

SYSTEM SUPPORT MANUAL

HP 71000 Modular Spectrum Analyzers

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CUSTOMER LABEL LOCATIONS

To aid in the servicing of your instrument, put customer labels (asset and calibration) only on the front panels of the modules. See Figure 1.

The instrument is serviced by replacing the faulty module core without replacing the front panel/frame of the module. Thus, putting customer labels on the front panel ensures that the labels will stay with the instrument. Refer to the Module Replacement and System Replaceable Parts sections of the Preparation For Use chapter.

Do not put labels behind the front door assembly, since they may be damaged when the front door is closed.

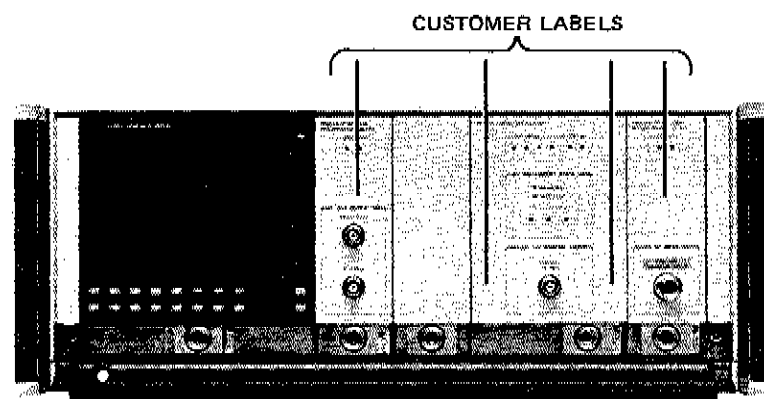


Figure 1. Customer Label Locations

SAFETY SYMBOLS

The following safety symbols are used throughout this manual and in the instrument. Familiarize yourself with each of the symbols and its meaning before operating this instrument.



Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the instrument against damage. Location of pertinent information within the manual is indicated by use of this symbol in the table of contents.



Indicates dangerous voltages are present. Be extremely careful.

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 voltages at 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.

DESTROYING DIAGNOSTICS

The HP 71100 and 71200 Modular Spectrum Analyzers are shipped with a troubleshooting program, named System Diagnostics, in RAM.

The USR (USER) screen soft key SIG TRK ON OFF has been relabeled DIAGNOSTICS. Pressing the DIAGNOSTICS soft key runs the program. The DISPOSE ALL command, any function that writes to RAM, or the PRESET USR KY soft key can destroy System Diagnostics or the DIAGNOSTICS soft key label.

To restore System Diagnostics refer to the Troubleshooting Tools section of the System Troubleshooting Chapter.

INTRODUCTION

MODULAR SPECTRUM ANALYZER DESCRIPTION

The HP 71000 Modular Spectrum Analyzers are a family of automatic spectrum analyzers which are part of the HP 70000 Measurement System. To meet your specific measurement needs, you can select one of the standard systems, have a custom system configured by the factory, or you can select individual modules and configure your own system. The standard HP 71000 Modular Spectrum Analyzers are available in three frequency ranges—RF, Microwave, and Millimeter.

SAFETY

Before operating this instrument, you should familiarize yourself with the safety markings on the instrument and the safety instructions in the manuals. The instrument is manufactured and tested to international safety standards. However, to ensure the safe operation of the instrument and your personal safety, the cautions and warnings in the manuals must be followed. Refer to the summary of safety information located near the front of this manual.

SUPPORT OPTIONS

W30 Two Years Additional Return-to-HP Service

This is an additional two years "Return to HP" service support, where available. Option W30 cost is listed for each module. W30 cost is for years two and three after the products one year of warranty. The System Option W30 price is the sum of

the separate modules option costs. This option is ordered at the point of sale by the customer.

On-Site Service

On-site service for HP 71000 systems is available in many areas. Contact your HP sales representative for information on availability and terms.

DOCUMENTATION DESCRIPTION

The following manuals are provided with the HP 71000A Modular Spectrum Analyzers.

SYSTEM SUPPORT MANUAL

This is the service manual for the Modular Spectrum Analyzers. It provides installation procedures, specifications, troubleshooting information, and user documentation for the System Verification software.

OPERATING MANUAL

This manual is divided into three parts:

Manual Operation (Part I) tells how to use the instrument manually.

Remote Operation (Part II) explains how to program and operate the instruments remotely.

Display Operation (Part III) describes features of the graphic display. It tells how to configure the display screen, obtain hardcopy outputs, examine the addresses of modules on the HP-MSIB, and receive error reports.

REMOTE LANGUAGE REFERENCE

This reference lists the Modular Spectrum Analyzer remote commands. Each command is described; each description contains a syntax flow chart and a definition of the command parameters including their range.

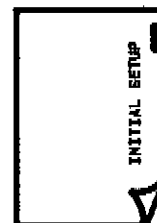
At the back of the reference is a keyword Summary, which lists the commands by function.

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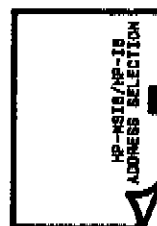
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PREPARATION FOR USE

INTRODUCTION

The first section of this chapter contains the information needed to begin operation of the HP 71000 Modular Spectrum Analyzer. The next section gives instruction on the removal, replacement, exchange, and shipment of a module. The next section gives a "short course" in HP-MSIB address selection. The final section is a listing of the system replaceable parts.

INITIAL SET UP

UNPACKING AND INSTALLING

Inspect the shipping container for damage. If the container or cushioning material is damaged, check the contents of the shipment both mechanically and electrically. See the Operating Manual for operating information. Also see the System Verification and System Troubleshooting sections in this manual.

If the instrument is damaged or defective, contact your nearest Hewlett-Packard office. Hewlett-Packard will arrange for repair or replacement of the damaged or defective equipment without waiting for a claim settlement. Keep the shipping materials for carrier's inspection.

It is also recommended that you keep the packaging materials for future shipment or storage of the instrument.

OPERATING REQUIREMENTS

Physical Requirements

Temperature, humidity, and power requirements, along with instrument weights and dimensions, are listed in the Specifications Table (System Verification), under the GENERAL heading.

PREPARATION FOR USE

Line Voltage Selection

WARNING

BEFORE TURNING THIS INSTRUMENT ON (1), make sure it is 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

BEFORE TURNING THIS INSTRUMENT ON, make sure it is set 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.

To select a line voltage, set the **LINE VOLTAGE SELECTOR** on the bottom of the instrument. See Figure 1.

Fuse Replacement

The line fuse for this instrument is located inside the power cord receptacle housing on the back of the instrument. Also included in this housing is a spare fuse. The fuses are 6.3A,

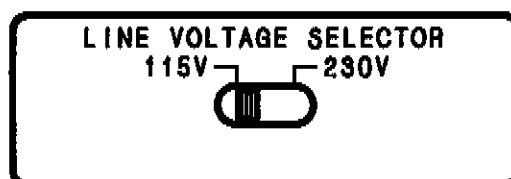


Figure 1. Line Voltage Selection

HP Part Number 2110-0703. Figure 2 illustrates removal and replacement.

Power Cables

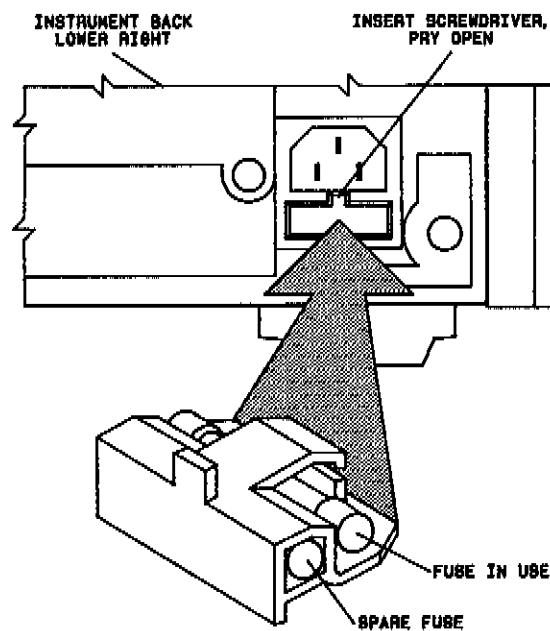


Figure 2. Line Fuse Removal and Replacement

PREPARATION FOR USE

In accordance with international safety standards, this instrument is equipped with a three-wire AC power cable. When connected to an appropriate AC power receptacle, this cable grounds the instrument cabinet. The type of power cable shipped with the instrument depends on the country of destination. If additional or different cables are needed, refer to Table 1.

PREPARATION FOR USE

Table 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, Rhodesia, Singapore, So. Africa, India
250V 	8120-1369 8120-0696	Straight*NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	Straight*CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754	Straight*NEMA5-15P 90° Straight*NEMA5-15P	203 (80) 203 (80) 91 (36)	Black Black Black	United States Canada, Japan (100 or 200V), Mexico, Phillipines, Taiwan
	8120-1378 8120-1521 8120-1676	Straight*NEMA5-15P 90° Straight*NEMA5-15P	203 (80) 203 (80) 91 (36)	Jade Gray Jade Gray Jade Gray	
250V 	8120-2104	Straight*SEV1011 1959-24507 Type 12	201 (79)	Gray	Switzerland
220V 	8120-0698	Straight*NEMA6-15P			
250V 	8120-1860	Straight*CEEE22-VI			
* Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug. ** E = Earth Ground; L = Line; N = Neutral.					

Mating Connectors

Mating connectors for the HP 71000 Modular Spectrum Analyzer are listed in Service Accessories, Table 2 (front of the book).

PREPARATION FOR USE

Rear Fan Filter

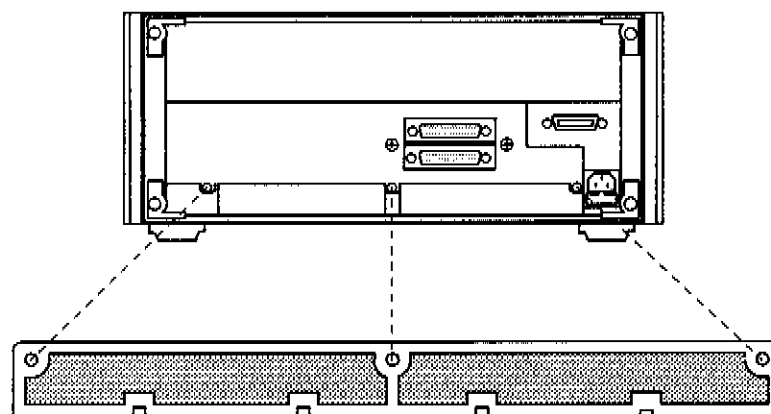
An optional Rear Fan Filter is available for the mainframe. Figure 3 illustrates its installation.

Display Screen Cleaning

To avoid damaging the coatings on the display CRTs, use a Thin Film Cleaner (TFC), such as Hewlett-Packard Display Cleaner (HP Part Number 8500-2163). This should be used with an abrasion-free cleaning tissue or soft cloth.

CAUTION

Paper towels, both hand and laboratory, should not be used to clean the screen, as they may scratch the coating.



HP 70001-40017

Figure 3. Rear Fan Filter

FIRMWARE REVISION DATE

Display Firmware

The firmware (ROM) revision of the Displays (see Figure 4) can be obtained two ways:

1. When the instrument is first started, the version and date appears on the screen for several seconds.
2. When the instrument is operating, the firmware version can be obtained by following these procedures:
 - a. Press the display hard key (DSP on the HP 70205A, DISPLAY on the HP 70206A).
 - b. When the Display screen appears press the DISPLAY TESTS soft key.
 - c. When the Display Test screen appears, press the DISPLAY ID soft key.

LO Firmware

The firmware (ROM) version of the Local Oscillator can be obtained as follows:

1. Press the menu hard key (MNU on the HP 70205A, MENU on the HP 70206A)
2. When the menu screen appears, press the CONFIG soft key.
3. When the next menu screen appears, press the ROM VERSION soft key. The ROM version now appears in the upper right of the screen.

PREPARATION FOR USE

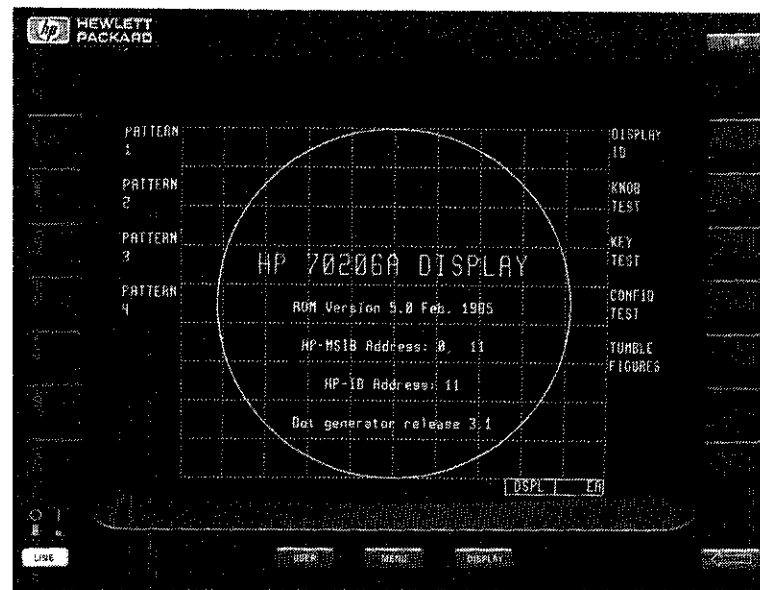


Figure 4. Firmware (ROM) Version

INSTALLING

NOTE

When replacing parts in this instrument, be sure to use identical hardware. This instrument contains both Metric and English threads.

Bench Operation

This instrument has plastic feet and fold-away tilt stands for convenience in bench operation. The plastic feet are shaped to make full width cabinets self-aligning when stacked. The instrument is shipped with front handles attached for ease of moving.

Front Handle Removal/Replacement

To install instrument rack mounting options, the front handles need to be removed. See Figure 5 for instructions. When installing an option refer the illustrations for the proper size screw.

Rack Mounting

Instrument Options 908 and 913 contain the necessary hardware to mount the instrument in a rack with 482.6 mm (19 inches) spacing. Option 908 is for rack mounting without handles (see Figure 5) and Option 913 is for rack mounting with the handles provided on the instrument (Figure 5). In addition to the rack mount flanges, additional support is required at the rear or sides of the instrument. Be sure to use the correct size screw (as indicated in the illustration) when attaching handles or brackets to the instrument.

Rack Mounting with Slides

Instrument Option 915 contains the necessary hardware to mount the instrument with slides in a rack with 482.6 mm (19 inch) spacing. The kit also contains adapters for mounting in other racks. The slides provide extra support at the sides of the instrument, and makes the instrument easily accessible. See the following steps and Figure 6 to install the Rack Mount Slides.

PREPARATION FOR USE

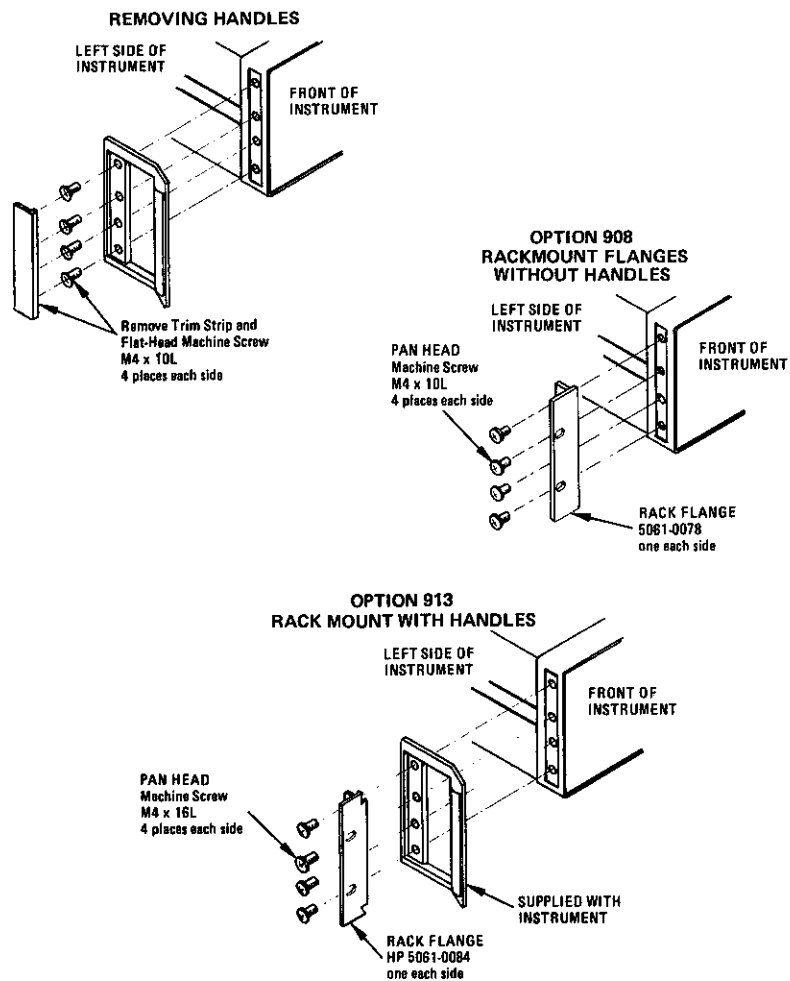


Figure 5. Front Handle Removal and Rack Mounting

PREPARATION FOR USE

1. To gain access to the slide mount holes, remove the strap handles from both sides of the instrument. Next remove the front handles.
2. Attach one slide inner-member bracket to each side of the instrument using two (Metric) M5x12L screws per side (included in kit). Attach the brackets to the inner members of the slide with the screws supplied in the kit.
3. Insert two Unistrut Nuts into each of the four vertical columns of the enclosure and attach the slide outer members with four pan head screws per side (supplied in the kit). Install the instrument by aligning the inner members (attached to the instrument) with the outer members (attached to enclosure). If there is any binding, adjust the slides by supporting the instrument and loosening the screws to the Unistrut Nuts at each side of the enclosure. Adjust the slides slightly until they operate freely.

Connecting Instrument Cabinets

Figure 7 illustrates the installation of hardware to connect either a Mainframe to another Mainframe, or a Mainframe to a Systems Graphics Display. Do not rack mount combined instrument cabinets; use separate rack mounting hardware kits for each cabinet.

PREPARATION FOR USE

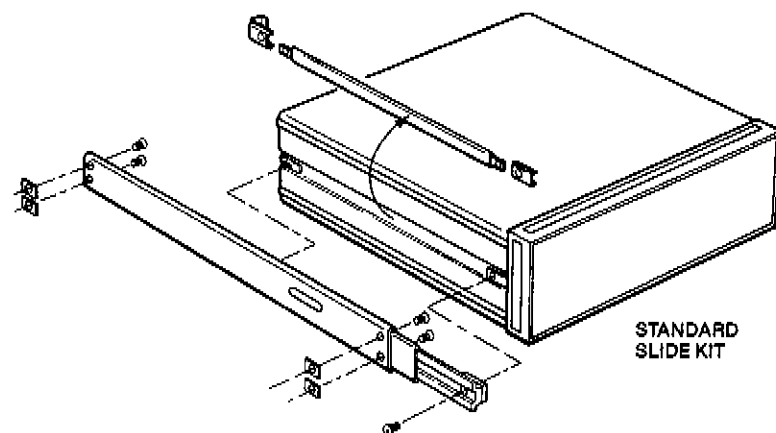


Figure 6. Attaching Rack Mount Slides

PREPARATION FOR USE

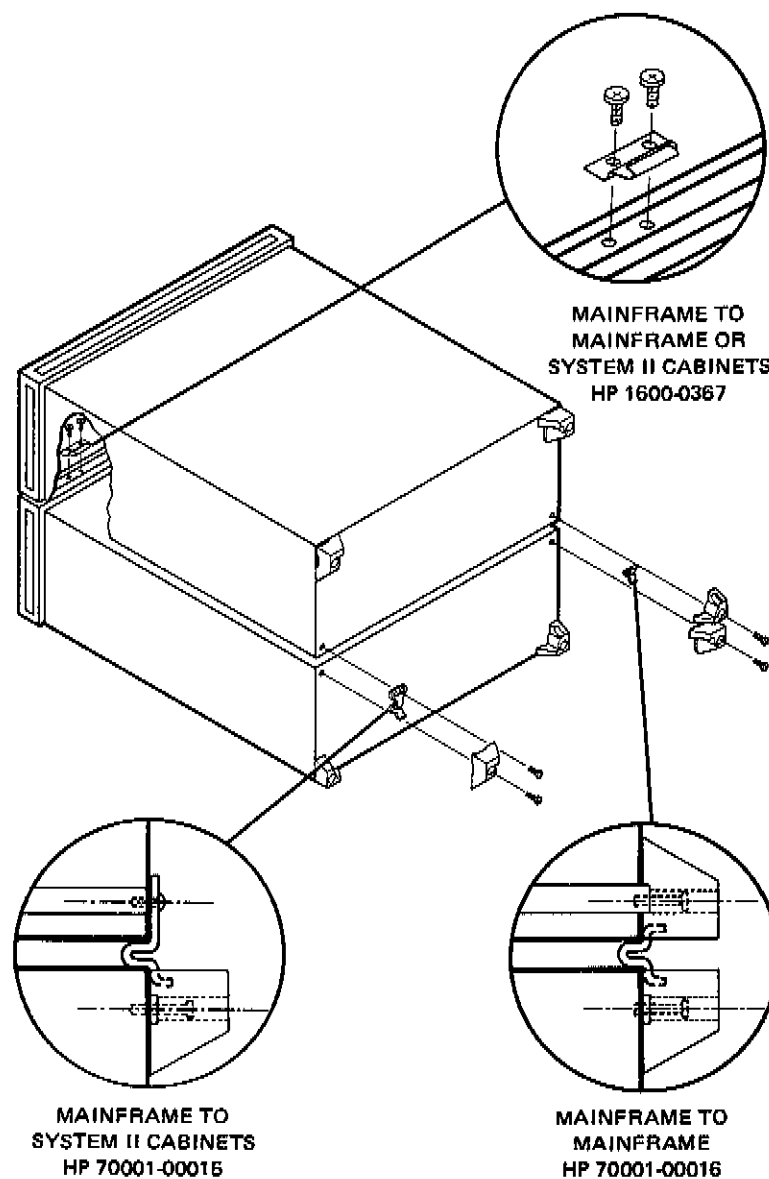


Figure 7. Connecting Instrument Cabinets

MODULE REPLACEMENT

MODULE REMOVAL

To remove a module from the mainframe, follow these steps (see Figure 8):

1. Turn instrument OFF (0).
2. Remove the cabling from the rear of the module.
3. Swing open (down) the front door. Note the door will not swing down unless the LINE switch is pushed in.
4. Loosen the module latch using 8mm Hex-Ball driver.
5. Slide the module forward, out of the instrument.

MODULE INSTALLATION

To install a module into the mainframe follow these steps (Figure 8):

1. Turn instrument OFF (0).
2. Swing open (down) the front door. Note the door will not swing down unless the LINE switch is pushed in.
3. Slide the module into the mainframe.
4. Tighten the module latch using 8mm Hex-Ball driver.
5. Connect inter-module cabling (see Figures 9—12).

PREPARATION FOR USE

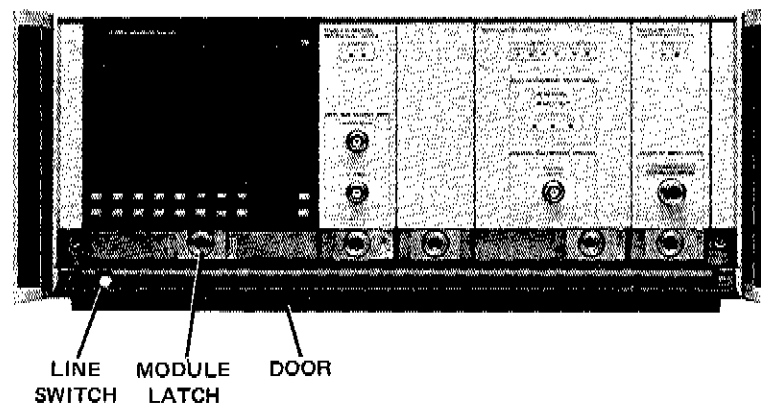


Figure 8. Module Removal/Replacement

MODULE-TO-MODULE CONNECTIONS

The rear-panel cable connections for the RF SECTION, HP 70904, are shown with one IF module in Figure 9.

The rear-panel connections for other RF SECTIONS, HP 70905 and HP 70906, are shown with two IF modules in Figure 10.

The rear-panel cable connections for the EXTERNAL MIXER INTERFACE module (EMIM), HP 70907, are shown with two IF modules in Figure 11.

The rear-panel cable connections for the EMIM with one MW module and with one IF module are shown in Figure 12.

The connection of a Mainframe-to-Mainframe is illustrated by Figure 13 and Mainframe-to-Mainframe to Systems Graphic Display (SGD) by Figure 14.

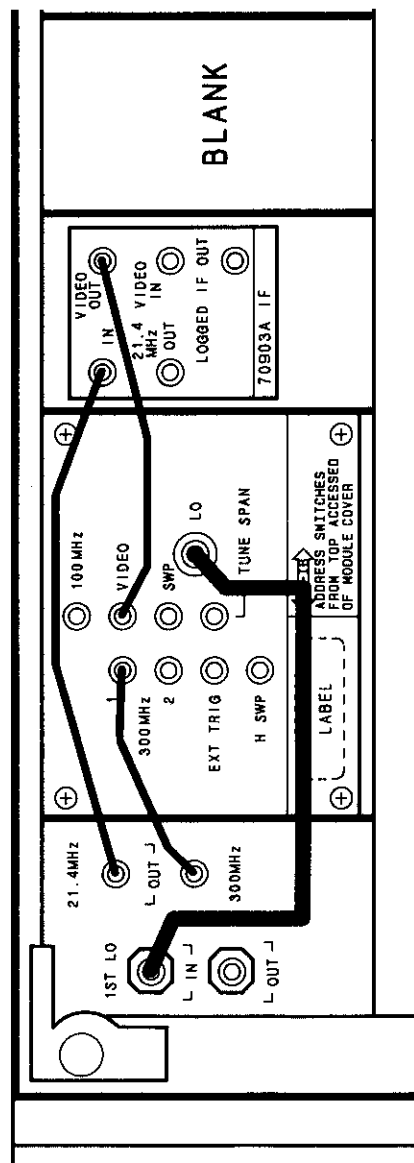


Figure 9. RF with One IF Module



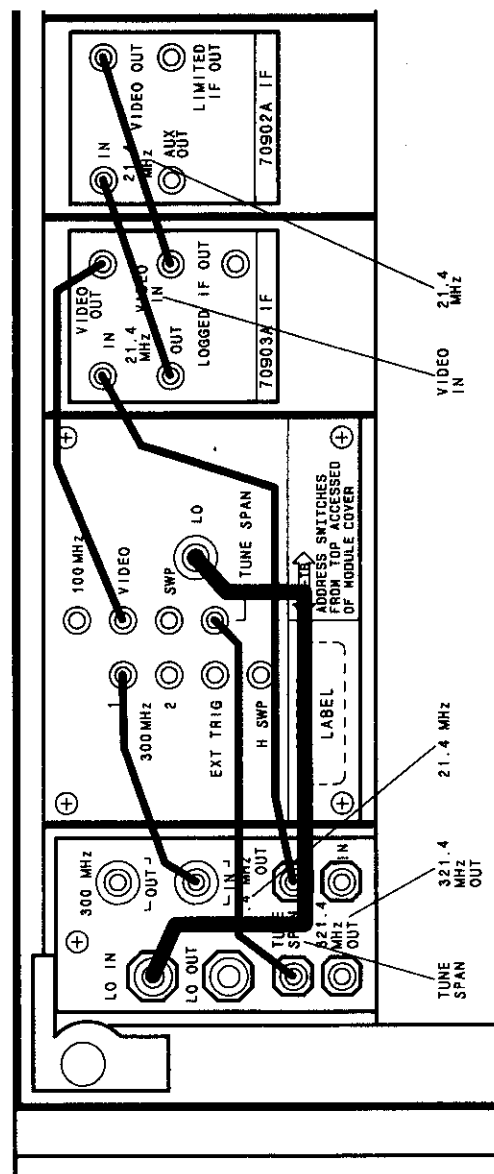


Figure 11. EMIM with Two IF Modules



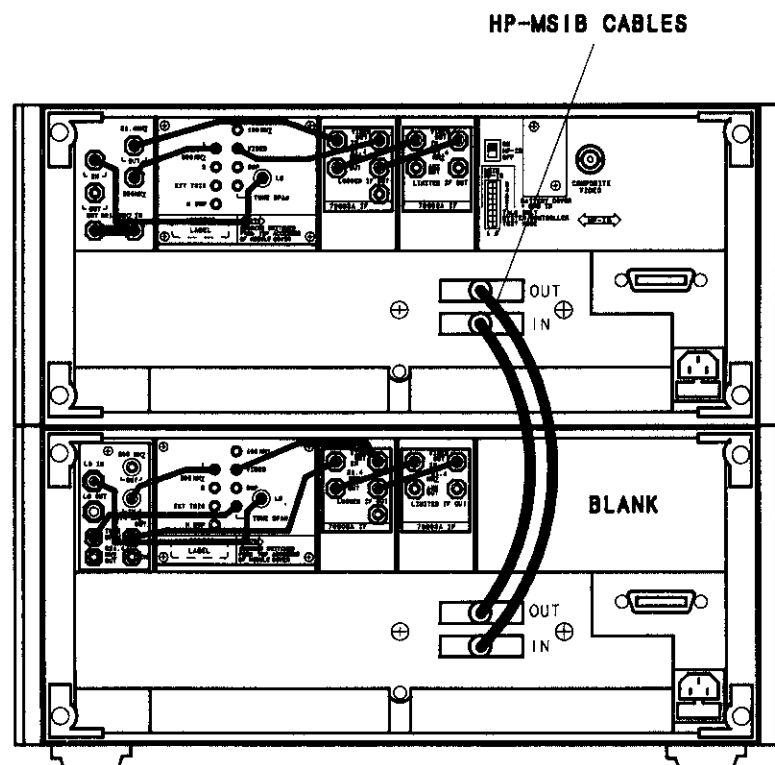
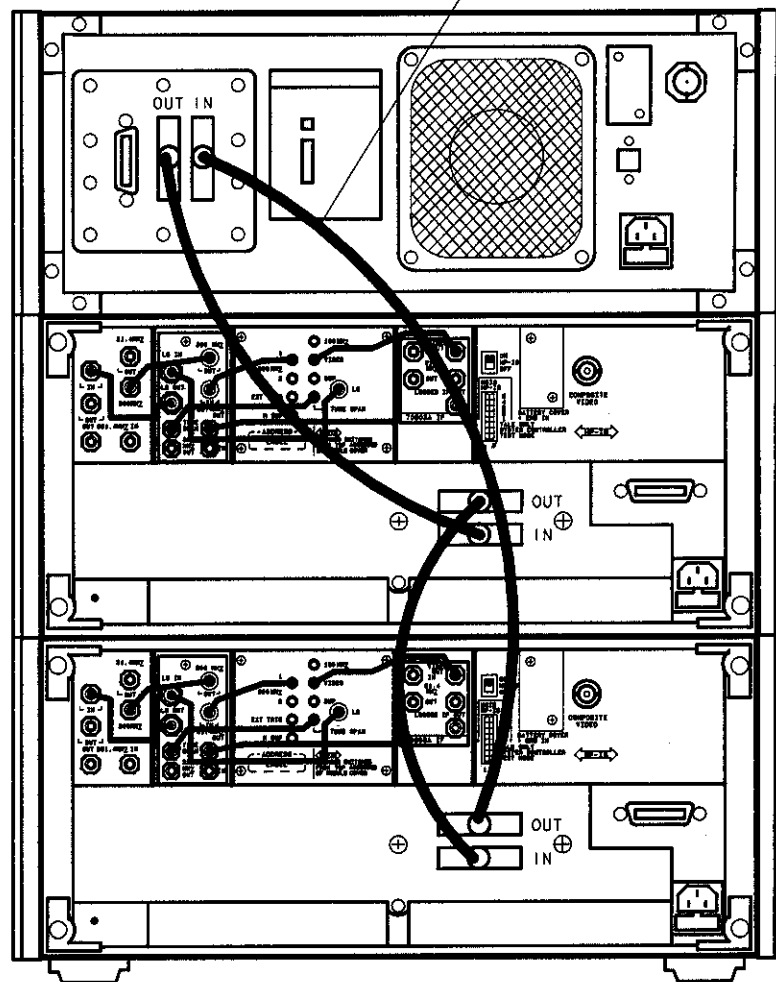


Figure 13. Mainframe-To-Mainframe



NOTE

ALWAYS CONNECT AN OUTPUT TO AN INPUT

Figure 14. Mainframe-To-SGD

MODULE EXCHANGE

Blue Stripe

The Blue Stripe Exchange Program is a system allowing the exchange of defective for rebuilt assemblies. It eliminates time-consuming component-level troubleshooting and reduces costs by providing an alternative to the purchase of new parts.

For modular spectrum analyzers, these assemblies comprise either the module core (for IF, RF, and LO) or assemblies (for Graphics Display, System Graphics Display, or the Mainframe). Core replacement consists of removing the front frames from the defective module and installing them on the replacement module core.

LO Front Frame Removal

1. Remove the four screws on cover top, and the four screws on on the cover sides. Lift cover off.
2. Unplug the SMB connector attached to the blue cable (connecting the front-panel connector to the top of the module). See Figure 15.
3. Remove the two cables attached to the control board and remove the three screws and plastic standoffs. When reassembling the module, place the shorter (yellow) standoff nearest the module front. See Figure 15.
4. Lift up on the control board, unplugging it from the mother board and lay it beside the instrument. The flexible cable at the back of the board may be left attached.
5. Remove the four front-panel mounting screws (from back side of frame). Lift the panel off the frame.
6. Remove front panel, then remove the four front-frame mounting screws at the front bottom of the frame.

PREPARATION FOR USE

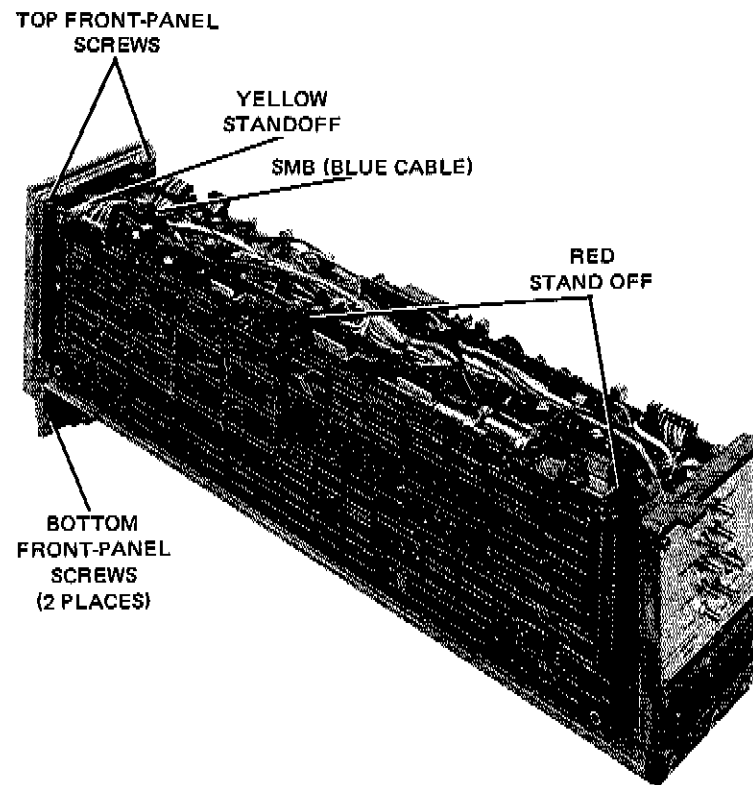


Figure 15. LO Front Frame Removal

IF Front Frame Removal

(To replace the IF Front Frame, reverse the following procedure).

NOTE

It is unnecessary to remove the top cover when removing the front frame (removing this cover may require that the module be recalibrated).

1. Remove the four frame screws (two top, two bottom) of the module. See Figure 16.
2. Unscrew the back-side cable nuts from both BNC connectors, and remove both cables. See Figure 17.
3. Remove the panel mounting bolts to remove the front panel.

PREPARATION FOR USE

FRONT-FRAME
MOUNTING SCREWS
(2 TOP, 2 BOTTOM)



Figure 16. IF Front Frame Removal

RF Front Frame Removal

(To replace the RF front frame, reverse the following procedure.)

1. Remove the module side covers by sliding the lock switch on side cover to rear and lifting cover at rear of module. See Figure 18.
2. Remove the SMA connector from the back side of the front-panel connector.

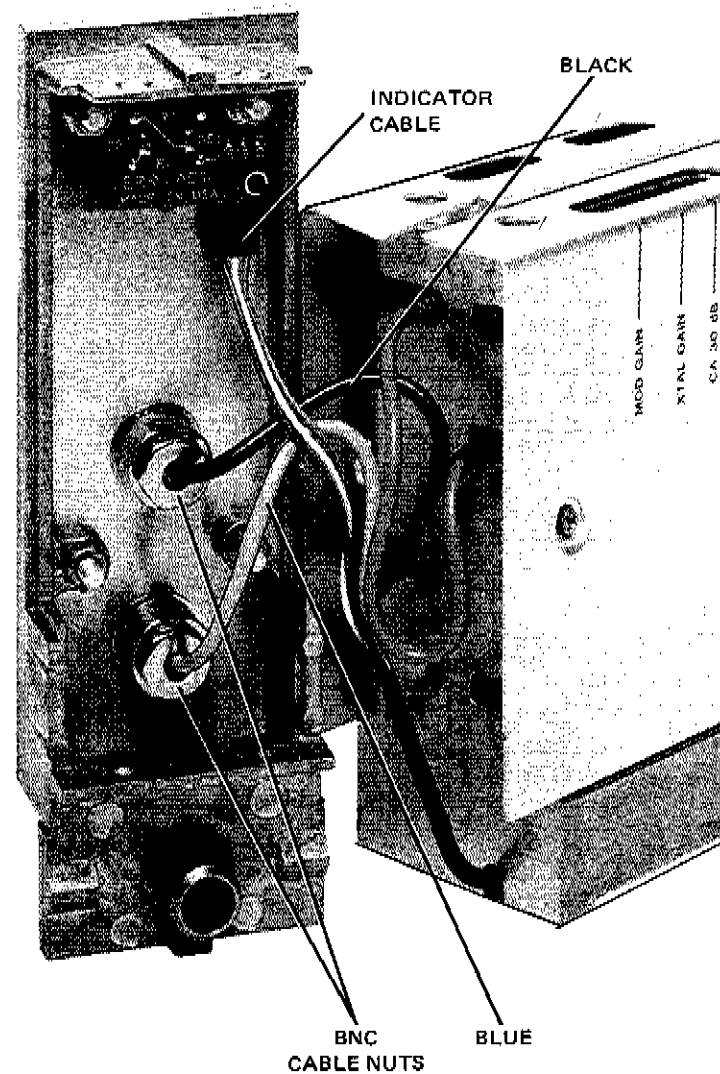


Figure 17. IF Front Panel Removal

PREPARATION FOR USE

3. Remove the four frame screws (two top, two bottom) of the module. See Figure 18. Lift the front-panel assembly from the module. Unplug the connecting cable and lift the frame assembly from the module housing.
4. Remove the panel mounting bolts to remove the front frame.

(To replace the EMIM Front Frame, reverse the following procedure.)

EMIM HP 70907A Front Frame Removal

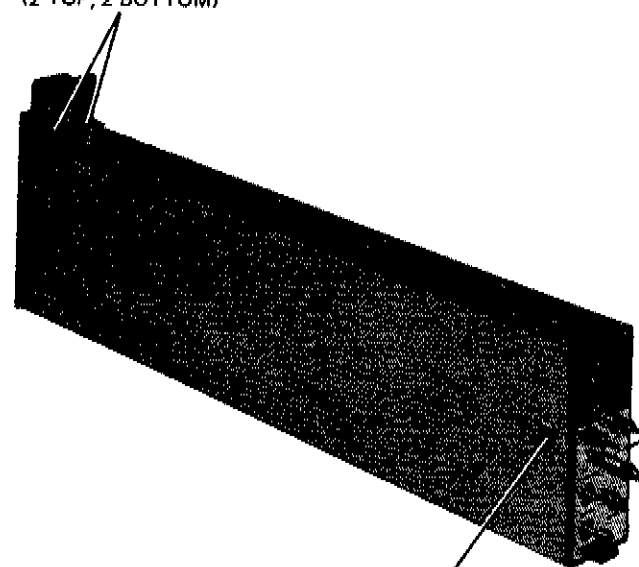
1. Follow the above procedure for removing the RF Front Frame, except remove three SMA connectors instead of one.

Repackaging

The original shipping containers and materials should be used when repackaging the mainframe with modules or modules alone. If these are not available, containers and materials identical to the original factory packaging can be purchased through Hewlett-Packard offices.

The packaging materials for the mainframe are illustrated in Figure 19. The packaging materials for individual modules are illustrated in Figure 20. When ordering packaging materials to ship modules, it is necessary to order the proper number of fillers. A 3/8 module (Graphics Display) requires no fillers; a 2/8 module (LO) requires one filler; a 1/8 module (IF, RF, and EMIM) requires two fillers.

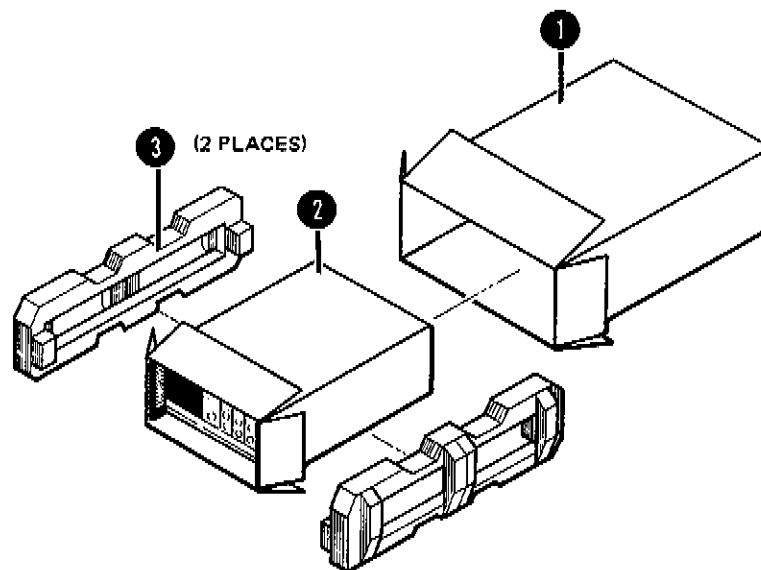
FRONT-FRAME
MOUNTING SCREWS
(2 TOP, 2 BOTTOM)



SIDE COVER
LATCH

Figure 18. RF Front Frame Removal

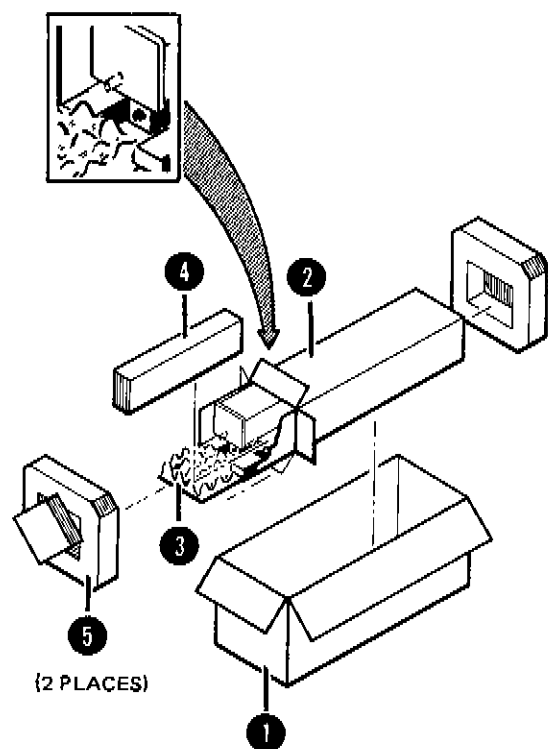
PREPARATION FOR USE



ITEM	QTY	HP PART NO.	DESCRIPTION
1	1	9211-4487	CARTON-OUTER
2	1	5180-2321	CARTON-INNER
3	2	5180-2319	FOAM PADS

Figure 19. Packaging Materials for Mainframe

PREPARATION FOR USE



ITEM	QTY	HP PART NO.	DESCRIPTION
1	1	9211-5118	CARTON—OUTER
2	1	9211-5119	CARTON—INNER
3	1	5180-2369	CARTON—SLIDER
4		4280-8493	FOAM INSERT (FOR QUANTITY SEE TEXT)
5	2	5180-2370	FOAM PADS

Figure 20. Packaging Materials for Modules

PREPARATION FOR USE

Return to H-P for Service

If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. A supply of these tags is provided at the end of this manual. Mark the container **FRAGILE** to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

HP-MSIB/HP-IB ADDRESS SELECTION

HP-MSIB and HP-IB address selection requires an understanding of the HP-MSIB address matrix, master/slave relationships, and module address switches. While the following chapter covers this material, the operator should also refer to the Operating Manual for additional information.

