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HP 71500 Series

Installation and Verification



HP Part No. 70820-90070
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Caution The *caution* sign denotes a hazard. It calls attention to a procedure which, 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 The *warning* sign 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* sign until the indicated conditions are fully understood and met.

General Safety Considerations

Warning *Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.*

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

Warning **There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.**

Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

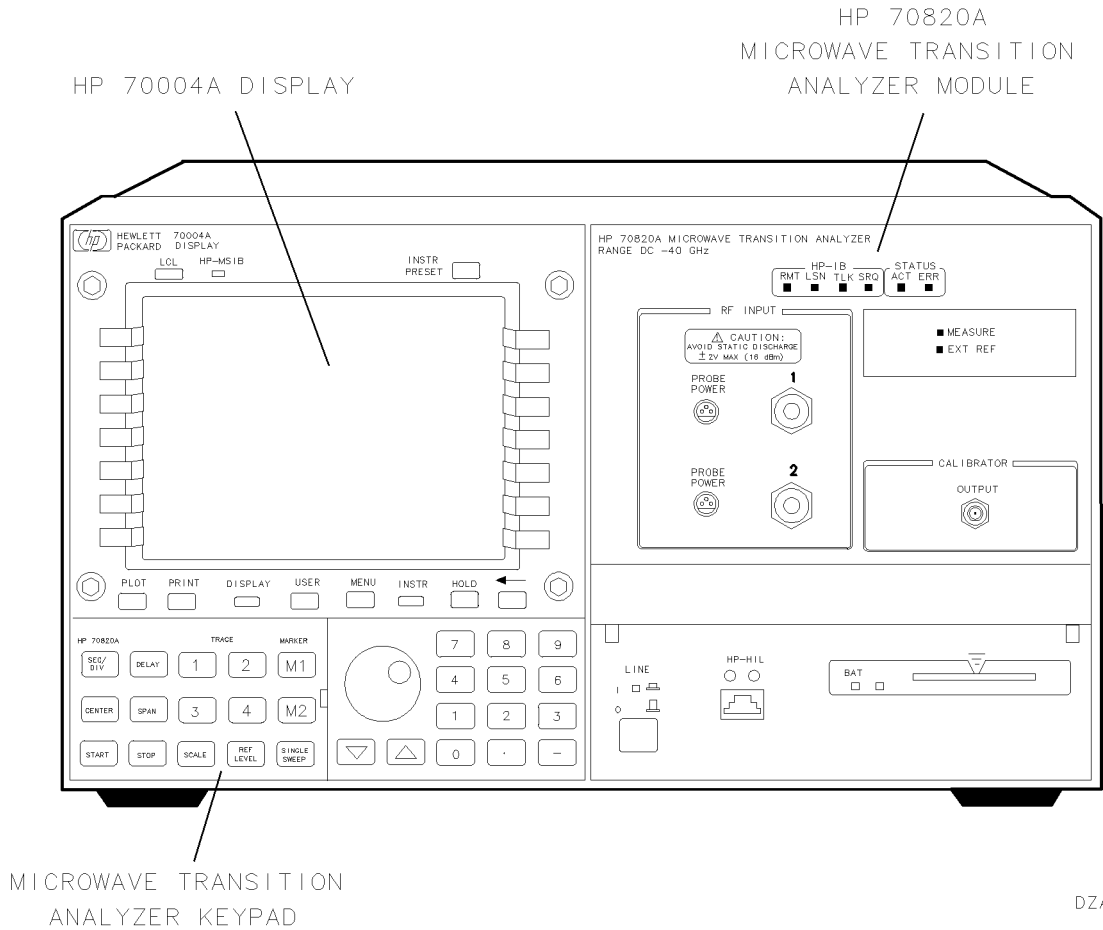
Caution *Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.*

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

Installation and Verification of the Microwave Transition Analyzer

HP 71500A Microwave Transition Analyzer System

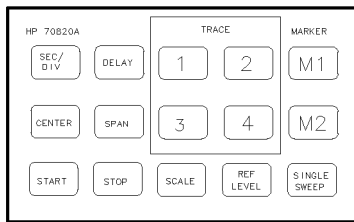
The HP 71500A microwave transition analyzer system is a preconfigured system that includes an HP 70820A microwave transition analyzer module, an HP 70004A color display/mainframe, and a microwave transition analyzer keypad. An external power pack is also shipped with the HP 71500A system and may be installed if desired. Installation instructions for the external power pack are provided in Chapter 1.



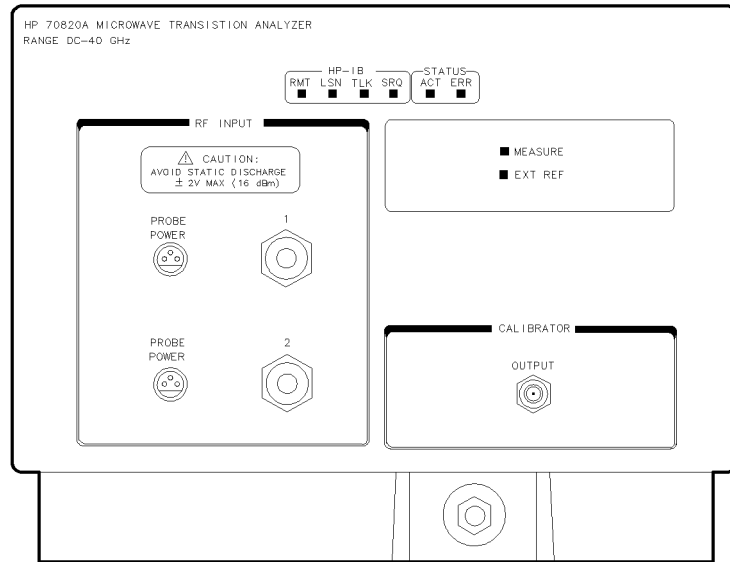
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HP 70820A Microwave Transition Analyzer Module

The HP 70820A microwave transition analyzer module is a 4/8-width module that must be installed into either an HP 70004A color display/mainframe or an HP 70001A mainframe. A microwave transition analyzer keypad is also shipped with the HP 70820A module. If you are using an HP 70004A color display/mainframe with the HP 70820A module, this keypad may be installed. Installation instructions for the microwave transition analyzer keypad are provided in Chapter 1. If you are using a black and white display (or no display at all), certain features (such as color) will not be available.



MICROWAVE TRANSITION
ANALYZER KEYPAD

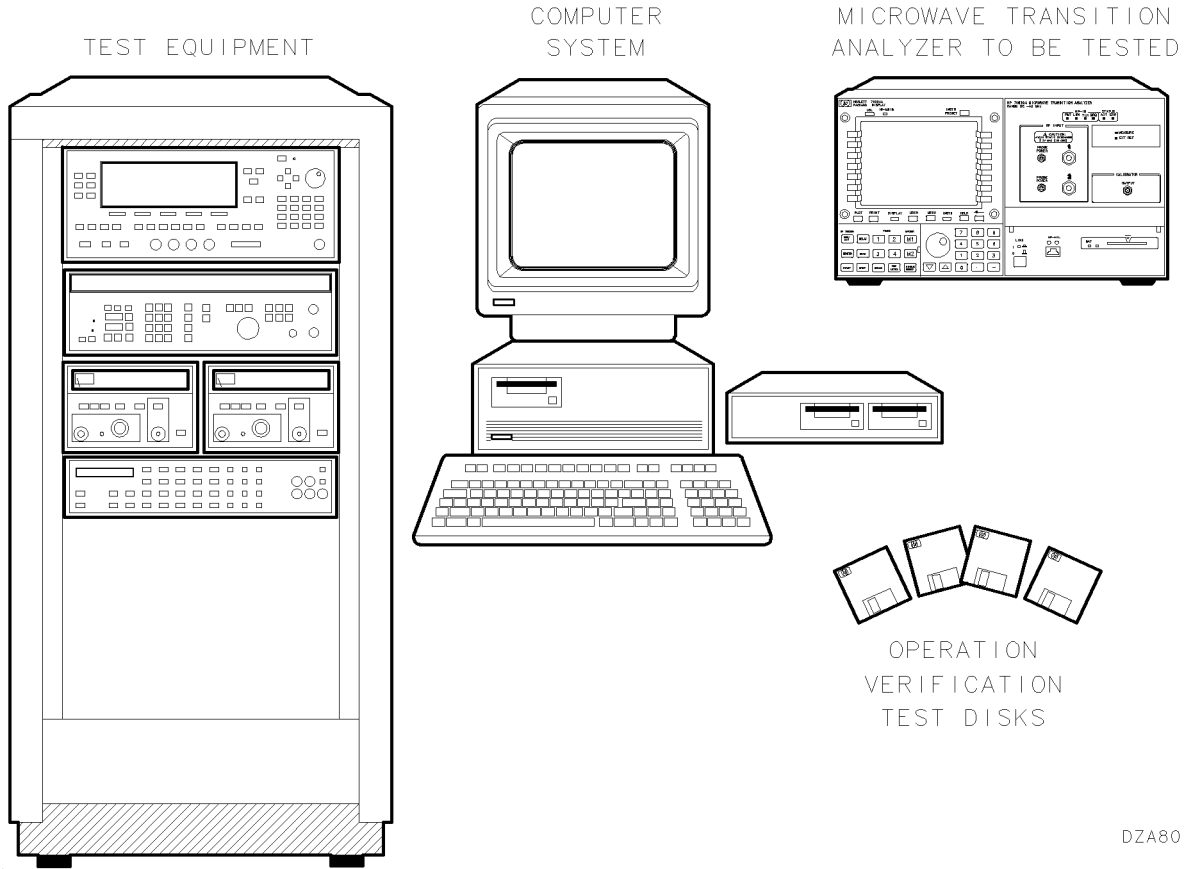


HP 70820A MICROWAVE
TRANSITION ANALYZER MODULE

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Operation Verification Tests

The operation verification tests are designed to give you an 80 percent confidence level that the microwave transition analyzer is operating correctly and meeting its specifications. Twenty one automated tests make up the operation verification tests. The operation verification test disks are shipped with the microwave transition analyzer. You will need a computer system and test equipment to perform the operation verification tests on the microwave transition analyzer.



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Caution

The RF INPUT circuits can be damaged by electrostatic discharge (ESD). Therefore, avoid applying static discharges to the front-panel RF INPUT connectors. Before connecting any coaxial cable to the connectors, momentarily short the center and outer conductors of the cable together. Avoid touching the front-panel RF INPUT connectors without first touching the frame of the instrument.

Be sure that the microwave transition analyzer is properly earth-grounded to prevent buildup of static charge.

In This Book

This book helps you install and verify the operation of the microwave transition analyzer. It provides step-by-step instructions of the installation and verification processes.

- Chapter 1 describes the HP 71500A microwave transition analyzer system, the HP 70820A microwave transition analyzer module, and the steps required to install both of these products. Several optional procedures for the microwave transition analyzers are also described in this chapter.
- Chapter 2 will help solve problems that may be encountered during the microwave transition analyzer's installation. A variety of problems that could be encountered during installation are identified. Each of these problems has a list of possible solutions to help correct the problem.
- Chapter 3 describes the steps involved in running the Operation Verification software. There are several steps required to get the Operation Verification tests running and several optional steps that will help to customize the software to your computer system.
- Chapter 4 contains information regarding the microwave transition analyzer's options and accessories, safety information, operation verification software details, and specific information regarding the operation verification tests.

Note

In this manual, normal front-panel keys are indicated in **boxed** letters. Softkeys are indicated by a **shadow** typeface.

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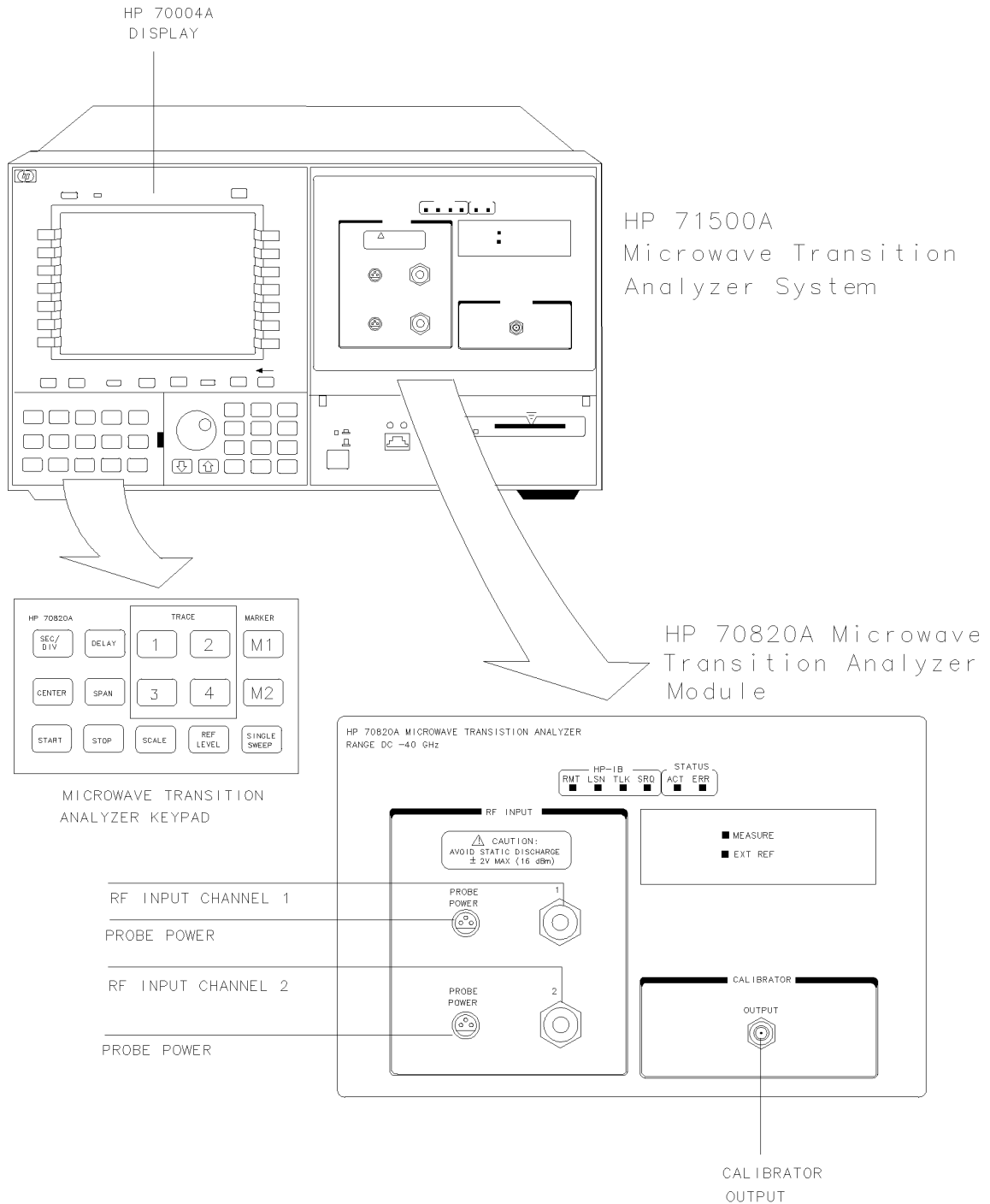
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Installation

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Installation at a Glance



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Installation at a Glance

The microwave transition analyzer is available as part of a preconfigured system or as a separate module that you can add to an existing system. The preconfigured system, the HP 71500A microwave transition analyzer system includes the HP 70820A microwave transition analyzer module installed in the HP 70004A Display. The HP 70820A microwave transition analyzer module may be installed in an existing HP 70004A Display or it may be installed in an HP 70001A Mainframe using another display or no display at all. Both models include a custom microwave transition analyzer keypad for use with the HP 70004A Display.

Tools Needed

No tools are required for the basic installation of the HP 71500A system. However, the HP 70820A module installation and the optional installation steps require these tools:

- An 8 mm hex ball driver for installing and removing modules.
- A nonconductive stylus, such as a toothpick or similar object, for setting address switches.
- A small Pozidriv screwdriver for installing the optional interlock kit.
- A large Pozidriv screwdriver for installing the optional external power pack and for mounting the microwave transition analyzer system into an equipment rack.
- A small flat-blade screwdriver for installing the microwave transition analyzer keypad in an HP 70004A display.

Installation Overview

The HP 71500A microwave transition analyzer system installation is straightforward. The system is preassembled at the factory and installation requires minimal time to complete. Optional installation steps, such as installing an external power pack, rack mounting the system, connecting the system to another display or mainframe, and setting the date and time are also included and may be used as desired. After installation, an RF source may be configured to the HP 71500A system.

The HP 70820A microwave transition analyzer module installation is more involved. The HP 70820A module installation procedures include several required and several optional steps. The required installation steps include:

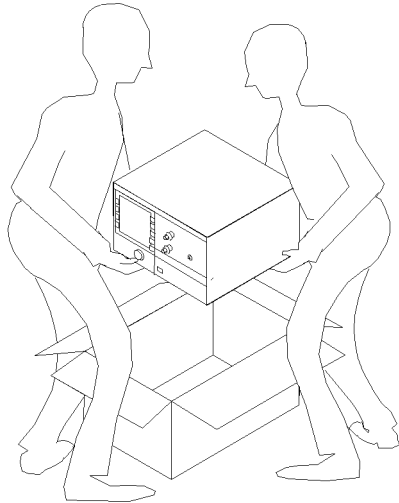
- Preparing to install the HP 70820A module.
- Checking the HP-MSIB address of the HP 70820A module.
- Checking the system's HP-MSIB addresses.
- Installing the HP 70820A module into a display or a mainframe.
- Configuring an RF source to the microwave transition analyzer.

The optional installation steps for the HP 70820A module include:

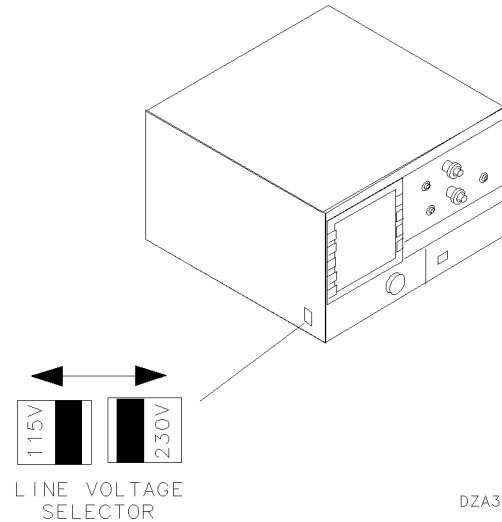
- Changing the HP-MSIB address of the HP 70820A module.
- Installing the microwave transition analyzer's keypad into the HP 70004A display.
- Installing the external power pack.
- Rack mounting the microwave transition analyzer system.
- Connecting the microwave transition analyzer system to another display or mainframe.
- Displaying and changing the time and date.

Installing the HP 71500A Microwave Transition Analyzer System

1 Unpack the HP 71500A microwave transition analyzer system from its shipping containers. Inspect the HP 71500A thoroughly to ensure that it was not damaged during shipment.



2 Set the line-voltage selector to the voltage corresponding to the power source used. The line-voltage selector is located on the left side of the microwave transition analyzer, near the front.



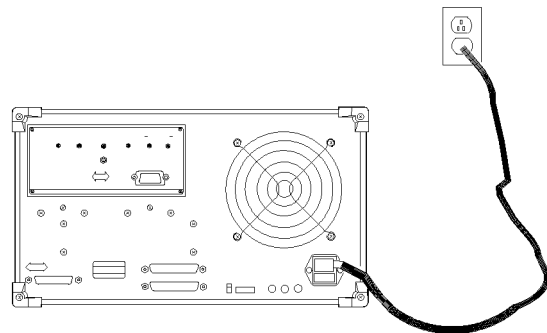
Caution



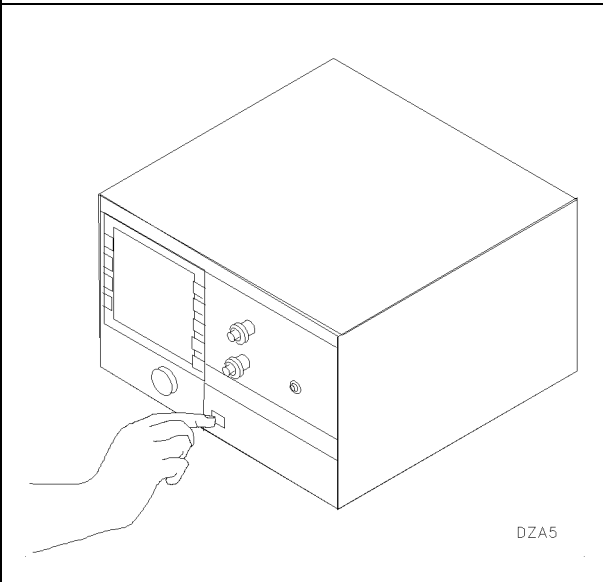
Before turning this instrument on, make sure the line-voltage selector is set to the voltage of the ac power source:

- 115 V position for 90 to 132 Vac line input voltages at 50, 60, or 400 Hz
- 230 V position for 198 to 264 Vac line input voltages at 50 or 60 Hz

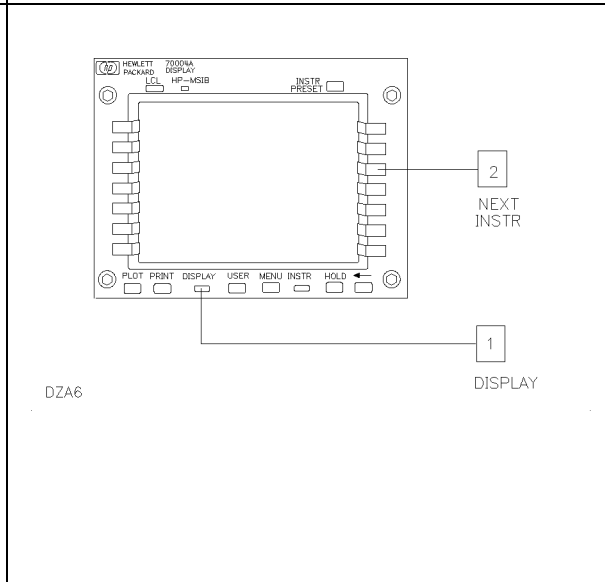
3 Connect the ac power cord to the rear of the microwave transition analyzer system. Then connect the other end of the ac power cord to the line voltage.



4 Press the microwave transition analyzer's front-panel **LINE** switch to turn the system on.



5 Press the **DISPLAY** key. Press the **NEXT INSTR** softkey.



If you want instructions for installing an external power pack, mounting the system in a rack, connecting the system to another display or mainframe, displaying the date and the time, or changing the date and the time, refer to the following optional installation steps:

- “Optional: Installing the External Power Pack” on page 1-20
- “Optional: Mounting the System in a Rack” on page 1-22
- “Optional: Connecting the Microwave Transition Analyzer System to Another Display or Mainframe” on page 1-24
- “Optional: Displaying the Time and the Date” on page 1-25
- “Optional: Changing the Time and the Date” on page 1-26

If you want to configure an RF source to your microwave transition analyzer, refer to “Configuring an RF Source to the Microwave Transition Analyzer” on page 1-6.

An RF source should be configured to your microwave transition analyzer to get the most from your microwave transition analyzer. Without configuring the RF source to the microwave transition analyzer, your measurements will be limited.

If you are ready to start making measurements, refer to the *HP 71500A/HP 70820A Microwave Transition Analyzer Quick Start Guide* to get started.

Configuring an RF Source to the Microwave Transition Analyzer

Step 1. Set Up the Frequency Reference

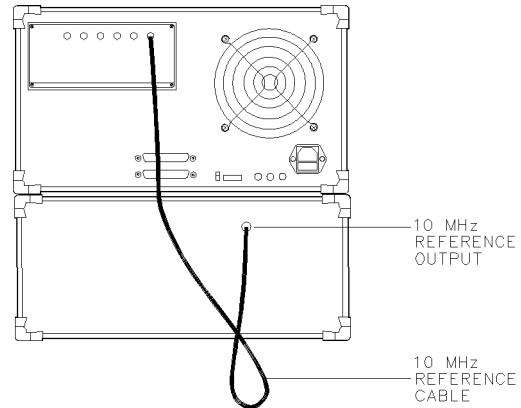
The microwave transition analyzer and RF source should use the same frequency standard. The microwave transition analyzer can be configured so that either the RF source's 10 MHz reference or the HP 70820A module's 10 MHz reference may be used as the frequency standard.

The HP 70820A module's 10 MHz reference is not kept warm when the microwave transition analyzer's power is turned off unless an external power pack is installed. The HP 70820A module's 10 MHz reference requires a minimum of 20 minutes to warm-up when the module is powered up.

If you want to use the RF source's 10 MHz reference as the frequency standard, perform only step 1 and step 3 on this page.

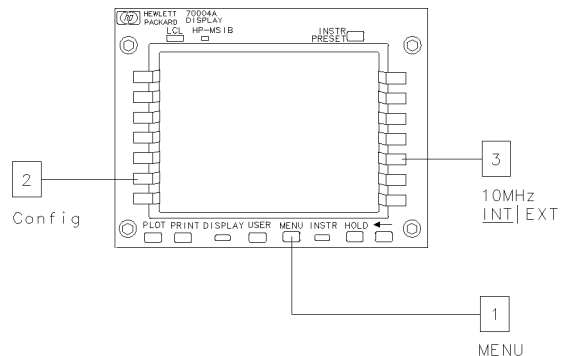
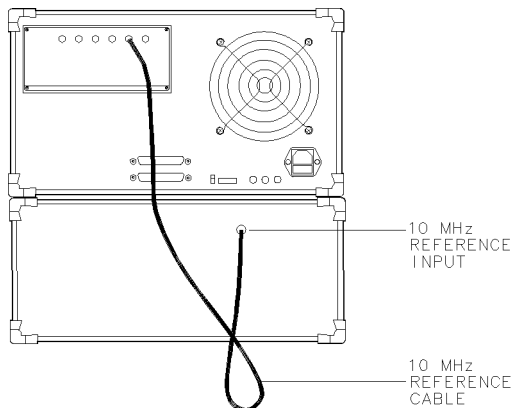
If you want to use the HP 70820A module's 10 MHz reference as the frequency standard, perform only step 2 and step 3 on this page.

1 Connect the 10 MHz reference cable from the RF source's 10 MHz reference output to the HP 70820A module's **10 MHz REFERENCE INPUT**. Continue at step 3 on this page.



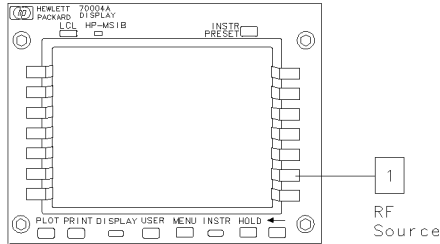
2 Connect the 10 MHz reference cable from the HP 70820A module's **10 MHz REFERENCE OUTPUT** to the RF source's 10 MHz reference input.

3 Press the **MENU** key. Then press the **Config** softkey. Press the **10 MHz INT|EXT** softkey until **EXT** is underlined if you are using the RF source's 10 MHz reference as the frequency standard or until **INT** is underlined if you are using the HP 70820A module's 10 MHz reference as the frequency standard.



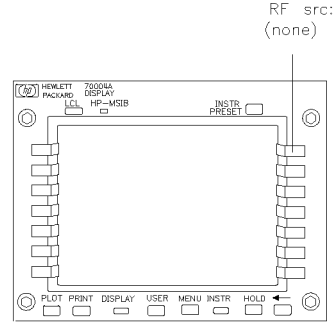
Step 2. Select the RF Source

1 Press the **RF source** softkey.



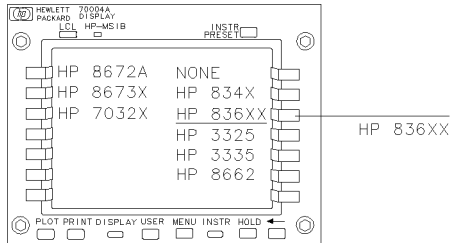
DZA65

2 Press the **RF src:** softkey. **RF src:** will be followed by the model number of the current RF source or the word **none** if an RF source has not been selected.



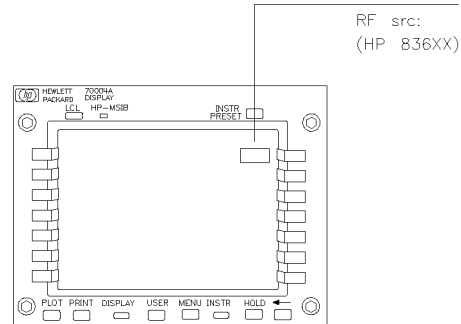
DZA9

3 Several model numbers of RF sources will be displayed on the display. Press the softkey adjacent to the model number of the RF source that is going to be used.



DZA66

The model number of the selected RF source will start to flash beneath **RF src:**. It will continue to flash until the RF source is properly configured to the microwave transition analyzer.



DZA13

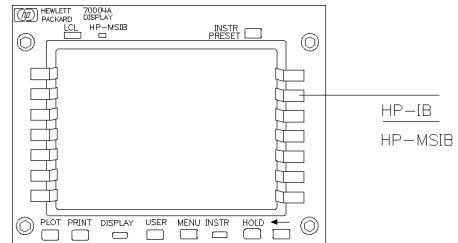
Step 3. Set Up the Instrument Bus

The microwave transition analyzer must use an instrument bus to control the RF source. Either an HP-IB or an HP-MSIB is used, depending on the type of bus that the RF source is equipped for. For RF sources that are equipped with both an HP-IB or an HP-MSIB, either bus may be used.

If you want to control the RF source using the HP-IB, perform step 1 and step 2 on this page.

