
3. Place the instrument on the work surface upside down, with the RF assembly facing up.
4. Remove the single inner shield screw located at the rear of the instrument, as indicated in Figure 4-3 on page 151.
5. Remove the screws labeled (1 - 6) as indicated in Figure 4-7.
6. Disconnect the RF ribbon cable (1) from the RF assembly at the rear of the instrument. Refer to Figure 4-8.
7. Disconnect the W2 coaxial cable from the A3 IF assembly.
8. Lift the RF assembly from the spectrum analyzer.

Figure 4-7 **A8 RF Assembly Removal**



sl712a

Figure 4-8 Instrument, Rear View



sl746a

Replacement

1. Place the instrument on the work surface upside down.
2. Connect W2 coaxial cable to the A3 IF assembly.
3. Connect the ribbon cable (1) to the RF assembly. Refer to Figure 4-8.
4. Position the RF assembly correctly on the chassis, taking care not to pinch the ribbon cable against the chassis.
5. Replace the six screws (1 - 6) that secure the RF assembly to the chassis. Torque to 9 inch pounds. Refer to Figure 4-7.
6. Replace the single screw that secures the inner shield to the RF assembly. Refer to Figure 4-3 on page 151.
7. Make sure the water seal is in place on the input connector.

A8 RF Assembly

8. Reconnect the A1 front frame to the chassis. Refer to the “A1 Front Frame Assembly” replacement procedure.
9. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
10. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

A8J10 Input Connector

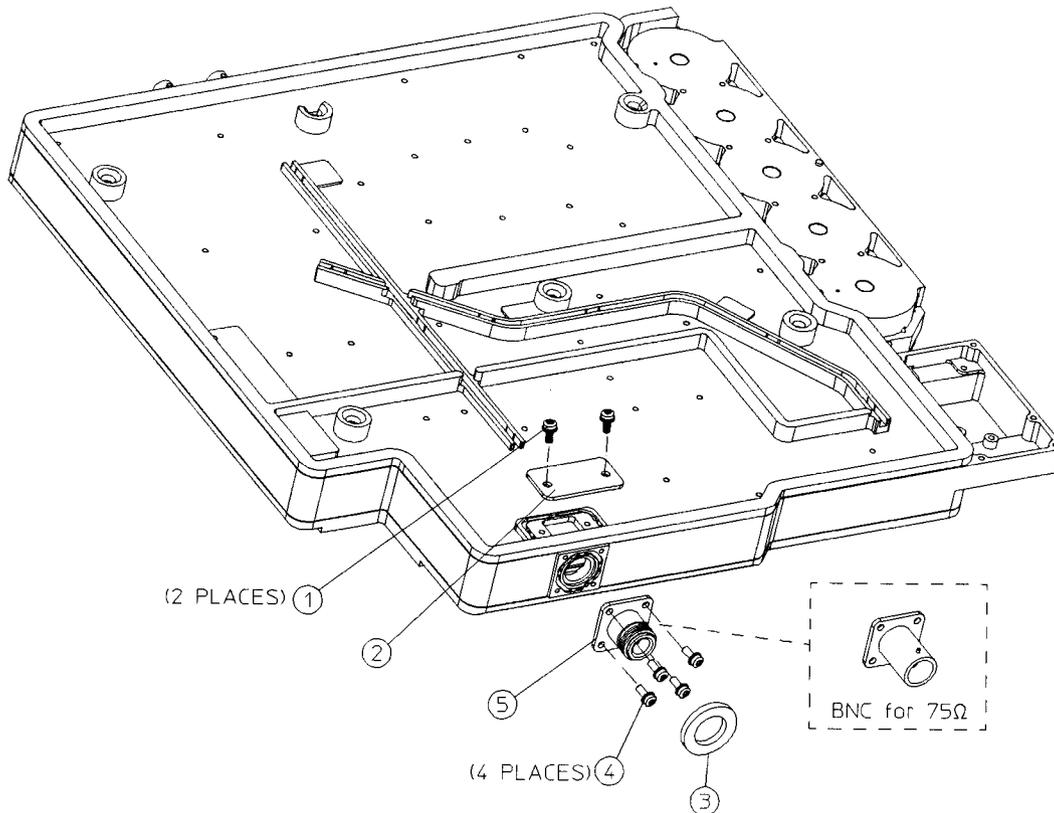
CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
2. Remove the A1 front frame assembly. Refer to the “A1 Front Frame Assembly” removal procedure.
3. Remove the two screws **(1)** that secure the input connector cover **(2)** and take the cover off. Refer to Figure 4-9.
4. Remove the water seal **(3)** from around the input connector.
5. Remove the 4 screws **(4)** securing the connector **(5)** to the RF frame.
6. Heat the connector center conductor on the RF board and pull the connector out gently.

Figure 4-9 **A8J10 RF Input Connector**



sn74a

Replacement

1. Remove excess solder from the RF board pad.
2. Fasten the new input connector (5) to the RF assembly frame with the four screws (4) torqued to 9 inch pounds.
3. Resolder the center conductor to the RF board.
4. Replace the input connector cover (2) and secure it with the two screws (1) torqued to 9 inch pounds. Replace the water seal (3) around the front of the input connector.
5. Reconnect the A1 front frame to the chassis. Refer to the “A1 Front Frame Assembly” replacement procedure.
6. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
7. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
8. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

A5 Power Supply

CAUTION

Use ESD precautions when performing this replacement procedure.

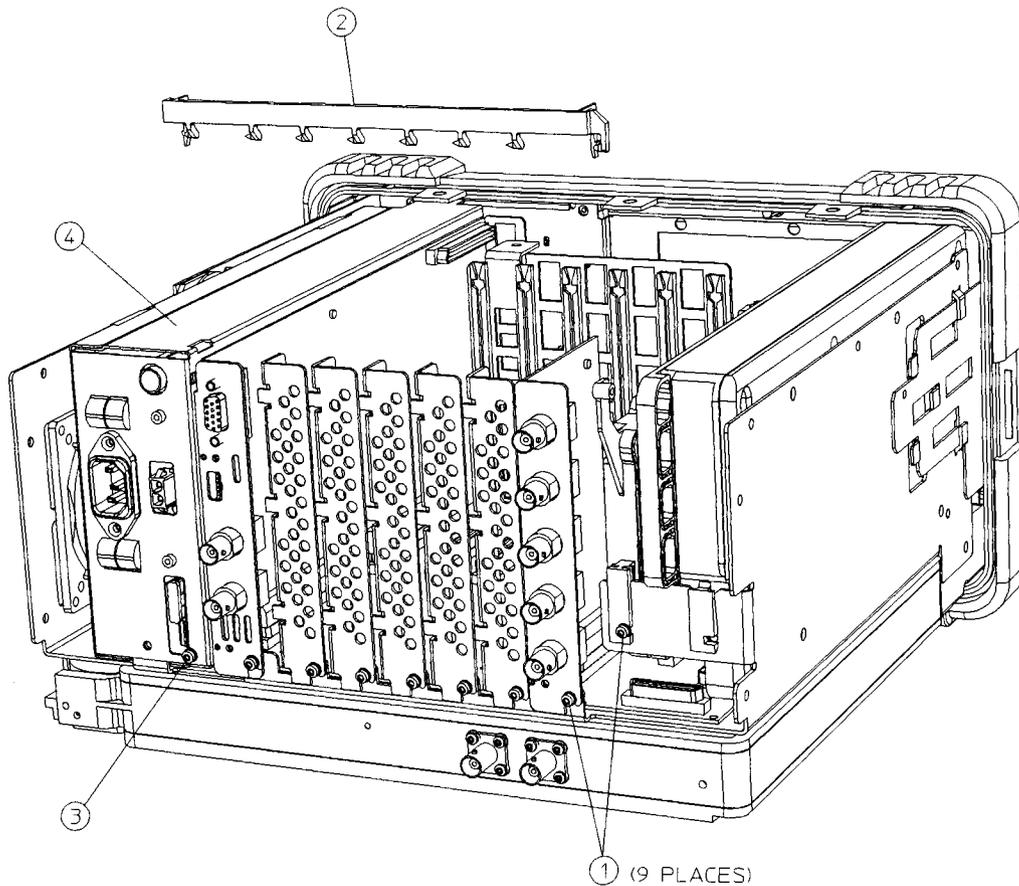
Removal

1. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
2. Loosen but do not remove all of the screws **(1)** securing the boards and blank plates at the rear of the chassis. Refer to Figure 4-10.
3. Remove the vibration support bar **(2)** at the top rear of the instrument by pinching in the ends of the bar and rotating upward. The support can be removed by sliding it out of the holes in each assembly. Refer to Figure 4-10.

CAUTION

The vibration support can be broken if it is forced. Remove with care.

Figure 4-10 Vibration Support



sl725a

4. Extend the A1 front frame assembly. Refer to the “A1 Front Frame Assembly” extension procedure.
5. Remove the single screw (3) securing the A5 power supply assembly (4) to the chassis at the rear of the instrument. Refer to Figure 4-10.
6. Carefully pull up on the power supply assembly to remove it from motherboard connector.

Replacement

1. Carefully plug the A5 power supply assembly into the motherboard.
2. Replace the single screw (3) that secures the power supply (4) to the chassis, but do not tighten it yet. Refer to Figure 4-10.
3. Reconnect the front frame assembly to the chassis. Refer to the “A1 Front Frame Assembly” replacement procedure.

4. Replace the vibration support (2) at the top rear of the instrument. Line up the tabs on the support with the holes in each assembly and rear blank panel. Slide the support side ways into the holes, then rotate down until the ends clip into the power supply and the IF assemblies. Refer to Figure 4-10.
5. Tighten all the screws that were loosened in the removal procedure. Torque to 9 inch pounds.
6. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
7. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
8. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

A5B1 Fan

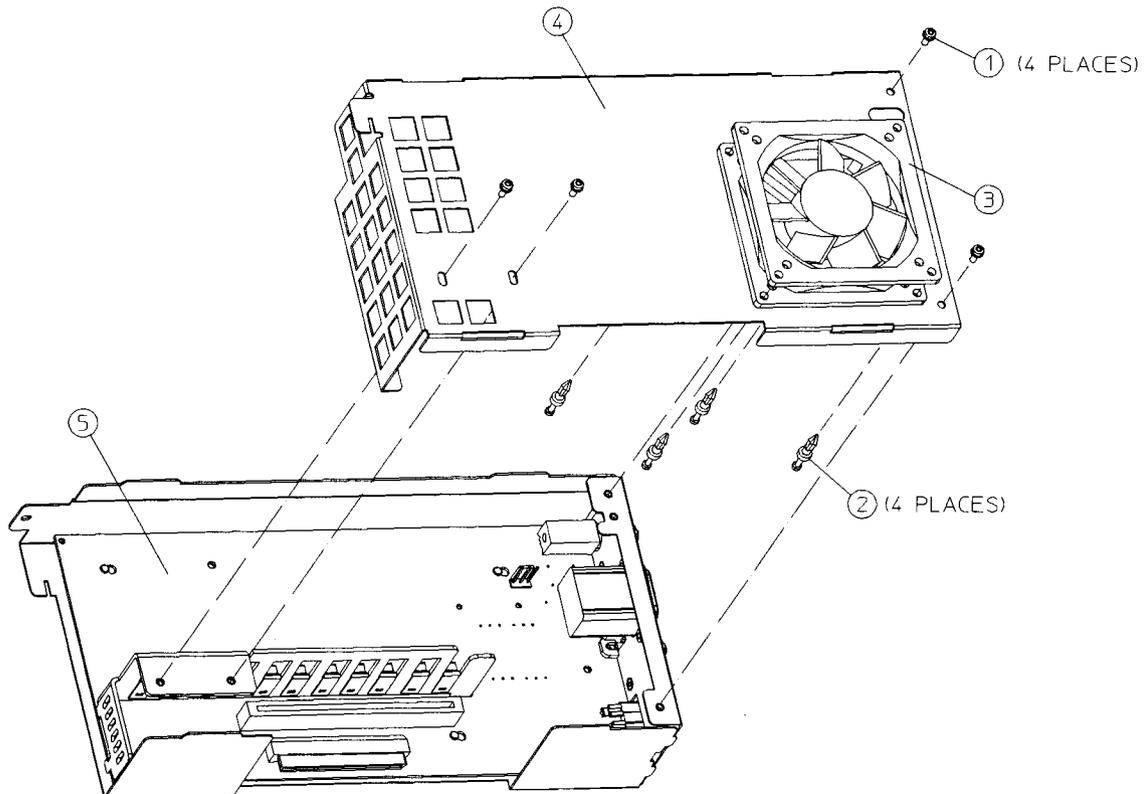
CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the power supply assembly. Refer to the “A5 Power Supply” removal procedure.
2. Unplug the fan connector from the power supply board inside the assembly.
3. Remove the four screws (1) securing the top cover (4) to the power supply assembly (5). Refer to Figure 4-11.

Figure 4-11 Power Supply Cover Removal

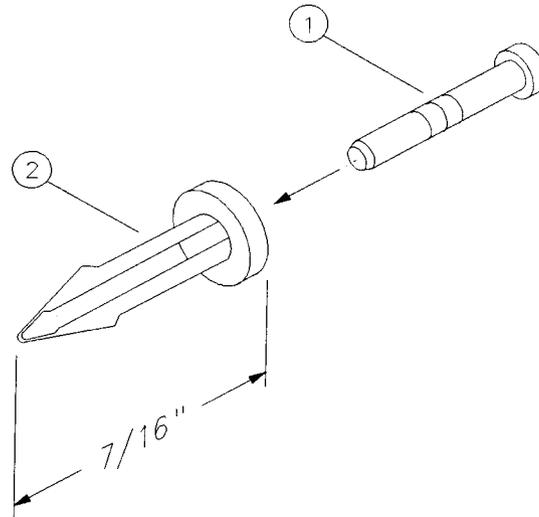


sl741a

4. Remove the top cover with the fan.
5. Locate the four plastic rivets (2) that secure the fan (3) to the cover.

6. Refer to Figure 4-12. Pry up the center post (1) of the rivet to contract the body (2) of the rivet. The rivet can now be removed by squeezing the end and pushing it out of the hole.

Figure 4-12 Fan Rivet



sh266e

7. The fan can be removed after the four rivets are taken out.

Replacement

1. Position the fan (3) on the outside of the power supply cover (4) so that the fan wires go through the opening and are aligned with the notch. Be careful to install the fan so that the arrow indicating the direction of the airflow, (on the body of the fan), is pointing away from the cover. This will ensure the proper airflow through the instrument and exiting through the side panel. Be careful not to pinch the fan wires against the cover.
2. With the rivets center post still raised, press the four rivets (2) through the cover and into the matching holes in the fan. Once they are in place, press down on the rivet center posts to expand the end and secure the fan to the cover. Refer to Figure 4-11.
3. Replace the power supply cover, with fan, on the power supply assembly. Make sure the lip on the top cover catches underneath the bottom cover.
4. Replace the four screws (1) that secure the top cover to the power supply assembly. Torque to 9 inch pounds.
5. Plug the fan connector into the power supply board.

A5B1 Fan

6. Replace the power supply assembly. Refer to the “A5 Power Supply” replacement procedure.
7. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

A2 Tracking Generator Assembly

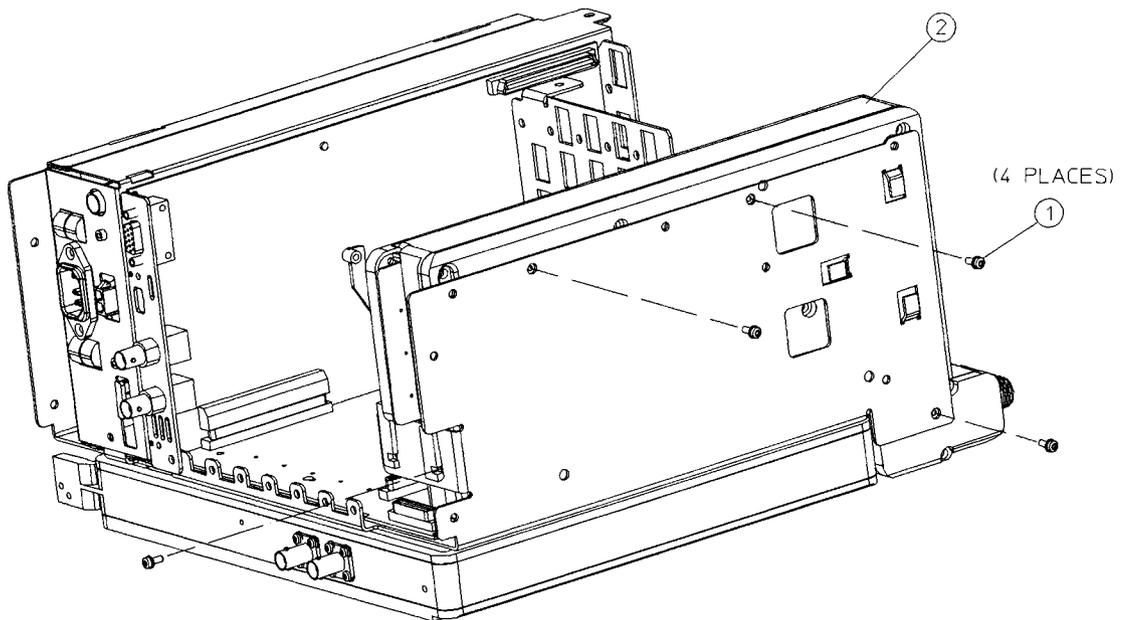
CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
2. Extend the A1 front frame assembly. Refer to the “A1 Front Frame Assembly” extension procedure.
3. Remove the four screws (1), (three from the side and one from the back), securing the A2 tracking generator assembly (2) to the chassis. Refer to Figure 4-13.
4. Carefully pull up on the tracking generator assembly to remove it from the motherboard connector.

Figure 4-13 **A2 Tracking Generator Removal**



sl742a

Replacement

1. Carefully plug the tracking generator assembly (2) into the motherboard.
2. Replace the four screws (1) that secure the tracking generator to the chassis. Torque to 9 inch pounds.
3. Replace the water seal around the front of the tracking generator connector
4. Reconnect the A1 front frame to the chassis. Refer to the “A1 Front Frame Assembly” replacement procedure.
5. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
6. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
7. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

Tracking Generator Boards

The removal and replacement of any of the three boards that make up the tracking generator assembly (T.G.) requires that the T.G. first be removed from the instrument. Refer to the “A2 Tracking Generator Assembly” removal and replacement procedures. After any board removal, refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required. For the following procedures, refer to Figure 4-14.

CAUTION

Use ESD precautions when performing the following replacement procedures.

A2 Tracking Generator Assembly

2. Carefully position the RF board onto the center shield, ensuring no cables will be pinched between the shields. Press down to engage the connectors at the output board.
3. Plug the output board wire harness (14) into the RF board.
4. Replace the RF shield (9) with the 20 screws removed earlier. Torque to 13.5 inch pounds.

Tracking Generator Control Board Removal (6)

Removal

1. Remove the 17 screws (1) that secure the control shield (7) to the center shield (4).
2. Unplug the ribbon cable (13) from the control board (6).
3. Unplug the coaxial cable (5) from the control board.

Replacement

1. Plug in the ribbon (13) and the coaxial cable (5) into the control board (6).
2. Position the control board onto the center shield (4), ensuring no cables will be pinched between the shields.
3. Replace the control shield (7) with the 17 screws removed earlier. Torque to 13.5 inch pounds.

Tracking Generator Output Board Removal (11)

Removal

1. Remove the 20 screws (1) that secure the RF shield (9) to the center shield (4).
2. Remove the 17 screws (1) that secure the control shield (7) to the center shield (4).
3. Unsolder the RF output connector (10).
4. Unplug the wire harness (14) from the RF board (8).
5. Carefully lift the RF board (8) straight away from the center shield to disconnect the connector on the output board (11).
6. Remove the 4 screws (2) that secure the output board (11) to the center shield (4).
7. Lift the output board from the center shield.

Replacement

1. Place the output board (11) into the center shield (4).
2. Carefully position the RF board (8) onto the center shield, ensuring no cables will be pinched between the shields. Press down to engage the connectors at the output board.
3. Replace the 4 screws securing the output board that were removed earlier. Torque to 9 inch pounds.
4. Plug the wire harness (14) into the RF board.
5. Resolder the RF output connector (10) to the output board.
6. Replace the RF and control shields. Torque all of the screws to 13.5 inch pounds.

Tracking Generator RF Output Connector

Removal

1. Remove the 17 screws (1) that secure the control shield to the center shield.
2. Remove the water seal (12) from around the RF output connector (10).
3. Remove the 4 screws (3) securing the connector to the center shield (4).
4. Heat the connector center contact on the output board and pull the connector out gently.

Replacement

1. Remove excess solder from the output board pad.
2. Fasten the new input connector to the center shield with the four screws (3) torqued to 9 inch pounds.
3. Resolder the center conductor to the output board.
4. Replace the water seal (12) around the RF output connector.
5. Replace the 17 screws that secure the control shield to the center shield. Torque to 13.5 inch pounds.

A3 IF Assembly

CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
2. Loosen but do not remove all of the screws securing the boards and blank plates at the rear of the chassis.
3. Carefully remove the vibration support bar at the top rear of the instrument by pinching in the ends of the bar and rotating upward. The support can be removed by sliding it out of the holes in each assembly. Refer to Figure 4-10 on page 164.
4. Remove the two screws (3) securing the A3 IF assembly (7) to the chassis. Refer to Figure 4-8 on page 159.
5. Disconnect the W2 coaxial cable from the IF assembly.
6. Carefully lift the IF assembly to remove it from the motherboard connector.

Replacement

1. Carefully plug the IF assembly into the motherboard.
2. Replace the two screws (3) that secure the IF assembly (7) to the chassis, but do not tighten them yet. Refer to Figure 4-8 on page 159.
3. Connect the W2 coaxial cable to the IF assembly.
4. Replace the vibration support bar at the top rear of the instrument. Line up the tabs on the support with the holes in each assembly and rear blank panel. Slide the support side ways into the holes, then rotate down until the ends clip into the power supply and the IF assemblies. Refer to Figure 4-10 on page 164.
5. Tighten all the screws that were loosened in the removal procedure. Torque to 9 inch pounds.
6. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
7. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
8. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

A4 Processor Assembly

CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
2. Loosen but do not remove all of the screws securing the boards and blank plates at the rear of the chassis.
3. Remove the vibration support bar at the top rear of the instrument by pinching in the ends of the bar and rotating upward. The support can be removed by sliding it out of the holes in each assembly. Refer to Figure 4-10 on page 164.
4. Remove the single screw (4) securing the A4 processor (8) assembly to the chassis. Refer to Figure 4-8 on page 159.
5. Disconnect the front panel ribbon cable from the processor assembly.
6. Carefully lift the processor assembly to remove it from the motherboard connector.

Replacement

1. Carefully plug the processor assembly into the motherboard.
2. Replace the single screw (4) that secures the processor assembly (8) to the chassis, but do not tighten it yet. Refer to Figure 4-8 on page 159.
3. Replace the vibration support at the top rear of the instrument. Line up the tabs on the support with the holes in each assembly and rear blank panel. Slide the support side ways into the holes, then rotate down until the ends clip into the power supply and the IF assemblies. Refer to Figure 4-10 on page 164.
4. Tighten all the screws that were loosened in the removal procedure. Torque to 9 inch pounds.
5. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
6. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
7. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

BT1 Battery

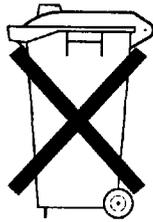
CAUTION

Use ESD precautions when performing this replacement procedure.

WARNING

There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to manufacturer's instruction.