ADDRESS MATRIX

All elements have an 8-bit HP-MSIB address. The three most significant bits (MSB) are defined as the row address and the five least significant bits (LSB) are defined as the column address (this column address is also the HP-IB address for masters). The decimal equivalent of the binary addresses will be used throughout the documentation (2, 24 is row address 2, column address 24). There are eight possible row addresses and 32 possible column addresses. Address 0, 31 is an illegal address, leaving 255 HP-MSIB addresses available. Figure 21 illustrates the row/column address matrix.

MASTER/SLAVE RELATIONSHIP

A Modular Spectrum Analyzer comprises a group of elements (modules on the HP-MSIB) that function together as a spectrum analyzer. The controlling element of the instrument is the master element; while those elements under control are the slave elements. Masters are the only elements to have HP-IB access.

PREPARATION FOR USE

2. The defining element must be in a row that is the same as or below that of the master. In Figure 22 the only element in a row equal to or below that of the master is the defining element at address 0, 29.

Defining Slave Area

When a defining element is found, the master sets the boundaries of its rectangular slave area as follows:

1. One side boundary is equal to the masters column address (in Figure 22 this is column 23).
2. The other side boundary equal to a column one less than that of the defining element (in Figure 22 this is column 28).
3. The bottom boundary is always set at a row address one greater than the row address of the master (in Figure 22 this is row 1).

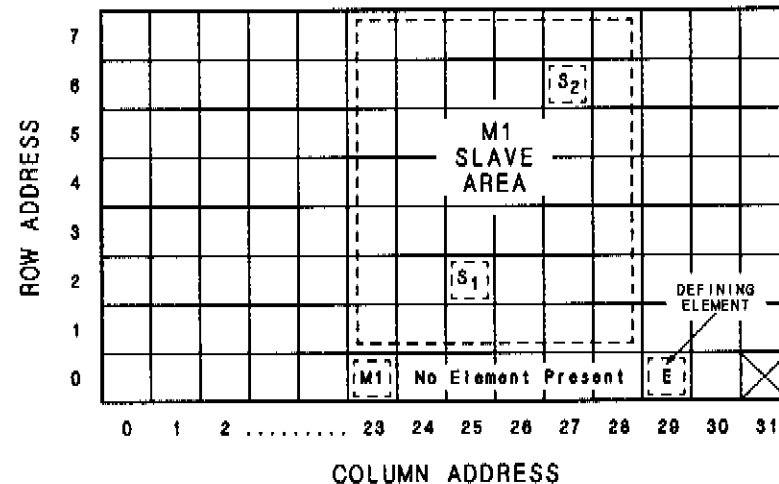


Figure 22. Master/Slave Addressing

PREPARATION FOR USE

4. The top boundary is the top of the matrix, or row 7.

If a new element is added to the area in the figure labeled "No Element Present", the right side boundary would move toward the master, since this new element is the new defining element.

LO, HP 70900A, Addressing Rules

The LO, HP 70900A, requires that the addresses of its slaves follow this order:

1. The master must be on a lower row and address than any of its slaves;
2. The IF module must be at the next higher address (if two IF modules are in the instrument, the HP 70903A must be at a higher row address than the HP 70902A);
3. The HP 70907A (if in the system) must be between the IF module(s) and any other RF SECTIONS (HP 70904A, HP 70905A, and HP 70906A).

In Figure 22, the master is at address 0, 23 and its two slaves (S1 and S2) are at addresses 2, 25 and 6, 27.

SUB-MASTER ADDRESSING

A master can also be a slave of another master, therefore functioning as a sub-master. Figure 23 illustrates a sub-master at address 3, 24. Sub-master M2, while a slave to master M1, has its own slave area defined. Master M1 can not directly access M2 slaves, but must go through M2.

If an element was added to the area labeled "No Element Present", the M2 slave area would be reduced since its slave area is defined by following the rules for boundary defining (see the Addressing Rules above).

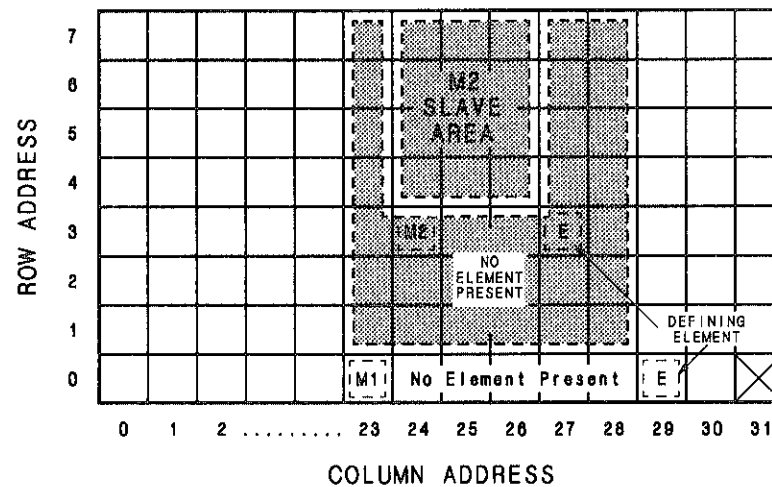


Figure 23. Sub-Master Address Matrix

HP-IB/HP-MSIB ADDRESS SWITCHES

The address switches on Local Oscillator and display modules set the HP-IB/HP-MSIB address. These switches are located on the side, top, or rear of the module. Their settings are read only at power on. See Figure 24.

It is also possible to set the Local Oscillator HP-IB address from the front panel of a display. At start-up, this address will override the address set by the module switches. See the Operating Manual for additional information.

Following is a description of the module address switches:

PREPARATION FOR USE

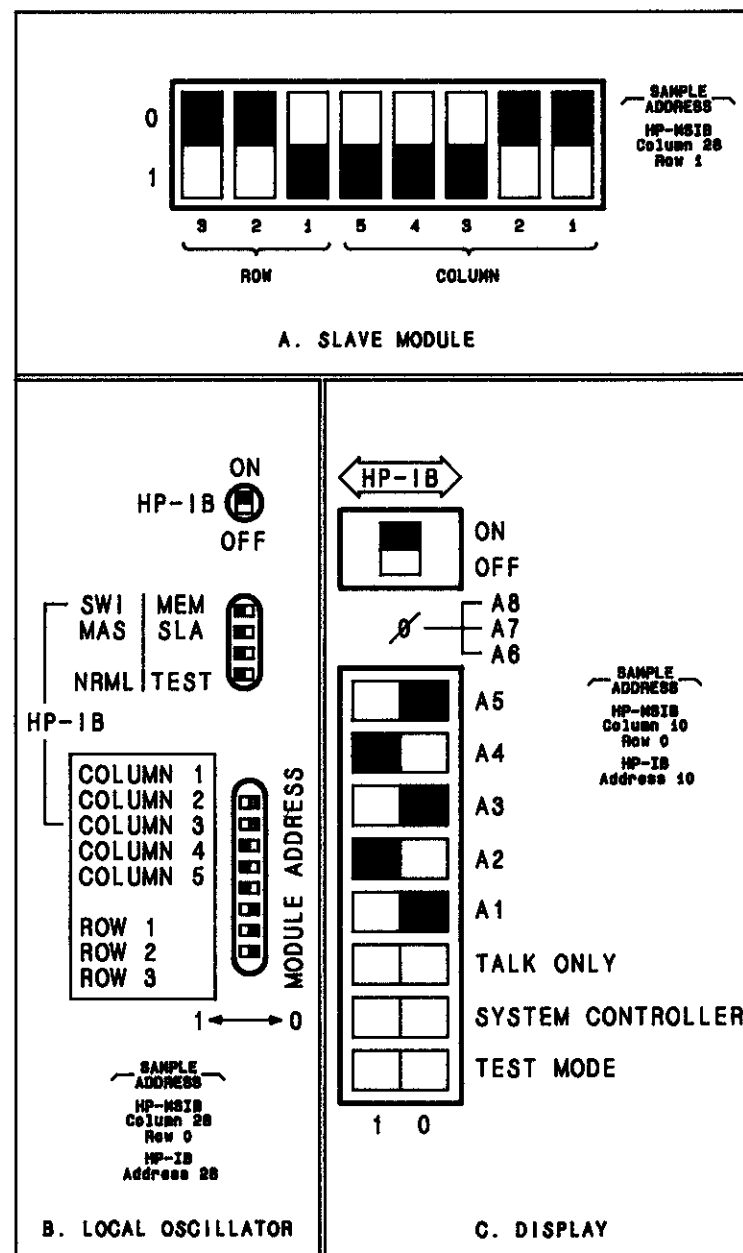


Figure 24. HP-MSIB/HP-IB Address Switches

Displays

A1-A5 HP-IB/HP-MSIB address switch. These switches set the HP-MSIB column address that also functions as the HP-IB address. See the previous module addressing information above for an explanation of HP-MSIB.

A6-A8 Default HP-MSIB row address, not able to be switched. See the previous module addressing information for an explanation of HP-MSIB.

HP-IB ON-OFF Switches the module OFF the HP-IB. This does not affect the operation of the analyzer on the bus, since the Local Oscillator (LO) provides the necessary HP-IB interface. If you desire to add the display to the bus, independent of the spectrum analyzer, position the switch to the ON position.

TALK ONLY When in the ON position, allows the Graphics Display to talk to the HP-IB and not require a reply (this might be necessary with some plotters). In normal operation, the switch is in the OFF position.

SYSTEM CONTROLLER When in the ON position allows the Graphics Display to function as a controller on the HP-IB. This switch is normally in the OFF position.

TEST MODE When in the ON position places the Graphics Display into a Test Mode. In normal operation, the switch is OFF. (Some tests use the normal position. See the Graphics Display troubleshooting information in the appendix.)

Local Oscillator (LO)

COLUMN 1--5 HP-IB/HP-MSIB address switches. These switches set both the HP-MSIB column address and the HP-IB address. See the previous module addressing information for an explanation of HP-MSIB.

PREPARATION FOR USE

ROW 1--3 These switches set the HP-MSIB row address for this module. See the previous module addressing information.

HP-IB ON-OFF When OFF, switches the module off the HP-IB.

SW1/MEM When in SW1 position, the HP-IB address is fixed by the row/column address switches. When in the MEM position, the HP-IB address is set from the module memory. For normal operation the switch should be in the MEM position.

MAS/SLA When in the MAS position the module has master element capabilities. When in SLA the LO module has slave element capabilities. The switch should normally be in the master position for HP 71000 Modular Spectrum Analyzers.

NRML/TEST During normal operation, the switch should be in the NRML position (normal). The TEST position is used during module troubleshooting procedures.

Slave Modules

Column/Row Address Switches Sets the HP-MSIB address as previously described.

SYSTEM REPLACEABLE PARTS

Parts List Organization

This section contains information for ordering replacement parts for the HP 71000 Modular Spectrum Analyzer. Several rebuilt electrical assemblies are available on an exchange basis; these are listed in Table 2. Table 3 is a list of system level parts including items such as configured system components, system options, interconnection cables, service tools, and troubleshooting aids.

Since repair of the HP 71000A Mainframe and the two displays, the HP 70205A and HP 70206A, is to the board or assembly level, the replaceable parts list for each is included within the appropriate module section in the appendix.

Exchange Assemblies

Table 2 lists rebuilt assemblies within the system that may be replaced on an exchange basis. Exchange, factory repaired and tested assemblies are available only on a trade-in basis; therefore, the defective assemblies must be returned for credit. For this reason, assemblies required for user spare parts stock must be ordered by the new assembly part number.

Ordering Information

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

PREPARATION FOR USE

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

Direct Mail Order System

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

1. Direct ordering and shipment from the H-P Parts Center in Mountain View, California.
2. No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local H-P office when the orders require billing and invoicing).
3. Prepaid transportation (there is a small handling charge for each order).
4. No invoices—to provide these advantages, a check or money order must accompany each order.

Mail order forms and specific ordering information are available through your local H-P office.

PREPARATION FOR USE

TABLE 2. EXCHANGE ASSEMBLIES

Model No.	Description	Model/Part Number	
		New	Rebuilt
HP 70001A	Mainframe Power Supply Assembly Interconnect Board Assembly HP-MSIB Board Assembly *Includes Board and RFI Gasket)	HP 70001A 70001-80052 70001-80002 70001-80049	— 70001-80022 70001-80023* 70001-80025*
HP 70205A	Graphics Entry Module Motherboard Assembly Processor (Host) Board Assembly Memory Board Assembly Dot Generator Board Assembly Power Supply Assembly	HP 70205A 70205-80001 70205-80002 70205-80003 70205-80004 70205-80015	70205-80037 70205-80030 70205-80031 70205-80032 70205-80033 70205-80035
HP 70206A	System Graphics Display Motherboard Assembly Line Filter Assembly Video Sweep Board Assembly HP-MSIB Assembly	HP 70206A 70206-80001 70206-80007 70206-80005 70206-80006	— — 70206-80036 70206-80032 70206-80033
HP 70300A	Tracking Generator	HP 70300A	70300-80040
HP 70900A	Local Oscillator	HP 70900A	70900-80024
HP 70902A	IF Section (Res BW 10 Hz - 300 kHz)	HP 70902A	70902-80024
HP 70903A	IF Section (Res BW 100 kHz - 3 MHz)	HP 70903A	70903-80024
HP 70904A	RF Section (100 Hz - 2.9 GHz)	HP 70904A	70904-80024
HP 70905A	RF Section (100 Hz - 22 GHz)	HP 70905A	70905-80024
HP 70906A	RF Section (50 kHz- 26.5 GHz)	HP 70906A	70906-80024
HP 70907A	External Mixer Interface Module	HP 70907A	70907-80024

PREPARATION FOR USE

TABLE 3. SYSTEM LEVEL REPLACEABLE PARTS (1 of 2)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
				CONFIGURED SYSTEM COMPONENTS HP 71100A RF SPECTRUM ANALYZER includes the following: HP 700001A MAINFRAME HP 70205A GRAPHICS DISPLAY HP 70900A LOCAL OSCILLATOR HP 70902A IF SECTION (RES BW 10 HZ - 300 KHZ) HP 70904A RF SECTION (100 HZ - 2.9 GHZ) HP 71200A MICROWAVE SPECTRUM ANALYZER includes the following: HP 70001A MAINFRAME HP 70205A GRAPHICS DISPLAY HP 70900A LOCAL OSCILLATOR HP 70902A IF SECTION (RES BW 10 HZ - 300 KHZ) HP 70905A RF SECTION (100 HZ - 22 GHZ) HP 71300A MILLIMETER SPECTRUM ANALYZER includes the following: HP 70001A MAINFRAME HP 70205A GRAPHICS DISPLAY HP 70900A LOCAL OSCILLATOR HP 70902A IF SECTION (RES BW 10 HZ - 300 KHZ) HP 70907A EXTERNAL MIXER INTERFACE SYSTEM OPTIONS (Except as noted, the following list of options apply to all standard systems.) OPTION 001: DELETE HP 70905A RF SECTION ADD HP 70906A RF SECTION (50 KHZ - 28.5 GHZ) (Applies to HP 71200A System only) OPTION 002: DELETE HP 70205A GRAPHICS DISPLAY ADD HP 70206A SYSTEMS GRAPHICS DISPLAY (50/60 Hz Operation) OPTION 003: DELETE HP 70205A GRAPHICS DISPLAY ADD HP 70206A SYSTEMS GRAPHICS DISPLAY (400 Hz Operation) OPTION 004: ADD HP 70903A IF SECTION (RES BW 100 KHZ - 3 MHZ) OPTION 005: DELETE HP 70902A IF SECTION ADD HP 70903A IF SECTION (RES BW 100 KHZ - 3 MHZ) OPTION 908: RACK FLANGE KIT (To mount without handles) OPTION 913: RACK FLANGE KIT (To mount with handles on instrument) OPTION 915: RACK MOUNT WITH SLIDES MAINFRAME SYSTEM GRAPHICS DISPLAY OPTION 910: EXTRA MANUAL MISCELLANEOUS SYSTEM LEVEL PARTS PANEL-MAINFRAME FRONT BLANK 1/8 MODULE COVER-MAINFRAME REAR PANEL EMC SHIELD FILTER-MAINFRAME AIR CABINET INTERCONNECT KIT (MAINFR-MAINFR) CABINET INTERCONNECT KIT (MAINFR-SGD)
	5061-9678	7		
	5061-9684	9		
	1494-0016	6		
	1494-0017	7		
	5061-9006	7		
	70001-40017	7		
	70001-20051	7		
	70001-20053	9		

PREPARATION FOR USE

TABLE 3. SYSTEM LEVEL REPLACEABLE PARTS (2 of 2)

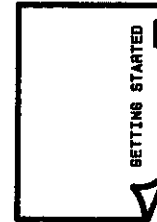
Item/ Ref. Des.	HP Part Number	C D	Qty	Description
HP 70800A HP 70800B HP 70800C HP 70800D HP 70800E				SYSTEM INTERCONNECTION HP-MSIB CABLES
				CABLE-HP-MSIB 0.5 METER
				CABLE-HP-MSIB 1.0 METER
				CABLE-HP-MSIB 2.0 METER
				CABLE-HP-MSIB 6.0 METER
				CABLE-HP-MSIB 30 METER
				SEMI-RIGID LO CABLES
				(To connect left side LO Output to right side LO Input as viewed from rear panel)
	5021-5448	1		CABLE-SEMI-RIGID COAX LO 1/8 MOD SPACE SMA
	5021-5449	2		CABLE-SEMI-RIGID COAX LO 2/8 MOD SPACE SMA
	5021-5450	5		CABLE-SEMI-RIGID COAX LO 3/8 MOD SPACE SMA
	5021-5451	6		CABLE-SEMI-RIGID COAX LO 4/8 MOD SPACE SMA
	5021-5452	7		CABLE-SEMI-RIGID COAX LO 5/8 MOD SPACE SMA
	5021-5453	8		CABLE-SEMI-RIGID COAX LO 6/8 MOD SPACE SMA
	5021-5454	9		CABLE-SEMI-RIGID COAX LO 7/8 MOD SPACE SMA
				SEMI-RIGID LO CABLES
				(To connect right side LO Output to left side LO Input as viewed from rear panel)
	5021-5491	4		CABLE-SEMI-RIGID COAX LO 1/8 MOD SPACE SMA
	5021-5492	5		CABLE-SEMI-RIGID COAX LO 2/8 MOD SPACE SMA
	5021-5493	6		CABLE-SEMI-RIGID COAX LO 3/8 MOD SPACE SMA
	5021-5494	7		CABLE-SEMI-RIGID COAX LO 4/8 MOD SPACE SMA
	5021-5495	8		CABLE-SEMI-RIGID COAX LO 5/8 MOD SPACE SMA
	5021-5496	9		CABLE-SEMI-RIGID COAX LO 6/8 MOD SPACE SMA
	5021-5497	0		CABLE-SEMI-RIGID COAX LO 7/8 MOD SPACE SMA
				FLEXIBLE COAX IF/VIDEO/REF CABLES
	5061-9015	0		CABLE-FLEX COAX IF/VIDEO/REF 1/8 MOD SMB
	5061-9016	1		CABLE-FLEX COAX IF/VIDEO/REF 2/8 MOD SMB
	5061-9017	2		CABLE-FLEX COAX IF/VIDEO/REF 3/8 MOD SMB
	5061-9018	3		CABLE-FLEX COAX IF/VIDEO/REF 4/8 MOD SMB
	5061-9019	4		CABLE-FLEX COAX IF/VIDEO/REF 5/8 MOD SMB
	5061-9020	7		CABLE-FLEX COAX IF/VIDEO/REF 6/8 MOD SMB
	5061-9021	8		CABLE-FLEX COAX IF/VIDEO/REF 7/8 MOD SMB
				MISCELLANEOUS SYSTEM CABLES
	5021-6311	9		CABLE-SEMI-RIGID COAX VERT MF-TO-MF SMA
	5061-9038	7		CABLE-FLEX COAX INTER-MODULE SMA
	5061-9039	8		CABLE-FLEX COAX MAINFR-TO-MAINFR SMA
				SYSTEM SERVICE ACCESSORIES
	70001-60013	5		MODULE SERVICE EXTENDER
	8710-1307	7		8MM HEX BALL DRIVER
	85680-60093	3		CABLE-SMB (F) TO BNC (M)
	8120-1578	3		CABLE-SMA (F) TO SMA (M)
	1251-2277	1		ADAPTER-BNC (F) TO DUAL BANANA (F)
	1250-1159	4		ADAPTER-SMA (M) TO SMA (M)
	70206-60029	0		SERVICE EXTENDER KIT (includes the following extenders)
	70205-60027	7		EXTENDER-HOST
	70205-60028	8		EXTENDER-MEM/DOT
	70205-60023	3		EXTENDER-50 PIN (HP-MSIB ONLY)
	70205-60022	2		EXTENDER-24 PIN (GEM SUPPLY/SGD SWP)
	08505-60109	8		EXTENDER-12 PIN (HP-MSIB PHYSICAL EXT. ONLY)
	70206-60041	6		EXTENDER-SPECIAL (SGD ONLY)
	70206-60038	1		OVERLAY-SGD
	70205-60038	0		OVERLAY-GEM

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INTRODUCTION

System Verification is a software program that verifies the HP 71000 Series Modular Spectrum Analyzer meet all their major specifications. It runs on HP Series 200 Computers and requires HP-IB controlled external test equipment (ETE). The program is flexible and therefore requires the user to configure it using the menus and function keys.

System Verification can automatically run all its specification tests, or it can allow the operator to control which tests are run. It also will automatically and quickly run just the most important tests.

Test results can be displayed on the computer CRT or printed. Printed test results are available in both table and graph form.

The program allows the use of various models of ETE. For example, three different synthesized sources can be used.

This chapter is a user manual for the program. It explains the program capabilities and lists the spectrum analyzer specifications.

GETTING STARTED

This section explains how to connect the external test equipment (ETE) and spectrum analyzer to the computer via HP-IB. It also explains how to load and run the program and configure the the Parameter and Test Equipment menus.

REQUIRED EQUIPMENT

Program Disks

Shipped with this manual are 5 1/4 and 3 1/2 inch disks. Both the 5 1/4 and 3 1/2 inch disks contain one copy of the System Verification program. The following part numbers are for replacement disks:

System Verification on 5 1/4 inch disks = 5010-1504

System Verification on 3 1/2 inch disks = 5010-1503

Computer Language

The program runs on HP BASIC 3.0 that has the following binaries loaded:

CLOCK
GRAPH
KBD
MS
HPIB

ERR
IO
MAT
PDEV
DISC

It will also run on HP BASIC 2.0 with Extensions 2.1.

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Computers

The program runs on the HP Series 200 Computers listed below:

- HP 9816 with a dual disk drive
- HP 9826 with a dual disk drive
- HP 9836

The HP 82901M (5 1/4 inch) and HP 9121D (3 1/2 inch) Dual Disk Drives can be used with either the HP 9816 or HP 9826. The program is not supported for a Winchester disk drive.

The HP 98624A HP-IB Interface (select code 8) can also be used with the program. Using this interface eliminates any potential address conflicts between the HP-IB test equipment and Modular Measurement System. (The HP 98624A HP-IB Interface must be in the controller (not slave) mode.)

To run BASIC 3.0 and System Verification the computer must have 750k of plug-in RAM.

Test Equipment

Table 2 lists the external test equipment (ETE) that can be used with System Verification. The test equipment categories listed in this table are those of the Test Equipment Menu. The HP model numbers are those allowed in each category of the menu.

Table 2 also indicates which models of test equipment are the recommended models. Using the program with all the recommended models maximizes the completeness of the spectrum analyzer testing. Using the program with the other models does not allow the program to do its maximum possible testing of the spectrum analyzer specifications.

Table 1 is a list of Additional Required Accessories. These accessories are required to connect the ETE to the spectrum analyzer when the tests are run.

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Table 1. Additional Required Accessories

Adapter N (f) to BNC (m)	HP P/N 1250-0077
Adapter N (m) to BNC (f) [HP 70904 only]	HP P/N 1250-0780*
Adapter APC-3.5 (f) to N (m)	HP P/N 1250-1744
Adapter BNC (f) to dual banana plug	HP P/N 1251-2277
Adapter APC-3.5 (f) to APC-3.5 (f) [HP 70906 only]	HP P/N 1250-1749*
Cable (4 ft) BNC (m) to SMB	HP P/N 85680-60093*
Cable (122 cm) BNC (m) to BNC (m)	HP 10503A
Cable (2 ft) SMA (m) to SMA (m)	HP P/N 8120-3124
Termination, N (m), 50 Ω	HP 908A
Termination, APC-3.5 (m), 50 Ω	HP 909D
* indicates the recommended accessory.	

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Table 2. External Test Equipment

CATEGORY	USABLE MODELS
Printer (Graphics/Non-Graphics):	Any HP-IB printer
Level Generator:	HP 3335A*†
Microwave Source:	HP 8340A*†
General Source:	HP 8340A † HP 3335A † HP 8662A HP 8663A
Synthesized Source:	HP 8340A*† HP 8663A HP 8662A
Clean Source:	HP 8663A* HP 8662A
Universal Counter:	HP 5316A*
Frequency Counter:	HP 5343A*†
Voltmeter:	HP 3456A† HP 3455A HP 3478A
Measurement Receiver:	HP 8902A*†
Signal Sensor:	HP 11722A*
Power Meter:	HP 8902A*† HP 436A
Power Sensor:	HP 8485A*† HP 8481A HP 8482A HP 11722A HP 11792A
External Mixer:	HP 11970K HP 11970A HP 11970U HP 11970G
Power Splitter (N):	HP 11667A‡ HP 11667B**
* indicates the recommended model of test equipment. † indicates models used in the μ W workstation. ‡ recommended only for RF Spectrum Analyzer. ** recommended only for μ W Spectrum Analyzer.	

SYSTEM VERIFICATION SETUP

The following procedure explains how to connect the external test equipment and the spectrum analyzer to the computer via HP-IB. It also explains how to load and run the program.

1. Connect the HP-IB port of the spectrum analyzer to the HP-IB port of the computer. If the computer has an HP 98624A HP-IB Interface, connect the HP-IB cable to the port labeled HP-IB SELECT CODE 8. If the computer doesn't have an HP 98624 HP-IB Interface, connect the HP-IB cable to the port labeled HP-IB SELECT CODE 7.
2. Connect the HP-IB ports of the external test equipment to the computer port labeled HP-IB SELECT CODE 7. Before running the System Verification tests, allow the test equipment to warm-up as specified in their manuals.
3. Connect the HP-IB of the external dual disk drive, if one is used, to the computer HP-IB port labeled HP-IB SELECT CODE 7.
4. Turn the spectrum analyzer ON (1). Allow it to warm-up for one hour before beginning the System Verification tests.
5. Turn the computer, and the external disk drive, ON (1).
6. Verify HP BASIC 3.0 and the Binaries listed earlier under Computer Language are loaded in the computer. (Refer to the computer manual for instructions on how to load BASIC.)
7. Insert the System Verification disk labeled "Executive Disk" into the default drive of the computer.
8. Load the executive program by typing the following command and then pressing EXECUTE (EXEC).

LOAD "SYS_VERF"

SYSTEM VERIFICATION

9. (For the HP 9826 Computer only.)

Change the default disk drive from the internal drive to the external dual disk drive. This is done with the MASS STORAGE IS command. (The internal drive is not used by the program.) For example, if you are using the HP 9121D or HP 82901M Dual Disk Drive, type the following command and then press EXECUTE (EXEC).

MASS STORAGE IS ".HP 8290X,700"

10. Insert the test disk into the second drive. For example, the HP 71100/71200 Spectrum Analyzer test disk is labeled "HP 71100/71200 Test Disk".

11. Place the "Operating Disk" in the default drive. (If you are using an HP 9816 or HP 9836 you will have to remove the "Executive Disk" from the default drive.)

12. Press the RUN key.

The computer will now display the Main Menu of the program. Before you press any of the Main Menu function keys, follow the USING SYSTEM VERIFICATION procedure below.

USING SYSTEM VERIFICATION

The following procedure explains how to configure the Parameter and Test Equipment menus for the first time. This must be done to successfully test the spectrum analyzer.

1. Press the "Parameter Menu" (Parm Mnu) function key.

The program will display the Parameter Menu, which determines the format and completeness of the test result data. It also determines if the configurations of the Test Equipment and Parameter menus are saved on disk.

2. Reset the program parameters according to your testing needs with the "Change" function key and the cursor (the => symbol).

For a complete explanation of each parameter, refer to the description of the Parameter Menu in the following section of the book called The Menus.

3. Press the "Equipment Menu" (ETE Menu) function key.

This displays the Test Equipment Menu.

NOTE

The model numbers and addresses you select must correspond to the actual configuration of the external test equipment. If they do not, the program cannot run its tests.

SYSTEM VERIFICATION

NOTE

Both the HP 70205A and HP 70206A Display have an HP-IB address. (Also, any HP-MSIB master has an HP-IB address.) These HP-IB addresses must be different than those of the external test equipment. To determine the HP-IB address of the display, see the description of the Address Map in the OPERATING MANUAL.

4. Set the model number and HP-IB address or serial number for each category of test equipment listed in the Test Equipment Menu. Use the "Change Model" (Model #), "Change Address" (Address), and "Change S/N" (S/N) function keys. If you do not have a test instrument for a particular category, enter "None" for the HP-IB address.
5. If you do not have a power sensor, skip steps 6 through 9.
6. Verify the correct Serial Number was entered for the Power Sensor and press the "View Cal. Data" (View Cal) function key.

Pressing the "View Cal. Data" (View Cal) function key displays the Power Meter Sensor screen.

7. Press the "Create" function key and enter the calibration factors for the power sensor.

If the program has been used before, and it already has the calibration factors for the power sensor you are using, it will present an "Edit" function key instead of the "Create" function key.

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8. When all the calibration factors are entered, press the "Return" function key.

The Test Equipment Menu will be displayed.

9. Press the Test Menu function key.

This displays the Test Selection Menu. Before selecting a testing mode, refer to the description of the Test Selection Menu in the following section called The Menus.

If the computer beeps and defaults to the Test Equipment Menu, note the position of the cursor and refer to the description of the Test Equipment Menu.

10. Press the function key for the testing mode you need. The program will test the spectrum analyzer accordingly.

To make the best use of the program, familiarize yourself with all the program menus and test result messages. Each menu is described in the following section called The Menus. Each test result message is described in the section called Messages and Codes.

THE MENUS

This section describes the five menus and the HP-MSIB Map Screen in the following order:

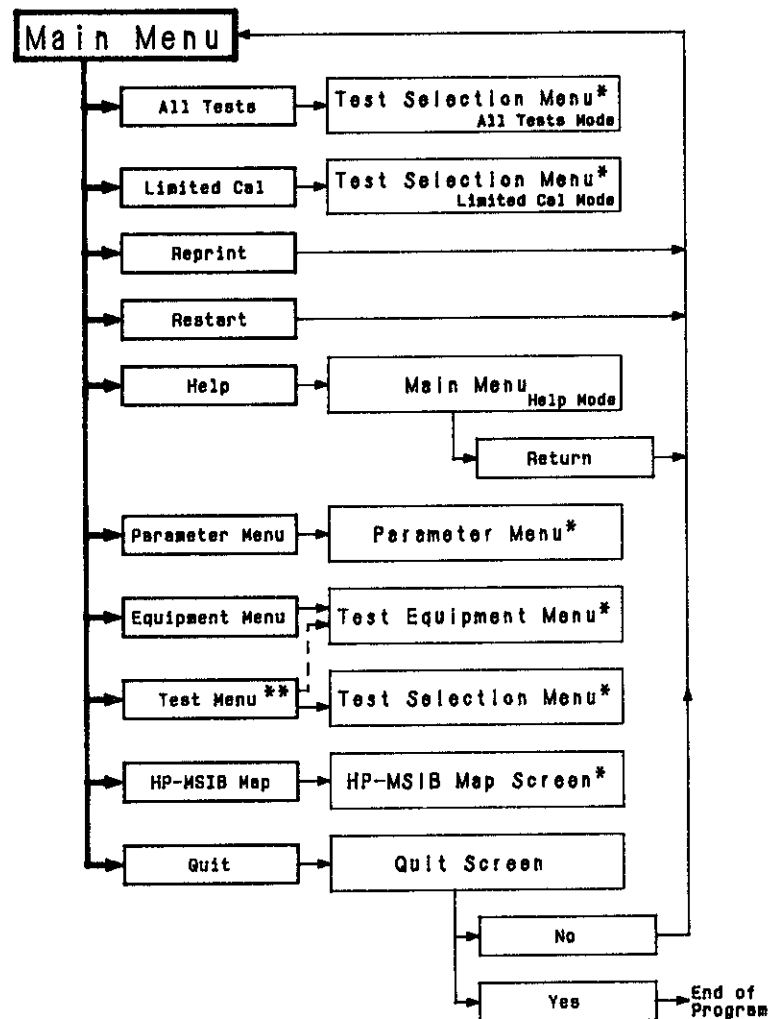
- Main Menu
- HP-MSIB Map Screen
- Parameter Menu
- Test Equipment Menu
- Test Selection Menu
- Test Auxiliary Menu

The menu descriptions use the function key labels of the HP 9816 and HP 9836 Computers. The function key labels for the HP 9826 Computer are abbreviated in the program. These abbreviated labels are not used in the following menu descriptions; however, the Messages and Codes section of this chapter contains a listing of the function key labels in both unabbreviated and abbreviated form.

NOTE

There are several minor anomalies between the appearance of the menus on the HP 9816/9836 Computers and the HP 9826 Computer. These anomalies are due to the smaller screen size of the HP 9826.

SYSTEM VERIFICATION



* Refer to separate flow chart for this menu.

** Test Menu can default to the Test Equipment Menu.
See description.

Figure 1. Main Menu Flow Chart

Main Menu

The Main Menu is the first menu displayed by the program. It provides access to other program menus and four program functions. The only menu that can not be accessed from the Main Menu is the Test Auxiliary Menu. (This menu provides auxiliary functions to the Test Selection Menu.) The four functions accessed through the Main Menu are All Tests, Limited Cal, Reprint, and Restart. These functions allow you to test Spectrum Analyzers or print the results of a previous test--without using other program menus.

Main Menu Function Keys

All Tests puts the program in the All Tests mode of the Test Selection Menu. This mode executes all the tests listed in the Test Selection Menu.

Limited Cal puts the program in the Limited Cal mode of the Test Selection Menu. This mode executes a modified form of some tests, omits others, and completely does the rest. For a list of what tests are done in the Limited Cal mode, refer to the description of the Test Selection Menu.

NOTE

The program will not enter the All Tests or Limited Cal modes if the Test Equipment Menu has not been set up. Instead, it automatically displays the Test Equipment Menu or its Power Mount Screen.

Reprint (conditional) prints a copy of the test results stored on disc. Test results are stored on disc if the Parameter

SYSTEM VERIFICATION

Menu was set up appropriately. If the test results exceeded the disc storage room allotted, only the results that fit on disc are reprinted. If no printer is present on the HP-IB bus, the program omits this function key. Refer to the description of the Parameter Menu and the "Print" function key of the Test Auxiliary Menu.

NOTE

The program erases the test results stored on disc the first time it enters the Test Selection Menu. Therefore, to print the test results stored on disc during a previous running of the program, use this Reprint function key.

Restart configures the program to test another spectrum analyzer. Restart flags the test results on disc for erasure when the Test Selection Menu is entered, updates the test list of the Test Selection Menu, and updates the HP-MSIB Map.

Help puts this menu in its Help Mode. This mode describes the menu. It also presents a "Return" function key which displays the menu again.

Parameter Menu displays the Parameter Menu. This menu allows you to specify several different operating parameters of the program. Refer to the description of the Parameter Menu.

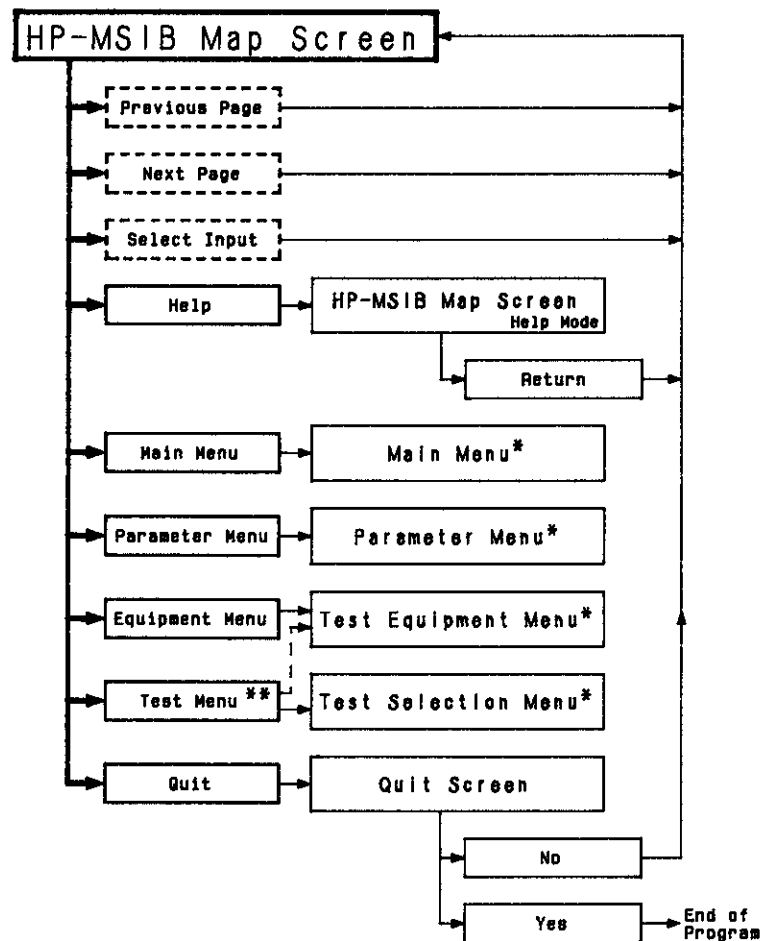
Equipment Menu displays the Test Equipment Menu, which allows you to enter the model numbers and HP-IB address of the external test equipment. Refer to the description of the Test Equipment Menu.

Test Menu displays the Test Selection Menu, which allows you to select among the different testing modes of the program. Refer to the description of the Test Selection Menu.

When "Test Menu" is pressed, the program searches the HP-IB to verify a test instrument is at each address specified in the Test Equipment Menu. If there is not, the program defaults to the Test Equipment Menu and puts the addresses for which there are no instruments in parentheses. The program also puts the Test Equipment Menu cursor on the last address for which there is instrument. Refer to the description of the "No Address" key of the Test Equipment Menu.

HP-MSIB Map displays the HP-MSIB Map Screen. This screen lists all the modules of the HP 71000 Modular Spectrum Analyzer under test. Refer to the description of the HP-MSIB Map Screen.

Quit displays the Quit Screen. This screen asks if you want to quit the program and presents two function keys: "Yes" and "No". Pressing "Yes" stops the program and returns the computer to the BASIC language. Pressing "No" displays the Main Menu.



* Refer to separate flow chart for this menu.

** Test Menu can default to the Test Equipment Menu.
See description.

Figure 2. HP-MSIB Map Screen Flow Chart

HP-MSIB Map Screen

The HP-MSIB Map Screen lists the modules (with their HP-MSIB addresses) of the modular spectrum analyzer under test. The program uses this screen to identify the type of modular spectrum analyzer and therefore what tests are needed. If necessary, the HP-MSIB Map can display 19 pages (or screens) of modules and addresses. This is enough display room for all 255 addresses allowed on the HP-MSIB.

HP-MSIB Map Screen Function Keys

Previous Page (conditional) displays the previous page of the HP-MSIB Map. If the Map is at page one or if there is only one page, the program omits this function key.

Next Page (conditional) displays the next page of the HP-MSIB Map. If there is only one page or if the Map is at the last page, the program omits this key.

Select Inst. (conditional) selects the front end module that is tested by the program. Put the cursor (the => symbol) on the model number of the front end to be tested and press "Select Inst.". The program will indicate with an asterisk which front end module was selected.

Help puts the HP-MSIB Map in its Help Mode, which displays a description of the HP-MSIB Map and its function keys. The Help Mode presents a "Return" function key. When pressed, this key displays the HP-MSIB Map Screen.

Main Menu displays the Main Menu, which allows you to select any of the program menus, reprint test results, or restart the program. Refer to the description of the Main Menu.

Parameter Menu displays the Parameter Menu, which allows you to specify several different operating parameters of the program. Refer to the description of the Parameter Menu.

SYSTEM VERIFICATION

Equipment Menu displays the Test Equipment Menu, which allows you to enter the model numbers and HP-IB addresses of the external test equipment. Refer to the description of the Test Equipment Menu.

Test Menu displays the Test Selection Menu, which allows you to select among the different testing modes of the program. Refer to the description of the Test Selection Menu.

When "Test Menu" is pressed, the program searches the HP-IB to verify a test instrument is at each address specified in the Test Equipment Menu. If there is not, the program defaults to the Test Equipment Menu and puts the addresses for which there are no instruments in parentheses. The program also puts the Test Equipment Menu cursor on the last address for which there is instrument. Refer to the description of the "No Address" key of the Test Equipment Menu.

Quit displays the Quit Screen. This screen asks if you want to quit the program and presents two function keys: "Yes" and "No". Pressing "Yes" stops the program and returns to the BASIC language. Pressing "No" displays the HP-MSIB Map screen.

Additional HP-MSIB Map Screen Information

If the map screen displays the wrong modular spectrum analyzer, go to the Test Equipment menu and select the correct HP-IB address for the analyzer.

This screen has a cursor, the => symbol. The cursor can be used to scroll to the next page of the map if there is more than one page of modules. To move the cursor, rotate the knob on the computer or press the ↑ or ↓ keys. These keys move the cursor up or down one item. To move the cursor to the first or last module listed, simultaneously press the SHIFT key and the ↑ or ↓ key.

Parameter Menu

The Parameter Menu asks a set of questions that allow you to indicate the program parameters you want. These questions are listed below. Answer each question with the cursor (the => symbol) and the "Change" function key. You can move the cursor by rotating the knob on the computer or pressing the ↑ or ↓ keys. To move the cursor to the first or last item in the menu, simultaneously press the SHIFT key and the ↑ or ↓ key.

Save these parameters on disc? Choices: Yes or No

If these parameters are saved on disc, the program configures this menu with the saved parameters whenever it runs. This parameter (Save these parameters on disc?) is always reset to "No" when this menu is selected.

Update test equip. config. on disc? Choices: Yes or No

"Yes" saves the configuration of the Test Equipment Menu on disc when it is exited (providing changes were made). Once saved, the configuration is automatically used by the program each time the program runs.

Test results sent where? Choices: None, Screen, or Printer

Choosing "None" sends test results to the menu and limits them to indicators, such as "Passed" or "Adjust Inst". Choosing "Screen" sends test result data to the screen. Choosing "Printer" sends test result data to the printer.

Type of format for test results? Choices: Short Table, Table, or Graph.

Selecting "Short Table" gives test result data formatted in a tabular form. For the tests that have many data points, some test result data is eliminated to keep the table to a

SYSTEM VERIFICATION

reasonable length. However, the most critical values are included and the appropriate "Passed" or "Adjust Inst" indicator is displayed in the Test Selection Menu.

Selecting "Table" gives all the test result data formatted in a tabular form. The results of some tests will create tables several pages long.

Selecting "Graph" gives some data in tabular and some in graph form. The program decides which format to use for each test. (If the output is sent to a printer, a graphics printer is required.)