If you want to control the RF source using the HP-MSIB, perform step 1 and step 3 on this page.

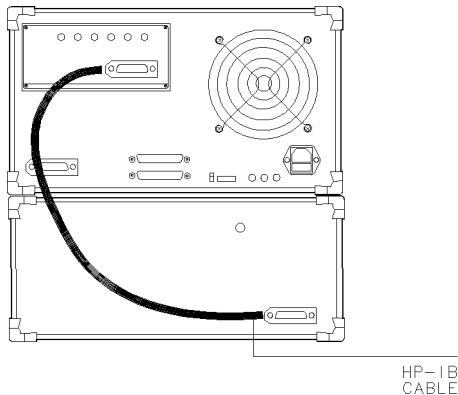
1 Press the **HP-IB** **HP-MSIB** softkey until the bus that is being used is underlined. The bus that is underlined is selected.



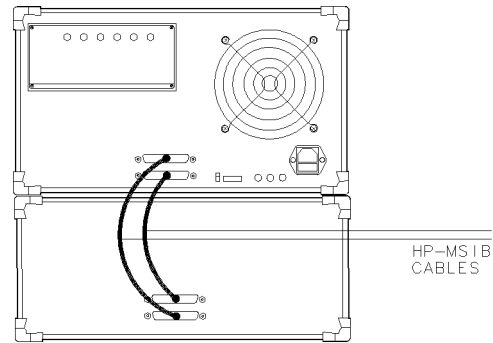
DZA11

2 Connect the HP-IB cable from the rear panel of the HP 70820A microwave transition analyzer module to the rear panel of the RF source. (Do not mistakenly connect the HP-IB cable to HP-IB connector on the rear panel of the display or the mainframe.) Continue at “Step 4. Specify the HP-IB Parameters” on page 1-9.

3 Connect the HP-MSIB cables from the rear panel of the microwave transition analyzer’s display or mainframe to the rear of the RF source or the RF source’s display or mainframe. The HP-MSIB cables must be routed serially. Continue at “Step 5. Specify the HP-MSIB Parameters” on page 1-10.



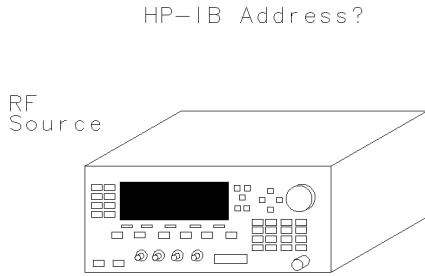
DZA67



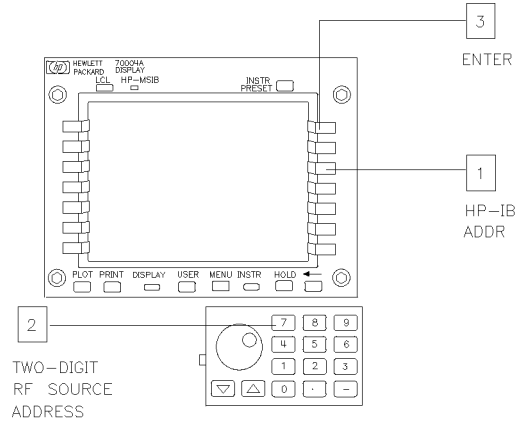
DZA68

Step 4. Specify the HP-IB Parameters

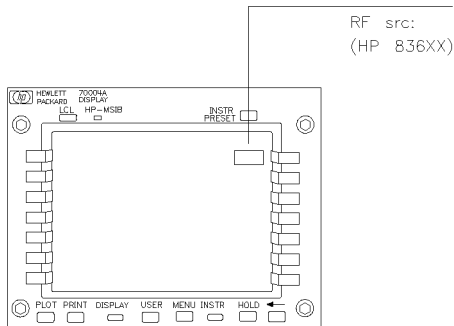
1 Determine the HP-IB address of the RF source. Refer to RF source's documentation for information regarding its HP-IB address.



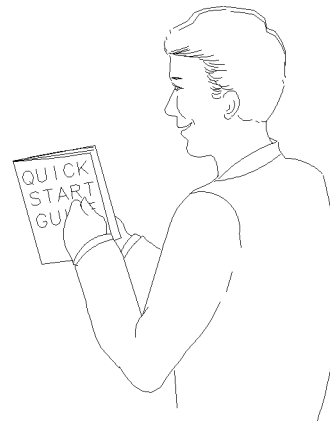
2 Press the **HP-IB ADDR** softkey. Enter the RF source's two-digit HP-IB address using the numeric keypad. Press the **ENTER** softkey.



3 Verify that the RF source is properly configured. When the RF source is properly configured, the microwave transition analyzer will perform an instrument preset on the RF source and the model number of the RF source that appears beneath **RF src:** on the display will no longer flash.



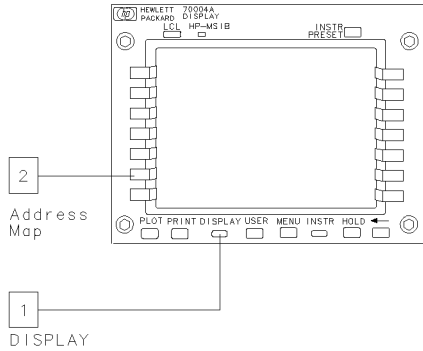
4 If you are ready to start making measurements, refer to the *HP 71500A/HP 70820A Microwave Transition Analyzer Quick Start Guide* to get started.



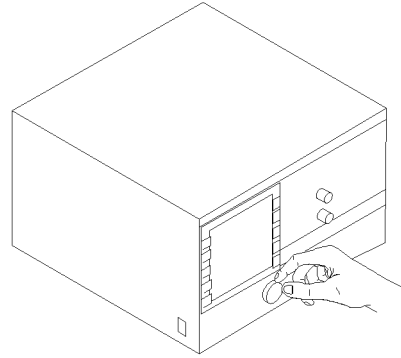
Step 5. Specify the HP-MSIB Parameters

1 Press the **DISPLAY** key. Then press the **Address Map** softkey.

2 Turn the display's front-panel knob to locate the desired RF source in the address map. As the knob is turned, each item listed on the HP-MSIB address map is highlighted, one at a time. When the RF source is highlighted on the address map, the ACTIVE LED on the front panel of the corresponding RF source turns on.



DZA71



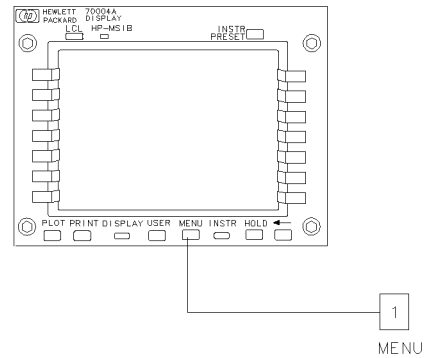
DZA72

3 Note the row and the column that the RF source is listed in. This is its HP-MSIB address.

4 Press the **MENU** key to return to the HP 70820A module's HP-MSIB menu.

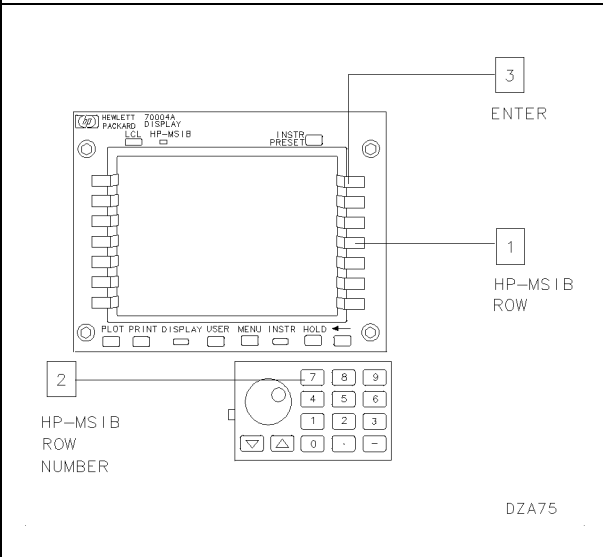
7				
6				
5				
4				
3				
2				
1				
0		83640A		
	18	19	20	21
	COLUMN			

DZA73

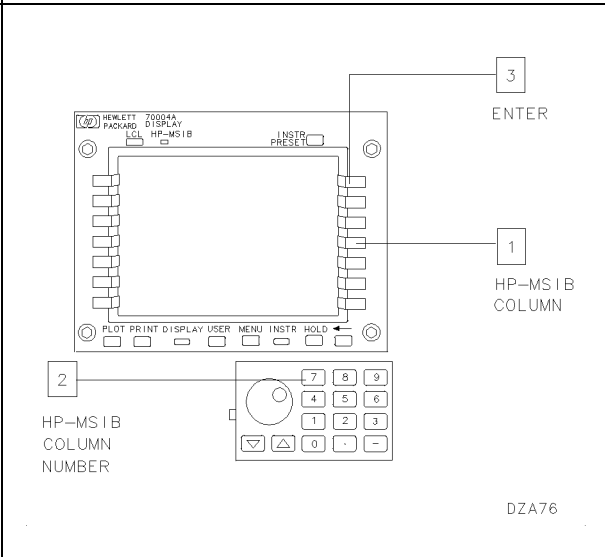


DZA74

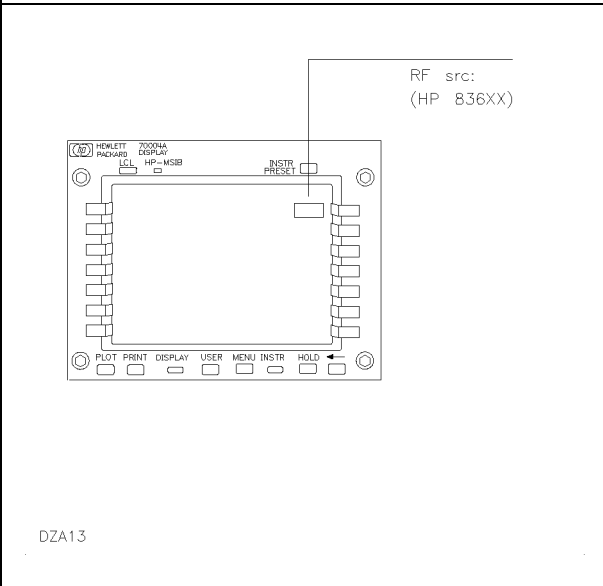
5 Press the **HP-MSIB ROW** softkey. Enter the number of the RF source's HP-MSIB row number using the numeric keypad. Press the **ENTER** key.



6 Press the **HP-MSIB COLUMN** softkey. Enter the number of the RF source's HP-MSIB column number using the numeric keypad. Press the **ENTER** softkey.



7 Verify that the RF source is properly configured. When the RF source is properly configured, the microwave transition analyzer will perform an instrument preset on the RF source and the model number of the RF source that appears beneath **RF src:** on the display will no longer flash.

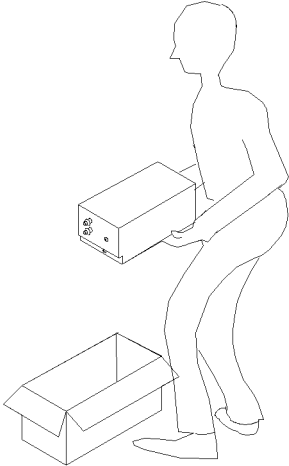
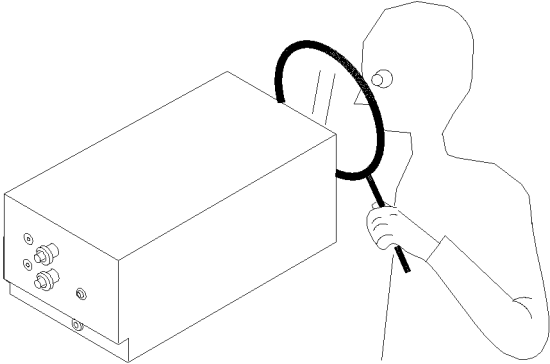
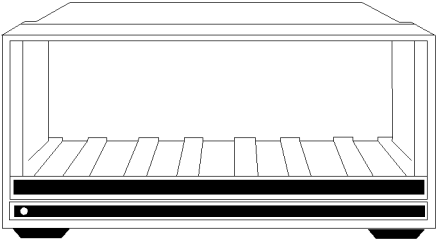
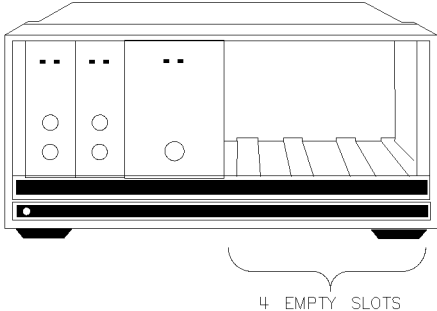


8 If you are ready to start making measurements, refer to the *HP 71500A/HP 70820A Microwave Transition Analyzer Quick Start Guide* to get started.



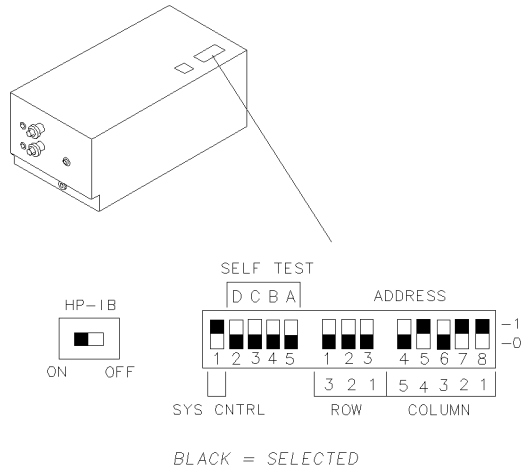
Installing the HP 70820A Microwave Transition Analyzer Module

Step 1. Prepare to Install the HP 70820A Microwave Transition Analyzer Module

<p>1 Unpack the HP 70820A microwave transition analyzer module from its shipping containers.</p>	<p>2 Inspect the HP 70820A thoroughly to ensure that it was not damaged during shipment.</p>
 <p>DZA14</p>	 <p>DZA15</p>
<p>3 Install the mainframe or the display that you will be using with the HP 70820A module. Refer to the appropriate installation manual for instructions.</p>	<p>4 The HP 70820A module is a 4/8-width module. It requires four adjacent, empty slots for installation. Remove previously installed modules from the mainframe or display to open the necessary slots.</p>
 <p>DZA16</p>	 <p>DZA17</p> <p>4 EMPTY SLOTS</p>

Step 2. Check the Address of the HP 70820A Microwave Transition Analyzer Module

1 Locate the eight address switches on the top of the HP 70820A module. These switches are factory preset to row address 0 and column address 11.



Note



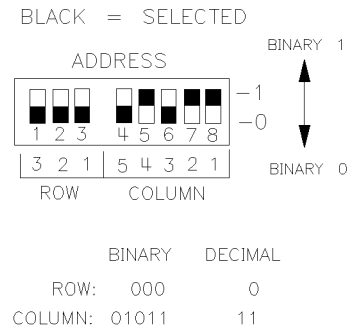
When using the HP 70820A microwave transition analyzer module with other factory-preset modules, the factory-preset address of the HP 70820A does not need to be changed.

Note

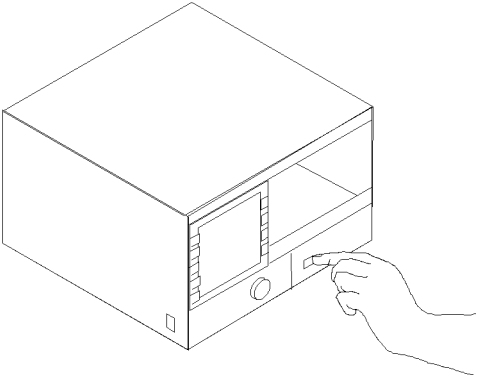
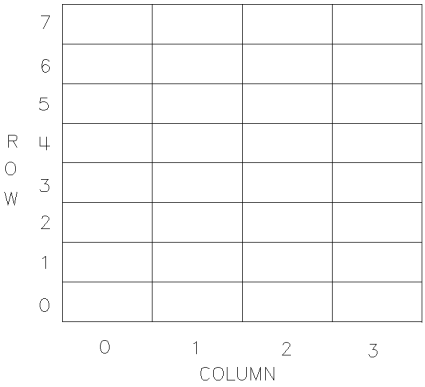
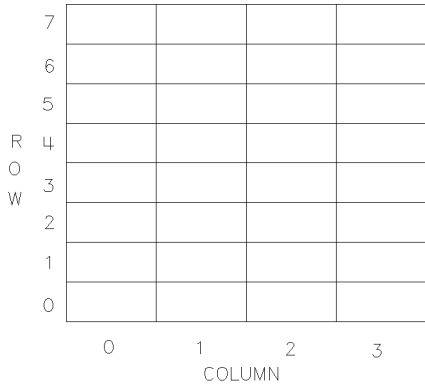


Each element must have a unique 8-bit binary HP-MSIB address. This address is determined by the 8 address switches. The three most significant bits (MSB) determine the row address. The five least significant bits (LSB) determine the column address. This manual refers to the decimal equivalent of the binary address.

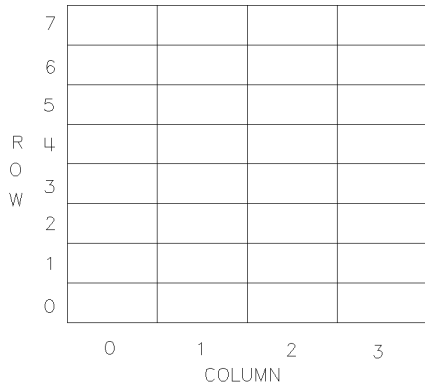
2 Determine the address that the HP 70820A module is set at.



Step 3. Check the System's HP-MSIB Addresses

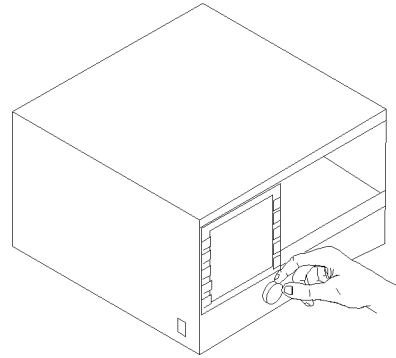
<p>1 Press the LINE switch to turn the mainframe or the display on.</p>	<p>If the display being used is an HP 70004A, continue at step 2 on this page.</p>
 <p>DZA20</p>	<p>If the display being used is an HP 70205A, continue at step 3 on this page.</p> <p>If the display being used is an HP 70206A, continue at step 4 of this procedure located on the next page.</p>
<p>2 For the HP 70004A Display, press the DISPLAY key, then press the Address Map softkey to display the system's HP-MSIB address map. Continue at step 5 of this procedure located on the next page.</p>	<p>3 For the HP 70205A Graphics Display, press the DSP key, then press the address map softkey to display the system's HP-MSIB address map. Continue at step 5 of this procedure located on the next page.</p>
 <p>DZA21</p>	 <p>DZA21</p>

4 For the HP 70206A System Graphics Display, press the **(DISPLAY)** key, then press the **address map** softkey to display the system's HP-MSIB address map.



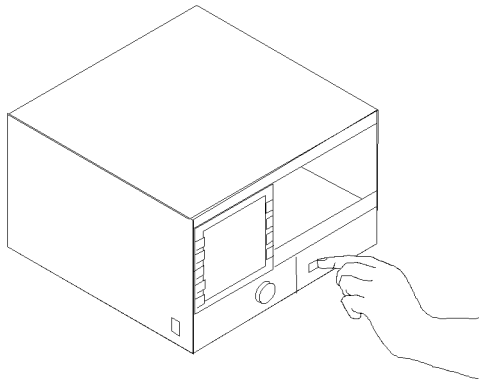
DZA21

5 Turn the front-panel knob of the display to see if any other modules are at the address that the microwave transition analyzer module is set to.



DZA22

6 Press the **LINE** switch of the mainframe or the display to turn it off.



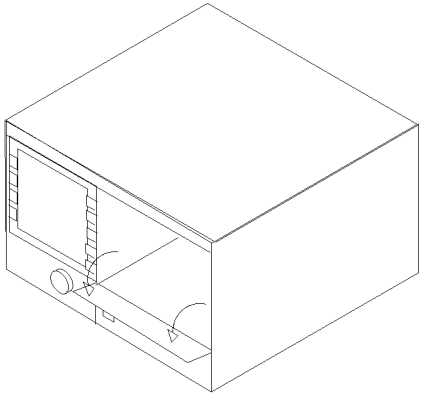
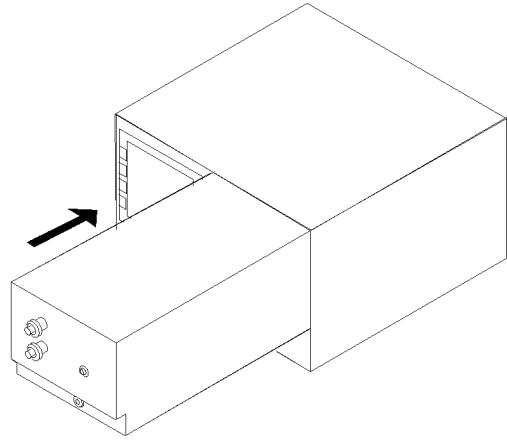
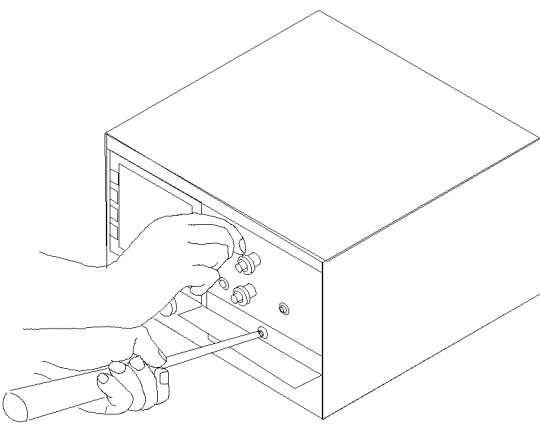
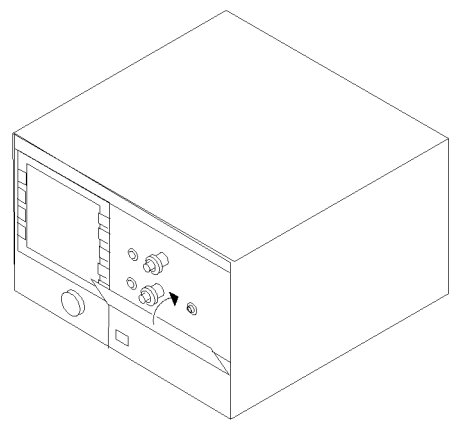
DZA20

If there are no other modules at the HP-MSIB address that the microwave transition analyzer module is set at, continue at "Step 4. Install the HP 70820A Microwave Transition Analyzer Module into the HP 70001A Mainframe or the HP 70004A Display" on page 1-16.

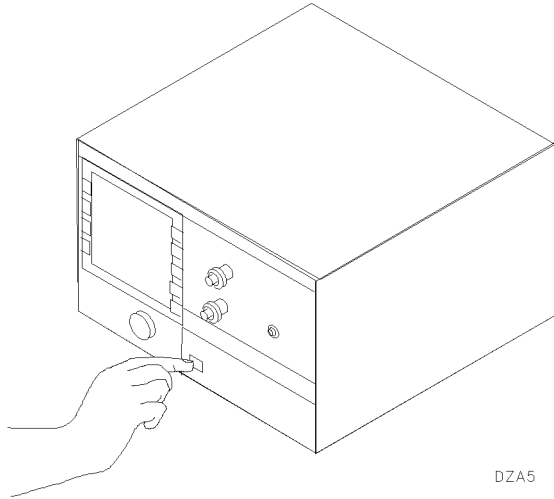
If there is another module at the HP-MSIB address that the microwave transition analyzer module is set to, you can change the HP-MSIB address of either the microwave transition analyzer module or the other module that is assigned to that address.

- If you want to change the address of the microwave transition analyzer module, continue at "Optional: Changing the HP-MSIB Address of the HP 70820A Microwave Transition Analyzer Module" on page 1-18.
- If you want to change the address of the other module, refer the installation manual for that module. After the address of that module has been changed, continue at "Step 4. Install the HP 70820A Microwave Transition Analyzer Module into the HP 70001A Mainframe or the HP 70004A Display" on page 1-16.

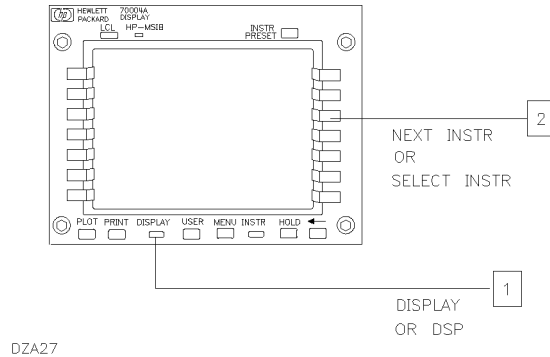
Step 4. Install the HP 70820A Microwave Transition Analyzer Module into the HP 70001A Mainframe or the HP 70004A Display

<p>1 Open the front-panel door on the mainframe or the display.</p>	<p>2 Slide the HP 70820A microwave transition analyzer module into the mainframe or the display.</p>
 <p>DZA23</p>	 <p>DZA24</p>
<p>3 Press against the HP 70820A module front panel while tightening the hex-nut latch with the 8 mm hex ball driver (HP part number 8710-1651).</p>	<p>4 Close the front-panel door on the mainframe or the display.</p>
 <p>DZA25</p>	 <p>DZA26</p>

5 Press the microwave transition analyzer's front-panel **LINE** switch to turn the system on.



6 Press the **DISPLAY** or the **DSP** key. Press the **NEXT INSTR** or the **SELECT INSTR** softkey. The key and softkey that you press depends on the display that you are using.



If you want instructions for installing the microwave transition analyzer's keypad, installing an external power pack, mounting the system in a rack, connecting the system to another display or mainframe, displaying the date and the time, or changing the date and the time, refer to the following optional installation steps:

- “Optional: Installing the Microwave Transition Analyzer's Keypad into the HP 70004A Display” on page 1-19
- “Optional: Installing the External Power Pack” on page 1-20
- “Optional: Mounting the System in a Rack” on page 1-22
- “Optional: Connecting the Microwave Transition Analyzer System to Another Display or Mainframe” on page 1-24
- “Optional: Displaying the Time and the Date” on page 1-25
- “Optional: Changing the Time and the Date” on page 1-26

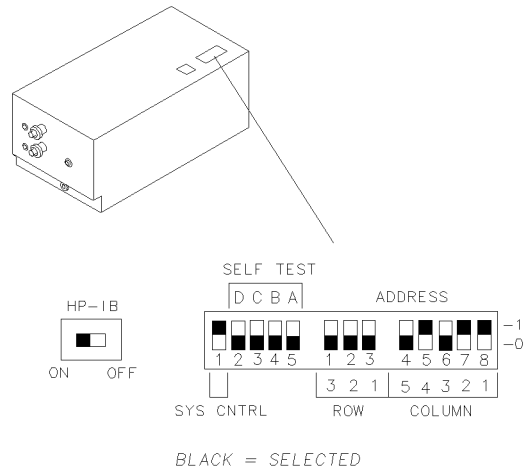
If you want to configure an RF source to your microwave transition analyzer, refer to “Configuring an RF Source to the Microwave Transition Analyzer” on page 1-6.

An RF source should be configured to your microwave transition analyzer to get the most from your microwave transition analyzer. Without configuring the RF source to the microwave transition analyzer, your measurements will be limited.

If you are ready to start making measurements, refer to the *HP 71500A/HP 70820A Microwave Transition Analyzer Quick Start Guide* to get started.

Optional: Changing the HP-MSIB Address of the HP 70820A Microwave Transition Analyzer Module

1 Locate the eight HP-MSIB address switches on top of the HP 70820A module. These switches are factory preset to row address 0 and column address 11.



DZA18

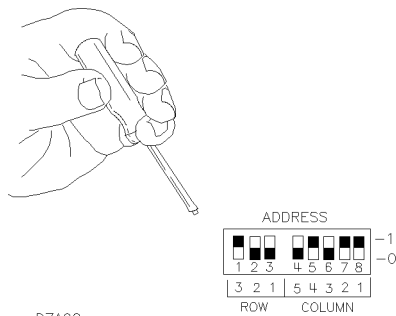
Each element must have a unique 8-bit binary HP-MSIB address. This address is determined by the 8 address switches. The three most significant bits (MSB) determine the row address. The five least significant bits (LSB) determine the column address. This manual refers to the decimal equivalent of the binary address.

Only the modules and the stand-alone instruments that have addresses in row 0 can communicate over the HP-IB bus.

Address 0, 31 is an illegal address. No elements may be set to this address.

A thin, nonconductive stylus, such as a toothpick or similar object, is useful for setting the address switches.

2 Set the address switches of the HP 70820A module to an HP-MSIB address in row 0 that does not have a module assigned to it.



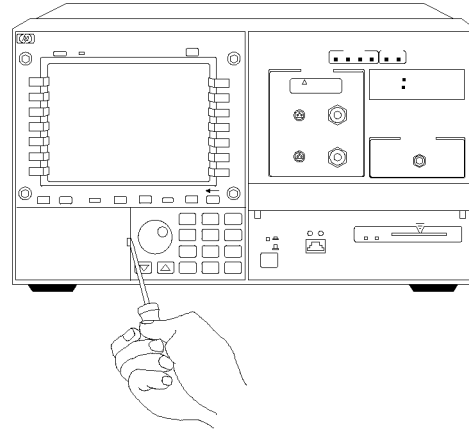
DZA28

Continue at "Step 4. Install the HP 70820A Microwave Transition Analyzer Module into the HP 70001A Mainframe or the HP 70004A Display" on page 1-16.

