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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. In other documentation, to reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product number/name was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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HP 70001A Mainframe Installation and Verification Manual

Supplement for use with HP 70000 Modular Spectrum Analyzer Installation and Verification Manual and HP 70900B Local Oscillator Source



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Safety Symbols

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

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 product or the user's work. 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 to the user. Do not proceed beyond a *WARNING* sign until the indicated conditions are fully understood and met.**
DANGER	**The *DANGER* sign denotes an imminent hazard to people. It warns the reader of a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *DANGER* sign until the indicated conditions are fully understood and met.**

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General Safety Considerations

WARNING

- **The instructions in this document are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**
- **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**
- **The power cord is connected to internal capacitors that may remain live for five seconds after disconnecting the plug from its power supply.**
- **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.**
- **For continued protection against fire hazard, replace fuse only with same type and ratings, (type nA/nV). The use of other fuses or materials is prohibited.**

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.
- **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.

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1

General Information

This 42-page installation and verification manual supplement for the HP 70001A mainframe supplements the installation and verification manual for the HP 70000 Series, HP 70900B local oscillator source-controlled modules. For information on installing and verifying components of the HP 70000 Series modular measurement system, refer to *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual and HP 70900B Local Oscillator Source*.

This manual contains the following five chapters:

- Chapter 1, "General Information," describes the mainframe and its accessories, gives electrostatic discharge and packaging information, and lists Hewlett-Packard Sales and Service Offices.
- Chapter 2, "Installation," provides information for preparing a mainframe for use and using it as a structural environment for installing and configuring instrument modules into HP 70000 Modular Measurement Systems.
- Chapter 3, "Specifications," lists mainframe specifications and characteristics.
- Chapter 4, "Verification," contains tests required to verify mainframe specifications.
- Chapter 5, "Troubleshooting," explains the probable causes of faults and problems indicated by front-panel fault indicators, and provides diagnosis and problem isolation techniques to help resolve these problems.

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Mainframe Description

A mainframe is a device into which plug-in modules may be installed to create an instrument in the modular measurement system. The HP 70001A mainframe provides the structural environment for plug-in instrument modules along with cooling, power, and digital communication interface buses.

It can accommodate 1/8-, 1/4-, 3/8-, and 1/2-width modules, and has a maximum capacity of eight 1/8-width modules.

Standard rack compatibility is provided, and bench-top use is facilitated with integral bails and retracting handles.

The Hewlett-Packard Modular System Interface Bus (MSIB) supports high-speed digital communication among instrument modules within a mainframe and among instruments connected to the external MSIB loop.

Every module in a mainframe has access to the standard Hewlett-Packard Interface Bus (HP-IB). This bus provides a path of communication among controllers, other HP-IB instruments and individual modules.

The ac power input is switchable between several ranges.

- 90-132 Vac, 47—66 Hz
- 199-264 Vac, 47—66 Hz
- 103-132 Vac, 356—444 Hz (with Option 400)

The mainframe power supply processes the ac line power to produces regulated 40 kHz ac power for the modules, 5 Vdc for the MSIB, dc power for the cooling fans and a TTL compatible line syncronization signal.

The primary power output, 24.3 Vac (average voltage, not rms) at 40 kHz, provides up to 200 Watts of power.

Two fans provide cooling for both the mainframe and up to eight installed 1/8-width modules. The cooling fans operate at variable speeds: they are slow at temperatures below 30°C, increasing their speed linearly above 30°C to a maximum speed for temperatures above 55°C. This provides adequate cooling over the permitted range of temperatures.

Mainframes with serial numbers 2704A01796 and lower may have single speed fans. A Fan Speed modification kit can be ordered for these units. This modification will provide variable speed fans, reducing fan noise about 3 dB at ambient temperatures below 30°C.

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Safety Considerations

Before operating this mainframe, familiarize yourself with any safety markings on the mainframe and the safety instructions in this manual. This mainframe has been manufactured and tested according to international safety standards. The cautions and warnings in this manual and on the mainframe must be followed to ensure the safe operation of the mainframe and protection of personnel. Refer to the summary of safety considerations at the front of this manual.

Mainframes Covered by Manual

The contents of this manual apply to HP 70001A mainframes with the serial number prefix(es) listed under “Serial Numbers” on the manual title page.

Serial Numbers

Attached to the front lower right frame of the mainframe, behind the swing-down door, is a mylar serial-number label. The serial number is divided into two parts. The first four digits and a letter are the serial number prefix, and the last five digits are the suffix. See Figure 1-1.

The prefix is coded for the date of the last configuration change and is the same for all identical mainframes; a prefix break or change only occurs when a significant modification is made to the product. The letter designates the country of origin. The suffix is assigned sequentially and is different for each mainframe.