Copy output to disk for reprinting? Choices: "Yes" or "No"

Choosing "Yes" stores on disk all test results that are sent to the printer, provided the disk has room. The stored test results can be reprinted with the Reprint function of the Main Menu or Test Auxiliary Menu. The stored test results can be purged with the Purge Output function of the Test Auxiliary Menu. Test results are automatically purged when the Test Selection Menu is first entered after running the program. (The program assumes these results are from a previous instrument.)

Power mains line frequency? Choices: 50 Hz, 60 Hz, or 400 Hz

The program prints this frequency with those test results which are affected by the power line frequency.

Last equip. calibration (months)?

The operator can enter the number of months that have passed since the external test equipment was calibrated. (The program uses this number in some of its measurement uncertainty calculations.)

Test person's identification?

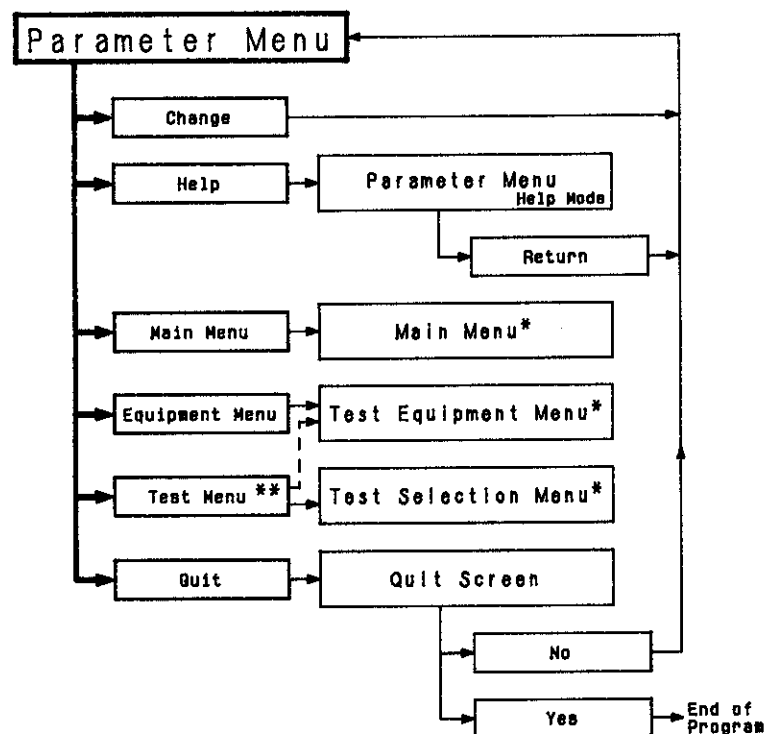
Put the cursor on this parameter and press "Change" to enter name or I.D. number. The entered identification is printed on the output report.

Number of lines of text to print?

This format allows you to have a message printed with your test results (only when the results are sent to a printer). For example, a message could contain the identification number of the tested system and the date of the test.

Press "Change" to enter the number of lines needed for the message (35 characters/line). Once you have entered the number of lines, you can move the cursor below this parameter question the specified number of lines. Each of these lines can be typed on to enter the message.

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* Refer to separate flow chart for this menu.

** Test Menu can default to the Test Equipment Menu.
See description.

Figure 3. Parameter Menu Flow Chart

Parameter Menu Function Keys

Change selects the next option or allows an appropriate entry for the parameter indicated by the cursor.

Help puts this Menu in its Help Mode. The Help Mode displays a description of the Parameter Menu and its function keys. This mode has a "Return" function key.

Main Menu displays the Main Menu, which allows you to select any of the program menus, reprint test results, or restart the program. Refer to the description of the Main Menu.

Equipment Menu displays the Test Equipment Menu, which allows you to enter the model numbers and addresses of the external test equipment. Refer to the description of the Test Equipment Menu.

Test Menu displays the Test Selection Menu, which allows you to select among the different testing modes of the program. Refer to the description of the Test Selection Menu.

When "Test Menu" is pressed, the program searches the HP-IB to verify a test instrument is at each address specified in the Test Equipment Menu. If there is not, the program defaults to the Test Equipment Menu and puts the addresses for which there are no instruments in parentheses. The program also puts the Test Equipment Menu cursor on the last address for which there is instrument. Refer to the description of the "No Address" key of the Test Equipment Menu.

Quit displays the Quit Screen. This screen asks if you want to quit the program, and it presents two function keys: "Yes" and "No". Pressing "Yes" stops the program and returns computer control to the BASIC language. Pressing "No" displays the Parameter Menu.

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Test Equipment Menu

This menu displays the types of external test equipment the program can use (refer to Table 1). It also allows you to assign a model number and HP-IB address or serial number for each type. (The program sets the HP-IB address of the Power Meter to "None" if there is no serial number entered for the power sensor.) The Parameter Menu determines if the configuration of this menu is stored on disk.

When this menu is exited, the program searches the HP-IB, verifying an instrument is at each specified address. If a specified address does not have an instrument, the program will return to this menu (refer to the description of the "No Address" key below).

NOTE

The HP-IB address and model numbers you select in this menu must match the actual addresses and model numbers of the equipment on the bus. If they do not, the program may not run.

NOTE

Many Modular Measurement System elements have HP-IB addresses (for example, the HP 70205A Graphics Display). All devices on the same HP-IB must have separate HP-IB addresses or the program can not run.

Test Equipment Menu Function Keys

Refer to Figure 4 (a fold out).

Change Model changes the model number of the test equipment indicated by the cursor. The model number automatically changes to the next selection. Refer to Table 1 for a listing of usable model numbers for each type of test equipment.

Change Address allows entry of HP-IB addresses for the test equipment listed in this menu, and for the Spectrum Analyzer under test. When this function key is pressed, the program asks you to enter the HP-IB address of the test equipment indicated by the cursor.

Change S/N allows entry of the serial number of the power sensor. When this key is pressed, the program asks you to enter the serial number. If the program does not have calibration data for that serial number on disc, it will automatically present a Power Sensor Screen when you select another menu. The Power Sensor Screen allows entry of the calibration factors for the power sensor.

View Cal Data works with the Power Sensor, Signal Sensor, or Ext. Mixer. test equipment categories. Putting the cursor on one of these categories and pressing "View Cal Data" displays a calibration-data entry screen (Power Sensor Screen, Signal Sensor Screen, or Ext. Mixer Screen). These screens allow you to view and either modify or enter calibration data. They have "Create" (conditional), "Edit" (conditional), and "Return" function keys.

If calibration data is already on disc for the model and serial number of the device selected with the cursor, the screen presents a table of this data and an "Edit" function key. Pressing "Edit" allows you to modify the data.

SYSTEM VERIFICATION

If calibration data is not on disc for the model and serial number of the device selected with the cursor, this screen presents the "Create" function key. Pressing "Create" allows you to enter the calibration factors of the device. You must enter all calibration factors before the "Return" function key will respond. Pressing "Return" displays the Test Equipment Menu.

Help puts this Menu in its Help Mode. The Help Mode displays a description of the Test Equipment Menu and its function keys. This mode has a "Return" function key. When pressed, this key displays the Test Equipment Menu.

Main Menu displays the Main Menu, which allows you to select any of the program menus, reprint test results, or restart the program. Refer to the description of the Main Menu.

Parameter Menu displays the Parameter Menu. This menu allows you to specify several different operating parameters of the program. Refer to the description of the Parameter Menu.

Test Menu displays the Test Selection Menu, which allows you to select among the different testing modes of the program. Refer to the description of the Test Selection Menu.

When "Test Menu" is pressed, the program searches the HP-IB to verify a test instrument is at each address specified in the Test Equipment Menu. If there is not, the program defaults to the Test Equipment Menu and puts the addresses for which there are no instruments in parentheses. The program also puts the Test Equipment Menu cursor on the last address for which there is instrument. Refer to the description of the "No Address" key of the Test Equipment Menu.

No Address (conditional) This key is presented only when the program can not find an instrument at each HP-IB

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addresses specified in this menu. Addresses that do not have corresponding instruments are set in parenthesis. The cursor is set on the last address for which there is no instrument. Pressing the "No Address" function key automatically changes these addresses to "None". You can also enter the correct addresses with the "Change Address" function key.

HP-MSIB Map (conditional) displays the HP-MSIB Map Screen. This screen lists all the modules of the Modular Spectrum Analyzer under test. This function key is presented whenever the "No Address" key is not presented. Refer to the description of the HP-MSIB Map Screen.

Quit displays the Quit Screen. This screen asks if you want to quit the program. It presents two function keys: "Yes" and "No". Pressing "Yes" stops the program and returns computer control to the BASIC language. Pressing "No" displays the Test Equipment menu (this menu).

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Additional Test Equipment Menu Information

This menu has a cursor, the => symbol, which indicates the test equipment the program acts on when the "Change Model", "Change Address", "Change S/N", or "View Cal Data" function key is pressed. To move the cursor, rotate the knob on the computer or press the ↑ or ↓ keys. To move the cursor to the first or last type, press the SHIFT key and the ↑ or ↓ key simultaneously.

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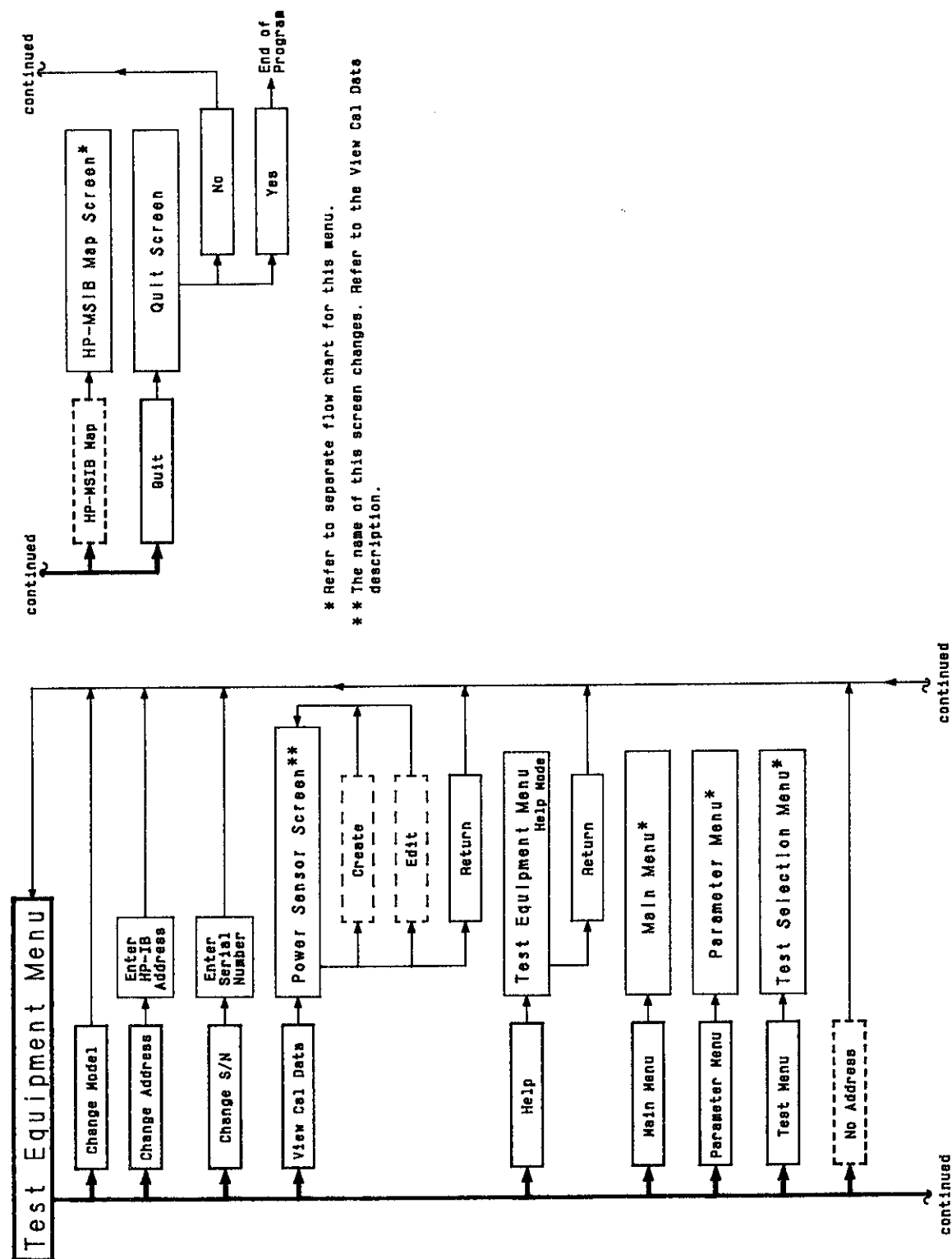


Figure 4. Test Equipment Menu Flow Chart

Test Selection Menu

The Test Selection Menu gives a list of available tests and provides access to the testing modes of the program. The list of available tests changes depending on which Modular Spectrum Analyzer the program finds on the HP-IB.

NOTE

The HP 70205A and 70206A Displays are NOT tested by this program. They are separate instruments of the HP 71000 Modular Measurement System.

Test Selection Menu Function Keys

Refer to Figure 5 (a fold out).

All Tests puts this menu in the All Tests mode, which sequentially runs all the tests listed in this menu.

This mode has two function keys: "End Testing" and "Abort Tests". When "End Testing" is pressed, the program completes the test in progress before returning to the Test Selection menu. When "Abort" is pressed, the program interrupts the test in progress and returns to the Test Selection menu. See Resume Testing.

Resume Testing (conditional) If the All Tests or Limited Cal mode has been quit using its "End Testing" or "Abort Tests" key, it can be resumed with the "Resume Testing" function key. The program presents this function key only when the All Tests or Limited Cal mode has been interrupted.

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Single Test puts this menu in its Single Test mode, which runs the test indicated by the cursor. The Single Test mode has an "Abort Test" function key, which when pressed interrupts the test in progress and returns the program to the Test Selection Menu.

Repeat Test puts this menu in its Repeat Test mode, which repeats the test indicated by the cursor. This mode gives an indicator next to the listing of the test being run. This indicator shows how many times the test was passed verses how many times it was run.

The test repeats until either the "End Testing" or "Abort Test" function key, which are provided by this mode, are pressed. The "End Testing" function key allows the test in progress to finish before returning the program to the Test Selection menu. The "Abort Test" key interrupts the current test and returns the program to the Test Selection menu.

Help puts this Menu in its Help Mode. This mode displays a description of the Test Selection Menu and its function keys. This mode has a function key called "Return". When pressed, this key displays the Test Selection Menu.

Limited Cal puts this menu in its Limited Cal mode, which tests only the most important specifications of the Spectrum Analyzer. Thus, it eliminates some tests and modifies others--shortening testing time and limiting the amount of required Test Equipment. The Test Descriptions section of this chapter indicates which test are run in Limited Cal.

The Limited Cal mode has an "End Testing" and "Abort Tests" function key. Pressing either key stops the Limited Cal test and returns the program to the Test Selection menu. The "End Testing" key allows the test in progress to finish before the program returns to the Test Selection Menu. The "Abort Tests" key interrupts the current test

SYSTEM VERIFICATION

PRGM ERROR

Program Error means the program has detected an error in itself. Contact the H- P Signal Analysis Division for assistance.

Setup Error

This message signifies the test was aborted because the program could not verify the external test equipment was properly connected.

Short Pass

Short Pass indicates the spectrum analyzer meets the tested specification; however, the program did not completely test the specification because either the external test equipment did not have sufficient range or the program was in the Limited Cal mode. (This mode shortens some tests.)

Timed Out

This message indicates the program aborted the test.

SYSTEM VERIFICATION

"Yes" and "No". Pressing "Yes" stops the program and returns computer control to the BASIC language. Pressing "No" displays the Test Selection menu.

Additional Test Selection Menu Information

If the External Test Equipment (ETE) required to do one of the tests is not present on the HP-IB bus, then the message "Missing ETE" appears on screen next to the test. The program will not run that test.

Once testing begins, the program asks you to make any necessary interconnections between the external test equipment and the spectrum analyzer. If the connections are not made correctly, the program asks you to try again. After the third try, it returns to this menu with the message "Setup Error" next to the appropriate test.

The cursor, a => symbol, indicates the test acted on when you press the "Single Test", "Repeat Test", "Multiple Tests", or "Repeat Mult" function key. To move the cursor, rotate the knob on the computer or press the ↑ or ↓ keys. To move the cursor to the first or last test, simultaneously press the SHIFT key and the ↑ or ↓ key.

This menu lists two pages of tests. The second page can be displayed by moving the cursor below the last test on page one.

When the program is first run, and it enters this menu for the first time, it erases the test results stored on disc. (The program assumes these results are from a previous spectrum analyzer.)

If you have purged the disc file of the power sensor calibration data, this menu automatically defaults to the Power Sensor Screen of the Test Equipment Menu. Once you re-enter the calibration data, the program will display this menu.

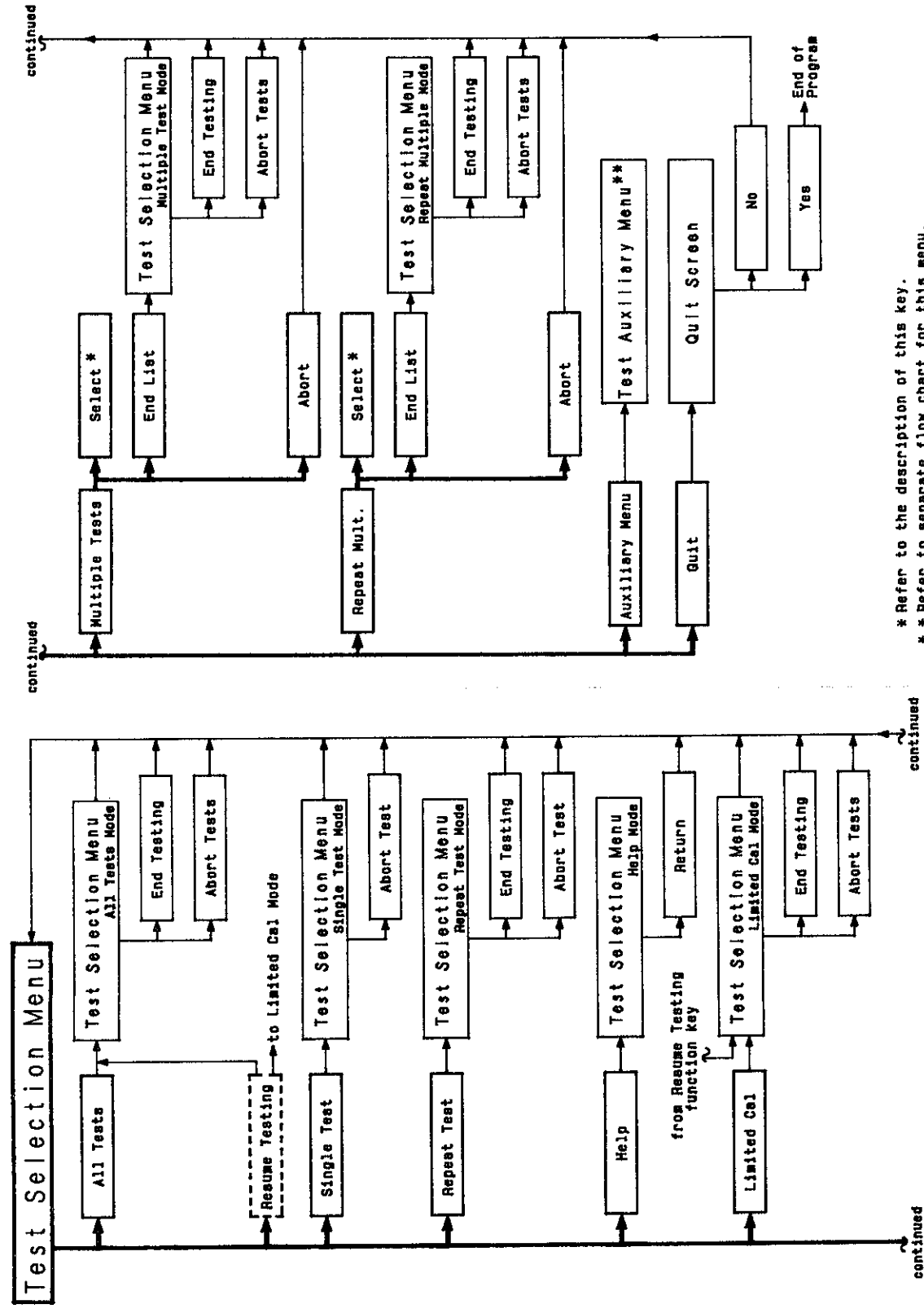
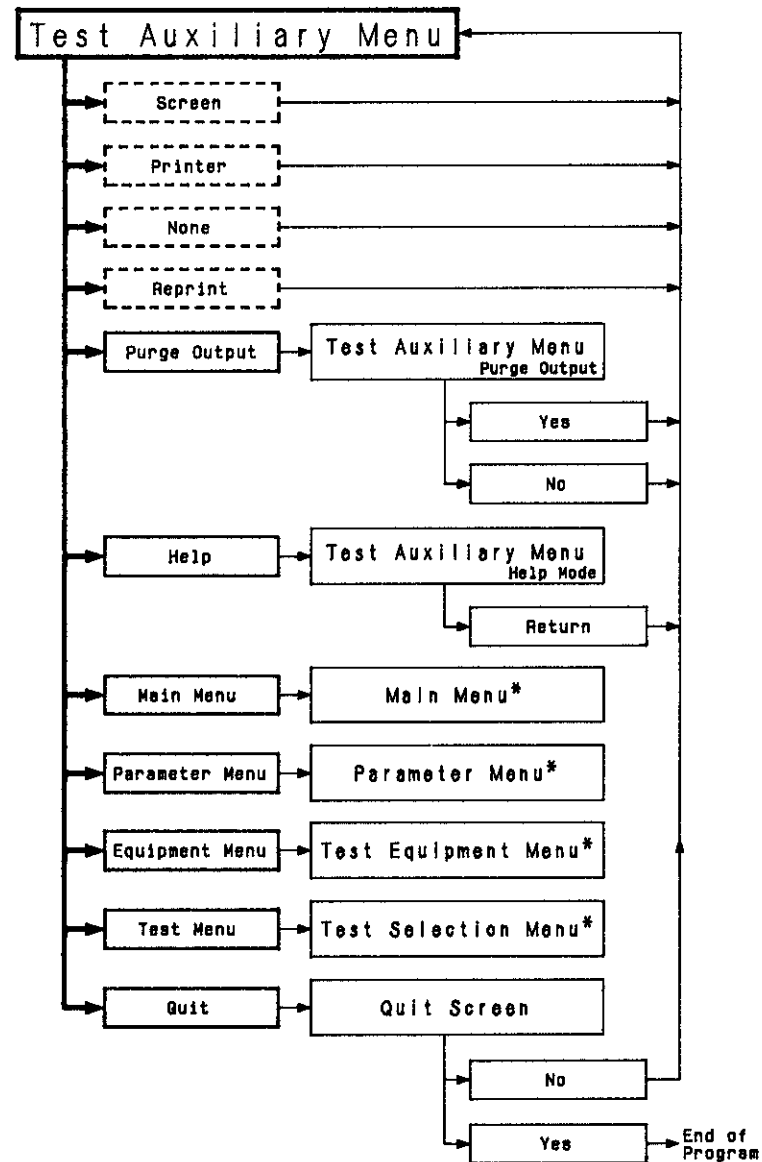


Figure 5. Test Selection Menu Flow Chart



* Refer to separate flow chart for this menu.

Figure 6. Test Auxiliary Menu Flow Chart

SYSTEM VERIFICATION

Test Auxiliary Menu

This menu is an auxiliary menu of the Test Selection Menu. It allows you to select how the program displays test results, to reprint test results, or purge test results from the disc. It also provides access to the other program menus (but not program screens) from the Test Selection menu.

Test Auxiliary Menu Function Keys

Screen (conditional) selects the computer screen as the output device for the test results. These results comprise test data formatted according to the "Test results sent where?" parameter of the Parameter Menu. This function key is displayed whenever "Screen" is not the selected output device.

Printer (conditional) selects the HP-IB printer as the output device for the test results. These results comprise test data formatted according to the "Type of format for test results?" parameter of the Parameter Menu. This function key is displayed whenever an HP-IB printer is not the selected output device.

None (conditional) This function key prevents the program from displaying test result data. Instead, the program displays indicators on the Test Selection menu, such as "Passed" and "Adjust Inst". This key is displayed when either the screen or an HP-IB printer was selected as the output device for test result data.

Reprint (conditional) prints the test results stored on disc. Refer to the description of the "Purge Output" function key. This function key is displayed whenever an HP-IB printer is being used with the program.

Purge Output causes the program to purge the disc file containing test results. This can be done if the disk is already full of test results from previous instruments. Refer to the description of the Reprint function key.

SYSTEM VERIFICATION

Help puts this menu in its Help Mode. This mode displays a description of the Test Auxiliary Menu and its function keys. It also has a "Return" function key. When pressed, this key displays the Test Auxiliary Menu.

Main Menu displays the Main Menu, which allows you to select any of the program menus, reprint test results, or restart the program. Refer to the description of the Main Menu.

Parameter Menu displays the Parameter Menu, which allows you to specify several different operating parameters of the program. Refer to the description of the Parameter Menu.

Equipment Menu displays the Test Equipment Menu, which allows you to enter the model numbers and HP-IB addresses or serial numbers of the external test equipment. Refer to the description of the Test Equipment Menu.

Test Menu displays the Test Selection Menu, which allows you to select among the different testing modes of the program. Refer to the description of the Test Selection Menu.

Quit displays the Quit Screen. This screen asks if you want to quit the program and presents two function keys: "Yes" and "No". Pressing "Yes" stops the program and returns computer control to the BASIC language. Pressing "No" displays the Test Auxiliary menu (this menu).

MESSAGES AND CODES

Listed below are the messages and codes produced by System Verification to indicate the status or result of a test. Following the messages and codes is a list of the function key names--including the abbreviated names used with the HP 9826 Computer.

<<<<

This symbol next to a test result denotes that even though the measurement uncertainties were added to the specification, the test result is still outside the specification.

<***>

This code next to a test result denotes the indicated test result far exceeded the expected value. This probably indicates test equipment, accessories, or spectrum analyzer failure.

Aborted

This message means the operator aborted the test.

Adjust Inst

Adjust Instrument indicates the spectrum analyzer must be adjusted to meet the tested specification.

Hdw Broken

Hardware Broken means the test results far exceed the expected values, indicating possible test equipment, accessory, or spectrum analyzer failure.

Passed

This message indicates the spectrum analyzer meets the tested specification.

SYSTEM VERIFICATION

PRGM ERROR

Program Error means the program has detected an error in itself. Contact the H- P Signal Analysis Division for assistance.

Setup Error

This message signifies the test was aborted because the program could not verify the external test equipment was properly connected.

Short Pass

Short Pass indicates the spectrum analyzer meets the tested specification; however, the program did not completely test the specification because either the external test equipment did not have sufficient range or the program was in the Limited Cal mode. (This mode shortens some tests.)

Timed Out

This message indicates the program aborted the test.

FUNCTION KEY NAMES

The function key names are listed below by menu. The full function key names, used by the HP 9816 and HP 9836 Computers, are listed in the left column. The abbreviated function key names, used by the HP 9826 Computer, are listed in the right column. An asterisk next to a function key name indicates that key is "optional": it appears only when the operator needs it.

Main Menu

All Tests		All Test
Limited Cal		Lim. Cal
Reprint	*	Reprint
Restart		Restart
Help		Help
Parameter Menu		Parm Mnu
Equipment Menu		ETE Menu
Test Menu		Test Mnu
HP-MSIB Map		Map
Quit		Quit

Map Screen

Previous Page	*	Previous
Next Page	*	Next
Help		Help
Main Menu		Main Mnu
Parameter Menu		Parm Mnu
Equipment Menu		ETE Menu
Test Menu		Test Mnu
Quit		Quit

SYSTEM VERIFICATION

Parameter Menu

Change
Help

Main Menu
Equipment Menu
Test Menu
Quit

Change
Help

Main Mnu
ETE Menu
Test Mnu
Quit

Test Equipment Menu

Change Model
Change Address
Change S/N
View Cal. Data
Help

Main Menu
Parameter Menu
Test Menu
No Address *

HP-MSIB Map *

Quit

Model #
Address
S/N
View Cal
Help

Main Mnu
Parm Mnu
Test Mnu
No Addr.
Map
Quit

Test Selection Menu

All Tests
Resume Testing *
Single Test
Repeat Test
Help

All Test
Resume
Single
Repeat
Help

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Limited Cal
Multiple Tests
Repeat Mult.
Auxiliary Menu
Quit

Lim. Cal
Multiple
Repeat M
Aux Menu
Quit

Test Auxiliary Menu

Screen *
Printer *
None *
Reprint
Purge Output
Help

Screen
Printer
None
Reprint
Purge
Help

Main Menu
Parameter Menu
Equipment Menu
Test Menu
Quit

Main Mnu
Parm Mnu
ETE Menu
Test Mnu
Quit

SPECIFICATIONS

The following specifications apply to the three Modular Spectrum Analyzer systems: HP 71100A, Radio Frequency Spectrum Analyzer; HP 71200A, Microwave Spectrum Analyzer; HP 71300A, Millimeter Spectrum Analyzer. Specifications for other configurations of the Modular Measurement System are not included in this section.

Where specifications are subject to minimization with error correction routines, corrected limits are given unless noted.

Specifications describe the warranted performance over the temperature range 0° to 55°C (except where noted) after one hour continuous operation.

Characteristics provide useful information by giving functional, but non-warranted, performance parameters.

SYSTEM VERIFICATION

FREQUENCY

Parameter	HP 71100A	HP 71200A	HP 71300A
FREQUENCY RANGE	100 Hz-2.9 GHz (dc coupled) 100 kHz-2.9 GHz (ac coupled) Tunable in <1 Hz increments	50 kHz-22 GHz 50 kHz-26.5 GHz (Opt. 001) Tunable in <1 Hz increments Band* 1H - 50 kHz-2.9 GHz 1L - 2.7 GHz-6.2 GHz 2L - 6.0 GHz-12.7 GHz 3L + 12.5 GHz-19.9 GHz 4L + 19.7 GHz-22 GHz 4L + 19.7 GHz-26.5 GHz** *H = 3.6214 GHz IF L = 321.4 MHz IF **(Opt. 001)	18-60 GHz with HP 11970 external harmonic mixers. 2.7-325 GHz with mixers available from other manufacturers. Tunable in <1 Hz increments
FREQUENCY READOUT ACCURACY Span ≤10 MHz x N* Span >10 MHz x N *N = harmonic mixing band number	± ((Frequency Readout x Frequency Reference Accuracy) + 1% of span + 10 Hz) ± ((Frequency Readout x Frequency Reference Accuracy) + 2% of span + 10 Hz)		
FREQUENCY REFERENCE ACCURACY Aging Temperature Drift	<3 x 10 ⁻⁶ /year <1 x 10 ⁻⁵ over 0°-55°C		

FREQUENCY

Parameter	HP 71100A	HP 71200A	HP 71300A
FREQUENCY SPAN Range	0-2.9 GHz in 0.5% increments	0-22 GHz 0-26.5 GHz (Opt. 001) in 0.5% increments	0 Hz to full band of external mixer or 3.6 GHz x N in 0.5% increments
Accuracy Span ≤ 10 MHz x N Span > 10 MHz x N	$\pm (1\% \text{ of span} + (\text{span} \times \text{Frequency Reference Accuracy}))$ $\pm (2\% \text{ of span})$		
FREQUENCY DRIFT	For spans > 10 MHz x N, frequency drift during one sweep is ± 1 kHz per sec. and ± 150 kHz per °C. Errors resulting from drift are not cumulative from sweep to sweep.		
RESOLUTION BANDWIDTHS (-3 dB) Range	10 Hz-300 kHz 10 Hz-3 MHz (Opt. 004) 100 kHz-3 MHz (Opt. 005) Adjustable in 1, 3, 10 sequence and 10% increments (except from 3 kHz-10 kHz) $\pm 20\%$ $< 12:1$ $< 16:1$		
Accuracy Selectivity (-60 dB/-3 dB) 10 Hz-3 kHz bandwidths 10 kHz-3 MHz bandwidths Shape	Synchronously-tuned, 5 poles (10 Hz-3 kHz), 4 poles (10 kHz-3 MHz) Approximately Gaussian shape		

SYSTEM VERIFICATION

FREQUENCY

Parameter	HP 71100A	HP 71200A	HP 71300A
VIDEO BANDWIDTH Range	3 Hz-300 kHz in 1, 3, 10 increments 3 Hz-3 MHz (Opt. 004) 300 Hz-3 MHz (Opt. 005) (When set to 300 kHz (Standard) or 3 MHz (Option 004), the filter is off and has an effective value of >300 kHz (Standard) or >3 MHz (Option 004)) ± 20%		
Accuracy (characteristic)			
RESIDUAL FM Span >10 MHz x N Span ≤10 MHz x N	<25 kHz x N p-p in .1 sec. (measurement BW = 100 kHz) In synthesized spans, residual FM is determined by noise sidebands. See noise sideband specifications for values.		
SPECTRAL PURITY Noise Sidebands (dBc/Hz) Offset	100 Hz- 2.9 GHz -69 -85 -90 -97 -108 -118 -128	Band 50 kHz- 2.7- 6.0- 12.5- 19.7- 2.9 GHz 6.2 12.7 19.9 22/26.5 -69 -70 -64 -60 -58 -85 -85 -79 -75 -73 -90 -90 -84 -80 -78 -97 -97 -91 -87 -85 -108 -110 -104 -100 -98 -118 -120 -114 -110 -105 -127 -129 -123 -118 -113	HP 11970 Band (GHz)(Char.) 18- 26.5- 33- 40- 26.5 40 50 60 -54 -52 -50 -50 -69 -67 -65 -65 -74 -72 -70 -70 -81 -79 -77 -77 -94 -92 -90 -90 -104 -102 -100 -100 -113 -111 -109 -109

FREQUENCY

Parameter	HP 71100A	HP 71200A	HP 71300A
SPECTRAL PURITY (Cont'd)			
Line- and System-related sidebands (dBc)			
Offset Frequency			
N x 50, 60, 400 Hz			
40 kHz	100 Hz- 2.9 GHz -65	50 kHz- 2.9 GHz -65	HP 11970 Band (GHz)(char.) 18- 26.5
80 kHz	-65	Band 2.7- 6.0- 12.5- 6.2 12.7 19.9	33- 40
24 kHz	-65	-66 -62 -59	50 -50
Synthesis-related sidebands (dBc)			
	100 Hz- 2.9 GHz -65	-65 -59 -55 -65 -59 -55 -67 -63 -59	-47 -45 -45 -49 -52 -50
		19.7- 22/26.5	33- 40
		19.7- 22/26.5	40- 60
		-53	-45

SYSTEM VERIFICATION

AMPLITUDE

Parameter	HP 71100A	HP 71200A	HP 71300A	
TOTAL AMPLITUDE RANGE	- 135 to + 30 dBm	Band (GHz) 10MHz-2.9 GHz 2.7-6.2 6.0-12.7 12.5-19.9 19.7-22.9 19.7-26.5* *(Opt. 001)	(dBm) - 130 to + 30 - 133 to + 30 - 126 to + 30 - 121 to + 30 - 118 to + 30 - 118 to + 30	11970 Band (dBm) - 130 to - 3 - 128 to - 5 - 124 to - 7 - 124 to - 7
MAXIMUM SAFE INPUT POWER AC average continuous power	+ 30 dBm	+ 15 dBm (0 dB attn.) + 25 dBm (10 dB attn.) + 30 dBm (>10 dB attn.)	+ 20 dBm with HP 11970 mixers	
Pulse Power	100 watts, 10 μ sec pulse ($\geq$ 20 dB attenuation)	100 watts, 10 μ sec pulse ($\geq$ 40 dB attenuation)	250 mW peak pulse power with <1 μ sec pulse (+ 20 dBm average power) with HP 11970 mixers	
DC	0 volts (dc coupled) $\pm$ 25 volts (ac coupled)	0 volts	N/A	

AMPLITUDE

Parameter	HP 71100A	HP 71200A	HP 71300A																																																								
GAIN COMPRESSION LEVEL	< -0.5 dB for signal levels $\leq$ -10 dBm at input mixer																																																										
	(Gain compression of system at 321.4 MHz input is < 5 dB for signal levels $\leq$ -35 dBm.)																																																										
DISPLAYED AVERAGE NOISE LEVEL	<table><tr><th>Band</th><th>Displayed Average Noise Level (dBm)</th></tr><tr><td>100 Hz-1 kHz</td><td>< -69</td></tr><tr><td>1 kHz-10 kHz</td><td>< -85</td></tr><tr><td>10 kHz-30 kHz</td><td>< -90</td></tr><tr><td>30 kHz-100 kHz</td><td>< -99</td></tr><tr><td>100 kHz-300 kHz</td><td>< -108</td></tr><tr><td>300 kHz-1 MHz</td><td>< -118</td></tr><tr><td>1 MHz-3 MHz</td><td>< -128</td></tr><tr><td>3 MHz-10 MHz</td><td>< -131</td></tr><tr><td>10 MHz-20 GHz</td><td>< -135</td></tr><tr><td>20 GHz-2.9 GHz</td><td>< -132</td></tr></table>	Band	Displayed Average Noise Level (dBm)	100 Hz-1 kHz	< -69	1 kHz-10 kHz	< -85	10 kHz-30 kHz	< -90	30 kHz-100 kHz	< -99	100 kHz-300 kHz	< -108	300 kHz-1 MHz	< -118	1 MHz-3 MHz	< -128	3 MHz-10 MHz	< -131	10 MHz-20 GHz	< -135	20 GHz-2.9 GHz	< -132	<table><tr><th>Band</th><th>Displayed Average Noise Level (dBm)</th></tr><tr><td>50 kHz-100 kHz</td><td>< -89</td></tr><tr><td>100 kHz-300 kHz</td><td>< -98</td></tr><tr><td>300 kHz-1 MHz</td><td>< -108</td></tr><tr><td>1 MHz-3 MHz</td><td>< -118</td></tr><tr><td>3 MHz-10 MHz</td><td>< -121</td></tr><tr><td>10 MHz-2.9 GHz</td><td>< -130</td></tr><tr><td>2.7 GHz-6.2 GHz</td><td>< -133</td></tr><tr><td>6.0 GHz-12.7 GHz</td><td>< -126</td></tr><tr><td>12.5 GHz-19.9 GHz</td><td>< -121</td></tr><tr><td>19.7 GHz-22 GHz</td><td>< -118</td></tr><tr><td>19.7 GHz-26.5 GHz*</td><td>< -118</td></tr></table> *(Opt.001)	Band	Displayed Average Noise Level (dBm)	50 kHz-100 kHz	< -89	100 kHz-300 kHz	< -98	300 kHz-1 MHz	< -108	1 MHz-3 MHz	< -118	3 MHz-10 MHz	< -121	10 MHz-2.9 GHz	< -130	2.7 GHz-6.2 GHz	< -133	6.0 GHz-12.7 GHz	< -126	12.5 GHz-19.9 GHz	< -121	19.7 GHz-22 GHz	< -118	19.7 GHz-26.5 GHz*	< -118	<table><tr><th>11970 Band (GHz)</th><th>Displayed Avg Noise Level (dBm)</th></tr><tr><td>18-26.5</td><td>< -130</td></tr><tr><td>26.5-40</td><td>< -128</td></tr><tr><td>33-50</td><td>< -124</td></tr><tr><td>40-60</td><td>< -124</td></tr></table>	11970 Band (GHz)	Displayed Avg Noise Level (dBm)	18-26.5	< -130	26.5-40	< -128	33-50	< -124	40-60	< -124
Band	Displayed Average Noise Level (dBm)																																																										
100 Hz-1 kHz	< -69																																																										
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10 Hz Res BW, 0 dB attenuation, HP 70902 IF																																																											

SYSTEM VERIFICATION

AMPLITUDE

Parameter	HP 71100A	HP 71200A	HP 71300A
DISPLAYED AVERAGE NOISE LEVEL (Cont'd) 100 kHz Res BW, 0 dB attenuation, HP 70903 IF	For frequencies > 3 MHz, displayed average noise level is 40 dB higher than the values with the HP 70902A IF.		
DISPLAY RANGE Scale Calibration Log Linear Reference Level Range Log Linear (50 ohm system)	10 division CRT .01-20 dB/div in increments of .5% 10% of reference level per division + 30 dBm to - 140 dBm 7.07 volts to 22 nanovolts		
SPURIOUS RESPONSES For mixer levels ≤ -40 dBm All spurious responses, except as listed below, are less than these values (10 dB attn.) Second Harmonic Distortion for input at mixer ≤ -40 dBm (10 dB attn.)	Input 100 Hz-10 MHz 10 MHz-2.9 GHz	Spurious < -60 dBc < -70 dBc	Spurious < -60 dBc < -70 dBc < -70 dBc (Opt. 001)
	Band 100 Hz-10 MHz 10 MHz-2.9 GHz	Second Harmonic < -60 dBc < -70 dBc	Second Harmonic < -60 dBc < -70 dBc < -60 dBc < -55 dBc < -50 dBc

AMPLITUDE

Parameter	HP 71100A			HP 71200A			71300A
SPURIOUS RESPONSES (Cont'd) Third Order Intermodulation Distortion with HP 70903A IF Section. For two signals, each ≤ -25 dBm at mixer (10 dB attn.) with HP 70902A IF Section. For two signals, each ≤ -30 dBm at mixer (10 dB attn.)	Center Frequency 100 Hz-10 MHz 10 MHz-2.9 GHz	Intermod. Products ≤ -56 dBc ≤ -60 dBc	Equiv. TOI + 3 dBm + 5 dBm	Center Frequency 50 kHz-10 MHz 10 MHz-6.2 GHz 6.0-22 GHz 6.0-26.5 GHz* (Opt. 001)	Intermod. Products ≤ -56 dBc ≤ -64 dBm ≤ -66 dBc ≤ -66 dBc	Equiv. TOI + 3 dBm + 7 dBm + 8 dBm + 8 dBm	Depends on external mixer used (TOI of system at 321.4 Input = -10 dBm)
	Center Frequency 100 Hz-10 MHz 10 MHz-2.9 GHz	Intermod. Products ≤ -66 dBc ≤ -70 dBc	Equiv. TOI + 3 dBm + 5 dBm	Center Frequency 50 kHz-10 MHz 10 MHz-6.2 GHz 6.0-22 GHz 2.7-26.5 GHz* (Opt. 001)	Intermod. Products ≤ -66 dBc ≤ -74 dBm ≤ -76 dBc ≤ -76 dBc	Equiv. TOI + 3 dBm + 7 dBm + 8 dBm + 8 dBm	Depends on external mixer used (TOI of system at 321.4 input = -10 dBm)
	Signals displayed at 6 MHz, 42.8 MHz, and 642.8 MHz below the applied signal frequency are ≤ -90 dBc.			Signals displayed at 6 MHz, 42.8 MHz, and 642.8 MHz (1H - band only) from the applied signal frequency are ≤ -85 dBc.			Signals displayed 6 MHz and 42.8 MHz from the applied signal frequency are ≤ -80 dBc.
Out-of-Range Responses (≥ 10 dB input attenuation)	Input (GHz) 4-12 12-18	Response ≤ -90 dBc ≤ -40 dBc	N/A				

SYSTEM VERIFICATION

AMPLITUDE

Parameter	HP 71100A	HP 71200A	HP 71300A
RESIDUAL RESPONSES (0 dB input attenuation with input terminated)	Range 10 MHz-2.9 GHz Response (dBm) < -100	Range 10 MHz-6.2 GHz 6.0 GHz-12.7 GHz 12.5 GHz-19.9 GHz 19.7 GHz-22 GHz 19.7 GHz-26.5 GHz* Response (dBm) < -100 < -92 < -88 < -83 < -83 *(Opt. 001)	11970 Band 18-26.5 GHz 26.5-40 GHz 33-50 GHz 40-60 GHz Response (dBm) < -97 < -95 < -91 < -91