Optional: Installing the Microwave Transition Analyzer's Keypad into the HP 70004A Display

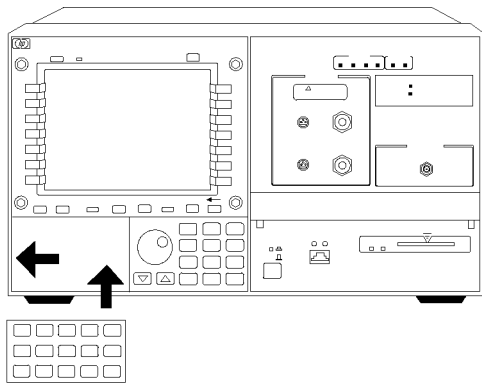
The microwave transition analyzer's keypad is designed to give the user front-panel keys that serve the same function as often-used softkeys. The use of this keypad will save steps when making measurements. This keypad may only be used with the HP 70004A display. However, even if this keypad is not installed, all of the microwave transition analyzer's functions are accessible using the display's softkeys.

1 Remove the existing keypad or cover from the HP 70004A by inserting a flat-blade screwdriver into slot on the keypad or cover. Push the screwdriver straight in until the spring release the existing keypad or cover. Do not move the screwdriver handle toward either side.



DZA29

2 Install the microwave transition analyzer's keypad by inserting the left side of the keypad into the HP 70004A's front panel. Press the right side of the keypad in until it snaps into the front panel.



DZA30

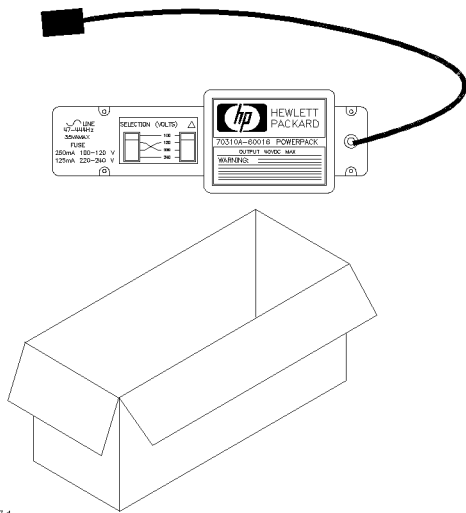
If you want instructions for installing an external power pack, mounting the system in a rack, connecting the system to another display or mainframe, or displaying or changing the date and time, refer to the following optional installation steps:

- "Optional: Installing the External Power Pack" on page 1-20
- "Optional: Mounting the System in a Rack" on page 1-22
- "Optional: Connecting the Microwave Transition Analyzer System to Another Display or Mainframe" on page 1-24
- "Optional: Displaying the Time and the Date" on page 1-25
- "Optional: Changing the Time and the Date" on page 1-26

If you want to configure an RF source to your microwave transition analyzer, refer to "Configuring an RF Source to the Microwave Transition Analyzer" on page 1-6.

Optional: Installing the External Power Pack

1 Unpack the external power pack from its shipping container. Inspect the external power pack and its power cable to ensure that they are not damaged.

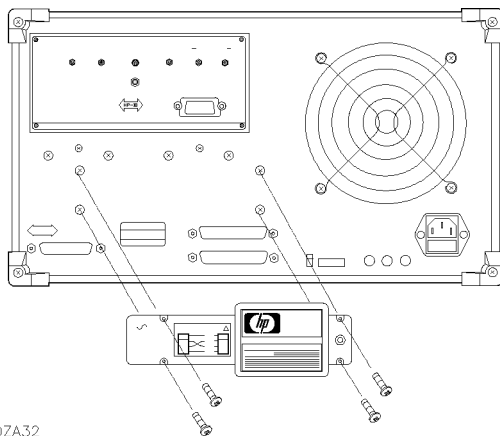


DZA31

If you want to install the external power pack to the rear of the microwave transition analyzer, refer to step 2 on this page.

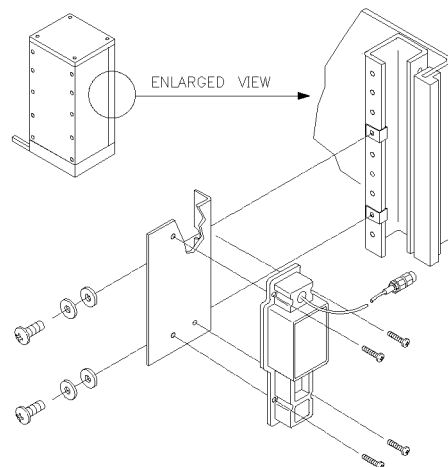
If your microwave transition analyzer is rack mounted and you want to install the external power pack to the equipment rack, refer to step 3 on this page.

2 Screw the external power pack onto the rear of the HP 70004A display or the HP 70001A mainframe. Use the four screws provided. Continue with step 4 of this procedure located on the next page.



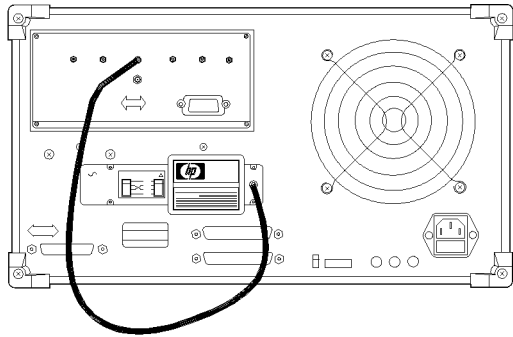
DZA32

3 The external power pack may also be mounted to an equipment rack as shown below. Order HP part number 70310-60030 for the external power pack's rack mount kit.



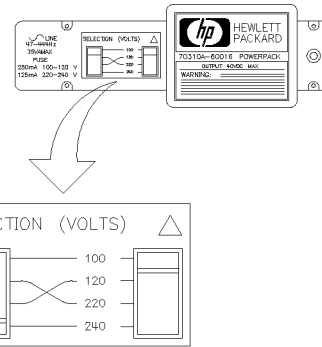
DZA33

4 Connect the external power pack cable to **EXT POWER** on the rear of the HP 70820A Microwave Transition Analyzer module.



DZA34

5 Set the two 2-position **SELECTION (VOLTS)** switches to the voltage of ac power source. The external power pack must have its line-voltage selector set correctly before the power pack is plugged into the ac power source. An incorrect line-voltage selection can cause damage to the external power pack.



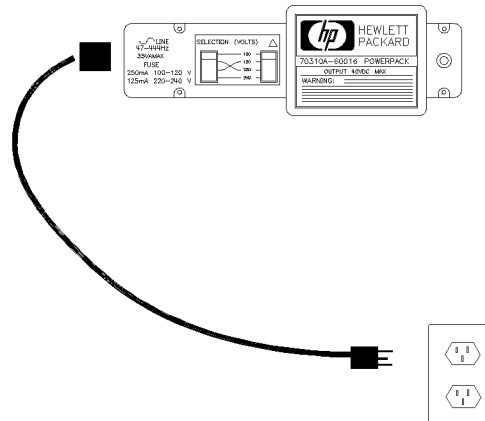
DZA35

Warning



Before plugging the external power pack into the ac power source, verify that the external power pack and the power cable are not damaged, and that the power-source socket outlet is provided with protective earth contact. Any interruption of the protective (grounding) conductor either on the inside or the outside of the external power pack, or disconnection of the protective earth terminal, can result in personal injury.

6 Plug the external power pack into the ac power source.



DZA36

Optional: Mounting the System in a Rack

Hardware kits are needed to rack mount the system. Refer to the lists of the hardware kits, below, for the options, the descriptions, and the HP part numbers.

For HP 70004A Display:

- Option 810* rackmount slide kit
(HP part number 5062-7086)
- Option 908* rack flange kit without handles
(HP part number 5062-3979)
- Option 913* rack flange kit with handles
(HP part number 5062-4073)

For HP 70001A Mainframe:

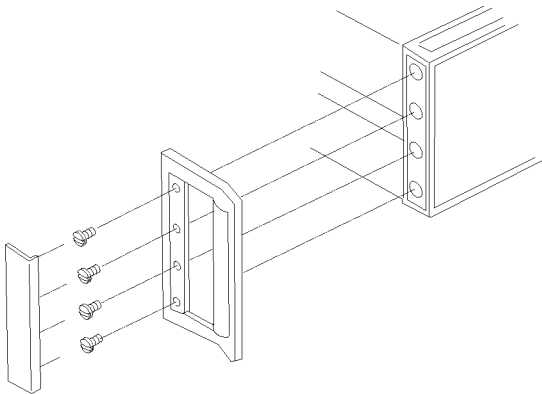
- Option 810* rackmount slide kit
(HP part number 5062-0781)
- Option 908* rack flange kit without handles
(HP part number 5062-3978)
- Option 913* rack flange kit with handles
(HP part number 5062-4072)

Caution



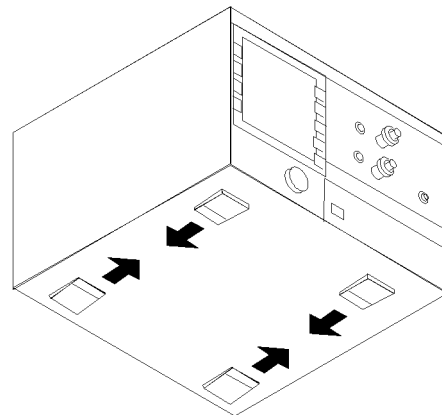
Do not rack mount multiple displays or mainframes with one rack-mount hardware kit. One rack-mount hardware kit must be ordered for each display or mainframe.

1 Slide the plastic trim strip on each handle forward and remove them. Remove the screws securing each handle to the instrument.



DZA37

2 Remove the feet from the bottom of the display or mainframe.



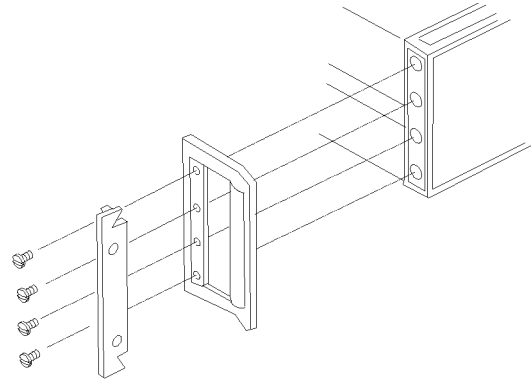
DZA38

Caution



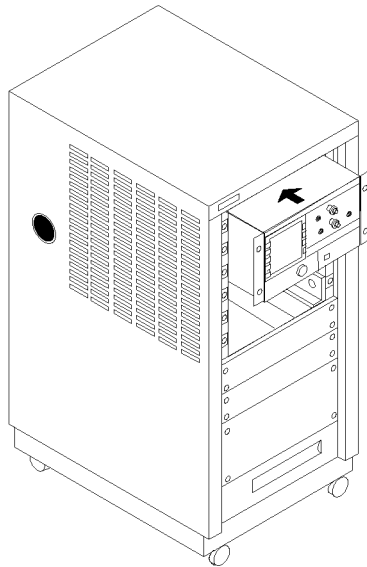
Be sure to use the correct hardware when replacing parts. Both metric and English hardware are used with these instruments. Using incorrect screw sizes may damage the instrument cabinet.

3 Install the rack-mount hardware kit on the display or mainframe. The installation instructions are included with each kit.



DZA39

4 Slide the display or mainframe into the rack. Insert two screws through the holes in the rack flange on each side of the instrument and into the front of the rack. Tighten each screw.



DZA40

If the system needs to be connected to another display or mainframe, refer to “Optional: Connecting the Microwave Transition Analyzer System to Another Display or Mainframe” on page 1-24.

If you want to configure an RF source to your microwave transition analyzer, refer to “Configuring an RF Source to the Microwave Transition Analyzer” on page 1-6.

Optional: Connecting the Microwave Transition Analyzer System to Another Display or Mainframe

The microwave transition analyzer system may be connected to another display or mainframe. The microwave transition analyzer system may be left separate or physically configured in one of two ways.

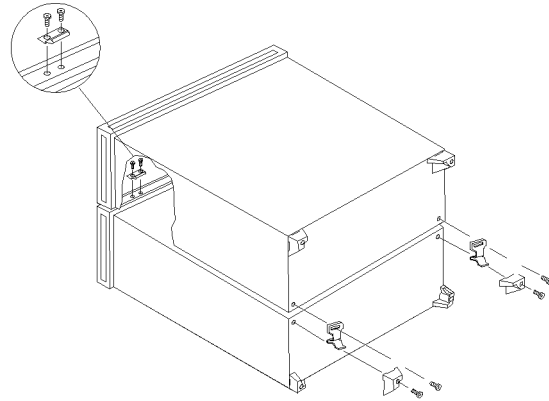
- Rack mounted
- Stacked and interlocked (with a mainframe only)

If you want to leave the microwave transition analyzer system and the display or mainframe separate, refer only to step 2 below.

If you want to rack mount the microwave transition analyzer system and the display or mainframe, refer to “Optional: Mounting the System in a Rack” on page 1-22 and to step 2 below.

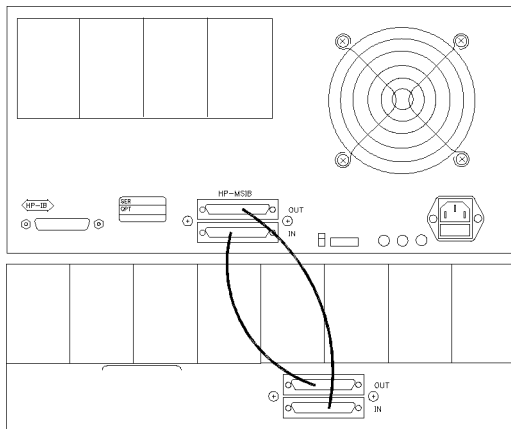
If you want to stack and interlock the microwave transition analyzer system with the mainframe, continue at step 1 on this page.

1 Assemble the microwave transition analyzer system to the HP 70001A Mainframe as shown below. Order interlock kit (HP part number 5061-9061) for hardware and instructions.



DZA41

2 Connect the HP-MSIB cables serially: coupling the input of one element to the output of the next until the loop is completed. The HP-MSIB cable connections between the HP 71500A and the HP 70001A Mainframe are shown below.



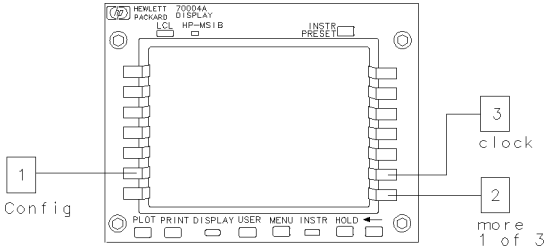
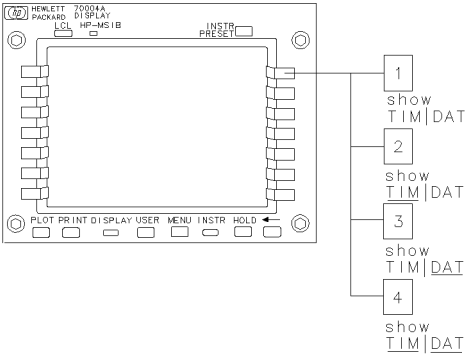
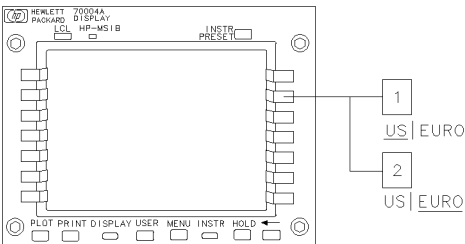
DZA42

Note



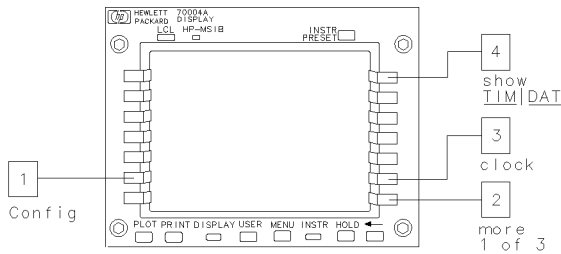
Long HP-MSIB cables between the display and mainframe allow remote operation. Since the signals on the HP-MSIB are digital, measurement speed is only slightly degraded. Measurement accuracy is not affected by HP-MSIB cable length.

Optional: Displaying the Time and the Date

<p>1 Press the Config softkey. Press the more 1 of 3 softkey. Press the clock softkey.</p>	<p>2 Press the show TIM DAT softkey. Continue pressing this softkey until both TIM and DAT are underlined and both the time and the date are displayed.</p>
 <p>DZA52</p>	 <p>DZA53</p>
<p>3 Press the US EURO softkey to toggle the date to be displayed in the desired format. For example, April 18th of 1991 is displayed as APR 18, 1991 in US format and is displayed as 18.04.1991 in EURO format.</p>	<p>If the time or the date is not current and you want to correct it, refer to “Optional: Changing the Time and the Date” on page 1-26.</p> <p>If the time and the date is current you may display either the time or the date, or both, or neither using the show TIM DAT softkey.</p>
 <p>DZA54</p>	<ul style="list-style-type: none"> ■ To display only the time, press show TIM DAT until only TIM is underlined. ■ To display only the date, press show TIM DAT until only DAT is underlined. ■ To display both the time and the date, press show TIM DAT until both TIM and DAT are underlined. ■ To display neither the time nor the date, press show TIM DAT until neither TIM nor DAT are underlined.

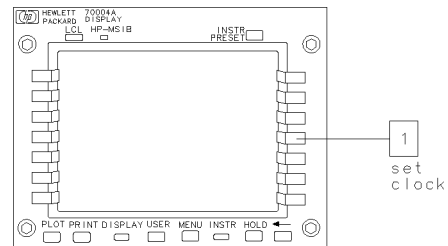
Optional: Changing the Time and the Date

1 Display the time and the date. Refer to “Optional: Displaying the Time and the Date” on page 1-25.



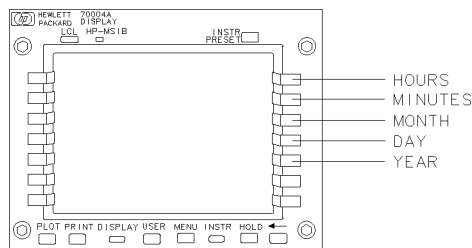
DZA55

2 With the clock softkeys displayed, press **set clock**.



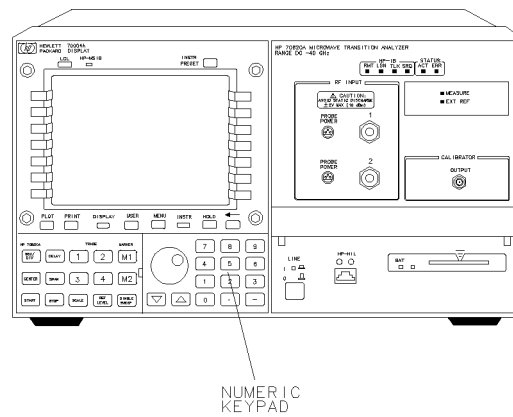
DZA56

3 Press the first time or date units softkey that you want to change. The units softkeys include **HOURS**, **MINUTES**, **MONTH**, **DAY**, and **YEAR**.



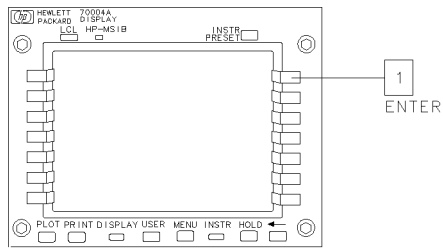
DZA57

4 If the time is being corrected, use the display's numeric keypad to input the correct hours or minutes. If the date is being corrected, use the numeric keypad to input the correct month, day, or year.



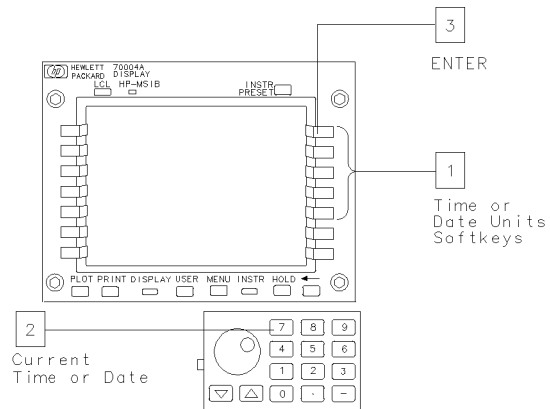
DZA58

5 Press **ENTER**.



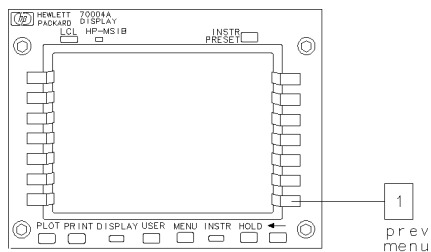
DZA59

6 Repeat steps 3, 4, and 5 of this procedure until the current time and date is displayed.



DZA60

7 Press **prev menu** to return to the clock softkeys.



DZA61

If the time and the date is current you may display either the time or the date, or both, or neither using the **show TIM|DAT** softkey.

- To display only the time, press **show TIM|DAT** until only TIM is underlined.
- To display only the date, press **show TIM|DAT** until only DAT is underlined.
- To display both the time and the date, press **show TIM|DAT** until both TIM and DAT are underlined.
- To display neither the time nor the date, press **show TIM|DAT** until neither TIM nor DAT are underlined.

If You Have a Problem During Installation

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Installation Problems

This chapter will help correct problems that may be encountered during the installation of the microwave transition analyzer. The problem or symptom is listed at the top of each page. Most problems have a brief description or explanation to provide additional information regarding the problem. Following the problem and its description, a checklist of items that could cause the problems during installation is provided. Using the checklist of possible solutions will help to correct the problem. If the problem is internal to the microwave transition analyzer, the checklist will also help to identify the faulty module, display or mainframe.

Problems Requiring Additional Technical Resources

Problems that are internal to a module, a display, or a mainframe will require additional technical information. Refer to the service documentation for the faulty module, display, or mainframe or return the instrument to Hewlett-Packard for servicing. Instructions for returning the instrument to Hewlett-Packard are provided in “If the Microwave Transition Analyzer Needs to be Returned for Service” on page 2-13.

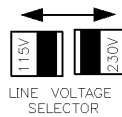
If the Microwave Transition Analyzer Appears to Be Dead

Each time that the microwave transition analyzer is turned on, the following actions take place:

1. The front-panel STATUS and HP-IB LEDs on the module light.
2. The display's model number is displayed.
3. The system runs through an INITIALIZING routine (power on initialization).
4. The SELF TEST routine runs (the front-panel LEDs turn off, one at a time during the self-test).
5. The MEASURE LED starts blinking at the end of the self-test.

If these actions do not occur, check the following things:

- Check that the microwave transition analyzer is connected to the ac power source.
- Check that the line voltage selector switch is set to the correct voltage for the power source. The line voltage selector switch is located on the left side of the HP 70004A Display, on the bottom of the HP 70001A Mainframe, or on the rear panel of the HP 70206A System Graphic Display. See Figure 2-1.

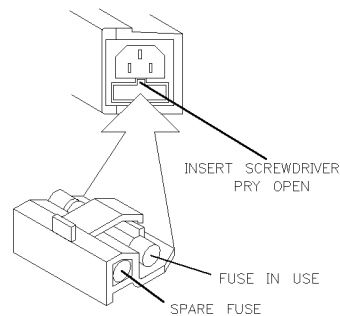


DZA43

Figure 2-1. Line Voltage Selector

- Check the line fuse on the display or the mainframe to ensure that it is not damaged.

The line fuse for this instrument is located inside the power-cord receptacle housing on the rear of the display and mainframe. Also included in this housing is a spare fuse. The fuse is a 5 by 20 mm fuse rated at 6.3A, 250 V (HP part number 2110-0703). This line fuse can be used with both 120 V and 230 V power sources. Refer to Figure 2-2.



DZA44

Figure 2-2. Line Fuse Removal and Replacement

If the Front-Panel LEDs Do Not Light When the Microwave Transition Analyzer Is Turned On

When the microwave transition analyzer is turned on, the module self-test procedure turns on the STATUS LEDs, the HP-IB LEDs, the MEASURE LED, and the EXT REF LED on the front panel of the module. As the self-test continues to run, the STATUS LEDs and the HP-IB LEDs are turned off in the following sequence. (The STATUS LEDs (ERR and ACT) are turned on and then turned off so quickly that it may not be apparent that they were turned on.)

1. ERR
2. ACT
3. SRQ
4. TLK
5. LSN
6. RMT

After the self-test is complete, the following actions will occur:

1. The MEASURE LED will start to blink.
2. The EXT REF LED will remain on if the external reference signal is connected to the 10 MHz REFERENCE INPUT connector on the rear panel of the module. If there is not an external reference signal connected to the 10 MHz REFERENCE INPUT connector, the EXT REF LED will turn off.

If the Front-panel LEDs do not light when the microwave transition analyzer is turned on:

- Ensure that the display or mainframe is operating properly.

If the display or mainframe is not providing the correct power to the microwave transition analyzer module, the microwave transition analyzer will not operate correctly. The microwave transition analyzer module may need to be removed to determine if the display or mainframe is operating properly. Refer to the display's or mainframe's installation manual for information regarding proper operation.

- If the display or mainframe is operating properly, the microwave transition analyzer module is probably faulty and additional technical resources are required. Refer to "Problems Requiring Additional Technical Resources" on page 2-2.
- If other instruments are connected to the display or the mainframe via the HP-MSIB, check that they are turned on.

If the Microwave Transition Analyzer Front-Panel ERR LED Remains Lit or Blinks After the Self-Test

The ERR LED is one of the two STATUS LEDs on the front panel of the microwave transition analyzer module. The ERR LED should be turned on and then turned off during the microwave transition analyzer's self-test. It is turned on and turned off so quickly during the self-test that it may not be able to be observed.

After the self-test, the ERR LED lights when an error (problem) is encountered. When it lights, it will either remain on continuously or it will blink.

If the ERR LED remains on continuously, it is indicating that there may be a problem with the microwave transition analyzer. Perform the following steps:

1. Press **DISPLAY** and **REPORT ERRORS**.
2. Check the display for the reported error.
3. Refer to "If Errors Are Reported on the Display" on page 2-7 for help correcting the error.

If the ERR LED blinks, it is indicating that there may be a problem with the HP-MSIB. Check the following items:

- Check that all HP-MSIB cables are securely connected and ensure that they are connected serially to form a loop.
- Check whether there are two modules in the system with the same HP-MSIB address.

If the Microwave Transition Analyzer Front-Panel HP-IB LEDs Remain Lit After the Self-Test

The HP-IB LEDs on the front panel of the microwave transition analyzer are turned on and then turned off, one at a time, during the microwave transition analyzer's self test. There are four HP-IB LEDs. They are service request (SRQ), talk (TLK), listen (LSN), and remote (RMT). The HP-IB LEDs reveal the status of the microwave transition analyzer module when it is being controlled by a computer.

The table below shows each HP-IB LED, its purpose, and what should be checked if it remains on after the self-test.

LED	Function	Solution
SRQ	This LED lights when the microwave transition analyzer has requested computer service.	Check for error messages on the display.
TLK	This LED lights when a controller has addressed the microwave transition analyzer to talk over the HP-IB.	The microwave transition analyzer module is probably faulty. It will require additional technical resources. Refer to "Problems Requiring Additional Technical Resources" on page 2-2.
LSN	This LED lights when a controller has addressed the microwave transition analyzer to listen over the HP-IB.	The microwave transition analyzer module is probably faulty. It will require additional technical resources. Refer to "Problems Requiring Additional Technical Resources" on page 2-2.
RMT	This LED lights if the remote enable (REN) line is asserted and the microwave transition analyzer is addressed by a controller. In addition, depending on the instructions received from the controller, the SRQ, the TLK, or the LSN LEDs may also light. If this LED is on, the microwave transition analyzer won't respond when the front-panel keys are pressed. The RMT LED will turn off when the display's LCL key is pressed.	The microwave transition analyzer module is probably faulty. It will require additional technical resources. Refer to "Problems Requiring Additional Technical Resources" on page 2-2.

If Errors Are Reported on the Display

- Note the error number and the error message.
- Refer to the list of common errors below. If the error is not on the list of common errors, refer to the complete list of errors in the *HP 71500A Microwave Transition Analyzer Reference*.

List of Common Errors

Error	Description
6203	no instrument present This can occur when the RF source is not turned on or when the RF source is not correctly configured to the microwave transition analyzer. Refer to “Configuring an RF Source to the Microwave Transition Analyzer” in Chapter 1.
6204	instrument does not match config This can indicate when the RF source is not correctly configured to the microwave transition analyzer. The selected RF source does not match the RF source configured to the microwave transition analyzer. Refer to “Configuring an RF Source to the Microwave Transition Analyzer” in Chapter 1.
6205	not active controller This indicates that the HP 70820A is not the active controller. Set the SYS CNTRL switch to 1. Refer to “Step 2. Check the Address of the HP 70820A Microwave Transition Analyzer Module” in Chapter 1 for location of the SYS CNTRL switch.
6396	no ext ref This indicates that the microwave transition analyzer is set for external reference when the external reference is not present. Refer to “Step 1. Set Up the Frequency Reference” in Chapter 1 to connect the external reference.
6611	questionable cal data (ch1) This indicates that channel 1 needs to be recalibrated. To recalibrate channel 1, press MENU , page 1 of 2 , Calib , i.f. calib , and CAL CH1 . Then follow the instructions on the display for recalibration.
6612	questionable cal data (ch2) This indicates that channel 2 needs to be recalibrated. To recalibrate channel 2, press MENU , page 1 of 2 , Calib , i.f. calib , and CAL CH2 . Then follow the instructions on the display for recalibration.
6385	clock broken or needs setting This indicates that there is a problem with the real time clock. Try to reset the clock. Refer to “Optional: Changing the Time and the Date” in Chapter 1 to reset the clock.