Figure 4-15



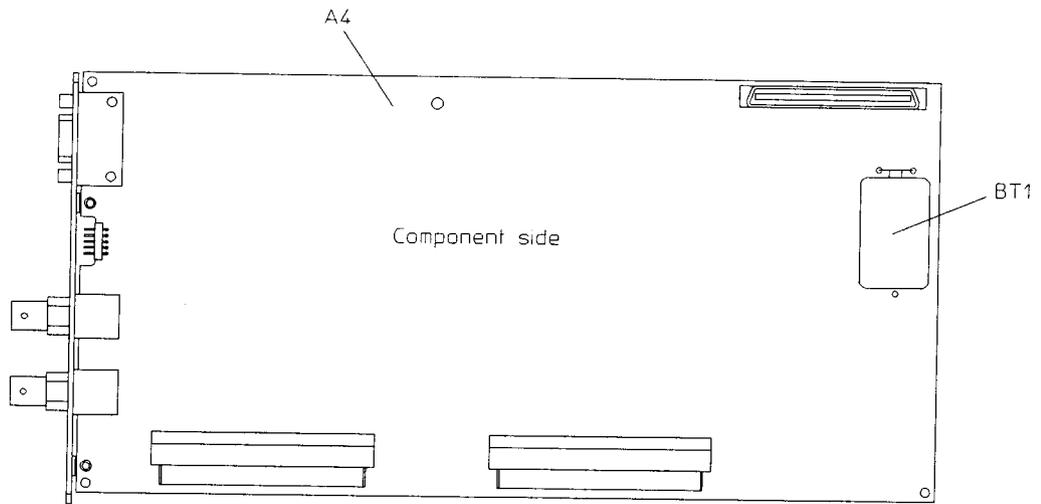
**DO NOT THROW BATTERIES AWAY BUT
COLLECT AS SMALL CHEMICAL WASTE.**

sk780a

Removal/Replacement

1. Remove the A4 processor assembly from the instrument. Refer to the “A4 Processor Assembly” removal procedure.
2. Unsolder the BT1 battery (3 V lithium) and remove it from the board. Refer to Figure 4-16.
3. Install the new battery, ensuring proper polarity as silkscreened on the A4 processor board assembly, and solder the leads.
4. Replace the processor assembly in the instrument. Refer to the “A4 Processor Assembly” replacement procedure.
5. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

Figure 4-16 Processor Battery Location



sl727a

A6 Speaker Assembly

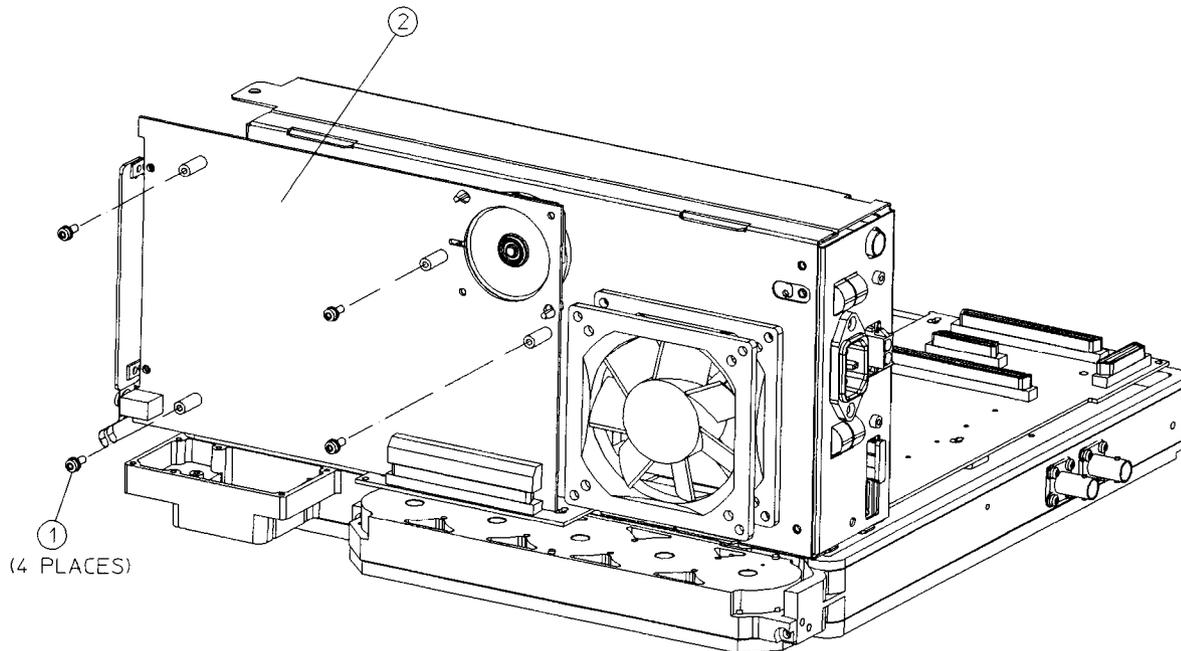
CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
2. Extend the A1 front frame. Refer to the “A1 Front Frame Assembly” extension procedure.
3. Remove the four screws (1) securing the A6 speaker assembly (2) to the side frame. Refer to Figure 4-17.
4. Carefully pull up on the speaker assembly to remove it from the motherboard connector.

Figure 4-17 A6 Speaker Assembly Removal



sl743a

Replacement

1. Carefully plug the A6 speaker assembly into the motherboard.
2. Replace the four screws (1) that secure the speaker assembly (2) to the side chassis. Torque to 9 inch pounds. Refer to Figure 4-17.

3. Reconnect the A1 Front Frame to the chassis. Refer to the “A1 Front Frame Assembly” replacement procedure.
4. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
5. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
6. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

I/O Assemblies

CAUTION

Use ESD precautions when performing this replacement procedure.

The following procedure can be used for all of the I/O assemblies:

- A7A1 Spectrum Analyzer Input/Output Assembly (option A4J)
- A7A2 HP-IB/Parallel Assembly (option A4H)
- A7A3 RS-232/Parallel Assembly (option 1AX)

Removal

1. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
2. Loosen but do not remove all of the screws securing the boards and blank plates at the rear of the chassis.
3. Remove the vibration support bar at the top rear of the instrument by pinching in the ends of the bar and rotating upward. The support can be removed by sliding it out of the holes in each assembly. Refer to Figure 4-10 on page 164.
4. Refer to the major assembly locations foldout at the beginning of this chapter to locate the correct I/O assembly.
5. Remove the single screw (5) securing the I/O assembly (9) to the chassis. Refer to Figure 4-8 on page 159.
6. Carefully pull up on the I/O assembly to remove it from the motherboard connector.

Replacement

1. Carefully plug the I/O assembly into the motherboard.
2. Replace the single screw (5) that secures the I/O assembly (9) to the chassis, but do not tighten it yet. Refer to Figure 4-8 on page 159.
3. Replace the vibration support at the top rear of the instrument. Line up the tabs on the support with the holes in each assembly and rear blank panel. Slide the support side ways into the holes, then rotate down until the ends clip into the power supply and the IF assemblies. Refer to Figure 4-10 on page 164.
4. Tighten all the screws that were loosened in the removal procedure. Torque to 9 inch pounds.

5. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
6. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
7. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

A7 Motherboard Assembly

CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

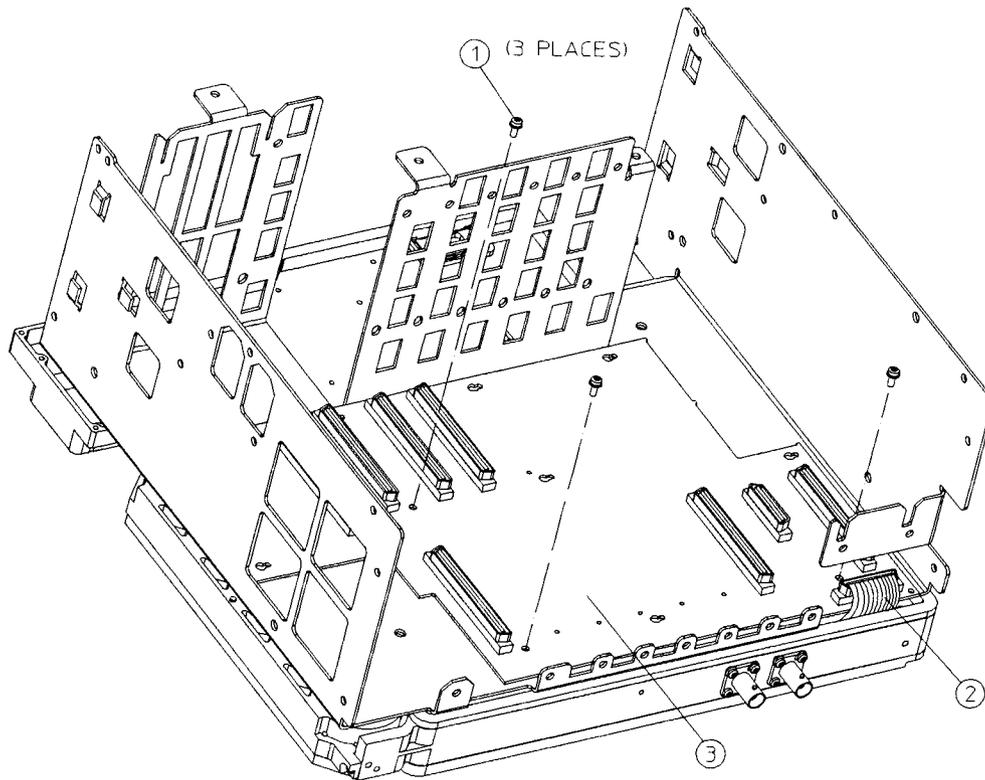
1. Remove the instrument outer case. Refer to the “Instrument Outer Case” removal procedure.
2. Remove the instrument inner shield. Refer to the “Inner Shield” removal procedure.
3. Extend the A1 front frame. Refer to the “A1 Front Frame Assembly” extension procedure.
4. Remove all of the screws (1) securing the boards and blank plates at the rear of the chassis. Refer to Figure 4-10 on page 164.
5. Remove the vibration support bar at the top rear of the instrument by pinching in the ends of the bar and rotating upward. The support can be removed by sliding it out of the holes in each assembly.
6. Remove the A6 speaker assembly. Refer to the “A6 Speaker Assembly” removal procedure.
7. If the instrument is an option 1DN, remove the A2 tracking generator. Refer to the “A2 Tracking Generator Assembly” removal procedure.
8. Remove the A3 IF assembly. Refer to the “A3 IF Assembly” removal procedure.
9. Remove the A4 processor assembly. Refer to the “A4 Processor Assembly” removal procedure.
10. Remove the A5 power supply assembly. Refer to the “A5 Power Supply” removal procedure.
11. If the instrument has the A7A1 SA I/O, A7A2 HP-IB, or A7A3 RS-232 assemblies, remove them. Refer to the “I/O Assemblies” removal procedure.
12. Disconnect the RF ribbon cable (2) from the motherboard (3). Refer to Figure 4-18.
13. Remove the three screws (1) as indicated in Figure 4-18.

NOTE

The motherboard is attached to the chassis by a number of shoulder lock standoffs. During removal of the motherboard you must slide the board sideways to disengage these locks.

14. Carefully lift the motherboard (3) out of the chassis.

Figure 4-18 **A7 Motherboard Removal**



sl744a

Replacement

1. Carefully place the motherboard (3) into the chassis.
2. Slide the motherboard sideways to engage the shoulder locks on the chassis.
3. Replace the three screws (1) that secure the motherboard to the chassis. Torque to 9 inch pounds. Refer to Figure 4-18.
4. Connect the RF ribbon cable (2) to the motherboard. Refer to Figure 4-18.
5. Replace the A5 power supply assembly. Refer to the “A5 Power Supply” replacement procedure.
6. Replace the A4 processor assembly. Refer to the “A4 Processor Assembly” replacement procedure.
7. Replace the A3 IF assembly. Refer to the “A3 IF Assembly” replacement procedure.

A7 Motherboard Assembly

8. Replace the A2 tracking generator assembly (option 1DN) if applicable. Refer to the “A2 Tracking Generator Assembly” replacement procedure.
9. Replace the A6 speaker assembly. Refer to the “A6 Speaker Assembly” replacement procedure.
10. Replace the I/O assemblies. Refer to the “I/O Assemblies” replacement procedure.
11. Reconnect the A1 front frame to the chassis. Refer to the “A1 Front Frame Assembly” replacement procedure.
12. Make sure all of the screws securing the boards and blank plates at the rear of the chassis are loose.
13. Replace the vibration support at the top rear of the instrument. Line up the tabs on the support with the holes in each assembly and rear blank panel. Slide the support side ways into the holes, then rotate down until the ends clip into the power supply and the IF assemblies. Refer to Figure 4-10 on page 164.
14. Tighten all the screws that were loosened in the removal procedure. Torque to 9 inch pounds.
15. Replace the inner shield. Refer to the “Inner Shield” replacement procedure.
16. Replace the outer case. Refer to the “Instrument Outer Case” replacement procedure.
17. Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

Front Frame Subassemblies

In order to remove any of the following subassemblies, it is necessary to remove the A1 front frame assembly from the main chassis. Refer to the “A1 Front Frame Assembly” removal procedure.

After the subassembly is replaced reconnect the front frame to the chassis. Refer to the “A1 Front Frame Assembly” replacement procedure.

Refer to Table 5-2 in Chapter 5 for the related adjustments and performance verification tests required for each assembly.

CAUTION

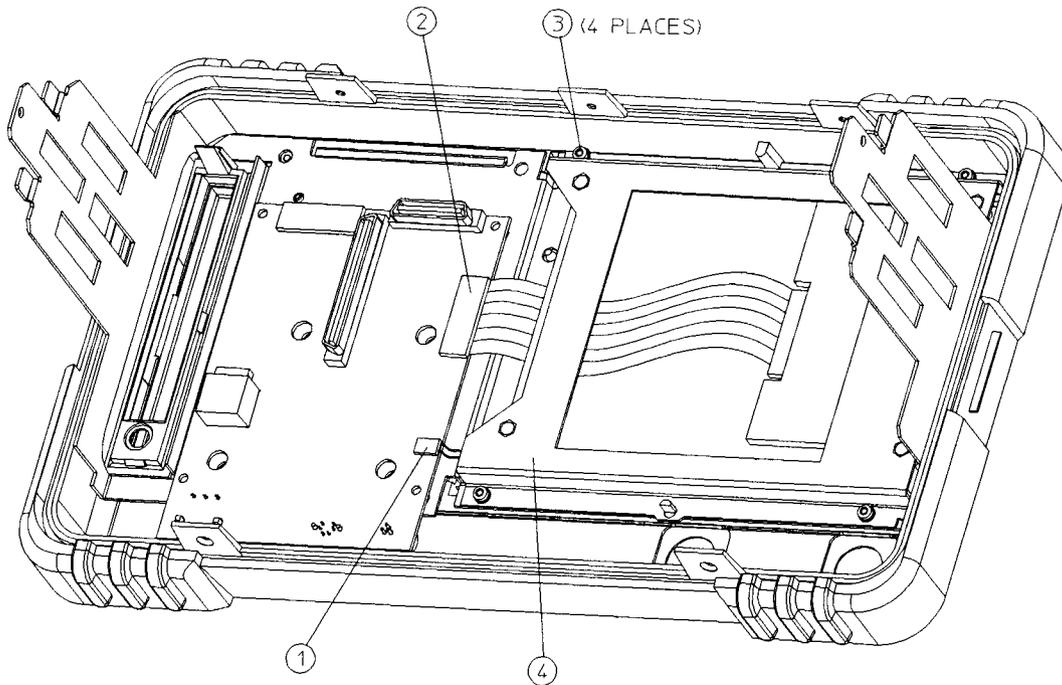
Use ESD precautions when performing the following replacement procedures.

A1A2 Display

Removal

1. Place the front frame assembly face down on the work surface.
2. Disconnect the 2-wire backlight cable (1) from the front panel interface board. Refer to Figure 4-19.
3. Disconnect W3 ribbon cable (2) from the front panel interface board.
4. Remove the four screws (3) securing the display (in a bracket) (4) to the front frame.
5. Carefully lift the display out of the front frame assembly.

Figure 4-19 **A1A2 Display Replacement**



sl745a

Replacement

CAUTION

The display monitor comes with a protective plastic sheet over the glass. Remove this plastic very slowly to avoid damage due to ESD.

CAUTION

The surface of the display is very easily scratched. Avoid touching it with your bare hands or other objects. Use a blower to remove any dust from the display surface.

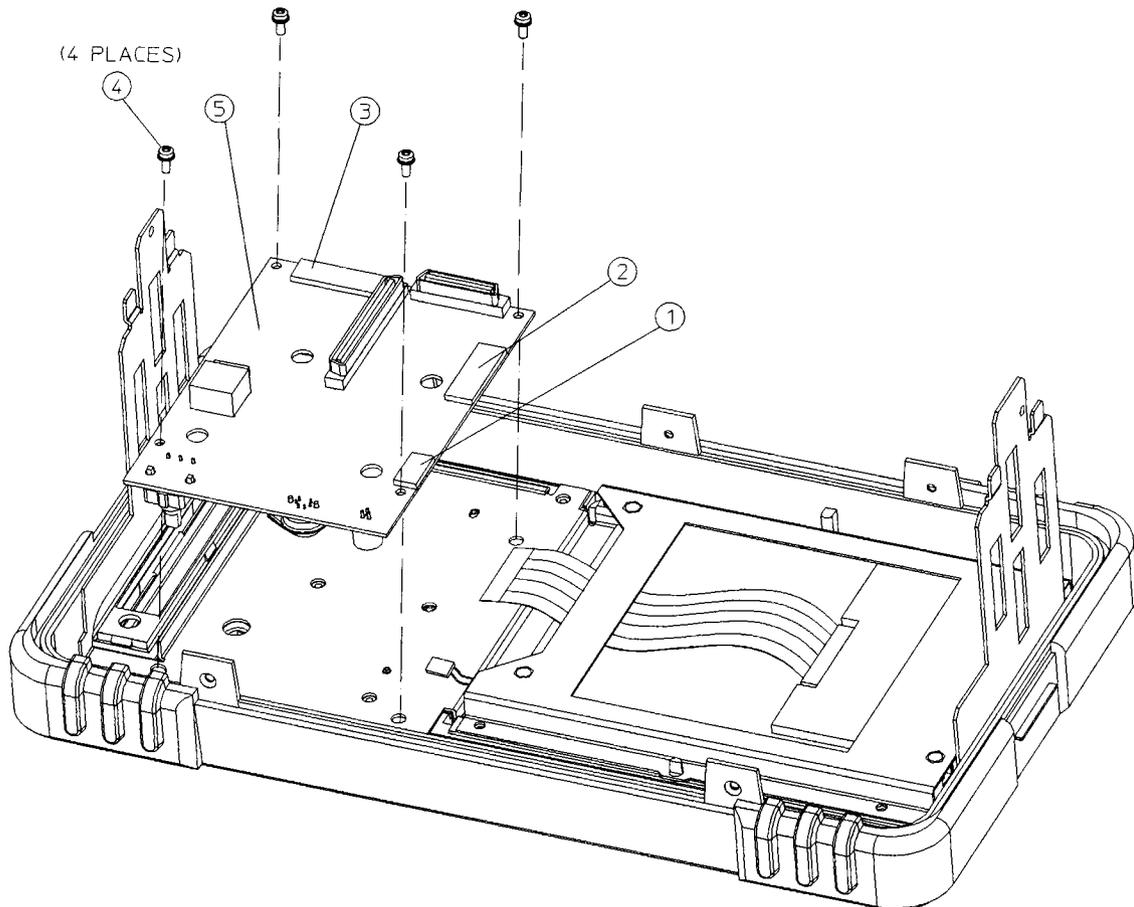
1. Clean the inside of the lens that is attached to the front frame.
2. Place the display (4) into the front frame assembly. Make sure that the cables are not pinched between the display and the front frame. Refer to Figure 4-19.
3. Replace the four screws (3) that secure the display bracket to the front frame. Torque to 9 inch pounds.
4. Connect the display ribbon cable (2) to the front panel interface board.
5. Connect the backlight cable (1) to the front panel interface board.

A1A1 Front Panel Interface Board

Removal

1. Remove the volume knob and the RPG knob by pulling straight off of the control shafts.
2. Disconnect the 2-wire backlight cable (1) from the front panel interface board. Refer to Figure 4-20.
3. Disconnect the W3 display ribbon cable (2) and keypad ribbon cable (3) from the front panel interface board.
4. Remove the four screws (4) that secure the A1A1 front panel interface board (5) to the front frame. Refer to Figure 4-20.
5. Remove the front panel interface board from the front frame assembly.

Figure 4-20 A1A1 Front Panel Interface Board Removal



sl747a

NOTE

There is a water seal gasket placed around the volume control shaft that will need to be repositioned during the replacement procedure.

Replacement

1. Place the front panel interface board **(5)** in the correct position in the front frame assembly. Make sure the water seal is in place around the volume shaft.
2. Replace the four screws **(4)** that secure the board to the front frame. Torque to 9 inch pounds.
3. Reconnect the W3 display ribbon cable **(2)**, and the keypad ribbon cable **(3)**.
4. Reconnect the 2-wire backlight cable **(1)**.
5. Press the volume and RPG knobs onto their control shafts.

Front Panel RPG

Removal/Replacement

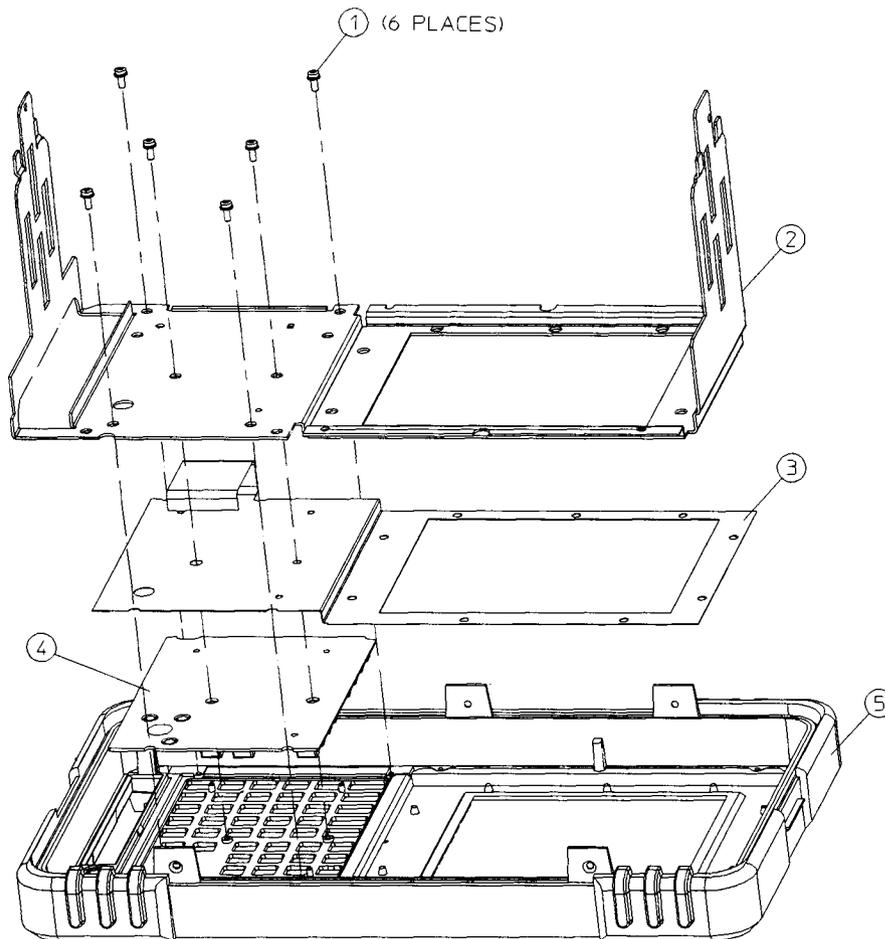
1. Remove the front panel interface board. Refer to the “A1A1 Front Panel Interface Board” removal procedure.
2. Unsolder the appropriate RPG and remove it from the front panel interface board.
3. Place the new RPG in the correct position and resolder the leads.
4. Replace the front panel interface board. Refer to the “A1A1 Front Panel Interface Board” replacement procedure.

Keypad/Flex Circuit

Removal

1. Remove the RPG knobs.
2. Refer to Figure 4-19. Remove the four screws **(3)** that secure the display to the front frame.
3. Refer to Figure 4-21. Remove the six screws **(1)** securing the subpanel **(2)** to the front frame **(5)**. Lift the subpanel, with the display and front panel interface board attached, from the front frame assembly.
4. Lift out the flex circuit **(3)** and the main keypad **(4)**. Be careful to avoid touching the keypad contacts with your fingers.

Figure 4-21 **Front Frame Subpanel Removal**



s1728a

Replacement

1. Place the main keypad (4) so it lays flat in the front frame (5). Be careful to avoid touching the keypad contacts with your fingers.
2. Lay in the flex circuit (3) so it aligns with the pegs on the front frame and lays flat. A small amount of circuit ripple will be unavoidable.

NOTE

If you are putting in a new flex circuit, it will need to be preformed for it to fit properly in the front frame. Slightly bend the circuit along the slits in two places between the main key section and the display section to form to the contours of the front frame. Be careful to not bend the circuit too much (no more than a 90° angle), and do not crease. This can damage the traces in the flex circuit.

3. Place the subpanel (2), with the display and the front panel interface board attached, on top of the flex circuit, taking care to not pinch the flex circuit ribbon cable underneath. Refer to Figure 4-21.
4. Ensure the flex circuit is aligned with the pegs and not visible through the screws holes in the subpanel. Replace the six screws that secure the subpanel to the front frame. Replace the four screws that secure the display to the front frame. Torque to 9 inch pounds.
5. Replace the RPG knobs.