AMPLITUDE ACCURACY

Parameter	HP 71100A	HP 71200A	HP 71300A
FREQUENCY RESPONSE (10 dB input attenuation)	Band 100 Hz-2.5 GHz 100 Hz-2.9 GHz	Band 400 kHz-2.9 GHz 50 kHz-2.9 GHz 2.7 GHz-6.2 GHz 6.0 GHz-12.7 GHz 12.5 GHz-19.9 GHz 19.7 GHz-22 GHz 19.7 GHz-26.5 GHz* *(Opt. 001)	11970 Band 18-26.5 GHz 26.5-40 GHz 33-50 GHz 40-60 GHz
	± 1 dB ± 1.5 dB	± 1 dB ± 2.3 dB ± 1 dB ± 1.5 dB ± 2 dB ± 2.5 dB ± 2.5 dB	± 1.9 dB ± 1.9 dB ± 1.9 dB ± 1.9 dB
Frequency Response referenced to 300 MHz, - 10 dBm calibrator (10 dB input attenuation)	Band 100 Hz-2.5 GHz 100 Hz-2.9 GHz	Band 50 kHz-2.9 GHz 400 kHz-2.9 GHz 400 kHz-6.2 GHz 400 kHz-12.7 GHz 400 kHz-19.9 GHz 400 kHz-22 GHz 400 kHz-26.5 GHz* *(Opt. 001)	N/A
CALIBRATOR UNCER- TAINTY	± 0.3 dB (-10 dBm, 300 MHz)		
AMPLITUDE TEMPERA- TURE DRIFT (Characteristic)	For - 10 dBm reference level (- 35 dBm for HP 71300A), 10 dB input attenuation 100 Hz resolution bandwidth (HP 70902A IF) or 300 kHz resolution bandwidth (HP 70903A IF), drift is $\pm .05$ dB/°C (accumulated error eliminated by recalibration)		
	Internal, $\pm .4$ dB at - 35 dBm and 321.4 MHz		

SYSTEM VERIFICATION

AMPLITUDE ACCURACY

Parameter	HP 71100A	HP 71200A	HP 71300A												
RESOLUTION BANDWIDTH SWITCHING UNCERTAINTY (Reference Bandwidth = 100 Hz in HP 70902, 300 kHz in HP 70903)	± 0.1 dB corrected (1, 3, 10 Bandwidths) ± 3 dB uncorrected														
LOG SCALE SWITCHING UNCERTAINTY	± 0.3 dB														
IF GAIN UNCERTAINTY	<table><tr><td>Gain</td><td></td></tr><tr><td>10 dB</td><td>± 0.1 dB</td></tr><tr><td>20 dB</td><td>± 0.1 dB</td></tr><tr><td>30 dB</td><td>± 0.2 dB</td></tr><tr><td>40 dB</td><td>± 0.2 dB</td></tr><tr><td>50 dB</td><td>± 0.3 dB</td></tr></table>			Gain		10 dB	± 0.1 dB	20 dB	± 0.1 dB	30 dB	± 0.2 dB	40 dB	± 0.2 dB	50 dB	± 0.3 dB
Gain															
10 dB	± 0.1 dB														
20 dB	± 0.1 dB														
30 dB	± 0.2 dB														
40 dB	± 0.2 dB														
50 dB	± 0.3 dB														
INPUT ATTENUATOR SWITCHING UNCERTAINTY (Reference position is 10 dB at calibration frequency)	± 0.2 dB		± 0.1 dB												
INPUT COUPLING SWITCHING UNCERTAINTY	± .1 dB (500 kHz-2.9 GHz)	N/A													

AMPLITUDE ACCURACY

Parameter	HP 71100A	HP 71200A	HP 71300A
SCALE FIDELITY Log HP 70902A IF (Standard) Bandwidths (corrected) ≥ 30 Hz and ≤ 100 kHz < 30 Hz > 100 kHz All Bandwidths (uncorrected)			
		Display (dB)	Display (dB)
		0 to 90	$\pm .5$
		10 to 90	$\pm .5$
		0 to 90	$\pm .8$
All Bandwidths (uncorrected) Incremental Accuracy (corrected)		0 to 90	$\pm .7$
		0 to 90	± 3
		$\pm .1$ dB/dB	
		Display (dB)	Display (dB)
		0 to 75	$\pm .5$
HP 70903A IF (Opt. 004) Bandwidths (corrected) ≤ 1 MHz > 1 MHz All Bandwidths (uncorrected)		0 to 80	$\pm .5$
		0 to 80	$\pm .7$
		0 to 80	± 3
		$\pm .1$ dB/dB	
		0 to 75	± 3
Incremental Accuracy (corrected) Linear		$\pm 7.5\%$ of reference level	
		± 0.1 dB	
DIGITIZING UNCERTAINTY			

SYSTEM VERIFICATION

SWEEP

Parameter	HP 71100A	HP 71200A	HP 71300A
SWEEP TIME Range	50 msec to 1000 sec in 500 μ sec increments Sweep times as low as 187 μ sec are available when traces with less than 801 points are defined $\pm 2\%$		
Accuracy			
TRIGGER	Free Run, Line, Video, and External		

INPUTS AND OUTPUTS

HP 71100A RF Spectrum Analyzer

HP 71200A Microwave Spectrum Analyzer

HP 70904A RF SECTION

HP 70905A RF SECTION

FRONT PANEL INPUTS

FRONT PANEL INPUTS

RF Input (100 Hz-2.9 GHz)

RF Input (50 kHz-22 GHz)

Type N, female connector
50 ohm impedance (characteristic)
VSWR < 1.3 (10 dB attn.) (char.)
VSWR < 2.9 (0 dB attn.) (char.)
LO emission < -100 dBm (10 dB attn.)
Maximum safe input power
AC: + 30 dBm (continuous)
100 watt, 10 μ sec pulse (attn.)
DC: 0 volts (dc coupled)
 $\pm$ 25 volts (ac coupled)

Type N _f female connector	
50 ohm impedance (characteristic)	
LO emission < -10 dBm (10 dB attn.)	
Frequency (GHz)	VSWR (attn.) (chara.)
	0-12.7
	12.7-18
	18-22

FRONT PANEL OUTPUTS

Probe Power

± 15 volts, - 12 volts and ground connections
150 mA maximum

REAR PANEL OUTPUTS

First LO Auxiliary Output

SMA, female connector
50-ohm impedance (characteristic)
3-6.6 GHz
+ 1.5 to + 12 dBm

REAR PANEL OUTPUTS

First LO Auxiliary Output

Secondary Output
SMA, female connector
50 ohm impedance (characteristic)
3-6.6 GHz
+1.5 to +12 dBm

70906A RF SECTION

RF Input (50 kHz-26.5 GHz)

3-0.0 GHz
+1.5 to +1.7 dBm

± 3.4 volts maximum voltage protection

INPUTS AND OUTPUTS

Common to HP 71100A, 71200A, and 71300A systems

70907A (Cont'd)

REAR PANEL OUTPUTS

First LO Auxiliary Output

SMA, female connector
50 ohm impedance (characteristic)
3-6.6 GHz
+ 6 to + 14 dBm

321.4 MHz IF Output

SMB, male connector
50 ohm impedance (characteristic)
50 MHz bandwidth
Output level tracks 21.4 MHz IF with - 18 dB $\pm$ 5 dB offset

70902A IF SECTION

FRONT PANEL OUTPUTS

Auxiliary Video Output

BNC, female connector
1K-ohm impedance (characteristic)
0-1 volt into open circuit

3 MHz IF Output

BNC, female connector
50 ohm impedance (characteristic)
Output is nominally - 15 dBm with - 10 dBm at RF input, 0 dB attn. and - 10 dBm reference level
Output linearly related to RF input, bandwidth controlled by resolution bandwidth setting

REAR PANEL OUTPUTS

21.4 MHz Auxiliary Output

SMB, male connector
50 ohm impedance (characteristic)
Output is nominally - 15 dBm with - 10 dBm at RF input, 0 dB attn. and - 10 dBm reference level
Bandwidth approximately 10 MHz

INPUTS AND OUTPUTS**Option 004****HP 70902A (Cont'd)****3 MHz Limited IF Out**

SMB, male connector
1 volt peak-to-peak $\pm 0.5V$
Triangle wave for use with frequency counter

HP 70903A IF SECTION**FRONT PANEL OUTPUTS****Auxiliary Video Output**

BNC, female connector
100-ohm impedance (characteristic)
0–1 volt into open circuit

21.4 MHz IF Output

BNC, female connector
50 ohm impedance (characteristic)
Output is nominally $-15 \text{ dBm} \pm 1 \text{ dB}$ (with -10 dBm at RF input, 0 dB attn. and -10 dBm reference level)
Output linearly related to RF input, bandwidth controlled by resolution bandwidth setting

REAR PANEL OUTPUTS**21.4 MHz Log IF Output**

SMB, male connector
21.4 MHz logarithmically related to RF input

INPUTS AND OUTPUTS

Common to HP 71100A, 71200A and 71300A systems

HP 70900A LO SECTION

FRONT PANEL OUTPUTS

300 MHz Calibrator Output

BNC, female connector
 50 ohm impedance (characteristic)
 - 10 dBm $\pm$ 0.3 dBm
 Frequency accuracy = (300 MHz $\times$ frequency reference accuracy)

REAR PANEL INPUTS

External Frequency Reference

SMB, male connector
 100 MHz
 - 3 to + 3 dBm power required
 50 ohm impedance (characteristic)
 Phase noise required to meet system specifications:

Offset	Phase Noise (dBc/Hz)
10 Hz	< -75
100 Hz	< -105
1 kHz	< -135
$\geq$ 10 kHz	< -145

Spurious required less than phase noise or < -115 dBc, whichever is greater

REAR PANEL OUTPUTS

Sweep Output

SMB, male connector
 0-10 volts
 Accuracy = $\pm$ 2%

Tune + Span Output

SMB, male connector
 4.5 to 9.9 volts (1.5V/GHz)

HSWP Output/Input

SMB, male connector
 TTL open collector
 Maximum sink current = 16 mA
 Maximum delay from HSWP to start of sweep = 40 μ sec

INPUTS AND OUTPUTS

Common to HP 71100A, 71200A, and 71300A systems Option 002

HP 70205A GRAPHICS DISPLAY

REAR PANEL OUTPUTS

Composite Video

BNC, female connector
Horizontal frequency = 24 kHz $\pm$ 1%
Signal level into 75 ohm load = 1V p-p $\pm$ 10%
60 Hz $\pm$ 1% refresh rate
25 MHz bandwidth

HP 70206A SYSTEM GRAPHICS DISPLAY

REAR PANEL OUTPUTS

Composite Video

BNC, female connector
Horizontal frequency = 24 kHz $\pm$ 1%
Signal level into 75 ohm load = 1V p-p $\pm$ 10%
60 Hz $\pm$ 1% refresh rate
25 MHz bandwidth

GENERAL

ENVIRONMENTAL

Temperature

Operation 0°C to +55°C
Storage -40°C to +75°C

Humidity

Operation 0 to 95% relative humidity at 40°C

EMI

Radiated interference is within the requirements of MIL-STD 461B, Class A1c, RE02

POWER REQUIREMENTS

HP 70001A Mainframe

100, 120, 220, and 240 VAC (+5%, -10%)

47-66 Hz (400 Hz operation is available as a special option. Contact your sales representative.)

650 VA maximum

Modules

All module power requirements are supplied by the mainframe

HP 70206A System Graphics Display

100, 120, 220, and 240 VAC (+5%, -10%)

47-66 Hz

47-66 Hz and 356-444 Hz with Option 400 (100, 120 VAC only)

300 VA maximum

WEIGHT (characteristic)

Systems

HP 71100A RF Analyzer
HP 71200A MW Analyzer
HP 71300A MM Analyzer

Net Wt.

30.9 kg (68.1 lb)
30.6 kg (67.5 lb)
30.5 kg (67.2 lb)

System Components

HP 70001A Mainframe
HP 70205A Graphics Display
HP 70206A System Graphics Display

14.5 kg (31.9 lb)
5.1 kg (11.2 lb)
18.6 kg (41 lb)

Modules

HP 70900A Local Oscillator
HP 70902A IF Section
HP 70903A IF Section
HP 70904A RF Section
HP 70905A RF Section
HP 70906A RF Section
HP 70907A External Mixer Interface
HP 70300A Tracking Generator

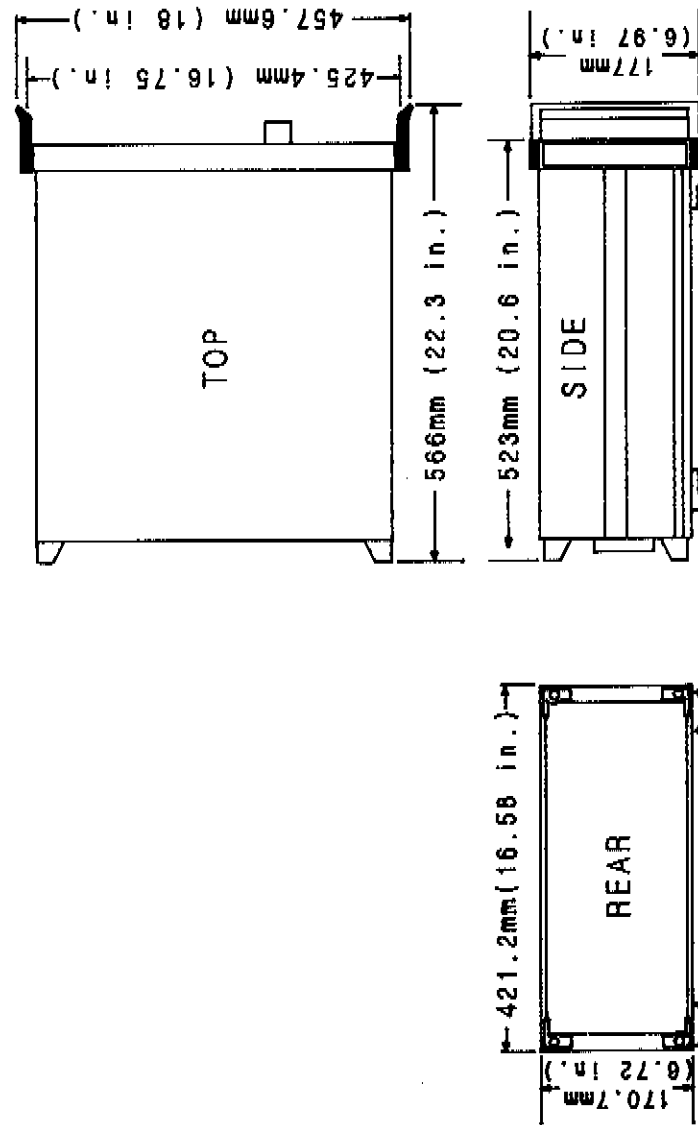
5.7 kg (12.6 lb)
2.4 kg (5.3 lb)
2.3 kg (5.1 lb)
3.2 kg (7.1 lb)
2.9 kg (6.4 lb)
2.9 kg (6.4 lb)
2.8 kg (6.2 lb)
5.0 kg (11.0 lb)

WARM-UP TIME

One hour warm-up from cold start (0°C-55°C)

SYSTEM VERIFICATION

GENERAL Physical Dimensions (Characteristic)



TEST DESCRIPTIONS

This section describes the uncertainty analysis methods used in the System Verification tests, lists the tests, and describes them. Each test description does the following things:

- references the tested specification
- lists the necessary test equipment
- describes the test equipment set up
- describes the test algorithm
- indicates if and how the test is done in Limited Cal

The test descriptions list the generic categories of equipment needed for a test. Table 2 lists the acceptable model numbers for each category. The table also indicates a recommended model which tests the specification either more completely, more accurately, or both.

SYSTEM VERIFICATION

MEASUREMENT UNCERTAINTY

Since test equipment models have different accuracies, the program calculates the measurement uncertainty for the model actually used. It also calculates the uncertainty for each measurement since different measurements may rely on different equipment specifications. The total measurement uncertainty involved in each measurement is listed with the test results when these results are sent to the computer screen or a printer (see Parameter Menu).

Combining Specification and Measurement Uncertainty

To determine if an instrument has passed a test, the program combines the tested specification with the total measurement uncertainty and compares this to the measured value. The specification is usually specified as a value plus or minus a value (e.g., 10 dB $\pm$ 1 dB). The measurement uncertainty is added at the extreme range of the specification (e.g. 11 dB + measurement uncertainty, 9 dB - measurement uncertainty). A measurement within this combined range is considered within specification. See Figure 8.

The total measurement uncertainty can be dependent on several separate measurement uncertainties. There are two ways the program can sum these separate uncertainties: Worst Case or Root-Sum-Square.

SYSTEM VERIFICATION

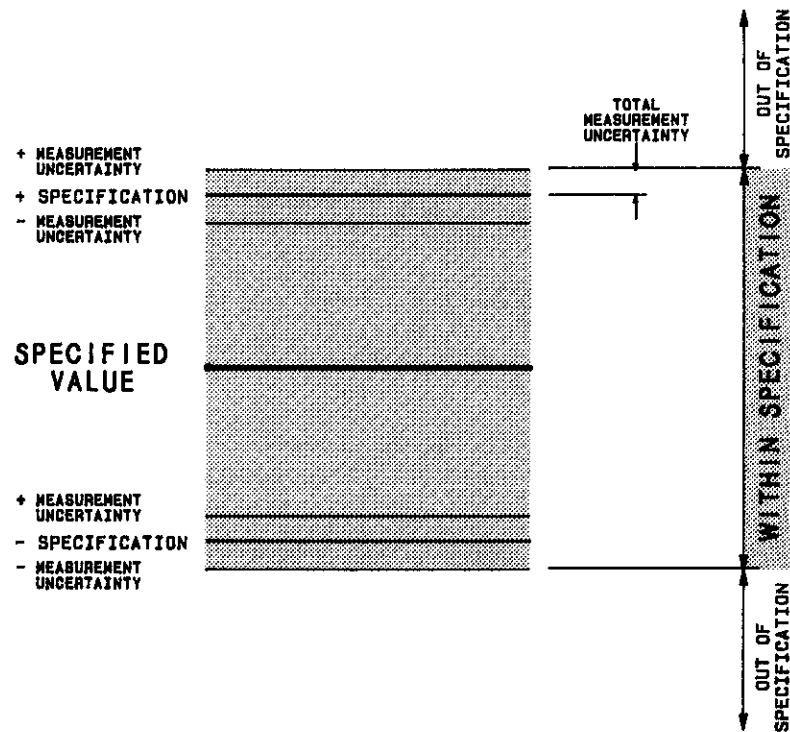


Figure 8. Acceptable Measurement Range

Worst Case

Worst Case analysis determines the largest possible value of the total measurement uncertainty. It does this by summing the absolute magnitudes of the extreme values of each of the individual measurement uncertainties, as follows:

$$\text{WORST CASE UNCERTAINTY} = |U_1| + |U_2| + |U_3| + \text{etc.}$$

SYSTEM VERIFICATION

Root-Sum-of-the-Squares (RSS)

RSS uncertainty is based on the fact that although most of the individual measurement uncertainties are systematic (not random), they are **independent** of one another. They can, therefore, be combined as random variables as follows:

$$\text{R.S.S. Uncertainty \%} = \sqrt{\left(\frac{U_1}{M_1}\right)^2 + \left(\frac{U_2}{M_2}\right)^2 + \left(\frac{U_3}{M_3}\right)^2 + \text{etc.}}$$

where

U_i = the uncertainty in the particular measurement (in linear)

M_i = the expected value of the measurement (in linear)

The **RSS** is an accurate and statistically significant estimate of the total measurement uncertainty. The **Worst Case Sum** simply defines the boundaries of the total uncertainty without giving a specific estimate to it.

DESCRIPTIONS

Some of the test descriptions apply to two or more separate tests. This is because many of the tests have the same algorithm but different data values. For example, the Log Fidelity test description covers both the HP 70902A and HP 70903A Log Fidelity tests.

Specification Test	Adjust or Repair
1. Frequency Reference Accuracy	HP 70900A
2. Calibrator Amplitude Accuracy	HP 70900A
3. Log Fidelity	IF Section
4. Linear Fidelity	IF Section
5. IF Gain Accuracy	IF Section
6. Resolution Bandwidth Tests	IF Section
7. Sweep Time Accuracy	HP 70900A
8. Frequency Readout Accuracy	HP 70900A
9. Frequency Span Accuracy	HP 70900A
10. Frequency Response	RF Section
11. Average Noise	RF Section, IF Section, or HP 70900A
12. Noise Sidebands	HP 70900A, RF Section
13. Image Responses	RF Section, IF Section
14. Residual Responses	RF Section, IF Section
15. Synthesis Related Sidebands	HP 70900A
16. Line & System Related Sidebands	HP 70900A
17. Gain Compression	RF Section, IF Section
18. Out of Range Responses	HP 70904A, HP 70900A
19. Input Coupling Switching	HP 70904A

SYSTEM VERIFICATION

1. FREQUENCY REFERENCE ACCURACY

Tested Specification

FREQUENCY, Frequency Reference Accuracy (Aging)

Equipment

Frequency Counter

Equipment Setup

The CALIBRATOR output of the HP 70900A is connected to the input of the Frequency Counter.

Description

With the DUT set to its internal frequency reference, the Frequency Counter is used to measure the 300 MHz Calibrator frequency.

This test is done in the Limited Cal mode.

2. CALIBRATOR AMPLITUDE ACCURACY

Tested Specification

AMPLITUDE ACCURACY, Calibrator Uncertainty

Equipment

Power Meter
Power Sensor

Equipment Set Up

Connect the Power sensor to the HP 70900A CALIBRATOR output connector.

Description

After zeroing and calibrating the Power Meter, the Power Sensor is connected to the DUT calibrator output. The calibrator amplitude is measured and corrected using the Cal Factor of the Power Sensor.

This test is done in the Limited Cal mode.

SYSTEM VERIFICATION

3. LOG FIDELITY

(for the HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE ACCURACY, Scale Fidelity, Log

Equipment

Level Generator

Equipment Set Up

Connect the 50 Ohm output of the Level Generator to the RF INPUT of the Spectrum Analyzer.

Description

The DUT is set for a Reference Level of +10 dBm, a Span of 0 Hz, and a Resolution Bandwidth of 100 kHz.

The Level Generator frequency is adjusted to peak the detected signal, and the amplitude is adjusted to the Reference Level of the Spectrum Analyzer.

The Level Generator is then stepped down in 2 dB increments while the amplitude error between the Level Generator and the displayed trace average is measured. In the Single Test mode 1 dB increments are used. The results of this test can be printed in a graph.

4. LINEAR FIDELITY

(for the HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE ACCURACY, Scale Fidelity, Linear

Equipment

Level Generator

Equipment Set Up

The 50 ohm output of the Level Generator is connected to the RF input of the Spectrum Analyzer.

Description

The Reference Level is set to 0 dBm. The HP 70902A test sets the Resolution Bandwidth to 30 kHz; the HP 70903A test sets the Resolution Bandwidth to 1 MHz. The LIN display mode is selected. The Level Generator is set to provide a signal near the Reference Level.

The Spectrum Analyzer marker is peaked and the Reference Level is set to that value. This establishes a reference at the top of the display.

The Level Generator is stepped down in 2 dB increments (4 dB for All Tests mode). The variation between the Level Generator amplitude and DUT marker amplitude is measured.

SYSTEM VERIFICATION

5. IF GAIN ACCURACY

(for the HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE ACCURACY, IF Gain Uncertainty

Equipment

Level Generator

Equipment Set Up

The 50 ohm output of the Level Generator is connected to the RF INPUT of the DUT.

Description

The spectrum analyzer is set for a Reference Level and RF Attenuator setting that corresponds to 0 dB IF Gain. The Level Generator is set to approximately 4 dB below this Reference Level to establish a reference amplitude.

The Reference Level is then decreased 10 dB. The Level Generator output is decreased until the reference amplitude is reached. The difference in Level Generator amplitude is the IF Gain. This is repeated for each IF Gain step.

This test is done in the Limited Cal mode.

6. RESOLUTION BANDWIDTH TEST

(for the HP 70902A or HP 70903A)

Tested Specifications

AMPLITUDE ACCURACY, Resolution Bandwidth Switching
Uncertainty

FREQUENCY, Resolution Bandwidths (-3 dB)

Equipment

Level Generator

Equipment Set Up

Connect the RF OUTPUT of the Level Generator to the RF INPUT of the DUT.

Description

The bandwidth switching variation is tested by setting a reference value at the widest resolution bandwidth. The DUT resolution bandwidth is then stepped down in a 1, 3, 10 sequence and the amplitude variation from the widest bandwidth is recorded. The data is then normalized to the reference bandwidth.

The 3 and 60 dB points of the resolution bandwidth response are tested as follows. The DUT is set to the 0 Hz span and the Level Generator frequency is adjusted to peak the response. The Level Generator amplitude is then stepped down 3(60) dB to establish a reference value. The Level Generator amplitude

SYSTEM VERIFICATION

is then returned to the original value and the frequency is decreased until the 3(60) dB reference amplitude is reached. This establishes the lower 3(60) dB frequency point. The Level Generator frequency is then incremented until the upper 3(60) dB point is found. The difference in Level Generator frequencies is the 3(60) dB bandwidth.

This test is done in the Limited Cal mode for some of the bandwidths.

7. SWEEP TIME ACCURACY

Tested Specification

SWEEP, Sweep Time

Equipment

Universal Counter

Equipment Set Up

The HSWP output on the rear panel of the HP 70900A Local Oscillator is connected to the input of the Universal Counter.

Description

The DUT sweep times are selected to turn on each of the 12 bits of the sweep DAC. Only one bit is on at a time except when the lower 6 bits are tested, then bit 6 is also on.

The DUT is set for a span of 0 Hz and a sweep is triggered. The sweep time is measured with the Universal Counter.

SYSTEM VERIFICATION

8. FREQUENCY READOUT ACCURACY

Tested Specification

FREQUENCY, Frequency Readout Accuracy

Equipment

Synthesized Source

Equipment Set Up

Connect the RF OUTPUT of the Synthesized Source to the DUT RF INPUT.

NOTE

A low loss cable such as HP P/N 8120-3124 must be used to connect the Synthesized Source to the DUT.

Description

For each Span and Readout Frequency selected, the frequency readout of the DUT is compared to the frequency of a synthesized source signal.

This is accomplished by setting the source so it produces a signal between the start and stop frequencies of the DUT,

SYSTEM VERIFICATION

peaking a marker on this signal, and reading the marker frequency.

The Frequency Readout Accuracy is tested at a maximum of 13 frequencies and 4 spans. In the Limited Cal mode it is tested at up to 7 frequencies and 3 spans.

SYSTEM VERIFICATION

9. FREQUENCY SPAN ACCURACY

Tested Specification

FREQUENCY, Frequency Span Accuracy

Equipment

Synthesized Source.

Equipment Set Up

Connect the RF OUTPUT of the Synthesized Source to the DUT RF INPUT.

Description

The DUT center frequency is set to 1.5 GHz. To test spans from 1 kHz to 1 GHz, the Synthesized Source frequency is set to place a signal on the second vertical graticule. The marker is peaked and the frequency recorded. The procedure is repeated at the 6th and 10th graticules.

This test is done with the DUT referenced to the internal frequency reference.

This test is done in the Limited Cal mode for spans from 10 kHz to 100 MHz.

10. FREQUENCY RESPONSE

(for the HP 70904A, HP 70905A, or HP 70906A)

Tested Specification

AMPLITUDE ACCURACY, Frequency Response

Equipment

Microwave Source
Level Generator (optional for frequencies < 50 MHz)
Power Meter
Power Sensor
Power Splitter

Equipment Set Up

Connect the RF OUTPUT of the Microwave Source to the input port of the Power Splitter. Connect one output of the Power Splitter to the DUT RF INPUT. Connect the other output of the Power Splitter to the Power Sensor. The Microwave Source must be provided with an external frequency reference.

NOTE

A low loss cable such as HP P/N 8120-3124 must be used to connect the Microwave Source to the DUT.

SYSTEM VERIFICATION

For frequencies less than 50 MHz, connect the OUTPUT of the Level Generator to the DUT RF INPUT.

Description

The Power Meter is calibrated. The DUT RF Input Attenuator is set to 10 dB. The Microwave Source output level is adjusted for a reading of -10 dBm at 300 MHz on the Power Meter. The DUT marker amplitude is read to establish a reference. Measurements are made in each frequency band above 50 MHz.

For frequencies less than 50 MHz the frequency response is measured with the Level Generator. The Level Generator output level is adjusted to produce the same DUT marker amplitude as that using the previous set up. The frequency response is measured.

The frequency response data is available in graph mode and the test is performed in the Limited Cal mode.

11. AVERAGE NOISE

(using the HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE, Displayed Average Noise

Equipment

50 ohm Termination

Equipment Set Up

Connect the 50 ohm Termination to the DUT RF INPUT.

Description

The Average Displayed Noise level is measured at frequencies across each band. Ten data points are taken below 10 MHz.

When the DUT system has an HP 70902A, a span of 0 Hz is used with a resolution bandwidth of 10 Hz and a video bandwidth of 3 Hz. When the DUT system has an HP 70903A, a span of 0 Hz is used with a resolution bandwidth of 100 kHz and a video bandwidth of 300 Hz. A sweep is taken and the trace information is averaged.

This test is performed in the Limited Cal mode.

SYSTEM VERIFICATION

12. NOISE SIDEBANDS

Tested Specification

FREQUENCY, Spectral Purity, Noise Sidebands

Equipment

Clean Source

Equipment Set Up

Connect the RF OUTPUT of the Clean Source to the DUT RF INPUT connector.

Description

The noise sidebands are measured at specified offset frequencies. The DUT is set for 0 dB attenuation and a span of 0 Hz. The signal amplitude is adjusted to the Reference Level, which is the carrier level. For each offset frequency the carrier frequency is incremented by the offset frequency. The DUT Resolution Bandwidth is set to 3% of the offset frequency. A sweep is taken and the data is averaged. The data is normalized to a 1 Hz bandwidth and corrected for Log detection and noise bandwidth.

This test is done with the DUT referenced to the internal frequency reference.

In the Limited Cal mode the test is done at 10 MHz only. In the Single Test mode additional measurements are taken.

13. IMAGE RESPONSES

Tested Specification

AMPLITUDE, Spurious Responses, Image Responses

Equipment

Microwave Source

Equipment Set Up

Connect the RF OUTPUT of the Microwave Source to the DUT RF INPUT.

Description

The source and DUT are tuned to a frequency of 250 MHz. The DUT's marker is used to determine the carrier amplitude.

The source is then tuned to the image frequencies and the image amplitude is measured.

The test is performed in the Limited Cal mode.

SYSTEM VERIFICATION

14. RESIDUAL RESPONSES

Tested Specification

AMPLITUDE, Residual Responses

Equipment

50 ohm Termination

Equipment Set Up

Connect the 50 ohm Termination to the DUT RF INPUT.

Description

The DUT RF input attenuator is set to 0 dB. The frequencies where residual responses can occur are calculated and the DUT is tuned to these frequencies. The residual product level is measured.

15. SYNTHESIS RELATED SIDEBANDS

Tested Specification

AMPLITUDE, Spectral Purity, Synthesis-related sidebands (dBc)

Equipment

Clean Source

Equipment Set Up

The RF OUTPUT of the Clean Source is connected to the RF INPUT of the DUT.

Description

Based on the Center Frequency tuning equations, the DUT is tuned to frequencies where synthesis related sidebands may exist. The Source carrier level is measured. Then the Source frequency is incremented to place the sideband on screen and the sideband level is measured.

SYSTEM VERIFICATION

16. LINE & SYSTEM RELATED SIDEBANDS

Tested Specification

FREQUENCY, Spectral Purity, Line and System related sidebands (dBc)

Equipment

Clean Source

Equipment Set Up

Connect the RF OUTPUT of the Clean Source to the DUT RF INPUT connector

Description

The source is set for an amplitude of -10 dBm. The line and system related sidebands are tested at a frequency of 32 MHz. The signal is peaked on the DUT and set to the Reference Level.

The source is then offset by the known sideband frequencies, and the sideband level is measured.

This test is done in the Limited Cal mode. In Single Test mode the measurements are repeated at 1200 and 2500 MHz.

17. GAIN COMPRESSION

(using the HP 70902A or HP 70903A)

Tested Specification

AMPLITUDE, Gain Compression Level

Equipment

Level Generator
Measurement Receiver
Signal Sensor

Equipment Set Up

The Level Generator is connected to the RF INPUT of the DUT. The Measurement Receiver is connected to the IF OUTPUT on the front panel of the HP 70902A/HP 70903A.

Description

The Level Generator is set to produce a signal within the range of the DUT. The DUT is tuned to this signal, and the input attenuator is set to 10 dB. The DUT is set to zero span and the Level Generator is tuned to the center of the DUT pass band.

The amplitude of the Level Generator is adjusted until a signal of -30 dBm or less is at the DUT input mixer. The Measurement Receiver then measures the signal path gain; this value is used as the reference for no gain compression.

The Level Generator amplitude is increased to produce a signal of -10 dBm at the DUT input mixer. The Measurement

SYSTEM VERIFICATION

Receiver again measures the signal path gain. The difference between the two gain measurements is the Gain Compression.

18. OUT OF RANGE RESPONSES

(for the HP 71100 only)

Tested Specification

AMPLITUDE, Spurious Responses, Out-of-range responses

Equipment

Microwave Source

Equipment Set Up

The RF output of the Microwave Source is connected to the RF INPUT of the DUT.

NOTE

A low loss cable such as HP P/N 8120-3124 must be used to connect the Microwave Source to the DUT RF INPUT.

Description

The Microwave Source is stepped in 100 MHz increments (250 MHz in the All Tests mode) from 4 to 18 GHz. At each 100 MHz increment the DUT is tuned to the center frequencies that could produce an out of range response. The response level is measured at each of these frequencies.

SYSTEM VERIFICATION

19. INPUT COUPLING SWITCHING

(for the HP 71100 only)

Tested Specification

AMPLITUDE ACCURACY, Input Coupling Switching
Uncertainty

Equipment

General Source

Equipment Set Up

Connect the RF output of the General Source to the RF INPUT connector of the DUT.

Description

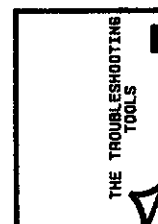
The input coupling switching is tested at signal frequencies of 500 kHz, 50 MHz, 500 MHz, and 2500 MHz. The DUT is set for DC coupling and the signal amplitude is measured. The input coupling is then switched to AC coupling and the difference is measured.

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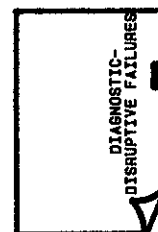
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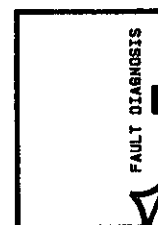
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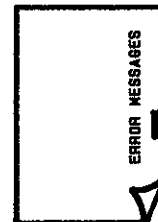
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INTRODUCTION

This chapter explains how to troubleshoot an HP 71100, 71200, or 71300 Modular Spectrum Analyzer to identify a faulty module, display, or mainframe.

These spectrum analyzers have many automatic, built-in, troubleshooting tools and two troubleshooting programs. This chapter explains these troubleshooting tools and programs. It also explains how to troubleshoot the spectrum analyzer when it has a problem that prevents access to the built-in troubleshooting tools.

THE TROUBLESHOOTING TOOLS

The Modular Spectrum Analyzer has the following automatic, built-in, troubleshooting tools:

- Indicator Lights
- Error Message Reporting
- Display Tests
- Analyzer Test

Built into the display of the spectrum analyzer is another troubleshooting tool: the HP-MSIB Troubleshooting Utility. This utility is not automatic—it interferes with normal system operation. The Diagnostic-Disruptive Failures section of this chapter describes the HP-MSIB Troubleshooting Utility.

Also, provided with the spectrum analyzer are the following troubleshooting programs:

- System Diagnostics
- System Verification

This section describes these troubleshooting tools and programs; however, to understand them you must understand the following terms.

Element: anything that talks on the HP-MSIB.

Module: anything that plugs into the HP 70001A Mainframe.

Slave: an element that is controlled by another element.

Master: any element which is used to control other elements.

Instrument: a module or group of modules that perform a measurement function.

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INDICATOR LIGHTS

Module Error Indicator

The module error indicator, the ERR light, indicates when the module has an error condition. If the module is a slave, then the error light of both the slave and its master will indicate the error condition.

Display Error Indicator

The display error indicator, an E in the status block, indicates an error condition in the display or any other module at row address 0. See Figure 1.

All elements at row address 0 (masters) report their error status to the display. Therefore, the display turns on its error indicator when any module on the HP-MSIB reports an error.

Flashing Error Indicator

The Error indicator of an element (module or display) flashes at a 1 Hz rate when the element cannot communicate on the HP-MSIB.

(Some errors, for example locking errors, may be only present when the spectrum analyzer sweeps and thus cause the Error indicator to flash at the sweep rate.)

Status Indicators

All elements have an Active status indicator; displays write an A (Active) in the status block; modules have an ACT (Active) light.

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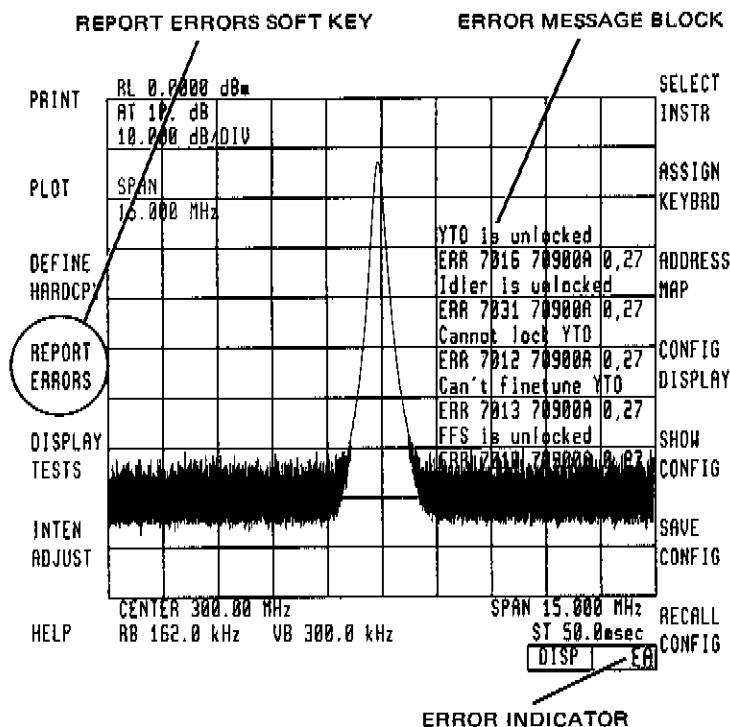


Figure 1. Error Reporting

An Active indicator of a display comes on when the display is addressed over HP-IB or when a DISPLAY (DSP) screen is selected.

An Active indicator of a module comes on when the module is making a measurement and its master has keyboard control of the display.

Both displays and modules turn their Active indicator on when the cursor of the Address Map (DISPLAY screen) is at their HP-MSIB address. Thus, the HP-MSIB address of each

SYSTEM TROUBLESHOOTING

element can be identified by scrolling the cursor through the Address Map and observing the Active indicators.

Mainframe Fault Indicators

The following comprise the mainframe fault indicators:

VOLT/TEMP
CURRENT
I/O CHECK

These fault indicators are explained in the Appendix (HP 70001A Mainframe).

ERROR MESSAGE REPORTING

Error Message Block

The local oscillator writes the error messages of the spectrum analyzer in the error message block of its display window. See Figure 1.

Each error message contains a description of the error, the error number, and the model number and address of the module with the error condition. Five error messages can be displayed at the same time.

Error Report Screen

The Error Report screen shows the errors of any display or master at row address 0. The REPORT ERRORS soft key of the DISPLAY (DSP) screen displays the Error Report. See Figures 1 and 2.

If both the display and a master (local oscillator) are reporting errors, the Error Report displays a MORE ERRORS soft key

SYSTEM TROUBLESHOOTING

	LOCAL OSCILLATOR REPORTING ERRORS	ERROR FROM SLAVE MODULE
PRINT	ERROR REPORT from	SELECT INSTR
	70900A,Lo/Ctlr (Row 0, Column 28)	
PLOT	7002 70905A 3,28 First LO unlevelled	ASSIGN KEYBD
	7013 70900A 0,28 Can't finetune YTO	
DEFINE HARDCPY		ADDRESS MAP
REPORT ERRORS		CONFIG DISPLAY
DISPLAY TESTS		SHOW CONFIG
INTEN ADJUST		SAVE CONFIG
HELP		RECALL CONFIG

DSPL E

Figure 2. Error Report Screen

and the errors of the element with the lowest column address. Pressing **MORE ERRORS** displays the errors of the element with next highest column address. See Figure 3.

Written at the top of the Error Report screen is the model number, description, and HP-MSIB address of the master or display that is reporting errors. See Figures 2 and 3.

The local oscillator reports its own errors and the errors of all its slaves on the same screen. Therefore, error messages

SYSTEM TROUBLESHOOTING

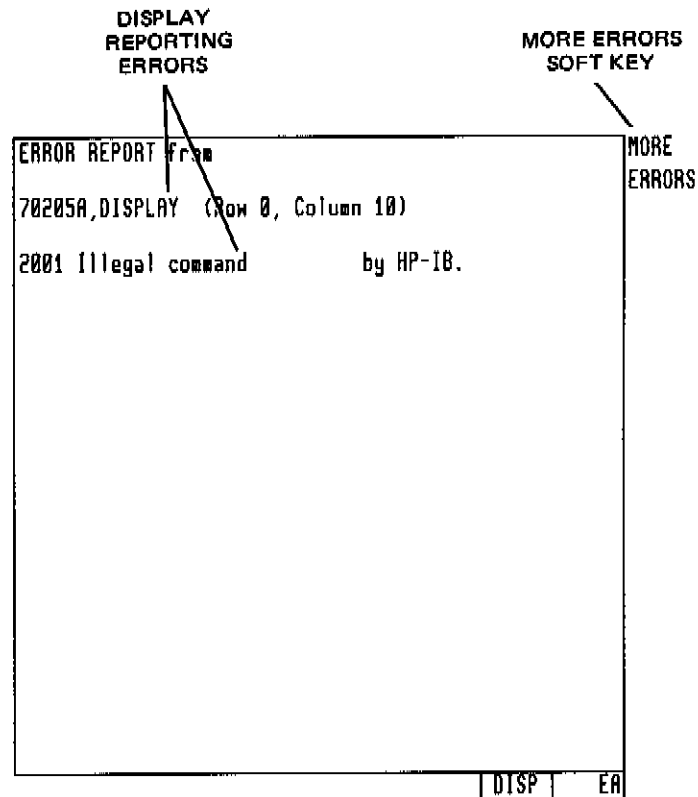


Figure 3. MORE ERRORS Soft Key

reported by the local oscillator show the model number and HP-MSIB address of the module that generated the error. See the error messages in Figure 2.

When the display reports Usage Errors it shows whether the Usage Error was generated by the HP-IB controller or by a master module. See the error message in Figure 3.

NOTE

The Error Report screen reports only the errors that were present when the **REPORT ERRORS** soft key was pressed. If the error condition clears before **REPORT ERRORS** is pressed, then the message "No Errors" will appear on the screen.

To exit the Error Report screen press the **USER (USR)** or **MENU (MNU)** key.

Display-Disruptive Errors

Display error conditions that might interfere with a normal display are called display-disruptive errors. Display-disruptive error messages are written on a mostly blank CRT in large, capital letters.

Title Line

The display indicates on the title line of the CRT if the display Confidence Test passed or failed. See Figure 4. Error messages generated by the Confidence Test must be viewed through the Error Report screen.

DISPLAY TESTS

The Display Tests comprise the diagnostic and adjustment routines of the display instruments (HP 70205A and HP 70206A). The **DISPLAY TESTS** soft key is located in the **DISPLAY (DSP)** screen. See Figure 5. This soft key accesses

SYSTEM TROUBLESHOOTING

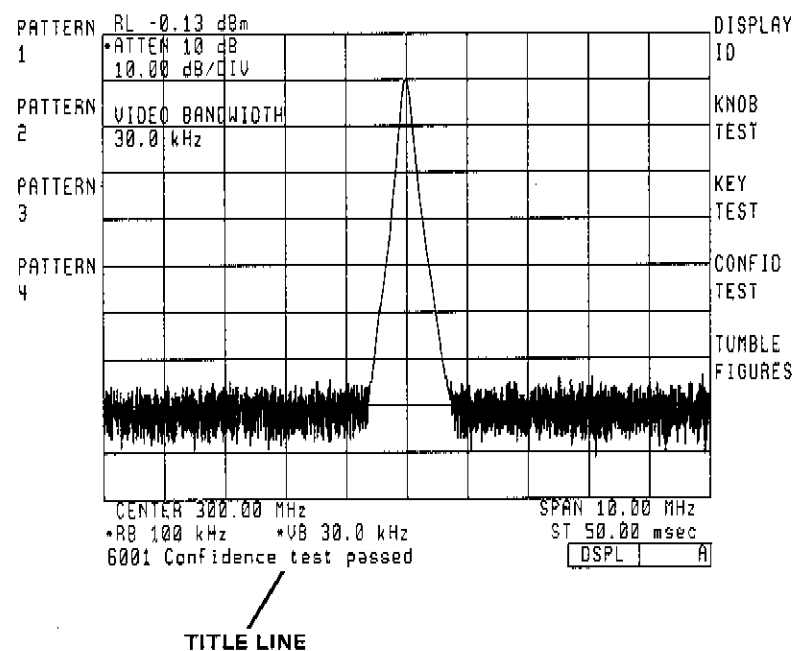


Figure 4. Confidence Test Results

the Display Tests screen, which contains the following soft keys. See Figure 6.