If the HP 70004A Display “HP-MSIB” or the HP 70001A Mainframe “I/O CHECK” Indicator Light Remains Lit

The HP 70004A Display HP-MSIB fault indicator light and the HP 70001A Mainframe I/O CHECK status indicator light indicate the status of the HP-MSIB. If either of the lights are on, there is a problem with the HP-MSIB.

- Verify that the power to all mainframes and stand-alone display instruments is on.
- Check that all HP-MSIB cables are securely connected and ensure that they are connected serially to form a loop.
- Check whether there are two modules in the system with the same HP-MSIB address.
- Check for a faulty mainframe or stand-alone display by removing all of the HP-MSIB cables and noting whether the indicator light remains on.
 - If the indicator light is still on, the mainframe or stand-alone display is probably causing the HP-MSIB problem.
 - If the indicator light goes out, the problem is either with the HP-MSIB cables or with the instrument that the mainframe or display was connected to.

If the HP 7001A Mainframe CURRENT Indicator Light Remains Lit

The CURRENT error indicator light turns on when the mainframe power supply senses a current overload.

- Check to see which module is causing the current overloading condition.
 - Remove one module from the mainframe.
 - Cycle the power.
 - If the indicator light is off, the module was faulty.
 - If the indicator light is still on, continue removing modules, one at a time, until the module causing the indicator light is identified.
 - If the indicator light remains on after all modules have been removed, the mainframe is probably faulty.

If the RF Source Does Not Go to Remote

The RF source must be in remote status to be controlled by the microwave transition analyzer. Most RF sources have an indicator light on the front panel to indicate when they are in remote status. If necessary, refer to the manual for the RF source being used to determine the location of the remote status indicator.

- Check that both the microwave transition analyzer and the RF source have the power turned on.
- Ensure that the RF source is configured to the microwave transition analyzer.

Press **MENU**, **Config**, and **RF source**. The model number of the selected RF source will be displayed beneath **RF src:** in the upper right-hand corner of the display.

- If the RF source is configured properly to the microwave transition analyzer, the model number will not flash.
- If the RF source is not configured properly to the microwave transition analyzer, the model number will flash.

If the RF source is not configured properly to the microwave transition analyzer, check the next three items. Refer to “Configuring an RF Source to the Microwave Transition Analyzer” in Chapter 1 for information on performing these checks.

- Check that the correct RF source is selected.
- If the RF source is HP-IB controlled, check the following items:
 - Check that the HP-IB cable is connected between the rear panel of the microwave transition analyzer module and the RF source.

The HP-IB cable must be connected to the HP 70820A module’s HP-IB connector, not the HP-IB connector on the rear of the display or the mainframe.
 - Check that the microwave transition analyzer has the correct HP-IB address for the RF source.
- If the RF source is HP-MSIB controlled, check the following items:
 - Check that all HP-MSIB cables are securely connected and ensure that they are connected serially to form a loop.
 - Check that the microwave transition analyzer has the correct HP-MSIB address for the RF source.

- Check the address of the microwave transition analyzer.

The microwave transition analyzer must be set to an HP-MSIB address in row 0 to communicate via the HP-IB bus.

- Look at the display's address map to ensure that the HP-MSIB address of the microwave transition analyzer is in row 0. Refer to "Step 3. Check the System's HP-MSIB Addresses" in Chapter 1 for information about using the address map.

If the HP-MSIB address is not in row 0, refer to "Optional: Changing the HP-MSIB Address of the HP 70820A Microwave Transition Analyzer Module" in Chapter 1.

- If the RF source is in the HP 8360 series (for example, the HP 83640), ensure the RF source is set for either TMSL, ANALYZER, or SCPI programming language. Refer to the RF source's documentation for information about changing the programming language.

If the Microwave Transition Analyzer's OVEN COLD Indicator Flashes

When the microwave transition analyzer is turned on, an indicator will flash on the display to advise that the circuitry for the 10 MHz frequency reference is cold. This **OVEN COLD** indicator flashes until the oven warms up to its operating temperature. When the oven is warm, the **OVEN COLD** indicator turns off.

- If the microwave transition analyzer is using a frequency reference from an external RF source, the **OVEN COLD** indicator should not flash. The indicator is disabled when microwave transition analyzer has an external reference. If the **OVEN COLD** indicator flashes, make the following checks:
 - Check that the reference cable from the RF source is connected to the 10 MHz REFERENCE INPUT connector on the rear of the microwave transition analyzer module.
 - Check that the RF source has a 10 MHz reference signal at its output.
 - Check that the 10 MHz reference cable between the RF source and the microwave transition analyzer module is not damaged.
- If the microwave transition analyzer has an external power pack installed, the oven is kept warm even when the microwave transition analyzer is turned off. The **OVEN COLD** indicator will only flash momentarily when the microwave transition analyzer is turned on. If the **OVEN COLD** indicator flashes, make the following checks:
 - Check that the external power pack cable is connected to the EXT POWER connector on the rear of the microwave transition analyzer module.
 - Check that the external power pack has been connected to the microwave transition analyzer and turned on long enough to allow it to warm the oven up to its operating temperature. Allow the external power pack approximately 30 minutes to warm up the oven when the external power pack is initially connected to the microwave transition analyzer.
 - Check that the external power pack is operating properly.

Refer to “Optional: Installing the External Power Pack” in Chapter 1.

 - Check that the voltage selector switch on the external power pack is set for the correct ac power source.
 - Check that the external power pack is connected to the ac power source.
 - Check that the unloaded output of the external power pack cable is between +35 Vdc and +40 Vdc.
 - Check that the line fuse of the external power pack is not damaged.
- If the microwave transition analyzer's internal frequency reference is being used without an external power pack, check the following if the **OVEN COLD** indicator flashes:
 - Check to see that the 10 MHz frequency reference warms up after the microwave transition analyzer is turned on.

Allow approximately 30 minutes for the frequency reference to warm up enough to turn off the **Oven Cold** indicator on the display.

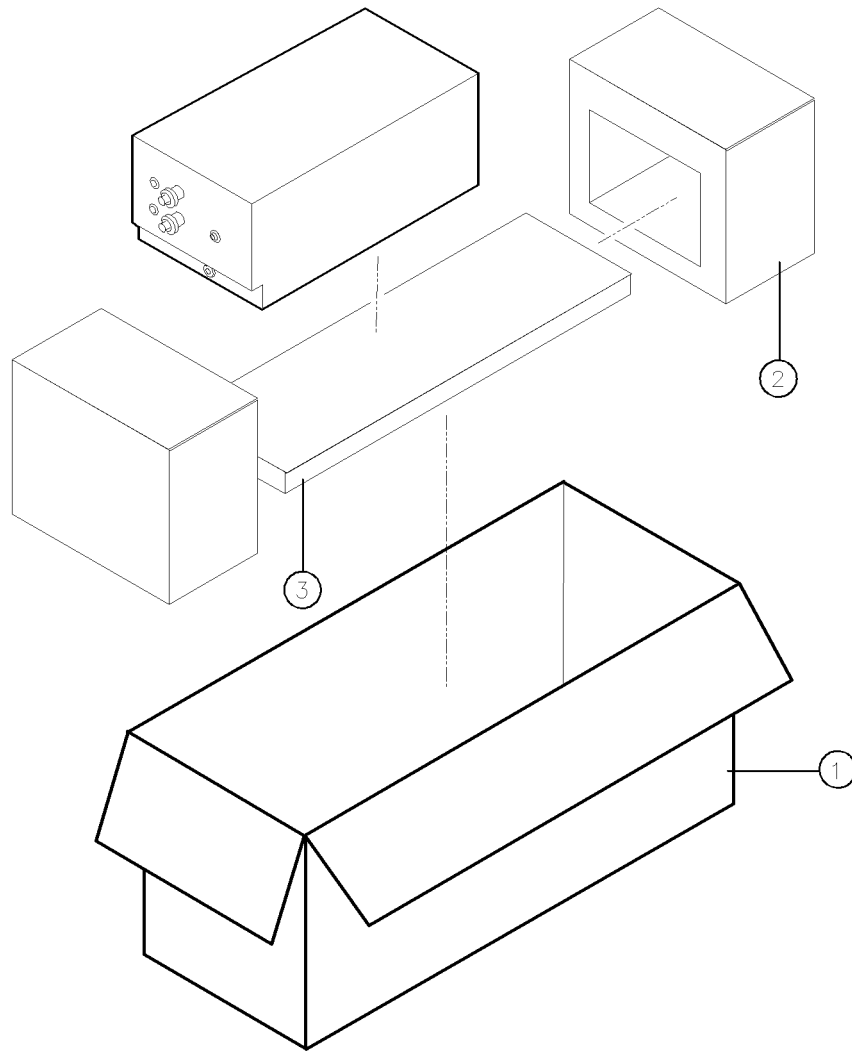
If the Microwave Transition Analyzer Needs to be Returned for Service

The original shipping containers and materials, or the equivalent, must be used when repackaging the display with the module or the module alone. Packaging materials identical to the original factory packaging (refer to Figure 2-3 on page 2-14 or to Figure 2-4 on page 2-15) can be purchased through any Hewlett-Packard office. However, if these shipping materials are not available, instruments can be repackaged using the information below.

Caution Instrument damage can result from using packaging materials other than the original shipping materials or equivalent. Never use styrene pellets as packaging materials. They do not adequately cushion the instrument or prevent it from shifting in the carton. They cause instrument damage by generating static electricity.

Use the following procedure to prepare the instrument for shipment:

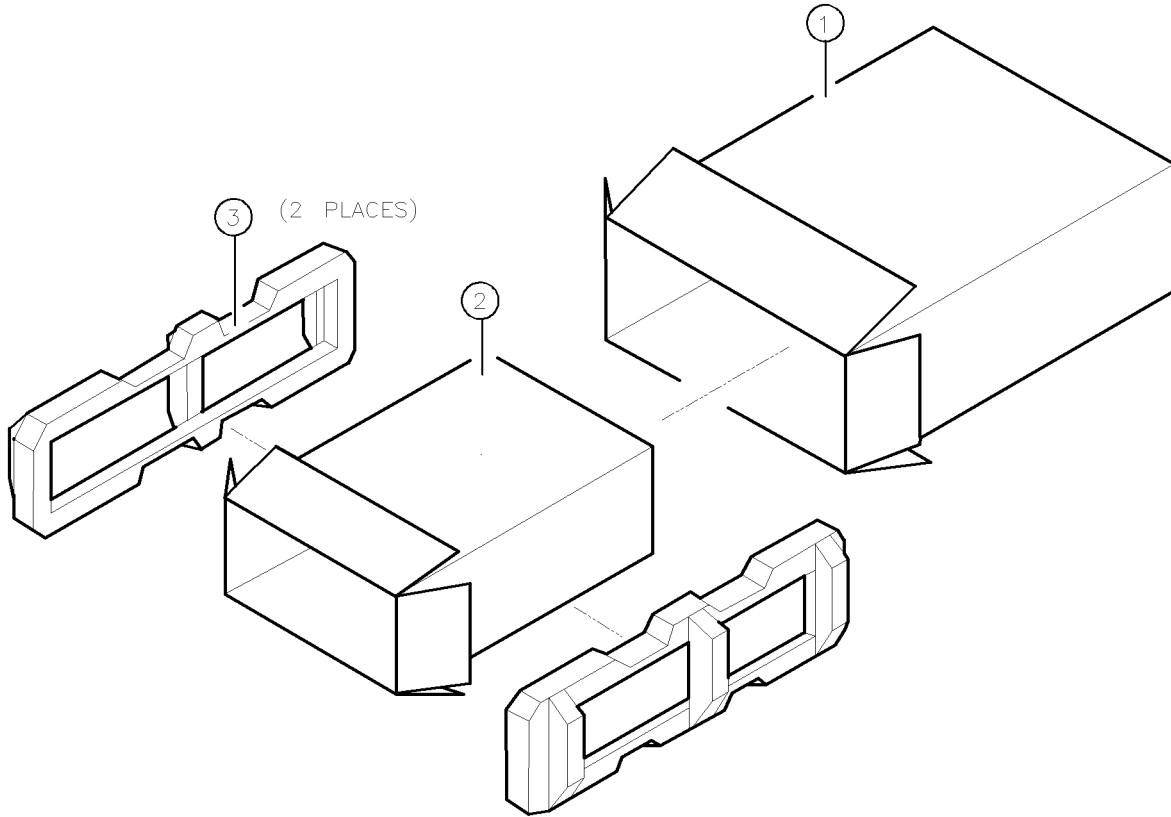
1. Fill out a blue repair card (located at the end of this manual) and attach it to the instrument. Also send copies of any error messages and performance data recorded for the instrument. If a blue repair card is not available, send the following information with the returned instrument:
 1. Type of service required.
 2. Description of the problem; state if the problem is constant or intermittent.
 3. Name and phone number of technical contact person.
 4. Return address.
 5. Model number of returned instrument.
 6. Full serial number of returned instrument.
 7. List of any accessories returned with instrument.
2. Pack the instrument in the original shipping materials (or the equivalent). However, if these are not available, instruments can be repackaged for shipment using the following instructions.
 1. Wrap the instrument in antistatic plastic to reduce the possibility of ESD-caused damage.
 2. For instruments that weigh less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength. The carton must be large enough and strong enough to accommodate the instrument. Allow at least 3 to 4 inches on all sides of the instrument for packing material.
 3. Surround the equipment with 3 to 4 inches of packing material to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation (Commerce, California 90001). Air Cap is a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink (antistatic) Air Cap to reduce static electricity. Wrap the instrument several times in this material to protect the instrument and prevent it from moving in the carton.
3. Seal the carton with strong nylon adhesive tape.
4. Mark the carton "FRAGILE, HANDLE WITH CARE."
5. Retain copies of all shipping papers.



FORMT106

Item	HP Part Number	CD	Qty	Description
1	9211-6561	8	1	Carton
2	9220-4836	5	1	Foam Pad Set
3	4208-0592	1	1	Spacer Pad

Figure 2-3. Packaging Materials for the HP 70820A Module



FORMAT42

Item	HP Part Number	CD	Qty	Description
1	9211-6353	6	1	Carton-Outer
2	9211-6355	8	1	Carton-Inner
3	9220-4742	2	1	Foam Pad Set

Figure 2-4. Packaging Materials for the HP 71500A System

Table 2-1. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS HEADQUARTERS	EUROPEAN OPERATIONS HEADQUARTERS	INTERCON OPERATIONS HEADQUARTERS
Hewlett-Packard Company 19320 Pruneridge Avenue Cupertino, CA 95014, USA (800) 752-0900	Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/Geneva Switzerland (41 22) 780.8111	Hewlett-Packard Company 3495 Deer Creek Rd. Palo Alto, California 94304-1316 (415) 857-5027
California Hewlett-Packard Co. 1421 South Manhattan Ave. Fullerton, CA 92631 (714) 999-6700 Hewlett-Packard Co. 301 E. Evelyn Mountain View, CA 94041 (415) 694-2000	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	Australia Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895
Colorado Hewlett-Packard Co. 24 Inverness Place, East Englewood, CO 80112 (303) 649-5000	Germany Hewlett-Packard GmbH Berner Strasse 117 6000 Frankfurt 56 West Germany (49 69) 500006-0	Canada Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232
Georgia Hewlett-Packard Co. 2000 South Park Place Atlanta, GA 30339 (404) 955-1500	Great Britain Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG11 5DZ England (44 734) 696622	Japan Yokogawa-Hewlett-Packard Ltd. 1-27-15 Yabe, Sagamihara Kanagawa 229, Japan (81 427) 59-1311
Illinois Hewlett-Packard Co. 5201 Tollview Drive Rolling Meadows, IL 60008 (708) 255-9800		China China Hewlett-Packard, Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888
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Operation Verification Testing

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Introduction

This chapter will help you install and perform the microwave transition analyzer's operation verification tests. This chapter contains both required and optional step-by-step instructions for running the operation verification test software.

You must get all of the test equipment listed in "Recommended Test Equipment" in Chapter 4 before you can perform all of the operation verification tests. If you do not have the recommended model of the test equipment, other equipment that meets the critical specifications listed in Table 4-3 may be substituted. The operation verification software was designed to support the recommended models of the test equipment, so equipment substitution may require that the software be modified.

For complete descriptions of each operation verification test, refer to "Operation Verification Test Descriptions" in Chapter 4.

Before starting the operation verification tests, make backup copies of the operation verification test disks to ensure that your original disks will not be altered. If the program data on an individual disk should become altered, it cannot be ordered separately. The entire set of disks must be ordered to replace any one disk.

Step 1. Set Up the Hardware for Operation Verification Testing

Operation verification software can run on the following HP 9000 Series 200/300 computers.

HP 9816	HP 9920 (with an HP 35721A monitor)
HP 9836	HP 9000 Series 300 computers

The computer should have a minimum of 2.5 megabytes of RAM available.

When an HP 9000 Series 300 computer is used, a medium-resolution monitor and either an HP 98203C or an HP 46020A keyboard is required. If a high-resolution monitor is used, you will not be able to print graphical test results. Due to the various keyboards supported, some minor text differences appear in the menus and softkeys displayed onscreen. Refer to “Alternate Key Labels” in Chapter 4.

1. Connect the HP 70820A microwave transition analyzer to the computer port. There are two possible configurations:

- If the computer has an HP 98624A HP-IB Interface:

Connect your microwave transition analyzer to the port labeled HP-IB SELECT CODE 8.

Check that the address switch on the HP 98624A HP-IB Interface matches the HP-IB controller device address.

If necessary, refer to the *HP 9000 Series 200/300 Peripheral Installation Guide, Volume 1*.

- If the computer does not have an HP 98624A HP-IB Interface:

Connect the microwave transition analyzer to the port labeled HP-IB SELECT CODE 7.

2. Connect the HP-IB cables from the test equipment to the computer's HP-IB SELECT CODE 7 port.
3. Connect the external disk drive's HP-IB to the HP-IB SELECT CODE 7 port using a 0.5 meter HP-IB cable (HP 10833D, or similar cable).

Occasionally disk drives exhibit unpredictable behavior when sharing the HP-IB with instruments. If you find that this occurs, connect the disk drive to a separate HP-IB interface.

4. Set the external test equipment and the microwave transition analyzer line switches to ON. Allow the equipment to warm up as specified for the operation verification tests.
5. Turn the disk drive (if used) and the computer on.

Step 2. Prepare the Computer

To run the operation verification test software, a BASIC programming language must be loaded into the computer. There are several binaries (BIN files) that must also be loaded into the computer.

1. Load BASIC 5.0 or later, with the appropriate binaries (BIN files), into an HP 9000 Series 200/300 computer. If necessary, refer to an HP BASIC reference manual.

The BIN files that should be loaded are listed below:

CLOCK	ERR	HPIB	MAT
CS80*	GRAPH	IO	MS
DISK†	GRAPHX	KBD	PDEV‡
DCOMM§	SRM§	HFS	

*Optional – supports Winchester disk drives.

†Optional – supports microfloppies and older Winchester disk drives.

‡Optional – provides debugging features for program development.

§Optional – required only for SRM (shared resource management) environment.

||Optional – required only for HFS (hierarchical file system) environment.

Caution

Make backup copies of all write-protected disks. If the program data on an individual disk should become altered, it cannot be ordered separately. The entire set of disks must be ordered to replace any one. Before making backup copies of write-protected disks, ensure that the backup disks have been initialized as follows:

```
INITIALIZE " : ,700,0" ,2,3.
```

Note that Format Option 3 must be used; however, the MSVS and Interleave Factor are specific to your system.

2. Assign the MSI (mass storage is) to the drive you will use as the default drive.

As an example, assigning the MSI to a disk drive looks like this: `MSI " : ,700,0"`

Step 3. Install the Operation Verification Software Menus

The verification software menus are installed with three disks: the Executive disk, the Operating disk, and the Driver disk. The Test disk is installed later.

1. Insert the Executive disk into the assigned default drive.
2. Type `LOAD "OP_VER",1` and then press `EXECUTE`.

The software version number appears on the screen that is displayed next. The Executive disk may require up to 2 minutes to load.

3. If the date and time prompt appears, enter the date and time in the following format: (dd mmm yyyy HH:MM).

where `dd` is the date,
`mmm` is the first three letters of the month,
`yyyy` is the year,
`HH` is the hour,
and `MM` is the minute.

For example, `10 MAR 1991 10:36` is the specified format for date and time.

4. If a message appears stating that mass storage data is needed, select a default storage table. Once the mass storage menu data is stored, this message will not reappear.

- If your computer system has dual floppy disk drives:

Press `PROCEED` and follow the onscreen prompts to select a default mass storage table.

- If your computer system has only one floppy disk drive:

Press `mass storage` to enter the mass storage menu.

Change the MSUS column of `DRIVER DISC 1` and `TEST DISC 1` so that the addresses entries match the `OPERATING DISC MSUS` address. Do not change the label in the MSUS column. Refer to “Optional: To Edit the Mass Storage Menu” on page 3-11 for information regarding making changes to the mass storage menu.

Press `DONE`, press `PROCEED`, and then press `PROCEED` again.

Note An error message may be displayed at this point. If the device under test does not match the module listed in the HP-MSIB address map, or if the software you are using belongs to another module of your system, refer to “Error and Status Messages” in Chapter 4 to determine a course of action.

5. When prompted to insert the Operating disk, remove the Executive disk, insert the Operating disk and press `PROCEED`.

The Operating disk probably needs to remain in the drive specified as the MSI default drive.

6. Insert the Driver disk when prompted to by the software, then press `PROCEED`.

This process may require up to 3 minutes.

Step 4. Enter the Power Sensor Information

The program prompts you to enter the power sensor's serial number and calibration data when the program is loaded for the first time. The power sensor information must be entered before you can perform complete operation verification testing; however, you can enter the information now or you can enter it before you start the testing.

If you enter the power sensor information now, follow the steps listed below. If you plan to enter the information later or if you do not have an HP 8487A power sensor available, simply press **ENTER** now and refer to "Optional: To Edit the Equipment Menu" on page 3-13 when you are ready to enter the power sensor information.

1. If the computer prompts you for the serial number of the HP 8487A power sensor, type in the power sensor's full serial number and press **ENTER**.

Enter serial # for HP8487A (leave blank if Not Available) and press [ENTER]? is the prompt to enter the power sensor's serial number. Type in the power sensor's ten-digit serial number (for example, 2845A02020) and press **ENTER**.

The power sensor's traceability number may be used instead of using its serial number.

2. Press **CREATE** to enter the power sensor's calibration data.

After entering the HP 8487A power sensor's serial number, the following messages will be displayed (02020 in the following message represents the last five characters of the power sensor's serial number):

```
ERROR MESSAGE: The calibration data for HP8487A with serial number 02020 is
not found on the current Operating Disc.
```

POSSIBLE FIX:

If the correct Operating Disc is loaded, press **CREATE** to create a new file. This error is normal when entering cal data for the first time.

Pressing **CREATE** transfers the program to the Edit Calibration Data edit screen and you are allowed to enter the power sensor's calibration data now.

3. Use the cursor arrow keys to move the [1]--> indicator to the first row of the CAL FACTORS column.

The [1]--> indicator indicates the column and the row that is selected. As the indicator is moved down the list, the number in the indicator increases. For example, the second row has [2]--> for an indicator; the third row has [3]-->, and so on.

4. Press **SELECT** to activate the first row of the CAL FACTORS column.

5. Type in the calibration data for the first frequency and press **ENTER**.

The calibration data is entered. The valid range for calibration data is between 0.3 and 1.6. For example, type in 1.14 and press **ENTER**.

6. Use the cursor arrow keys to move the [2]--> indicator to the CAL FACTOR column of the next frequency.
7. Press **SELECT**, type in the calibration data for the corresponding frequency, and press **ENTER**.
8. Repeat steps 6 and 7 until you have entered calibration data for all of the frequencies.

Not all frequencies are displayed on the screen at once. Be sure to scroll through the entire list of frequencies using the cursor arrow keys. Calibration data for each of the frequencies must be entered.

When you are entering the calibration data you may use the default frequencies or you may change any of the frequencies if necessary. However, 20 MHz must have calibration factors entered for it. Refer to “Edit Calibration Data” in Chapter 4 for additional information.

9. Press **DONE** when all calibration data is entered.

This stores the calibration data on the Operating disk in the following format:

S87A_XXXXX where XXXXX is last five digits of the power sensor's serial number.

The calibration data does not need to be entered each time the operation verification test is installed. In the future, you can access the power sensor information (serial number and calibration data) from the Equipment menu and the Equipment menu's Calibration Data edit screen.

Step 5. Decide Whether to Start Testing

All or part of the following prompt will now be displayed:

Some tests cannot be completed because there is required test equipment missing. These tests will be flagged as Missing ETE in the Test Menu.

Some tests cannot be completed because there are required passive devices missing. These tests will be flagged as Missing ETE in the Test Menu.

You can decide to start testing by selecting `ALL TEST`, or make changes to the Equipment Menu by selecting `equipment menu`, or go to the Main Menu by selecting `main menu`. From the Main Menu you can go to any other menu.

The first and second messages of this prompt will not always be displayed. If only the third message of this prompt is displayed, the Equipment menu is set up completely.

The first message indicates that there is required test equipment that the Equipment menu that does not have an address assigned.

The second message indicates that not all of the required passive devices are available. For example, the power sensor may not be shown as `Available` in the address column.

- If the first message of prompt is displayed, press `equipment menu`.

Check that the test equipment information in Equipment menu is complete. Refer to “Optional: To Edit the Equipment Menu” on page 3-13.

- If the second message of the prompt is displayed, press `equipment menu`.

Check that the passive device information in the Equipment menu and the Edit Calibration Data menu is complete. Refer to “Optional: To Edit the Equipment Menu” on page 3-13 and follow the instructions for entering the power sensor’s information.

- If you want to customize the operation verification software to run on your computer system, press `main menu` and then refer to “Optional: To Edit the Mass Storage Menu” on page 3-11.
- If you want to customize how the operation verification tests run or how the results are displayed, press `main menu` and then refer to “Optional: To Edit the Parameter Menu” on page 3-12.

- If you do not plan to use the recommended test equipment, press `equipment menu` to change the equipment information.

Refer to “Recommended Test Equipment” in Chapter 4 for a complete list of test equipment needed to perform the operation verification tests. Refer to “Optional: To Edit the Equipment Menu” on page 3-13 for information about changing the test equipment.

- If only the third message is displayed and you are ready to run the operation verification tests, press `ALL TEST`.

This softkey runs all of the operation verification tests sequentially.

- If you want to exit this program, press `main menu` and then press `quit`.

You may leave this program by pressing the `quit` softkey in the Main menu.

Step 6. Start the Operation Verification Testing

The operation verification tests may be run individually by selecting the tests in the Test menu or they may be run automatically by pressing **ALL TEST**. This procedure explains the ALL TEST method. Refer to “Test Menu” in Chapter 4 for information on running individual operation verification tests.

1. Press **ALL TEST**.

To start running the sequence of operation verification tests, press **ALL TEST** from either the prompt explained in “Step 5. Decide Whether to Start Testing” on page 3-8 or from the Main Menu.

2. When you are prompted to insert the Test disk, remove the Driver disk and insert the Test disk into the disk drive.
3. Press **PROCEED** to load the Test disk.

The program now starts with the first operation verification test and runs sequentially until all of the tests have been run.

4. If you must use the **ABORT** softkey during a test, you can use the **RESUME TESTING** softkey to continue testing at the next test in the ALL TEST sequence.

Refer to “Test Menu” in Chapter 4 for additional information.

Optional: To Edit the Mass Storage Menu

The BASIC operating system can use a number of mass storage devices. These include internal disk drives, external disk drives, and SRM systems. The Mass Storage menu allows you to assign the areas where the program stores the system and operation data. Refer to “Mass Storage Menu” in Chapter 4 for additional information.

1. From the Main menu, press **mass storage** to display the Mass Storage menu edit screen.
2. Move the indicator []--> next to the column item that you want to change.

There are three columns in the edit screen (VOLUME LABEL, MSUS, and DIRECTORY PATH). The MSUS and the DIRECTORY PATH columns may be changed. The VOLUME LABEL column may not be changed.

The annotations <=more and more=> indicate that there is a column off of the display that you must scroll the screen left or right to view.

3. Press **SELECT** to activate the item that you want to change.
4. Type in the new location (msus or directory path). Press **(ENTER)** when the new entry for the item is complete.

Leave the DIRECTORY PATH column blank unless you are using an SRM (shared resource management) or an HFS (hierarchical file system) system.

5. Repeat steps 2, 3, and 4 until you have finished making changes.
6. Press **DONE** to display the Mass Storage menu command screen.
7. Press **STORE** to store the Mass Storage menu changes.

Pressing **STORE** stores the changes that were made to the Mass Storage menu onto the Operating disk. Storing the Mass Storage menu data for the first time causes an error message that prompts you create a file. Just press **CREATE** to create the file.

8. Press **main menu** to return to the Main menu.

Optional: To Edit the Parameter Menu

The Parameter menu allows you to determine and edit some operating conditions of the software program. You can select whether the test results are printed, additional output parameters, the line frequency being used, whether the beeper is activated, and whether the presence of each instrument on the HP-IB is verified. Refer to “Parameter Menu” in Chapter 4 for detailed information.

1. From the Main menu, press **parameter menu** to display the Parameter menu edit screen.
2. Move the []--> indicator to the row to be edited.
3. Press **SELECT/TOGGLE** to edit the Selection column for the selected row.