Lens/Keypad Assembly

Removal

1. Remove the keypad/flex circuit. Refer to the “Keypad/Flex Circuit” removal procedure.
2. The lens/keypad assembly is pressed into place, using adhesive instead of hardware. To remove it from the front frame, apply pressure along the edges of the lens from the front side until it pops out.

Replacement

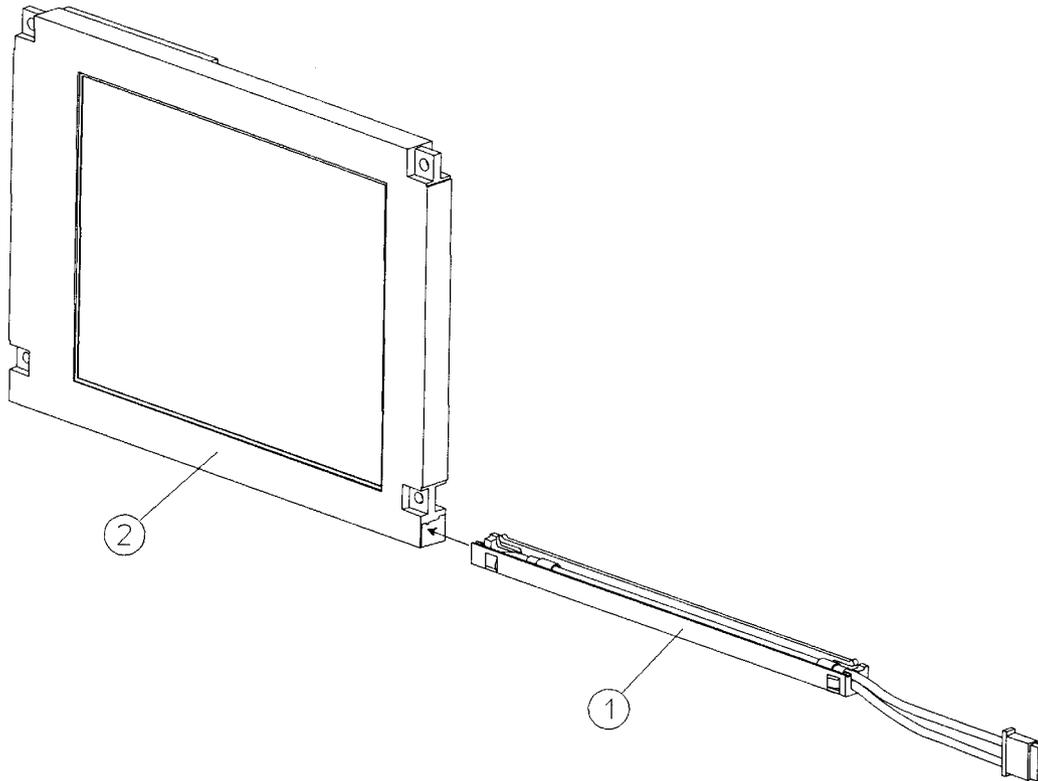
1. Remove the paper covering the adhesive on the lens/keypad assembly.
2. Carefully fit the new lens/keypad assembly into place in the front frame. Press along the edges of the lens from the inside to adhere it to the front frame.
3. Make sure the inside of the lens is clean from contaminants such as lint and fingerprints before proceeding.
4. Replace the main keypad, flex circuit, and subpanel assembly (with the display and front panel interface board attached). Refer to the “Keypad/Flex Circuit” replacement procedure.
5. After the front frame is reattached to the chassis, remove the protective plastic covering from the lens.

Display Backlight

Removal

1. Remove the display. Refer to the “A1A2 Display” removal procedure.
2. Locate the 2-wire connector on the display. This is the backlight assembly (1). Care fully press on the opposite end from the wires to slide the backlight assembly partially out of the display (2). Once the end of the backlight casing is exposed, you can pull it straight out from the display. Refer to Figure 4-22.

Figure 4-22 **Display Backlight Replacement**



sl735a

Replacement

NOTE

Do not touch the bulb encased in the plastic backlight assembly.

1. Insert the new backlight assembly (1) by sliding it into the display, non-wired end first, taking care not to force it. It is keyed so it will only fit properly one way. Slide it all the way in to the end of the casing.
2. Replace the display. Refer to the “A1A2 Display” replacement procedure.

Media Door/Bezel

1. The media door snaps on and off of the media bezel.
2. To remove the media bezel, it is necessary to remove the front frame. Refer to the “A1 Front Frame Assembly” removal procedure.
3. The bezel also snaps into place. It can be removed by pressing the tabs together from the inside and pushing the bezel out of the front frame.

The procedures in this chapter adjust the spectrum analyzer electrical performance to the specifications described in the Users and Calibration Guide for your spectrum analyzer. Automated software is required to provide some of the spectrum analyzer adjustments. Never perform adjustments as routine maintenance. Adjustments should be performed after a repair or a performance test failure. For information on which tests to perform, refer to Table 5-2 in this chapter. For information on installing and using the adjustment software, refer to the following two chapters.

Safety

Familiarize yourself with the safety symbols marked on the spectrum analyzer, and read the general safety considerations and the safety note definitions in the front of this guide, *before* you begin the procedures in this chapter.

Before You Start

There are three things you should do before starting an adjustment procedure:

- ❑ Check that you are familiar with the safety symbols marked on the spectrum analyzer, and read the general safety considerations and the symbol definitions given in the front of this service guide.
- ❑ Check that the spectrum analyzer has been turned on and allowed to warm up for at least 30 minutes at room temperature before making any adjustments. The spectrum analyzer *must* be allowed to stand at room temperature at least 2 hours prior to the 30 minute warm-up.
- ❑ Read the rest of this section.

If there are abnormal indications during adjustment

If the indications received during an adjustment do not agree with the normal conditions given in the adjustment procedures, a fault exists in your spectrum analyzer. The fault should be repaired *before* proceeding with any further adjustments. Refer to the troubleshooting and repair information in Chapter 1 of this guide.

Periodically verifying calibration

The spectrum analyzer requires periodic verification of operation. Under most conditions of use, you should test the spectrum analyzer at least once a year with either operation verification or the complete set of performance verification tests located in the users and calibration guide for your spectrum analyzer.

When test results show proper operation and calibration, no adjustments are necessary. However, if test results indicate that the instrument does not meet specifications, the cause should be determined and rectified. Refer to the troubleshooting information in Chapter 1 before attempting to recalibrate.

If you replace or repair an assembly

If one or more spectrum analyzer assemblies has been replaced or repaired, related adjustment procedures should be done prior to verifying operation. Refer to Table 5-2 to determine which adjustment to perform after replacing or repairing an assembly. Find the assembly that has been repaired or replaced in the left-hand column. Then perform the adjustments marked across the adjustment column for that assembly. It is important that adjustments are performed in the order indicated to ensure that the instrument meets all of its specifications.

List of Tests and Adjustments for Calibration

To perform calibration:

1. Run all performance verification tests listed in column 1 of Table 5-1.
2. If any of the performance verification tests fail, perform the appropriate calibration adjustments listed in column 2 of Table 5-1 which corresponds to the failure.
3. Repeat ALL of the performance verification tests listed in column 1 of Table 5-1 if ANY calibration adjustments were made in step 2. This will confirm that there is no interaction between adjustments which could negatively impact board performance.

NOTE

If performance verifications fail and there are no corresponding calibration adjustments to be performed, or if failures continue to occur after calibration adjustments have been performed, this indicates a hardware problem. Review the troubleshooting tips in column 3 of Table 5-1 for possible defective assemblies.

Table 5-1 Calibration Requirements

Test #	Column 1 Performance Verification Tests	Column 2 Calibration Adjustments	Column 3 Troubleshooting Tips
1	10 MHz Reference Accuracy	10 MHz Frequency Reference Adjustment	RF
2	Resolution Bandwidth Switching Uncertainty	21.4 MHz IF Calibrator	RF
3	Noise Sidebands	None	RF/IF
4	System Related Sidebands	None	RF
5	Residual FM	None	RF
6	Frequency Span Readout Accuracy	None	RF
7	Reference Level Accuracy	21.4 MHz IF Calibrator	RF
8	Scale Fidelity	21.4 MHz IF Calibrator	RF
9	Resolution Bandwidth Accuracy	None	IF
10	Frequency Readout and Marker Count Accuracy	None	IF/Processor/RF
11	Absolute Amplitude Accuracy	50 MHz Calibrator	RF

Post-Repair Procedures
List of Tests and Adjustments for Calibration

Test #	Column 1 Performance Verification Tests	Column 2 Calibration Adjustments	Column 3 Troubleshooting Tips
12	Frequency Response	Uncorrected Flatness Corrected Flatness	RF
13	Spurious Responses	None	RF
14	Gain Compression	None	RF
15	Other Input Related Spurious Responses	None	RF
16	Sweep Time Accuracy	None	RF
17	Displayed Average Noise Level	Frequency Response Adjustment	RF/IF
18	Residual Responses	None	RF
19	Tracking Generator Feedthrough, Option 1DN only	None	TG
20	Absolute Amplitude, Vernier, and Power Sweep Accuracy, Option 1DN only	Tracking Generator ALC Calibration Tracking Generator Frequency Slope	TG
21	Tracking Generator Level Flatness, Option 1DN only	Tracking Generator ALC Calibration Tracking Generator Frequency Slope	TG
22	Harmonic Spurious Outputs, Option 1DN only	None	TG
23	Non-Harmonic Spurious Outputs, Option 1DN only	None	TG

List of Tests and Adjustments for Post-Repair

Table 5-2 lists the adjustments and performance tests needed after an assembly repair or replacement. Adjustments are located at the end of this chapter. Performance tests are located in the *HP ESA-L1500A User's and Calibration Guide*.

Table 5-2 Adjustments and Tests for Replaced or Repaired Assemblies

Assembly changed or repaired	Perform the following adjustments in the order listed	Perform the following performance tests after the adjustments are completed
A1 front frame assembly	None	Displayed Average Noise Level Residual Responses
A2 tracking generator assembly	Tracking Generator ALC Calibration ^a Tracking Generator Frequency Slope ^a None ^b	Tracking Generator Feedthrough Absolute Amplitude, Vernier, and Power Sweep Accy Tracking Generator Level Flatness Harmonic Spurious Outputs Non-Harmonic Spurious Outputs
A3 IF assembly	None	Reference Level Accuracy Scale Fidelity Resolution Bandwidth Accuracy Resolution Bandwidth Switching Uncertainty
A4 processor assembly	Initialize the Analyzer Utility	Reference Level Accuracy Scale Fidelity Absolute Amplitude Accuracy Displayed Average Noise Level
A4BT1 processor battery	Initialize the Analyzer Utility	Reference Level Accuracy Scale Fidelity Absolute Amplitude Accuracy Displayed Average Noise Level
A5 power supply assembly	None	Noise Sidebands System-Related Sidebands Displayed Average Noise Level Residual Responses

Post-Repair Procedures
List of Tests and Adjustments for Post-Repair

Assembly changed or repaired	Perform the following adjustments in the order listed	Perform the following performance tests after the adjustments are completed
A6 speaker assembly	None	None
A7 motherboard	None	Reference Level Accuracy Scale Fidelity Absolute Amplitude Accuracy
A8 RF assembly	10 MHz Reference ^a 21.4 MHz IF Calibrator ^a 50 MHz Calibrator ^a Uncorrected Flatness ^a Corrected Flatness ^a None ^b	10 MHz Reference Accuracy Noise Sidebands System-Related Sidebands Residual FM Frequency Span Readout Accuracy Frequency Readout and Marker Count Accuracy Absolute Amplitude Accuracy Frequency Response Spurious Responses Gain Compression Other Input Related Spurious Responses Displayed Average Noise Level Residual Responses

- a. Only necessary after a repair to the assembly
b. Only necessary after assembly replacement

Test equipment you will need

Refer to Table 5-3 for a list of recommended equipment for the spectrum analyzer adjustments. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Table 5-3 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model
Digital Multimeter	Input Resistance: ≥ 10 megohms Accuracy: ± 10 mV on 100 V range	HP 3458A
Universal Counter	Time Interval Range: 25 ms to 100 ms Single Operation Range: +2.5 Vdc to -2.5 Vdc	HP 53132 or HP 5316B
Frequency Standard	Frequency: 10 MHz Timebase Accy (Aging): $< 1 \times 10^{-9}$ /day	HP 5071A

Equipment	Critical Specifications for Equipment Substitution	Recommended Model
Measuring Receiver	Compatible with Power Sensors dB Relative Mode Resolution: 0.01 dB Reference Accuracy: $\pm 1.2\%$	HP 8902A
Power Meter	Compatible with power sensors dB relative mode. Resolution: 0.01 dB Reference accuracy: $\pm 1.2\%$ (Option 1DP)	HP 436A
Power Sensor	Frequency Range: 100 kHz to 1500 MHz Maximum SWR: 1.60 (100 kHz to 300 kHz) 1.20 (300 kHz to 1 MHz) 1.1 (1 MHz to 2.0 GHz)	HP 8482A
Power Sensor, 75 Ω	Frequency Range: 1 MHz to 1500 MHz Maximum SWR: 1.18 (600 kHz to 1500 MHz) Impedance: 75 Ω Amplitude Range: -30 dBm to +20 dBm (Option 1DP)	HP 8483A
Power Sensor, Low Power	Frequency Range: 300 MHz Amplitude Range: -20 dBm to -70 dBm Maximum SWR: 1.1 (300 MHz)	HP8481D or HP 8484A
Synthesized Signal Generator	Frequency Range: 1 MHz to 1000 MHz Amplitude Range: -35 to +16 dBm SSB Noise: < -120 dBc/Hz at 20 kHz offset	HP 8663A
Synthesized Sweeper	Frequency Range: 10 MHz to 1.5 GHz Frequency Accuracy (CW): $\pm 0.02\%$ Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: -35 to +16 dBm	HP 8340A/B or HP 83630A
Synthesizer/Function Generator	Frequency Range: 0.1 Hz to 20 MHz Frequency Accuracy: $\pm 0.02\%$ Waveform: Triangle	HP 33120A or HP 3324A

Post-Repair Procedures
List of Tests and Adjustments for Post-Repair

Equipment	Critical Specifications for Equipment Substitution	Recommended Model
Computer	Refer to Computer Hardware Requirements on page 220	
Adjustment Software	HP E44XX Adjustment Software	E4411-10001

Table 5-4 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model
Power Splitter	Frequency Range: 50 kHz to 1.5 GHz Insertion Loss: 6 dB (nominal) Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	HP 11667A
Minimum Loss Adapter	Frequency Range: dc to 2 GHz Insertion loss: 5.7 dB, nominal (Option 1DP)	HP 11852B
Termination, 50 Ω	Impedance: 50 Ω (nominal) Connector: BNC (m)	HP 11593A

Table 5-5 Recommended Adapters

Critical Specifications for Adapter Substitution	Recommended Model
BNC (f) to dual banana plug	1251-1277
BNC tee (m) (f) (f)	1250-0781
BNC (m) to BNC (m), 75 Ω (Option 1DP)	1250-1288
Type-N (f) to APC 3.5 (f)	1250-1745
Type-N (m) to BNC (f) (2 required)	1250-1476
Type-N (m) to N (m)	1250-1475
Type-N (m) to BNC (m), 75 Ω (Option 1DP)	1250-1533
Type-N (f) to BNC (m), 75 Ω (Option 1DP)	1250-1534
Type-N (f), 75 Ω , to Type-N (m), 50 Ω (Option 1DP)	1250-0597

Table 5-6 Recommended Cables

Critical Specifications for Cable Substitution	Recommended Model
Frequency Range: dc to 1 GHz Length: ≥ 122 cm (48 in) Connectors: BNC (m) both ends (<i>2 required</i>)	HP 10503A
Type-N, 152 cm (60 in)	HP 11500D
BNC, 75 Ω , 30 cm (12 in) (Option 1DP)	5062-6452
BNC, 75 Ω , 120 cm (48 in) (Option 1DP)	15525-80010

Adjustments

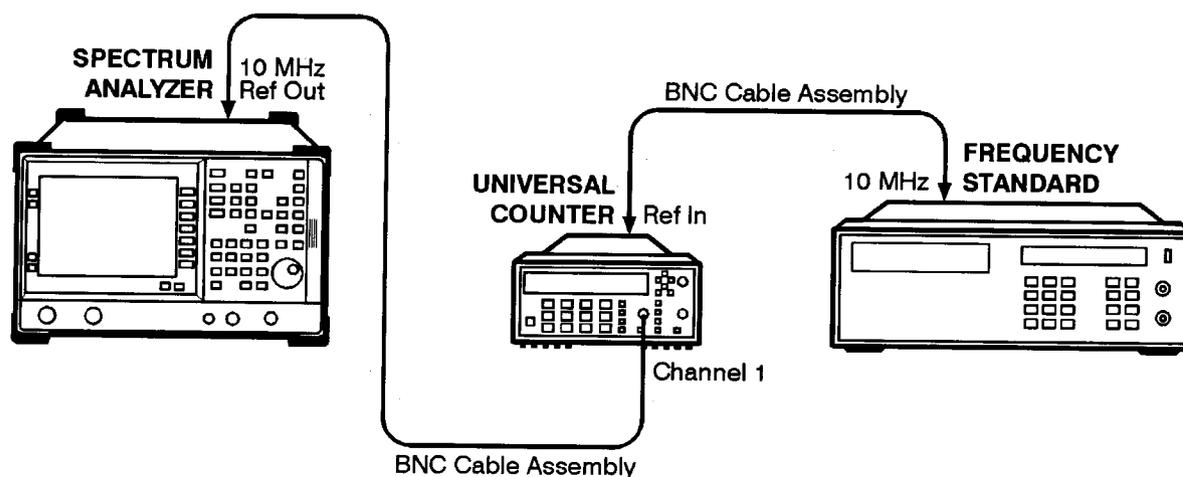
This section contains brief descriptions and setups for the following automated adjustment procedures. Refer to Chapter 6 and Chapter 7 for information on loading and using the adjustment software.

1. 10 MHz Reference on page 205
2. 21.4 MHz IF Calibrator on page 206
3. 50 MHz Calibrator on page 207
4. Uncorrected Flatness on page 208
5. Corrected Flatness on page 210
6. Tracking Generator ALC Calibration on page 211
7. Tracking Generator Frequency Slope on page 212

1. 10 MHz Reference

The internal 10 MHz timebase is adjusted for frequency accuracy. A frequency counter is connected to the “10 MHz Ref Out” at the rear of the instrument. The timebase is adjusted to 10 MHz using the coarse and fine DACs.

Figure 5-1 **10 MHz Reference Adjustment Setup**

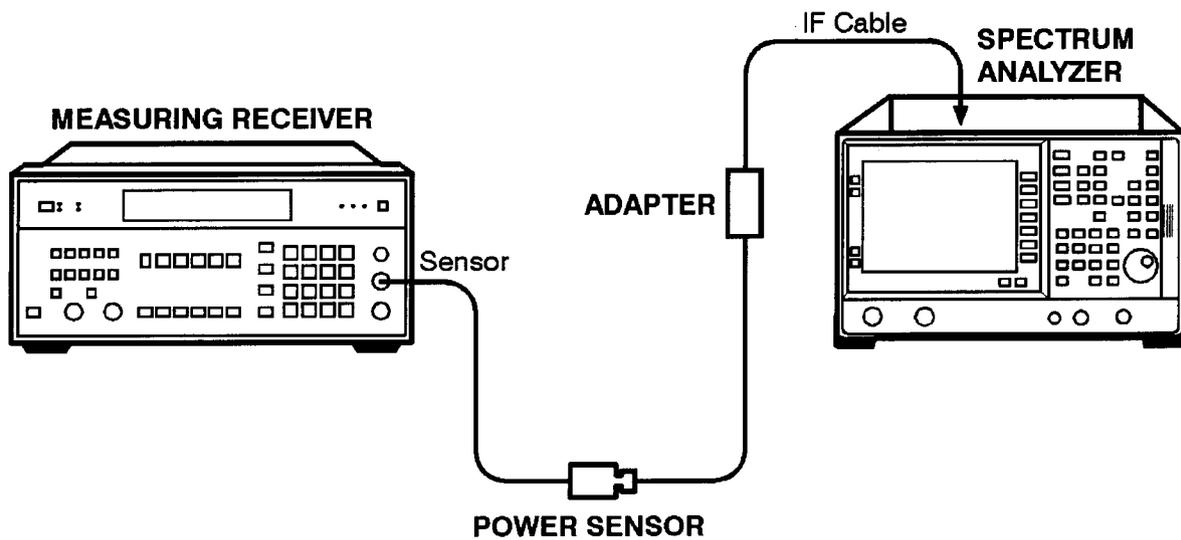


n171a

2. 21.4 MHz IF Calibrator

The measurement of the 21.4 MHz IF calibrator requires the removal of the outer case and the inner shield of the spectrum analyzer. Refer to Chapter 4 for these removal procedures. The IF coaxial cable is removed from the IF assembly, and a power sensor is connected to measure the amplitude of the 21.4 MHz signal. The measured amplitude is then stored on the RF and processor assemblies.

Figure 5-2 21.4 MHz IF Calibrator Adjustment Setup



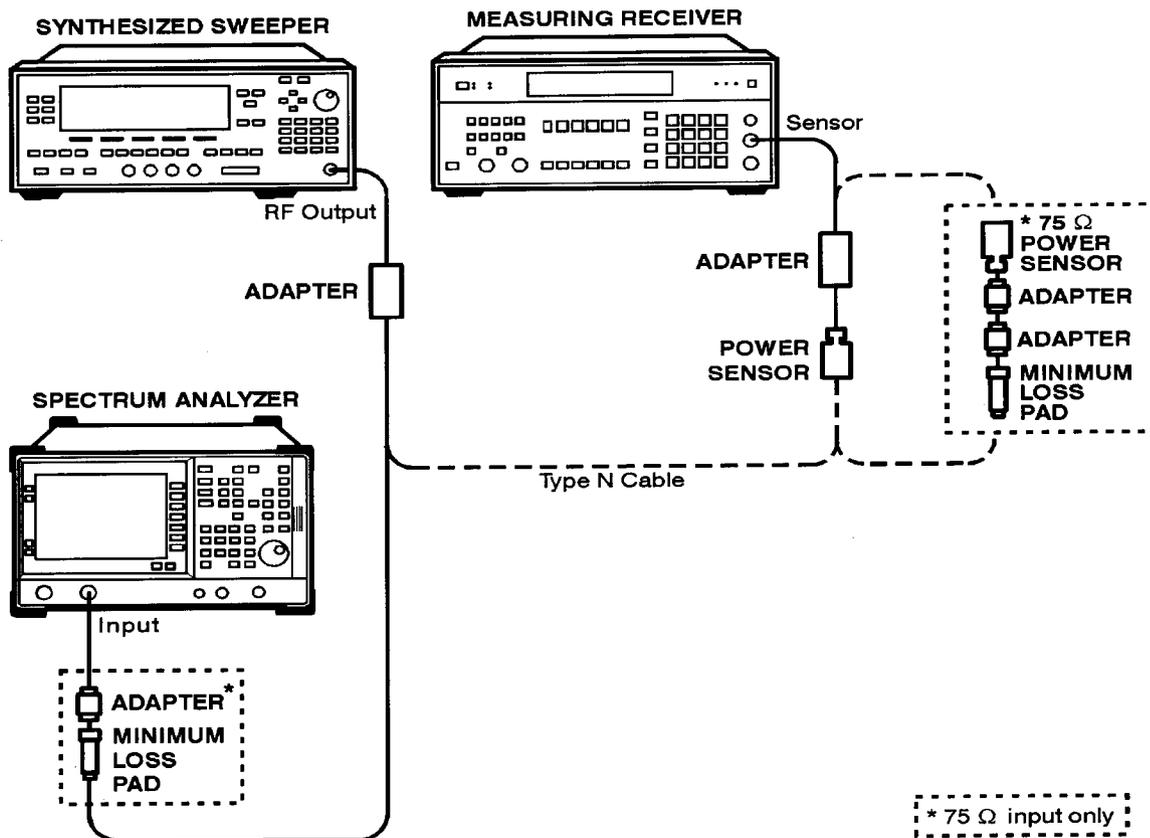
s1731a

3. 50 MHz Calibrator

The amplitude of the internal 50 MHz calibrator signal is determined by measuring a substituted external 50 MHz signal.

The internal 50 MHz signal is first turned on and the on-screen level is noted. The internal signal is then turned off, and the external 50 MHz signal is turned on. The external source amplitude is adjusted to match the level of the internal signal. A power meter is then connected to the cable to measure the amplitude of the external 50 MHz signal at the spectrum analyzer input. This level is stored in the analyzer.