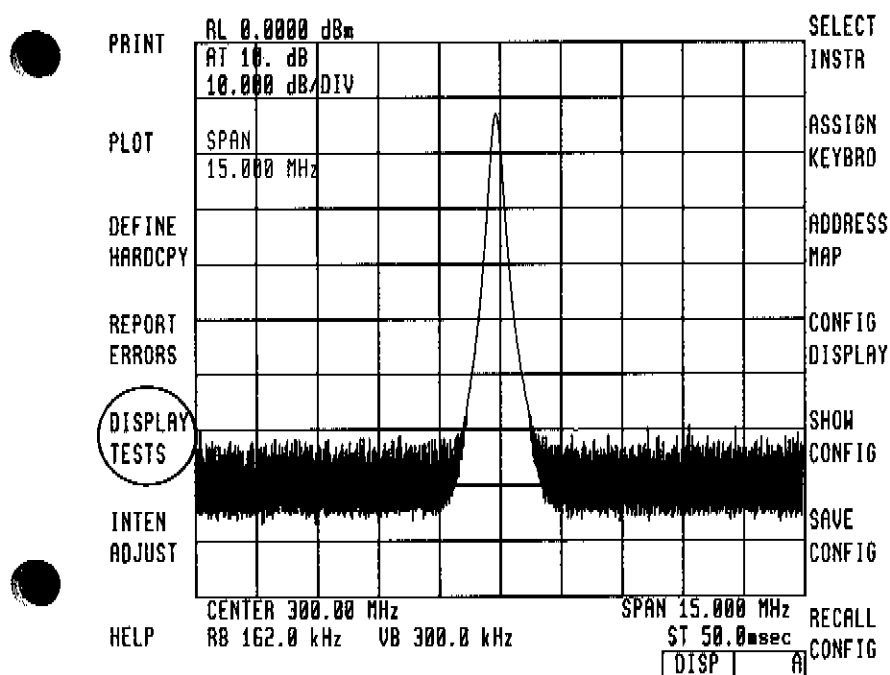


Figure 5. DISPLAY TESTS Soft Key

PATTERN 1, 2, 3, and 4, Soft Keys

These soft keys display test patterns which are used to adjust the display module. The Appendix (HP 70205A and HP 70206A) explains the test patterns and related adjustments.

DISPLAY ID Soft Key

Pressing the DISPLAY ID soft key shows the firmware version, HP-MSIB address, HP-IB address, and Dot Generator release of the display.

Table 1
Sht 2 of 3

**OTHER
INDICATORS:**

POW
SUI
LEE

DOT GEN A3 - If this light is on, an error on the Dot Generator board is indicated. However, it may come on momentarily during start-up or during confidence test.

MSIB - Indicates that the 5 volts to the MSIB board is out of range.

MICROPROCESSOR A6 - Indicates an error on the Microprocessor board.

POWER SUPPLY - The power supply indicator lights located on Power Supply board, must all be green. If any of the lights are not on, this indicates a power supply failure.

SYSTEM TROUBLESHOOTING

If the display passes the Confidence Test and the CRT displays no visible distortion, there is a 95% confidence that the display instrument is functioning correctly. The title line of the CRT indicates whether the display passed or failed the test. See Figures 4 and 6.

If the display fails the Confidence Test, it writes an E (Error) in the status block. Any error messages produced by the Confidence Test can be viewed by pressing the REPORT ERRORS soft key of the DISPLAY (DSP) screen.

The display automatically runs the Confidence Test at power on; however, it only indicates if the test failed, not if it passed. The HP-MSIB capability of the display instrument is also tested at power on. If this test fails, the error indicator (E) will blink.

TUMBLE FIGURES Soft Key

This soft key starts a demonstration routine. While this routine is running, the display instrument cannot communicate on HP-IB, HP-MSIB, or respond to any front-panel keys except Back Arrow (←) and the figure selection soft keys.

ANALYZER TEST

Analyzer Test is a self test routine of the HP 71100, 71200, and 71300 Spectrum Analyzers. (The displays, the HP 70205A and 70206A, are not tested by Analyzer Test.)

If the spectrum analyzer passes this test, then the analog circuits of the HP 70900A (LO) module and all the processor, memory, and HP-MSIB circuits of the spectrum analyzer are functioning correctly.

To access the ANALYZR TEST soft key press the SPECIAL FUNCTIONS soft key of the MENU (MNU) screen. See

SYSTEM TROUBLESHOOTING

Figures 7 and 8. Analyzer Test is automatically run at power ON. It is also run by the System Diagnostics program.

Error messages from Analyzer Test are displayed in the Error Message Block of the local oscillator display window (if one is assigned). When Analyzer Test detects an error, both the local oscillator and display turn on their error indicators, even if the local oscillator does not have a display window. Analyzer Test error messages can also be viewed with the Error Report screen.

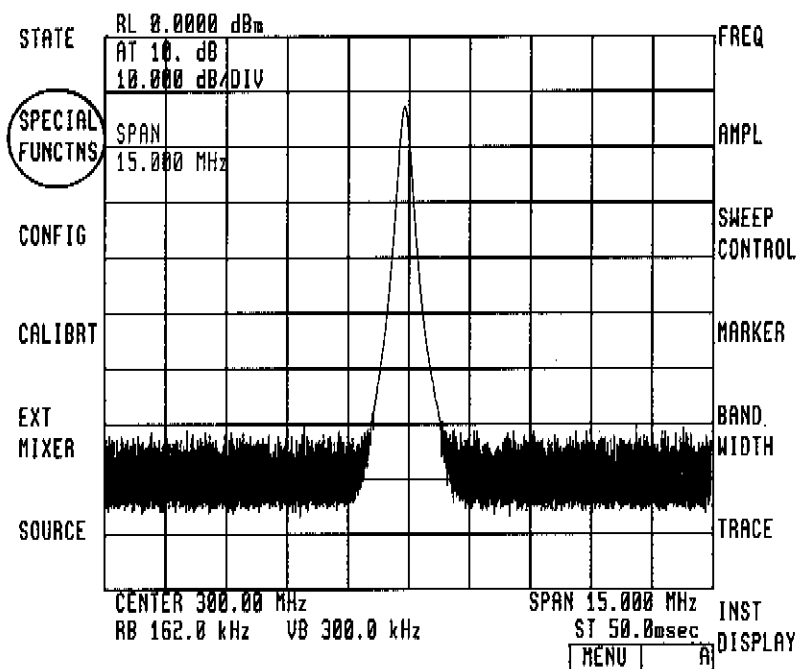


Figure 7. SPECIAL FUNCTIONS Soft Key

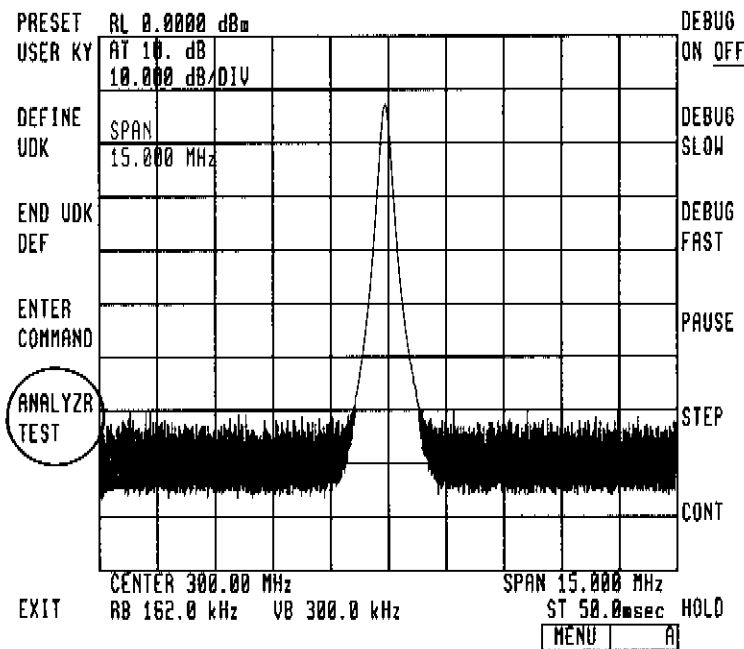


Figure 8. ANALYZR TEST Soft Key

Background Tests

The spectrum analyzer continuously checks for certain error conditions. These checks are called background tests. Examples of background test errors are Usage Errors and locking or leveling errors.

SYSTEM DIAGNOSTICS

System Diagnostics is a troubleshooting program for the analog and digital circuitry of the HP 71100 and 71200

SYSTEM TROUBLESHOOTING

Modular Spectrum Analyzers. It is loaded into the RAM of the HP 70900A Local Oscillator at the factory.

When System Diagnostics is loaded at the factory, the USER (USR) screen soft key SIG TRK ON OFF is relabeled DIAGNOSTICS. Pressing the DIAGNOSTICS soft key runs System Diagnostics. (See Figure 9.) The program takes approximately 5 minutes to run. After it runs, the spectrum analyzer is left in the uncorrected state. Error messages produced by the program are displayed in the Error Message Block of the spectrum analyzer display window.

NOTE

When System Diagnostics runs it erases all instrument state (NSTATE) definitions.

NOTE

Because System Diagnostics is a down-loaded program, it can easily be disrupted or destroyed by spectrum analyzer functions that affect RAM. The Running System Diagnostics and Destroying System Diagnostics sections describe how the program can be disrupted or destroyed.

System Diagnostics tests the analog circuits of the spectrum analyzer with the CALIBRATOR signal and built-in service detectors. It tests the controller and memory circuits by running the Analyzer Test. It does not test the display instruments (HP 70205A and 70206A). They can be tested with their Confidence Test function.

SYSTEM TROUBLESHOOTING

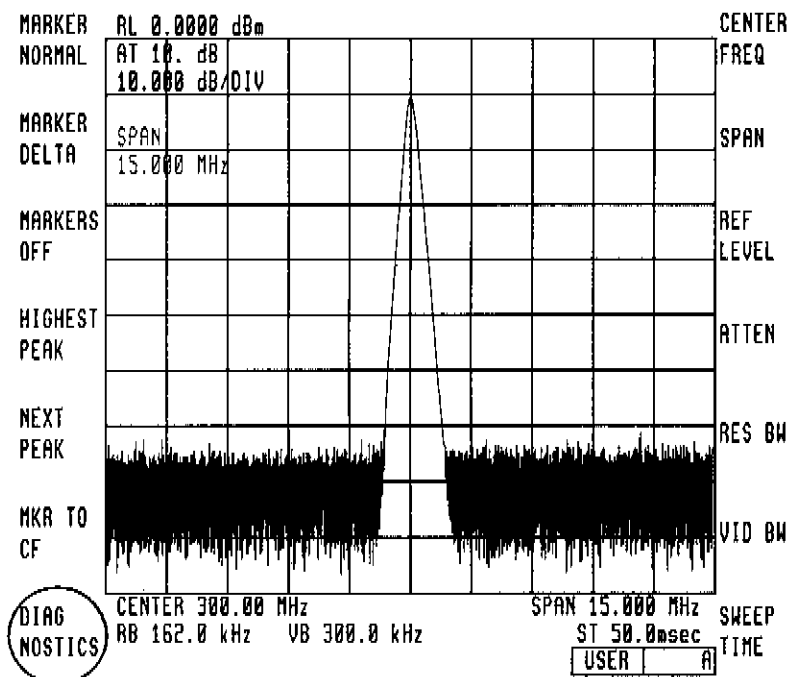


Figure 9. DIAGNOSTICS Soft Key

Running System Diagnostics

Before System Diagnostics can run, the following three requirements must be met:

1. **HP 70900A Available RAM.** The local oscillator (HP 70900A) must have 1,000 bytes of available RAM.

The SHOW CATALOG soft key of the INSTR STATE screen (MENU key) shows how much RAM is available.

There are three major ways RAM is used: trace length definitions, instrument state storage, and user defined

SYSTEM TROUBLESHOOTING

functions and variables. Trace lengths can be reset to nominal values with the IP key (Instrument Preset). Instrument states can be reset to 0 with the NO. OF STATES soft key of the STATE screen of the MENU (MNU) key. User defined functions and variables can be erased with the DISPOSE command. The easiest way to do this is with the System Diagnostics utilities explained under "System Diagnostics On Disk" on the following pages.

2. HP-MSIB Addressing Order. In addition to meeting the normal addressing requirements of the HP 70900A, the HP-MSIB addresses of the spectrum analyzer must meet these additional requirements:

All modules must have the same column address.

The local oscillator must have a row address of 0. (For example 0, 27.)

The local oscillator must have a lower column address than other local oscillators at row address 0.

The Address Map soft key of the DISPLAY (DSP) screen shows the addresses of all elements on the HP-MSIB.

3. Cal Signal. The CALIBRATOR output of the HP 70900A must be connected to the RF INPUT of the RF Section.

Destroying System Diagnostics

The PRESET USR KY Soft Key. If the PRESET USR KY soft key is pressed, then the DIAGNOSTICS soft key label will be erased and the default SIG TRK ON OFF soft key label will return. Erasing the DIAGNOSTICS soft key label makes System Diagnostics inaccessible but does not erase it.

To relabel the SIG TRK ON OFF soft key as DIAGNOSTICS, execute the following command string with the ENTER COMMAND soft key of the SPECIAL FUNCTIONS screen.

SYSTEM TROUBLESHOOTING

KEYDEF 14, DIAG,/DIAG-L_PNOSTICS/;

This command string can also be sent over the HP-IB (to the HP 70900A) with an external controller.

The ENTER COMMAND soft key can also be used to run System Diagnostics without a soft key by executing just the DIAG command. The ENTER COMMAND soft key is explained in the Manual Operation section of the Operation Manual.

The DISPOSE ALL command. Executing the DISPOSE ALL command erases all user defined functions and variables, including the System Diagnostics program.

To avoid losing System Diagnostics, it is recommended that you make a back-up copy when you receive the spectrum analyzer. If you have access to an HP Series 200 Computer, the System Diagnostics disk shipped with this manual can serve as the back-up (see the following section). If you do not have an HP Series 200 Computer, use the USTATE command to make a back-up copy for your computer.

The USTATE command puts the contents of the HP 70900A RAM (including System Diagnostics) on the HP-IB. The following program lines demonstrate a suggested algorithm for reading the RAM, including System Diagnostics.

```
10 ! Dimension memory for RAM contents
20 DIM U__state${30000}
30 ! Send the USTATE command to the local oscillator
40 OUTPUT Lo__hpib__addr;"USTATE?;"
50 ! Read the length bytes of the USTATE data string
60 ENTER Lo__hpib__addr USING "#,2X,W";Data__length
70 ! Set A$ equal to length and format (ASCII)
80 A$=VAL$(Data__length)&"A"
90 ! Enter the data string according to A$
100 ENTER Lo__hpib__addr USING A$;U__state$
110 !
120 ! Now write U__state$ to storage device
```

SYSTEM TROUBLESHOOTING

System Diagnostics On Disk

A copy of the System Diagnostics utility programs was shipped with this manual on both 5 1/4 and 3 1/2 inch disks. These utility programs run on HP Series 200 Computers that have HP BASIC 2.0 or the equivalent. Each disk contains these utilities:

SAVE_STATE saves the spectrum analyzer state on disk.

RSTR_STATE (Restore State) down loads the above state to the spectrum analyzer.

DOWN_DIAG (Download Diagnostics) erases most of RAM with the **DISPOSE ALL** command and sets the number of instrument states to zero. It then down loads the System Diagnostics program and labels soft key 14 as **DIAGNOSTICS**. Pressing the **DIAGNOSTICS** soft key runs the program.

REM_DIAG (Remote Diagnostics) does the same thing as **DOWN_DIAG**. It also runs System Diagnostics and reports any errors to both the instrument and computer displays.

These utilities were designed to be used in this way: store the instrument configuration and down-loaded user applications on disk with **SAVE_STATE**. Down load and run System Diagnostics with **DOWN_DIAG** or **REM_DIAG**. Now, restore the original instrument configuration and down-loaded user applications to RAM with **RSTR_STATE**.

Running The System Diagnostics Utilities Use this procedure to run any of the utilities on an HP Series 200 Computer.

1. Load BASIC 2.0.
2. Connect the HP-IB of the computer and the spectrum analyzer together with an HP-IB cable.

SYSTEM TROUBLESHOOTING

3. Insert the disk labeled System Diagnostics into the computer default disk drive.
4. Type the command LOAD. Follow it with a space and the name of the utility in quotes (for example, LOAD "SAVE_STATE").
5. Press EXECUTE (EXEC).
6. Press the RUN key and follow the instructions on the computer screen.

SYSTEM VERIFICATION

System Verification is an external test program. It runs on the HP Series 200 Computers and requires external test equipment.

The primary purpose of System Verification is to verify the spectrum analyzer meets all its major specifications; however, it also contains several testing modes that are useful for troubleshooting. For example, System Verification has modes that allow repeated testing of individual specifications, which can be useful for troubleshooting intermittent problems.

Since System Verification tests the spectrum analyzer against its specifications, it can also find "soft" or marginal failures that are not found by System Diagnostics.

The System Verification chapter contains a list of the System Verification tests. This list indicates which modules may need adjustment or repair if a test is not passed.

SYSTEM TROUBLESHOOTING

The following table summarizes the Display Tests, Analyzer Test, and System Diagnostics troubleshooting tools.

Table 1. Troubleshooting Tools

	Screen	Soft Key	Runs at Power on	Background
Display Tests	DSP	DISPLAY TESTS	Yes	Some
Analyzer Test	MNU	ANALYZR TEST	Yes	Some
Diagnostics	USR	DIAG-NOSTICS	No	No

DIAGNOSTIC-DISRUPTIVE FAILURES

A diagnostic-disruptive failure is a failure that prevents the spectrum analyzer from running its troubleshooting routines. These failures usually result in no display, a distorted display, flashing Error lights, or no USER (USR) or MENU (MNU) soft keys.

A faulty HP 70900A Local Oscillator, 70001A Mainframe, 70205A Graphics Display, or 70206A System Graphics Display is the usual cause of a diagnostic-disruptive failure.

Before troubleshooting a diagnostic-disruptive failure, verify the correct line power is applied to the mainframe, and verify the power ON indicator comes on when the LINE switch is pulled. If the power ON indicator does not come on, refer to the HP 70001A Mainframe chapter.

SYMPTOMS

There are two groups of symptoms that help isolate a diagnostic-disruptive failure:

- Indicator lights
- Abnormal displays

Indicator Lights

The mainframe and modules have indicator lights. The display has indicator letters, which are displayed in the "status block" in the lower-right corner of the CRT.

Mainframe Fault Indicators The HP 70001A Mainframe has three fault indicators: VOLT/TEMP, CURRENT, and I/O CHECK. If any Mainframe fault indicator is on, refer to the HP 70001A Mainframe chapter.

SYSTEM TROUBLESHOOTING

ERR Indicators The modules have an ERR (Error) light; the displays have an E (Error) indicator letter. If the Error indicator of an element flashes at a one Hertz rate, the element cannot talk on the HP-MSIB and is probably faulty.

If more than one module flashes its error indicator, either the mainframe HP-MSIB is faulty or a faulty module is disrupting the whole HP-MSIB. (It is possible, but not probable, for a module to disrupt the whole HP-MSIB without lighting its own Error indicator.) The Troubleshooting section of the HP 70001A Mainframe Appendix explains how to isolate a mainframe HP-MSIB problem from a module HP-MSIB problem.

Abnormal Display

An abnormal display on the CRT can indicate which module (or mainframe) is faulty. Cycle power and observe the display. Select the symptom that best describes it.

1. Display is blank or distorted.

The display module is faulty. Refer to the HP 70205A or HP 70206A Appendix for repair information.

2. Display is blank except for a message written in large block letters.

This message is a display-disruptive error message. It indicates a faulty display module. Refer to the HP 70205A or 70206A Appendix for repair information.

3. Display shows the model number, firmware version, HP-MSIB address, HP-IB address, and Dot Generator release date of the display.

This display indicates the display window is not assigned to the local oscillator or the display cannot talk to the local oscillator.

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Assign the display window to the local oscillator by pressing the **DISPLAY (DSP)** key and then the **SELECT INSTR** soft key. (This assigns the display to the master with lowest column address. Press the Up Arrow key (↑) to assign the display to the instrument with the next highest address.)

If the display window cannot be assigned to the local oscillator in the above manner, then a module with a faulty **HP-MSIB** interface is "hanging up" the spectrum analyzer or the **HP-MSIB** or local oscillator is faulty.

To isolate the **HP-MSIB** problem, refer to the following section.

HP-MSIB TROUBLESHOOTING

There are two methods for troubleshooting an **HP-MSIB** problem. The first method uses the presence of flashing Error indicators and involves removing modules from the mainframe. This method is explained in the **HP 70001A** Appendix. The second method uses the **HP-MSIB** Troubleshooting Utility. The second method is more complicated than the first, but it does not rely on flashing Error indicators. It also allows troubleshooting without removing modules. This method is explained below.

NOTE

The following description covers **MOST** failure modes of the **HP-MSIB**.

SYSTEM TROUBLESHOOTING

HP-MSIB Troubleshooting Utility

The HP-MSIB Troubleshooting Utility, a routine of the display instrument, allows you to verify if an element can communicate on the HP-MSIB. By determining which elements can communicate and which cannot, you can isolate the HP-MSIB problem.

To use the utility you must know the HP-MSIB addresses of the elements. It is recommended that you keep a written list of the HP-MSIB addresses.

NOTE

The Address Map "freezes" if there is an HP-MSIB problem. Thus, after an HP-MSIB problem occurs the Address Map cannot be relied on to determine the addresses of the elements.

If you do not know the HP-MSIB addresses, they can be deduced from the HP-IB address of the local oscillator, the addressing rules, and the response of the troubleshooting utility.

NOTE

The HP-MSIB Troubleshooting Utility inhibits normal operation of the HP 70000 System. Using the utility may put the system in a state that can only be recovered from by cycling power.

Purging Window Assignments When the HP-MSIB is not working, the troubleshooting utility cannot be used unless the display is prevented from automatically communicating with other HP-MSIB elements. This is done by purging ALL window assignments of the display. The SHOW CONFIG soft key of the DISPLAY (DSP) screen shows which windows are assigned. Use the following procedure to purge window assignments.

1. Press the DISPLAY (DSP) key.
2. Press the CONFIG DISPLAY soft key.
3. Press the PURGE WINDOW soft key.
4. Select the window to be purged by pressing the Up Arrow (↑) or Down Arrow (↓) key.
5. Press EXECUTE to purge the window.
6. Repeat steps two through five until all windows are purged.
7. Cycle power.

When all window assignments are purged the USER screen will be blank, except for the status block.

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Accessing The Utility To access the HP-MSIB Troubleshooting Utility, press the DISPLAY (DSP) key and then the DISPLAY TESTS and KNOB TEST soft keys. The CRT display should look like Figure 10. Note that the Knob Test value is 00. With the value at 00, press the lower-left soft key (unlabeled). The HP- MSIB Troubleshooting Utility will now be displayed. See Figure 11. This utility is entered through an unlabeled soft key to prevent users from accidentally disrupting normal system operation.

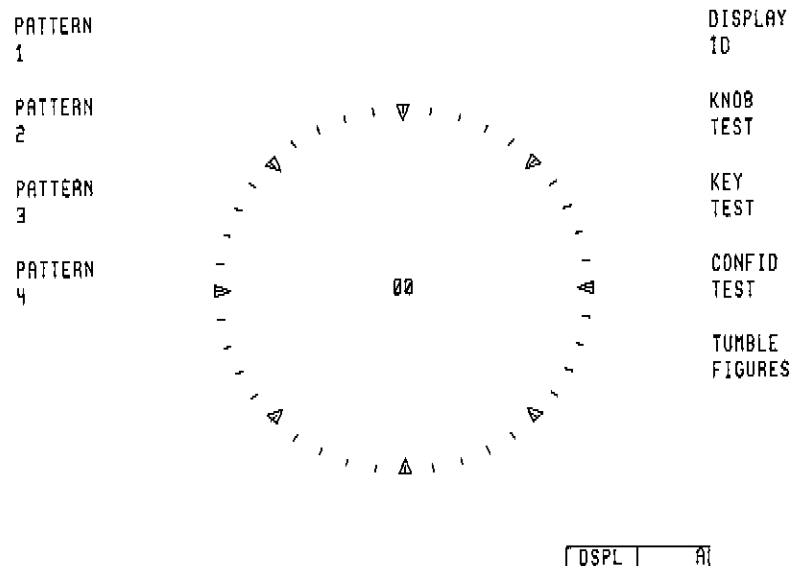


Figure 10. Knob Test Display

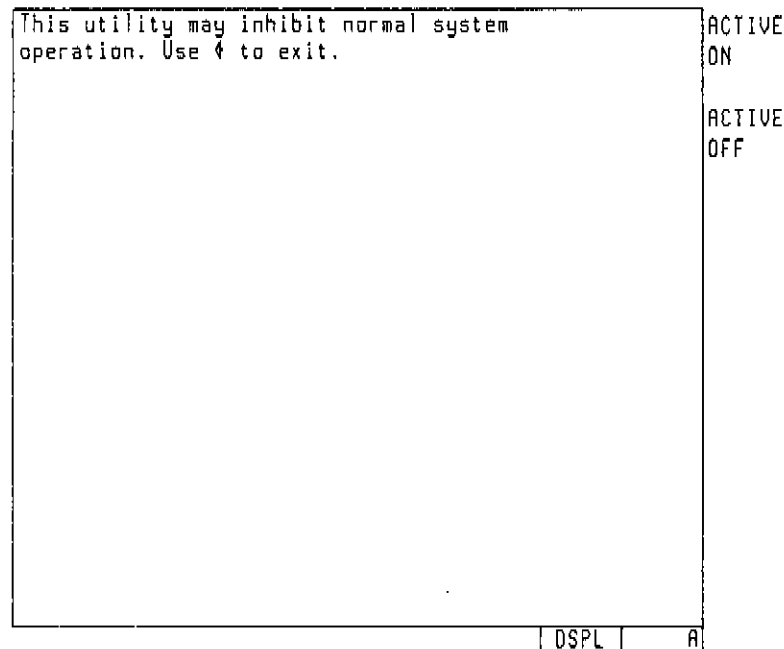


Figure 11. HP-MSIB Troubleshooting Utility

Using The Utility The utility has two main soft keys: **ACTIVE ON** and **ACTIVE OFF**. See Figure 11. These soft keys send the HP-MSIB command to turn the Active indicator of an element on and off. Once the command is sent, the display examines the HP-MSIB to see if the element received the instruction. Use the following procedure to send the Active On command.

1. Press the **ACTIVE ON** soft key.
2. Using the numeric key pad, enter the row address of the module that is to have its Active light turned on.
3. Press the **ENTER** soft key.

SYSTEM TROUBLESHOOTING

4. Enter the column address--in hexadecimal--of the module. Use the alphabetical soft keys and the key pad to enter hexadecimal numbers. See Figure 12. Refer to the conversion table below.

DECIMAL/HEXADECIMAL CONVERSION

Decimal	Hexadecimal	Decimal	Hexadecimal
0	0	16	10
1	1	17	11
2	2	18	12
3	3	19	13
4	4	20	14
5	5	21	15
6	6	22	16
7	7	23	17
8	8	24	18
9	9	25	19
10	A	26	1A
11	B	27	1B
12	C	28	1C
13	D	29	1D
14	E	30	1E
15	F	31	1F

5. Press the ENTER soft key.

The utility has a two second time out. Allow two seconds for the utility to respond to the ENTER soft key. The utility responds by displaying one of the following messages. (See the example messages in Figure 13.)

Module not accepting data. This message indicates there is an element at the specified address—but it cannot communicate on the HP-MSIB.

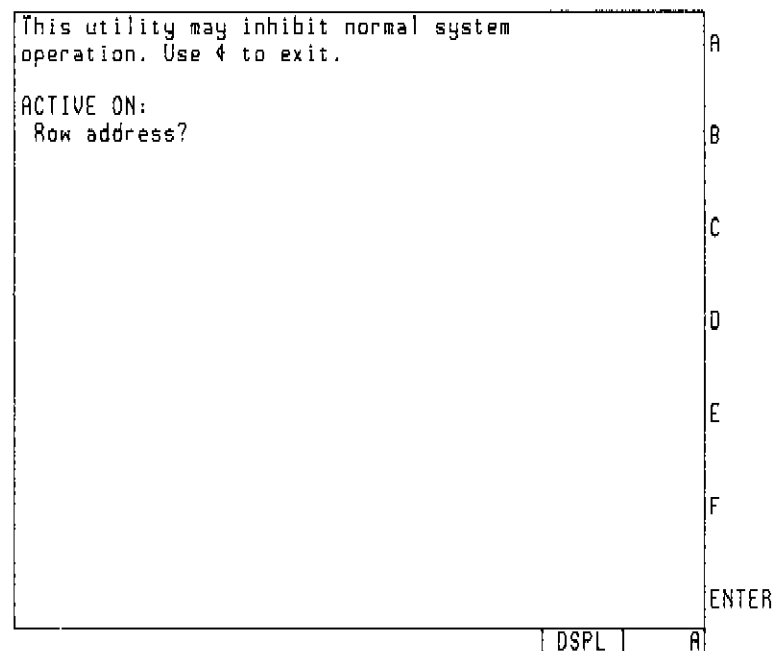


Figure 12. Alphabetical Soft Keys

Communication complete. This message indicates the HP-MSIB of the element works correctly. Note: the Active light of the module should be ON.

Module not present. This message indicates there is no element at the specified address.

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```
This utility may inhibit normal system  
operation. Use ^ to exit.  
  