The **SELECT/TOGGLE** toggles between predefined selections in these four rows.

Parameter Items	Selection
Results sent to:	Screen or Printer
Line frequency:	60, 50, or 400
Beeper to be activated:	No or Yes
Verify equipment on HP-IB:	No or Yes

For the remaining rows, information must be typed in and entered. For a complete definitions of each parameter item, refer to “Parameter Menu Edit Screen” in Chapter 4.

4. Edit the User Lines items:

The user lines allow the user to enter additional information that will be printed on the header page of printed test results. To edit the user lines:

- Position the indicator to the first user line.
 - Press **SELECT/TOGGLE**.
 - Type in your message when the prompt **Enter additional information** appears.
 - Press **ENTER**.
 - Position the cursor at **Number lines added:**. Type in the number of **User Lines** that are entered. Press **ENTER**.
5. When you have finished making edits, press **DONE** to display the Parameter menu command screen.
 6. Press **STORE** to store the Parameter menu changes.

Pressing **STORE** stores the changes that were made to the Parameter menu onto the Operating disk. Storing the Parameter menu data for the first time may cause an error message that prompts you create a file. Just press **CREATE** to create the file.

7. Press **main menu** to return to the Main menu.

Optional: To Edit the Equipment Menu

The Equipment menu edit screen displays a list of all the equipment required to perform the HP 70820A microwave transition analyzer's operation verification tests. Next to each DEVICE TYPE in the equipment list is a column labeled DEVICE MODEL for the model number, ADDRESS for the HP-IB address, and SERIAL or ID NO. (for example, calibration lab number). Refer to "Equipment Menu" in Chapter 4 for additional information.

1. From the Main menu, press **equipment menu** to display the Equipment menu edit screen.
2. Move the []--> indicator to the row and column to be edited.

There is a row for each piece of test equipment that is required. There are four columns (DEVICE TYPE, DEVICE MODEL, ADDRESS, and SERIAL or ID NUM.). Entries in the DEVICE TYPE column can not be edited. The annotations <=more and more=> indicate that there is a column off of the display that you must scroll the screen left or right to view.

3. Press **SELECT** to activate the item that you want to edit.
4. Type in the information for the selected item and press **ENTER**.

Each column contains unique information. The address column should have the HP-IB address for test equipment and should have either **Available** or **Not Available** for passive devices. Refer to "Equipment Menu Edit Screen" in Chapter 4 for additional information on each column.

5. Repeat steps 2, 3, and 4 until you have finished making changes.
6. Press **DONE** to display the Equipment menu command screen.
7. If you edited the power sensor information, continue at "Optional: To Edit the Power Sensor's Calibration Data" on page 3-14.

Editing the power sensor information requires that new calibration data be entered. However, if you did not edit the power sensor information, continue with the next step.

8. Press **STORE** to store the Equipment menu changes.

Pressing **STORE** stores the changes that were made to the Equipment menu onto the Operating disk. Storing the Equipment menu data for the first time may cause an error message that prompts you create a file. Just press **CREATE** to create the file.

9. Press **main menu** to return to the Main menu.

If you press **main menu** and the **NO ADDRESS** softkey appears, the program cannot find an instrument at a specified HP-IB address. To check which instruments are not responding:

- Access the Equipment menu edit screen by pressing **EDIT**.
- Examine the ADDRESS column for addresses that are enclosed in parenthesis. For example, (719).
- Ensure that the instrument with the denoted address is on.
- Press **SELECT** to activate the denoted address.
- Either enter the correct address to correct the problem or return to the Equipment menu command screen and press **NO ADDRESS** to delete all fault-addresses from the edit menu.

Optional: To Edit the Power Sensor's Calibration Data

The power sensor requires that its calibration data be entered. You probably entered your power sensor's calibration data when you first installed the operation verification software. However, if you bypassed that step, recalibrated your power sensor, or plan to use another power sensor, the calibration data can be entered now.

The power sensor's calibration frequencies may also be changed if necessary. 10 MHz and 300 MHz must have a calibration factor entered for them. Refer to "Edit Calibration Data" in Chapter 4 for additional information.

If you have not already done so, enter the power sensor's serial number before starting this procedure. Refer to "Optional: To Edit the Equipment Menu" on page 3-13 for instructions.

1. From the Equipment menu command screen, press **edit cal data**.

This transfers the program to the Equipment menu's Select Passive Device screen.

2. Move the [1]--> indicator to point to the power sensor and press **SELECT**.

3. Press **CREATE** if you are prompted to create a file.

Editing the power sensor's calibration data for the first time may cause an error message. The error message prompts you create a file.

4. Use the cursor arrow keys to move the [1]--> indicator to the first item to edit.

The [1]--> indicator shows the column and the row that is selected. As the indicator is moved down the list, the number in the indicator increases. For example, the second row has [2]--> for an indicator; the third row has [3]-->, and so on.

5. Press **SELECT** to activate the first row of the CAL FACTORS column.

6. Type in the calibration data for the first frequency and press **ENTER**.

The calibration data is entered. The valid range for calibration data is between 0.3 and 1.6. For example, type in 1.14 and press **ENTER**. This is stored as a percentage by the program.

When deleting an item, clear the line, and press **ENTER**.

7. Move the []--> indicator to the CAL FACTOR column of the next frequency.

8. Press **SELECT** and enter the calibration data for the corresponding frequency.

9. Repeat steps 6 and 7 until you have entered calibration data for all of the frequencies.

Not all frequencies are listed on the screen at once. Be sure to enter calibration data for all of the frequencies listed on the display.

10. Press **DONE** when all calibration data is entered.

This stores the calibration data on the Operating disk and returns the program to the Equipment menu's Select Passive Device screen.

11. Press **DONE** to return to the Equipment menu command screen.

Installation and Operation Verification Reference

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Introduction

This chapter contains information on recommended products for the microwave transition analyzer, electrostatic discharge information, an overview of the operation verification software, descriptions of each of the operation verification software menus, listings of error and status messages that may be encountered when running the software, a table identifying required test equipment, and operation verification test descriptions.

Microwave Transition Analyzer Options Lists the options available for the HP 71500A/HP 70820A microwave transition analyzer.

Microwave Transition Analyzer Accessories Lists the accessories available for the HP 71500A/HP 70820A microwave transition analyzer.

System Power Cables Identifies the power cables available for HP products. The description, HP part number, and the countries of use for which each cable was intended is listed.

Serial Number Labels Describes the serial-number label and the module location where the serial-number label is attached.

Electrostatic Discharge Information Explains how to reduce the risk of damage caused by electrostatic discharge. Lists products available to assist in preventing damage caused by electrostatic discharge.

Computer Compatibility Lists the computers, the programs, the BIN files required to run the operation verification tests, and the alternate key labels for computer keyboards not matching the default keyboard.

Operation Verification Software Overview Describes features that the operation verification software provides.

Operation Verification Software Menus Describes the purpose of each of the operation verification software menus and the softkeys that are available in each menu.

Operation Verification Software Menu Softkey Diagrams Illustrates the menu structure for each HP 70820A operation verification software menu. All paths for each menu are displayed.

Error and Status Messages Describes each of the user interface messages, providing information about test results, operator errors, and system conditions.

Recommended Test Equipment Lists equipment required to perform the operation verification tests, the critical specifications, and recommended model numbers for the equipment.

Operation Verification Test Descriptions Describes the purpose of each operation verification test, the required equipment to perform the test, and the equipment set up. The description of the test and a listing of which module assemblies to check if the test fails are also included.

Microwave Transition Analyzer Options

The following options are available for the HP 71500A/HP 70820A microwave transition analyzer. Some options are available only for the HP 71500A microwave transition analyzer system. The HP part number is also included so that these parts may be ordered separately.

Option 001 Delete adaptor and cable accessories. The deleted parts include:

Description	Quantity	HP Part Number
Cables, SMB (female) to BNC (male) (For frequency reference and pulse modulator outputs)	2	85680-60093
Cable, SMA (male) to SMA (male) (For IF calibration)	1	8120-5068
Adapters, APC-2.4 (female) to APC-3.5 (female)	2	1250-2277
Adapters, APC-2.4 (female) to APC-2.4 (female)	2	1250-2188
Feedthrough, 50Ω, BNC (For to improve the impedance match between the HP 70820's rear-panel MOD OUTPUT connector and the input of some modulators. The HP 10100C may be needed in situations where faulty triggering is caused by pulse modulators having high input impedance. Long connecting cables can aggravate this problem.)	1	HP 10100C

Option 002 Delete external power pack (HP part number 70310-60016). The external power pack supplies power to the HP 70820 module's frequency reference oven when the mainframe power is turned off. This option is available for the HP 71500A microwave transition analyzer system only.

Option 003 Add tutorial kit. Includes tutorial and demonstration parts for a self-paced class on the operation and capabilities of the microwave transition analyzer. Most parts are useful accessories after the completion of the tutorial.

Description	Quantity	HP Part Number
Tutorial labguide	1	70820-90033
Power splitter	1	HP 11667B
20 dB coaxial attenuator, APC-3.5	1	HP 8493C Option 020
Demonstration DUT, limiter	1	5086-7746
Demonstration DUT, PIN switch	1	70820-60066
SMA cables	3	5061-5458
SMA barrels (male-male)	2	1250-1159
SMA barrel (female-female)	1	1250-1158
1/4 inch wrench	1	8720-0014
5/16 inch wrench	1	8720-0015
Multiple product notes		

- Option 810 Add rackmount slide kit (HP part number 5062-7086). This option is available for the HP 71500A microwave transition analyzer system only; however, the HP part number can be used to order the rackmount slide kit separately.
- Option 908 Add rack flange kit for instrument without handles (HP part number 5062-3979). This option is available for the HP 71500A microwave transition analyzer system only; however, the HP part number can be used to order the rack flange kit separately.
- Option 910 Add an additional set of user's manuals.
- Option 913 Add rack flange kit for instrument with handles (HP part number 5062-4073). This option is available for the HP 71500A microwave transition analyzer system only; however, the HP part number can be used to order the rack flange kit with handles separately.
- Option 915 Add service manuals. Includes assembly level service manual and component level information for the HP 70820A microwave transition analyzer module. This option for the HP 71500A microwave transition analyzer system also includes service information for the HP 70004A display.

Microwave Transition Analyzer Accessories

The following tables show the accessories that are available for use with the microwave transition analyzers. Each accessory listed has a description and an HP part number except for the phase stable flexible cables available from Adams-Russell. These cables include the description and the Adams-Russell part number.

Convenience Kits

The three convenience kits listed below were designed to allow you to order adapters, shorts, and attenuators that will be needed while using the microwave transition analyzer. The kit (for example, HP 83023A) can be ordered instead of ordering each accessory individually. The parts in each kit are designed to be used in a specific frequency range. Consider the anticipated frequency of use before deciding which convenience kit to order.

HP 83023A Type-N (18 GHz connectors) Convenience Kit

Item	Quantity	HP Part Number
Adapter, APC-2.4 (female) to type-N (female)	2	HP 11903B
Adapter, APC-3.5 (female) to type-N (male)	1	1250-1744
Coaxial short, type-N (male)	2	1250-1530
20 dB coaxial attenuator, type-N	2	HP 8491B Option 020
3 dB coaxial attenuator, type-N	2	HP 8491B Option 003

HP 83024A APC-3.5 (26.5 GHz connectors) Convenience Kit

Item	Quantity	HP Part Number
Adapter, APC-2.4 (female) to APC-3.5 (female)	2	1250-2277
SMA coaxial shorts (male)	2	0960-0055
20 dB coaxial attenuator, APC-3.5	2	HP 8493 Option 020
3 dB coaxial attenuator, APC-3.5	2	HP 8493 Option 003

HP 83025A APC-2.4 (50 GHz connectors) Convenience Kit

Item	Quantity	HP Part Number
Adapter, APC-2.4 (female) to APC-2.4 (female)	2	1250-2188
Adapter, APC-3.5 (female) to APC-2.4 (male)	1	1250-2276
Coaxial short, APC-2.4 (male)	2	HP 85140A
20 dB coaxial attenuator, APC-2.4	2	HP 8490D Option 020
3 dB coaxial attenuator, APC-2.4	2	HP 8490D Option 003

Coaxial Fixed Attenuators

HP Model Number	Description														
HP 8493C	dc to 26.5 GHz; 2 W, APC-3.5 connectors														
HP 8490D	dc to 50 GHz; 2 W, APC-2.4 connectors														
	Options for the HP 8493C and HP 8490D attenuators include:														
	<table><thead><tr><th>Option</th><th>Attenuation</th></tr></thead><tbody><tr><td>Option 003</td><td>3 dB</td></tr><tr><td>Option 006</td><td>6 dB</td></tr><tr><td>Option 010</td><td>10 dB</td></tr><tr><td>Option 020</td><td>20 dB</td></tr><tr><td>Option 030</td><td>30 dB</td></tr><tr><td>Option 040</td><td>40 dB</td></tr></tbody></table>	Option	Attenuation	Option 003	3 dB	Option 006	6 dB	Option 010	10 dB	Option 020	20 dB	Option 030	30 dB	Option 040	40 dB
Option	Attenuation														
Option 003	3 dB														
Option 006	6 dB														
Option 010	10 dB														
Option 020	20 dB														
Option 030	30 dB														
Option 040	40 dB														
HP 8498A Option 030	High power 30 dB attenuator, dc to 18 GHz at 25 W avg; dc to 5.8 GHz at 500 W peak, 5.8 GHz to 18 GHz at 125 W peak. Type-N (male, female)														

Adapters

HP Part Number	Description
HP 11900B	APC-2.4 (female) to APC-2.4 (female)
HP 11901B	APC-2.4 (female) to APC-3.5 (female)
HP 11902B	APC-2.4 (female) to APC-7
HP 11903B	APC-2.4 (female) to Type N (female)
HP 11904B	APC-2.4 (female) to K (female)
1250-2326	APC-2.4 (male) to APC-2.4 (male)
1250-1200	SMA (male) to BNC (female)

Coaxial Shorts and Opens

HP Part Number	Description
0960-0054	Short, SMA (female)
0960-0055	Short, SMA (male)
HP 85140A	Short, APC-2.4 (male)
HP 85140B	Short, APC-2.4 (female)
HP 85141A	Open, APC-2.4 (male)
HP 85141B	Open, APC-2.4 (female)

dc Blocking Capacitors

HP Model Number	Description
HP 11742A	10 MHz to 26.5 GHz, 50 V, APC-3.5 connectors
HP 11742E	10 MHz to 50 GHz, 50 V, APC-2.4 connectors

Bias Networks

HP Model Number	Description
HP 11612A	45 MHz to 26.5 GHz, 40 V, APC-3.5 connectors
HP 11612B	45 MHz to 50 GHz, 40 V, APC-2.4 connectors

Phase-Stable Cables

HP Model Number	Description
HP 85133C	Semirigid cable (81 cm), APC-2.4 connector device side (female)
HP 85133D	Semirigid cable set (53 cm each); APC-2.4 connectors device side (one male, one female)
HP 85133E	Flexible cable (81 cm), APC-2.4 connector device side (female)
HP 85133F	Flexible cable set (53 cm each), APC-2.4 connectors device side (one male, one female)
HP 85134D	Semirigid cable set (53 cm each), APC-3.5 connectors device side (one male, one female)
HP 85134F	Flexible cable set (53 cm each), APC-3.5 connectors device side (one male, one female)
HP 85135D	Semirigid cable set (53 cm each), APC-7 connectors device side (one male, one female)
HP 85135F	Flexible cable set (53 cm each), APC-7 connectors device side (one male, one female)

The following phase-stable flexible cables are available from Adams-Russell. Contact Test Product Sales, (508) 388-5210

Adams-Russell Part Number	Description
1946-8000-0130	Phase stable flexible cable assembly (1 m). APC-2.4 (female) test port connector on one end; APC-2.4 (male) connector on the device side.
1946-8000-0131	Phase stable flexible cable assembly (1 m). APC-2.4 (female) test port connector on one end; APC-3.5 (male) connector on the device side.
1946-8000-0132	Phase stable flexible cable assembly (1 m). APC-2.4 (male) connectors on both ends.
1946-8000-0133	Phase stable flexible cable assembly (1 m). APC-3.5 (male) connectors on both ends.

4-8 Installation and Operation Verification Reference

HP-MSIB Cables

HP-MSIB cables are used to interconnect mainframes and displays. Two or more cables are needed for each system with multiple mainframes.

HP Model Number	Description
HP 70800A	HP-MSIB cable, 0.5 m
HP 70800B	HP-MSIB cable, 1.0 m
HP 70800C	HP-MSIB cable, 2.0 m
HP 70800D	HP-MSIB cable, 6.0 m
HP 70800E	HP-MSIB cable, 30 m

Tools

HP Part Number	Description
8710-1307	8 mm hex-ball driver, 6-1/2 inch shaft
8710-1651	8 mm hex-ball driver, 1-3/4 inch shaft
8710-1765	8 in-lb torque wrench for APC-2.4 and APC-3.5 connectors
8710-1764	8 in-lb torque wrench for 20 mm nut

Miscellaneous Parts and Supplies

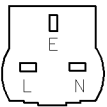

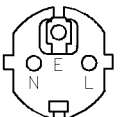
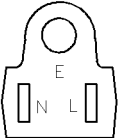
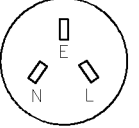
HP Part Number	Description
2110-0703	Fuse, 6.3 A, 250 V
5061-9006	Panel-mainframe front blank, 1/8 module width
8500-2163	Display cleaner, thin-film cleaner

System Power Cables

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When this cable is connected to a properly grounded power receptacle, the instrument cabinet is grounded.

A suitable cable for systems shipped to international customers is included with each system. If additional cables need to be ordered, refer to Table 4-1 for part numbers.

Table 4-1. Power Cables

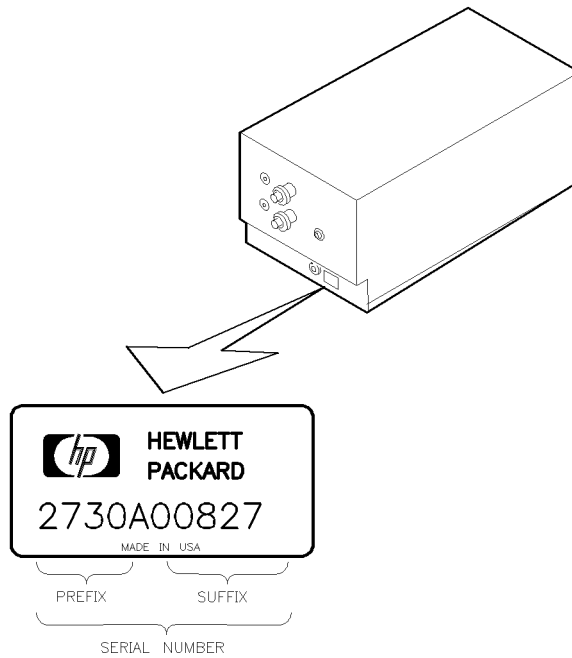
PLUG TYPE **	CABLE HP PART NUMBER	PLUG DESCRIPTION	CABLE LENGTH CM (INCHES)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight *BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Great Britain, Cyprus, Nigeria, Singapore, Zimbabwe
250V 	8120-1369 8120-0696	Straight *NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Argentina, Australia, New Zealand, Mainland China
250V 	8120-1689 8120-1692	Straight *EE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Central African Republic, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1538	Straight *NEMA5-15P 90°	203 (80) 203 (80)	Black Black	United States Canada, Japan (100 V or 200 V), Brazil, Colombia, Mexico, Philippines, Saudia Arabia, Taiwan
	8120-1378	Straight *NEMA5-15P	203 (80)	Jade Gray	
	8120-4753	Straight	230 (90)	Jade Gray	
	8120-1521	90°	203 (80)	Jade Gray	
	8120-4754	90°	230 (90)	Jade Gray	
250V 	8120-5182 8120-5181	Straight *NEMA5-15P 90°	200 (78) 200 (78)	Jade Gray Jade Gray	Israel
<p>* Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug.</p> <p>** E = Earth Ground; L = Line; N = Neutral.</p>					

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Serial Number Labels

A serial-number label is attached to the front frame of the microwave transition analyzer module. The serial number is divided into two parts. The first four digits and letter are the serial-number prefix; the last five digits are the suffix. Refer to Figure 4-1.

The prefix is the same for all identical modules; the prefix changes only when a significant modification is made to the product. The suffix, however, is assigned sequentially and is different for each module.



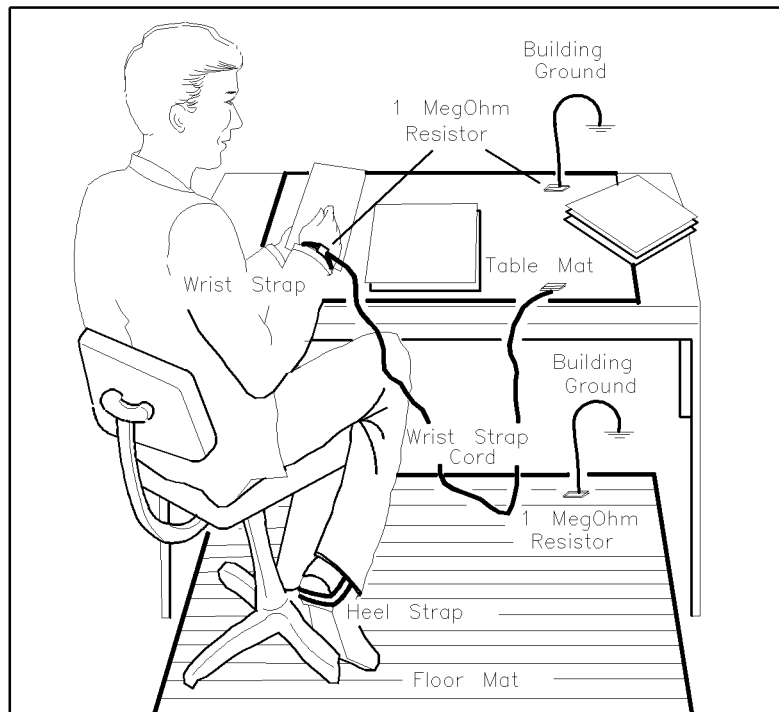
DZA47

Figure 4-1. Module Serial-Number Label

Electrostatic Discharge Information

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-safe workstation.

Figure 4-2 shows an example of a static-safe workstation. Two types of ESD protection are shown (a) conductive table mat and wrist strap combination and (b) conductive floor mat and heel strap combination. The two types *must* be used together to ensure adequate ESD protection. Refer to “Static-Safe Accessories” for a list of static-safe accessories and their part numbers.



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Figure 4-2. Static-Safe Workstation

Reducing ESD Damage

Below are suggestions that may help reduce the amount of ESD damage that occurs during testing and servicing instruments.

PC Board Assemblies and Electronic Components

- Handle these items at a static-safe workstation.
- Store or transport these items in static-shielding containers.

Caution

Do not use erasers to clean the edge connector contacts. Erasers generate static electricity and degrade the electrical quality of the contacts by removing the thin gold plating.

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

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

PC board assembly edge-connector contacts may be cleaned by using a lint-free cloth with a solution of 80 percent electronics-grade isopropyl alcohol and 20 percent deionized water. This procedure should be performed at a static-safe workstation.

Test Equipment

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

Static-Safe Accessories

Table 4-2. Static-Safe Accessories

HP Part Number	Description
Order the following through any Hewlett-Packard Sales and Service Office	
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).

Computer Compatibility

Operation Verification software is written in HP 9000 Series BASIC 5.0 and can run on the following HP 9000 Series 200/300 computers. The computer should have a minimum of 2.5 megabytes of RAM available.

HP 9816	HP 9920 (with HP 35721A monitor)
HP 9836	HP 9000 Series 300 computers

When an HP 9000 Series 300 computer is used, a medium-resolution monitor and either an HP 98203C or an HP 46020A keyboard is required. If a high-resolution monitor is used, you will not be able to print graphical test results. Due to the various keyboards supported, some minor text differences appear in the menus and softkeys displayed onscreen. Refer to “Alternate Key Labels” on page 4-16.

Computer Language Compatibility

The software program runs on HP BASIC 5.0, or later, with the BIN files in RAM that are listed below. A procedure for loading HP BASIC is provided in “Step 2. Prepare the Computer” in Chapter 3.

CLOCK	ERR	HPIB	MAT
CS80*	GRAPH	IO	MS
DISK†	GRAPHX	KBD	PDEV‡

*Optional – supports Winchester disk drives.

†Optional – supports microfloppies and older Winchester disk drives.

‡Optional – provides debugging features for program development.

In an HFS (hierarchical file system) environment, the following BIN file is also required:

HFS

In an SRM (shared resource management) environment, the following BIN files are also required:

DCOMM
SRM

Note

If you have set up some RAM memory for specific usage, be aware that this program uses RAM memory Volume “:MEMORY, 0, 15”. If the default DATA Volume from the Mass Storage table has not been modified, this program also uses RAM memory Volume “:MEMORY, 0, 0”. Move any information stored at this Volume to another location before running the operation verification software program.

Printer Compatibility

Operation Verification Software supports any HP-IB printer; however, many of the printed test results require a graphics printer. Graphical test results are not output to a non-graphics printer.

Alternate Key Labels

For simplicity in this document, we assume that you are using an HP 9000 Series 200 keyboard. Refer to the list below if your keyboard key labels do not match the ones used in text.

Keyboard Key Labels

Alternate Key Labels

EXECUTE	RETURN
ENTER	RETURN
RUN press SYSTEM , then	RUN
CONTINUE press SYSTEM , then	CONTINUE

Operation Verification Software Overview

Error Messages or Warnings Defined

There are three kinds of error messages or warnings generated by the program.

- One type appears briefly at the bottom of the display. The program then goes automatically to a menu that asks you for corrections or modifications.
- Another type of error message begins with **ERROR MESSAGE** and provides special softkeys. These errors are user-correctable and anticipated by the program. There is usually a **Possible Fix** message displayed to help you clear the problem.
- The final type begins with **ERROR** and provides no special softkeys. The message informs you of an unanticipated error. There is no suggested fix displayed. If you cannot recover from one of these errors, please contact your Hewlett-Packard Sales and Service Office.

Single Tests Defined

You may select individual tests with this program. Refer to “Test Menu” on page 4-29 for a description of how to select individual tests.

Printed Test Results

The program shows whether each procedure passed or failed. You may configure the computer operations to format and print test results via the Parameter menu. If an HP-IB printer is on the bus and an address is provided in the Equipment menu, and you configured the Parameter menu to print test results, the program automatically prints the test results. The printout includes a title and a summary page.

The title page lists the following data:

- Module software used and the test date.
- Serial number of the module tested.
- Firmware version of the module tested.
- Power line frequency.
- Test person’s identification.
- Test equipment model numbers and names, addresses, and ID or serial number.

The total test time and whether or not the operation verification tests were completed and passed are printed on the summary page. Each test is listed beneath one of the following categories on the summary page:

- The following Limited Cal Tests need to be completed:
- The following tests showed insufficient performance:
- The following tests met the appropriate requirements:
- The following additional tests were not completed:
- The following tests were not completed:

Operation Verification Software Menus

The operation verification test software has a variety of menu levels. From the Main menu, four sub-level menus may be accessed. Each of these sub-level menus has a variety of sub-levels beneath it. The menu maps, Figure 4-3 through Figure 4-6, show how each menu is structured.

Menu Structure

An initial screen is displayed when the operation verification test software is installed that offers a variety of choices. This initial screen allows you to either go to the Main menu, to begin all of the operation verification tests, or to go to the Equipment menu. From the Main menu, you can access any of the following menus:

- Mass Storage menu
- Parameter menu
- Equipment menu
- Test menu

Except for the Test menu, these menus are configuration menus through which you initialize the software for program operation. You can enter configuration information about equipment such as disk drives, environmental conditions, test equipment, and the module under test using these menus. Each of these menus is documented in this chapter. Refer to the section about each specific menu for detailed information.

In the Test menu, you select and execute operation verification tests. The Test menu provides some testing options. Refer to “Test Menu” on page 4-29 for details.

The Mass Storage menu, the Parameter menu, and the Equipment menu each have two menu screens. One is the edit screen, the other is the command screen.

- In edit screens, you can edit displayed data or input data to the screen.
- In command screens, you may perform various menu-specific functions, which include storing edited data, selecting test mode, accessing the help screen, and accessing the Main menu.

Edit and Command Screen Menus

The following softkeys are present for menus that appear in Figure 4-3 through Figure 4-6. Not all of the menus have edit screens, but all have command screens. When softkey labels are written in lowercase letters, a sub-level softkey menu exists for that particular softkey. Softkey labels written in uppercase letters indicate that no further sub-level softkey menus exist for that softkey.

Edit Screen Menus

The following softkeys are present for edit menus that appear in Figure 4-3 through Figure 4-6.

- SELECT** or **SELECT/TOGGLE** either one or the other, not both, will appear in the edit screen menu. **SELECT** activates the column item where the cursor is located, but **SELECT/TOGGLE** activates predefined choices in the menu.
- DONE** exits the edit screen, then displays the menu's command screen.

Command Screen Menus

The following softkeys are present for the command screen menus pictured in Figure 4-3 through Figure 4-6. An additional softkey, **edit cal data**, appears only in the Equipment menu command screen. Refer to "Equipment Menu Command Screen" on page 4-27 for information about this softkey.