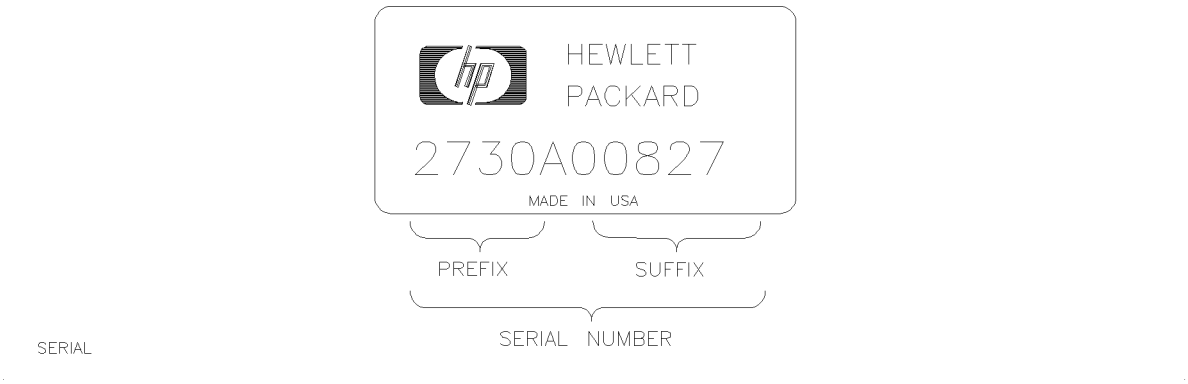


Figure 1-1. Typical Serial Number Label

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Manual Updating Supplement

A mainframe manufactured before or after this manual was printed may have a serial number prefix other than that listed under “Serial Numbers” on the manual title page. A lower serial-number prefix means that all current changes may not have been made to this mainframe. A higher serial-number prefix means that changes have been made to the mainframe since the manual was printed. These changes are documented in the Manual Updating Supplement for this manual. The Manual Updating Supplement may also contain information for correcting errors in the manual. To keep the manual as current and accurate as possible, periodically request the latest Manual Updating Supplement for this manual from your nearest Hewlett-Packard Sales and Service office.

Initial Inspection

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the mainframe has been checked mechanically and electrically. Refer to table 1-1 to determine what accessories should have been shipped with the mainframe. If the shipping contents are incomplete or damaged, notify the nearest Hewlett-Packard Sales and Service Office.

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Accessories

The accessories supplied with an HP 70001A Mainframe ordered separately or as part of a preconfigured HP 70000 Modular Measurement System are the same. These accessories are listed in Table 1-1. Contact the nearest Hewlett-Packard Sales and Service Office for a description of all power cables currently available for different country destinations.

Table 1-1. Accessories Supplied

Accessory	HP Part Number
8 mm hex ball driver	8710-1651
Power Cable	Part number depends on country of destination

When ordered with a preconfigured HP 70000 Modular Measurement System, cables are supplied to connect the modules in that configuration. Refer to the installation and verification manual for the system master for cables available for custom configurations.

Options

The following options are available and can be ordered from the nearest Hewlett-Packard Sales and Service Office.

Table 1-2. Options

Option number	Description	HP Part Number
400	400 Hz Input Isolation Transformer	70001-60066
913	Rack mount with handles	5061-9772
908	Rack mount without handles	5061-9678
010	Rack slide	5062-0781

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Front/Rear-Panel Features

Front-Panel Indicators

LINE ON Indicator

A green LINE ON indicator LED, located on the lower left front-panel, is illuminated when power is applied to the unit.

Fault Indicator LEDs

The following three fault indicators are located on the lower center front-panel.

- VOLT/TEMP red fault LED.
- CURRENT red fault LED
- I/O red fault LED

Some older models may have a fourth fault indicator labeled AIR FLOW. The circuitry for this indicator has been disabled.

A description of conditions that can cause these fault indicators to turn on is supplied in Chapter 5, “Troubleshooting.”

Module Latch

The module hex-nut latch secures a module in a mainframe. When a module is being installed into or removed from an HP 70001A Mainframe, an 8 mm hex-ball driver is used to turn the module latch screw. Refer to Chapter 2, “Module Installation.”

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Rear-Panel Features

Inputs/Outputs

Two MSIB Input/Output connectors and one HP-IB connector are located on the rear panel. Each module can have an interface to the MSIB bus and to the HP-IB bus.

Hewlett-Packard Interface Bus (HP-IB). The HP-IB connector provides feedthrough communication among controllers, other HP-IB instruments, and with each module installed in the mainframe.