ACTIVE ON:  
Row address? 4  
Column address? 5  
Module not present  
  
ACTIVE ON:  
Row address? 1  
Column address? 1C  
Communication complete  
  
ACTIVE OFF:  
Row address? 1  
Column address? 1C  
Communication complete
```

A
B
C
D
E
F
ENTER

DSPL A

Figure 13. Completed HP-MSIB Communication

NOTE

The "Module not accepting data" message is returned for a master module if one of its slaves has a faulty HP-MSIB interface. Therefore, verify that all of the slaves of a master can communicate before determining that the master is unable to communicate.

SYSTEM TROUBLESHOOTING

If none of the elements on the HP-MSIB can communicate, the mainframe HP-MSIB circuits are probably faulty, or the display instrument has a faulty HP-MSIB interface and the utility is giving erroneous results.

HP70900A LOCAL OSCILLATOR HARD RESET

When the local oscillator cannot respond to soft keys, the HP-MSIB Troubleshooting Utility, HP-IB commands, or the Address Map, it can often be made to respond with a "hard reset". A hard reset occurs when the local oscillator resets its stack pointer and rebuilds its tables.

NOTE

A hard reset erases most of HP 70900A RAM, including instrument states, calibration data, serial number data, and down-loaded functions (like System Diagnostics). A hard reset erases the same things as the ERASE command.

The following procedure causes the HP 70900A Local Oscillator to hard reset.

1. Disconnect the rear panel cables from the HP 70900A.
2. Remove the HP 70900A from the mainframe.
3. Set the NRML/TEST switch, located at the top of the HP 70900A, to the TEST position.
4. Plug the HP 70900A back into the mainframe.
5. Turn the instrument ON.

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6. Wait until the MEASURE light flashes. (If the MEASURE light does not flash after two minutes, the HP 70900A is faulty.)
7. Turn the instrument OFF.
8. Remove the HP 70900A and return the NRML/TEST switch to the NRML position.
9. Reinstall the HP 70900A in the mainframe and reconfigure the rear panel cables. (The Preparation For Use chapter, Module Removal section, shows the correct configuration of the rear panel cables.)

The HP 70900A has now done a hard reset.

FAULT DIAGNOSIS

This section contains a procedure for troubleshooting the HP 71100, 71200, and 71300 Spectrum Analyzers.

If you have not already read the Troubleshooting Tools section of this chapter, read it now.

Cycle power

If the display does not show the USER (USR) screen soft keys, press the SELECT INSTR soft key of the DISPLAY (DSP) screen. Press the USER key. If the USER (USR) screen still is not displayed, the spectrum analyzer has a diagnostic-disruptive failure. Refer to the Diagnostic-Disruptive Failures section of this chapter.

NOTE

If there is more than one spectrum analyzer on the HP-MSIB, the SELECT INSTR soft key will assign the display window to the spectrum analyzer with the lowest HP-MSIB column address. If you do not want to test this spectrum analyzer, press the UP ARROW key to select the spectrum analyzer with next highest HP-MSIB column address. In this manner you can assign the display window to any spectrum analyzer.

SYSTEM TROUBLESHOOTING

TROUBLESHOOTING FROM THE FRONT PANEL

The following procedure uses all the diagnostics of the spectrum analyzer. Before attempting to diagnose an instrument failure, you should exercise all the diagnostics to collect all possible clues as to which module is faulty.

1. Press the **DISPLAY TESTS** soft key of the **DISPLAY (DSP)** screen.
2. Press the **CONFID TEST** soft key.
3. Note if the Confidence Test passed or failed at the title line of the CRT.
 - a. If the Confidence Test failed, press the **REPORT ERRORS** soft key. Record the errors and refer to the HP 70205A or HP 70206A chapter to repair the display.
 - b. If the Confidence Test passed, proceed to step 4.
 - c. If the display shows a display disruptive error, refer to the HP 70205A or HP 70206A chapter to repair the display.
4. If you are testing an HP 71100 or 71200 Spectrum Analyzer, skip steps 8 and 9. If you are testing an HP 71300 Spectrum Analyzer, skip steps 5 through 7.
5. Connect the **CALIBRATOR** signal of the local oscillator to the **RF INPUT** of the spectrum analyzer.
6. Press the **DIAGNOSTICS** soft key of the **USER (USR)** screen. This program takes approximately 4 minutes to run.

NOTE

If there is no **DIAGNOSTICS** soft key label, or if the System Diagnostics program does not run when the **DIAGNOSTICS** soft key is pressed, refer to the Troubleshooting Tools section (System Diagnostics).

7. Record any error messages displayed in the error message block of the display.
8. Press the **ANALYZR TEST** soft key of the Special Functions screen of the **MENU (MNU)** key.
9. Record any errors written in the Error Message Block of the spectrum analyzer display window.

The Error Messages section categorizes the error messages of the spectrum analyzer and indicates which elements generate which errors. This information can be used to locate the faulty element. The faulty element can be exchanged as described in the Module Exchange section of the Preparation For Use chapter.

If no error messages were generated by the procedure and you still suspect an instrument failure, run the System Verification program to verify the spectrum analyzer meets its specifications.

The System Verification chapter contains a table of the System Verification tests. This table indicates which modules may need adjustment or repair if a specification test was not passed.

SYSTEM TROUBLESHOOTING

TROUBLESHOOTING OVER HP-IB

Troubleshooting over HP-IB is recommended only if you do not have access to an HP 70205A or 70206A display instrument.

Analyzer Test

The following spectrum analyzer remote commands can be used to run the Analyzer Test from an external HP-IB computer.

TEST begins the Analyzer Test routine of the HP 70900A.

ERR query returns the error number for each active spectrum analyzer error. These errors include both the errors reported by Analyzer Test and any User Errors.

XERR query is the same as the **ERR** query, except it also returns an ASCII description for each error and the HP-MSIB address of the module that generated each error.

The above commands and their syntax are described in the Remote Language Reference manual.

System Diagnostics

The System Diagnostics routine of the HP 71100 and 71200 Spectrum Analyzers automatically runs Analyzer Test; it also does a functional test of the analog circuits of the spectrum analyzer.

System Diagnostics can be run with an HP Series 200 Computer by using the **REM_DIAG** utility program. This program was shipped with the instrument on both the 5 1/4 and 3 1/2 inch System Diagnostics disks. The Troubleshooting Tools section of this chapter explains how to use the **REM_DIAG** program.

ERROR MESSAGES

The following pages list the spectrum analyzer error messages by category. Each category has its own series of numbers.

Types	Numbers
User Application	0001-0999
Usage	2000-4999
Hardware-Warning	6000-6999
Hardware-Broken	7000-7999
Computation	8000-8999
Display-Disruptive	not applicable

The listing for each category begins with a definition of the category.

The User Application category lists the error messages of the System Diagnostics program. Each of these messages is explained for troubleshooting.

The error messages of the Usage, Hardware-Warning, Hardware-Broken, and Computation categories are reported with the model number and HP-MSIB address of the element with the error. The model number and HP-MSIB address can be used to identify the faulty element.

SYSTEM TROUBLESHOOTING

USER APPLICATION ERROR MESSAGES

(0001-0999 numbers)

The 0001-0999 numbers have been reserved for the error messages of down-loadable user application programs. The System Diagnostics program is a down-loadable application designed by Hewlett-Packard. Its error messages are listed below.

System Diagnostics Error Messages

An asterisk (*) before an error message indicates the program stops running when it generates the indicated message. (The asterisk is not part of the error message.)

***0001 NO LO?** The program cannot find an HP 70900A at row address 0.

***0002 HP-MSIB addr 70902** The HP-MSIB address of the HP 70902A IF Section does not follow the addressing rules.

***0003 HP-MSIB addr 70903** The HP-MSIB address of the HP 70903A IF Section does not follow the addressing rules.

***0004 HP-MSIB addr 70904** The HP-MSIB address of the HP 70904A RF Section does not follow the addressing rules.

***0005 HP-MSIB addr 70905/6** The HP-MSIB address of the HP 70905A or 70906A RF Section does not follow the addressing rules.

SYSTEM TROUBLESHOOTING

- *0007 21.4MHz daisy chain** The 21.4 MHz rear-panel daisy chain cables of the IF Sections are not connected correctly.
- *0008 NO RF SECTION?** The program cannot find an RF Section module with the same column address as the HP 70900A.
- *0009 NO I.F. SECTION?** The program cannot find an IF Section with the same column address as the HP 70900A.
- *0020 21.4MHz input cable** The program cannot find the rear-panel 21.4 MHz input signal for the HP 70902A IF Section.
- *0021 Video output cable** The rear-panel VIDEO OUT signal from the HP 70902A IF Section is not getting to the VIDEO input of the HP 70900A or 70903A.
- 0022 LC bandwidths** The signal amplitude of the HP 70902A is too low when it is set to the LC bandwidths (10 to 300 kHz).
- 0023 CRYSTAL bandwidths** The signal amplitude of the HP 70902A is too low when it is set to the crystal bandwidths (10 Hz to 3 kHz).
- 0024 Problem/ampl low?** The signal amplitude of the HP 70902A is too low in both the LC and Xtal bandwidths. The program stops testing the HP 70902A when this error is generated.
- 0025 Step gain amplifier** One or more of the step gain amplifiers of the HP 70902A IF Section does not have the correct gain.
- 0026 Res BW-accuracy** One or more of the HP 70902A resolution bandwidths are not the correct value.
- 0027 Res BW-amplitude** The amplitude variation between the HP 70902A resolution bandwidths is too large.

SYSTEM TROUBLESHOOTING

0028 Calibration atten One or more of the calibration attenuators of the HP 70902A are not functioning correctly.

0029 Log amplifier The log amplifier of the HP 70902A is not functioning correctly.

***0030 21.4MHz input cable** The program cannot find the rear-panel 21.4 MHz input signal for the HP 70903A IF Section.

***0031 Video output cable** The rear-panel VIDEO OUT signal of the HP 70903A IF Section is not getting to the HP 70900A VIDEO input.

0032 LC board Signal amplitude is too low on the LC Board of the HP 70903A IF Section.

0033 Log board Signal amplitude is too low on the Log Board of the HP 70903A IF Section.

0034 Problem/ampl low? The signal amplitude of the HP 70903A internal 21.4 MHz IF is too low. The program stops testing the HP 70903A when this error is generated.

0035 Step gain amplifier The step gain amplifier of the HP 70903A IF Section does not have the correct gain.

0036 Res BW-accuracy One or more of the HP 70903A resolution bandwidths are not the correct value.

0037 Res BW-amplitude The amplitude variation between the HP 70903A resolution bandwidths is too large.

0038 Calibration atten One or more of the calibration attenuators of the HP 70903A IF Section are not functioning correctly.

0039 Log amplifier The log amplifier of the HP 70903A is not functioning correctly.

SYSTEM TROUBLESHOOTING

***0040 Problem/LO cable?** The program cannot find the rear-panel LO signal in the RF Section.

***0041 300MHz input cable?** The program cannot find the rear-panel 300 MHz input signal in the RF Section.

***0042 Cal/I.F. cables?** The front-panel CALIBRATOR output of the HP 70900A is not connected to the RF INPUT of the RF Section (a prerequisite for running the program); or, the rear-panel 21.4 MHz output of the RF Section is not connected to the IF Section.

***0043 Problem/ampl low?** The signal amplitude of the RF Section is too low. The program stops testing the RF Section when this error is generated.

0044 Low/high band switch The low/high band switch of the HP 70905A or HP 70906A RF Section is not functioning correctly.

0045 RF attenuator The RF attenuator of the RF Section is not functioning correctly.

SYSTEM TROUBLESHOOTING

USAGE ERRORS

(2000 numbers)

These errors are generated when the spectrum analyzer is used incorrectly. They are usually generated during remote operation. The Operating Manual explains the correct manual and remote operation of the spectrum analyzer. The Remote Language Reference explains the correct syntax for the spectrum analyzer remote commands.

2000 No errors

2001 Illegal command (or Illegal cmd)

2002 Illegal parameter

2003 Missing parameter

2004 Illegal character

2005 Illegal character set

2006 Parm out of range (Parameter out of range)

2007 Missing terminator

2009 Protocol error

2010 Cmd out of sequence (Command out of sequence)

2011 Memory overflow

2013 Item not found

2014 Duplicate identifier

SYSTEM TROUBLESHOOTING

- 2015 Too many user defs (Too many user definitions)
- 2016 Label too long
- 2018 State protected
- 2019 Illegal marker type
- 2020 No active marker
- 2021 Bad IF/ENDIF nesting
- 2022 REPEAT/UNTIL error
- 2023 Illegal Cal signal (Illegal calibration signal)
- 2024 Illegal HP-MSIB comm (Illegal HP-MSIB communication)
- 2025 System error (slave)
- 2026 Check mixer bias
- 2028 Idler is unlocked
- 2029 Command syntax error
- 2030 Scaling overflow
- 2031 Too many errors
- 2032 Hardware not present
- 2033 Single band only
- 2034 Test switch on
- 2035 Illegal operation
- 2036 HP-IB multiple cntlr (HP-IB multiple controllers)

SYSTEM TROUBLESHOOTING

2037 No HP-IB instr resp (No HP-IB instrument response)

2038 Span+trace too large

2039 User stack overflow

2040 Partial USTATE data

HARDWARE-WARNING ERROR MESSAGES

(6000 numbers)

These error messages indicate the hardware of the spectrum analyzer is **probably** broken. The spectrum analyzer can still make measurements—but the accuracy of the measurement is uncertain.

6000 EAROM unprotected

6001 Confidence test passed

6002 A6 RAM check sum

6003 FFS won't tune low (Fractional frequency source will not tune low)

6004 FFS won't tune high (Fractional frequency source will not tune high)

6005 Idler tuning range

6006 YTO tuning range (YIG-tuned oscillator tuning range)

6007 HP-MSIB NMAA rec'd (HP-MSIB "no module at address" received)

6008 Confidence test failed

6009 No module label

6010 Err in MDOC response (Error in module output capabilities response)

6011 RBW hardware error (Resolution bandwidth hardware error)

SYSTEM TROUBLESHOOTING

6012 Gain hardware error

6013 LOGAMP hardware error

HARDWARE-BROKEN ERROR MESSAGES

(7000 numbers)

Hardware-broken error messages indicate faulty spectrum analyzer hardware.

7000 ROM Check error

7001 LO unleveled

7002 First LO unleveled

7003 Second LO unlocked

7004 300 MHz error

7005 321.4 MHz error

7006 21.4 MHz error

7007 Cal error (Calibration error)

7008 FFS handshake (Fractional frequency source handshake)

7010 FFS is unlocked (Fractional frequency source is unlocked)

7011 125 Kz to FFS (125 kHz to fractional frequency source)

7012 Cannot lock YTO (Cannot lock YIG-tuned oscillator)

7013 Can't finetune YTO (Cannot finetune YIG-tuned oscillator)

SYSTEM TROUBLESHOOTING

- 7014 12.5 Mz to YTO LK BD (12.5 MHz to YIG-tuned oscillator lock board)
- 7015 YTO unlevelled (YIG-tuned oscillator unlevelled)
- 7016 YTO is unlocked (YIG-tuned oscillator is unlocked)
- 7017 External ref (100 MHz) (External reference (100 MHz))
- 7018 50 Mz to sampler (50 MHz to sampler)
- 7019 300 Mz post filtr det (300 MHz post filter detector)
- 7020 300 Mz AGC (300 MHz automatic gain control)
- 7021 600 Mz doubler level (600 MHz doubler level)
- 7022 Low idler range
- 7023 High idler range
- 7024 Tune DAC (Tune digital to analog converter)
- 7025 Decade span atten (Decade spanwidth attenuator)
- 7026 Binary span atten (Binary spanwidth attenuator)
- 7027 Sweep dac (Sweep digital to analog converter)
- 7028 Correction dac (Correction digital to analog converter)
- 7029 Video proc: 0 volt (Video processor: 0 volt)
- 7030 Video proc: 2 volt (Video processor: 2 volt)
- 7031 Idler is unlocked
- 7036 HP-MSIB error

SYSTEM TROUBLESHOOTING

7037 A3 char ROM (A3 character ROM)

7038 (A6) error in 8041 (A6, error in 8041 processor)

7039 A4 memory

7040 A3 dot gen (A3 dot generator)

7041 FFS won't tune low (Fractional frequency source will not tune low)

7042 FFS won't tune high (Fractional frequency source will not tune high)

7043 Freq board adjust (Frequency board adjust)

7044 YTO tuning range (YIG-tuned oscillator tuning range)

7046 Illegal bandslct cde (Illegal bandselect code)

7047 RAM failure

SYSTEM TROUBLESHOOTING

COMPUTATION ERRORS

(8000 numbers)

The spectrum analyzer generates computation errors if it has been asked to perform an illegal math operation.

8000 Divide by zero

8001 Float pt overflow (Floating point overflow)

8002 Log of zero

8003 Log of negative

8004 Integer overflow

8005 Square root error

8006 Modulus of zero

DISPLAY-DISRUPTIVE ERROR MESSAGES

For The HP 70205A and 70206A

These error messages indicate faulty hardware in the display instrument (HP 70205A or 70206A). They are called display-disruptive error messages because the normal CRT display is blanked except for the error message. These error messages are written in large, block letters.

The display instrument uses a display-disruptive error message for error conditions that would interfere with a normal display, and thus normal error reporting. The HP 70205A and 70206A appendices contain recommended repair procedures for these error conditions.

A3 SERIAL INTERFACE

- A3 MEMORY READ
- A3 MEMORY WRITE
- A3 MEMORY R/W
- A3 MEMORY ADDRESS
- A3 CHAR ROM
- A3 RETURN FAILED
- A3 MARK FAILED
- A3 ??? FAILED
- A3 WRONG DATECODE
- A3 CHAR ROM

A4 PIXEL RAM

A6 8041 INTERFACE TEST

- A6 68000: BUS ERR
- A6 68000: ADDR ERR
- A6 68000: ILLEGAL
- A6 68000: ZERO DIV
- A6 68000: CHECK
- A6 68000: TRAPV

SYSTEM TROUBLESHOOTING

A6 68000: PRIV VIO

A6 68000: TRACE

A6 68000: 1010

A6 68000: 1111

A6 68000: RESERVED

A6 68000: UNINIT

A6 68000: SPURIOUS

A6 ROM ___ CHECKSUM (The ___ will be a 1, 2,
and/or 3)

A6 RAM ADDRESS ERROR

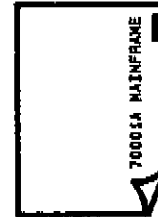
A6 RAM DATA ERROR (U37)

A6 RAM DATA ERROR (U38)

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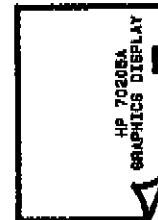
HP 70001A MAINFRAME

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HP 70206A SYSTEMS GRAPHICS DISPLAY

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APPENDIX--HP 70001A

This appendix provides both the troubleshooting and repair information for the HP 70001A System Mainframe. The troubleshooting suggestions are given to assist you in isolating a fault. Following this fault isolation section are assembly removal procedures.

WARNING

The Power Supply Board has lethal voltages, with lethal currents, in ALL areas. ALWAYS remove the power cord before servicing. NEVER service with power on; observe the HIGH VOLTAGE indicator light on the board (see Assembly Repair, Figure 3).

WARNING

The HIGH VOLTAGE Light indicates that the primary filter capacitors are still charged to more than 80 volts. Wait 2 minutes or more for capacitors to discharge fully. Use extreme care when servicing the power supply board—dangerous voltages can exist on the board EVEN when the power is OFF.

MAINFRAME FAULT ISOLATION

There are four electronic assemblies in the mainframe: the power supply, MS-IB, HP-IB, and Interconnect boards. To isolate faults to an assembly, follow this troubleshooting guide.

POWER SUPPLY FAULT ISOLATION

When turning the HP 70001A System Mainframe ON (1), check for the following:

1. Listen for fan noise to determine if the fan is running, and observe the Airflow indicator. Note that the Airflow indicator is normally ON during the instrument warm-up period.
2. Observe the front-panel indicators: Current Limit, Volt/Temp, Airflow, and I/O. The following guide indicates fault conditions related to these indicators.

No Observed power, No Front Panel Lights

1. Check AC line supply, check fuse in AC line socket (see instructions in Preparation For Use).
2. Check power supply fuse F2. See bottom cover removal and Figure 3 in Assembly Repair.
3. Replace Mainframe Power Supply, follow instructions in Assembly Repair.

No observed power, ON light is ON

1. Check power supply bias fuse F1, see bottom cover removal instructions in Assembly Repair.

2. Replace Mainframe Power Supply, follow instructions in Assembly Repair.

Volt/Temp Light ON

1. AC input voltage low. Check that the Line Range Switch setting, on the bottom of the instrument, matches the AC line voltage supplied.
2. Internal temperature on the mainframe power supply board exceeds 70° to 75°C. The instrument will attempt self restart if temperature decreases to normal operating range.

NOTE

This does not necessarily indicate an instrument fault, since the instrument could be operating in high temperature conditions.

Verify the cooling fans are operating properly by checking for airflow into BOTH sections of the rear casting. See Figure 1, Assembly Repair.

3. Output voltage exceeds more than 30 percent over-voltage. The instrument is latched in a fault condition, it will not attempt to restart. Attempt to restart by cycling AC LINE power.
4. Check power supply fuse F3. If power supply fuse F3 is open, the instrument is latched in a fault condition, it will not attempt to restart. Replace fuse (see Assembly Repair, Power Supply Board Removal, and Figure 3).

APPENDIX, HP 70001A

5. If light is still on after performing above procedures, replace power supply board (see instructions in Assembly Repair).

CURRENT Light ON

1. Power supply senses too much load at the voltage regulator. Remove all modules and see if the power supply will start. If it does not start, replace the modules one by one; cycle AC line power each time to isolate faulty module. See instructions in the Preparation For Use section for module removal/replacement.
2. Remove flex-cable from power supply board connector J2. Attempt to restart the instrument. See instructions in Assembly Repair.
3. If instrument does not start, reconnect flex-cable to connector J2. Replace the HP-MSIB board. Attempt to restart instrument.
4. If the instrument does not start, exchange the interconnect board. Attempt to restart.

AIRFLOW Light ON

NOTE

This is a normal indication at start. The light should go out within five minutes.

1. Check back of instrument to see if fan intakes are blocked (see Assembly Repair, Figure 1).
2. Visually check inside air intakes to see if blocked.
3. Verify (by feel) that air is flowing into each fan intake. If both fans are operating, this could signal front-panel

indicator failure. If one fan is not working, replace fan. See Assembly Repair.

4. Check front-panel error indicators on the modules (ERR). If the ERR indicators are not flashing, this indicates that the HP-MSIB circuit is working. Since this circuit shares fuse F3 with the fan circuit, both fans could be dead, or the fan circuit could be faulty. Replace fans as instructed in Assembly Repair.

NOTE

If light is still on after performing above checks, replace power supply board.

I/O CHECK LIGHT ON

1. Other mainframes in error status. Disconnect other HP-MSIB instruments from the bus.
2. HP-MSIB cable connections incorrect. Check for proper HP-MSIB cable connections (if one cable is disconnected, the I/O light will be on; if both cables are disconnected, the I/O light will remain off).
3. Faulty HP-MSIB cables. Disconnect HP-MSIB cables. If error is eliminated, change cables.
4. Visually inspect HP-MSIB connectors (Hughes Connectors). If damaged, replace interconnect board. See Assembly Repair.
5. HP-MSIB board or Interconnect board fault. First, exchange the HP-MSIB board. If fault is not corrected,

APPENDIX, HP 70001A

exchange the interconnect board. See Assembly Repair for instructions.

ERR lights flashing

1. HP-MSIB in reset mode. Remove service cover on back panel (see Assembly Repair, Figure 1). Look through service port and observe Red LED.
 - a. If the red LED is on, change Mainframe Power Supply board as described under Assembly Repair.
 - b. If the red LED is off, with the ERR light on the front panel of the modules flashing, change the HP-MSIB board as described under Assembly Repair.

OTHER FAULTS

At start HP-MSIB fails

Remove modules, one at a time, and restart each time to isolate faulty module.

Display Freezes

First, cycle power. If display freezes again, remove modules one by one and cycle power each time to isolate faulty module.

ASSEMBLY REPAIR

POWER SUPPLY/FANS/LINE SOCKET

WARNING

The Power Supply Board has lethal voltages, with lethal currents, in ALL areas. NEVER service this board with power on; observe the HIGH VOLTAGE indicator light on the board (see Assembly Repair, Figure 3). Use extreme care when servicing the power supply board—dangerous voltages can exist on the board EVEN when the power is OFF.

WARNING