Figure 5-3 50 MHz Calibrator Adjustment Setup



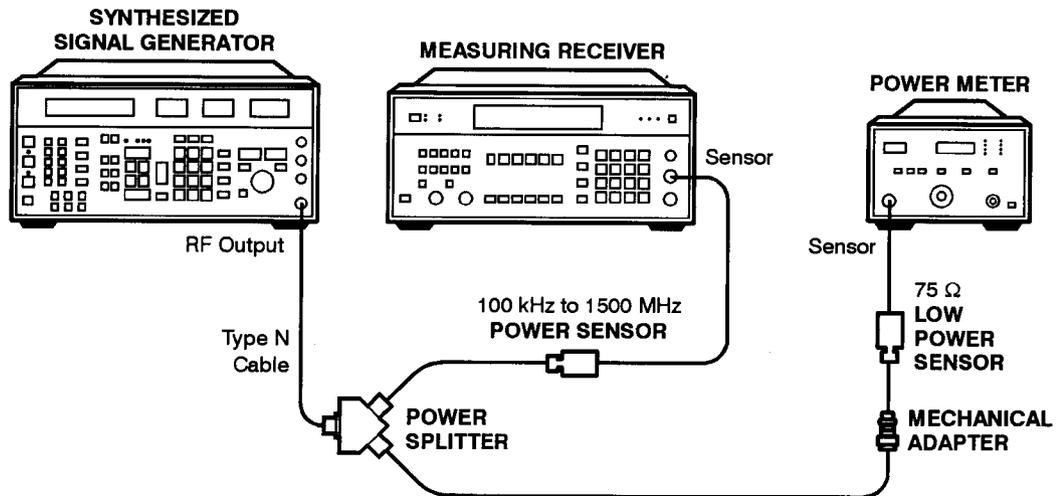
sn71a

4. Uncorrected Flatness

The frequency response (flatness) of the spectrum analyzer is measured with the corrections off. The source is adjusted to place the displayed signal at a constant horizontal graticule line.

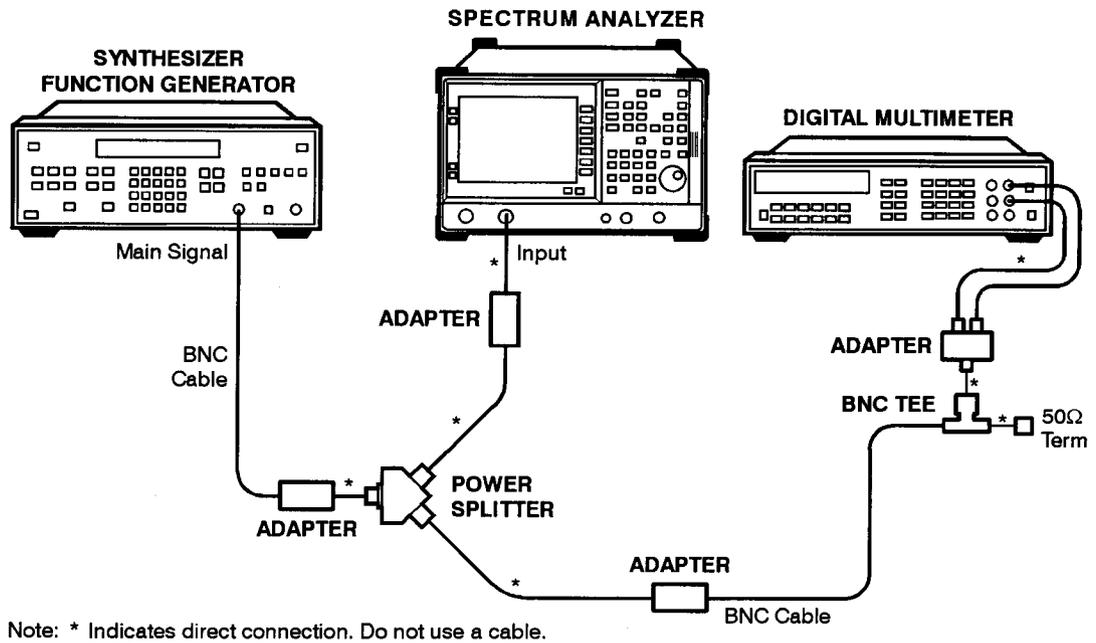
No error corrections are stored into the spectrum analyzer at this point.

Figure 5-4 System Characterization Setup for 75 Ω Input



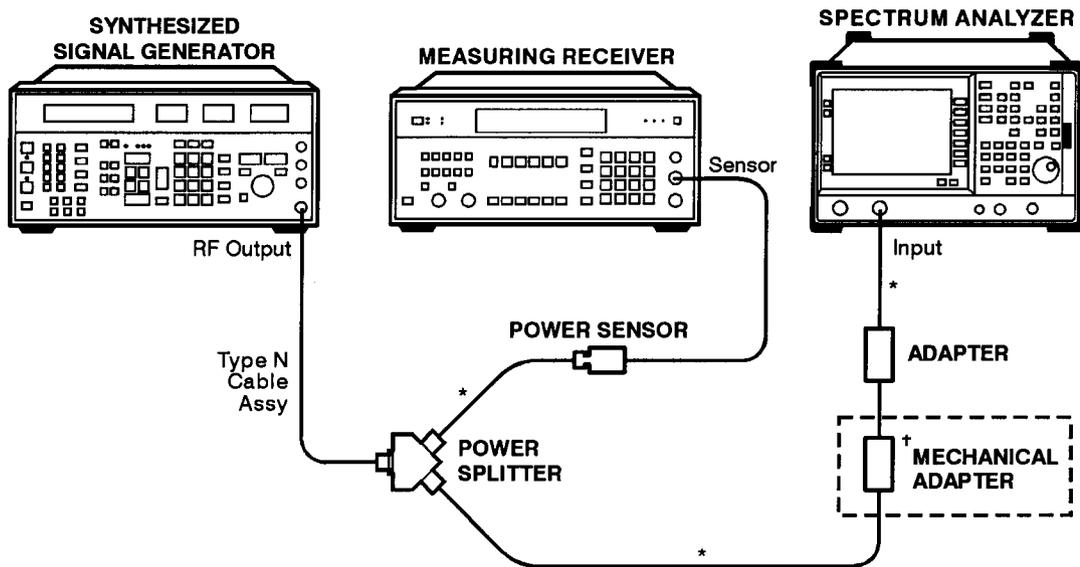
n1758a

Figure 5-5 **Uncorrected Flatness Setup, <100 kHz**



sn72a

Figure 5-6 **Uncorrected Flatness Setup, ≥100 kHz, 50 Ω and 75 Ω**



sn73a

5. Corrected Flatness

This procedure requires the data from the uncorrected flatness procedure. The flatness data that was measured in the uncorrected flatness procedure is now used to generate error corrections referenced to 50 MHz and 30 dB input attenuation. The error corrections are then stored into the spectrum analyzer.

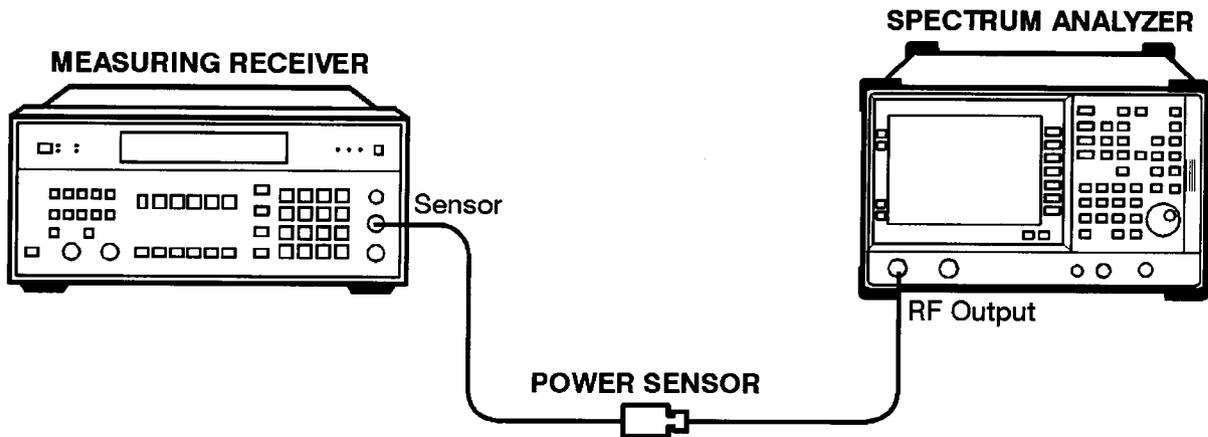
There is no setup required for this procedure.

6. Tracking Generator ALC Calibration

The tracking generator automatic level control (ALC) calibration sets the values for three DACs. The ALC high-band offset DAC is the level DAC number which gives 0 dBm at 50 MHz. The ALC slope/gain amplitude DAC is a correction factor for the ALC level DAC. The ALC low-band offset DAC is also set.

For a complete tracking generator calibration, complete this adjustment first, then perform the tracking generator frequency slope adjustment which follows.

Figure 5-7 Tracking Generator ALC Calibration Setup

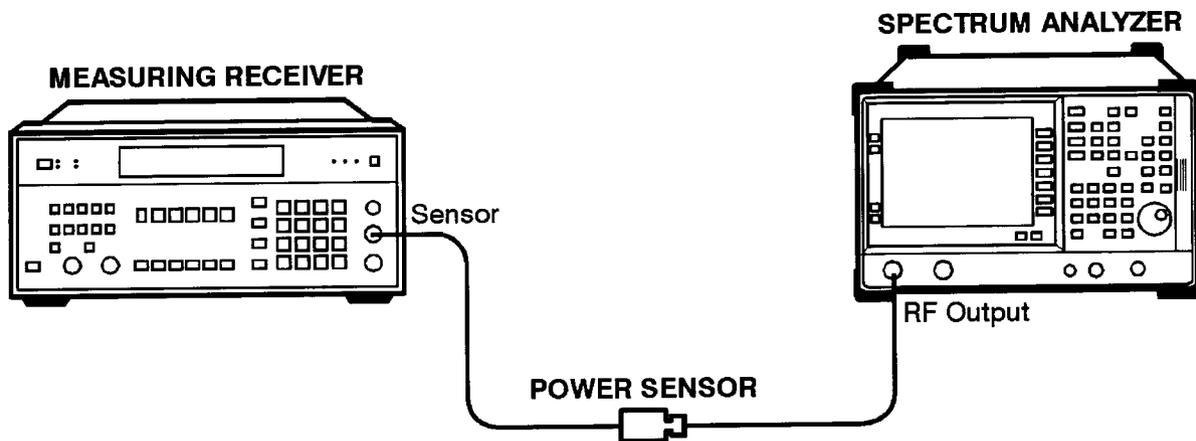


nl721a

7. Tracking Generator Frequency Slope

The tracking generator frequency slope adjustment is performed after the ALC calibration is completed. In this adjustment the slope DAC is initially set to 0. The flatness output across the band is measured, and the slope DAC is calculated and set. The flatness is then measured again.

Figure 5-8 Tracking Generator Frequency Slope Adjustment Setup



n1721 a

Utilities

Initialize the Analyzer

Included in the adjustment software is the utility to re-initialize your spectrum analyzer. This would be needed if certain data stored in the analyzer is lost.

When the initialize utility is used, the following data is re-stored to the EEPROM:

- product number (ex. E4411A)
- model name (ex. HPESA-L1500A)
- model description (ex. spectrum analyzer)
- instrument serial number
- instrument options

The utility also performs the same function as pressing the **Default Config** key on the front panel. This resets the spectrum analyzer to the user configuration originally set at the factory. It also performs an instrument preset. The following table shows the default user-configuration settings.

Configuration	Default Value
Analyzer address (Option A4H)	18
Baud rate (Option 1AX)	9600
Date mode	Month-day-year format
External preamp	0 dB
Internal lock	Off
Power on	IP
Print softkeys	On
Printer address (Option A4H)	1
Printer port (Options A4H and 1AX)	Parallel
Time/Date display	On

This chapter describes how to use the HP Calibration Test Manager (CTM) and how it can simplify your instrument testing.

What is CTM?

CTM serves as the common interface that manages instrument-specific tests designed for Hewlett-Packard test and measurement products.

CTM uses the window-menu design to allow easy control of test applications, management of the test equipment, and printing of the test reports.

Features

With CTM as the user interface, the following features are available:

- A common user interface for managing test applications.
- Convenient substitution of test equipment.
- Standard menu interface across instrument-model types.
- Test reports printed on local or spooler printers.
- Test application data management and storage.
- Configuration choices that allow you to customize the program to fit your needs.
- Operation with flexible disk, SRM (shared resource management), and HFS (hierarchal file structure) directory systems.
- Access to on-line help information. Look for the message about accessing help information at the bottom of the display window.

Program Disks

The user-interface software is contained on two 3.5 inch disks. Test applications are contained on one or more separate disks.

How to Use this Chapter

This chapter is intended for use by individuals who test HP test and measurement products.

The information provided in this chapter is divided into the following sections:

- “Installation” - provides installation information.
- “Running the Program” - explains how to use CTM in a flexible-disk, HFS, and SRM environment.
- “Task Reference” - contains sample procedures using CTM’s menu choices.

- “Using HP CTM’s Utilities” - explains how to optimize CTM’s operating interface.

Conventions Used in This Chapter

The conventions used throughout this chapter in reference to keyboard keys, menus, menu selections, general terminology, and on-screen text are as follows:

Return, ↑, or ↓ This convention represents computer keyboard keys.

MAIN MENU Menu titles are indicated with boldface characters.

TEST UUT Menu selections are indicated with boldface characters.

/CTM/SYSTEM On-screen text or messages and typed-in text that appear are indicated with boldface characters.

Unit Under Test (UUT)

UUT refers to a specific instrument model being tested, identified by the serial number. The UUT information requires serial numbers so that same model-number instruments can be tested, but the information saved after testing is completed is sorted by the instrument’s serial number.

Model Under Test (MUT)

MUT refers to the model number of the instrument being tested. Instrument model numbers identify the test application used to test UUTs. The MUT entry in the menu identifies which model number CTM needs to load.

Electronic Test

Equipment (ETE) ETE refers to the equipment that CTM uses to test the UUT. ETEs are further divided into calibration standards, non-standards, and accessories. These three categories are explained below:

Calibration Standards

The calibration of these instruments must be kept current. Before these instruments are selected, CTM checks the calibration information saved in a data base for calibration due dates. If these standards are out-of-cal (needing to be recalibrated) the program warns you.

Non-standards The instruments used in calibration procedures that do not require current calibration status.

Accessories Accessories may include cables, adapters, attenuators, or any other passive device not requiring calibration used during test application procedures.

Test Application Test application refers to software used to test the MUT (model under test).

Who to Call for Assistance

Contact your Hewlett-Packard Sales Representative if you need assistance.

Installation

This section contains the following information:

- “Computer Hardware and Memory Requirements”
- “Operating System and Language Extension File Requirements”
- “Mouse Operation and Computer Keyboard Compatibility”
- “Making CTM Working Copies”
- “Installing CTM for SRM or HFS System”
- “Equipment Setup Procedure”
- “Mass Storage Setup Procedure”

Computer Hardware and Memory Requirements

The following information describes the hardware and memory requirements necessary to operate the CTM.

Computer Hardware Requirements

- HP 9000, Series 200/300 computer (excluding HP 9826A computers). The Series 200/ 300 computer must have inverse video capability.
- HFS formatted hard disk system, SRM system, or double-sided, 3.5 inch flexible disk system.
- HP-IB interface system. The workstation needs the controller and all the required test equipment configured on the HP-IB.

Memory Requirements

The required memory is 4 Mbytes of RAM (random access memory), or less depending on the hardware configuration and the size of the test application.

Operating System and Language Extension File Requirements

The CTM requires HP BASIC 5.0 (or higher) and the language extension files listed below:

Table 6-1 HP Basic 5.0 Language Extension File Requirements

NAME	VERSION	DESCRIPTION
GRAPH	5.2	Graphics
GRAPHX	5.2	Graphics Extensions
IO	5.1	I/O
MAT	5.1	Matrix Statements
PDEV	5.0	Program Development
KBD	5.1	Keyboard Extensions
CLOCK	5.0	Clock
MS	5.1	Mass Storage
SRM	5.1	Shared Resource Management
ERR	5.1	Error Messages
DISC	5.0	Small Disk Driver
CS80	5.0	CS80 Disk Driver
HPIB	5.0	HPIB Interface Driver
FHPIB	5.0	Fast Disk Interface Driver
DCOMM	5.0	Datacomm Interface Driver
CRTB	5.2	Bit-mapped CRT Driver
CRTA	5.1	Alpha CRT Driver
CRTX	5.1	CRT Extensions
EDIT	5.1	List and Edit
HFS	5.3	Hierarchical File System

NOTE

Additional language extension files may be needed depending on the test application (for example, COMPLEX).

Mouse Operation and Computer Keyboard Compatibility

The following information explains use of different keyboard models and how to use a mouse with the software. Read the information headed by the model number and keyboard combinations that you have.

Using a Mouse with Series 300 Computers

The menus in the CTM use a window format, displaying the choices available in that menu. Slide the mouse to highlight choices, then select them as explained below:

1. Slide the mouse up or down to highlight your preference.
2. Choose the highlighted item by pressing the left-hand button on the mouse, or slide the mouse to the right.
3. If **QUIT** or **EXIT** is displayed in a menu, select one of these to exit the menu. Otherwise, slide the mouse to the left to exit. When you exit menus, the program displays another menu.

NOTE

Press the right-hand mouse button to access on-screen help information for the selection you have highlighted. Help information appears in a display window. Press the left-hand mouse button to turn off the help screen.

Using an ITF Keyboard with Series 300 Computers

An ITF keyboard (HP 46020A) in this configuration causes CTM to assume a mouse is connected.

The following keyboard strokes work whether a mouse is connected or not.

1. Press the ↑ or ↓ keys until your preference is highlighted.
2. Choose the highlighted item by pressing **RETURN** or **SELECT** on the keyboard.
3. If **QUIT** or **EXIT** is displayed in a menu, select one of these to exit the menu. Otherwise, press (home key) to exit. When you exit menus, the program displays another menu.

NOTE

Press ? to access on-screen help information for the selection you have highlighted. Help information appears in a display window.

Press **RETURN** or **SELECT** on the keyboard to turn off the help screen.

Using a Nimitz Keyboard and Series 300 Computers

A Nimitz keyboard (HP 98203C) in this configuration causes CTM to assume a mouse is connected.

The following key strokes work whether a mouse is connected or not.

1. Rotate the keyboard knob to highlight an item in the menu. You may also use the ↑ and ↓ keys to highlight menu items.
2. Choose the highlighted item by pressing **ENTER** or **EXECUTE**.

3. If **QUIT** or **EXIT** is displayed in a menu, select one of these to exit the menu. Otherwise, press **CONTINUE** to exit the menu. When you exit menus, the program displays another menu.

NOTE

Press **?** to access on-screen help information for the selection you have highlighted. Help information appears in a display window.

Press **ENTER** or **EXECUTE** on the keyboard to turn off the help screen.

Using a Nimitz Keyboard and Series 200 Computers

Use the following operation information when you are using a Nimitz keyboard (HP 98203C) and a Series 200 Computer.

1. Rotate the keyboard knob to highlight an item in the menu. You may also use the **↑** and **↓** keys to highlight menu items.
2. Choose the highlighted item by pressing **ENTER** or **EXECUTE**.
3. If **QUIT** or **EXIT** is displayed in a menu, select one of these to exit the menu. Otherwise, press **CONTINUE** to exit a menu. Exiting menus displays another menu.

NOTE

Press **?** to access on-screen help information for the selection you have highlighted. Help information appears in a display window.

Press **ENTER** or **EXECUTE** on the keyboard to turn off the help screen.

Making CTM Working Copies

For each of the CTM master disks, copy the master-disk contents onto an initialized blank disk to create a working copy. A suggested procedure follows:

1. Execute the **INITIALIZE** command, such as **INITIALIZE " : , 700 , 0 " , 2 , 3**, for each blank disk.
2. Execute the **COPY** command, such as **COPY " : , 700 , 1 " TO " : , 700 , 0 "**, to transfer the contents of each master disk onto an initialized blank disk, creating working copies.
3. Store the master disks in a safe location.

Installing CTM for SRM or HFS System

Use this procedure to install CTM from the flexible disks to an SRM or HFS environment.

A software program called **INSTALL**, found on the Calibration Test Manager disk, can be used to automatically create the file structure shown below and copy the program files to this structure.

- **/CTM**
- **/CTM/SYSTEM**
- **/CTM/MUTS**
- **/CTM/MUTS/test application** (use the test name listed on the test application disk)
- **/CTM/RESULTS**
- **/CTM/STATIONS**
- **/CTM/SYSTEM/CAL_STANDARD**

Also, depending on the test application, there is a software program called **INSTALL** on the test application disk. The **INSTALL** program on the test application disk copies the files from the test application disk to the file structure shown above. In either case, refer to the procedure shown below.

1. Insert the disk containing the **INSTALL** program into the appropriate flexible disk drive.
2. Type **LOAD "INSTALL", 1** and press **RETURN** (or equivalent key).

Equipment Setup Procedure

The procedure that follows should be performed before a test can be successfully executed. Failure to set up the equipment properly in the program will result in error messages indicating that equipment requirements need resolution. Therefore, careful attention should be given in setting up this list of equipment.

It is assumed that this is the first time the program has been run.

1. Get the serial numbers, model numbers, options information, and any other model-specific information for the instruments you are adding.
2. Load the **BASIC** operating system.
3. Insert the **CTM** disk into the appropriate disk drive.
4. Type **LOAD "EXEC", 1** to load the **CTM**.
5. Press the **E** key at the following prompt:

>Press 'E' for system administration utilities - any other key to proceed.

6. Verify the directory path (if applicable) and MSVS, and enter the password as appropriate. For SRM, use the READ protect password; otherwise, use three underscores.
7. Highlight, then select, **EQUIPMENT** in the **SYSTEM ADMINISTRATION UTILITIES** menu.
8. Highlight, then select, **ADD NEW EQUIPMENT** in the **EDIT EQUIPMENT** menu.
9. Fill in the data fields of the **INSTRUMENT INFORMATION** menu.

NOTE

The **STATION** and **AVAILABILITY** fields apply only to SRM and HFS users. For information about these features, refer to the subsection titled "Editing and Assigning Test Equipment" on page 232, under "Changing Equipment Availability" and "Adding New Workstations".

10. Exit the **INSTRUMENT INFORMATION** menu.
11. Repeat the above steps to enter information for other new equipment that you want to add.
12. When all the new equipment is entered, highlight, then select **STORE EQUIPMENT LIST** in the **EDIT EQUIPMENT** menu.

Mass Storage Setup Procedure

The CTM contains a list of mass-storage paths used to keep track of the places that information is located. Refer to the section titled "Configuring the Mass Storage Volumes" in Chapter 7 for a detailed description of the mass-storage scheme.

You need to edit the mass-storage table to meet the needs of your individual work station's configuration.

1. Load the BASIC operating system.
2. Insert the CTM disk into the appropriate disk drive.
3. Type **LOAD "EXEC",1** to load the CTM.
4. Press the **E** key at the following prompt:

>Press 'E' for system administration utilities - any other key to proceed.

5. Verify the directory path (if applicable) and MSVS, and enter the password as appropriate. For SRM, use the READ protect password; otherwise, use three underscores.
6. Highlight, then select, **MASS STORAGE** in the **SYSTEM ADMINISTRATION UTILITIES** menu.

7. Highlight, then select, **EDIT MSVSs & DIRECTORY PATHS** in the **MS EDIT MENU**.
8. Highlight, then select, the desired mass-storage volume from the **VOLUMES** menu.
9. Edit the text in the data-entry field that appears.
10. Exit the menu to continue.
11. Highlight, then select, and edit any additional mass-storage volumes information.
12. Exit to continue.
13. To permanently store your changes, highlight, then select **STORE MS TABLE** in the **MS EDIT MENU**.
14. Verify and select **YES** in the dialogue menu that appears.

Running the Program

This section contains information about operating the program from a flexible-disk, HFS, and SRM environment.

Quick Start From a Flexible-Disk System

1. Insert the CTM disk into the assigned flexible-disk drive.
2. Type **LOAD "EXEC",1** to load CTM.
3. Press any key other than **E** at the following prompt:

```
> Press 'E' for system administration utilities - any other key to proceed.
```
4. If no workstation labels exist, CTM prompts you to insert the first MUT (model under test) disk into the active drive. Insert a disk containing the test application for the instrument you want to test. Refer to the prompt to continue.
5. The **SPECIFIC MODEL?** menu appears next:

NOTE

The **SPECIFIC MODEL?** menu appears only when more than one model number exists. If you have only one model number, proceed to step c.