- main menu** returns you to the Main menu. Refer to "Main Menu" on page 4-21 for details.
- EDIT** appears if there is an edit screen in the menu you are working in. Pressing this key returns you to the menu's edit screen.
- STORE** appears if you have data that needs to be stored on the OPERATING VOLUME.
- CREATE** appears if you tried to store data when there is no existing file available. **CREATE** activates the store function and creates a file on the OPERATING VOLUME.
- REPEAT** appears if the correct Operating disk containing calibration data is not in the disk drive. This key allows you to insert the Operating disk into the disk drive and try again.
- ABORT** displays the Main menu screen. **ABORT** is available in various special task screens but never in a menu screen. In general, pressing this key a time or two will display the Main menu, which has a **quit** softkey.

If the Main menu has not appeared for the first time, pressing **ABORT** produces a message asking you to press **(RUN)**, which returns you to where you were when you pressed **ABORT**.

HELP

accesses menu and softkey descriptions. Listed below are softkey selections and functions available via this softkey.

NEXT PAGE takes you to the top of the next available menu page.

PREVIOUS PAGE returns you to the top of the preceding menu page.

PRINT HELP generates a printout of help-screen information.

DONE returns you to the command or edit screen of the menu you were previously in.

quit

displays the quit screen. This softkey is available only from menu command screens. After you press **quit**, you are asked if you really want to return to BASIC operating system. The following two softkey selections are available via the **quit** softkey.

YES stops the program, retains any data files you stored before pressing **quit**, and returns you to BASIC operating system. (You can press **RUN** to restart the program and return to the Main menu. The program retains all previously entered and stored data.)

NO displays the edit screen of the previous menu, or the command screen if there is no edit screen.

Cursor Keys and Menu Selections

When a cursor is present, use the cursor arrow keys (**→**), (**←**), (**↓**), and (**↑**) to position the cursor at the column item you wish to edit.

Note

In most cases, there are more selections available than are displayed onscreen. Be sure to move the cursor to the right and down as far as you can. **NEXT PAGE** and **PREVIOUS PAGE** softkeys are provided to speed your vertical searches.

Main Menu

From the Main menu screen you can access all other menus. There is no edit screen for this menu. Figure 4-3 illustrates the Main menu softkey organization.

Main Menu Softkeys

Aside from the common softkeys, there are two special softkeys presented in the Main menu. One is **ALL TEST**, which begins the operation verification tests sequence for a module. The second is the **RESTART** softkey. Press **RESTART** to reconfigure the program and retest a module, or to test a different module. Pressing this key affects the test status column of the Test menu command screen. The remaining Main menu softkeys include **mass storage**, **parameter menu**, and **equipment menu**. The Mass Storage menu, the Parameter menu, and the Equipment menu are explained in detail in this chapter.

If you have stored calibration data on another HP 70000 software product operating disk, replace your current Operating disk with that one and access the data. Be sure to return the Operating disk belonging with your module under test to the default drive.

Mass Storage Menu

The BASIC operating system can use a number of mass storage devices. These include internal disk drives, external disk drives, and SRM systems. You are prompted to assign the areas where the program stores system and operation data. You do this by assigning Volume Labels to an **msus** (mass storage unit specifier). An msus is a string expression that points to a mass storage location. A mass storage Volume is composed of one or more files. Files are data items or subprograms. A Volume might consist entirely of files on a floppy disk, or some number of files on a small portion of a hard disk. The Mass Storage menu lists Volume Labels that show the location of certain types of program information. These Volume Labels are explained below.

- DATA is where the test results are temporarily stored.
- ERROR LOG is where unanticipated errors are recorded for possible future use.
- OPERATING is where all the program data is stored.

The program retrieves specific information from the following Volume Labels:

- SYSTEM contains the Executive disk program code. There must be an msus assigned to this Volume Label.
- OPERATING contains the menu configuration files and calibration data.
- DRIVER DISK contains the driver instrument control program code. There must be an msus assigned to this Volume Label.
- TEST DISK contains the operation verification test programs.

Volume Labels each have a default msus. From the Mass Storage menu, you can reassign the current msus or directory path designation to another designation. You cannot edit Volume Labels, but you may edit their msus designations and directory path data fields.

Mass Storage Menu Edit Screen

Refer to “Optional: To Edit the Mass Storage Menu” in Chapter 3 for step-by-step instructions. The Mass Storage menu softkeys and their functions are described below.

SELECT activates the column item where the cursor is located.

DONE exits the edit screen, then displays the Mass Storage menu command screen.

Leave the Directory Path field blank unless you are using an SRM system, or HP BASIC 5.0 (or later version) that uses directory path hierarchy.

The Data Volume is predefined to use RAM DISK ":MEMORY,0,0". If this RAM disk is not initialized to at least 1520 records, or contains additional files not required by operation verification, BASIC error 64 may occur. Either reinitialize the RAM disk or use the Mass Storage menu edit screen to select another medium.

Mass Storage Menu Command Screen

From the command screen, you can press **STORE** to save the edited data. Saving Mass Storage menu data for the first time causes an error message prompting you to create a file. Do this simply by pressing **CREATE**.

Next, press **main menu** to return to the Main menu screen, or press **EDIT** and return to the Mass Storage menu edit screen.

Parameter Menu

You may determine some operating conditions of the software program in the Parameter menu. You can select the printer and its output parameters, decide whether you want the program beep feature on or off, or include a message on the test-results output. Use the **SELECT/TOGGLE** softkey to select the parameter item and enter data, or toggle to a predefined state. The parameter items and their appropriate selections are defined below. Refer to “Optional: To Edit the Parameter Menu” in Chapter 3 for Parameter menu instructions.

Parameter Menu Edit Screen

- Results sent to:** Your choices are Screen or Printer. Press **SELECT/TOGGLE**. When **Screen** is displayed, the test results appear on the display. When **Printer** is displayed, test results are both displayed onscreen and printed out.
- Printer Lines:** Lines allowed are from 50 to 70. Press **SELECT/TOGGLE**. Enter a number from 50 to 70 to set the number of lines per printed page.
- Line Frequency:** Valid frequency selections are 50, 60, and 400 Hz. Press **SELECT/TOGGLE** until the power line frequency for your system is displayed. The line frequency value affects some test results.
- Ambient temperature:** Valid Celsius temperature entries are 0 to 55. Press **SELECT/TOGGLE**. Type a number from 0 to 55, then press **ENTER**. This provides the program with the test environment temperature in Celsius, allowing the test limits to reflect temperature-drift guard-bands, if necessary.
- Ambient humidity:** Valid entries for ambient humidity are 0% to 105%. Press **SELECT/TOGGLE**. Type a number from 0 to 105, then press **ENTER**.
- Beeper to be activated:** Your choices are Yes or No. Press **SELECT/TOGGLE**. When **Yes** is displayed, the warning and time-lapse reminder beeps are activated. When **No** is displayed, the program’s beep feature is disabled.
- Verify equipment on HP-IB:** Your choices are Yes or No. Press **SELECT/TOGGLE** to indicate your choice. **Yes** causes the program to verify the presence of each instrument on HP-IB at the address shown in the Equipment menu. Select **No** to bypass this feature.

Customer: Press **SELECT/TOGGLE**, type the customer's name or ID number, then press **ENTER**. This allows the name or ID number to be included on the output report. There is a 30 character limit.

Work order number: Press **SELECT/TOGGLE**, type the work order number, then press **ENTER**. This allows the work order number to be included on the output report. There is a 30 character limit.

Test person's ID: Press **SELECT/TOGGLE**, then enter your name or ID number to include it on the output report.

Number lines added: Pressing **SELECT/TOGGLE** allows you to include a printed message with the test results. Depending on the program, you can enter up to 30 lines, with no more than 30 characters per line. Enter the message you wish to have printed in this screen by selecting User Line.

User Line: Press **SELECT/TOGGLE** to select a user line to enter additional information that will be printed on the test results. A maximum of 30 user lines are available. Each line is limited to 30 characters. After the information for each line is typed in, press **ENTER**. Each line must be selected and entered separately. The **Number lines added:** row must reflect the number of user lines that information was entered on.

Parameter Menu Command Screen

Press **DONE** when you are finished with the Parameter menu edit screen. The next screen displayed is the command screen. Press **STORE** to save any edited Parameter menu data, **EDIT** to return to the edit screen, or **main menu** to return to the Main menu screen.

Saving Parameter menu data for the first time causes an error message. The message prompts you to create a file. Do this simply by pressing **CREATE**.

Equipment Menu

The Equipment menu edit screen displays a list of all the equipment required to test the DUT. Next to each DEVICE TYPE in the equipment list is a column labeled DEVICE MODEL for the model number, ADDRESS for the HP-IB address, and SERIAL or ID NO. (for example, calibration lab number).

A table of required test equipment is located on page 4-43. Using the recommended models of test equipment assures the most complete operation verification testing. Refer to “Operation Verification Test Descriptions” beginning on page 4-44 for individual test descriptions.

Equipment Menu Edit Screen

From the Equipment menu edit screen, you can enter data about your test equipment. You may use the cursor arrow keys to position the cursor at the column item you wish to edit. The column names and information about their uses are listed below:

DEVICE TYPE	lists the names of test equipment required to complete the operation verification testing. This column cannot be edited.
DEVICE MODEL	lists the model number of each device. This column must be edited to reflect the model number of equipment that is being used.
ADDRESS	lists the HP-IB addresses of each device. The HP-IB address includes the HP-IB select code and the actual HP-IB address. For example, an HP 70820A microwave transition analyzer on HP-IB select code of 7 at an HP-IB address of 11 yields an HP-IB address of 711. <ul style="list-style-type: none">■ The HP-IB select code is a one-digit or a two-digit number and must be between 7 and 14, inclusive.■ The actual HP-IB address is a two-digit number and must be between 00 and 30, inclusive.

Valid HP-IB addresses are in the ranges listed below:

700–730	800–830	900–930	1000–1030
1100–1130	1200–1230	1300–1330	1400–1430

If a DEVICE MODEL listing has no address in the ADDRESS column, a **Missing ETE** (missing electronic test equipment) message is displayed in the Test menu’s STATUS column next to the tests that required the device. Tests tagged with **Missing ETE** are not performed.

Note The addresses of DUTs that function as slaves should match their master device’s address.

Passive devices (non-programmable devices such as power sensors) have addresses that are either **Available** or **Not Available**. For some of the passive devices, entering **Available** in the address column requires entering calibration data and a serial number for the device. The calibration data for a passive device is stored on the Operating disk.

Passive devices tagged **Not Available** in the address column cause a **Missing ETE** (missing electronic test equipment) message to be displayed in the Test menu's STATUS column requiring the passive device. The **Missing ETE** message is also printed next to the test name requiring the passive device on the printed test results. Tests tagged with **Missing ETE** are not performed.

SERIAL or ID NUM. lists the serial number or the identification number of the device. This number must be 10 digits or less. This column is optional for most test equipment. However, the passive devices that have **Available** displayed in the address column and require that calibration data be entered, must also have a serial number entry.

Equipment Menu Command Screen

After you have finished editing the Equipment menu, press **DONE** to enter the Equipment menu command screen. Press **STORE** to save the edited data.

The first time that Equipment menu data is saved, an error message is generated that prompts you to create a file. To create the file, just press **CREATE**. When **CREATE** is pressed, the command screen displays the following additional softkeys:

edit cal data displays the Select Passive Device screen. From this screen, move the cursor to the passive device that needs its calibration data edited. Press **SELECT**, then enter the required data. Refer to "Edit Calibration Data" on page 4-28 for more information.

NO ADDRESS appears only if the Parameter menu's **Verify equipment on HP-IB:** feature is selected and the program cannot find an instrument at a specified HP-IB address. When the program cannot find an instrument at its specified HP-IB address, either press **NO ADDRESS** to delete all faulty addresses from the edit menu, or find out which instruments are not responding and correct their addresses. Refer to "Optional: To Edit the Equipment Menu" in Chapter 3 to check which instruments are not responding.

Note Either exiting the Equipment menu or entering the Test menu causes the program to search the addresses in the Equipment menu for instruments assigned to HP-IB, if this feature is selected in the Parameter menu.

Edit Calibration Data

The program requires calibration data for some of the passive devices listed in the Equipment menu edit screen. The Select Passive Device screen displays all passive devices that require calibration data to be entered. Press **edit cal data** from the Equipment menu command screen to enter the Select Passive Device screen.

If a passive device that needs a serial number is selected, the program generates a prompt requesting that you enter the serial number and then it returns you to the Equipment menu.

Not all frequencies are listed on the screen at once. Be sure to enter calibration data for frequencies listed on the next pages of the display. If calibration frequencies are changed or added, it is not necessary to enter new frequency values in numeric order. The program sorts them before storing them on the Operating disk.

For power sensors, you must enter a frequency and calibration factor for 20 MHz, even if the device has no factor listed at 20 MHz. Enter values from the list of valid calibration factors below. Other frequencies outside the normal range of the device may also be required. Prior to using your device, you may need to calibrate it at these frequencies to ensure accurate measurement results.

Passive Device

Valid Calibration Factors

Power sensors 0.3 to 1.6 (stored as a percentage by the program)

Items may be deleted by moving the cursor to the column item, pressing **SELECT**, clearing the line, and pressing **ENTER**.

Test Menu

After selecting **test menu**, a list of the operation verification tests is displayed. Press **ALL TEST** to begin running the operation verification tests sequentially or **SINGLE TEST** to run tests individually. Press **main menu** to return to the Main menu.

Caution Pressing either **RESTART** or **equipment menu** any time after testing begins purges the information from Test menu's STATUS column. The assumption is that operation verification-test status will most likely be modified if you have modified the electronic test equipment (ETE) model numbers.

Review the Test menu's STATUS column for tests performed.

If the **Missing ETE** (missing electronic test equipment) message is displayed in the STATUS column of any test, additional test equipment is required to perform that test. To determine which test equipment is missing, move the cursor to that test in the list and press **SINGLE TEST**. The Missing ETE screen displays the missing test equipment for that test.

A message stating that calibration data for passive devices is missing may also appear. If the correct Operating disk is in the default drive, store the calibration data there. Press **CREATE** to build the calibration data file. After the problem is cleared, the Test menu is displayed.

Test Menu Command Screen

The Test menu only has a command screen. It deviates from the command screen formats previously described. The following list defines the softkeys available in this menu.

- | | |
|-----------------------|--|
| ALL TEST | begins a sequence of all operation verification tests. Review the Test menu's test name list for all available tests. During the test sequence, the keys listed below are also available. |
| END SEQUENCE | interrupts the test sequence at the end of the test in progress. The Test menu is displayed with an additional softkey labeled RESUME TESTING . Press this key to resume the test sequence where the program left off. |
| ABORT | ends the testing process and displays the Test menu. From there you may choose some other action. |
| RESUME TESTING | allows you to continue the test sequence after you have pressed ALL TEST followed by END SEQUENCE . |
| SINGLE TEST | lets you select an individual test to run. If a Missing ETE (missing electronic test equipment) message is displayed in the STATUS column, you can review which test equipment is missing. Locate the cursor beside that test name, then press SINGLE TEST . The Missing ETE screen is displayed. If you choose to return to the Equipment menu to install the missing test equipment, you lose the status of any tests that have already been performed. To run a single test that has the necessary ETE, locate the cursor beside the test name and press SINGLE TEST . |

multiple test

lets you organize a group of tests sequentially. Locate the cursor beside the test you want to run. Press **SELECT** to assign the first number of the series to that test. Continue to locate the cursor and press **SELECT** until you have organized the tests you want to run. Press **END LIST** when you are ready to begin testing. During testing, the following softkeys are also available.

END SEQUENCE interrupts the test sequence at the end of the test in progress, then displays the Test menu.

ABORT ends the testing process and displays the Test menu. From there you may choose some other action.

repeat mult.

allows you to select a test sequence (you determine the quantity and order). The tests loop through this sequence until you decide to stop them. Locate the cursor beside the test you want to run, press **SELECT**, move the cursor to the next test, press **SELECT**. Continue selecting tests until you are ready to begin testing. It is acceptable to select the same test for repeated testing. Press **END LIST** to start the test sequence. During testing, the following softkeys are also available.

END SEQUENCE interrupts the test sequence at the end of the test in progress, then displays the Test menu.

ABORT ends the testing process and displays the Test menu. From there you may choose some other action.

more keys

toggles between **SUMMARY**, **select output**, and **PURGE CAL DATA** and the previously explained Test menu command screen softkeys.

SUMMARY

gives you a printout of the current tests run.

select output

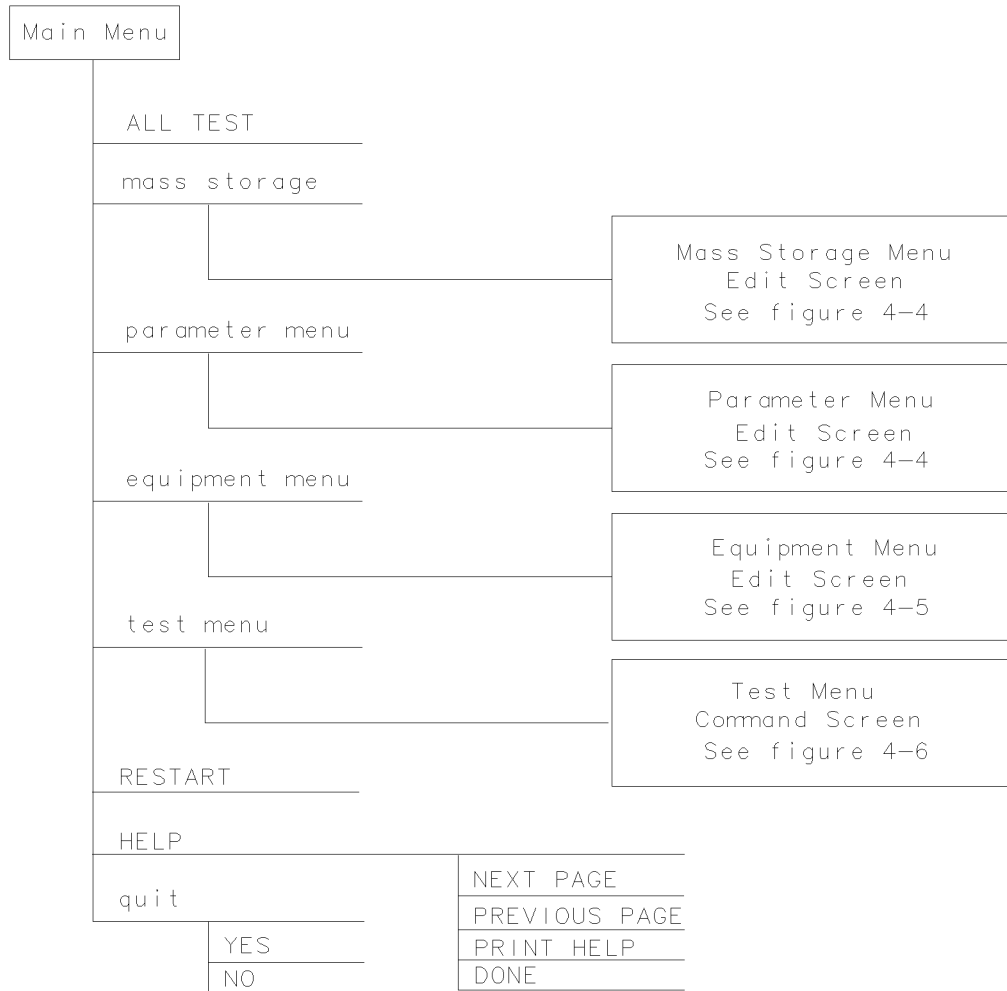
chooses an output device. You can print test results by pressing **PRINTER**, or you can print the current display by pressing **SCREEN**. Press **RETURN** to return to the previous set of softkeys in the Test menu command screen.

PURGE CAL DATA

deletes stored calibration data for the microwave transition analyzer and any other calibration routines used for testing. Before operation verification tests can be run again, equipment calibration routines have to be redone.

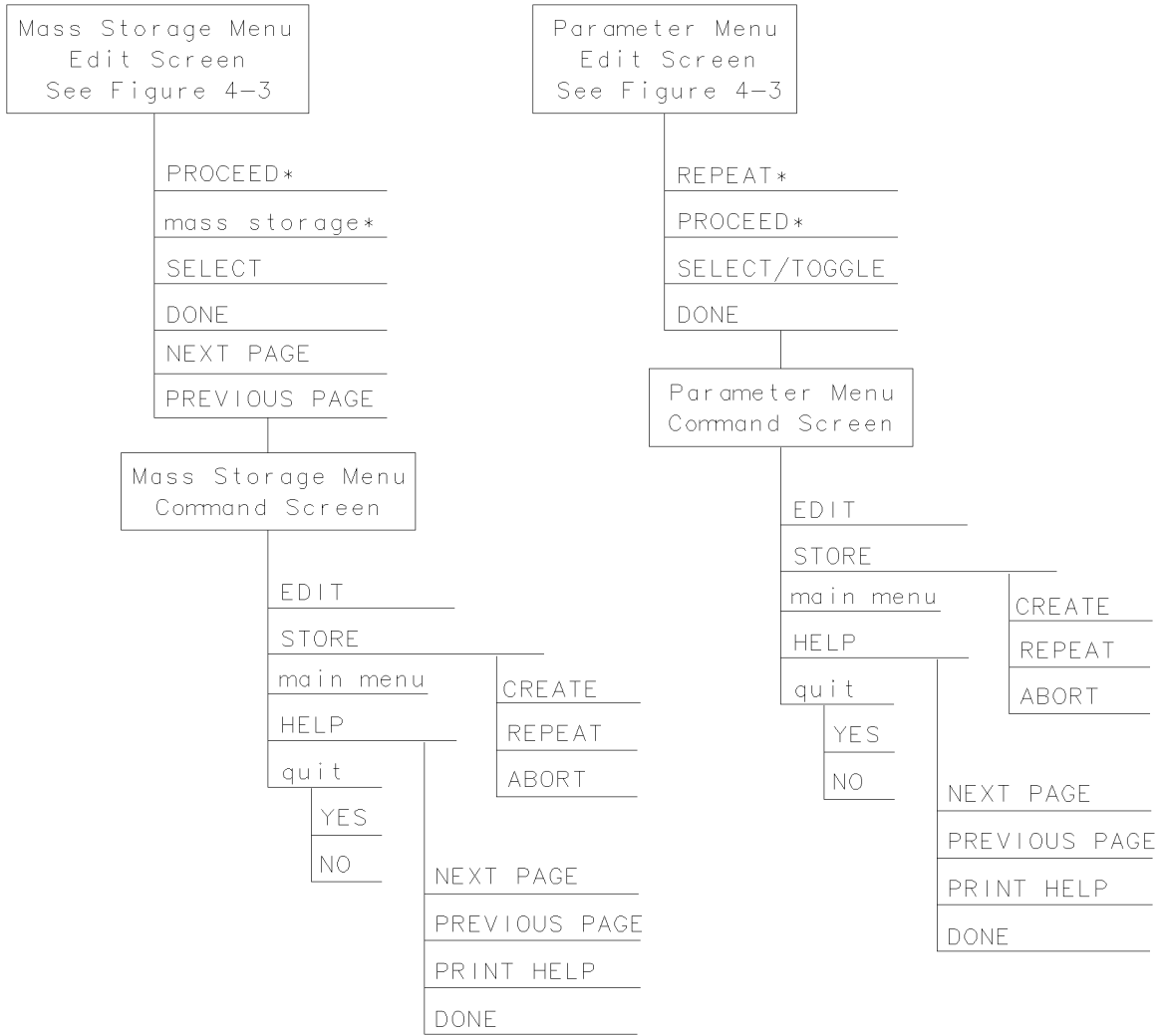
Menu Softkey Diagrams

Diagrams of the Main menu, the Mass Storage menu, the Parameter menu, the Equipment menu and the Test menu are provided. These diagrams show the menu structure for each of these menus. All paths for each menu are displayed.



DZA48

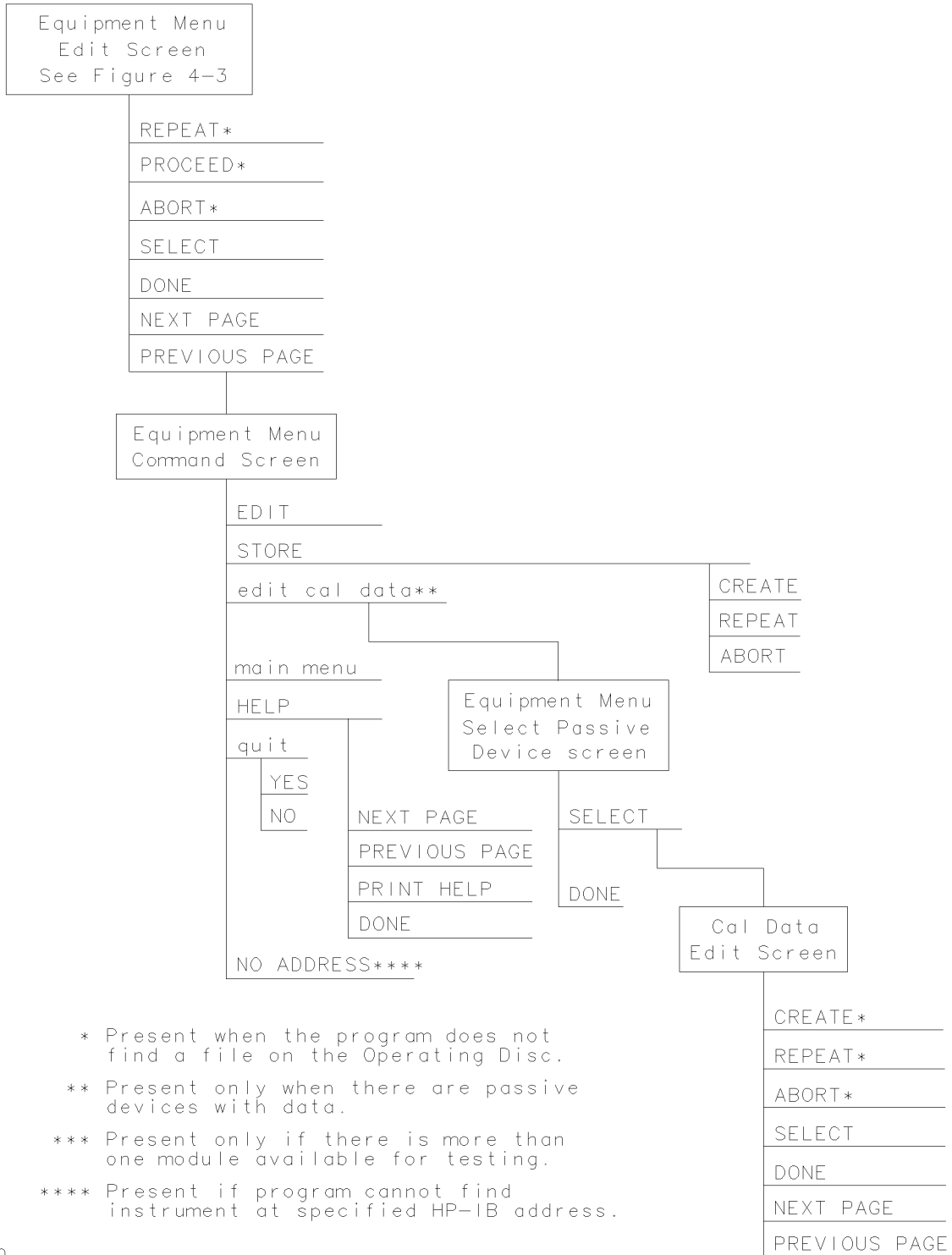
Figure 4-3. Main Menu Softkeys



* Present when the program does not find a file on the Operating Disc.

DZA49

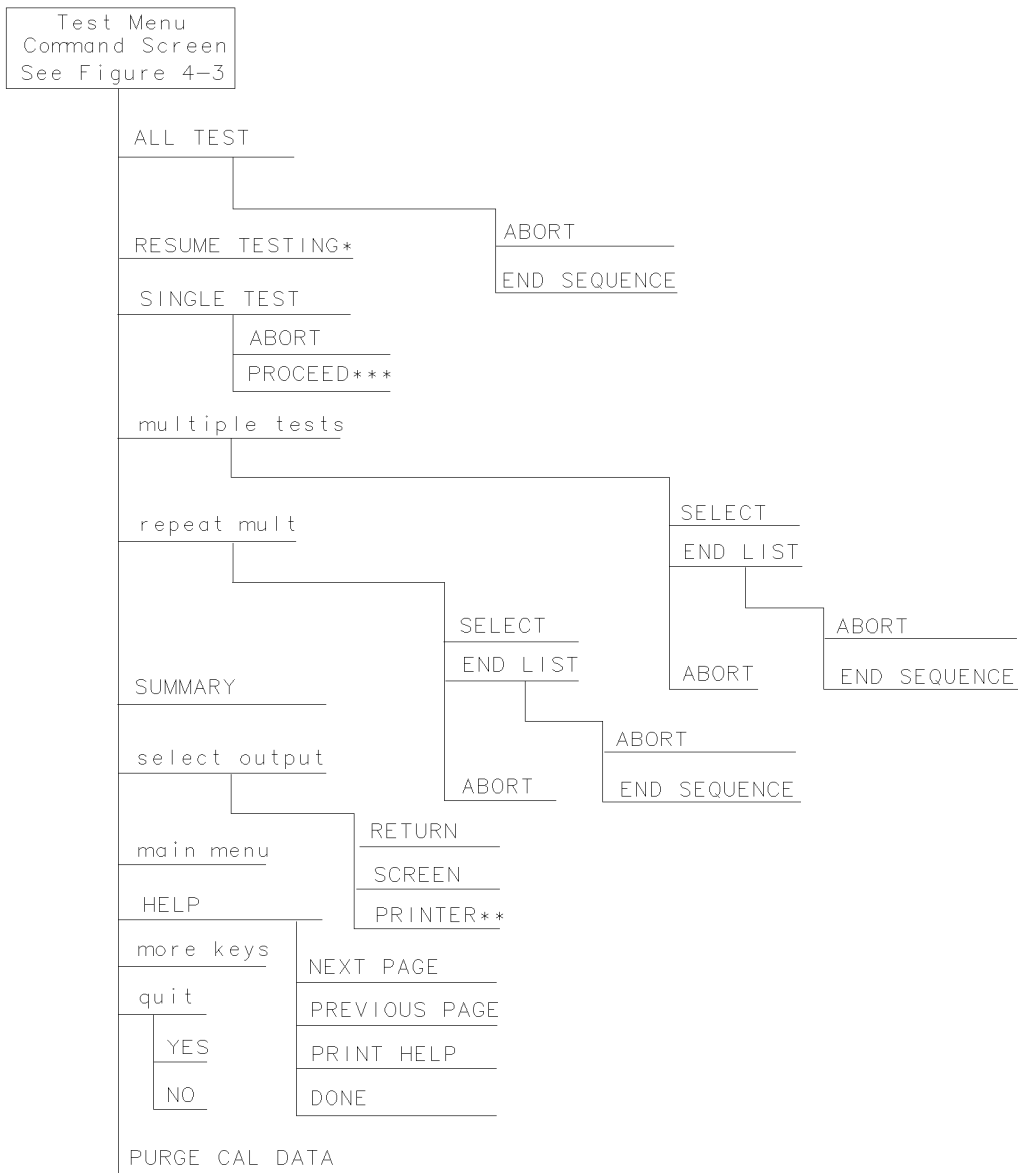
Figure 4-4. Mass Storage Menu and Parameter Menu Softkeys



- * Present when the program does not find a file on the Operating Disc.
- ** Present only when there are passive devices with data.
- *** Present only if there is more than one module available for testing.
- **** Present if program cannot find instrument at specified HP-IB address.