The HIGH VOLTAGE indicator shows that the primary filter capacitors are still charged to more than 80 volts. Wait 2 minutes or more after the HIGH VOLTAGE indicator turns off for capacitors to discharge fully.

Power Supply/Bottom Cover Removal

(To replace the power supply board, reverse the above procedure.)

CAUTION

The power supply board and the fans are attached to the bottom cover, with a combined weight of approximately 15 pounds.

1. Remove the AC power cord.
2. Put the LINE switch in out position. To avoid damage the LINE switch must remain in the out position during board removal or replacement.
3. Turn mainframe cabinet over and remove four bottom feet (lift TAB and slide). Loosen and remove 12 bottom screws as illustrated in Figure 2.
4. Lift power supply/bottom cover assembly.

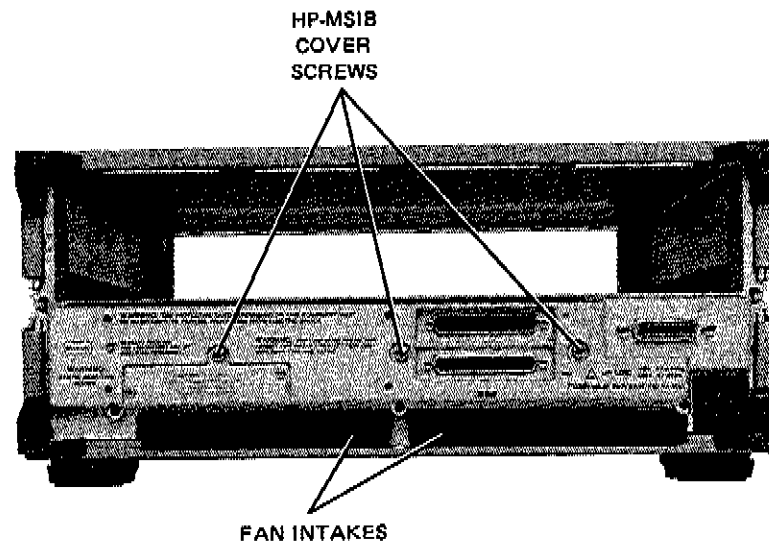


Figure 1. HP 70001A Mainframe Rear View

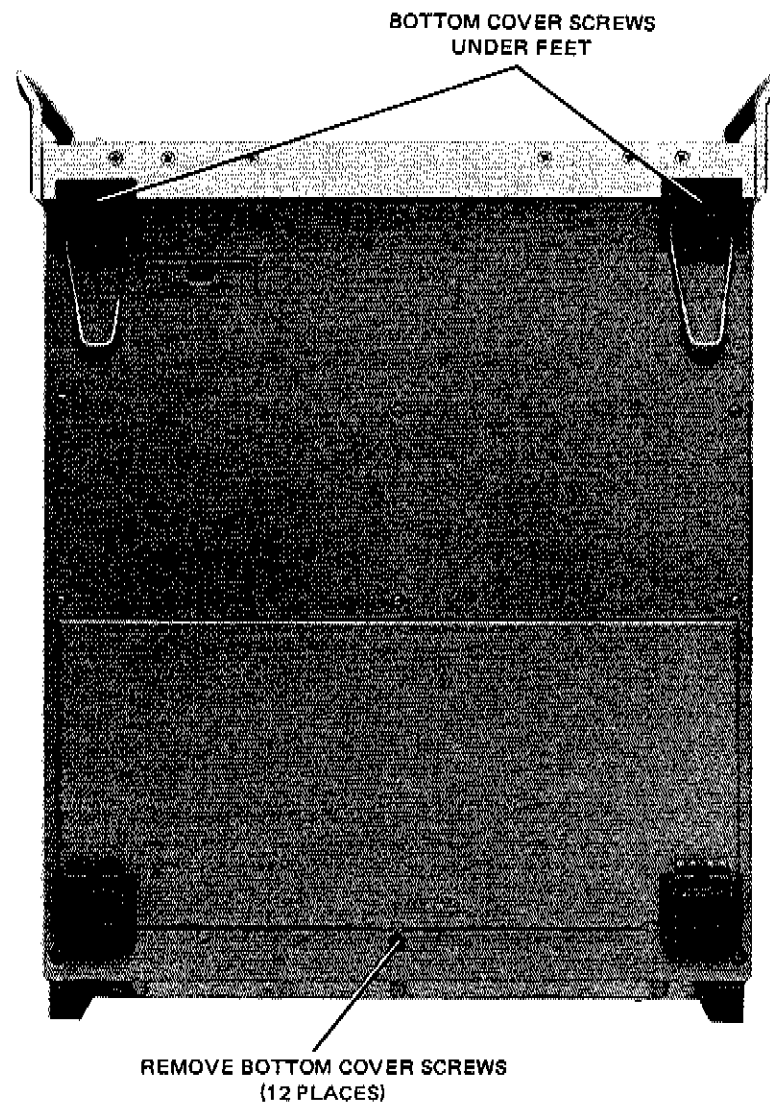


Figure 2. HP 70001A Mainframe Bottom View

APPENDIX, HP 70001A

5. Remove the following connectors (see Figure 3):

AC Line Input from connector J1
Ribbon Cable from connector J2
Fan power cables from connectors J3 and J4

6. Remove the six stand-offs used to hold board to bottom cover.
7. Lift board from bottom cover.

Fan Removal

(To replace a fan, reverse the following procedure.)

1. Turn instrument OFF (0).
2. Remove the bottom cover.
3. Remove the fan connector from connector J3 or J4 (corresponding to fan being removed (see Figure 3)).
4. Remove the fan screws as indicated in Figure 3.
5. Remove the fan.

AC Line Socket Removal

(To replace an AC Line Socket, reverse the following procedure. Be careful to re-attach grounding lugs as shipped from the factory.)

1. Turn instrument OFF (0) and remove power cord.
2. Remove the bottom cover.
3. Remove the AC Line cable from the power supply board AC input connector, see Figure 3.
4. Loosen screw holding AC line socket, and remove socket.

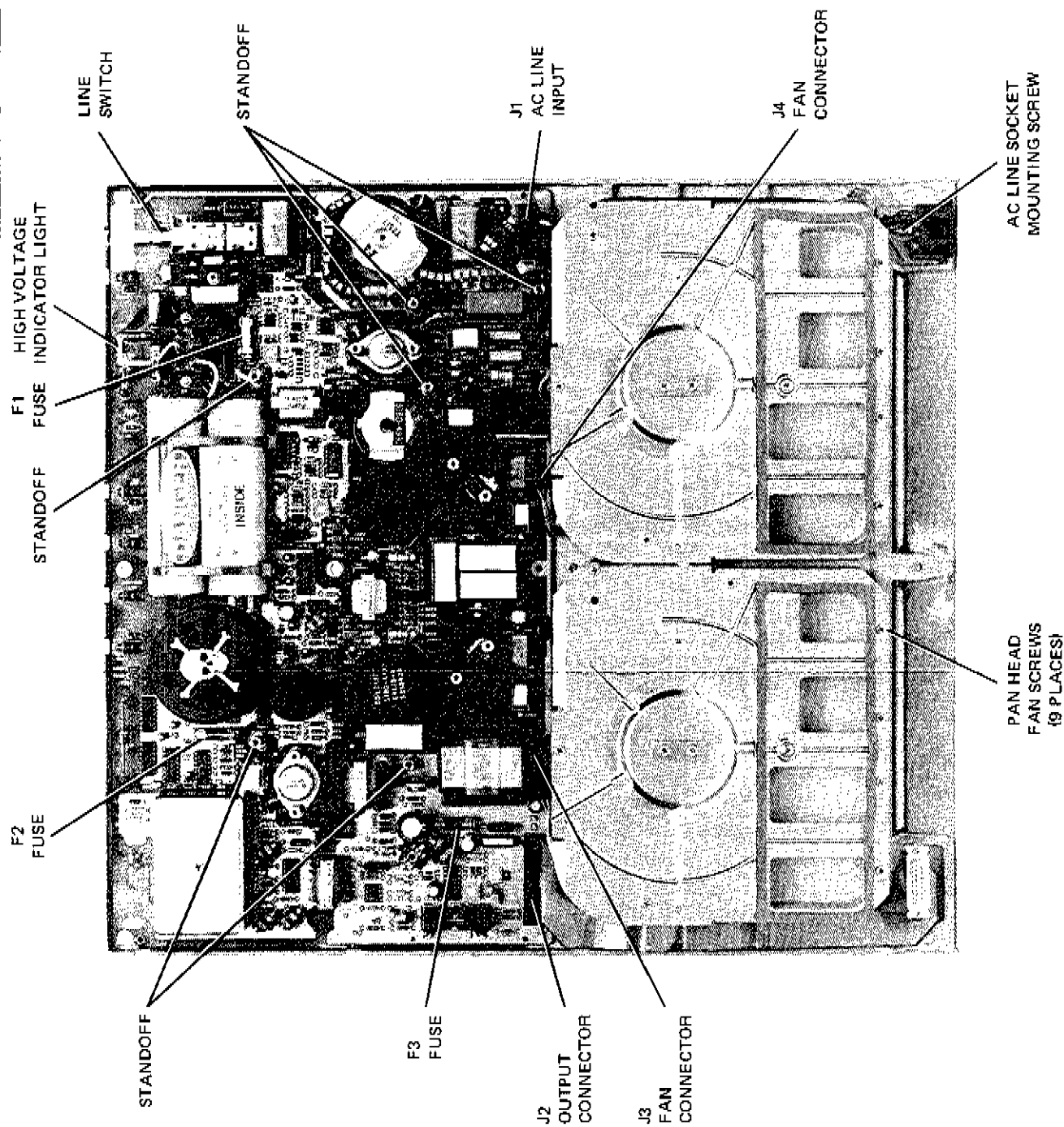


Figure 3. HP 70001A Power Supply Board and Fans

HP-IB/HP-MSIB BOARDS

Rear Cover Removal

1. Turn instrument OFF (0).
2. Loosen three screws in HP-MSIB cover (see Figure 1) and remove cover.

CAUTION

To avoid damage when replacing the 3 HP-MSIB cover screws (Figure 1) **DO NOT TIGHTEN MORE THAN 6 INCH LBS.**

HP-MSIB Board Removal

(To replace HP-MSIB board, reverse the following procedure.)

1. Turn instrument OFF (0).
2. Remove the HP-MSIB cover.
3. The HP-MSIB board is attached to the HP-MSIB cover. Remove the three screws and the four nuts. (The nuts around the HP-MSIB connectors are M5.5, the connectors on the back side are M5. See Figure 4.)
4. Lift board from cover.

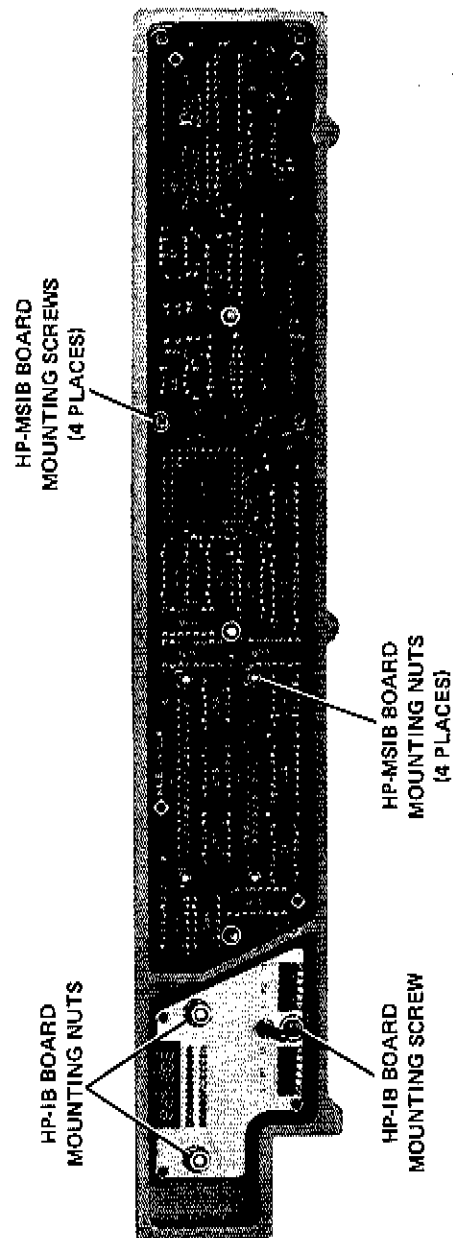


Figure 4. HP-IB and HP-MSIB Boards

HP-IB Board Removal

(To replace the HP-IB board, reverse the following procedure.)

1. Turn instrument OFF (0).
2. Remove the HP-MSIB Cover.
3. Remove the two nuts (nuts and connector are both M7) and lift HP-IB board off cover. See Figure 4.

INTERCONNECT BOARD

Inner Cover and RFI Gasket Removal

1. Remove the rear cover as described above.
2. Loosen three large screws, Screws A, on interconnect cover. (Loosen these screws only until they slide freely in the cover, do not remove from the cover. See Figure 5).
3. Remove three screws, Screws B, on interconnect cover.
4. Remove 8 screws, Screws C, on interconnect cover.
5. Lift cover off housing, carefully remove RFI gasketing (if undamaged, this is reusable).

NOTE

Do not remove screws at the bottom left of board. These are to secure the support bracket for the board connector. The board connector may be damaged if the bracketed screws are removed.

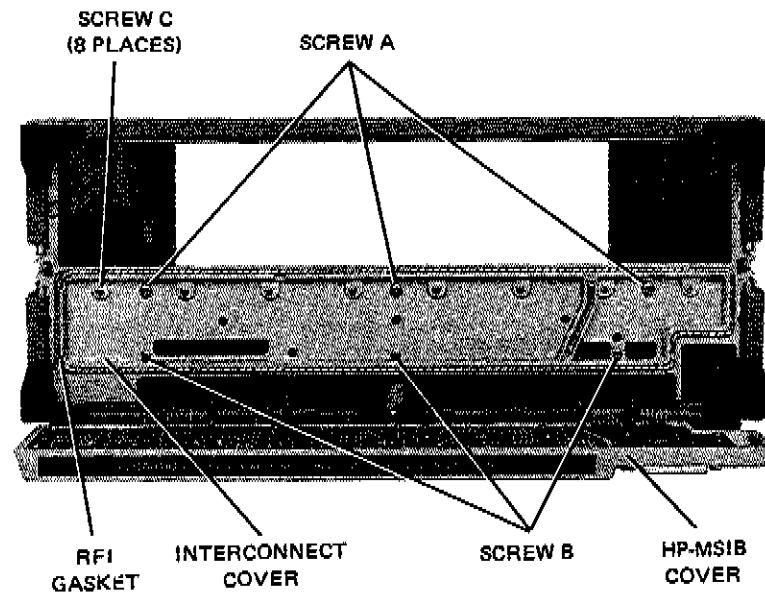


Figure 5. Interconnect Cover Removal

Inner Cover and RFI Gasket Replacement

1. Place interconnect cover onto mainframe and insert three screws (Screws A on Figure 5).
2. Insert RFI gasket between cover and mainframe.
3. Install remaining screws—Screws B then Screws C.
4. Tighten all screws.

Interconnect Board Removal

(To replace the Interconnect Board reverse the following procedure.)

1. Remove modules (see instructions in Preparation For Use).
2. Remove bottom cover.
3. Remove HP-MSIB and interconnect covers.
4. Remove Interconnect Board.

MECHANICAL ASSEMBLIES

Module Latch Screw Removal.

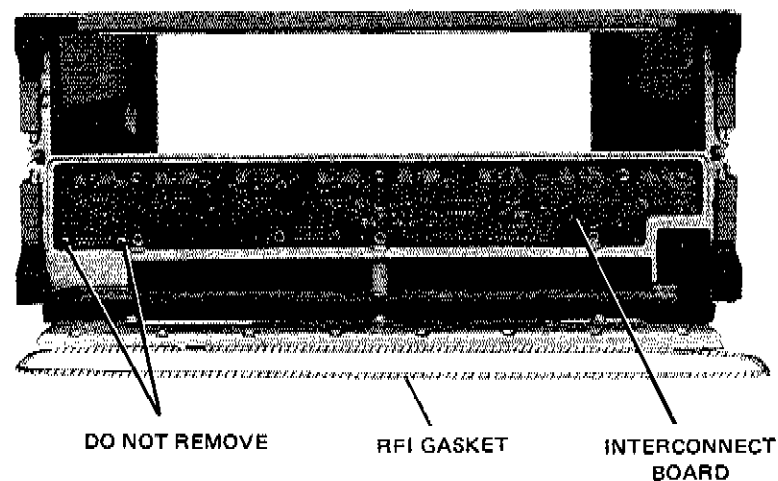


Figure 6. Interconnect Board Removal

APPENDIX, HP 70001A

(To replace the Module Latch Screw, reverse the following procedure.)

1. Remove modules from Mainframe (see instructions in Preparation For Use).
2. Remove two screws retaining Module Latch Screw assembly (refer to Figure 7).
3. Lift Module Latch Screw assembly from Mainframe.

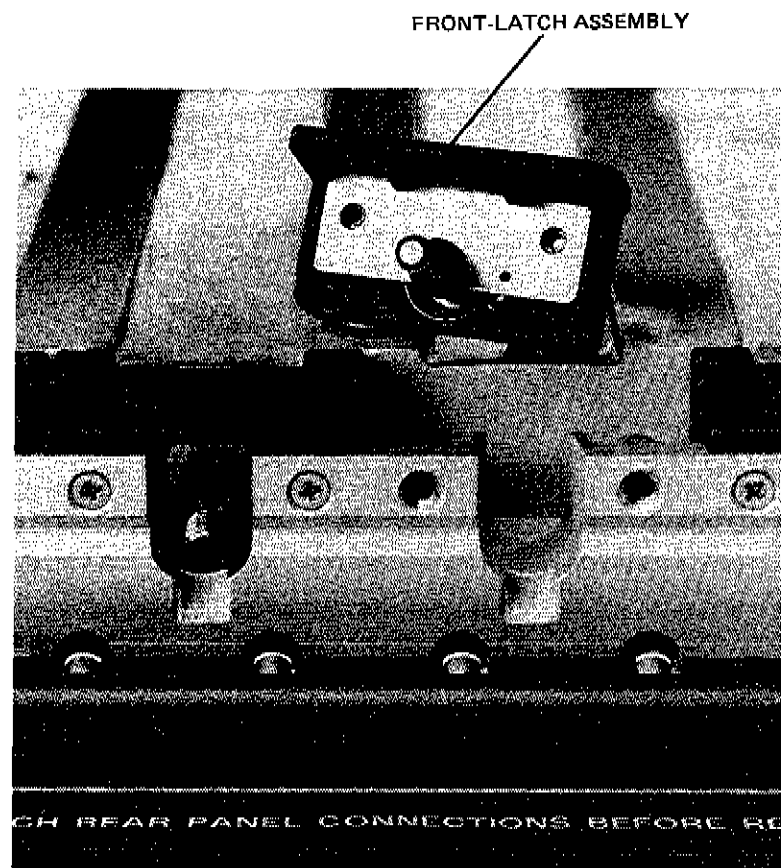


Figure 7. Module Latch Screw Assembly

APPENDIX, HP 70001A

TABLE 1. HP 70001A MAINFRAME REPLACEABLE PARTS (1 of 3)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
ELECTRICAL ASSEMBLIES				
A1	70001-60052	1	1	POWER SUPPLY ASSEMBLY (NEW)
A1	70001-60022	8	1	POWER SUPPLY ASSEMBLY (REBUILT)
A1F1	2110-0710	2	1	FUSE 2A 250V NTD IEC
A1F2	2110-0700	4	1	FUSE 1A 250V NTD IEC
A1F3	2110-0701	5	1	FUSE 1.6A 250V NTD IEC
	0380-1708	1	8	STANDOFF-HEX 16-MM-LG M3.0X0.5-THD
A2	—	—	1	INTERCONNECT BOARD ASSEMBLY
A2	70001-60002	8	1	INTERCONNECT BOARD ASSEMBLY KIT (NEW) (Includes new A2 Assembly and RFI Gasket)
A2	70001-60023	7	1	INTERCONNECT BOARD ASSEMBLY KIT (REBUILT) (Includes rebuilt A2 Assembly and RFI Gasket)
	70001-20024	4	8	CONNECTOR SUPPORT STANDOFF
A3	70001-60003	3	1	HP-IB BOARD ASSEMBLY
	0535-0006	1	2	NUT-HEX DBL-CHAM M4X0.7 3.2MM-THK
	2190-0588	2	2	WASHER-LK HLCL 4.0MM 4.1-MM-ID
	70001-20023	3	2	SCREW-HP-IB CONNECTOR MOUNTING
	0515-0888	3	1	SCREW-MACH M3X0.5 6MM-LG PAN-HD
A4	—	—	1	HP-MSIB BOARD ASSEMBLY
A4	70001-60049	0	1	HP-MSIB BOARD ASSEMBLY KIT (NEW) (Includes new A4 Assembly and RFI Gasket)
A4	70001-60025	9	1	HP-MSIB BOARD ASSEMBLY KIT (REBUILT) (Includes rebuilt A4 Assembly and RFI Gasket)
	0515-0888	3	4	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	70001-20022	2	4	HP-MSIB CONNECTOR MOUNTING SCREW
B1	70001-60009	9	2	FAN ASSEMBLY
B2	70001-60009	9		FAN ASSEMBLY (FAN ASSEMBLY includes fan, mounted in steel panel, with attached gasket. Does not include mounting screws.)
	0515-0888	3	18	SCREW-MACH M3X0.5 6MM-LG PAN-HD
A5	70001-60011	3	1	CABLE ASSEMBLY-AC RECEPTACLE
A5F1	2110-0703	7	1	FUSE 6.3A 250V NTD IEC
	0535-0025	3	1	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	0535-0025	8	2	NUT-HEX DBL-CHAM M3X0.5 2.4MM-THK
	2190-0584	1	2	WASHER-LK HLCL 3.0MM 3.1-MM-ID
W1	70001-60047	5	1	POWER SUPPLY FLEXIBLE CABLE
	0515-0888	5	2	SCREW-MACH M2X0.4 6MM-LG PAN-HD

APPENDIX, HP 70001A

TABLE 1. HP 70001A MAINFRAME REPLACEABLE PARTS (2 of 3)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
FRONT FRAME/DOOR MECHANICAL PARTS				
	70001-20033	5	1	SHAFT-DOOR LOCK
	70001-40009	2	5	LIGHT PIPE
	70001-40008	6	1	HOLDER-LIGHT PIPE
	0535-0042	0	1	NUT-HEX PLSTC-LKG M3X0.5 4MM-THK
	3050-0891	1	1	WASHER-FL MTLC 3.0MM 3.3-MM-ID
	70001-40007	9	1	BEARING BLOCK-LEFT
	70001-40006	4	1	BEARING BLOCK-RIGHT
	0515-1129	4	6	SCREW-MACH M4X0.7 16MM-LG 90-DEG-FLH
	70001-20011	8	1	CASTING-FRONT DOOR
	0535-0042	5	6	NUT-HEX PLSTC-LKG M3X0.5 4MM-THK
	3050-0891	7	6	WASHER-FL MTLC 3.0MM 3.3-MM-ID
	70001-00025	3	1	DRESS PANEL-FRONT RIGHT
	70001-00026	4	1	DRESS PANEL-FRONT LEFT
	0535-0042	5	6	NUT-HEX PLSTC-LKG M3X0.5 4MM-THK
	3050-0891	7	6	WASHER-FL MTLC 3.0MM 3.3MM-ID
	70001-00013	9	1	DRESS PANEL-BOTTOM
	70001-00017	3	1	GROUND SPRING-LEFT
	70001-00018	4	1	GROUND SPRING-RIGHT
	70001-40011	1	1	MOUNTING BLOCK-LABEL (LEFT)
	70001-40010	0	1	MOUNTING BLOCK-LABEL (RIGHT)
	0515-1238	9	6	SCREW-MACH M3X0.5 14MM-LG
	70001-80005	7	1	SYSTEM NAMEPLATE
	0570-1290	1	1	PLUNGER-METRIC BALL 3.20 MM DIA; M6 X
	70001-00019	5	1	SPRING-SWITCH SHAFT LOCKING
	70001-20034	6	1	SHAFT-SWITCH
	70001-40005	3	1	KNOB-ON/OFF
	70001-40012	2	2	DETENT-FRONT DOOR
	0515-1231	4	2	SCREW-THD-RLG M3X0.5 10MM-LG PAN-HD
	70001-80001	3	1	LABEL-CABLE REMOVAL CAUTION
	70001-80009	1	1	LABEL- SERIAL PLATE
	70001-80010	2	8	FRONT LATCH ASSEMBLY
	0515-1127	7	16	SCREW-MACH M3X0.5 25MM-LG 90-DEG-FLH

APPENDIX, HP 70001A

TABLE 1. HP 70001A MAINFRAME REPLACEABLE PARTS (3 of 3)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
CHASSIS/REAR FRAME PARTS				
	70001-20012	0	1	CASTING-H-FRAME
	70001-00007	1	1	INSULATOR H-FRAME
	70001-20020	0	8	AIRSEAL SPRING
	70001-40004	2	8	SEAL-AIR MOD/MF
	70001-20026	6	8	PIN-GUIDE
	0590-0849	4	8	NUT-HEX DBL-CHAM M5X0.8 2.5MM-THK
	3050-0894	0	8	WASHER-FL MTLIC 5.0MM 5.4-MM-ID
	70001-20006	9	1	FRONT FRAME CASTING
	0515-1238	1	4	SCREW-SKT-HD-CAP M5X0.8 20MM-LG
	70001-20041	5	4	NUT M5 RECT
	70001-20013	1	1	CASTING-FRONT TOP RAIL
	0515-0886	3	2	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	70001-20007	3	1	CASTING-REAR FRAME
	0515-1238	1	4	SCREW-SKT-HD-CAP M5X0.8 20MM-LG
	70001-20041	5	4	NUT M5 RECT
	70001-20010	8	1	CASTING-TOP RAIL REAR
	0515-0885	2	2	SCREW-MACH M4X0.7 8MM-LG PAN-HD
	70001-00024	2	8	GROUNDING SPRING-REAR FRAME
	70001-40003	1	8	SNUBBER-RUBBER
	70001-00002	1	1	COVER-BOTTOM
	0515-0886	3	3	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	70001-20014	2	1	CASTING-BOTTOM COVER
	0515-1059	4	12	SCREW-MACH M3X0.5 5MM-LG PAN-HD
	3050-0105	6	12	WASHER-FL MTLIC NO. 4 .125-IN-ID
	70001-00006	0	1	INSULATOR-BOTTOM COVER
	70001-20008	4	1	INTERCONNECT CASTING
	0515-0894	3	8	SCREW-MACH M2.5X0.45 8MM-LG PAN-HD
	0515-0110	6	3	SCREW-MACH M3X0.5 12MM-LG PAN-HD
	70001-20009	5	1	COVER-HP-MSIB CASTING
	70001-20025	5	3	SCREW-HP-MSIB COVER MOUNTING
	70001-20015	3	1	COVER-HP-MSIB INSPECTION
	7120-4627	8	1	LABEL-INSPECTION PLATE WARNING
	70001-80001	3	1	LABEL-CABLE REMOVAL CAUTION
	0515-0886	3	2	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	8160-0484	2	1	RFI GASKET 0.125IN DIA
	8160-0485	3	1	RFI GASKET 0.063IN DIA
DRESS COVERS/TRIM/FEET				
	70001-00001	5	1	COVER-TOP
	70001-00021	9	1	TRIM STRIP-LEFT
	0515-0886	3	5	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	70001-00022	0	1	TRIM STRIP-RIGHT
	0515-0880	9	5	SCREW-MACH M3X0.5 6MM-LG 90-DEG-FLH-HD
	5040-7202	9	1	TRIM-FRONT FRAME TOP
	5060-8804	3	2	STRAP-SIDE HANDLE ASSEMBLY
	5060-9900	0	2	FRONT HANDLE ASSEMBLY
	5020-8897	8	2	TRIM-HANDLE FRONT
	70001-40001	9	2	CAP-HANDLE STRAP FRONT
	70001-40002	0	2	CAP-HANDLE STRAP REAR
	0515-1072	1	4	SCREW-MACH M5X0.8 14 MM-LG FH
	0535-0022	1	2	NUT-HEX DBL-CHAM M5X0.8 4.5MM-THK
	70001-40018	8	2	FOOT-REAR LEFT
	70001-40019	8	2	FOOT-REAR RIGHT
	0515-1115	3	4	SCREW-MACH M4X0.7 12MM-LG PAN-HD
	0900-0010	2	4	O-RING .101-IN-ID 0.7-IN-XSECT-DIA NTRL
	5040-7201	8	4	FOOT-BOTTOM COVER
	1460-1345	5	2	SPRING-WIREFORM INSTRUMENT STAND
	0470-0010	8	1	ADHESIVE LOCTITE 496/PERMABOND #10
	0470-1302	4	1	SEALANT PACER TECH TLC 22 CYNACR-ETM 1P

APPENDIX--HP 70205A

This appendix provides the troubleshooting suggestions, repair information, and adjustment procedures for the HP 70205A Graphics Display. The troubleshooting suggestions are based on the internal diagnostics as explained in System Troubleshooting. Following these suggestions are assembly removal and replacement procedures. The final section contains the adjustments that may be required after replacing some of the assemblies or the CRT.

NOTE

This troubleshooting information is for this specific module. If you have not already done so, it is recommended that you refer to the Systems Troubleshooting chapter before proceeding.

HP 70205A TROUBLESHOOTING

Faults with the Graphics Display are indicated in two ways: one is by error messages on the CRT, and the other is by a series of LEDs on the circuit boards. In this section, the interpretations of all fault indicators will be limited to the board level.

ERROR MESSAGES

If the error can be repeated, and on more than one instrument, call your nearest Hewlett-Packard field office.

If the power is recycled and the instrument does not restart, or if the error is repeatable only on one instrument, follow the procedures as described below. After each step, attempt to restart the instrument.

The following are error messages, with suggested troubleshooting suggestions.

6002 A6 RAM check sum

1. Cycle power.
2. Remove the module from the mainframe and remove the top cover. Insert the module extender into the mainframe and connect the module to the extender cable. Restart the instrument and, using a DVM, measure the voltage of the battery (underload). Replace if battery will not hold charge.
3. Remove Microprocessor board and reseal.

7036 HP-MSIB error

1. Replace A6 Microprocessor board, restart the instrument.

7037 A3 char ROM

1. Replace A3 Dot Generator board, restart the instrument.

7038 A6 error in 8041

1. Replace A6 Microprocessor board, restart the instrument.

7039 A4 memory

1. Replace the A4 Memory board, restart the instrument.
2. Replace the A6 Microprocessor board, restart the instrument.
3. Replace the A3 Dot Generator board, restart the instrument.
4. Replace the A2 Sweep/Mother board, restart the instrument.

7040 dot gen

1. Replace the A3 Dot Generator board, restart the instrument.

DISPLAY-DISRUPTIVE ERROR MESSAGES

These errors appear as large block letters on an otherwise blank CRT. If these appear, first attempt to restart the instrument and perform the steps prior to the error message appearing. If the error does not repeat, you may continue with normal operation.

If the error can be repeated on more than one instrument, call your nearest Hewlett-Packard field office.

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If the power is recycled and the instrument does not restart, or if the error is only repeatable on one display, follow the procedures as described below. After each step, attempt to restart the instrument.

For the following errors replace the A6 Microprocessor board:

A6 68000: BUS ERR
A6 68000: ADDR ERR
A6 68000: ILLEGAL
A6 68000: ZERO DIV
A6 68000: CHECK
A6 68000: TRAPV
A6 68000: PRIV VIO
A6 68000: TRACE
A6 68000: 1010
A6 68000: 1111
A6 68000: RESERVED
A6 68000: UNIT
A6 68000: SPURIOUS

For the following error messages, replace the A3 Dot Generator board and restart the instrument. If the error is still present, replace the A4 Memory board and again restart the instrument:

A3 MEMORY READ
A3 MEMORY WRITE
A3 MEMORY R/W
A3 MEMORY ADDRESS

For the following error messages, replace the A3 Dot Generator board and restart the instrument.

A3 CHAR ROM
A3 RETURN FAILED
A3 MARK FAILED
A3 ??? FAILED
A3 WRONG DATECODE

For each of the following error messages, perform the steps indicated. Restart the instrument after each step:

A3 SERIAL INTERFACE

1. Change the A3 Dot Generator board.
2. Change Microprocessor board.

A3 ??? FAILED

1. Change the A3 Dot Generator board
2. Change Microprocessor board.

A4 PIXEL RAM

1. Change A4 Memory board.
2. Change A6 Microprocessor board.
3. Change A3 Dot Generator board.
4. Change A2 Sweep/Mother board.

INTERNAL DIAGNOSTICS INTERPRETATION

When the Systems Diagnostics procedure indicates a display disruptive error, the error LEDs on the printed circuits inside the module will light (see Table 1). The errors messages indicated by these light patterns are a duplication of the display error messages described above.

To check these LED indicators, proceed as follows:

1. Remove the module from the mainframe following the procedures in Preparation For Use.
2. Remove the top cover from the module following the top cover removal procedures below.
3. Connect the module through the module extender to the mainframe and turn the instrument ON (1).

BOARD FAILURE LED INDICATION

The LEDs are used in two test modes: normal and error. In the normal mode the LEDs indicate which board has failed, while in the error mode the LEDs indicate which test has failed. To set the instrument to the correct mode, refer to Figure 1, and set the rear-panel switches to the position indicated. It is necessary to restart each time the test mode switch is reset. The settings of the switches, other than those indicated in Figure 1, have no effect on the test.

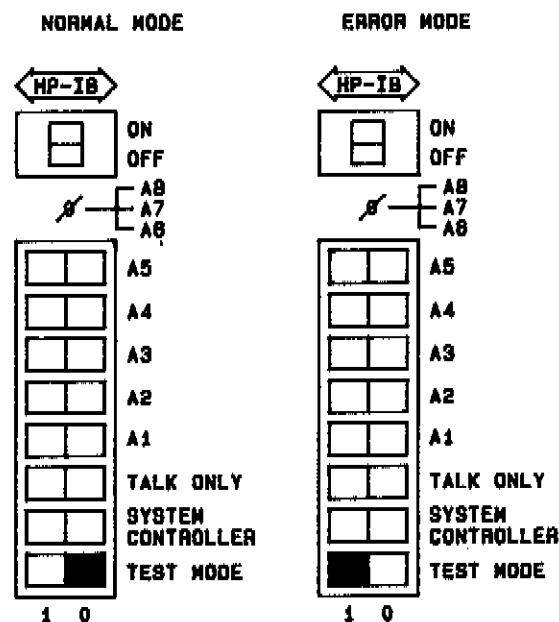


Figure 1. Mode Select

BLANK OR DISTORTED DISPLAY

If the display is blank or distorted, first refer to the horizontal and vertical adjustment procedures following in this section of the manual. After making these adjustments if there is still no display, replace the A2 Sweep/Mother board. If there is still

no display after replacing this board, replace the CRT assembly.

Table 1
Sht 1 of 3

LED INDICATOR REAR-TO-FRONT

REAR PANEL
TEST SWITCH IN
NORMAL POSITION
(SEE FIGURE 1)

1	2	3	4	5	6
			X		
		X			
	X				

A3 DOT GENERATOR
A4 MEMORY
A6 MICROPROCESSOR

REAR PANEL
TEST SWITCH
IN ERROR POSITION
(SEE FIGURE 1)

1	2	3	4	5	6
X					X
X				X	
X				X	X
X			X		
X			X		X
X			X	X	
X			X	X	X
X		X			
X		X			X
X		X		X	
X	X				X
X	X			X	X
X	X			X	
X	X			X	
X	X				
X	X		X		
X	X		X		X

A3 SERIAL INTERFACE
A3 MEMORY READ
A3 MEMORY WRITE
A3 MEMORY R/W
A3 MEMORY ADDRESS
A3 CHAR ROM
A3 RETURN FAILED
A3 MARK FAILED
A3 ??? FAILED
A3 WRONG DATECODE
A6 ROM * CHECKSUM
A6 RAM ADDR ERROR
A6 RAM DATA ERROR (U37)
A6 RAM DATA ERROR (U38)
A6 8041 INTERFACE TEST
A4 PIXEL RAM
A3 CHAR ROM

*: ROM NUMBER

X: LED LIT

Table 1
Sht 2 of 3

**OTHER
INDICATORS:**

POW
SUI
LEE

DOT GEN A3 - If this light is on, an error on the Dot Generator board is indicated. However, it may come on momentarily during start-up or during confidence test.

MSIB - Indicates that the 5 volts to the MSIB board is out of range.

MICROPROCESSOR A6 - Indicates an error on the Microprocessor board.

POWER SUPPLY - The power supply indicator lights located on Power Supply board, must all be green. If any of the lights are not on, this indicates a power supply failure.

Table 1
 Sht 3 of 3

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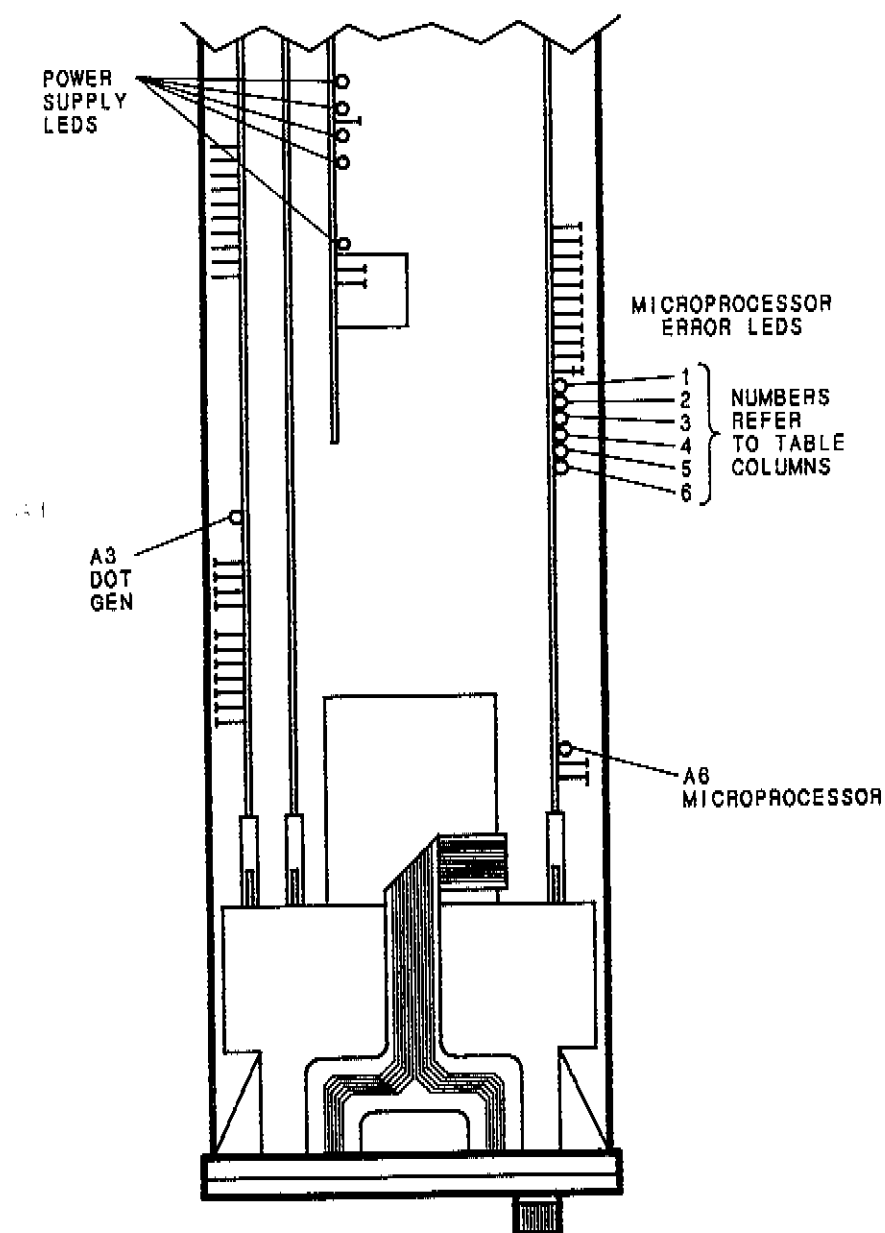


Table 1. LED Error Patterns

ASSEMBLY REPAIR

COVER REMOVAL/REPLACEMENT

Top Cover Removal

1. Remove the six screws holding the top cover (two front top, two rear top, and one each rear side). See Figure 2.
2. Using slots in the rear panel, pry the top cover up and lift off the housing.

CAUTION

When prying the top cover loose, insert the screwdriver blade into pry slots and push handle down. If the screwdriver is inserted too far, or if the handle is lifted, internal components may be damaged.

Top Cover Replacement

1. Align the cover with the front of the module and insert the two front top-cover screws and tighten until they make contact (See Figure 2).
2. Press the rear of cover firmly down until the screw holes are aligned.

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3. Insert the two rear-top screws and the two rear-side screws. see Figure 2.
4. Tighten all screws.

Bottom Cover Removal

1. Remove the bottom-cover screws as indicated in Figure 3, and lift bottom cover from module.

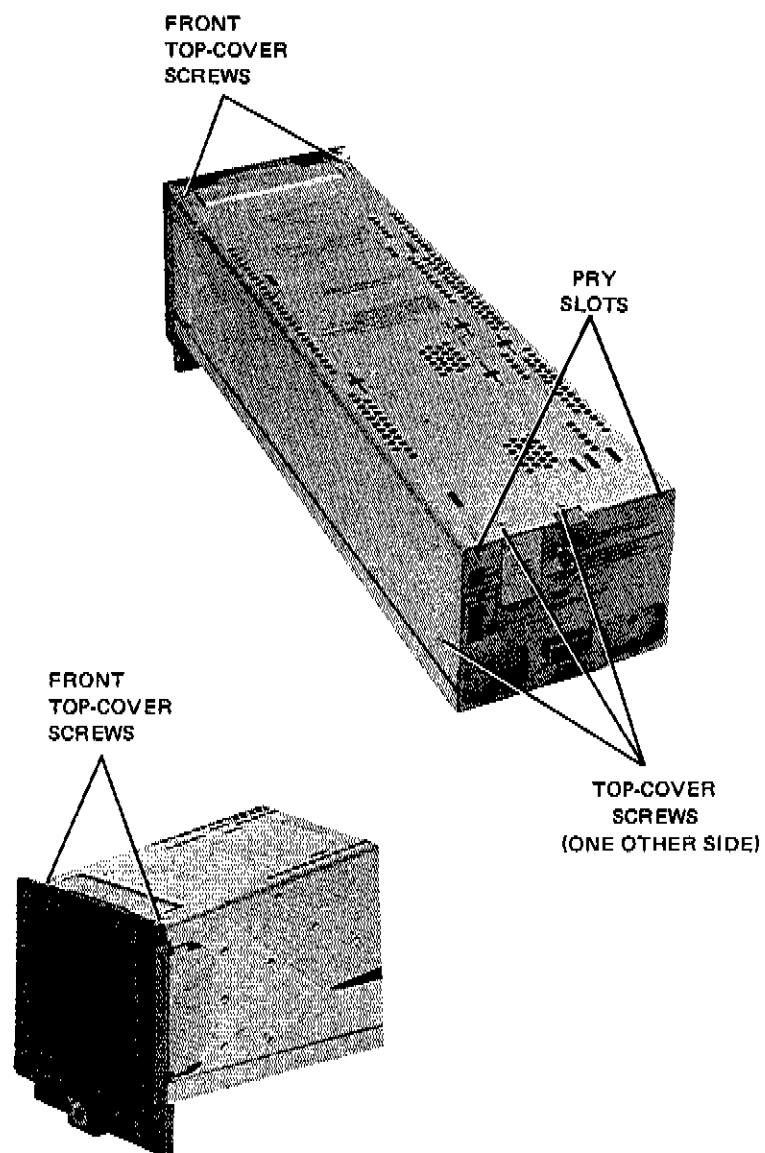


Figure 2. Top Cover Removal and Replacement

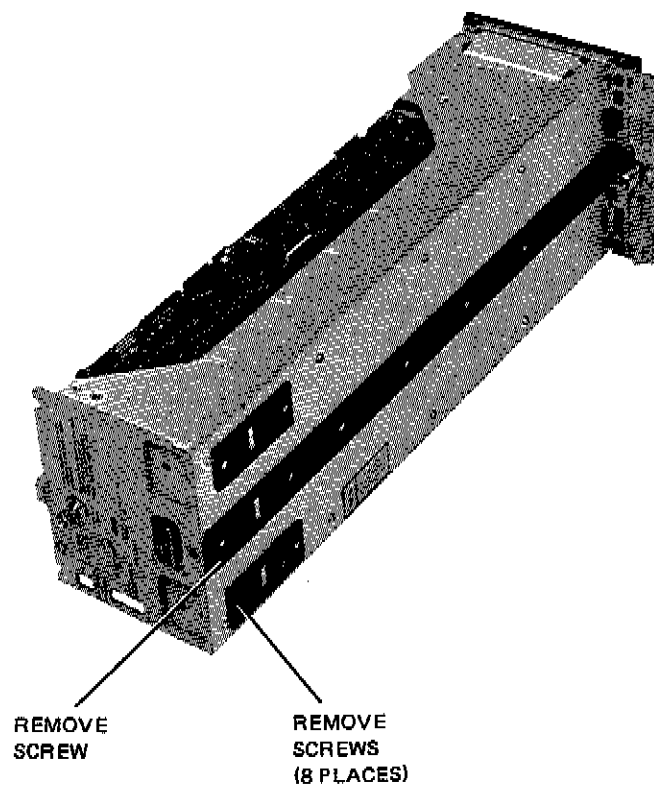


Figure 3. Bottom Cover Removal

REMOVAL OF BOARDS AND REAR PANEL

(To replace the boards and rear panel, reverse the following procedure.)

1. Remove top cover.

2. Using tabs, lift out the three digital boards and the one power supply board. See Figure 4.
3. Remove the following cables:
 1. Video
 2. Battery
 3. Flexible
 4. High Voltage
 5. Yoke
 6. CRT Bus
 7. RPG
 8. Keyboard
5. Remove four screws, two on each side, holding rear panel.
6. Slide rear panel, with attached Sweep/Mother board to the rear.
7. Remove two screws holding Sweep/Mother board to rear frame.

FRONT PANEL REMOVAL/REPLACEMENT

(To replace Front Panel, reverse the following procedure.)

1. Remove the top cover following the procedure above.
2. Unplug keyboard flexible cable from Sweep/Mother board.
3. Remove the two set screws holding the display knob, and remove knob. See Figure 5.
4. Remove 4 screws (one at each side corner) holding keyboard to front frame.
5. Remove keyboard assembly, carefully guiding flexible cable through frame.

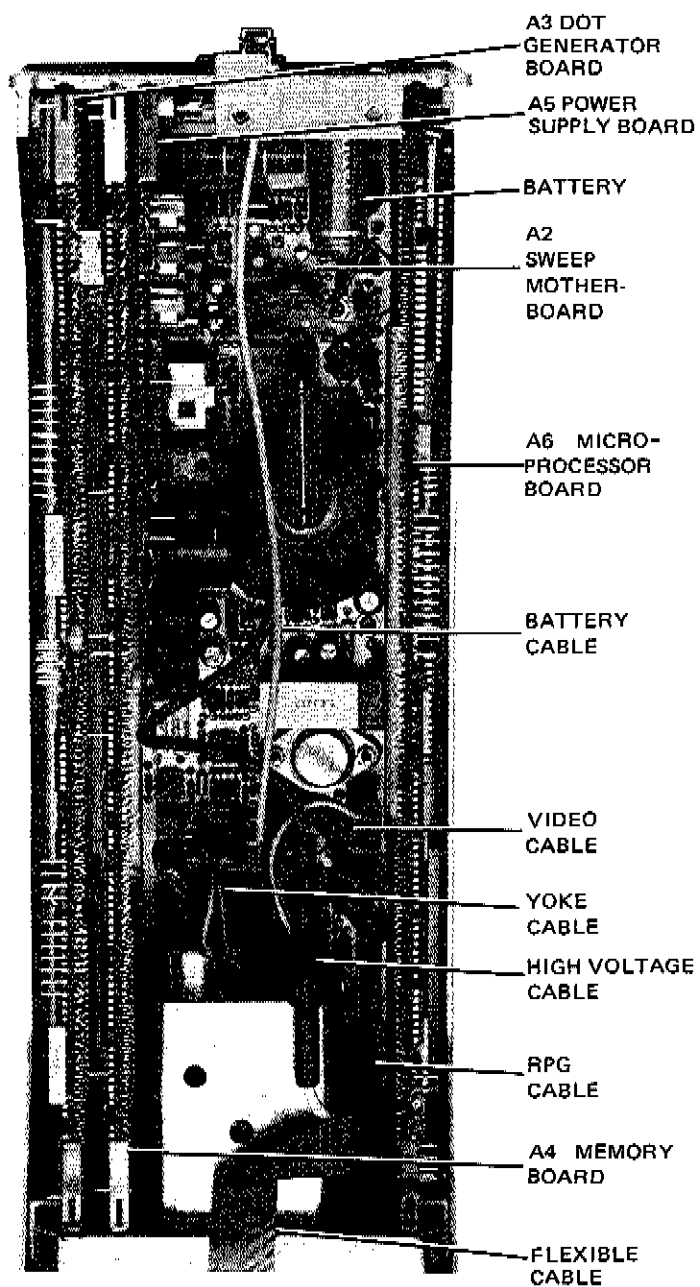


Figure 4. Assembly Locations

CAUTION

Do not remove the Torx bolts holding the front frame in place without installing the CRT Spring Compression Screws. See CRT Removal below.

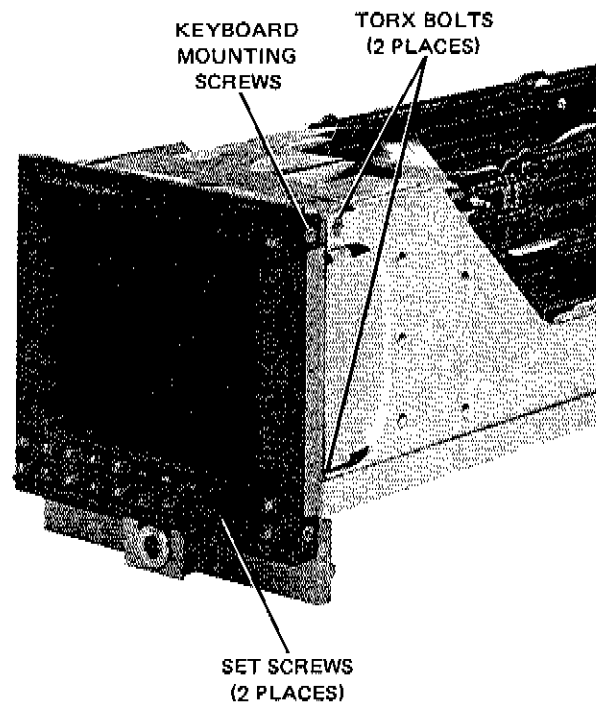


Figure 5. Front Panel and Keyboard Removal

CRT REMOVAL

1. Remove the top cover, bottom cover, and circuit boards (only those which plug into the Sweep/Mother board--the Sweep/Mother board remains in place).
2. Unplug the following cables (see Figure 4).

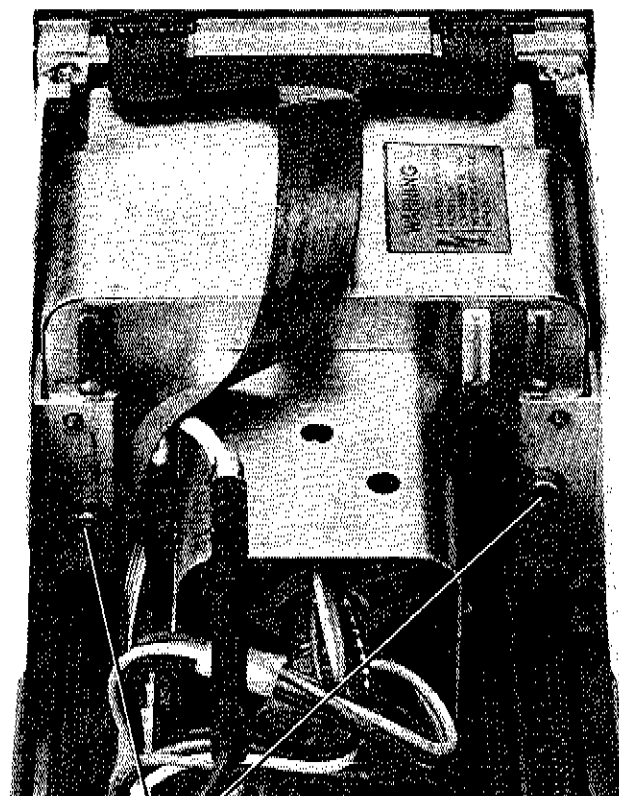
High Voltage
Yoke
Flexible
RPG
Video

3. Install 5 mm cap screws (located inside top cover) to compress the CRT springs. Use a 4 mm (5/32") Hex-Ball driver or an allen wrench to tighten. Tighten each screw, alternately 5 turns, until tight. See Figure 6.

CAUTION

Since the CRT is mounted under pressure, the 5 mm cap screws must be installed prior to removing the front frame or the CRT. Removal of the front frame without installing the 5 mm cap screws can damage to the CRT, the pressure plate, or both.

4. Remove the front panel, following the procedure previously described in this section.
5. Remove the four Torx bolts holding the front frame to the module frame. (Use Torx handle, HP Part Number 8710-1413, and T9 Bit, HP Part Number 8710-1521. See Figure 5.



CRT SPRING
COMPRESSION
SCREWS

Figure 6. CRT Spring Compression Screws

6. Tip instrument on its side and remove the front frame.
7. Remove the CRT and the front gasket. Save the gasket for reinstallation. See Figure 7.

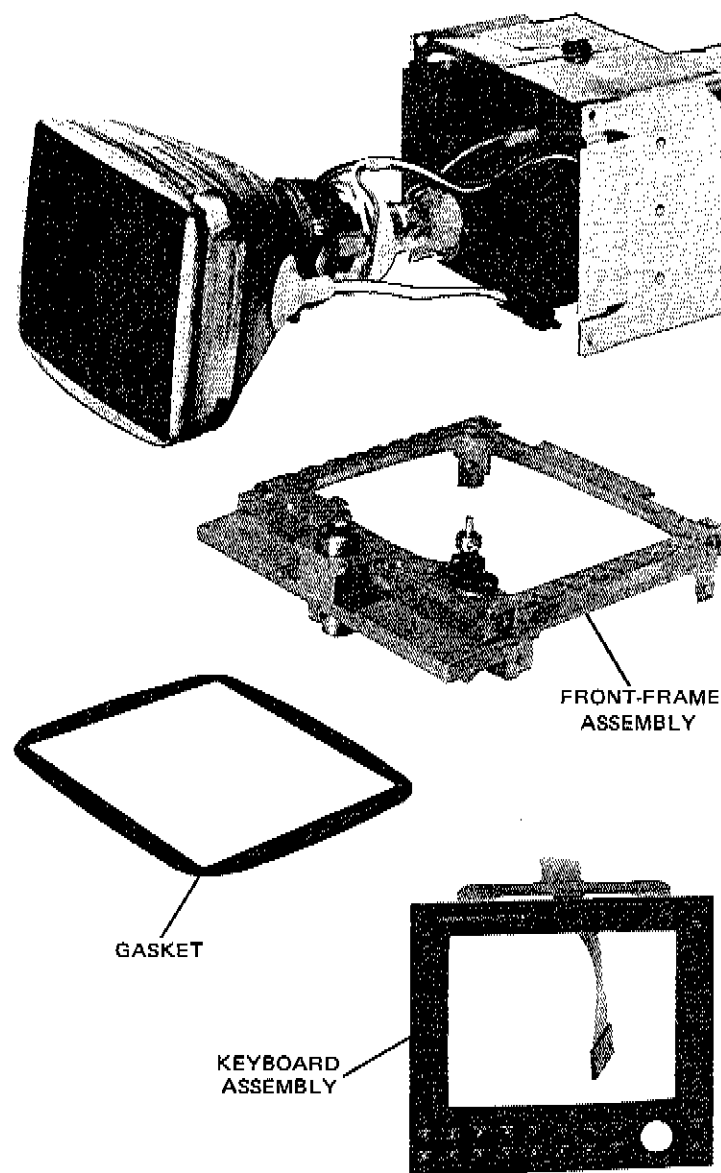


Figure 7. CRT Removal and Replacement

CRT REPLACEMENT

1. Supporting the module on the rear panel, place the CRT into the instrument housing and replace the front gasket. See Figure 7.
2. Align the front frame and install the four Torx bolts.
3. Route the RPG cable as shown in Figure 8, and install the keyboard assembly. Also install the display knob.
4. Connect the cables removed during CRT removal (see above procedure).

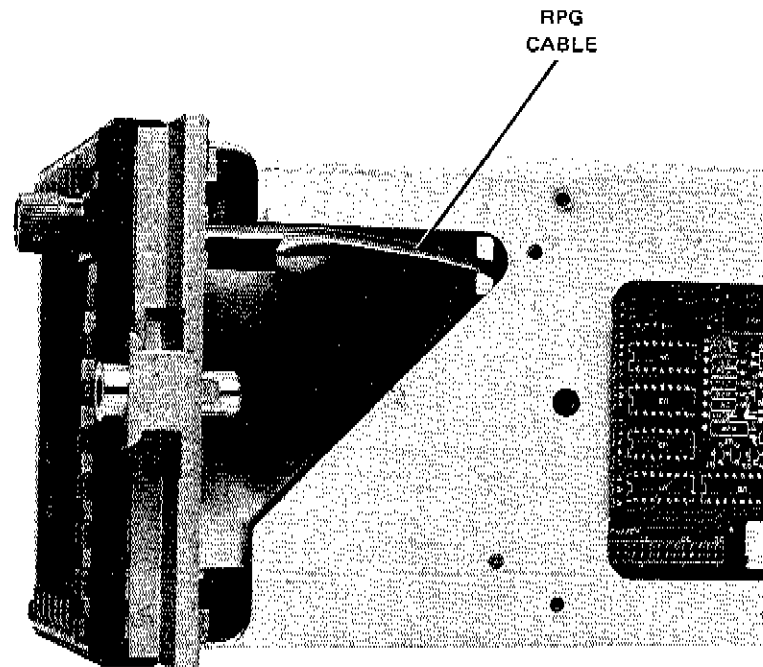


Figure 8. RPG Cable Installation

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5. Loosen the CRT spring screws (alternately 5 turns each) and remove.
6. Install the plug-in circuit boards into the color-coded slots and reinstall the cables and covers.
7. Install the top cover.

DISPLAY ADJUSTMENTS

DESCRIPTION

Test patterns are generated by the internal firmware of the Display and are used to adjust intensity, focus, horizontal position and gain, vertical position and gain, and vertical linearity. In addition, a high voltage compensation adjustment is performed using a separate test pattern.

EQUIPMENT

Oscilloscope	HP 1980A
Probe (10:1)	HP 10080A

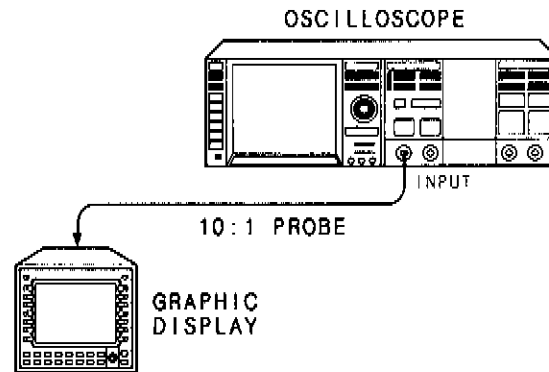


Figure 9. Test Point Voltage Measurement

PROCEDURE

1. Turn instrument OFF (0), disconnect power cord, and remove the display from the mainframe.
2. Install Module Extender (HP Part Number 70001-60013) in mainframe and attach cable to rear of display.
3. Following the procedure under Assembly Repair in this section, remove the top cover.
4. Reconnect power cord and turn instrument ON (1).

NOTE

If no display is present, go to the horizontal and vertical adjustments (steps 9 and 10). If the problem is corrected, continue with step 5. If the problem persists, go to the Blank or Distorted Display in the front part of this section of the manual.

5. Accessing Adjustment Test Patterns:
 - a. Turn instrument ON.
 - b. When the User Screen (Figure 11) appears, press the DISPLAY hard key.
 - c. When the Display Screen (Figure 12) appears, press the Display Test soft key.
 - d. When the Display Tests Screen appears, select the desired Test Pattern.

NOTE

If the screen is not properly adjusted, the soft keys may not properly align with soft key labels. Refer to the illustrations in this section when selecting a test pattern if any distortion or misalignment is present.

6. Focus

- a. Obtain test pattern by following the procedure in step 5 (Accessing Adjustment Test Patterns) and pressing DISPLAY ID soft key (TEST PATTERN is shown in Figure 14).
- b. Adjust A2R86 - FOCUS (refer to Figure 10 for location) until all characters and figures are focused.

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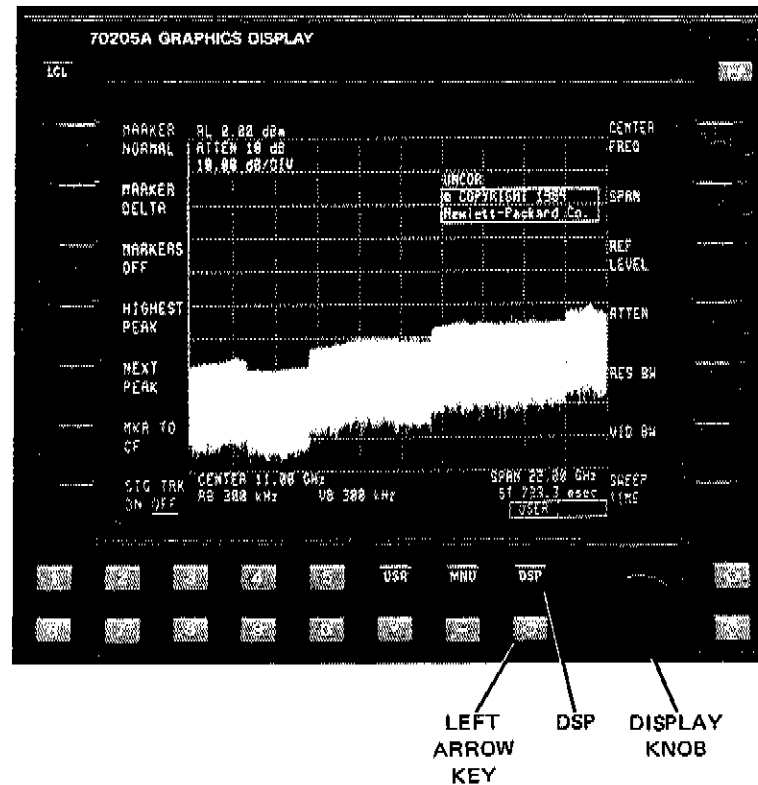


Figure 11. Keyboard with User Screen.

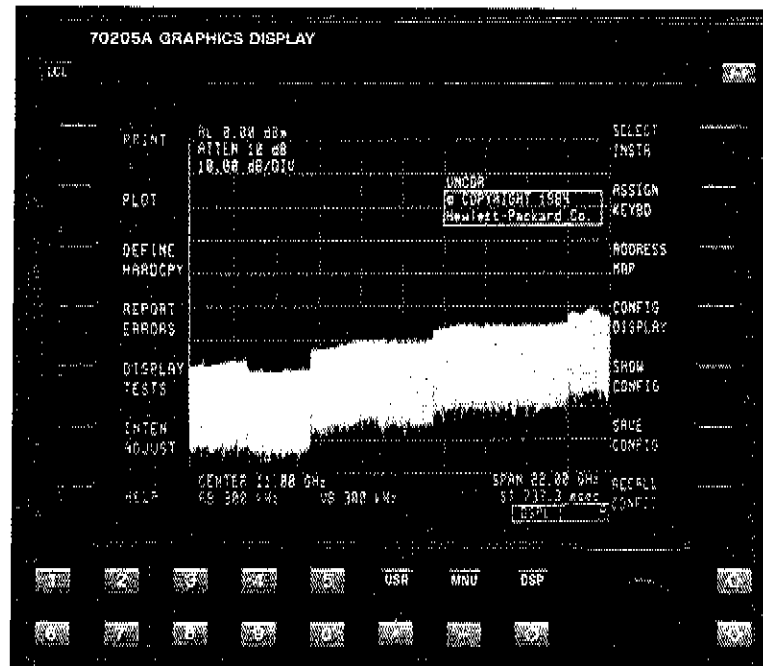


Figure 12. Display Screen.

7. Intensity Limit

- a. Obtain test pattern by following the procedure in step 5 (Accessing Adjustment Test Patterns) and pressing **PATTERN 1** soft key (Test **PATTERN 1** is shown in Figure 14).
- b. Connect oscilloscope to **TP-12** on the **A2 Sweep/Mother board**. Refer to Figures 1 and 2 for setup and test point locations.
- c. Set the oscilloscope to 0.05 volts/Div (10:1 probe used) with a sweep time of 5 msec/Div.

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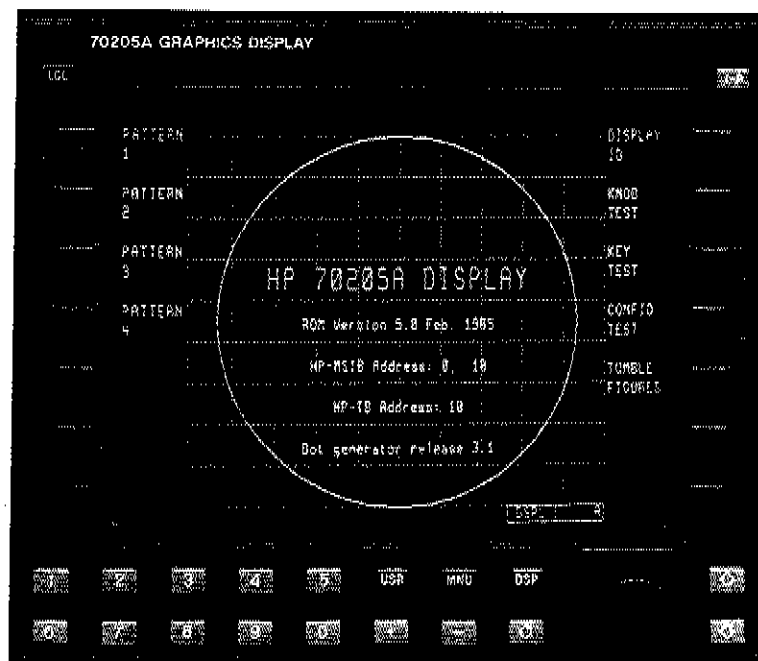


Figure 13. Test Pattern

- d. Adjust A2R94 - INTEN (refer to Figure 10 for location) to obtain a 300 mV peak-to-peak square wave.
 - e. Once this adjustment procedure is completed, press the left arrow key (refer to Figure 11) to return to the main menu.
8. High Voltage Compensation
- a. Obtain test pattern by following the procedure in step 5 (Accessing Adjustment Test Patterns) and pressing

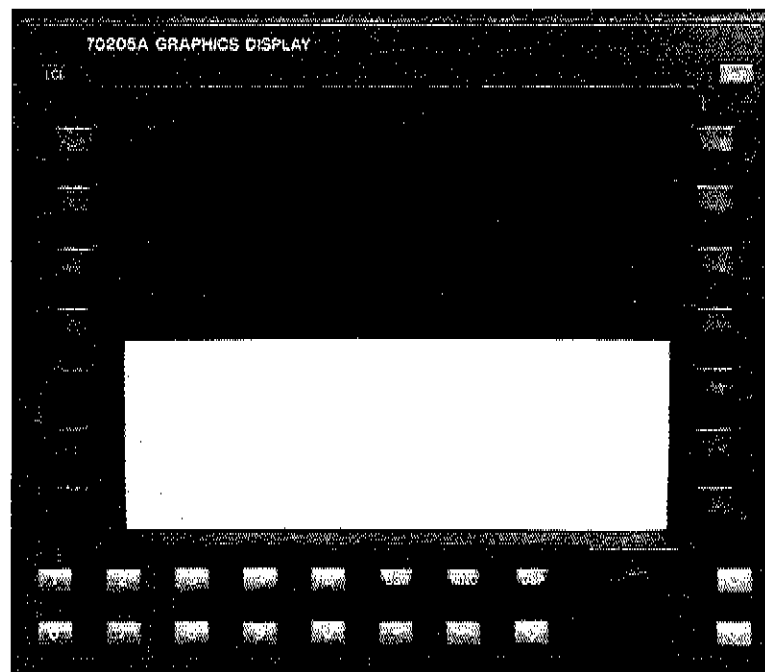


Figure 14. Test Pattern 1