- a. Highlight the exact model number of the instrument you want to test using the cursor keys or knob, then select the instrument.
 - b. Insert the disk requested by the prompt into the active drive. Refer to the prompt to continue.
 - c. Wait until the **MAIN MENU** appears.
 - d. Choose **TEST UUT** from the **MAIN MENU**.
6. If there is no model number information stored in the program's data base, the **UUT SELECTIONS** menu appears.
 - a. Choose **NEW/UNTESTED UUT**, enter the UUT serial number, and check the **CONTROLLER** field.
 - b. If a secondary controller, other than the one you are running the CTM on, is required, enter its model number, otherwise a message appears telling you a controller is not needed.
 - c. Choose **OPTIONS** and enter the applicable option information.

NOTE

Ensure that the correct option information is entered.

- d. Entering information into the remaining fields is optional.
- e. Refer to the prompt below the menu to continue.

- f. A message is displayed telling you to verify the serial number.
7. Continue responding to the program and disk prompts as appropriate.

If **ASSIGN EQUIP PRIOR TO TESTING**, in the **USER INTERFACE CONFIGURATION** menu, is set to **YES**, the program will attempt to assign test equipment to every test. If the program cannot find test equipment it needs to run a test, you are prompted to resolve the problem by selecting **RESOLVE** and working through the displayed menus.

If **ASSIGN EQUIP PRIOR TO TESTING**, in the **USER INTERFACE CONFIGURATION** menu, is set to **NO**, the program assigns test equipment corresponding only to the currently selected test in the **TEST LIST** menu. This method is especially useful when you do not wish to run all tests in the **TEST LIST** menu. Again, if equipment problems are encountered at this point, you are prompted to resolve the problem by selecting **RESOLVE** and working through the displayed menus.

NOTE

At this point, CTM control is passed to the test application.

8. Refer to the section titled "Menu Reference" in Chapter 7 for explanations of the remaining **CTM MAIN MENU** choices.

Quick Start From an SRM or HFS System

1. Type **MSI "/CTM/SYSTEM"** after following the previous CTM SRM or HFS installation procedure.
2. Type **LOAD "EXEC",1** to start CTM running.
3. Press any key other than **E** at the following prompt:

> Press 'E' for system administration utilities - any other key to proceed.
4. Choose a station ID, if workstation labels are assigned, or none. This menu does not appear until workstations are created.
5. Choose the model number of the instrument you want to test from the **SPECIFIC MODEL?** menu.

NOTE

The **SPECIFIC MODEL?** menu appears only when more than one model number exists.

6. Wait until the **MAIN MENU** appears.
7. Press **TEST UUT** to continue testing.
 - a. Choose **NEW/UNTESTED UUT** from the **UUT SELECTIONS** menu.
 - b. Enter the UUT serial number, and check the **CONTROLLER** field.

- c. If a secondary controller, other than the one you are running the CTM on, is required, enter its model number, otherwise a message appears telling you a controller is not needed.
- d. Choose **OPTIONS** and enter the applicable option information.

NOTE

Ensure that the correct option information is entered.

- e. Entering information into the remaining fields is optional.
 - f. Refer to the prompt below the menu to continue.
 - g. A message is displayed for you to verify the serial number.
8. Follow the subsequent prompts to continue.

If **ASSIGN EQUIP PRIOR TO TESTING**, in the **USER INTERFACE CONFIGURATION** menu, is set to **YES**, the program will attempt to assign test equipment to every test. If the program cannot find test equipment it needs to run a test, you are prompted to resolve the problem by selecting **RESOLVE** and working through the displayed menus.

If **ASSIGN EQUIP PRIOR TO TESTING**, in the **USER INTERFACE CONFIGURATION** menu, is set to **NO**, the program assigns test equipment corresponding only to the currently selected test in the **TEST LIST** menu. This method is especially useful when you do not wish to run all tests in the **TEST LIST** menu. Again, if equipment problems are encountered at this point, you are prompted to resolve the problem by selecting **RESOLVE** and working through the displayed menus.

NOTE

At this point, CTM control is passed to the test application.

9. Refer to the section titled “Menu Reference” in Chapter 7 for explanations of the remaining CTM **MAIN MENU** choices.

Task Reference

This section contains the following information:

- “Selecting the Unit Under Test (UUT)”
- “Editing and Assigning Test Equipment”
- “Configuring CTM”
- “Quit”

Selecting the Unit Under Test (UUT)

CTM can manage multiple testing sessions. This means that if you are performing tests on a certain instrument and realize that a piece of test equipment is unavailable, CTM allows you to set aside that instrument's test until another time, and start working on another instrument test. The steps below explain how to do this.

Calibrating a Different UUT of the Same Model Number

CTM allows you to end testing on one instrument and begin testing another. If the new instrument has the same model number, then it can be tested with the current test application. The following procedure explains how to interrupt a test application procedure on one UUT, and begin testing another UUT.

1. Highlight, then select, **NEW UUT (SAME MODEL NUMBER)** from the **MAIN MENU**.
2. Highlight, then select, **NEW/UNTESTED UUT** from the **UUT SELECTIONS** menu.
3. Fill in the data fields of the **UUT:XXXXXXXX** menu.
4. Exit the **UUT:XXXXXXXX** menu.
5. Double check the UUT serial number.

To select a UUT that was previously tested, follow the steps below:

1. Highlight, then select, **NEW UUT (SAME MODEL NUMBER)** from the **MAIN MENU**.
2. Highlight, then select, the appropriate serial number listed in the **UUT SELECTIONS** menu.
3. Verify the information in the data fields of the **UUT:XXXXXXXX** menu.
4. Exit the **UUT:XXXXXXXX** menu.
5. Highlight, then select, **TEST UUT** from the **MAIN MENU** to return to the **TEST MENU**.

If the options of the new UUT match those of the previous UUT, the current equipment assignment is accepted. If the options between them are different, then the test equipment assignments need to be updated before beginning the test. Editing and assigning test equipment information is provided after the next procedure.

Calibrating a UUT With a Different Model

Use the following procedure to test a model number that is not listed in the current **MODEL SELECTIONS** menu.

This procedure shows how to interrupt the current tests and load the new tests corresponding to the model number of interest.

1. Insert the new test application into the appropriate disk drive (flexible-disk users only).
2. Highlight, then select, **NEW MODEL NUMBER** in the **MAIN MENU**.
3. Highlight, then select, the appropriate name from the **MODEL SELECTIONS** menu (SRM or HFS users only).
4. Highlight, then select, the model number of interest from the **SPECIFIC MODEL?** menu. Note that this menu appears only if more than one model is supported by the particular test application.
5. The program loads the new model number's test application. In a flexible-disk environment, you may be prompted to insert another disk.

Adding New Workstations

The following information deals only with HFS or SRM workstations. Flexible-disk environments do not need to use this procedure.

CTM links test equipment listed in the Equipment Table to workstations. Work stations consist of two names. One name is a descriptive name presented to users in menus, the other is a valid file-system name used by CTM to create a workstation directory. To create a new workstation directory and enter a new workstation into a directory, use the following procedure:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **EXEC UTILITY** in the **CONFIGURATION** menu. Verify the MSVS and enter the password as appropriate.
3. Highlight, then select, **STATIONS** in the **SYSTEM ADMINISTRATION UTILITIES** menu.
4. Highlight, then select, **ADD NEW STATION** in **EDIT STATIONS TABLE** menu.
5. Highlight, then select, **STATION NAME** and enter the workstation name.

6. Highlight, then select, **DIRECTORY NAME** and enter the directory information. Refer to the prompt below the window to continue.
7. Add more workstations, if desired, then highlight and select **STORE STATION LIST** in the **EDIT STATIONS TABLE** menu.

Editing and Assigning Test Equipment

The CTM maintains a database of available test equipment. To keep the most efficient equipment database, regularly update the information stored there. This information includes the availability status and calibration due dates.

Adding Instruments to the Test Equipment Table

If you want to add test equipment to the CTM equipment table, use the procedure that follows:

1. Get the serial number, model number, options information, and any other model-specific information for the instrument you are adding.
2. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
3. Highlight, then select, **EXEC UTILITY** in the **CONFIGURATION** menu. Verify the MSVS and enter the password as appropriate.
4. Highlight, then select, **EQUIPMENT** in the **SYSTEM ADMINISTRATION UTILITIES** menu.
5. Highlight, then select, **ADD NEW EQUIPMENT** in the **EDIT EQUIPMENT** menu.
6. Fill in the data fields of the **INSTRUMENT INFORMATION** menu.
7. Exit the **INSTRUMENT INFORMATION** menu.
8. Repeat the above steps to enter information for other new equipment that you want to add.
9. When all the new equipment is entered, highlight, then select **STORE EQUIPMENT LIST** in the **EDIT EQUIPMENT** menu.

Changing Equipment Availability

For each piece of equipment in the database, an **AVAILABILITY** field is provided. This field can assume one of two states, **AVAILABLE** or **MISSING**. If the instrument is listed **MISSING**, then CTM ignores it when it automatically assigns equipment to a test application procedure. Equipment that is on loan or being repaired should be listed as **MISSING** until it is available again.

If you want to change the availability status of the test equipment in CTM equipment list, use the procedure below:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **EXEC UTILITY** in the **CONFIGURATION** menu. Verify the MSVS and enter the password as appropriate.
3. Highlight, then select, **EQUIPMENT** in the **SYSTEM ADMINISTRATION UTILITIES** menu.
4. Highlight, then select, **EDIT EQUIPMENT BY STATION**, then select the workstation name of interest, or select **EDIT ALL EQUIPMENT** in the **EDIT EQUIPMENT** menu.
5. Highlight, then select, your instrument in the list.
6. Highlight, then select, **VIEW/EDIT EQUIPMENT**.
7. Highlight, then select, **AVAILABILITY** in the **INSTRUMENT INFORMATION** menu.
8. Highlight, then select, **AVAILABLE** or **MISSING**.
9. Exit the menus until you return to the **EDIT EQUIPMENT** menu, then select **STORE EQUIPMENT LIST**.

Deleting Equipment from the Equipment Table

Updating the equipment table can be partly accomplished by permanently removing from the database any equipment that is no longer available or required. This saves space and speeds up CTM operation.

To select and permanently remove pieces of equipment from CTM's equipment table, use the procedure below:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **EXEC UTILITY** in the **CONFIGURATION** menu. Verify the MSVS and enter the password as appropriate.
3. Highlight, then select, **EQUIPMENT** from the **SYSTEM ADMINISTRATION UTILITIES** menu.
4. Highlight, then select, **EDIT EQUIPMENT BY STATION** or **EDIT ALL EQUIPMENT** in the **EDIT EQUIPMENT** menu.
5. Highlight, then select, the equipment to permanently delete from the list.
6. Highlight, then select, **DELETE EQUIPMENT** from the next menu that appears. Information stored in the program about the piece of equipment is also deleted.
7. Exit the menus until you reach the **EDIT EQUIPMENT** menu, then select **STORE EQUIPMENT LIST**.

Editing Available Equipment Information

Editing the status of the currently available equipment is part of updating CTM's available equipment information. Test equipment information includes model number, serial number, interface-bus address, workstation, options, availability, calibration due date, and general comments. Any of these fields may be modified to reflect changes to the equipment or to correct errors made during initial data entry.

To review and update equipment-related information, use the procedure below:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **EXEC UTILITY** in the **CONFIGURATION** menu. Verify the MSVS and enter the password as appropriate.
3. Highlight, then select, **EQUIPMENT** in the **SYSTEM ADMINISTRATION UTILITIES** menu.
4. Highlight, then select, **EDIT EQUIPMENT BY STATION** or **EDIT ALL EQUIPMENT** in the **EDIT EQUIPMENT** menu.
5. Highlight, then select, the instrument to update from the list.
6. Highlight, then select, **VIEW/EDIT EQUIPMENT** in the next menu that appears.
7. Modify the appropriate data fields in the **INSTRUMENT INFORMATION** menu.
8. Exit these menus until you reach the **EDIT EQUIPMENT** menu, then select **STORE EQUIPMENT LIST**.

Viewing or Editing Equipment Used

Prior to beginning any test, CTM assigns test equipment required to perform the test. If this cannot be done automatically, CTM provides an interface so that the user can enter required equipment manually.

CTM attempts to pick the best test setup based on the available equipment in the equipment table.

CTM can use test equipment for a particular test setup even if the test equipment has not been defined in the list of available equipment. If you see this happening often, perhaps the list of available equipment needs updating. Refer to the preceding "Editing Available Equipment Information" section.

Making Minor Equipment Changes

Use the following procedure to view or make only minor changes to the list of equipment used. These edits include changing serial number, HP-IB address, instrument options, and calibration due date information.

1. Highlight, then select, **VIEW/EDIT EQUIPMENT USED** in the **MAIN MENU**.
2. Highlight, then select, **EQUIPMENT LIST** in the **EQUIPMENT USED** menu.
3. Highlight, then select, the desired instrument to edit in the **EQUIPMENT USED FOR TESTS** menu.
4. Highlight, then select, and edit the information fields in the **HPXXXX** (model number) menu.
5. These changes are not saved automatically and are only valid during the current testing. To save changes, you must update the equipment list using the **EDIT EQUIPMENT** menu in the system administration utilities area of the program. Refer to the following section.

Making Major Equipment Changes

Use this procedure to perform major changes to the list of equipment used. Usually, this means modifying equipment setups or changing instrument model numbers. If needed, use the equipment editing features in the **SYSTEM ADMINISTRATION UTILITIES** menu to change the available-equipment list. As an example, if you want to force CTM to use an alternate piece of test equipment, or provide the manual, equipment-assignment interface, then make a key piece of test equipment **MISSING** in the **INSTRUMENT INFORMATION** menu.

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **EXEC UTILITY** in the **CONFIGURATION** menu. Verify the **MSVS** and enter the password as appropriate.
3. Highlight, then select, **EQUIPMENT** in the **SYSTEM ADMINISTRATION UTILITIES** menu.
4. Highlight, then select, **EDIT EQUIPMENT BY STATION** or **EDIT ALL EQUIPMENT** in the **EDIT EQUIPMENT** menu.
5. Highlight, then select, the instrument of interest.
6. Highlight, then select, **VIEW/EDIT EQUIPMENT** in the next menu that appears.
7. Highlight, then select, **AVAILABILITY** in the **INSTRUMENT INFORMATION** menu.

Task Reference

8. Highlight, then select, **AVAILABLE** or **MISSING**.
9. Exit the series of menus until **STORE EQUIPMENT LIST** in the **EDIT EQUIPMENT** menu appears.
10. Return to CTM's **MAIN MENU**, then highlight and select **VIEW/EDIT EQUIPMENT USED**.
11. Highlight, then select, **RE-ASSIGN ALL TESTS** in the **EQUIPMENT USED** menu.
12. Continue responding to the equipment assignment prompts.
13. Eventually, the **INDIVIDUAL TESTS** selection appears in the **EQUIPMENT USED** menu. In this menu, you may modify the equipment assignments for specific tests.
14. Highlight, then select, the desired test and work through the manual-assignment inter face. CTM attempts to match your changes with any other tests that use the same equipment.

Occasionally, the complexity of some equipment specifications makes automatic updating of similar tests impossible.

Before proceeding with testing, it is recommended that you first verify the equipment assignments in other tests.

Viewing Equipment Requirements Prior to a Test

CTM normally lists the equipment and accessories required for performing a test just after the equipment is assigned. It is also possible to view the required equipment just prior to beginning an individual test. Refer to the procedure below:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **USER INTERFACE** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **SHOW EQUIPMENT BEFORE EACH TEST**. Verify that this field is set to **YES**.

As you exit these menus, you encounter a prompt to save the changes. If you save these changes, any subsequent CTM sessions use the modified settings. Even if you exit CTM and re-load the program your changes are recalled.

If you do not store your changes, the modifications are effective only until one of the following occurs: 1) you select **QUIT** in the **MAIN MENU**, 2) you clear program COM (execute **BASIC SCRATCH C**), or 3) you turn the computer's power off.

Assigning Equipment Prior to Individual Testing

The CTM default setting is to assign all required test equipment for all tests just before starting any test on a new UUT. You can change this default and have CTM assign equipment on a per-test basis, and just before each test begins. This setting is useful when you are running only a partial test on a UUT.

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **USER INTERFACE** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **ASSIGN EQUIP PRIOR TO TESTING**. Verify that this field is set to **YES**.

As you exit these menus, you encounter a prompt to save the changes. If you save these changes, any subsequent CTM sessions use the modified settings. Even if you exit CTM and re-load the program your changes are recalled.

If you do not store your changes, the modifications are effective only until one of the following occurs: 1) you select **QUIT** in the **MAIN MENU**, 2) you clear program COM (execute **BASIC SCRATCH C**), or 3) you turn the computer's power off.

Printing Test Reports

After completing one or more tests, you can print a copy of the test report. Follow the procedure below to learn to print a copy of the test report:

1. Highlight, then select, **PRINT TEST REPORT** in the **MAIN MENU**.
2. If the destination **OUTPUT DEVICE** differs from the displayed **OUTPUT DEVICE**, then highlight and select **OUTPUT DEVICE** and change the setting to the appropriate device listed in the menu.
3. Highlight, then select, **INDIVIDUAL SEGMENTS** or **ALL SEGMENTS** from the menu. **INDIVIDUAL SEGMENTS** presents a list of choices to print that are related to the formal test report.

Configuring CTM

Use these procedures to modify the CTM interface.

Turning Audible Prompts On or Off

The default setting is for audible prompts or beeps to occur when user prompts are presented. You can change this default and have CTM prompts appear silently.

Task Reference

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **USER INTERFACE** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **FLAG OPERATOR WITH BEEP**. Verify that this field is set to **NO**.

As you exit these menus, you encounter a prompt to save the changes. If you save these changes, any subsequent CTM sessions use the modified settings. Even if you exit CTM and re-load the program, your changes are recalled.

If you do not store your changes, the modifications are effective only until one of the following occurs: 1) you select **QUIT** in the **MAIN MENU**, 2) you clear program COM (execute **BASIC SCRATCH C**), or 3) you turn the computer's power off.

Modifying Test Report Printing Features

CTM provides the user some control over the format and layout of test reports. These controls include lines per page, first-page number, indentation, report header information, and various printing modes. Task summaries provided below can help you modify the features of test report printing.

Adjusting the Left-Hand Margin Width

To adjust the left-hand margin of a test report, follow the procedure below:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **REPORTS** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **LEFT MARGIN** in the **FORMATTING AND CONTROL OF REPORTS** menu.
5. Use the \uparrow or \downarrow keys to adjust the number of columns to indent the test report.

Adjusting the Lines Printed per Page

If you want to change the number of lines that are printed on a page of the test report, use the following procedure:

- Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
- Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
- Highlight, then select, **REPORTS** in the **OPERATING FEATURES** menu.
- Highlight, then select, **LINES PER PAGE** in the **FORMATTING AND CONTROL OF REPORTS** menu.
- Use the ↑ or ↓ keys to adjust the number of lines-per page.

Modifying Test-Report Print Mode

Use the print-mode controls to modify what is printed on a test report. You can modify these parameters: **PRINT ALL TESTS** outputs data and status for all tests run, **PRINT FAILING TESTS** only outputs the data and status for all tests that fail, and **PASS/FAIL STATUS ONLY** outputs just the pass or fail status of each test with out printing any test data. The procedure follows:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **REPORTS** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **PRINT MODE** in the **FORMATTING AND CONTROL OF REPORTS** menu.
5. Highlight, then select, the appropriate setting in the menu that appears.

Printing Test Reports Immediately After Testing

You can either print the test report after all test routines are finished, or print the report immediately after an individual test is completed. Use the procedure below:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **REPORTS** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **PRINT IMMEDIATE** in the **FORMATTING AND CONTROL OF REPORTS** menu. Verify that you have selected **YES** for printing the report at the completion of each test.

Modifying the Text of Test-Report Headers

You can enter information such as the name of the site's testing department on the formal test report. The information that follows explains the procedure:

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **REPORTS** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **EDIT REPORT FIELDS** in the **FORMATTING AND CONTROL OF REPORTS** menu.
5. Highlight, then select, and enter or edit the appropriate information in the header fields.

Changing the Line Frequency Default Value

The CTM default line-frequency value is 60 Hz. You can modify this setting on a per-UUT basis when you enter UUT information, or you can change the program's default line-frequency value.

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **OPERATING FEATURES** in the **CONFIGURATION** menu.
3. Highlight, then select, **ADMINISTRATOR FEATURES** in the **OPERATING FEATURES** menu.
4. Highlight, then select, **DEFAULT FREQUENCY** in the **ADMINISTRATOR FEATURES** menu.
5. Highlight, then select, the desired line-frequency value listed in the next menu that appears.

As you exit these menus, you encounter a prompt to save the changes. If you save these changes, any subsequent CTM sessions use the modified settings. Even if you exit CTM and re-load the program your changes are recalled.

If you do not store your changes, the modifications are effective only until one of the following occurs: 1) you select **QUIT** in the **MAIN MENU**, 2) you clear program COM (execute **BASIC SCRATCH C**), or 3) you turn the computer's power off.

Setting CTM Memory Mode

CTM is designed to accommodate many different HP computers and memory settings or profiles. The program's default memory profile is the medium mode. You can select from three memory-modes. Select the largest memory mode available for running your test application. Explicit guidelines about selecting a memory mode to meet your needs are difficult to provide. If you have a lot of memory installed in your controller, such as 5 megabytes in an HP 9836 controller, then you can try running CTM at maximum memory-mode capacity.

Basically, the larger the memory mode, the less CTM loads and unloads program segments. Loading and unloading significantly reduces program-execution speed.

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **ADMINISTRATOR FEATURES** in the **OPERATING FEATURES** menu.
3. Highlight, then select, **MEMORY PROFILE** in the **ADMINISTRATOR FEATURES** menu.
4. Highlight, then select, the desired memory mode from the next menu that appears.

Modifying SRM-Printer Spooler Paths

NOTE

This section about SRM-printer spoolers only applies to SRM-based operation.

CTM fully supports SRM-printer spooling. A list of spooler paths is maintained and may be modified by the user. This list is presented to the user when an alternative-printer path is requested for printing test reports.

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **EXEC UTILITY** in the **CONFIGURATION** menu.
3. Highlight, then select, **SRM SPOOLERS** in the **SYSTEM ADMINISTRATION UTILITIES** menu.
4. Highlight, then select, **ADD, EDIT, or DELETE**.
5. When modifications are completed, exit back to the **MAIN MENU**.

Modifying Mass-Storage Paths

CTM maintains a list of mass-storage paths to keep track of the places that information is located. Refer to the section titled “Configuring the Mass Storage Volumes” in Chapter 7 for a detailed description of the mass-storage scheme.

You need to edit the mass-storage table to meet the needs of your individual work station’s configuration.

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** in the **MAIN MENU**.
2. Highlight, then select, **MASS STORAGE** in the **CONFIGURATION** menu.&
3. Highlight, then select, **EDIT MSVSS & DIRECTORY PATHS** in the **MS EDIT MENU**.
4. Highlight, then select, the desired mass-storage volume from the **VOLUMES** menu.
5. Edit the text in the data-entry field that appears.
6. Exit the menu to continue.
7. Highlight, then select and edit, any additional mass-storage volumes information.
8. Exit to continue.
9. To permanently store your changes, highlight, then select, **STORE MS TABLE** in the **MS EDIT MENU**.
10. Verify and select **YES** in the dialogue menu that appears.

Viewing READ_ME or DATA_SHEET Files

CTM makes developer and installation notes available to you via the **MAIN MENU**. The information contained in these files should be read before using or installing any new test application.

1. Highlight, then select, **VIEW APPLICATION NOTES** in the **MAIN MENU**.
2. Highlight, then select, **READ ME** or **DATA SHEET** in the **MUT INFORMATION** menu.
3. Highlight, then select, the desired output device from the next menu that appears.

Running a Single Test

Occasionally, you may need to run only one test. Use the steps in the procedure that follow:

1. Highlight, then select, **TEST UUT** in the **MAIN MENU**.

2. If you have not defined a UUT yet, CTM prompts you for UUT information now. Enter the proper information requested in the menus and data-entry fields presented.
3. Highlight, then select, **RUN/VIEW TESTS** in the **TEST MENU**.
4. Highlight, then select, the desired test from the **TEST LIST** menu.

Modifying UUT Information

You may need to change information initially entered into the UUT-data fields. Typically, these changes are to the HP-IB address and the comments field.

You can not modify UUT serial numbers at this stage. Results-data is stored with respect to serial numbers, therefore this field can not be changed once established. The only work-around is to re-calibrate a UUT that is assigned a different serial number.