DZA50

Figure 4-5. Equipment Menu Softkeys



*Present only if END SEQUENCE was previously selected for FINAL TESTS.
 **Present only if a printer address is available in Equipment Menu.
 ***Present when you've selected SINGLE TEST for a test having
Missing ETE in the status column.

DZA51

Figure 4-6. Test Menu Softkeys

Error and Status Messages

User interface messages used with HP 70000 Series software products are alphabetized in this section. The messages are designed to provide information about items such as test results, operator errors, and system conditions. Refer to your *HP BASIC Language Reference* for system error information.

Aborted

You aborted the test indicated.

EEPROM for _____ is defective.

The EEPROM needs to be replaced.

Failed

The module under test needs adjustment or repair to pass the test number indicated.

CAUTION: Some Model #'s are not supported. (See Edit Screen).

You have model numbers in the Equipment menu that are not supported by the software. Ignore this caution if you are sure program memory contains a driver for these models. A driver that is required but missing causes the error message **Undefined function or subprogram** to appear onscreen. You are returned to the Test menu if this error appears.

Equipment list is not acceptable.

You attempted to enter the Test menu, but the program could not locate all the instruments for which you have specified HP-IB addresses. Verify that the indicated equipment is turned on, then return to the Equipment menu edit screen to verify the accuracy of addresses that are flashing in either the address column or the private bus column.

Equipment list shows no analyzer to test.

The DUT has no assigned HP-IB address. Return to the Equipment menu and edit the Address column.

ERROR: Address matches system disk drive.

You entered an HP-IB address matching that of the computer's external disk drive. HP-IB protocol allows only one instrument per address.

Address not in acceptable range.

You entered an HP-IB address outside the acceptable range. (Refer to "Equipment Menu Edit Screen".)

ERROR: Duplicate HP-IB address.

You attempted to exit the Equipment menu after assigning the same HP-IB address to different model numbers. HP-IB protocol allows only one instrument per address. (It is acceptable to assign the same address to identical model numbers, implying multiple use of the same instrument.)

ERROR: Non-responding HP-IB address.

You attempted to exit the Equipment menu after assigning an HP-IB address to an instrument that is not responding on the HP-IB.

ERROR: Search for ____ unsuccessful.

The program tried to find the disk identified but could not. Either assign a drive to the disk and press **REPEAT**, or insert the required disk into its appropriate drive and press **REPEAT**.

ERROR: Some devices listed as Available require serial numbers.

You pressed **View Cal Data**, then selected a device to which you have not assigned a required serial number. Display the Equipment menu edit screen and assign the serial number.

ERROR MESSAGE: Address is HP-IB controller address.

You entered an HP-IB address matching the computer's address. HP-IB protocol allows only one instrument per address.

ERROR MESSAGE: Attempt to close file ____ failed.

There is a problem with the data file on the Operating disk. Correct the problem, then do one of the following:

- Press **REPEAT** to try again.
- Press **CREATE** to create a new file.
- Press **ABORT** to return to the Main menu.

ERROR MESSAGE: Attempt to create file ____ failed.

There is a problem with the data file on the Operating disk. Correct the problem, then do one of the following:

- Press **REPEAT** to try again.
- Press **CREATE** to create a new file.
- Press **ABORT** to return to the Main menu.

ERROR MESSAGE: Attempt to Edit Mass Storage failed.

Your edits to the Mass Storage menu were not valid. Return to this menu and correct the errors.

ERROR MESSAGE: Attempt to store Mass Storage failed.

You pressed **ABORT** after pressing **STORE** to save something in the mass storage. The Mass Storage menu failed. Press **ABORT** to return to the Main menu.

ERROR MESSAGE: Bad instrument address in equipment list. Address matches controller.

You entered an HP-IB address matching that of the controller. HP-IB protocol allows only one instrument per address and only one controller per HP-IB system. (The factory preset controller address is 21.)

ERROR MESSAGE: Calibration data frequency exceed acceptable limits.

Return to the Calibration Data edit screen and correct the data entries that are flashing.

ERROR MESSAGE: Calibration data frequency is less than minimum range of ____.

The frequency entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid frequencies for the values that are flashing.

ERROR MESSAGE: Calibration data frequency is greater than maximum range of ____.

The frequency entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid frequencies for the values that are flashing.

ERROR MESSAGE: Calibration data for ____ is blank for some frequencies listed.

Return to the Calibration Data edit screen to enter the calibration data for frequencies indicated with flashing markers.

ERROR MESSAGE: Calibration data for ____ is less than minimum range of ____.

The factor entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid values for the ones that are flashing.

ERROR MESSAGE: Calibration data for ____ is greater than maximum range of ____.

The factor entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid values for the ones that are flashing.

ERROR MESSAGE: Calibration data file not found for ____ with serial number ____.

The data file cannot be found or there is a problem with the data file on the Operating disk. Correct the problem, then either press **REPEAT** to try again or press **CONTINUE**.

ERROR MESSAGE: DUT does not have an address.

You attempted to leave the Equipment menu, but the program cannot verify the DUT at the specified HP-IB address. First check the address. If the address is correct, cycle the main power of the system under test.

ERROR MESSAGE: DUT was not at address in the equipment list. DUT was expected at address ____.

The DUT is not at the specified address, or HP-IB is at fault, or main power is off on the DUT. Press **ABORT**, then return to the Equipment menu to verify the address.

ERROR MESSAGE: DUT was not found at address in equipment list.

The address specified for the DUT is not valid. Press **ABORT**, then return to the Equipment menu to verify the address.

ERROR MESSAGE: Equipment address matches external disk drive.

You entered an equipment address matching that of the external disk drive. HP-IB protocol allows only one instrument per address.

ERROR MESSAGE: Equipment menu data not found on ____ .

The program could not find the Equipment menu data file on the Operating disk. Possible Fix instructions appear with the onscreen error message. If the data file is available in a location other than the one currently specified in the Mass Storage menu, return to that menu and change the msus or the directory path of the Operating disk. It may also be that the Operating disk accessed by the program is not the one containing the Equipment menu file. Insert the correct Operating disk, then press **REPEAT** or **CONTINUE**.

ERROR MESSAGE: Equipment does not have an address .

There is no address assigned to the DUT. Return to the Equipment menu edit screen and verify or enter an address in the Address column.

ERROR MESSAGE: ERROR XXX in XXXXX ____ .

An unanticipated occurrence in the program caused a program failure. For clarification, call your Hewlett-Packard Sales and Service Office.

ERROR MESSAGE: File ____ not found while assigning I/O path.

You attempted to **STORE** a list (equipment, mass storage, or parameter) for the first time on the current Operating disk. Possible Fix instructions appear with the onscreen error message. Follow the onscreen instructions or return to the Mass Storage menu to change the location of the Operating disk.

ERROR MESSAGE: Incorrect Volume found. ____ required.

The wrong disk is in the required storage medium. Either correct the fault and press **REPEAT** to retry, or select **mass storage** to return to the Mass Storage menu. From here you can indicate a different mass storage drive.

ERROR MESSAGE: Parameter menu data not found on ____ .

The program could not find Parameter menu data file on the Operating disk. Possible Fix instructions appear with the onscreen error message. If the data file is available in a location other than the one currently specified in the Mass Storage menu, return to that menu and change the msus or the directory path of the Operating disk. It may also be that the Operating disk accessed by the program is not the one containing the Parameter menu data file. Insert the correct Operating disk, then press **REPEAT** or **CONTINUE**.

ERROR MESSAGE: Read ____ data from file ____ failed.

There is a problem with the data file on the Operating disk. Correct the problem, then either press **REPEAT** to try again or **CONTINUE** to use default values.

ERROR MESSAGE: Selected instrument under test is ____; but the software supports the ____ .

The module entered in the HP-MSIB map is not currently supported by software. Either load the correct software or select a different module in the Equipment menu.

ERROR MESSAGE: Sensor model # ____ not supported.

Software does not support the sensor model number entered for the signal sensor in the Equipment menu. Return to the Equipment menu and select a sensor with a model number that is supported.

ERROR MESSAGE: Test Parameter data file not found on ____.

The program could not find parameter-list data file on the Operating disk. Possible Fix instructions appear with the onscreen error message. If the data file is available in a location other than the one currently specified in the Mass Storage menu, return to that menu and change the msus or the directory path of the Operating disk. It may also be that the Operating disk being accessed by the program is not the one containing the parameter-list data file. Insert the correct Operating disk, then press **REPEAT** or **CONTINUE**.

ERROR MESSAGE: The ____ is listed as the DUT in the Equipment menu, but the ____ is selected in the HP-MSIB Address menu.

The DUT and the model selected in the HP-MSIB address map do not agree. You are given suggested fix instructions either to modify the module or change the DUT.

ERROR MESSAGE: The Operating Disk is write protected.

Make a working copy of the Operating disk and store the original in a safe place, or remove the write-protect.

ERROR MESSAGE: Too many Cal Data frequencies were eliminated. There must be at least two frequencies.

Only one cal frequency remains in the Cal Data edit screen. Return to that screen and enter more frequencies in the frequency column.

ERROR MESSAGE: Write ____ data to file ____ failed.

There is a problem with the data file on the Operating disk. Correct the problem, then do one of the following:

- Press **REPEAT** to try again.
- Press **CREATE** to create a new file.
- Press **ABORT** to return to the Main menu.

ERROR MESSAGE: Wrong device at specified address. DUT was expected at address ____.

The address specified for the DUT is actually that of a test instrument. Possible Fix instructions appear with the onscreen error message. If necessary, return to the Equipment menu.

ERROR MESSAGE: ____ Volume was not located.

The program cannot access the listed Volume. If the Volume is correct, press **REPEAT** to retry. If the Volume is incorrect, press **mass storage** to return to the Mass Storage menu. From here you can indicate a different mass storage medium for the Volume in question.

FORMAT ERROR: Observe date format and character position.

You entered the date/time in an unacceptable format. Enter date/time in the format dd mmm yyyy and hh:mm, then press **ENTER**.

Hdw Broken

Actual test results far exceed the expected results. This is often an indication of a hardware failure (hardware broken) or incorrect connections.

Logging errors to ERRORLOG failed. Operating Disk is write protected.

The program tried to store error data onto the Operating disk and could not because of the write-protect. Make a working copy of the Operating disk and store the original in a safe place, or remove the write-protect.

KEYBOARD SYSTEM CRASH WITH KEYBOARD: ____.

The software program does not support the current keyboard. Install a keyboard having one of the part numbers listed at the beginning of this chapter, then restart the program.

Passed

The module meets the tested characteristics.

PAUSED. PRESS CONTINUE.

You pressed **PAUSE** on the computer keyboard. Press **CONTINUE** to resume program execution.

PRGM ERROR

The program detected an error within itself. For clarification contact Hewlett-Packard Signal Analysis Division.

Reading errors from ERRORLOG failed. Check disk at ____.

The program tried to read error data from the Operating disk. Check that the Operating disk is installed in the drive specified in the error message.

Return to Equipment menu to enter serial number for ____.

You must return to the Equipment menu edit screen and enter a SERIAL or ID NO. for the passive device selected before you can edit the device's calibration data.

Setup Error

The program aborted the test after attempting to verify the test setup. Ensure that all required electronic test equipment (ETE) is present, has been turned on, and is properly connected.

SORRY, but your SERIAL NUMBER must end in a NUMERIC -- This is ____.

Contact Hewlett-Packard Santa Rosa Systems Division for assistance.

Test can not be done.

Required electronic test equipment (ETE) is missing. Return to the Equipment menu and enter all ETE listed as required for the current test.

TEST_LIST is not compatible.

A bad test list exists. Contact Hewlett-Packard Signal Analysis Division for assistance.

The controller does not have sufficient memory. This software cannot load. See the computer hardware system documentation for information on adding additional memory.

Either refer to the appropriate manual to extend the memory capability of your system, or off-load some data to make room for the program.

The ____ at address ____ was not found on HP-IB.

When Verify HP-IB is set to ON in the Parameter menu, this error message displays the electronic test equipment (ETE) with the address that is either missing or not set to ON.

The 436A is in lowest range, waiting 10 seconds.

The current power measurement requires the lowest power-meter range. Program execution will resume in 10 seconds.

The 8902A needs repair (Error 6).

There is a problem related to the HP 8902A. Correct the fault or return to the Equipment menu where you can enter a different model number.

The DUT must have an HP-IB address.

You attempted to leave the Equipment menu, but the program cannot find the HP 70000 system at the assigned HP-IB address.

THIS COLUMN CAN NOT BE EDITED.

You pressed **SELECT** with the cursor positioned in the first column of the Mass Storage menu edit screen or the Equipment menu edit screen. This column cannot be edited.

THIS IS ____ AND FOUND DUPLICATE FILES: ____.

Contact Hewlett-Packard Santa Rosa Systems Division for assistance.

This test can not be selected because of missing ETE.

You were in either Multiple Tests or Repeat Multiple, then tried to select a test that has missing electronic test equipment (ETE). This is not allowed. Check the STATUS column of the Test menu to verify a Missing ETE tag next to the test name you attempted to select.

Timed Out

The program aborted the test.

WARNING: Duplicate Address

You entered a duplicate HP-IB address to an item in the Equipment menu. (You may have to scroll through the menu to find the duplication.)

WARNING: String is too long. It has been truncated.

You entered too many characters in a user's line of the Parameter menu edit screen. Select the line and enter 30 or fewer characters.

Write protected.

You attempted to store data on a write-protected disk. After correcting the fault, press **CONTINUE**.

Recommended Test Equipment

The external test equipment and accessories required to perform the operation verification tests are listed in Table 4-3. If the recommended test equipment is not available, substitutions may be used if they meet the critical specifications listed in the table.

If either of the low-pass filters listed in the Table 4-3 is unavailable, refer to “60 MHz Low-Pass Filter” on page 4-74 and “110 kHz Low-Pass Filter” on page 4-76 for instructions on building the filters. The schematic diagram, component location, and parts list for each filter is provided.

If a matched set of cables is not available, an alternative method of testing described in “Alternative to Using a Matched Set of Cables for Testing” on page 4-73.

A technical computer is necessary to perform the operation verification tests but is not listed in Table 4-3. Refer to “Computer Compatibility” on page 4-15.

Table 4-3. Recommended Test Equipment

Equipment Name	Critical Specifications	Recommended Equipment
Test Equipment		
Digital voltmeter	dc voltage accuracy $\pm 0.005\%$	HP 3458A digital voltmeter
Oscilloscope	Bandwidth ≥ 300 MHz Rise time ≤ 1.2 ns dc voltage accuracy $\leq 3\%$	HP 54502A oscilloscope
Power meter	Accuracy $\pm 1.2\%$	HP 436A power meter
Power sensor	Frequency range 10 MHz–40 GHz Power range -30 dBm to $+10$ dBm	HP 8487A power sensor with a special calibration frequency point
Function generator	dc voltage accuracy $\pm(0.5\% + 20$ mV)	HP 8116A pulse/function generator
Synthesized sweeper	Minimum leveled power <12.5 GHz $+10$ dBm 12.5 GHz to 20 GHz $+7$ dBm >20 GHz $+1$ dBm Harmonics <1.8 GHz -25 dBc ≥ 1.8 GHz -20 dBc Subharmonics <2.3 GHz -54 dBc 2.3 GHz to 20 GHz -60 dBc >20 GHz -40 dBc Source match (VSWR) <1.8 Amplitude accuracy 100 MHz to 120 MHz ± 0.4 dB at $+7$ dBm Reference accuracy 10 MHz ± 0.1 Hz	HP 83640A synthesized sweeper Option 001 and Option 008 or HP 83650A synthesized sweeper Option 001 and Option 008
Level generator	Frequency range 1 kHz to 20 MHz Power range 0 dBm to -70 dBm Power accuracy (single frequency) 0 dBm to -30 dBm ± 0.025 dB -30 dBm to -50 dBm ± 0.030 dB -50 dBm to -70 dBm ± 0.090 dB	HP 3335A synthesizer/level generator

Table 4-3. Recommended Test Equipment (continued)

Equipment Name	Critical Specifications	Recommended Equipment
Accessories		
60 MHz low-pass filter	Insertion loss ≤ 60 MHz ≤ 1 dB 80 MHz ≥ 25 dB 320 MHz ≥ 30 dB 50 Ω VSWR ≤ 1.5	HP part number 0955-0600
110 kHz low-pass filter	Insertion loss ≤ 110 kHz ≤ 2 dB 220 kHz ≥ 30 dB 10 MHz ≥ 30 dB 50 Ω VSWR ≤ 1.5	HP part number 0955-0599
Power splitter	Frequency range dc to 40 GHz VSWR ≤ 1.5 Tracking ≤ 0.4 dB Insertion loss ≤ 8 dB	HP 11667C power splitter
Cables, Terminations, and Adapters		
Cables, matched set of two	Propagation delay difference ≤ 0.4 ps	HP part number 70820-60064
40 GHz Cable	Frequency range dc-40 GHz	
50 Ω termination, SMA (m)	Frequency range dc-40 GHz 50 Ω VSWR ≤ 1.25	HP part number 1810-0118
Adapter, APC-2.4 (f) to APC-2.4 (f) (two required)		HP 11900B
Adapter, APC-2.4 (f) to APC-3.5 (f)		HP 11901B

Operation Verification Test Descriptions

The operation verification tests are designed to give you confidence that your microwave transition analyzer is working properly. The measured results of these tests are compared with the specifications for the microwave transition analyzer. The operation verification software records whether the measured results of the test meet the specifications or not. If the test specifications were met, “pass” is recorded; if the test specifications were not met, “fail” is recorded. Refer to “Specifications and Characteristics” in the *HP 71500A/HP 70820A Microwave Transition Analyzer Reference* manual for the specifications.

These nineteen operation verification tests were also designed to be completed in the minimum time possible. These tests will take approximately 1-1/2 hours to complete. The sequence of these tests was chosen to minimize setup time of equipment and cabling.

A list of test equipment that is required to perform these operation verification tests is located in “Recommended Test Equipment” on page 4-42.

This section has a description of each operation verification test. Included in the description is the purpose of the test, the equipment required to perform the test, a description of how the equipment is set up, a description of the test, and a list of the microwave transition analyzer assemblies most likely to cause the test to fail.

Pulse Generator (MOD OUTPUT)

This test measures the following characteristics of the HP 70820A microwave transition analyzer module's pulse generator square wave signal:

- Polarity
- Frequency
- Duty cycle
- Voltage level
- Rise and fall times

Equipment

- Oscilloscope

Equipment Setup

Connect channel 1 of the oscilloscope to the MOD OUTPUT connector on the rear panel of the HP 70820A module.

Description

Modulator Polarity Check The modulator output is set to OFF and positive polarity. Setting the modulator output to OFF and positive polarity will cause the dc voltage level to be constant. The output voltage of the modulator is measured; it should be at a TTL LOW (0.0 to 0.5 volts). Then the modulator output is set to negative polarity and the modulator output voltage is measured. It should be at a TTL HIGH (3.5 to 5.5 volts).

Frequency Check The modulator output signal frequency is tested at 200 Hz, 10 kHz, and 1 MHz. Each frequency is measured and checked to verify that it is within 10 percent of the frequency setting.

Duty Cycle Check This test checks the duty cycle of the modulator output's pulsed signals. The duty cycle of the modulator output signal is set at 10 percent, 50 percent, and 90 percent. The duty cycle is measured with an oscilloscope and is checked to ensure that it is within 10 percent of the duty cycle setting. The duty cycles are checked at 200 Hz, 10 kHz, and 1 MHz.

TTL Level Check This test measures the maximum and minimum voltages of the modulator output's signal. This test is checked at 200 Hz, 10 kHz, and 1 MHz with the oscilloscope set for a 50 Ω input impedance.

Rise and Fall Time Check This check measures the rise and fall time of the modulator output signal. The time is measured at the 10 percent and 90 percent points of the slope. The rise and fall times are checked at 200 Hz, 10 kHz, and 1 MHz.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A4 LO board assembly

DAC Output

This test measures the dc voltages at the DAC OUTPUT connector of the HP 70820A microwave transition analyzer module.

Equipment

Digital voltmeter

Equipment Setup

Connect the digital voltmeter's input connector to the DAC OUTPUT connector on the rear panel of the HP 70820A module.

Description

The DAC OUTPUT voltage is determined by a 12-bit DAC that drives the output voltage from 0 to 10 volts. The DAC is programmed to hexadecimal 0FFF (representing a 10 V output) and the DAC OUTPUT voltage is measured. The measured voltage is compared to the nominal value to ensure that it meets its specification. The measurement is repeated with the DAC programmed to hexadecimal 0000 (representing a 0 V output).

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A1 Front-panel Status board assembly

Time Scale Accuracy

This test measures the time scale accuracy of the HP 70820A microwave transition analyzer module.

Equipment

Synthesized sweeper

Equipment Setup

Connect the RF output of the synthesized sweeper to RF INPUT 1 on the front panel of the HP 70820A module.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

The time scale accuracy is measured at 20 MHz and 20 GHz under each of the following conditions:

- Using the FIND SIGNALS feature and the frequency references phase-locked together.
- Using the FIND SIGNALS feature and the frequency references not phase-locked together.
- With the RF input signal's frequency entered and the frequency references phase-locked together.

The time scale accuracy is measured in the time domain with the noise filter on and three cycles of the measured wave form displayed. The time period for each setting is measured. The measured time periods for each frequency are compared to the calculated time period for the frequency tested. The following equation is used to determine the error:

$$\text{Error} = \text{Average Measured Period} \times \text{RF Frequency}$$

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A12 10 MHz Reference assembly
- A4 LO board assembly

Relative Noise Level (CW)

This test checks four parameters of the HP 70820A microwave transition analyzer module. The following parameters are tested:

- Full-scale signal-to-noise for CW inputs
- Noise level
- Single-shot noise level
- Residuals

Equipment

- Synthesized sweeper

Equipment Setup

Connect the RF output of the synthesized sweeper to RF INPUT 1 of the HP 70820A module. After channel 1 is checked, connect the synthesized sweeper to RF INPUT 2 to check channel 2.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

Full-Scale Signal-to-Noise (CW inputs) Signal-to-noise ratio is defined as the ratio of the signal power to noise power. The signal-to-noise test is performed five times for five different input frequencies: 100 MHz, 500 MHz, 1 GHz, 4 GHz, and 40 GHz. The input power is set at approximately 0 dBm.

In this test, the HP 70820A module is set up to take a time sweep at the test frequency. An FFT (fast Fourier transformation) of the trace is taken with a uniform window. The output of the FFT is formatted using the linear magnitude feature with volts being the units measured. The trace data is sorted, identifying the signal and any harmonics present. It is assumed that the five highest data values are the signal and its harmonics. The remaining 1019 data values are considered noise. The signal-to-noise ratio (Sgns) is calculated using the following formula:

$$Sgns = 10 \times \log_{10}(E_s/N_s)$$

Where $E_s = \Sigma(\text{Signal}^2 + \text{Harmonic}1^2 + \dots + \text{Harmonic}4^2)$
and $N_s = \Sigma(\text{Noise}1^2 + \text{Noise}2^2 + \dots + \text{Noise}1019^2)$

Noise Level The noise level is measured at the same five frequencies as the signal-to-noise test above. This test is performed with the synthesized sweeper's output power turned off. The HP 70820A module is set up to take a time sweep at the test frequency. An FFT of the trace is taken with a uniform window. The output of the FFT is formatted linear magnitude with volts being the units measured. The trace data is sorted to identify any residuals present. The three highest data points are assumed to be residuals and are saved for the residual test. The noise level is calculated using the following equation:

$$\text{Noise Level (dBm)} = 10 \times \log_{10}(V_{\text{rms Noise}}^2 \times 20)$$

Where

$$V_{\text{RmsNoise}} = \sqrt{\sum (\text{ns1})^2 + (\text{ns2})^2 + \dots + (\text{ns1021})^2}$$

Single-Shot Noise Level This test measures the noise floor with the HP 70820A module set to the single shot mode with a sample rate of 200 kHz. The Auto Range feature is used to set the reference level. The effective span is 100 kHz. The single shot noise level is calculated in the same manner as the noise level calculations above. This test checks the noise floor with higher resolution than the Noise Level check. The bandwidth for the 200 kHz sample rate is 195 Hz (200 kHz/1024).

Residuals When the noise level is measured, the highest residual is converted from volts to dBm using the equation below:

$$\text{Highest Residual (dBm)} = 10 \times \log_{10}(V_{\text{Highest Residual}}^2 \times 20)$$

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A4 LO board assembly
- A5 IF board assembly

Relative Noise Level (Pulse)

This test measures the signal-to-noise ratio and the single-shot signal-to-noise ratio of the HP 70820A microwave transition analyzer module in its pulsed RF measurement state.

Equipment

Synthesized sweeper

Equipment Setup

Connect the RF output of the synthesized sweeper to RF INPUT 1 of the HP 70820A module. After channel 1 is checked, connect the synthesized sweeper to RF INPUT 2 to check channel 2.

Caution

The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

Signal-to-noise ratio is defined as the ratio of the signal power to noise power. For this test, the HP 70820A module is set in the state it uses to make pulsed RF measurements. Two types of measurements are made with the HP 70820A in this state, signal-to-noise ratio and single-shot signal-to-noise ratio. During the signal-to-noise ratio test, the LO filter is turned on. This test is the basis of the relative noise level versus frequency specification for pulsed RF signals. The LO filter is turned off during the single-shot signal-to-noise ratio check. This check is designed to screen for noise that is caused by hardware.

For each type of measurement, the test is performed with five different input frequencies: 100 MHz, 500 MHz, 1 GHz, 4 GHz, and 40 GHz. The power for each of these input frequencies is approximately 0 dBm.

In this test, the HP 70820A module is set up to take a time sweep at the test frequency. An FFT (fast Fourier transformation) of the trace is taken with a uniform window. The output of the FFT is formatted using the linear magnitude feature with volts being the units measured. The trace data is sorted, identifying the signal and any harmonics present. It is assumed that the five highest data values are the signal and its harmonics. The remaining 1019 data values are considered noise. The signal-to-noise ratio (Sgns) is calculated using the following formula:

$$Sgns = 10 \times \log_{10}(E_s/N_s)$$

Where $E_s = \Sigma(\text{Signal}^2 + \text{Harmonic}1^2 + \dots + \text{Harmonic}4^2)$
and $N_s = \Sigma(\text{Noise}1^2 + \text{Noise}2^2 + \dots + \text{Noise}1019^2)$

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A4 LO board assembly
- A5 IF board assembly

External Trigger (SYNC INPUT)

This test checks the HP 70820A microwave transition analyzer module's external trigger capability.

Equipment

- Level generator
- Function generator

Equipment Setup

Connect the output connector of the level generator to the HP 70820A module's RF INPUT 1. Connect the function generator output to the SYNC INPUT on the HP 70820A module's rear panel. After channel 1 is checked, connect the level generator to RF INPUT 2 to check channel 2.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

The level generator's output signal is set to 15 MHz at -10 dBm. It is applied to the HP 70820A module's RF input. The frequency and amplitude of this signal is not critical; its purpose is to provide a trigger signal.

The amplitude of the function generator's output signal is set for TTL levels of 0 volts and +5 volts. The HP 70820A module is set to ARM=EXT TRG=CH1 (ARM=EXT TRG=CH2 when channel 2 is checked) and the trigger level is set to 0 volts.

With this trigger setting, the module will trigger when both of the following conditions are met:

- An input signal is present on the HP 70820A's RF input.
- The external trigger signal level is at a TTL high (+5 volts).

The triggering function is checked under two conditions:

- With a signal of sufficient amplitude present at the HP 70820A's RF input.
- With no signal present.

After each condition is set up, the HP 70820A module's Status Byte register is read to determine whether the trigger occurred.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A9 Channel 2 A-D Converter board assembly
- A10 Channel 1 A-D Converter board assembly

External 10 MHz Reference

This test measures the minimum power needed to keep the HP 70820A microwave transition analyzer module's phase lock circuits locked.

Equipment

Level generator

Equipment Setup

Connect a cable from the level generator's RF output to the 10 MHz REFERENCE INPUT connector on the HP 70820A module's rear panel.