PATTERN 2 soft key (Test Pattern 2 is shown in Figure 15).

- b. Adjust A2R95 - HVCOMP (refer to Figure 2 for location) until the left and right edges of the blinking figure align with the display border.
- c. Once the adjustment procedure is completed, press the left arrow key (refer to Figure 11) to return to the main menu.

9. Horizontal Adjustments

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- a. Obtain test pattern by following the procedure in paragraph 1 (Accessing Adjustment Test Patterns), and pressing the DISPLAY ID soft key.
- b. Press the left arrow key (refer to Figure 11 for location).
- c. Adjust A2R87 - HPOS and A2L4 -WIDTH (refer to Figure 10 for location) until all the characters for the soft key labels are completely visible on screen (refer to Figure 4).
- d. Once this adjustment procedure is completed, press the left arrow key (refer to Figure 11) to return to the main menu.

10. Vertical Adjustments

- a. Obtain test pattern by following the procedure in step 5 (Accessing Adjustment Test Patterns) and pressing DISPLAY ID soft key (Test Pattern is shown in Figure 13).

NOTE

A2R43 and A2R57 are interactive adjustments; therefore some interaction is required in the following adjustments.

- b. Adjust A2R41 - VPOS and A243 - HEIGHT (refer to Figure 10 for location) until the soft key labels are centered on each soft key (refer to Figure 4).
- c. Adjust A2R57 - VLIN (refer to Figure 10 for location) until the graticule is symmetrical, with evenly spaced lines (refer to Figure 14).

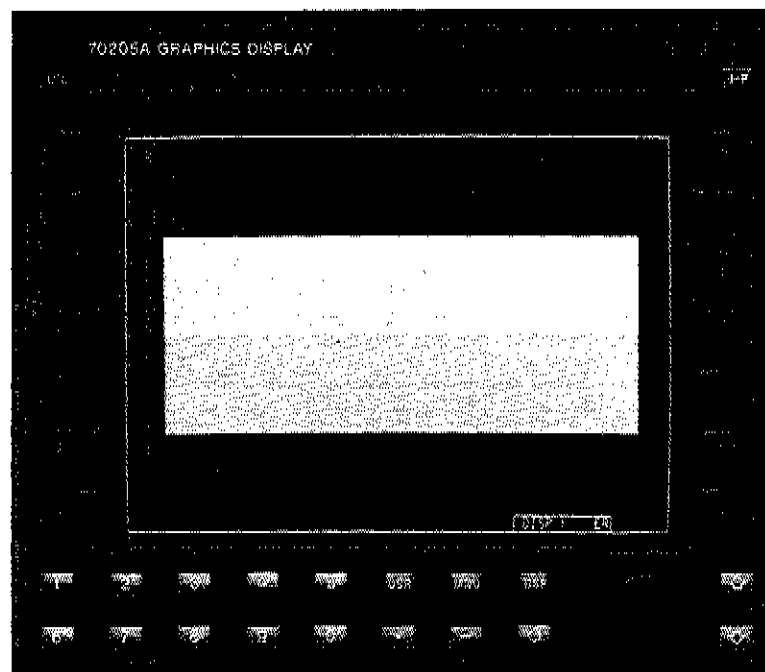


Figure 15. Test Pattern 2

- d. Once this adjustment procedure is completed, press the left arrow key to return to main menu (see Figure 11).
11. Press **LINE** switch **OFF** (0), disconnect power cord, and disconnect and remove Module Extender (HP Part Number 70001-60013).
12. Following the procedure in Assembly Repair, replace the top cover.

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TABLE 2. HP 70205A GRAPHICS DISPLAY REPL. PARTS (1 of 2)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
ELECTRICAL ASSEMBLIES				
	70205-60002	8	1	PROCESSOR (HOST) BOARD ASSY (NEW)
	70205-60031	3	1	PROCESSOR (HOST) BOARD ASSY (REBUILT)
	70205-60003	9	1	MEMORY BOARD ASSY (NEW)
	70205-60032	4	1	MEMORY BOARD ASSY (REBUILT)
	70205-60004	0	1	DOT GENERATOR BOARD ASSY (NEW)
	70205-60033	9	1	DOT GENERATOR BOARD ASSY (REBUILT)
	70205-60015	3	1	POWER SUPPLY ASSY (NEW)
	70205-60035	7	1	POWER SUPPLY ASSY (REBUILT)
	2110-0693	4		FUSE .3A 125V M
	2110-0692	1		FUSE 1.2A 250V F
	2110-0681	0		FUSE 2.5A 250V F
CRT ASSEMBLY COMPONENTS				
	70205-00004	4	1	CRT SHIELD
	0515-0886	3	4	SCREW-MACH M3X0.5 8MM-LG PAN-HD
	70205-40002	6	1	CRT PLATE (PLASTIC)
	1460-2041	0	4	CRT SPRINGS
	1460-0174	6	1	GROUND SPRING
	70205-60011	9	1	CRT TUBE
	0460-0142	7	1	FRICTION TAPE 60MM LONG
	9140-0606	9	1	DEFLECTION YOKE CABLE ASSY (Includes yoke clamp and screw)
	70205-60025	5	1	ANODE CABLE
	70205-80015	5	1	CRT GASKET
	8120-3267	1	1	CRT CABLE
	70205-80029	1	1	LABEL-WARNING
	1460-1917	7	3	GROUND SPRING
	8500-2163	0	1	CRT CLEANER-OCLE TFC

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TABLE 2. HP 70205A GRAPHICS DISPLAY REPL. PARTS (2 of 2)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
FRONT CASTING ASSEMBLIES				
	70205-20016	0	1	FRONT CASTING
	0905-1023	8	1	O-RING
	5021-3290	7	1	LATCH
	0510-1244	5	1	RETAINER RING
	6040-0024	0	1	GREASE
	70205-00003	3	1	STRUT (FRAME)
	0515-1083	0	4	SCREW-MACH M3X0.6 PCFLTxs
	70205-80006	2	1	BEZEL ASSEMBLY (Includes all keys; does not include RPG)
	0515-0890	9	4	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	5061-1092	7	1	RPG
	0515-0586	6	2	SCREW-MACH M3X0.8 PCFLPOS
	70205-40006	0	1	KNOB
	70205-80016	8	1	DECAL-KNOB CAP
	3030-0007	5	2	SET SCREW
	5180-2350	4	1	LABEL-SERIAL NUMBER
REAR CASTING ASSEMBLIES				
	70205-20017	1	1	REAR CASTING
	70205-80007	0	1	HP-IB BOARD ASSY
	5001-5835	8	2	BAR CONNECTOR
	1480-2045	4	4	SPRING-CPR .180 OD
	0535-0042	5	4	NUT-HAX PLSTC-LKG M3X0.5 4MM-THK
	5001-5840	5	1	SPRING-GROUND PIN
	0515-1058	1	2	SCREW-MACH M2.5X4 PCHPNPD
	70205-80001	7	1	MOTHERBOARD
	0515-0888	3	2	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	0515-0890	9	4	SCREW-MACH M3X0.5 6MM-LG 90-DEG-FLH-HD
	70205-40003	7	1	BATTERY BODY
	0515-0890	9	2	SCREW-MACH M3X0.5 6MM-LG 90-DEG-FLH-HD
	70205-60018	6	1	BATTERY HOLDER/CABLE
	1420-0315	3	1	BATTERY
	70205-00008	6	1	COVER-BATTERY
	0515-0888	3	2	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	70205-6019	9	1	VIDEO CABLE (INCLUDES NUT)
	0580-1251	6	1	NUT
	2190-0102	8	1	WASHER
	1400-0248	7	3	TY-RAP
TOP/BOTTOM COVER ASSEMBLIES				
	70205-00001	1	1	BOTTOM COVER
	7120-4182	6	1	LABEL-WARNING
	0515-0886	3	8	SCREW-MACH M3X0.5 6MM-LG PAN-HD
	0515-0570	2	1	SCREW-MACH M3X0.8 PCFLPOS
	70205-00002	2	1	TOP COVER
	0515-0872	7	2	SCREW-CAP M5.0 30.0 HX
	3050-0884	0	2	WASHER-FL MTLG 5.0MM 5.4-MM-ID
	0515-0570	2	6	SCREW-MACH M3X0.8 PCFLPOS

APPENDIX--HP 70206A

This appendix provides the troubleshooting suggestions, repair information, and adjustment procedures for the HP 70206A Graphics Display. The troubleshooting suggestions are based on the internal diagnostics as explained in System Troubleshooting. Following these suggestions are assembly removal and replacement procedures. These include the CRT, circuit boards, and battery. The final section contains the adjustments that may be required after replacing some of the assemblies or the CRT.

NOTE

This troubleshooting information is for this specific module. If you have not already done so, refer to the Systems Troubleshooting chapter before proceeding.

HP 70206A TROUBLESHOOTING

INTRODUCTION

System Graphics Display faults are indicated in three ways: front-panel error indicators; error messages on the CRT; circuit board LEDs. In this section, the interpretations of all fault indicators will be limited to the board level.

FRONT PANEL ERROR LIGHTS

AIRFLOW Indicator ON

1. Airflow insufficient—this is a normal indication at turn-on. The light should go out within five minutes.

Check to see if the fan is operating or if the input is blocked.

NOTE

If the room temperature suddenly rises, the AIRFLOW indicator may come on, and stay on until the internal instrument temperature stabilizes.

I/O Indicator ON

1. Other mainframes in error status.

Disconnect other HP-MSIB instruments from the bus.

2. HP-MSIB cable connections incorrect.

Check for proper HP-MSIB cable connections (if one cable is disconnected, the I/O light will be on; if both cables are disconnected, the I/O light will remain off).

3. Faulty HP-MSIB cables

Disconnect HP-MSIB cables. If error is eliminated, change cables.

ERROR MESSAGES

Following are error messages, with troubleshooting suggestions included. After each step, attempt to restart the instrument.

6002 A6 RAM check sum

1. Turn the instrument off, then restart.
2. Remove the top covers of the instrument, and with a DVM measure the voltage of the battery (under load). Replace if the battery will not hold a charge.
3. Remove Microprocessor board and reseal. Restart the instrument.

7036 HP-MSIB error

1. Replace HP-MSIB board, restart the instrument.
2. Replace A6 Microprocessor board, restart the instrument.

7037 A3 char ROM

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1. Replace A3 Dot Generator board, restart the instrument.

7038 A6 error in 8041

1. Replace A6 Microprocessor board, restart the instrument.

7039 A4 memory

1. Replace the A4 Memory board, restart the instrument.
2. Replace the A6 Microprocessor board, restart the instrument.
3. Replace the A3 Dot Generator board, restart the instrument.
4. Replace the A2 Mother Board, restart the instrument.

7040 dot gen

1. Replace the A3 Dot Generator board, restart the instrument.

DISPLAY-DISRUPTIVE ERROR MESSAGES

These errors appear as large block letters on an otherwise blank CRT. If these appear, first attempt to restart the instrument and perform the steps prior to the error message appearing. If the error does not repeat, you may continue with normal operation.

If the error can be repeated on more than one instrument, call your nearest Hewlett-Packard field office.

If the power is recycled and the instrument does not restart, or if the error is only repeatable on one display, follow the procedures as described below. After each step, attempt to restart the instrument.

For the following errors, replace the A6 Microprocessor board:

A6 68000 BUS ERR
A6 68000: ADDR ERR
A6 68000: ILLEGAL
A6 68000: ZERO DIV
A6 68000: CHECK
A6 68000: TRAPV
A6 68000: PRIV VIO
A6 68000: TRACE
A6 68000: 1010
A6 68000: 1111
A6 68000: RESERVED
A6 68000: UNIT
A6 68000: SPURIOUS

For the following error messages, replace the A3 Dot Generator board and restart the instrument. If the error is still present, replace the A4 Memory board and again restart the instrument:

A3 MEMORY READ
A3 MEMORY WRITE
A3 MEMORY R/W
A3 MEMORY ADDRESS

For the following error messages, replace the A3 Dot Generator board and restart the instrument.

A3 CHAR ROM
A3 RETURN FAILED
A3 MARK FAILED
A3 ??? FAILED
A3 WRONG DATECODE

For each of the following errors, perform the steps indicated. Restart the instrument after each step:

A3 SERIAL INTERFACE

1. Change the A3 Dot Generator board.
2. Change Microprocessor board.

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A3 ??? FAILED

1. Change the A3 Dot Generator board.
2. Change Microprocessor board.

A4 PIXEL RAM

1. Change A4 Memory board.
2. Change A6 Microprocessor board.
3. Change A3 Dot Generator board.
4. Change A2 Mother board.

INTERNAL DIAGNOSTICS INTERPRETATION

When a display-disruptive error message is displayed, the LED error indicators on the printed circuits inside the module will light. The errors indicated by these light patterns are a duplication of the display error messages described above. To view the LEDs, remove the top cover, leaving the inner cover in place. See Table 1.

BOARD FAILURE LED INDICATION

The LEDs are used in two test modes: normal and error. In the normal mode, the LEDs indicate which board has failed; in the error mode, the LEDs indicate which test has failed (see Table 1). To set the instrument to the correct mode, refer to Figure 1. Set the rear-panel switches to the position indicated. It is necessary to restart each time the test mode switch is reset. (The switches with no setting indicated in Figure 1 may be set in either position.)

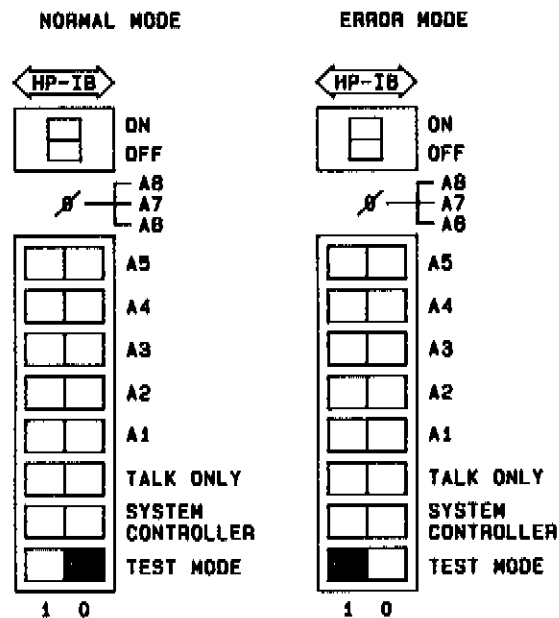


Figure 1. Mode Select

BLANK OR DISTORTED DISPLAY

If the display is blank or distorted, it is recommended that you first refer to the horizontal and vertical adjustment procedures in this section of the manual. If after making these adjustments there is still no display, replace the A2 Sweep/Mother board. Restart the instrument. If there is still no display, replace the CRT assembly.

Table 1

Sht 1 of 2

LED INDICATOR REAR-TO-FRONT

REAR PANEL
TEST SWITCH IN
NORMAL POSITION
(SEE FIGURE 1)

1 2 3 4 5 6

			X		
		X			
	X				

A3 DOT GENERATOR
A4 MEMORY
A6 MICROPROCESSOR

REAR PANEL
TEST SWITCH IN
ERROR POSITION
(SEE FIGURE 1)

1 2 3 4 5 6

X					X
X				X	
X				X	X
X			X		
X			X		X
X			X	X	X
X		X			
X		X			X
X		X		X	
X	X				X
X	X			X	X
X	X			X	
X	X			X	
X	X				
X	X		X		
X	X		X		X

A3 SERIAL INTERFACE
A3 MEMORY READ
A3 MEMORY WRITE
A3 MEMORY R/W
A3 MEMORY ADDRESS
A3 CHAR ROM
A3 RETURN FAILED
A3 MARK FAILED
A3 ??? FAILED
A3 WRONG DATECODE
A6 ROM * CHECKSUM
A6 RAM ADDR ERROR
A6 RAM DATA ERROR (U37)
A6 RAM DATA ERROR (U38)
A6 8041 INTERFACE TEST
A4 PIXEL RAM
A3 CHAR ROM

*: ROM NUMBER
X: LED LIT

OTHER INDICATORS:

POWER
SUPPLY

DOT GEN A3 - If this light is on, an error on the Dot Generator board is indicated. However, it may come on momentarily during start-up or during confidence test.

MSIB - Indicates that the 5 volts to the MSIB board is out of range.

MICROPROCESSOR A6 - Indicates an error on the Microprocessor board.

POWER SUPPLY - The power supply indicator lights located on the mother/sweep board, must all be green. If any are not on, this indicates a power supply failure.

HORIZ SYNC
VIDEO IN

HORIZ SYNC AND VIDEO IN - If the instrument is in the normal operating mode, these lights (located on the mother/sweep board) should not be lit. If they are lit, this indicates that the signal is not getting to the mother/sweep board from the memory board.

POWER
SUPPLY

Table 1
Sht 2 of 2

is on, an
erator board
er, it may
during
onfidence

volts to the
range.

es an error
r board.

oply indicator
e mother/sweep
reen. If any
icates a power

f the instrument
rating mode,
d on the mother/
not be lit.
s indicates that
tting to the
rom the memory

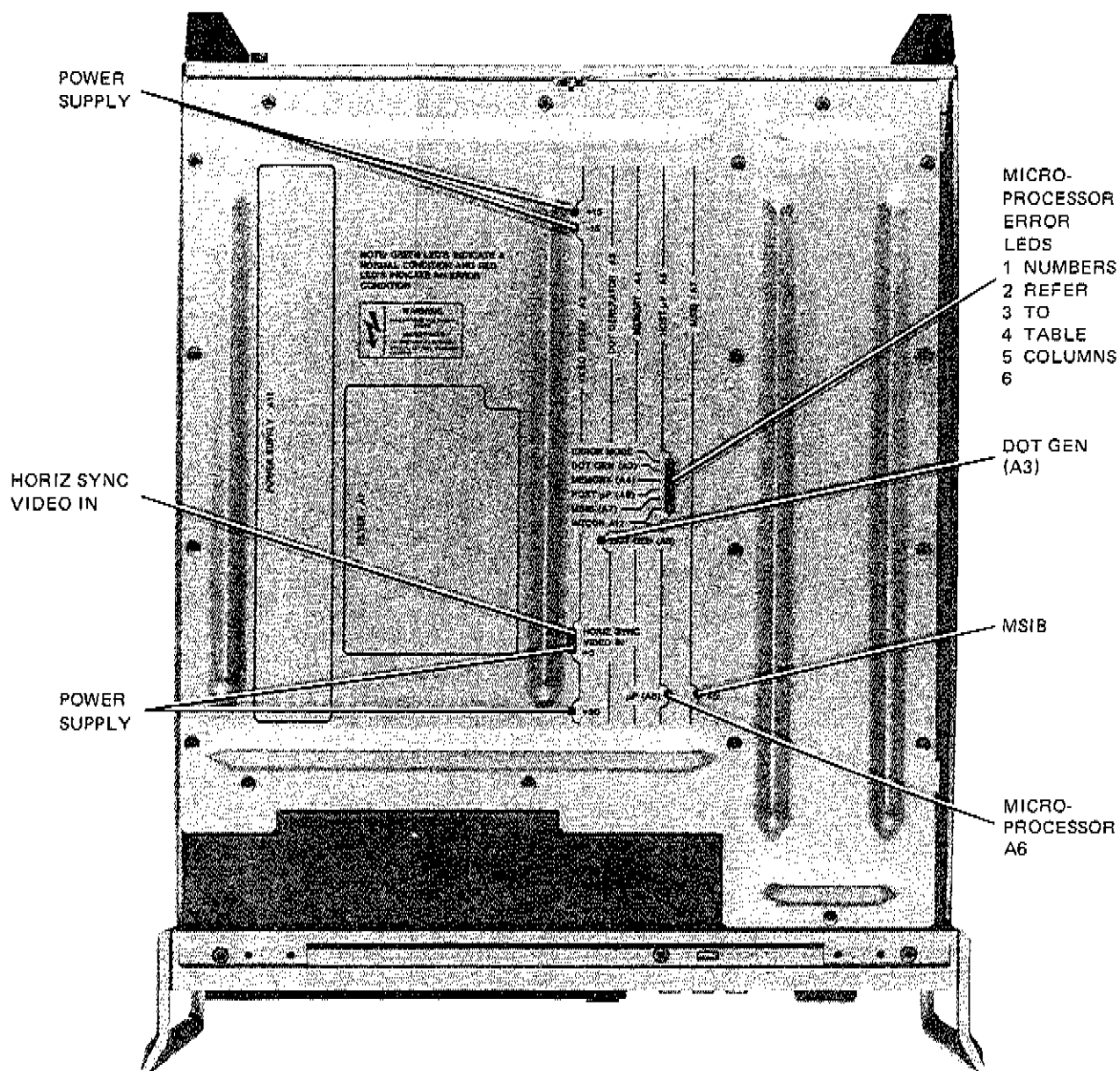


Table 1. LED Error Patterns

ASSEMBLY REPAIR

POWER SUPPLY/BOARD/CRT/REMOVAL

Top Cover Removal

(To replace the top cover, reverse the following procedure.)

1. Remove rear feet (top two only).
2. Loosen screw in top cover, rear edge. As this screw is backed out, the top cover will slide to the rear. Slide the cover to the back, off the instrument.
3. Twist the 14 inner-cover screws one-quarter turn counter-clockwise, and remove the inner cover. (For normal error indication interpretation, it is not necessary to remove this inner cover).

Power Supply Removal

1. Remove top covers as described above.
2. Remove the left-hand (facing instrument) strap handle and side cover.
3. Remove four screws holding power supply to side frame.
4. Remove battery and holder.
5. Remove the power supply cable and lift the power supply partially out of the instrument.
6. Remove the grounding cable, COM1 (from power supply to rear frame of instrument).

APPENDIX, HP 70206A

7. Lift power supply out of instrument.

Circuit Board Removal

(To replace the top cover, reverse the following procedure.)

1. Remove top covers as described above.
2. Remove circuit board retainer. See Figure 2
3. Remove circuit boards.

CRT/Front Panel Removal

(To replace the CRT and front panel, reverse the following procedure.)

1. Remove the top cover (as described above) and the inner cover.
2. Remove the front-top trim strip exposing the front frame retaining screws. Remove the six retaining screws, three top and three bottom. Refer to Figure 2.
3. Using the pry slots (Figure 2), pry the front frame from the instrument housing.
4. Disconnect the ribbon cable from the front panel. Refer to Figure 3.
5. Disconnect the following cables (refer to Figure 2):
 - High Voltage
 - Yoke
 - Video
6. Referring to Figure 3, remove the four CRT assembly screws.

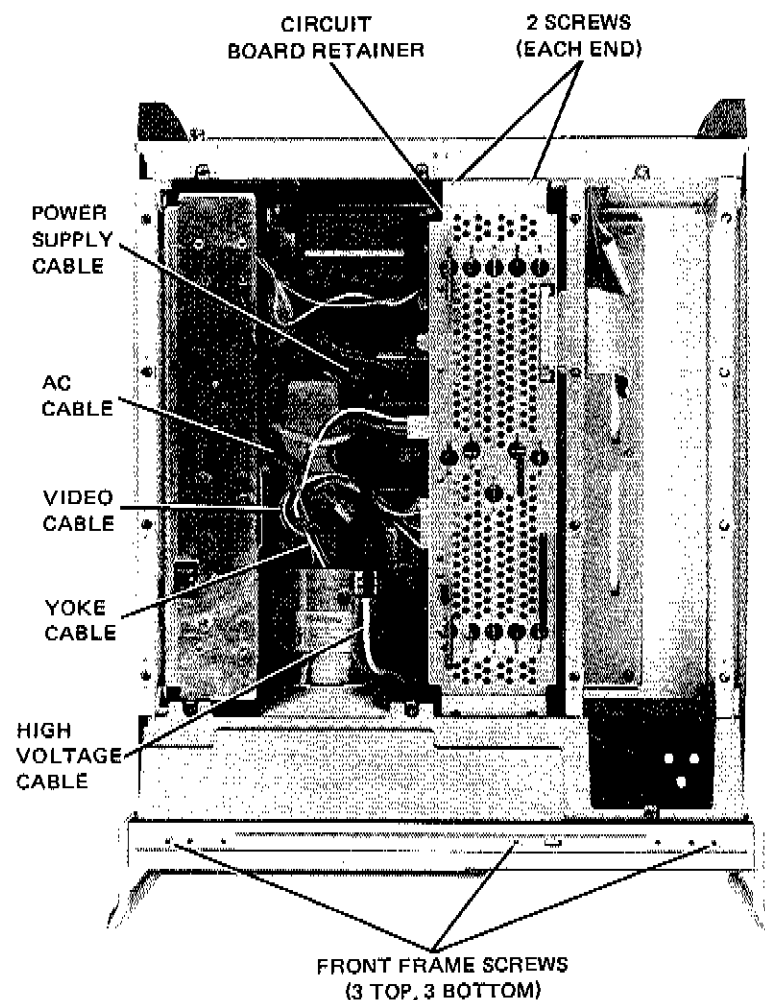


Figure 2. Assembly Location

APPENDIX, HP 70206A

7. Slide the CRT assembly out of the instrument.

NOTE

Replace CRT as an assembly only (HP Part Number 70206-60021).

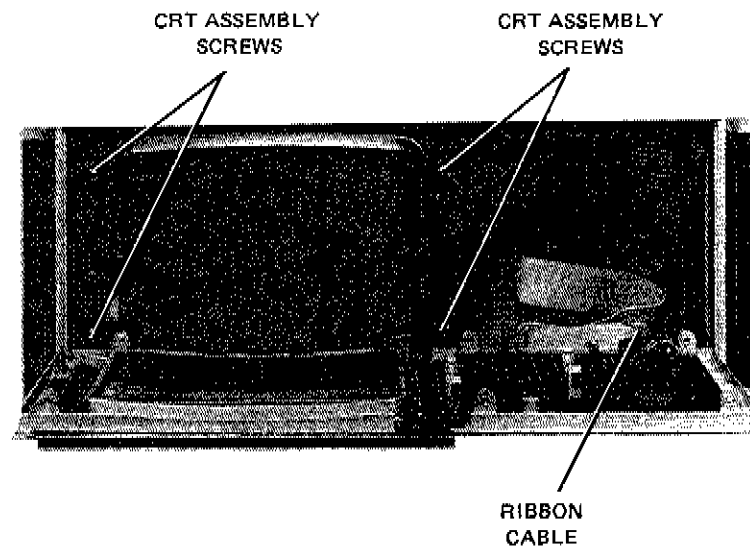


Figure 3. Front Panel/CRT Removal

HP 70206A ADJUSTMENTS

DESCRIPTION

Test patterns are generated by the internal firmware of the Display and are used to adjust intensity, focus, horizontal position and gain, vertical position and gain, and vertical linearity. In addition, a high voltage compensation adjustment is performed using a separate test pattern.

EQUIPMENT

Oscilloscope	HP 1980A
Probe (10:1)	HP 10080A

PROCEDURE

1. Turn instrument OFF (0), disconnect power cord, and remove the top and the inside covers.
2. Using the 24 pin Extender (HP Part Number 70206-60041) and a single 12 pin Extender (HP Part Number 70206-60029) placed at the opposite ends of the A2 Video/Sweep assembly, extend the A2 assembly.
3. Reconnect power cord and turn instrument ON (0).

NOTE

If no display is present, go to the horizontal and vertical adjustments (steps 9 and 10). If problem persists, go to the Blank or Distorted Display section in this section.

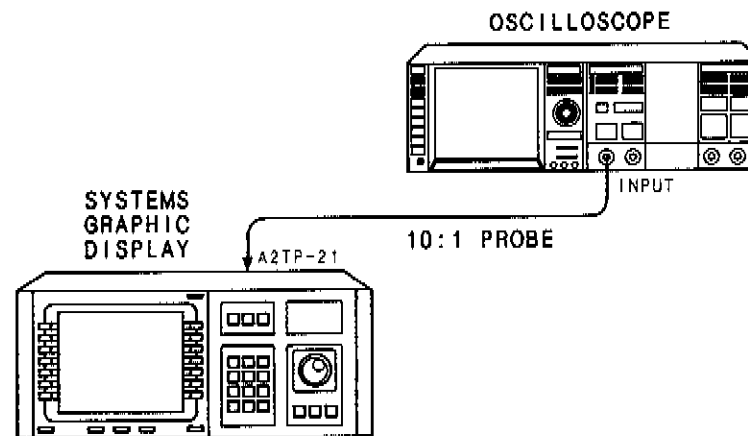


Figure 4. Intensity Limit Adjustment Test Setup

4. Accessing Adjustment Test Patterns

NOTE

If the screen is not properly adjusted, the soft keys may not properly align with soft key labels. Refer to the illustrations in this section when selecting a test pattern if any distortion or misalignment is present.

To access the patterns used in the adjustment routines, perform the following steps:

1. Turn instrument ON.
2. When the User Screen appears (see Figure 7), press the DISPLAY hard key.
3. When the Display Screen appears (see Figure 8), press the Display Test soft key.
4. When the Display Tests Screen (Figure 9) appears, select the desired Test Pattern (see Figure 9).

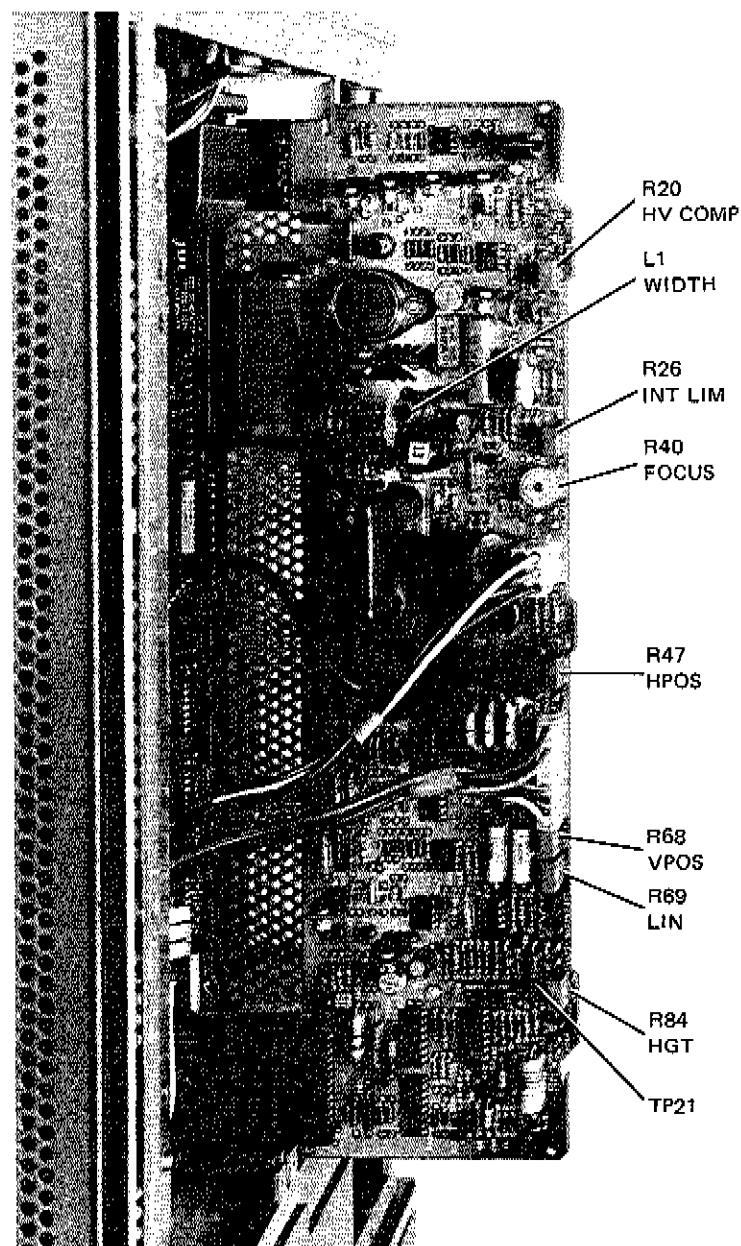


Figure 5. Adjustment & Test Point Locations

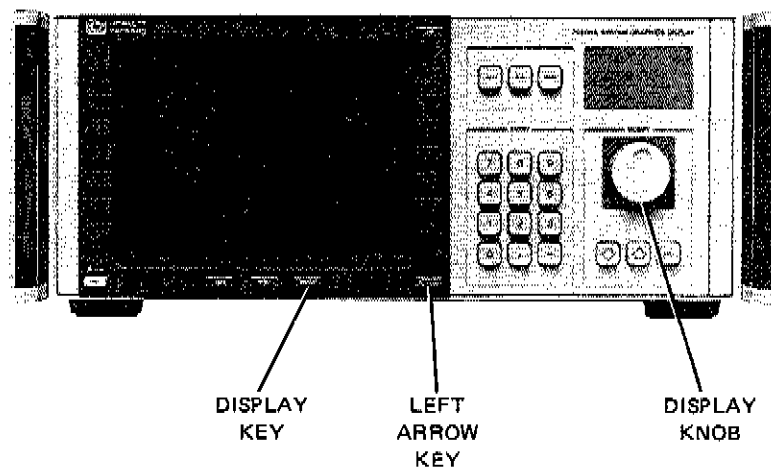


Figure 6. Display Keyboard

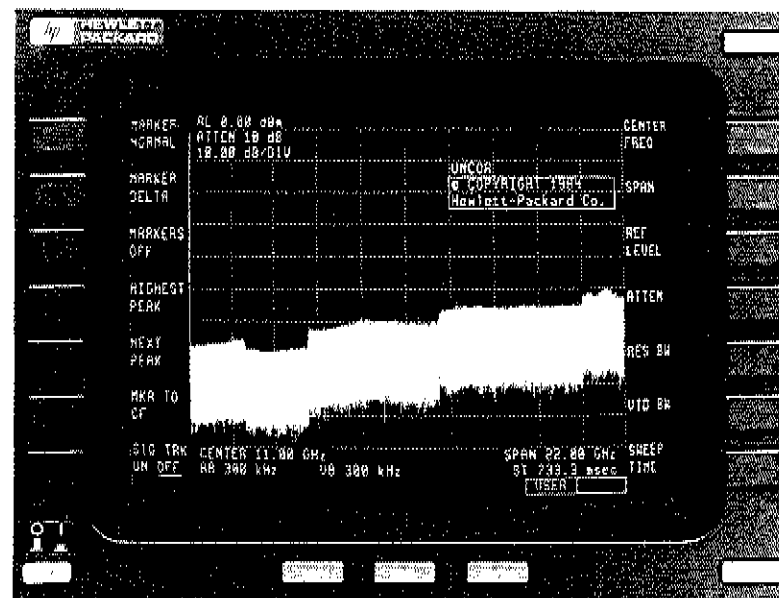


Figure 7. User Screen

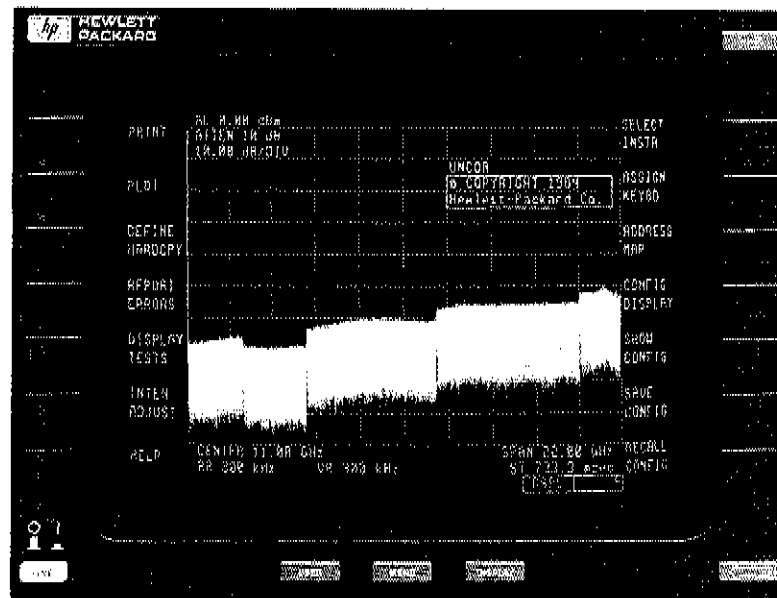


Figure 8. Display Screen

5. Focus

- a. Obtain the Display Tests screen (see Figure 9) following the procedure in step 4. Press DISPLAY ID soft key to obtain Test Pattern. (Test Pattern is shown in Figure 10).
- b. Adjust A2R40 - FOCUS (refer to Figure 5 for location) until all characters and figures are focused.

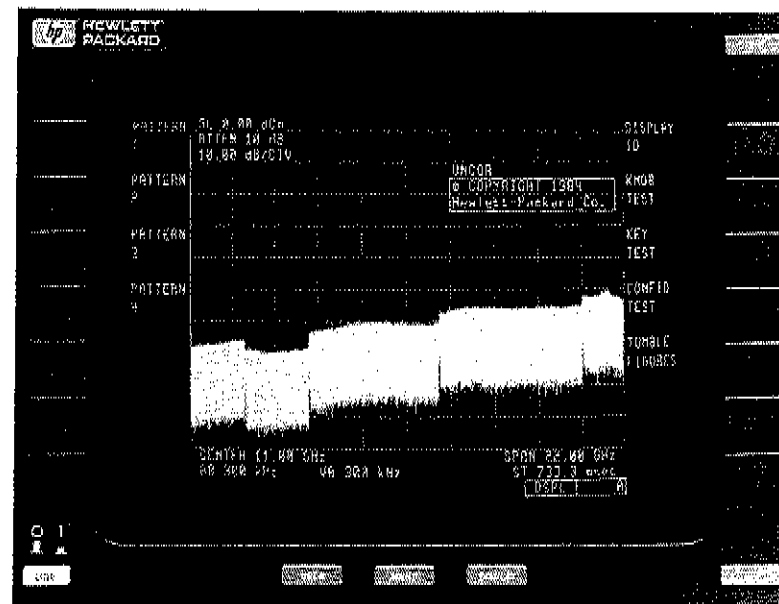


Figure 9. Display Tests Screen

6. Intensity Limit

- a. Obtain Test Pattern 1 by following the procedure in Step 4 (Accessing Adjustment Test Patterns) and pressing PATTERN 1 soft key (see Figure 11).
- b. Connect oscilloscope to TP-21 on the A2 Video/Sweep assembly (Refer to Figure 4 and 5 for setup and test point location).
- c. Set the oscilloscope to 0.05 volts/Div (10:1 probe used) with a sweep time of 5 msec/Div.
- d. Adjust A2R26 - INT LIM (refer to Figure 5 for location) to obtain a 300 mV peak-to-peak square wave.

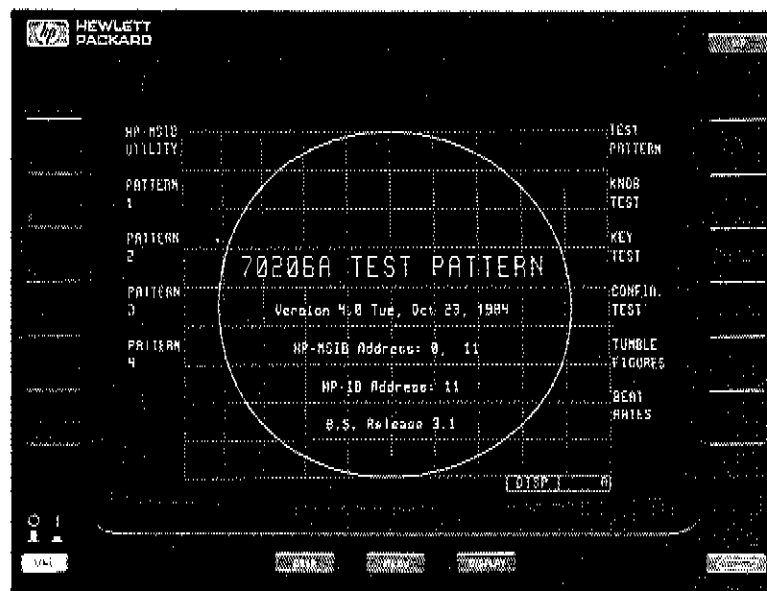


Figure 10. Test Pattern

- e. Once this adjustment procedure is completed, press the left arrow key (refer to Figure 6), to return to the main menu.
7. High Voltage Compensation
 - a. Obtain the Test Pattern 2 by following the procedure in step 4 (Accessing Adjustment Test Patterns) and pressing PATTERN 2 soft key (Test PATTERN 2 is shown in Figure 12).
 - b. Adjust A2R20 - HVCOMP (refer to Figure 5 for location) until the left and right edges of the blinking figure align with display borders.

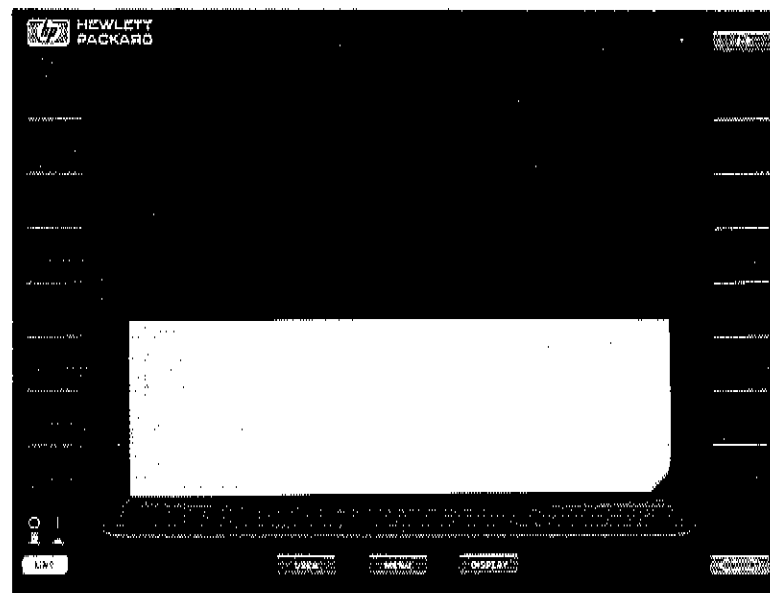


Figure 11. Test Pattern 1.

- c. Once this adjustment procedure is completed, press the left arrow key (refer to Figure 6), to return to the main menu.

8. Horizontal Adjustments

- a. Obtain test pattern by following the procedure in step 4 (Accessing Adjustment Test Patterns), and pressing the **DISPLAY ID** soft key.
- b. Press the left arrow key (refer to Figure 6 for location).
- c. Adjust **A2R47 - HPOS** and **A2L1 - WIDTH** (refer to Figure 5 for location) until all the characters for the soft key labels are completely visible on screen (refer to Figure 10).

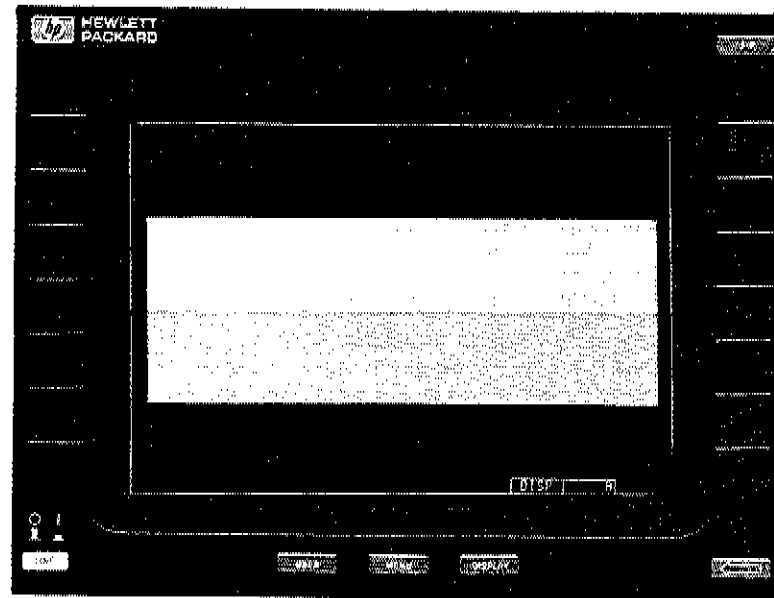


Figure 12. Test Pattern 2

- d. Once this adjustment procedure is completed, press the left arrow key (refer to Figure 6) to return to the main menu.
9. Vertical Adjustments
- a. Obtain Test Pattern by following the procedure in step 4 (Accessing Adjustment Test Patterns), and pressing Display ID soft key (see Figure 10).

NOTE

A2R68, A2R84, and A2R69 require interactive adjusting.

- b. Adjust A2R68 - VPOS and A2R84 - HGT (refer to Figure 5 for location) until the soft key labels are centered on each soft key (refer to Figure 10).
 - c. Adjust A2R69 - LIN (refer to Figure 5 for location) until the graticule is symmetrical, with evenly-spaced lines (refer to Figure 10).
 - d. Once this adjustment procedure is completed, press the left arrow key (refer to Figure 6) to return to main menu.
10. Set LINE switch OFF, disconnect power cord, replace A2 Video/Sweep assembly, replace shield cover and instrument top cover.

APPENDIX, HP 70206A

TABLE 2. HP 70206A SYSTEM GRAPHICS DISPLAY REPL. PARTS (1 of 3)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
ELECTRICAL ASSEMBLIES				
	70206-60005	2	1	VIDEO SWEEP BOARD ASSEMBLY (NEW)
	70206-60032	5	1	VIDEO SWEEP BOARD ASSEMBLY (REBUILT)
	70206-60006	3	1	HP-MSIB ASSEMBLY (NEW)
	70206-60033	6	1	HP-MSIB ASSEMBLY (REBUILT)
	70206-60007	4	1	LINE FILTER ASSEMBLY (NEW)
	70206-60036	9	1	LINE FILTER ASSEMBLY (REBUILT)
	0515-0885	2	5	SCREW-MACH M4X0.7 8MM-LG PAN-HD
	70206-60001	8	1	MOTHERBOARD ASSEMBLY
	0515-0885	2	8	SCREW-MACH M4X0.7 8MM-LG PAN- HD
	3050-0893	9	8	WASHER-FL MTL C M4.0 ID
	70205-60002	8	1	PROCESSOR (HOST) BOARD ASSEMBLY (NEW)
	70205-60031	3	1	PROCESSOR (HOST) BOARD ASSEMBLY (REBUILT)
	70205-60003	9	1	MEMORY BOARD ASSEMBLY (NEW)
	70205-60032	4	1	MEMORY BOARD ASSEMBLY (REBUILT)
	70205-60004	0	1	DOT GENERATOR ASSEMBLY (NEW)
	70205-60033	9	1	DOT GENERATOR ASSEMBLY (REBUILT)
	0950-1730	0	1	POWER SUPPLY
	9135-0251	9	1	LINE MODULE FILTER
	70206-00024	9	1	SHIELDED-POWER SUPPLY
	0515-0912	6	3	SCREW-MACH
	0515-0885	2	4	SCREW-MACH M4X0.7 8MM-LG PAN-HD
	2110-0703	7	2	FUSE 6.3A 250V F
	70206-60021	2	1	CRT ASSEMBLY
	0515-1241	8	4	SCREW-MACH M5.0 12 PCPNPDS
	8500-2163	2	1	CLEANER-OCLI-TFC
FRONT PANEL ASSEMBLY				
	70206-20014	9	1	FRONT BEZEL CASTING
	70206-00010	3	1	PANEL-FRONT DRESS
	70206-00011	4	1	SPACER-FRONT
	0510-1148	2	8	RETAINER-PO .140ID
	70206-80001	0	1	PLATE-HP LOGO
	70206-80002	1	1	LABEL IN 70206A
	70206-80003	2	1	INSULATOR 10.5 X 28.5MM
	70206-60040	5	1	RPG ASSEMBLY
	0370-3033	0	1	KNOB
	2950-0001	8	1	NUT-HEX 3/8-32
	2190-0016	3	1	WASHER-LK .377ID
	8160-0500	3	1	RFI STRIP 403.7MML
	8160-0502	5	1	RFI STRIP 160.3MML
	70206-60008	5	1	BEZEL ASSEMBLY KEYBOARD
	0515-1242	7	10	SCREW-M2.5 3 PNPDS
	3050-0890	6	10	WASHER-FLAT
	0515-1243	8	16	SCREW-M2.5 5 PNPDS
	70206-60009	6	1	NUMERIC KEYBOARD ASSEMBLY
	0515-1243	8	17	SCREW-M2.5 5 PNPDS

APPENDIX, HP 70206A

TABLE 2. HP 70206A SYSTEM GRAPHICS DISPLAY REPL. PARTS (2 of 3)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
FRONT PANEL ASSEMBLY (cont'd)				
	70206-40004	9	1	KEY CAP-SOFT KEY
	70206-40005	0	1	KEY CAP-C
	70206-40006	1	1	KEY CAP-MENU
	70206-40007	2	1	KEY CAP-DISP
	70206-40008	0	1	KEY CAP-USER
	70206-40009	4	1	KEY CAP-1
	70206-40010	7	1	KEY CAP-2
	70206-40011	8	1	KEY CAP-3
	70206-40012	9	1	KEY CAP-4
	70206-40013	0	1	KEY CAP-5
	70206-40014	1	1	KEY CAP-6
	70206-40015	2	1	KEY CAP-7
	70206-40016	7	1	KEY CAP-8
	70206-40017	4	1	KEY CAP-9
	70206-40018	5	1	KEY CAP-0
	70206-40019	8	1	KEY CAP-
	70206-40020	9	1	KEY CAP-
	70206-40021	0	1	KEY CAP-LOCAL
	70206-40022	1	1	KEY CAP-PLOT
	70206-40023	2	1	KEY CAP-PRINT
	70206-40024	3	1	KEY CAP-HOLD
	70206-40025	4	1	KEY CAP->
	70206-40026	5	1	KEY CAP-LINE
	70206-40027	6	1	KEY CAP-IP
WIRE/CABLE ASSEMBLIES				
	70205-60019	7	1	CABLE ASSEMBLY-VIDEO
	70206-60002	9	1	CABLE ASSEMBLY-FAN (60 HZ)
	70206-60003	0	1	CABLE ASSEMBLY-FAN (400 HZ)
	70206-60004	1	1	CABLE ASSEMBLY-LINE MODULE
	70206-60014	3	1	CABLE ASSEMBLY-HP-IB
	70206-60015	4	1	CABLE ASSEMBLY-KEYBOARD
	70206-60031	4	1	CABLE ASSEMBLY-GROUND
	8120-3217	1	1	CABLE ASSEMBLY-CRT SKT
	70206-60012	1	1	CABLE-BATTERY
	70206-60010	9	1	CABLE-DC POWER
	70206-60011	0	1	CABLE-AC POWER
	70206-60016	5	1	CABLE-HP-MSIB INPUT
	70206-60017	6	1	CABLE-HP-MSIB OUTPUT
	8150-3284	5	1	WIRE 18 600V 0.3 FT
	0360-0269	4	1	TML SLDR LUG 8

APPENDIX, HP 70206A

TABLE 2. HP 70206A SYSTEM GRAPHICS DISPLAY REPL. PARTS (3 of 3)

Item/ Ref. Des.	HP Part Number	C D	Qty	Description
CHASSIS PARTS				
	70205-40003	1	1	BODY-BATTERY MOUNT
	0515-0890	9	2	SCREW-MACH M3X0.5 6MM-LG 90-DEG-FLH-HD
	70205-00006	6	1	COVER-BATTERY
	0515-0888	3	2	SCREW-MACH M3X0.5 6MM-LG
	1420-0315	3	1	BATTERY 3.6V 1.7AH
	70206-00001	2	1	CHASSIS
	70206-20012	4	4	CHASSIS MOUNT
	70206-20013	8	1	FRONT FRAME CASTING
	0515-1240	5	4	SCREW-CAP M5.0 12 PCFLPDS
	0515-0896	5	4	SCREW-MACH M4.0 10 PCFHPDS
	70206-20015	0	1	REAR FRAME CASTING
	0515-1240	5	4	SCREW-CAP M5.0 12 PCFLPDS
	70206-00020	9	1	RETAINER-PC BOARD
	0515-0898	5	4	SCREW-MACH M4.0 6 PCFHPDP
	70206-00002	3	1	PLENUM COVER
	0515-0885	2	8	SCREW-MACH M4.0 8 PCPNPDS
	70206-40002	7	1	AIR SCOOP
	3150-0490	4	1	FILTER-AIR AL MESH
	70206-60003	4	1	DIVIDER
	70206-00004	5	1	COVER-CONNECTOR
	70206-00006	5	1	COVER-INNER
	70206-20017	2	1	MOUNT-LINE SW
	0515-1006	1	2	SCREW
DRESS COVERS/TRIM/FEET				
	0560-9835	0	1	COVER-TOP 18-IN
	0515-1232	5	1	SCREW-MACH M3.5 8 PCPNPDS
	0560-9847	4	1	COVER-BOTTOM 18-IN
	0515-1232	5	1	SCREW-MACH M3.5 8 PCPNPDS
	0561-2006	5	2	COVER-SIDE
	0540-7222	3	2	FOOT-BOTTOM FRONT
	0540-7201	8	2	FOOT-BOTTOM COVER
	0540-7221	2	4	FOOT-REAR
	0515-1232	5	4	SCREW-MACH M3.5 8 PCPNPDS
	0560-9804	3	2	STRAP-SIDE HANDLE ASSY
	0560-9800	0	2	FRONT HANDLE ASSY
	0520-8897	6	2	TRIM-HANDLE FRONT
	0540-7219	8	2	CAP-HANDLE STRAP FRONT
	0540-7220	1	2	CAP-HANDLE STRAP REAR
	0515-1239	2	4	SCREW-MACH M5.0 12 PCFLPDS
	70206-00008	7	4	STRAP NUT
	0515-1255	2	12	NUT-M4.0 8 PCFLHXS
	70206-40030	1	1	TRIM STRIP-TOP
	70206-80004	4	1	LABEL-70206 HP-IB
	7121-2380	3	1	LABEL-SERIAL NUMBER
	70205-80029	7	1	LABEL-WARNING

INDEX

This book has two indexes. The first is a general index and the second is an error message index. The page number references in these indexes comprise a chapter name and page number. The chapter name is necessary because each chapter has its own page numbers and is numbered starting with the number 0. The chapter names in the page number references are as follows:

Preparation for Use = Prep for Use

System Verification = Sys Verif

System Troubleshooting = Sys Trouble

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