NOTE

Whenever the UUT-option list is changed, all equipment assignments and test results are cleared.

The list of tests performed usually depends on the UUT-option information.

1. Highlight, then select, **VIEW/EDIT UUT INFORMATION** in the **MAIN MENU**.
2. Highlight, then select, and edit the desired fields in the **UUT : XXXXXXXX** menu.
3. Exit the **UUT : XXXXXXXX** menu.

Purging UUT Results

In SRM or HFS systems, results files can begin to accumulate over time. Use the information that follows if you want to remove some old, or unnecessary results files.

NOTE

If you do not intend to use anything other than flexible-disks, the purging utility is not needed. In a flexible-disk environment, the disk saves results from one UUT at a time. In HFS and SRM systems, the results can accumulate in the Results files. Make sure the MSVS for the RESULTS and MUTs directories are for the SRM or HFS files.

1. From the **MAIN MENU**, highlight then select, **EXEC UTILITY**.
2. If required, enter the **EXEC UTILITY** password. For flexible disks or HFS formatted disks, the password is three underscores. For SRM formatted disks, use the **READ** and **MANAGER** protected password you assigned to the program **EXEC UTILITY** file. If none are assigned to the **SRM EXEC UTILITY** file, enter a space bar (null string).
3. Highlight, then select, **PURGING UTILITY**.

Task Reference

4. From the **MODEL SELECTIONS** menu, choose the product model number you want to review.
5. The MUT group may have several serial numbers (UUTs) listed in the **UUT SELECTIONS** menu. Highlight, then select, the serial number of interest.
6. Choose **PURGE SELECTED UUT** to delete the results saved for the serial number you selected.
7. Choose **PURGE ALL UUTs** if you want all the results saved for all serial numbers of the MUT you chose to be removed from memory.
8. Exit these menus using keystrokes or the mouse operation that is appropriate for your system.

Quit

The best practice is to formally exit CTM. When you do so, the program frees allocated equipment and runs through proper exit routines.

- **QUIT** Choose to accomplish the above condition. Other CTM sessions can be resumed by typing **RUN**.

Using HP CTM's Utilities

CTM contains interface features you can use to optimize your operating environment.

This section contains information about the following interface features:

- “Creating or Editing the Equipment Table”
- “CTM Configuration Menu”
- “Setting Up CTM Workstations”
- “Setting Up Mass Storage”
- “Setting Up SRM Spoolers”
- “Purging Data from the Results File”

Creating or Editing the Equipment Table

Entering the Model Numbers Correctly

Model numbers must be entered properly for CTM to work correctly. Use the following conventions to ensure that the model numbers are entered correctly:

- Remove the space between the model numbers and the “HP” when you enter HP equipment numbers. For example, enter **HP432A**, not **HP 432A**.
- Enter a space between the model number and the manufacturer name for non-Hewlett-Packard equipment.

Entering or Editing Equipment Listings in the Global Equipment

CTM accesses test-equipment information from a single, global equipment table. If you are entering or editing equipment listed in the table, use the System Administration Utilities with the following procedure:

1. Select **EXEC UTILITY**, enter the password, then select **EQUIPMENT** from the **SYSTEM ADMINISTRATION UTILITIES** menu. The **EDIT EQUIPMENT** menu is displayed.
2. Highlight, then select, **ADD NEW EQUIPMENT**.
3. You are required to enter information in the equipment's model number and serial number fields.
4. Enter the applicable option information one at a time.

5. Enter information in the remaining optional fields. The list following this procedure gives short descriptions of these fields.
6. Exit the data entry screen. To continue after data entry is complete, refer to the instructions in the prompt below the screen.
7. If more equipment must be added, select **YES**, then repeat steps 2 and 6 until all the required equipment is added. Highlight and select **STORE EQUIPMENT LIST** to store the list in the global equipment table.

Descriptions of the Instrument Information Menu Fields

The following list gives brief descriptions of the fields presented in the INSTRUMENT INFORMATION menu. Refer to the section titled "Menu Reference" in Chapter 7 for additional information.

MODEL NUMBER Enter all HP model numbers using the form, **HPnnnna**. **HP** stands for Hewlett-Packard and **nnnna** is the model number with the version letter. Do not insert a space between "HP" and the numeric part of the model number. For example, enter HP432A or HP3456A.

For non-Hewlett-Packard models, enter the manufacturer name, a space, then the model number. The READ_ME file shipped with each test application should provide the conventions used for that specific test.

SERIAL NUMBER Enter the serial number. CTM separates instruments having the same model number by the instrument's serial number.

ADDRESS TYPE You can choose **HP-IB**, **NONE**, or **OTHER**.

ADDRESS Enter the address of the instrument you are identifying.

STATION Enter the workstation name to which the equipment usually belongs. If the equipment is not part of a specific workstation (a floater), enter **NONE**.

OPTIONS If the equipment has options, enter the option number or identifier. Continue to select **OPTIONS** until all the options for the specific equipment are entered. Option numbers must be entered one at a time. If there are three options on the equipment, select **OPTIONS** three times to enter each one.

AVAILABILITY Toggle between **AVAILABLE** and **MISSING** until the proper choice is displayed. Making equipment available allows it to be used from the global equipment table. Selecting **MISSING** keeps the equipment from being used.

CAL DUE DATE Enter the correct calibration due date for the equipment that requires calibrating. Entering the calibration due date allows the CTM program to alert users when any piece of equipment being used for testing needs calibration.

COMMENTS Enter appropriate comments into this field.

CTM Configuration Menu

The **CONFIGURATION** menu presents the **OPERATING FEATURES** menu. From this screen you can set the operating parameters that CTM uses. The parameters are identified completely in the section titled "Menu Reference" in Chapter 7.

Setting Up CTM Workstations

CTM uses workstation-specific information during operation. This information includes equipment model and serial numbers, as well as addresses and select codes. Workstation names are needed if you plan to use dedicated workstations.

Use the following procedure to set up CTM workstations.

NOTE

To complete or activate each step, enter the appropriate completion sequence (**RETURN**, **ENTER**, mouse button selection, etc.) for your computer and keyboard configuration. Refer to the section titled "Installation" for information.

1. Highlight, then select, **VIEW/EDIT CONFIGURATION** from the **MAIN MENU**.
2. Highlight, then select, **EXEC UTILITY** to access the **SYSTEM ADMINISTRATION UTILITIES** menu.
3. Highlight, then select, **STATIONS**.
4. Highlight, then select, **ADD NEW STATION**.
5. Highlight, then select, **STATION NAME** and type in the name of the CTM workstation (for example, **STATION 1**).
6. Highlight, then select, **DIRECTORY NAME** and type in the directory name that corresponds to the workstation name entered in step 5.

NOTE

Any valid SRM or HFS directory name may be used. CTM uses this workstation-specific directory to access and store information related to tests performed at the individual workstations.

7. Press **CONTINUE** or slide the mouse to the left to return to the previous menu.
8. If more workstations need to be set up, select **YES**, then repeat steps 4 through 7 to add another workstation. Repeat these steps until all workstations are set up.
9. When you are finished setting up workstations, select **NO** to return to the previous menu.
10. Highlight, then select, **STORE STATION LIST** to store the workstations you have set up.

Setting Up Mass Storage

Set up mass storage to control the source and destination of the operating information. The labels assigned to the test application files, results information, and other program information are called volumes. The term “volumes” means labels that CTM uses to manage its operating information. This information might include such things as calibration-data files, test application files, or test-results files. When the program prompts you for the **VOLUME**, it expects to receive keyboard input for the directory path, when appropriate, and the mass storage volume specifier (MSVS). Here are some examples of volumes that might be used:

- The directory name and MSVS for a volume called MUTS using a local flexible disk drive might be **:CS80,700,0**.
- To locate the MUTS volume on an HFS formatted disk, it might be **/CTM/ MUTS:CS80,700,0**.
- To locate the MUTS volume on an SRM system might be found at **/CTM/MUTS:RE NOTE 21,0**.

When you choose one of the volume labels listed in the **VOLUMES** table, a data-entry field appears expecting the directory name (path), if appropriate, and MSVS. A directory name specifies a directory of files on a hierarchically structured mass storage volume.

More complete menu information is provided in the section titled “Menu Reference” in Chapter 7.

Setting Up SRM Spoolers

CTM can be programmed to recognize your local SRM spooler names by using the System Administration Utilities with the following procedure.

NOTE

To complete or activate each step, enter the appropriate completion sequence (**RETURN**, **ENTER**, mouse button selection, etc.) for your computer and keyboard configuration. Refer to the section titled "Installation" for information.

1. Highlight, then select, **SRM SPOOLERS** from the **SYSTEM ADMINISTRATION UTILITIES** menu.
2. Highlight, then select, **ADD** to add a new spooler.
3. Key in the directory path of the SRM spooler. (As an example, **/LP.**)
4. Repeat steps 2 and 3 to add additional spoolers.
5. Select **YES** if you want to save the changes.

Purging Data from the Results File

Occasionally, you may want to purge old test-results data from the **RESULTS** file. To access the purge utility, you need to run the system administration utilities program. From the **MAIN MENU**, select **VIEW/EDIT CONFIGURATION**, then use the following procedure to purge results data.

NOTE

To complete or activate each step, enter the appropriate completion sequence (**RETURN**, **ENTER**, mouse button selection, etc.) for your computer and keyboard configuration. Refer to the section titled "Installation" for information.

1. Select **EXEC UTILITY**, then select **PURGING UTILITY**.
2. From the **MODEL SELECTIONS** menu, choose the product model number that you want to review.
3. From the **UUT SELECTIONS** menu, choose the unit's name that needs to be purged.
4. Choose to purge only the highlighted UUT data by selecting **PURGE SELECTED UUT**, or purge all data from this UUT file by selecting **PURGE ALL UUTs**.

7

**Calibration Test Manager
Concepts**

This chapter contains the following information:

- Using HP Calibration Test Manager Menus
- What are System Administration Operations?
- Categories of CTM Test Equipment
- CTM UUT Information
- Configuring CTM
- Using the Test Sequences
- Configuring the Mass Storage Volumes
- Understanding Workstations Setup
- Understanding Equipment Management
- Understanding System Administration Utilities
- Understanding UUT-Results Management (HFS or SRM only)
- Using Printers with CTM
- Making Calibration-Factor Files
- Finding Application Notes
- Understanding System Files
- Menu Reference

Using HP Calibration Test Manager Menus

HP Calibration Test Manager (CTM) is an interactive, menu-driven program that uses windows. Typically you are selecting the items listed in menus, moving between menu levels, or exiting from menus. The control of the window menus is determined by the computer configuration, keyboard model, and the use of a mouse or knob. On-screen help information is available for many of the menu items. Refer to the section titled “Installation” in Chapter 6 for information about computer configurations and accessing help screens.

Selections made in the menus can either display another window menu, request data input from the keyboard, or start test application routines.

NOTE

The text displayed beneath the menu area is provided for your convenience. It includes reminders about how to make menu selections, display help information, or exit a menu.

What are System Administration Operations?

The **SYSTEM ADMINISTRATION UTILITIES** menu is designed to be CTM's maintenance menu. From this menu, you can perform the following tasks:

- Install CTM program software.
- Install test application.
- Establish or modify program configuration values to optimize the performance of CTM.
- Manage unit-under-test (UUT) results files.
- Manage the program's global equipment table.

References to Mass-Storage Volumes

This chapter uses the name mass-storage volume when referring to media management. CTM can be used on flexible-disk or hard-disk based systems. When appropriate, the text specifies whether the information is for flexible- or hard-disk operation. You need only read information related to your operating environment. The generic term *volume* is used when there is no difference between flexible- or hard-disk operations.

The term volumes means labels that CTM uses to manage its operating information. This information might include such things as calibration-data files, test application files, or test-results files.

When the program prompts you for the **VOLUME**, it expects to receive keyboard input for the directory path, when appropriate, and the mass storage volume specifier (MSVS). Here are some examples of accessing volumes that might be used:

- The directory name and MSVS for a volume called MUTS using a local flexible disk drive might be **:CS80,700,0**.
- To locate the MUTS volume on an HFS formatted disk, it might be **/CTM/MUTS:CS80,700,0**.
- To locate the MUTS volume on an SRM system might be found at **/CTM/MUTS:REMOTE 21,0**.

When you choose one of the volume labels listed in the **VOLUMES** table, a data- entry field appears expecting the directory name (path), if appropriate, and MSVS. A directory name specifies a directory of files on a hierarchically structured mass storage volume.

NOTE

Flexible-disk users: think of *volume* as equivalent to “disk-drive.”

Hard-disk users: the term *volume* is in reference to directories in an HFS or SRM environment.

Using CTM Software

CTM operations include system administration and test application execution. These are further defined below:

CTM system administration operations provide the user interface through which all of the following are performed:

- Modification of system configuration values.
- Customizing of test-results printer operation.
- Creation and updating of the global equipment table (list). This table is the list of equipment that is available for performing test application procedures with the CTM overhead.

Using CTM with Individual Test Application Routines

Test application procedures designed to work with CTM include the following capabilities:

- Verify, initialize, and control the UUT and all the test equipment used to perform test application procedures.
- Provide equipment connection instructions to the test person.
- Collect, format, display, and store test results.
- Provide READ_ME and DATA_SHEET files that contain test application information.
- Assignment of unit under test (UUT) test equipment.

Categories of CTM Test Equipment

CTM refers to three categories of test equipment used during testing. These three categories are the unit under test (UUT), the model under test (MUT), and electronic test equipment (ETE). These three categories are defined below:

Unit Under Test

(UUT) UUT refers to a specific instrument model being tested, identified by the serial number. The UUT information requires serial numbers so that same model-number instruments can be tested, but the information saved after testing is completed is sorted by the instrument's serial number.

Model Under Test

(MUT) MUT refers to the model number of the instrument being tested. Instrument model numbers identify the test application used to test UUTs. The MUT entry in the menu identifies which model number CTM needs to load.

Electronic Test

Equipment (ETE) ETE refers to the equipment that CTM uses to test the UUT. ETEs are further divided into calibration standards, non-standards, and accessories. These three categories are explained below:

Calibration Standards

The calibration of these instruments must be kept current. Before these instruments are selected, CTM checks the calibration information saved in a data base for calibration due dates. If these standards are out-of-cal (needing to be recalibrated), the program warns you.

Nonstandards

The instruments used in calibration procedures that do not require current calibration status.

Accessories

Accessories may include cables, adapters, attenuators, or any other passive device not requiring calibration used during test application procedures.

CTM UUT Information

Test reports are typically printed after a test application procedure is completed. The report contains test-specific results and the pass or fail status of the unit under test (UUT). There is additional, important information that needs to be printed after UUT tests are completed. This information is entered into the data-entry menu provided prior to running test application procedures. The data-entry menu includes the following items:

- SERIAL NUMBER** The UUT serial number is usually located on the serial-number label (often on the rear panel of instruments). The serial number of the UUT is a very important piece of information. It is used to store and retrieve test data, and is printed on the test report. If it is incorrect it may be difficult, or even impossible, to access the test data file for this instrument. Take the time to verify the accuracy of the serial number before continuing.
- TECH ID** The name, employee identification number, or other identification of the person to perform the tests.
- OPTIONS** The model's options are usually listed on the serial-number label, typically located on the rear panel of the UUT.
- ADDRESS TYPE** The UUT's interface type (the default type is HP-IB).
- ADDRESS** The UUT's interface-bus address.
- CONTROLLER** The instrument that the test application identifies as the controller when 2 or more instrument modules are a part of the UUT procedure. Calibration Test Manager collects controller information from input in the **CONTROLLER** selection of the UUT menu.
- DATE** The date the UUT test is performed (defaults to the current date). The computer's clock must be accurate, of course.
- TEMPERATURE** The temperature of the environment or area where the UUT is calibrated.
- HUMIDITY** The humidity of the environment or area where the UUT is calibrated.
- LINE FREQUENCY** The power line frequency of the UUT (defaults to 60 Hz).

CTM UUT Information

COMMENTS Any additional comments you want to enter about the UUT.

Configuring CTM

CTM provides three categories of user-configurable operating features. Use these features to modify program operation to meet your specific needs. The three categories that can be configured are printer operation, mass-storage destinations, and program operating features.

PRINTERS Select this item to enter the address of the default printers, or directory paths when using an SRM spooler.

MASS STORAGE Select this item to modify the various volume directory paths, such as the Results directory. Refer to the Designating Mass Storage information that follows for more detail.

OPERATING FEATURES Select this item to access the **USER INTERFACE**, **REPORTS**, and **ADMINISTRATOR FEATURES** selections. Most of the operating features are self explanatory. Some of the less obvious features are defined below:

FLAG OPERATOR

WITH BEEP when enabled, the user is prompted by audible tones. If you prefer, and the test software provides an on and off option, you can disable the beep feature.

LOOP SEQUENCE this parameter is used in conjunction with **MAXIMUM REPEATS** to have test sequences automatically re-run at completion.

REPEAT ON FAIL this parameter is used in conjunction with **MAXIMUM REPEATS** to determine whether or not a measurement or a test should be repeated upon failure.

PAUSE ON FAIL this parameter controls whether or not the program pauses after a measurement or test has failed.

MAXIMUM REPEATS this parameter, along with **LOOP SEQUENCE** and **REPEAT ON FAIL**, controls the number of times an event

is repeated. The event may be a test sequence, a measurement, a failed test, or a failed measurement.

**CONTINUE
DELAY**

in this field, define how many seconds you have to respond to the **TEST ACTION MENU** displayed between tests. It is also used to control the delay between tests when printing test results to the computer screen.

OPERATING MODE

in this field, modify the behavior of CTM to accommodate different user types, either Standard, Demonstration, or Training.

**ASSIGN EQUIP
PRIOR TO
TESTING**

enter **YES** to have CTM attempt to resolve the equipment needs for ALL of the tests prior to running any test. Entering a **NO** response delays the equipment assignment until you actually run a test. At that time, the program only resolves the equipment for that test. A **NO** response can be a time saver when you only need to run a subset of tests.

**SHOW EQUIP
BEFORE EACH
TEST**

when set to **YES**, a list of equipment and accessories used for a selected test is displayed prior to running the test. You can make any last-minute address changes to the equipment list or it can be used to remind you of the equipment needed to run the test, interruption free.

**PRINT
IMMEDIATE**

when enabled, the program immediately prints the test report before proceeding to the next test.

REPORT FIELDS these entries allow you to customize the test report header. Simply enter text for the values and they will show up on your reports.

**VERIFY CAL DUE
DATES**

when set to **YES**, CTM checks the calibration due dates of the calibration standards being used. If any ETE needs calibration, a listing of the ETEs requiring calibration is displayed.

NOTE

CTM selects available ETE from the equipment table whether it is out of calibration or not; the warning message is displayed only to alert you.

MEMORY PROFILE

manages CTM's memory and the default setting is **MEDIUM**. Select **MINIMUM** to have subroutines loaded only when needed, then discarded when done. This slows down the testing considerably, but it allows you to use less memory while running the program. Select **MAXIMUM** if you have plenty of memory to load all subroutines for all tests. The appropriate settings are dependent on the test application you are running as well as the type of computer and display you are using.

DEFAULT

FREQUENCY this sets the default line frequency used in the UUT information menu.

Using the Test Sequences

Each test application contains a list of tests that can be used on the UUT. You may re-arrange the default order, define subsets of tests, or select developer-defined, alternative test lists. CTM provides an interface for you to define and select customized test sequences.

Configuring the Mass Storage Volumes

CTM indirectly accesses mass storage devices. The program is therefore not dependent on any particular mass storage configuration. CTM assigns a *volume name* to the different mass storage volumes. It also associates a *mass storage volume specifier* (MSVS) and, optionally, a directory path with each volume name. The different mass storage volumes used by the CTM program are described below.

Consider the following example. You are designing a program to store test results on mass storage media, and you want your program to use flexible disks, SRM (Shared Resource Manager), or HFS (Hierarchical File System). Rather than explicitly stating the mass storage volumes in your program code, assign the *logical volume* RESULTS to the volume on which test results are stored.

Using this method lets the program access the volume, such as a flexible disk containing the test results, then passes the RESULTS volume name to a look-up routine. The look-up routine accesses the table that links a specific MSVS to RESULTS, and returns this volume specifier. If an HP 9836A computer is being used with flexible disks, the specifier returned might be : **INTERNAL, 4, 0**.

For each computer that runs your program, this table is customized to designate the appropriate links between MSVSs and logical volume names. The table is called the *Mass Storage Table*. It is a map connecting the mass storage volumes, MSVSs, and directory paths.

SYSTEMS volume This volume contains programs and files which directly support the CTM. Some of these programs and files include the actual CTM program, the HELP-text menu file, the system administrator utility, and the mass storage table.

MUT(S) volume This directory contains the test applications.

RESULTS volume This directory contains the test application results.

WORKSTATION

volume This volume contains workstation-specific configuration files. Workstation concepts are more thoroughly explained in the Workstations section that follows.

SYSTEM CAL

volume This volume contains the calibration-factor files, like those for power sensors, needed by some test applications.

Understanding Workstations Setup

It is very important, *but not mandatory*, to establish workstation (**STATIONS**) identities for your group. For example, if you have named a workstation SYSTEM-I, enter all the equipment that normally resides at that workstation into the equipment table. Specify a workstation name, such as SYSTEM-I, using the **STATIONS** feature in the administrator's utility.

NOTE

Make certain that this workstation is already entered into the system with the administrator's utility before you enter the equipment into the equipment table.

Remember that a workstation is made up of some test equipment normally located together. In the above example, SYSTEM-I represents a workstation since it is not just a controller, like an HP 9836. In many cases, however, a single computer controller is included as part of a workstation.

Appropriately using the **STATIONS** feature can tremendously improve the process of equipment assignment. Equipment assignments can be localized, as opposed to scattered. Test-equipment needs during testing can be more quickly resolved when the **STATIONS** feature is properly set up.

Understanding Equipment Management

CTM contains provisions to accommodate complicated equipment substitutions and equipment-option dependencies. Test equipment is specified on a per-test basis to ensure that each test uses only the pieces of equipment needed. The real benefit of this flexibility becomes clear when only a few tests need to be run.

Advantages of a Global Equipment Table

The program tracks all of the test equipment in a single file referred to in this section as the global-equipment table. The global-equipment table is a file accessed whenever a new MUT is selected, the options on an existing UUT are changed, or you want to modify the test equipment assignments.

Test equipment used during test application procedures are entered in the global equipment table, but cables, attenuators, connectors, adapters, and other minor accessories are not usually entered here. Each test application prompts you for what should be entered into the global-equipment table via the individual **READ_ME** or **DATA_SHEET** files. (The **READ_ME** or **DATA_SHEET** files are accessed from the **VIEW APPLICATION NOTES** selection in the **MAIN MENU**.)

Assigning Test Equipment For Test Application Procedures

When you begin an automated test, the program first reads the Equipment file to determine what equipment belongs to your workstation, and if it is available. After all of your equipment is assigned (resolved), the Equipment file is updated to indicate the test equipment that is to remain available for other workstations to use, and to indicate which pieces of equipment are busy.

Occasionally, you may find that when you want to run a test, some of the test equipment is busy. The global equipment table is shared by all users on an SRM system, therefore the program displays a message when a conflict between users occurs. After a reasonable amount of time has passed, you can select **TRY AGAIN** to see if the equipment is available.

Use the **SYSTEM ADMINISTRATION UTILITIES** menu to add new equipment to the global equipment table or to modify existing equipment entries.

Test Equipment Assignments

One of the primary CTM functions is to determine the test equipment needed to run your test. Equipment needs are dependent on the model number being tested (MUT), the specific unit's options, and the tests that you need to run. Remember, equipment is specified and assigned on a per-test basis. CTM steps through the test list as it resolves equipment needs.

The list of available equipment used to perform your test application procedure is determined by the selections available in the global equipment table and by the workstation you have identified to use. CTM first tries to resolve your equipment needs using only the equipment located at your workstation. If needed equipment is identified as **MISSING**, not available, does not exist in the global equipment table, or an option requested cannot be matched with any in the equipment table, then CTM looks for floaters. "Floaters" are any test equipment not tied to a workstation. CTM does not look for equipment belonging to other workstations. If automatically resolving the equipment needs for a test is impossible, an option to manually resolve the equipment needs is made available.

Finally, you may choose to resolve the equipment needs for all tests prior to running any test, or you can wait to resolve each test's equipment needs before beginning the test.

Delaying equipment assignment is useful when you are only running a few tests. You can choose the desired mode by selecting **VIEW/EDIT CONFIGURATION** from the **MAIN MENU**. Select **OPERATING FEATURES**, then **USER INTERFACE**. Enter **YES** in the **ASSIGN EQUIP PRIOR TO TESTING** field if you want all the equipment needs resolved before running any test.