Description

The HP 70820A module is set to external reference. The level generator provides a 10 MHz external reference signal to the HP 70820A module. The amplitude of the level generator is initially set to 0 dBm. The level generator, simulating the external reference, has the amplitude of its 10 MHz signal decreased in 1 dB steps until an unlock error is indicated by the HP 70820A module. The module is checked for unlock errors each time the external reference signal power is decreased. If an unlock error is not indicated, the power is decreased until it reaches -20 dBm.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A4 LO board assembly

Trigger Level

This test checks the HP 70820A microwave transition analyzer module's trigger level circuitry to ensure that it is operating correctly.

Equipment

Level generator

Equipment Setup

Connect the output of the level generator to RF INPUT 1 on the HP 70820A module. After channel 1 is checked, connect the level generator to RF INPUT 2 to check channel 2.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

This test checks the HP 70820A's trigger circuitry by stepping the trigger level from 0.320 volts to -0.320 volts while the channel being tested is set to the 640 mV range. The actual voltage that the trigger occurred at is then used to calculate the error. The error is the deviation between the actual trigger voltage and the voltage that the trigger is set to occur at (trigger level voltage). The percent of error is calculated as follows:

$$\text{Error Percentage} = [(\text{Actual Trigger Voltage} - \text{Trigger Level Voltage}) / \text{Voltage Range}] \times 100$$

The error is then normalized to compensate for losses and gains in the HP 70820A's front end. When the trigger level is set to its maximum and minimum limits, trigger hysteresis can cause false triggering. To correct for this problem, the amplitude of the input signal is adjusted so that it exceeds the limits on the top and the bottom of the displayed range. The IF calibration data is not used during this test.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A9 Channel 2 A-D Converter board assembly
- A10 Channel 1 A-D Converter board assembly

DC Accuracy

This test measures the marker accuracy for dc test signals input into the HP 70820A microwave transition analyzer module.

Equipment

Digital voltmeter

Function Generator

Equipment Setup

First, disconnect any inputs on the **RF INPUT 1** connector. After the DC Null operation is complete, connect the function generator to a tee connector, and connect this to **RF INPUT 1**. Connect the DVM to the third leg of the tee connector. A measurement of the internal dc gain of the HP 70820A is made. If it is not within the limits, then a short calibration procedure is followed with the calibrator connected to the **RF INPUT 1** connector. After the calibration is completed, the original tee connection is made again on **RF INPUT 1**. After channel 1 is checked, connect the function generator and DVM through the tee to the **RF INPUT 2**.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to **RF INPUT 1** or **RF INPUT 2** by grounding the cable's center and outer conductors.

Description

The dc accuracy of a marker reading is defined by the following formula:

$$dc\ accuracy\ in\ percent = \frac{100(marker\ reading - DVM\ reading)}{DVM\ reading}$$

Several voltages between ± 320 mv are input into the HP 70820A. For each voltage, a marker reading is taken as well as a DVM reading. The error for each measurement is calculated in percent. The HP 70820A readings are taken with **AUTORANGE** mode on.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- Worn cabling or high coaxial adapter resistance
- A5 IF board assembly
- A9 Channel 2 A-D Converter board assembly
- A10 Channel 1 A-D Converter board assembly

This test depends upon successful completion of the AC Gain Adjustment, DC Alignment, and Calibrator Signal Adjustment tests.

IF Step and Impulse Response

This test measures the HP 70820A microwave transition analyzer module's IF step and impulse responses in the time domain.

Equipment

Power splitter

Equipment Setup

Connect a cable from the CALIBRATOR connector on the front panel of the HP 70820A module to the input of a power splitter. Connect the outputs of the power splitter to the HP 70820A's RF INPUT 1 and RF INPUT 2 connectors.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

This test measures the IF step and impulse responses of a waveform in the time domain. Aberrations on a response are caused by imperfect IF calibration data that is applied to the waveform. Perfect calibration data would yield no aberrations. Aberrations are measured by comparing the step response of the HP 70820A with a theoretically perfect step.

The trigger delay is programmed to shift the step transition from the center of the screen slightly to the left in order to measure a greater portion of the waveform after the transition.

Sometimes a data point will fall on the transition of the step. In order to keep this from occurring, the fractional N phase is adjusted until no data points fall on the transition.

The calibrator is used as the source of the step; it is assumed to have a perfect step. This test checks calibrator frequencies between 19.1 MHz and 20.0 MHz in 100 kHz increments. Each frequency has a unique amplitude and a number of averages that are programmed to it.

The perfect step is found by taking averages of the data points at the beginning of the step response and at the end of the step response. The data point averages from the beginning of the trace are extended out to simulate a perfect step before the step transition occurred. The data point averages from the end are extended to simulate a perfect step after the step transition. The measured step response data is then scaled to match the simulated perfect step transition, and the ideal step is removed. The resulting waveform is then shifted to position the step transition near the left hand of the display.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A4 LO board assembly
- A5 IF board assembly

Harmonic Distortion (≤ 10 MHz)

This test measures the distortion of the second and the third harmonic of the HP 70820A microwave transition analyzer module at base band frequencies (less than or equal to 10 MHz).

Equipment

Level generator

Power splitter

60 MHz low-pass filter

Equipment Setup

Connect the output of the level generator to the input of the 60 MHz low-pass filter. Connect the output of the filter to the input of the power splitter. Connect the power splitter outputs to RF INPUT 1 and RF INPUT 2 of the HP 70820A module.

Caution	The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.
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Description

This test checks the second and third harmonic levels for a variety of sampler drive rates and **bin positions** (the horizontal positions on the microwave transition analyzer's display). Ten different sampler drive rates, from 10 MHz to 20 MHz, are checked. These sampler drive rates were chosen to cover the full range of drive rates available. The bin positions that are checked are prime numbers that are approximately equally spaced between 1 and 512 (the length of the trace).

For each sampler drive rate and bin position, the RF input frequency is calculated so that the fundamental will fall on that bin position of the trace when a fast Fourier transformation (FFT) of the time record is computed. This calculated RF input frequency is then supplied by the level generator. A 60 MHz low-pass filter on the output of the level generator filters the harmonics generated in the level generator. The level of the RF input and its second and third harmonics are measured. The highest second and third harmonic distortion measurements are saved for each sampler drive rate. The amplitude of the RF input signal is adjusted to be 6 dB below the top of the screen. This simulates the normal operation of the HP 70820A when the auto range function is being used. This amplitude is also the worst case amplitude for harmonic distortion. These measurements are performed using both RF inputs.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A9 Channel 2 A-D Converter board assembly
- A10 Channel 1 A-D Converter board assembly
- A5 IF board assembly

Harmonic Distortion (> 10 MHz)

This test measures the distortion of the second and the third harmonic of the HP 70820A microwave transition analyzer module for frequencies greater than 10 MHz.

Equipment

Level generator

Power splitter

110 kHz low-pass filter

Equipment Setup

Connect the output of the level generator to the input of the 110 kHz low-pass filter. Connect the output of the filter to the input of the power splitter. Connect the power splitter outputs to RF INPUT 1 and RF INPUT 2 of the HP 70820A module.

Caution

The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

This test checks non-base band harmonic distortion. The level generator is set to 100 kHz because mixing at this frequency is the worst case. A 110 kHz low-pass filter on the output of the level generator filters harmonics generated in the level generator. This test checks 21 sampler drive rates. These drive rates were selected to cover the full band of drive rates (10 MHz to 20 MHz).

A fast Fourier transformation (FFT) measurement is taken. The trace is formatted using log magnitude trace format. The amplitude of the fundamental and its second and third harmonics are measured. The amplitude of the RF input signal is adjusted to be 6 dB below the top of the screen. This simulates the normal operation of the HP 70820A when the auto range function is being used. This amplitude is also the worst case amplitude for harmonic distortion. These measurements are performed using both RF inputs.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A9 Channel 2 A-D Converter board assembly
- A10 Channel 1 A-D Converter board assembly
- A5 IF board assembly

Edge Triggered Sensitivity

This test verifies that the HP 70820A microwave transition analyzer module's edge triggering function operates correctly.

Equipment

- Level generator
- Power splitter

Equipment Setup

Connect the output of the level generator to the input of the power splitter. Connect the power splitter outputs to RF INPUT 1 and RF INPUT 2 of the HP 70820A module.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

This test verifies the edge triggering sensitivity of the HP 70820A module. The HP 70820A module is placed in the frequency domain mode. The measurement is taken using a fast Fourier transformation (FFT). In this mode, the marker peak function is used to measure the phase of the signal.

The level generator output is measured 50 times at each RF input frequency. To eliminate amplitude errors, the level generator's amplitude is adjusted to within ± 0.2 dB of -43 dBm at the input of the HP 70820A module.

The 50 sweeps are taken and phase data is retrieved for each sweep using marker functions. The phase data of each sweep is used to determine the phase of the HP 70820A module's trigger point. The average of the 50 phase measurements is calculated. Each measurement is compared to the calculated average to verify that all measurements deviate less than 30 degrees from the phase average. If the HP 70820A module is triggering correctly, the phase will only deviate a few degrees between sweeps. If the HP 70820A module fails to trigger, a maximum of ± 180 degree swing in phase is indicated.

This measurement is performed at four different RF input frequencies, 1 kHz, 10 MHz, 10.3 MHz and 10 GHz. This test is performed at RF INPUT 1 and RF INPUT 2.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A9 Channel 2 A-D Converter board assembly
- A10 Channel 1 A-D Converter board assembly
- A5 IF board assembly

RF Response

This test measures the corrected and the uncorrected RF response of the HP 70820A microwave transition analyzer module.

Equipment

Synthesized sweeper

Power meter

Power sensor

Power splitter

Equipment Setup

Connect the synthesized sweeper to the input of the power splitter. Connect one output port of the power splitter to the power sensor and the other output port to RF INPUT 1 on the HP 70820A module. After channel 1 is tested, move the connection between the power splitter's output power and RF INPUT 1 to connect the power splitter to RF INPUT 2.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

The RF response of the HP 70820A microwave transition analyzer module is measured by stepping the synthesized source from 20 MHz to 40 GHz. The synthesized source's output signal is split and input to the RF input of the HP 70820A and to the power sensor.

The HP 70820A module is set up in the frequency domain mode by formatting the time trace to log magnitude. The resulting benefits of the fast Fourier transformation (FFT) are a noise floor reduction and separation of the signal's harmonics from the fundamental.

At each frequency tested, the measured amplitude of the HP 70820 is compared to the measured amplitude of the power meter to determine the error.

This test is repeated so that the RF response is measured with the RF calibration data turned on and with the RF calibration data turned off (corrected and uncorrected response). After RF INPUT 1 is tested, RF INPUT 2 is tested.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A2 Channel 2 Edge-Sharpener
- A3 Channel 1 Edge-Sharpener
- A5 IF board assembly
- A6 Step-Recovery Diode (SRD) assembly
- A7 Step-Recovery Diode (SRD) Driver board assembly

RF Compression

This test measures the RF compression of the HP 70820A microwave transition analyzer module.

Equipment

Synthesized sweeper

Power meter

Power sensor

Power splitter

Equipment Setup

Connect the synthesized sweeper to the input of the power splitter. Connect one output port of the power splitter to the power sensor and the other output port to RF INPUT 1 on the HP 70820A module. After channel 1 is checked, move the connection between the power splitter's output port and RF INPUT 1 to connect the power splitter to RF INPUT 2.

Caution

The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

RF compression in the HP 70820A module varies with both the RF input frequency and with the placement that the signal is placed in the IF range. Compression improves at high RF input frequencies. For example, compression at 20 GHz is 0.03 to 0.04 dB better than compression at 10 MHz. Also, compression improves when the signal is placed below 80 kHz in the IF range rather than when it is placed higher in the IF range.

This test measures compression at RF input frequencies of 10 MHz and 10 GHz. Both RF input frequencies are checked at IF frequencies of 78 kHz and 2 MHz. The RF input power is first checked at $-6 \text{ dBm} \pm 0.03 \text{ dB}$. Then it is increased to $+1 \text{ dBm} \pm 0.03 \text{ dB}$. The HP 70820A module measures the power with the -6 dBm input and with the $+1 \text{ dBm}$ input. These measured power levels are then used to calculate the compression, using this equation:

$$\text{Compression} = \Delta\text{Power Input} - \Delta\text{Power Measured}$$

Where $\Delta \text{ Power Input} = \text{Power Input at } +1 \text{ dBm} - \text{Power Input at } -6 \text{ dBm}$

and $\Delta \text{ Power Measured} = \text{measured power at } +1 \text{ dBm} - \text{measured power at } -6 \text{ dBm}$

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A5 IF board assembly
- A2 Channel 2 Edge-Sharpener
- A3 Channel 1 Edge-Sharpener
- A7 Step-Recovery Diode (SRD) Driver board assembly

Amplitude and Phase Ratio

This tests measures the amplitude and phase ratio versus frequency and time delay between channels of the HP 70820A microwave transition analyzer module.

Equipment

Synthesized sweeper

Power splitter

Matched set of two cables (Refer to “Alternative to Using a Matched Set of Cables for Testing” on page 4-73.)

Equipment Setup

Connect the synthesized sweeper to the input of the power splitter. Using the matched set of cables, connect the power splitter outputs to RF INPUT 1 and RF INPUT 2 on the HP 70820A module. Connect an HP-IB cable from the HP 70820A module’s rear panel HP-IB connector to the synthesized sweeper.

Caution

The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable’s center and outer conductors.

Description

The HP 70820A module is set to network analysis mode. In the network analysis mode, the HP 70820A becomes the controller and controls the synthesized sweeper’s settings. The synthesized sweeper is swept from 10 MHz to 40 GHz at 0 dBm. The resulting channel 1/channel 2 (CH1/CH2) measurement is stored. The amplitude versus frequency information is obtained by reading the stored trace with the log magnitude trace format. The phase versus frequency information is obtained by reading the stored trace with the phase trace format. The Auto Shift feature is used to remove the linear phase difference between channel 1 and channel 2. The resulting trace is the phase deviation from linear phase. The amount of phase slope required to remove the phase deviation present when the Auto Shift feature is initiated is the time delay between cables.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A5 IF board assembly
- RF INPUT 1 or RF INPUT 2 connectors
- A2 Channel 2 Edge-Sharpener and A3 Channel 1 Edge-Sharpener matching

Low Frequency Amplitude and Phase Ratio

This test measures the ratio of amplitude and phase versus frequency of the HP 70820A microwave transition analyzer module's RF inputs over the frequency range of 200 Hz to 80 MHz.

Equipment

Level generator

Power splitter

Matched set of two cables (Refer to "Alternative to Using a Matched Set of Cables for Testing" on page 4-73.)

Equipment Setup

Connect the level generator to the input of the power splitter. Using the matched set of cables, connect the power splitter outputs to RF INPUT 1 and RF INPUT 2 on the HP 70820A module. Connect an HP-IB cable from the HP 70820A module's rear panel HP-IB connector to the level generator.

Caution

The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

The HP 70820A module is set to network analysis mode. In the network analysis mode, the HP 70820A module becomes the controller and controls the level generator's settings. The level generator is swept from 200 Hz to 80 MHz at 0 dBm. The measured channel 1/channel 2 (CH1/CH2) trace is stored. The amplitude versus frequency information is obtained by reading the stored trace with the log magnitude trace format. The phase versus frequency information is obtained by reading the stored trace with the phase trace format. The linear slope is then removed from the phase data. At these low frequencies, there is very little phase slope to remove. The phase slope, also called channel skew, is removed by software.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A5 IF board assembly
- RF INPUT 1 or RF INPUT 2 connectors
- A2 Channel 2 Edge-Sharpener and A3 Channel 1 Edge-Sharpener matching

Sampler Feedthrough

This test measures the sampler feedthrough of the HP 70820A microwave transition analyzer module with the sampler turned off.

Equipment

Level generator

Power splitter

Equipment Setup

Connect the level generator to the input of the power splitter. Connect the power splitter outputs to RF INPUT 1 and RF INPUT 2 of the HP 70820A module. Connect an HP-IB cable from the HP 70820A module's rear panel HP-IB connector to the level generator.

Caution	The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.
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Description

Sampler feedthrough is measured with the HP 70820A module set for a frequency sweep with a fixed LO frequency of 20 MHz. The start frequency is set to 1 MHz and the stop frequency is set to 9.9 MHz. A sweep traces out the shape of the IF. This trace is stored. Then the microwave sampler located on the IF board is shut off by reverse biasing the sampler. Ideally, no signals will get through the sampler. A second sweep of the IF is taken with the sampler turned off. This sweep is normalized against the previous sweep, which had the sampler in normal operation. This trace contains the sampler feedthrough information.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A5 IF board assembly
- A7 Step-Recovery Diode (SRD) Driver board assembly

IF Isolation

This test measures the IF isolation between the two input channels of the HP 70820A microwave transition analyzer module.

Equipment

- Level generator
- 50 Ω termination

Equipment Setup

Connect the level generator to RF INPUT 1 on the HP 70820A module. Terminate RF INPUT 2 with a 50 Ω termination to prevent spurious signals from entering the module. Connect an HP-IB cable from the HP 70820A module's rear panel HP-IB connector to the level generator. Connect the 10 MHz reference output of the level generator to 10 MHz REFERENCE INPUT on the rear panel of the HP 70820A. After channel 1 is checked, connect the level generator to RF INPUT 2 and terminate RF INPUT 1 with the 50 Ω termination.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

Isolation has two separable components. One component is RF isolation and the other component is IF isolation. Poor IF isolation is the result of coupling taking place between channels on the IF board.

The HP 70820A module is set to the network analysis mode. In network analysis mode, the HP 70820A controls the level generator. The level generator sweeps from 1 kHz to 9.999 MHz. The HP 70820A maintains a fixed LO frequency during the sweep. This sweep traces out the shape of the IF. IF Isolation is measured by taking the ratio of the two input channels. IF isolation is calculated using the following equations:

$$\text{IF Isolation}_{\text{CH1}} = \text{Power}_{\text{CH2}} / \text{Power}_{\text{CH1}}$$

Where channel 1 is swept
and channel 2 is terminated by a 50 Ω termination.

$$\text{IF Isolation}_{\text{CH2}} = \text{Power}_{\text{CH1}} / \text{Power}_{\text{CH2}}$$

Where channel 2 is swept
and channel 1 is terminated by a 50 Ω termination.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A5 IF board assembly

Input Crosstalk Isolation

This test measures the crosstalk between the two input channels of the HP 70820A microwave transition analyzer module.

Equipment

Synthesized sweeper

50 Ω termination

Equipment Setup

Connect the synthesized sweeper to RF INPUT 1 on the HP 70820A module. Terminate RF INPUT 2 with a 50 Ω termination to prevent spurious signals from entering the module. Connect an HP-IB cable from the HP 70820A module's rear panel HP-IB connector to the synthesized sweeper. Connect the 10 MHz reference output of the level generator to 10 MHz REFERENCE INPUT on the rear panel of the HP 70820A. After channel 1 is checked, connect the synthesized sweeper to RF INPUT 2 and terminate RF INPUT 1 with the 50 Ω termination.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

Description

Isolation has two separable components. One component is RF isolation and the other component is IF isolation. Poor RF isolation is the result of coupling taking place at the input of the samplers; this allows input crosstalk to occur.

The HP 70820A module is set to the network analysis mode. In network analysis mode, the HP 70820A controls the synthesized sweeper. The synthesized sweeper sweeps from 10 MHz to 40 GHz with 0 dBm output. The input crosstalk is measured by taking a ratio measurement between the two RF input channels of the HP 70820A module. The input crosstalk is calculated using the following equations:

$$\text{Input Crosstalk Isolation}_{\text{CH1}} = \text{Power}_{\text{CH2}} / \text{Power}_{\text{CH1}}$$

Where channel 1 is swept
and channel 2 is terminated by a 50 Ω termination.

$$\text{Input Crosstalk Isolation}_{\text{CH2}} = \text{Power}_{\text{CH1}} / \text{Power}_{\text{CH2}}$$

Where channel 2 is swept
and channel 1 is terminated by a 50 Ω termination.

In Case of Failure

If this test fails, the following items may need repair or adjustment:

- A5 IF board assembly
- Loose connections in the signal path

Amplitude Accuracy versus Input Power Level

This test measures the amplitude accuracy versus the input power level of the HP 70820A microwave transition analyzer module.

Equipment

Level generator

Power splitter

Equipment Setup

Connect the output of the level generator to the input connector of the power splitter. Connect the output connectors of the power splitter to RF INPUT 1 and RF INPUT 2 on the HP 70820A module. Connect an HP-IB cable from the HP 70820A module's rear panel HP-IB connector to the level generator.

Caution	The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.
----------------	--

Description

This test measures the amplitude accuracy versus the input power level by comparing the amplitude measured by the HP 70820A with the stepped amplitude of the level generator. The HP 70820A performs a power sweep in the network analysis mode. The HP 70820A controls the level generator in this mode. The level generator's amplitude is stepped so that the HP 70820A measures from 0 dBm to -70 dBm at its input. This range is measured in 1 dB steps. The results of this power sweep are normalized to the amplitude measured at -10 dBm and compared with the level generator's amplitude.

In Case of Failure

If this test fails, the following assemblies may need repair or adjustment:

- A5 IF board assembly

Alternative to Using a Matched Set of Cables for Testing

This alternative method of testing can be used if a matched set of cables is not available to connect between the power splitter's two outputs and the microwave transition analyzer's two RF inputs.

Caution The HP 70820A microwave transition analyzer module may be damaged by electrostatic discharge. Discharge any cable prior to connecting it to RF INPUT 1 or RF INPUT 2 by grounding the cable's center and outer conductors.

1. Have the test results sent to a printer.

This is done using the Parameter menu. Refer to "Optional: To Edit the Parameter Menu" in Chapter 3.

2. Run the test using any two cables available to replace the matched set of cables.

One cable connects a power splitter output to RF INPUT 1 and the other cable connects a power splitter output to RF INPUT 2. (The test will probably fail.)

3. Print the test results.

4. Switch the RF inputs that the two cables are connected to.

Move the cable attached to RF INPUT 1 to RF INPUT 2, and move the cable attached to RF INPUT 2 to RF INPUT 1.

5. Rerun the test. (The test will probably fail again.)

6. Print the results of the second test.

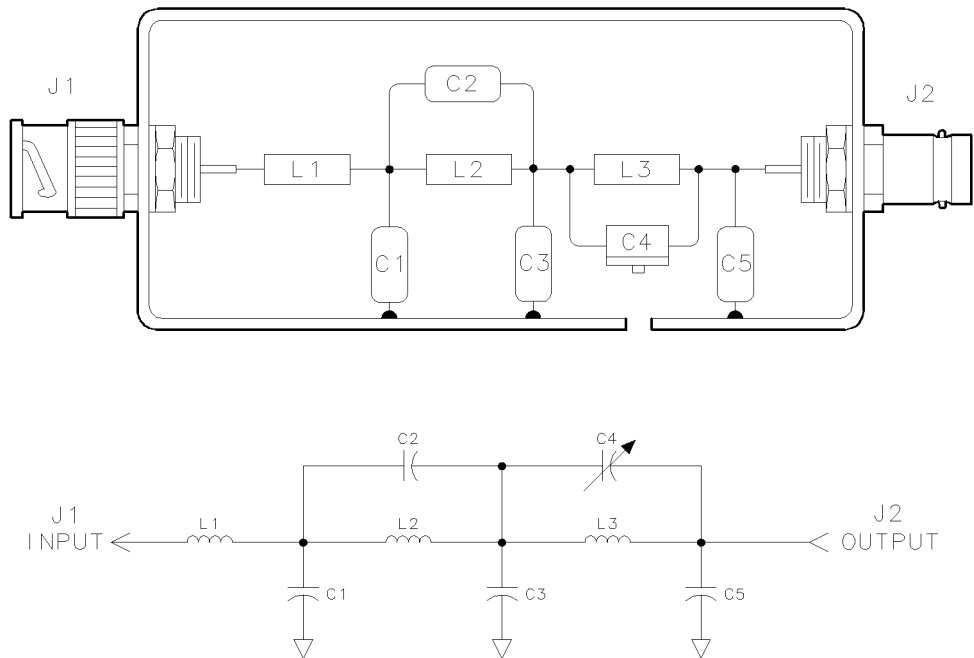
7. Using the printed results, manually average the measurements of the two tests.

This test software will not perform the averaging of the two sets of test results.

The average of the two measurements should meet the specification for the test. There is no way to get the software to print the averaged data or to indicate that the test passed. A note written by the operator that includes the calculated performance must serve as the official test record of this test.

60 MHz Low-Pass Filter

If you do not have a 60 MHz low-pass filter available, the schematic diagram, component location and parts list for building the filter is provided. All capacitors except C4 should be silver mica capacitors. Capacitors C1, C3, and C5 (shown as grounded on one side) should be soldered to the box to make the ground connection. An adjustment procedure for adjusting C4 is also included. A small hole should be drilled into the steel box so that C4 may be adjusted with the lid on the box.



DZA82

Figure 4-7. 60 MHz Low-Pass Filter Schematic Diagram and Component Location

Table 4-4. 60 MHz Low-Pass Filter Parts List

Part	Description	HP Part Number
C1	Capacitor, Fixed Mica 62 pF 300 V	0140-0205
C2	Capacitor, Fixed Mica 33 pF 300 V	0160-2150
C3	Capacitor, Fixed Mica 68 pF 300 V	0140-0192
C4	Capacitor, Variable Cer 5.5–18 pF	0121-0061
C5	Capacitor, Fixed Mica 47 pF 300 V	0160-2307
J1	Connector, BNC (M)	1250-0045
J2	Connector, BNC (F)	1250-0212
L1	Inductor, 180 nH 10%	9100-2250
L2	Inductor, 120 nH 10%	9100-2248
L3	Inductor, 150 nH 10%	9100-2249
	Box, Steel, Tin-dipped	7100-1040
	Lid, Steel, Tin-dipped	7100-1048
	Washer, Lock (Quantity 2)	2190-0016
	Nut, Hex (Quantity 2)	2950-0001

60 MHz Low-Pass Filter Alignment Procedure

The 60 MHz low-pass filter is aligned by sweeping the filter with a network analyzer or a tracking generator. Adjust C4 for the flattest response between 10 kHz and 62 MHz.

Verify that the filter meets the critical specifications listed in Table 4-3 on page 4-43.

110 kHz Low-Pass Filter

If you do not have a 110 kHz low-pass filter available, the schematic diagram, component location and parts list for building the filter is provided. Capacitors C1, C3, C5 and C7 (shown as grounded on one side) should be soldered to the box to make the ground connection. Verify that the filter meets the critical specifications listed in Table 4-3 on page 4-43.

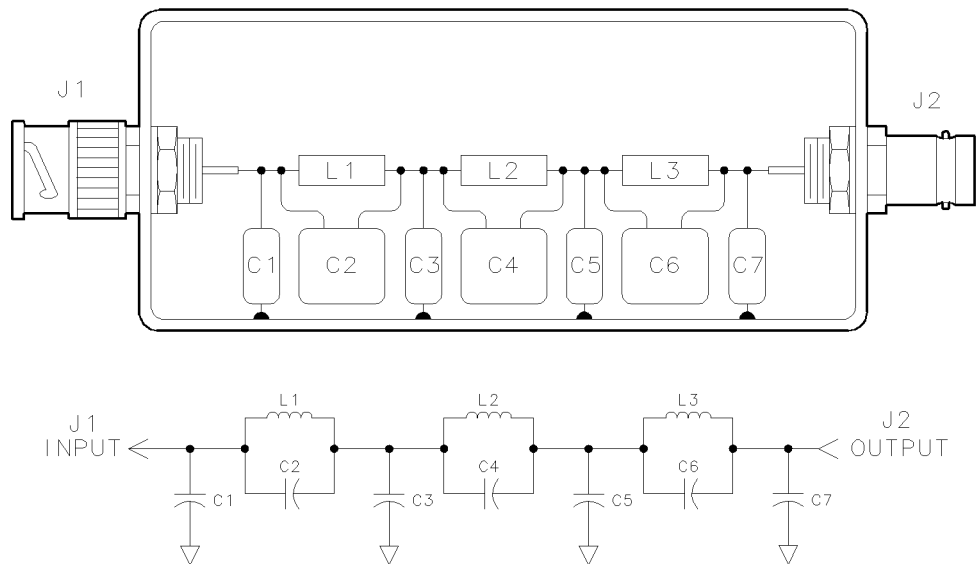


Figure 4-8. 110 kHz Low-Pass Filter Schematic Diagram and Component Location

Table 4-5. 110 kHz Low-Pass Filter Parts List

Part	Description	HP Part Number
C1	Capacitor, Fixed PE 0.033 μ F 200 V	0160-0163
C2	Capacitor, Fixed PE 5600 pF 200 V	0160-0158
C3	Capacitor, Fixed PE 0.047 μ F 200 V	0170-0040
C4	Capacitor, Fixed PE 0.018 μ F 200 V	0160-0302
C5	Capacitor, Fixed PE 0.039 μ F 200 V	0160-0164
C6	Capacitor, Fixed PE 0.039 μ F 200 V	0160-0164
C7	Capacitor, Fixed PE 0.018 μ F 200 V	0160-0302
J1	Connector, BNC (M)	1250-0045
J2	Connector, BNC (F)	1250-0212
L1	Inductor, 82 μ H 5%	9140-0238
L2	Inductor, 68 μ H 5%	9100-1633
L3	Inductor, 39 μ H 5%	9100-1627
	Box, Steel, Tin-dipped	7100-1040
	Lid, Steel, Tin-dipped	7100-1048
	Washer, Lock (Quantity 2)	2190-0016
	Nut, Hex (Quantity 2)	2950-0001

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