Manual Assignment of Test Equipment

If CTM cannot completely and automatically resolve the equipment needs for a particular test, use the following procedure to attempt to resolve equipment requirements. If the needed test equipment is simply not available in the equipment table, the information about the equipment must be entered manually.

- When multiple setups exist, a list appears from which you can choose the setup you need. The differences between available setups should be obvious by their names. The preferred test setup is placed at the top of the list.
- When the list of equipment functions needed to perform the test appears, look for the pieces marked **MISSING**. Select these items to resolve. For items that have equipment assigned to them, you may select them if you want to change the automatic assignment.

- When there are substitute model numbers for the equipment function you need, a list of these substitutions appears. Select an appropriate substitution. The recommended model number was placed at the top of the list.
- CTM now searches the global equipment table for any model number needed to satisfy the manually-chosen equipment. No discretion is given to workstation-owned equipment, availability, or options. If any model numbers are found, you can select or view any in the list. Remember, however, this list may display the equipment being used by another. Therefore, be sure the equipment is really available before you attempt to select it.
- If the model number of the required test equipment cannot be found, enter the equipment information manually. CTM prompts you for information and warns you if there are option requirements on the models you enter. Enter the information carefully so that subsequent tests needing the same equipment can be resolved quickly and easily. (Equipment information entered at this point is not automatically saved to the master equipment list. Therefore, remember to update and save the master equipment list.)

Reassignment of Test Equipment

Select **VIEW/EDIT EQUIPMENT USED** from the **MAIN MENU** to modify equipment assignments.

To edit basic instrument information or serial numbers, select **EQUIPMENT LIST**. Select **INDIVIDUAL TESTS** to completely re-assign equipment. Once you select the test that you want to re-assign, follow the procedure above to manually resolve equipment needs.

After you have changed the equipment assignment for a test, CTM looks for other tests with the same setup and changes their assignments as well. Often, however, complicated equipment specifications prevent this effort. Be sure other tests that might be affected by assignment changes are affected correctly.

Understanding System Administration Utilities

System administration utilities are used to manage system configuration, equipment needs, and test application data records. Load and run CTM to access the administrator utilities. When the introduction screen appears, press the letter **E**. The menu that follows allows you to edit the equipment-table file, modify the site-configuration values, enter and edit workstation information, update the mass- storage table, or edit the spooler parameters.

Administration utilities are also accessible by selecting **CONFIGURATION** in the **MAIN MENU**.

Understanding UUT-Results Management (HFS or SRM only)

For each UUT, an independent results directory is created. When you test a UUT, recognized UUTs are listed in a menu. You can either select a UUT or enter a new serial number. As a result, other UUTs can be tested without having to change the test procedure software.

The number of results directories can increase over time. It is recommended that you routinely archive, then purge old results directories. Using the **PURGING UTILITY** selection in the **SYSTEM ADMINISTRATION UTILITIES** menu, select the MUT of interest. From the **UUT SELECTIONS** menu, either delete all serial numbers for the model, or delete the test results for a selected serial number.

Using Printers with CTM

CTM defines two classifications of printers. One is the report class and the other is the segment (workstation) class. The report printer is typically a shared printer used for printing test reports following the completion of all tests. The segment printer is usually connected to an individual workstation and used for printing a single workstation's test results. One printer can serve both classifications.

Either of the classifications can be assigned to the computer display, to an SRM spooler, or to a local HP-IB connection.

Making Calibration-Factor Files

Occasionally, test applications require attenuator, power sensor, or thermal-converter calibration factors for making accurate measurements.

You need to use provided software utilities for storing these calibration factors. Instructions for running these utilities should reside in the test application `READ_ME` or `DATA_SHEET` files.

CTM power-sensor calibration factors are stored in the volume labeled **SYSTEM CAL**. After the first time a power sensor is used, its calibration factors are stored and available for future use.

With SRM or HFS systems, calibration factor files are available for use when testing other instrument models at different workstations. After each power sensor is used, its associated calibration factors are entered into the volume called **SYSTEM CAL**. Stored calibration factors are valid until the equipment's cal-due date is encountered.

Finding Application Notes

Typically, `READ_ME` and `DATA_SHEET` files are included in the test application programs. `READ_ME` files contain pertinent information about installing the test application. `DATA_SHEET` files typically contain the following information:

- Test application descriptions.
- Instrument options recognized by the program.
- Test equipment required for calibration.
- Performance test descriptions.
- Developer-defined test sequence descriptions.
- Program revision history.

Understanding System Files

System Volume Contains the following files:

EXEC	the CTM-executable program file.
CONFIG	the site-configuration values file.
EQUIPMENT	the global test equipment file.
MS_TABLE	the group's mass storage table file.
PERIPHERAL	the printer-paths file.
HELP	the CTM user help messages.

Workstations Volume

contains workstation-specific configuration information. This file is like the system CONFIG file, but customized values for individual workstations are stored here.

Results Volume contains MUT test results. CTM creates path names that resemble this example:

**results_volume/uut_model_number/
uut_serial_number.**

MUT Volume contains the test application library. It is normally organized hierarchically by instrument function, then model number.

System CAL-Factors Volume

contains the power-sensor calibration data for the various test application programs.

Menu Reference

This section provides descriptions of every menu selection found in the CTM program.

How to Use the Menu Reference

The titles that appear at the top of most screens are referred to as menus and are indicated with boldface characters. For example, **ACCESSORIES USED** menu, **MAIN MENU**, **TEST MENU**, **UUT SELECTIONS** menu, etc.

Within each menu are the menu selections indicated with shaded text. For example, **TEST UUT**, **PRINT TEST REPORT**, **VIEW/EDIT UUT INFORMATION**, etc.

This section is organized in alphabetical order. Note that generic titles are given to those menus that are dependent upon test applications being used, specific UUT being tested, user-specific information, etc.

For example, the menu title for a specific UUT will be dependent upon the model number of the UUT being tested. In this case for the corresponding menu selection descriptions, you would refer to **UUT: XXXXXXXX** in this section.

ACCESSORIES USED

=== ACCESSORIES USED ===
91 CM FLEXIBLE COAX CABLE Type-N(M) TO N(M) HP 8120-5140
.
.

The **ACCESSORIES USED** menu is dependent upon the test application being used and is intended for information purposes only. This list shows only the accessories corresponding to resolved tests.

Related Menus

- **EQUIPMENT USED**

ADMINISTRATOR FEATURES

=== ADMINISTRATOR FEATURES ===
VERIFY CAL DUE DATES YES
MEMORY PROFILE MIN
DEFAULT FREQUENCY 60 Hz

VERIFY CAL DUE DATES

is set to **YES** to warn the user, before a test begins, if a piece of equipment is due for calibration. Set to **NO** to disable this feature.

MEMORY PROFILE

accesses the minimum (**MIN**), medium (**MED**), or maximum (**MAX**) memory-mode choices.

MINIMUM

SYSTEM MEMORY allows the test application routines to use the least amount of memory during execution. After each test or report, the programs are deleted from the computer's memory. This configuration requires the longest test time.

MEDIUM SYSTEM

MEMORY allows the program to load and delete test application files as needed. This is the program's default setting.

MAXIMUM

SYSTEM MEMORY is chosen if you have plenty of memory available. The program loads and saves the test application in memory. This configuration allows the shortest test time.

DEFAULT

FREQUENCY allows you to choose the frequency that is correct for your power source of your UUT. The choices are 60 Hz, 50 Hz, and 400 Hz.

Related Menus

- **OPERATING FEATURES**

CONFIGURATION

=== CONFIGURATION ===
OPERATING FEATURES
PRINTERS
MASS STORAGE
EXEC UTILITY

OPERATING FEATURES

accesses the **OPERATING FEATURES** menu. Modify or review the settings that control the CTM's user interface, printing, and program control features.

PRINTERS

accesses **REPORT PRINTER** and **SEGMENT PRINTER**. The report printer is used for the formal reports while the segment printer is used for informal reports. For example, the report printer might be a laser printer used to produce high quality test reports for a customer. Conversely, the segment printer might be used to produce test reports on a line printer for immediate evaluation by the technician performing the tests.

REPORT PRINTER allows the selection of an output device to be used for formal test results printout. Select **CRT**, **LOCAL PRINTER**, or **SRM SPOOLER**. Report printer output is initiated by selecting **PRINT TEST REPORT** from the **MAIN MENU**.

SEGMENT PRINTER

allows the selection of an output device to be used for informal test results printout. Select **CRT**, **LOCAL PRINTER**, or **SRM SPOOLER**. Segment printer output is initiated by selecting **REPORT** from the menu shown below (shown after completion of individual test).

<p>NEXT TEST</p> <p>REPEAT TEST</p> <p>REPORT</p> <p>EQUIP USED</p> <p>CONFIG</p> <p>EXIT</p>

Note that if **PRINT IMMEDIATE**, in the **FORMATTING AND CONTROL OF REPORTS** menu, is set to **YES**, the test results are automatically sent to the segment printer after each test is completed.

MASS STORAGE accesses the **MS EDIT MENU**. The selections in the **MS EDIT MENU** allow you to modify directory and MSVS path information.

EXEC UTILITY accesses the **SYSTEM ADMINISTRATION UTILITIES** menu used to set up the CTM's operating parameters.

NOTE

A message appears for you to enter the correct MSVS and directory-path data in the field provided.

After you press **ENTER** (or equivalent key), the message **Type in the Exec Util Password** appears.

The password is three underscores for flexible or HFS formatted disks; for SRM, use the **READ** and **MANAGER** protected password you assigned to the program **EXEC_UTIL** file. If none are assigned to the **SRM EXEC_UTIL** file, enter a space bar (null string).

Related Menus

- **FORMATTING AND CONTROL OF REPORTS**
- **MS EDIT MENU**
- **OPERATING FEATURES**
- **SYSTEM ADMINISTRATION UTILITIES**

EDIT ADDRESSES

==== EDIT ADDRESSES ====
HPXXX XXAXX XXX
. . .
. . .

The **EDIT ADDRESSES** menu appears when a device address conflict among the test instruments exists, and you select **EDIT ADDR** to resolve the conflict.

Related Menus

- **EQUIPMENT USED FOR THIS TEST**

EDIT EQUIPMENT

==== EDIT EQUIPMENT ====
EDIT EQUIPMENT BY STATION
EDIT ALL EQUIPMENT
ADD NEW EQUIPMENT
PRINT EQUIPMENT LIST
STORE EQUIPMENT LIST

EDIT EQUIPMENT

BY STATION allows you to edit the electronic test equipment (ETE) assigned to a workstation. If none is assigned, the following message appears:

Sorry...no equipment assigned to this station.OK

If workstation names are defined, the **STATION ID** screen appears.

Select the workstation name of interest, and the list of equipment for the selected workstation appears. Scroll through the equipment list. Select any piece of test equipment listed.

VIEW/EDIT EQUIP accesses the **INSTRUMENT INFORMATION** menu that is used to view or edit information specific to the previously selected piece of test equipment.

DELETE EQUIP deletes the selected equipment from the equipment list.

EDIT ALL EQUIPMENT accesses the **MODEL SERIAL ADDR** menu. You can select any of the model numbers listed to edit their information.

ADD NEW EQUIPMENT accesses the **INSTRUMENT INFORMATION** menu to add models to the available equipment list.

When you exit the **INSTRUMENT INFORMATION** menu, the following message appears:

More instruments to add? YES NO

Select **YES** to add more instruments, or **NO** to exit.

PRINT EQUIPMENT LIST accesses the desired output device used to print the equipment list. If the printer does not respond, the message **Printer timed out REPEAT** or **ABORT** appears. Select the appropriate action after resolving why the printer did not respond.

LOCAL PRINTER selects a local printer to print equipment list. The **PRINTER ADDRESS** appears to enter the correct printer address. **GRAPHICS CAPABILITY** can be set from **YES** to **NO**. Set to **YES** only if your printer has graphics capability.

SRM SPOOLER selects an SRM spooler as the output device used in printing the equipment list.

STORE EQUIPMENT LIST stores the modified contents of the equipment list. The message **Please wait...saving the EQUIPMENT list.** is displayed as the program stores the list.

Related Menus

- **FLOATING EQUIPMENT**

Menu Reference

- **INSTRUMENT INFORMATION**
- **MODEL SERIAL ADDR**
- **STATION ID**
- **SYSTEM ADMINISTRATION UTILITIES**

EDIT REPORT FIELDS

==== EDIT REPORT FIELDS ====
HEADER1 FORMAL REPORT
HEADER2 HEADER
HEADER3 INFORMATION
HEADER4 AREA

HEADER1 to
HEADER4

allow entry of up to four lines that appear at the top of the header page of a formal report (that is, a report printed on the report printer that is initiated by selecting **PRINT TEST REPORT** in the **MAIN MENU**). Up to 66 characters may be entered in each line.

This header information area can be used to enter the name of your company.

NOTE

The header information does not appear in reports printed on the segment printer.

Related Menus

- **FORMATTING AND CONTROL OF REPORTS**
- **MAIN MENU (PRINT TEST REPORT)**
- **OPERATING FEATURES**

EDIT STATIONS TABLE

==== EDIT STATIONS TABLE ====
EDIT STATIONS
ADD NEW STATION
STORE STATION LIST

EDIT STATIONS accesses the **STATION DIRECTORY** menu that lists all predefined workstation names. Select a workstation to change the workstation name or directory information. Once you have edited the information, refer to the prompt below the screen to exit the menu.

NOTE

The predefined workstation names may not all be displayed simultaneously. Therefore, you may need to scroll through the list of workstation names to view them all.

**ADD NEW
STATION**

adds workstation names and directory information to the **STATION DIRECTORY** menu. More workstations can be added by responding to the **More stations to add? YES NO** prompt with **YES**. Once you have edited the information, refer to the prompt below the screen to exit the menu.

**STORE STATION
LIST**

stores workstation names and directory information once editing is completed. Once the data is saved, refer to the prompt below the screen to exit the menu.

Related Menus

- **STATION DIRECTORY**
- **SYSTEM ADMINISTRATION UTILITIES (STATIONS)**

EQUIPMENT NEEDED

===== EQUIPMENT NEEDED =====
POWER METER HPXXXX XXXXXAXXXX
. . .
. . .

The **EQUIPMENT NEEDED** menu shows the equipment requirements for a particular test. The equipment in this menu is dependent upon the test application being used.

Related Menus

- **ETE ALTERNATIVES**

EQUIPMENT USED

=== EQUIPMENT USED ===
EQUIPMENT LIST
ACCESSORIES LIST
INDIVIDUAL TESTS
RE-ASSIGN ALL TESTS

Related Menus

- **MAIN MENU (VIEW/EDIT EQUIPMENT USED)**

EQUIPMENT USED FOR TESTS

===== EQUIPMENT USED FOR TESTS =====
(HP436A 2512A22448) 713
HP8482A XXXXXAXXXX NONE
. . .
. . .

The **EQUIPMENT USED FOR TESTS** menu shows the equipment list for all tests and allows you to edit individual test equipment by accessing the **HPXXXX** menu. The equipment in this menu is dependent upon the test application being used.

Related Menus

- **EQUIPMENT USED**

EQUIPMENT USED FOR THIS TEST

<p>==== EQUIPMENT USED FOR THIS TEST ====</p>
<p>HPXXXX XXXXXAXXXX XXX</p> <p>. . .</p> <p>. . .</p> <p>. . .</p> <p>. . .</p>

The **EQUIPMENT USED FOR THIS TEST** menu shows the equipment used for the selected test. The equipment in this menu is dependent upon the test application being used. This list shows only the equipment corresponding to resolved tests. This menu allows you to edit individual test equipment by accessing the **HPXXXX** menu.

Related Menus

- **TEST LIST**

ETE ALTERNATIVES

<p>=== ETE ALTERNATIVES ===</p>
<p>HPXXXX</p> <p>.</p> <p>.</p> <p>.</p> <p>.</p>

Menu Reference

The **ETE ALTERNATIVES** menu shows a list of alternate test equipment that might be used in place of the one selected in the **EQUIPMENT NEEDED** menu. These alternatives are defined in the test application.

Related Menus

- **EQUIPMENT NEEDED**

FLOATING EQUIPMENT

===== FLOATING EQUIPMENT =====
12 MHZ LPF XXXXAXXXX NONE
HP436A XXXXAXXXX 713
. . .
. . .

The **FLOATING EQUIPMENT** menu is a list of test equipment that has not been assigned to a workstation. This menu accesses **VIEW/EDIT EQUIPMENT** and **DELETE EQUIPMENT** allowing you to view, edit, or delete the equipment shown.

Related Menus

- **EDIT EQUIPMENT**
- **SYSTEM ADMINISTRATION UTILITIES (EQUIPMENT)**

FLOPPY MSUSs

=== Floppy MSUSs ===
:,700,0
:,700,1

The **FLOPPY MSUSs** menu appears if flexible MSUSs have been predefined. It is accessed by selecting **EDIT DISK DRIVE LABELS** in the **MS EDIT MENU**.

Related Menus

- **MS EDIT MENU (EDIT DISK DRIVE LABELS)**

FORMAL REPORT

```
FORMAL REPORT
HEADER
INFORMATION
AREA

MODEL NUMBER: HPXXXXXXX TEST DATE: 02 JAN 1991
SERIAL NUMBER: XXXXAXXXX
OPTION: XXX

TEMPERATURE: 23.0 DEG C TEST PROGRAM REV.: A.00.00
HUMIDITY: 50.0% TEST PERFORMED BY:

CALIBRATION STANDARDS USED
-----
MODEL NO. SERIAL NO. ASSET NO. TRACE NO. CAL DUE DATE
-----
HPXXXX XXXXAXXXX XXXX XXXX 08 FEB 1991
```

The report shown above is printed on the report printer and is initiated by selecting **PRINT TEST REPORT** from the **MAIN MENU**.

Reports printed on the report printer are considered formal reports. The report printer might be a laser printer used to produce high quality test reports for a customer.

The page shown above appears in a formal report only. Note that the first four lines of this report are defined in the **EDIT REPORT FIELDS** menu. This header information area can be used to enter the name of your company.

Related Menus

- **CONFIGURATION (PRINTERS)**
- **EDIT REPORT FIELDS**
- **FORMATTING AND CONTROL OF REPORTS**

FORMATTING AND CONTROL OF REPORTS

=== FORMATTING AND CONTROL OF REPORTS ===
PRINT IMMEDIATE NO
PRINT MODE ALL
FIRST PAGE NUMBER 1
LINES PER PAGE 56
LEFT MARGIN 1
EDIT REPORT FIELDS

PRINT IMMEDIATE toggles from **YES** to **NO**. If it is set to **YES**, informal test reports are printed on the segment printer immediately after testing is completed. If set to **NO**, informal test reports are not printed until **REPORT** is selected from the following menu:

NEXT TEST
REPEAT TEST
REPORT
EQUIP USED
CONFIG
EXIT

Formal test reports are not printed on the report printer until **PRINT TEST REPORT** is selected from the Main Menu.

PRINT MODE allows the following print option selections:

PRINT ALL TESTS prints all test segments on the segment printer.

PRINT FAILING TESTS prints only the tests that have failed. These tests are printed on the segment printer.

PASS/FAIL

STATUS ONLY prints only the status report and excludes the test detail. The pass/fail status is printed on the segment printer.

FIRST PAGE

NUMBER sets the first page number of the test report. This feature is specific to the report printer used for formal reports.

LINES PER PAGE sets the number of lines to print on a page of the test report. You can print from 1 to 56 lines per page.

LEFT MARGIN sets the width of the test report's left-hand margin. The unit of measure is "spaces".

EDIT REPORT

FIELDS accesses the **EDIT REPORT FIELDS** menu that is used to enter up to four lines of information at the top of the header page of a formal report (that is, a report printed on the report printer that is initiated by selecting **PRINT TEST REPORT** in the **MAIN MENU**). Up to 66 characters may be entered in each line.

NOTE

The header information does not appear in reports printed on the segment printer.

Related Menus

- **CONFIGURATION (PRINTERS)**
- **EDIT REPORT FIELDS**
- **OPERATING FEATURES (REPORTS)**

HPXXXX

Allows editing of specific test equipment data, such as serial number and address.

===== HPXXXX =====
SERIAL NUMBER
ADDRESS TYPE HP-IB
ADDRESS 700

Menu Reference

```

===== HPXXXX =====
OPTIONS
CAL DUE DATE 02 JAN 1991
COMMENT
    
```

SERIAL NUMBER is selected to review or edit the serial number of the test equipment currently chosen.

ADDRESS TYPE specifies **HP-IB**, **NONE**, or **OTHER** as the address type. The address type is dependent upon the test equipment.

ADDRESS accesses **SEARCH FOR ADDRESS** and **TYPE IN ADDRESS**. Either the program enters the test equipment's address or you enter the address.

OPTIONS allows entry of test equipment options. If options are already stored in the program, the **OPTIONS** menu appears listing these options.

Select **OPTIONS** to display the **OPTIONS MENU** where you can **ADD**, **REMOVE**, or **EDIT** options information. Enter option numbers one at a time.

CAL DUE DATE accesses the following message:

```

Is this instrument a calibration standard?
YES NO
    
```

Select **YES** if the model chosen from the previous menu is a calibration standard. Then, enter the calibration due date. Select **NO** if the test equipment is not a calibration standard.

If **VERIFY CAL DUE DATES**, in the **ADMINISTRATOR FEATURES** menu, is set to **YES**, the program will automatically prompt you when a piece of test equipment is overdue for calibration.

COMMENT allows entry of comments about the specific piece of test equipment.

Related Menus

- **EQUIPMENT NEEDED**
- **ETE ALTERNATIVES**
- **EQUIPMENT USED FOR THIS TEST**

INSTRUMENT INFORMATION

=== INSTRUMENT INFORMATION ===
MODEL NUMBER HP...
SERIAL NUMBER
ADDRESS TYPE HP-IB
ADDRESS 700
STATION
OPTIONS
AVAILABILITY AVAILABLE
CAL DUE DATE 02 JAN 1991
COMMENT

MODEL NUMBER allows model number editing of the currently selected piece of test equipment.

SERIAL NUMBER is selected to review or edit the serial number of the test equipment currently chosen.

ADDRESS TYPE specifies **HP-IB**, **NONE**, or **OTHER** as the address type. The address type is dependent upon the test equipment.

ADDRESS accesses **SEARCH FOR ADDRESS** and **TYPE IN ADDRESS**. Either the program enters the test equipment's address or you enter the address.

STATION accesses the **STATION ID** menu if workstation names are defined. Scroll to the workstation name desired, select it, and the workstation title will appear in the **INSTRUMENT INFORMATION** menu.

OPTIONS allows entry of test equipment options. If options are already stored in the program, the **OPTIONS** menu appears, listing these options.

Select **OPTIONS** to display the **OPTIONS MENU** where you can **ADD**, **REMOVE**, or **EDIT** options information. Enter option numbers one at a time.

AVAILABILITY toggles between **MISSING** or **AVAILABLE**. Select **AVAILABLE** if the instrument is available for use as a piece of test equipment. Otherwise, select **MISSING** to free the instrument for other workstations to use.

Menu Reference

CAL DUE DATE accesses the following message:

**Is this instrument a calibration standard?
YES NO**

Select **YES** if the model chosen from the previous menu is a calibration standard. Then, enter the calibration due date. Select **NO** if the test equipment is not a calibration standard.

NOTE

If **VERIFY CAL DUE DATES**, in the **ADMINISTRATOR FEATURES** menu, is set to **YES**, the program will automatically prompt you when a piece of test equipment is overdue for calibration.

COMMENT allows entry of comments about the specific piece of test equipment.

Related Menus

- **EDIT EQUIPMENT**
- **FLOATING EQUIPMENT**
- **MODEL SERIAL ADDR**
- **STATION ID**
- **SYSTEM ADMINISTRATION UTILITIES**

MAIN MENU

```
===== MAIN MENU =====  
  
TEST UUT  
  
PRINT TEST REPORT  
  
VIEW/EDIT UUT INFORMATION  
  
NEW UUT (SAME MODEL NUMBER)  
  
NEW MODEL NUMBER  
  
VIEW/EDIT EQUIPMENT USED  
  
VIEW/EDIT CONFIGURATION  
  
VIEW APPLICATION NOTES  
  
QUIT
```

TEST UUT accesses either the **UUT SELECTIONS** menu or the **TEST MENU** depending on whether or not UUT information has been entered previously.

For example, when selecting **TEST UUT** for the first time, the **UUT SELECTIONS** menu appears allowing you to access the **UUT:XXXXXXXX** menu where you can enter pertinent information about the specific UUT. Then, if you return to the **MAIN MENU** and select **TEST UUT** again, the **TEST MENU** appears allowing you to bypass the entry of UUT information.

PRINT TEST REPORT allows you to control which reports are printed, the number of test reports printed, and whether to use the CRT, local printer, or SRM spooler as the report printer.

NOTE

Reports initiated by selecting **PRINT TEST REPORT** are output to the report printer. The report printer differs from the segment printer; the report printer is used for formal reports while the segment printer is used for informal reports. Also, the header page, found only in a formal report, will show the information defined in the **EDIT REPORT FIELDS** menu. This information appears at the top of the header page.

The following menu appears:

INDIVIDUAL SEGMENTS
ALL SEGMENTS
OUTPUT DEVICE CRT
REPORT FORMAT TABULAR
NUMBER COPIES 1

INDIVIDUAL SEGMENTS accesses the **TEST SEGMENTS** menu that is a list of all tests. Select a test having the word **Passed** after it. This identifies the tests that have been run and that have test results available to print. If the word **Passed** does not appear after a test, a prompt appears indicating that the particular test was not run and there are no test results to print.

Menu Reference

ALL SEGMENTS prints all available test results. If a message appears stating that no equipment log file exists, it means that test reports have not been generated. The test-report file results from completing a test.

OUTPUT DEVICE Choose to identify where the test results are to be printed.

REPORT FORMAT accesses **TABULAR**, **GRAPHICS**, and **BOTH**.

TABULAR generates an output in a tabular format. **GRAPHICS** generates an output in a graphical format. **BOTH** provides both tabular and graphical types of output.

NUMBER COPIES selects the number of printed copies desired using the ↑ and ↓ keys.

VIEW/EDIT UUT

INFORMATION accesses the **UUT:XXXXXXXX** menu for review. Note that you cannot edit the serial number field here.

NEW UUT (SAME

MODEL NUMBER) accesses the **UUT SELECTIONS** menu. This selection allows you to enter information about an instrument having the same model number as the currently loaded UUT. The CTM differentiates between instruments of the same model number by their unique serial number.

**NEW MODEL
NUMBER**

accesses the **SPECIFIC MODEL?** menu allowing you to select another MUT to test. This selection displays the model numbers supported by the currently loaded test application.

**VIEW/EDIT
EQUIPMENTUSED**

accesses the list of test equipment. If no test equipment is currently assigned, the following message appears:

Sorry...equipment has not been assigned for the UUT yet. Select ASSIGN EQUIP to build the equipment list.

NEVER MIND returns you to the **MAIN MENU**.

ASSIGN EQUIP accesses the **UUT:XXXXXXXX** menu. Enter the serial number, verify whether a controller is required, and enter any other pertinent information into the data fields.

VIEW/EDIT

CONFIGURATION accesses the **CONFIGURATION** menu. You can modify the user interface, printer information, redirect the MSVS, or access the **SYSTEM ADMINISTRATION UTILITIES** menu.

VIEW APPLICATION NOTES

accesses the **MUT INFORMATION** menu. Use this selection to access application notes or data sheets specific to the UUT.

QUIT

exits the CTM. By exiting using this selection, the program frees allocated equipment and runs through proper exit routines. The following message appears:

Quit the Test Executive Program? YES NO

Related Menus

- **CONFIGURATION**
- **EQUIPMENT USED**
- **MUT INFORMATION**
- **SPECIFIC MODEL**
- **TEST MENU**
- **UUT SELECTIONS**

MODEL SELECTIONS

```
=== MODEL SELECTIONS ===  
  
EMI_RECEIVERS  
  
HI_PERF  
  
HP71100A  
  
HP71200A
```

Menu Reference

The **MODEL SELECTIONS** menu is a listing of SRM or HFS directories containing specific MUTs to test. (These directory names were predefined when installing the test application.) The **MODEL SELECTIONS** menu is accessed by selecting **PURGING UTILITY** from the **SYSTEM ADMINISTRATION UTILITIES** menu.

From this menu, select the model number (or name) of the directory containing the UUTs of interest. The **UUT SELECTIONS** menu appears showing a listing of serial numbers corresponding to the specific UUTs. Select the appropriate serial number to purge, or purge all UUTs.

This menu can also be accessed by selecting **NEW MODEL NUMBER** from the **MAIN MENU**. It is used here to enter a new model number to test.

Related Menus

- **SYSTEM ADMINISTRATION UTILITIES (PURGING UTILITY)**

MODEL SERIAL ADDR

= MODEL SERIAL ADDR =
12 MHZ LPF NONE
HP436A 2512A22448 713
. . .
. . .
. . .
. . .

The **MODEL SERIAL ADDR** menu is accessed by selecting **EDIT ALL EQUIPMENT** from the **EDIT EQUIPMENT** menu. You can select any of the model numbers listed to edit their information in the **INSTRUMENT INFORMATION** menu.

Related Menus

- **EDIT EQUIPMENT (EDIT ALL EQUIPMENT)**
- **INSTRUMENT INFORMATION**

MS EDIT MENU

===== MS EDIT MENU =====
Edit MSVSs & Directory Paths
Edit Disc Drive Labels
Store MS Table
Load MS Table

Edit MSVSs & Directory Paths accesses the **VOLUMES** menu that allows you to modify directory and MSVS path information.

Edit Disc Drive Labels modifies the flexible-disk labels or directory paths when using the CTM in a flexible-disk environment.

If you are using an SRM or HFS system, the following message appears:

No flexible MSVSs currently defined OK

Store MS Table stores the **MS EDIT MENU** information after you finish editing.

Load MS Table loads the predefined mass storage table.

Related Menus

- **CONFIGURATION (MASS STORAGE)**
- **SYSTEM ADMINISTRATION UTILITIES (MASS STORAGE)**

MUT INFORMATION

=== MUT INFORMATION ===
READ ME
DATA SHEET

READ ME retrieves any **READ_ME** files that are available for the UUT.

Menu Reference

VIEW ON CRT or **PRINT** selects where you want the information presented.

If **READ_ME** files are not available, the following message appears:

**Failed attempt to access file READ_ME
REPEAT ABORT**

Select **REPEAT** if you want the program to look again. If **ABORT** is selected and the requested **READ_ME** file is not found, the following message appears:

The READ_ME doesn't seem to exist OK

Refer to the prompt below the screen to continue.

DATA SHEET retrieves any **DATA_SHEET** files that are available for the UUT.

VIEW ON CRT or **PRINT** selects where you want the information presented.

If **DATA_SHEET** files are not available, the following message appears:

**Failed attempt to access file DATA_SHEET
REPEAT ABORT**

Select **REPEAT** if you want the program to look again. If **ABORT** is selected and the requested **DATA_SHEET** file is not found, the following message appears:

The DATA_SHEET doesn't seem to exist OK

Refer to the prompt below the screen to continue.

Related Menus

- **MAIN MENU (VIEW APPLICATION NOTES)**

OPERATING FEATURES

=== OPERATING FEATURES ===
USER INTERFACE
REPORTS
ADMINISTRATOR FEATURES

USER INTERFACE accesses the **USER INTERFACE CONFIGURATION** menu. This allows you to modify the program's interactive interface.

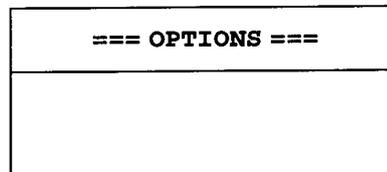
REPORTS accesses the **FORMATTING AND CONTROL OF REPORTS** menu. This allows you to modify the content and style of the test reports output.

ADMINISTRATOR FEATURES accesses the **ADMINISTRATOR FEATURES** menu. This allows you to access the program control features.

Related Menus

- **ADMINISTRATOR FEATURES**
- **CONFIGURATION (OPERATING FEATURES)**
- **FORMATTING AND CONTROL OF REPORTS**
- **SYSTEM ADMINISTRATION UTILITIES (CONFIGURATION)**
- **USER INTERFACE CONFIGURATION**

OPTIONS



The **OPTIONS** menu is accessed by selecting **OPTIONS** from either the **HPXXXX** or **INSTRUMENT INFORMATION** menu. Use the **ADD**, **REMOVE**, or **EDIT** selections in the **OPTION MENU** to enter appropriate information for your piece of test equipment.

Related Menus

- **HPXXXX (OPTIONS)**
- **INSTRUMENT INFORMATION (OPTIONS)**
- **OPTION MENU**

OPTION MENU

=== OPTION MENU ===
ADD
REMOVE
EDIT

ADD allows you to add an option. Select **ADD** and type the desired option number.

REMOVE allows you to remove an option. First, select the desired option number in the **OPTIONS** menu. Then, select **REMOVE** in the **OPTION MENU**.

EDIT allows you to edit an option number shown in the **OPTIONS** menu. First, select the desired option number in the **OPTIONS** menu. Then, select **EDIT** and enter corrections using the editing features on your keyboard.

Related Menu

- **HP:XXXX (OPTIONS)**
- **INSTRUMENT INFORMATION (OPTIONS)**
- **OPTIONS**

PERFORMANCE TEST DATA (Informal Report)

PERFORMANCE TEST DATA	
PAGE 01	

REPORT NUMBER:	TEST DATE: 02 JAN 1991
MODEL NUMBER:	HPXXXX
SERIAL NUMBER:	XXXXAXXXXX

The report shown above is printed on the segment printer and is initiated by selecting **REPORT** from the menu shown below.

NEXT TEST
REPEAT TEST
REPORT
EQUIP USED
CONFIG
EXIT

Another method of initiating this report is by setting **PRINT IMMEDIATE**, in the **FORMATTING AND CONTROL OF REPORTS** menu, to **YES**. The test results will then be automatically sent to the segment printer after each test is completed.

Reports printed on the segment printer are considered informal reports. These reports might be used to produce test results on a line printer for immediate evaluation by the technician performing the tests.

Related Menus

- **CONFIGURATION (PRINTERS)**
- **FORMATTING AND CONTROL OF REPORTS**

SELECT HPXXXX

=== SELECT HPXXXX ===
HPXXXXA XXXXAXXXXX
NONE OF THE ABOVE

The **SELECT HPXXXX** menu appears if more than one instrument of the same model number exists in the equipment list. This menu allows you to select the desired instrument or proceed to the **HPXXXX** menu to define one not currently on the equipment list.

Related Menus

- **ETE ALTERNATIVES**
- **HPXXXX**

SET-UPS FOR XXXX TEST

=== SET-UPS FOR XXXX TEST ===
SET-UP_1
SET-UP_2

The **SET-UPS FOR XXXX TEST** menu appears if more than one setup exists for a test. Selecting a set-up will access the **EQUIPMENT NEEDED** menu.

Related Menus

- **TEST LIST**

SPECIFIC MODEL?

=== SPECIFIC MODEL? ===
HP8566A
HP8566B
.
.
.
.

The **SPECIFIC MODEL?** menu is a list of specific UUTs to test and is test application dependent. If there is only one model number supported by the test application, this menu will not appear. This menu is accessed by selecting a model (directory) from the **MODEL SELECTIONS** menu.

NOTE

The **MODEL SELECTIONS** menu appears when operating from SRM or HFS. This menu will not appear when operating from flexible disk.

Related Menus

- **MAIN MENU (NEW MODEL NUMBER)**

SRM SPOOLERS

```
===== SRM SPOOLERS=====
/SPOOLER/TEMP
XXXX
```

The **SRM SPOOLERS** menu is a list of SRM spooler directory paths. This menu can be used to add, edit, or delete SRM spooler path information.

- ADD** adds another SRM spooler directory path to the program.
- EDIT** allows you to change SRM spooler directory path information that was previously assigned.
- DELETE** removes an assigned SRM spooler directory path from the list.

Related Menus

- **SYSTEM ADMINISTRATION UTILITIES (SRM SPOOLERS)**

STATION DIRECTORY

```
= STATION DIRECTORY =
XXXXX : ,700,0
```

The **STATION DIRECTORY** menu displays the currently active workstation (the one you chose in the **SYSTEM ADMINISTRATION UTILITIES** menu). Select the workstation if you want to change the workstation name or directory information. Once you have edited the information, refer to the prompt below the screen to exit the menu.

Related Menus

- **EDIT STATIONS TABLE (EDIT STATIONS)**

STATION ID

=== STATION ID ===
XXXXX
XXXXX

The **STATION ID** menu is a listing of workstations that have been defined using the **ADD NEW STATION** and **EDIT STATIONS** selections in the **EDIT STATIONS TABLE** menu.

NOTE

This menu will appear only if workstations have been predefined.

Related Menus

- **EDIT EQUIPMENT (EDIT EQUIPMENT BY STATION)**
- **INSTRUMENT INFORMATION (STATION)**

SYSTEM ADMINISTRATION UTILITIES

=== SYSTEM ADMINISTRATION UTILITIES ===
EQUIPMENT
CONFIGURATION
STATIONS
MASS STORAGE
SRM SPOOLERS
PURGING UTILITY

EQUIPMENT accesses the **EDIT EQUIPMENT** menu. The **EDIT EQUIPMENT** menu is used to edit, add, print, and store test equipment information.

CONFIGURATION accesses the **OPERATING FEATURES** menu. The **OPERATING FEATURES** menu is used to configure the user interface, reports, and certain administrator features.

STATIONS accesses the **EDIT STATIONS TABLE** menu. The **EDIT STATIONS TABLE** menu is used to edit workstation name or directory path information, add a new workstation name and directory path, and store the information.

MASS STORAGE accesses the **MS EDIT MENU**. The **MS EDIT MENU** is used to perform mass storage operations.

SRM SPOOLERS accesses the **SRM SPOOLERS** menu. The **SRM SPOOLERS** menu can be used to add, edit, or delete SRM spooler path information.

PURGING UTILITY accesses the **MODEL SELECTIONS** menu. The **MODEL SELECTIONS** menu is used to select the directory where specific UUTs reside. Then, you can select the desired UUT(s) to purge.

Related Menus

- **EDIT EQUIPMENT**
- **EDIT STATIONS TABLE**
- **MODEL SELECTIONS**
- **MS EDIT MENU**
- **OPERATING FEATURES**
- **SRM SPOOLERS**

TEST LIST

```
===== TEST LIST =====  
XXXXX XXXXX XXXXX OK  
.  
.  
.
```

The **TEST LIST** menu is a list of tests corresponding to the currently loaded test application. At this point, the desired test is selected. The test application will then be in control. However, if the equipment list in the CTM is not accurate or has not been set up to meet the needs of the particular test application, you will be prompted to resolve these equipment needs. Each test application routine handles the equipment assignment as appropriate for its design.

Related Menus

- **TEST MENU (RUN/VIEW TESTS)**

TEST MENU

===== TEST MENU =====
RUN/VIEW TESTS
RUN/VIEW/EDIT SEQUENCES
DEFINE NEW TEST SEQUENCE

RUN/VIEW TESTS accesses the **TEST LIST** menu. The **TEST LIST** menu is a list of tests corresponding to the currently loaded test application. At this point, the desired test is selected. The test application will then be in control. However, if the equipment list in the CTM is not accurate or has not been set up to meet the needs of the particular test application, you will be prompted to resolve these equipment needs. Each test application routine handles the equipment assignment as appropriate for its design.

RUN/VIEW/EDIT SEQUENCES accesses the **TEST SEQUENCES** menu. This is a list of predefined test sequences. You can run the sequence of tests, or you can review, edit, or add to the sequence. If no sequences have been defined, the following message appears:

No test sequences have been defined yet.OK

DEFINE NEW TEST SEQUENCE accesses the **TYPE IN SEQUENCE NAME** menu that is used to create a test sequence. After entering a sequence name, the **TEST LIST** menu is accessed for you to select test names and thus create a test sequence.

Related Menus

- **MAIN MENU (TEST UUT)**
- **TEST SEQUENCE**
- **TYPE IN SEQUENCE NAME**

TEST SEGMENTS

==== TEST SEGMENTS ====
XXXXX XXXXX XXXXX
.
.
.
.

The **TEST SEGMENTS** menu is a list of all tests. Select a test having the word **Passed** after it. The word **Passed** identifies the tests that have been run and that have test results available to print. If the word **Passed** does not appear after a test, a prompt appears indicating that the particular test was not run and there are no test results to print.

Related Menus

- **MAIN MENU (PRINT TEST REPORT)**

TEST SEQUENCES

=== TEST SEQUENCES ===
SAMPLE SEQUENCE 1
SAMPLE SEQUENCE 2

The **TEST SEQUENCES** menu is a list of predefined test sequences that can be run, viewed, or edited. These test sequences were defined using the **DEFINE NEW TEST SEQUENCE** selection from the **TEST MENU**.

Related Menus

- **TEST MENU (RUN/VIEW/EDIT SEQUENCES)**

TYPE IN SEQUENCE NAME

=== TYPE IN SEQUENCE NAME ===
SAMPLE SEQUENCE 3

The **TYPE IN SEQUENCE NAME** menu is accessed by selecting **DEFINE NEW TEST SEQUENCE** from the **TEST MENU**. The **TYPE IN SEQUENCE NAME** is used to enter a name for a new sequence, and also to enter the desired test sequence from the **TEST LIST** menu by using **ADD TEST**, **INSERT TEST**, or **DELETE TEST**.

Related Menus

- **TEST MENU (DEFINE NEW TEST SEQUENCE)**

USER INTERFACE CONFIGURATION

== USER INTERFACE CONFIGURATION ==
FLAG OPERATOR WITH BEEP NO
LOOP SEQUENCE NO
REPEAT ON FAIL NO
PAUSE ON FAIL NO
MAXIMUM REPEATS 3
CONTINUE DELAY 9.00
OPERATING MODE STANDARD
ASSIGN EQUIP PRIOR TO TESTING YES
SHOW EQUIP BEFORE EACH TEST YES

FLAG OPERATOR

WITH BEEP toggles from **YES** to **NO**. Set to **YES** if you wish the program to beep. Disable this feature by setting it to **NO**.

LOOP SEQUENCE toggles from **YES** to **NO**. If set to **YES**, the program loops back to repeat the tests in a sequence as many times as you determine in **MAXIMUM REPEATS** setting that follows in this menu. Disable this feature by setting it to **NO**.

REPEAT ON FAIL toggles from **YES** to **NO**. If set to **YES**, the program repeats tests that have failed. The number of repeats is determined by the **MAXIMUM REPEATS** setting that follows in this menu. Disable this feature by setting it to **NO**.

PAUSE ON FAIL toggles from **YES** to **NO**. If set to **YES**, the program pauses after a failed test and does not continue with other tests in a sequence until it is commanded by you to continue. Disable this feature by setting it to **NO**.

MAXIMUM REPEATS determines the number of times the program loops back to repeat tests in a test sequence.

CONTINUE DELAY sets the number of seconds you want the program to delay after each test is completed. The minimum number of seconds is 10; the maximum number of seconds is 999.99.

OPERATING MODE selects **STANDARD**, **DEMONSTRATION**, or **TRAINING** operating modes. For routine use, select **STANDARD**. Select **DEMONSTRATION** or **TRAINING** if the program is to be used in either of these situations.

ASSIGN EQUIP PRIOR TO TESTING toggles from **YES** to **NO**. If set to **YES**, the test equipment is assigned by the program before entering the **TEST MENU**. If set to **NO**, the program assigns test equipment when you select a test from the **TEST LIST**.

SHOW EQUIP BEFORE EACH TEST toggles from **YES** to **NO**. If set to **YES**, the **EQUIPMENT USED FOR THIS TEST** menu is displayed before the test begins. If set to **NO**, the test begins without displaying the **EQUIPMENT USED FOR THIS TEST** menu.

Related Menus

- **OPERATING FEATURES (USER INTERFACE)**
- **SYSTEM ADMINISTRATION UTILITIES (CONFIGURATION)**

UUT OPTIONS

===== UUT OPTIONS =====
001 NO 75 OHM INPUT
. . .
. . .
. . .
. . .

The **UUT OPTIONS** menu is accessed by selecting **OPTIONS** in the **UUT:XXXXXXXX** menu. This menu is used to enable the applicable options. This is done by first selecting the desired option, then setting **NO** to **YES**.

The UUT options are test application dependent and cannot be edited here.

Related Menus

- **UUT:XXXXXXXX (OPTIONS)**

UUT SELECTIONS

=== UUT SELECTIONS ===
NEW/UNTESTED UUT
TEST OLD UUT

NEW/UNTESTED

UUT accesses the **UUT:XXXXXXXX** menu where applicable information about a new UUT can be entered.

TEST OLD UUT appears only when the CTM is operated from flexible disk. If **TEST OLD UUT** is selected, the last entered UUT information on flexible disk is loaded.

When operating from SRM or HFS, serial numbers for previously tested UUTs appear in place of **TEST OLD UUT**.

Related Menus

- **MAIN MENU (TEST UUT or NEW UUT (SAME MODEL NUMBER))**

The following **UUT SELECTIONS** menu is accessed by first selecting **PURGING UTILITY** in the **SYSTEM ADMINISTRATION UTILITIES** menu, then any selection in the **MODEL SELECTIONS** menu.

=== UUT SELECTIONS ===
US36450110
2730A00427
.
.
.

This menu allows you to either purge the selected UUT using **PURGE SELECTED UUT**, or purge all UUTs using **PURGE ALL UUTS**.

Related Menus

- **MODEL SELECTIONS**
- **SYSTEM ADMINISTRATION UTILITIES (PURGING UTILITY)**

UUT:XXXXXXXX

=== UUT:XXXXXXXX ===
SERIAL NUMBER
TECH ID
OPTIONS
ADDRESS TYPE HP-IB
ADDRESS 718
CONTROLLER
DATE 02 JAN 1991
TEMPERATURE 23.0 DEG C
HUMIDITY 50.0%
LINE FREQUENCY 60 Hz
COMMENTS

SERIAL NUMBER allows UUT serial number entry.

Menu Reference

TECH ID is used if you wish to enter your identification.

OPTIONS accesses the **UUT OPTIONS** menu. Select **OPTIONS** if the UUT you are testing has options. Select the options that are appropriate for your UUT.

ADDRESS TYPE specifies **HP-IB**, **NONE**, or **OTHER** as the address type. The address type is dependent upon the test equipment.

ADDRESS accesses **SEARCH FOR ADDRESS** and **TYPE IN ADDRESS**. Either the program enters the test equipment's address or you enter the address.

CONTROLLER accesses either the message

It seems that a controller is not needed for this UUT.OK

or a data-entry field for you to type in the controller information as shown below.

<p>===== HPXXXX =====</p>
<p>SERIAL NUMBER</p> <p>ADDRESS TYPE HP-IB</p> <p>ADDRESS 700</p> <p>CAL DUE DATE 02 JAN 1991</p> <p>COMMENT</p>

DATE allows entry of the instrument's test date.

TEMPERATURE allows the temperature value to be changed. Select, then use the cursor keys (↑, ↓) to change the temperature value.

HUMIDITY allows the humidity value to be changed. Select, then use the cursor keys (↑, ↓) to change the humidity value.

LINE FREQUENCY allows the selection of either 60 Hz, 50 Hz, or 400 Hz as appropriate for your power-line frequency.

COMMENTS allows comments to be entered. The content here is optional and does not appear on test reports. Refer to the prompt at the bottom of the screen to exit this menu.

Related Menus

- **MAIN MENU (VIEW/EDIT UUT INFORMATION)**
- **UUT SELECTIONS**

VOLUMES

==== VOLUMES ====
MUT (S)
RESULT (S)
SYSTEMS
WORKSTATIONS
SYSTEM CAL
SYSTEMS TEMP
MUT TEMP
UUT TEMP
SCRATCH TEMP
MUT
RESULTS

The selections in the **VOLUMES** menu allow you to modify directory and MSVS path information.

NOTE

The term “volumes” means labels that the CTM uses to manage its operating information. This information might include such things as calibration-data files, test-software files, or test-results files.

When the program prompts you for the **VOLUME**, it expects to receive keyboard input for the directory path, when appropriate, and the mass storage volume specifier (MSVS). Here are some examples of accessing volumes that might be used:

The directory name and MSVS for a volume called MUTS using a local disk drive might be **:CS80,700,0**.

To locate the MUTS volume on an HFS formatted disk, it might be **/CTM/ MUTS:CS80,700,0**.

To locate the MUTS volume on an SRM system, it might be found at **/CTM/ MUTS:REMOTE 21,0**.

Menu Reference

When you select one of the volume labels listed in the **VOLUMES** menu, a data-entry field appears expecting the directory name (path), if appropriate, and **MSVS**. A directory name specifies a directory of files on a hierarchically structured mass storage volume.

Select any of the volumes labels listed in the menu. The currently active directory path (for SRM or HFS systems) and **MSVS** is displayed in the data field. The following message appears:

Enter the directory path and MSVS

View or edit the information in this field.

When you have completed editing the volumes information, exit this menu as instructed by the prompt below the screen.

Related Menus

- **MS EDIT MENU (EDIT MSUSs & DIRECTORY PATHS)**

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