Hewlett-Packard Modular System Interface Bus (MSIB). The MSIB is the high-speed digital bus used by master, slave modules and other elements for exchanging control information and data. It consists of both an internal and an external bus. The internal bus is housed in the HP 70001A Mainframe and connects to each installed module within the mainframe. External MSIB cables connect mainframes to each other, to the Graphics Display, and to other MSIB compatible devices. This external MSIB bus allows multiple instruments to communicate and be displayed simultaneously. The use of longer MSIB cables allows you to locate a display some distance from the rest of the instrument. See "Remote Operation" in Chapter 2, "Installation."

Refer to the installation and verification for the system master for additional information related to the HP-IB and MSIB buses and cabling instructions.

Mainframe/Module Interconnect

The mainframe has slots to accommodate eight 1/8-width modules. Each of these slots has air holes to deliver cooling air and a multiple-pin connector providing power-supply voltages and MSIB connections for module communication and control.

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Electrostatic Discharge Information

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. Figure 1-2 shows an example of a static-safe work station using two types of ESD protection: (1) wrist-strap (with greater than 1mΩ isolation to ground) and table-mat combination, (2) heel-strap (with greater than 1mΩ isolation to ground) and conductive floor-mat combination. The two types must be used together to ensure adequate ESD protection. Isolation to ground must be provided for personnel protection. Refer to Table 1-3 for a list of static-safe accessories and their part numbers.

WARNING **In order to provide proper personnel protection, the wrist- and heel-straps must have greater than 1mohm isolation to ground.**

Hazards of Internal Repair and Adjustment

If the HP 70001A bottom cover is removed for any reason, the following precautions must be observed.

WARNING

Disassembly, adjustments, and internal repairs should only be attempted by qualified technical personnel.

The mainframe internal power supplies have lethal voltages, with lethal currents, in all areas.

DANGEROUS VOLTAGES exist on boards in this instrument even when the power is off.

Board assembly voltages cannot be safely measured without an isolation transformer.

AC power line voltage is present on the power supply board, even when the power switch is off.

The power supply board circuit common can be at approximately −200 V, not earth ground.

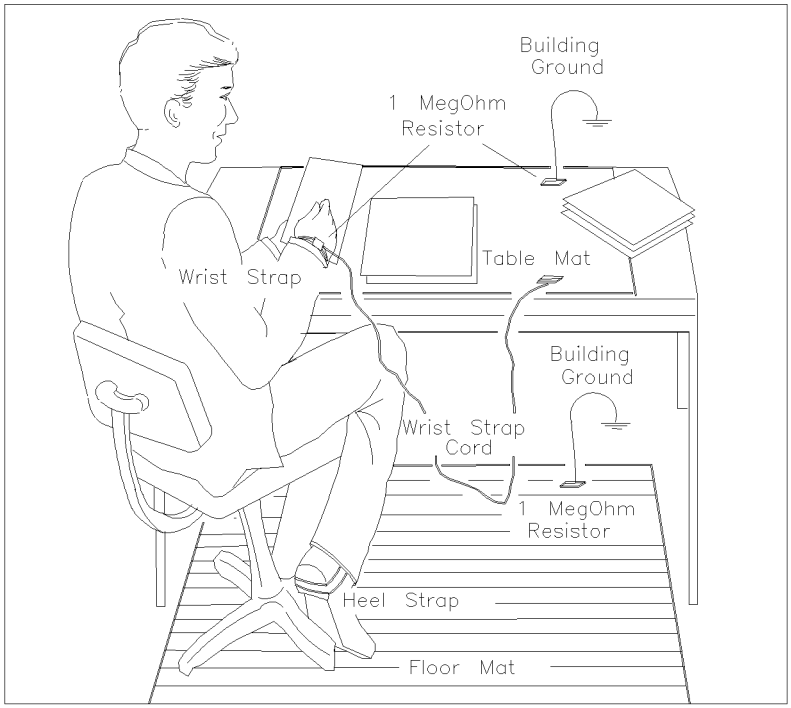
Capacitors may retain high-voltage stored charges for several minutes, even with no power applied.

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Reducing ESD Damage

Care and Handling of Electronic Components

- Handle these items at a static-safe work station.
- Store or transport these items in static-shielding containers.
- Use proper handling techniques.



ESDPARTS

Figure 1-2. Example of a Static-Safe Work Station

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Static-Safe Accessories

Table 1-3. Static-Safe Accessories

HP Part Number	Description
9300-0797*	set includes: 3M static control mat 0.6 m × 1.2 m (2ft × 4ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980*	Wrist-strap cord 1.5 m (5 ft)
9300-1383*	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169*	ESD heel-strap (reusable 6 to 12 months).
9300-0793*	Shoe ground strap.
*Order through any Hewlett-Packard Sales and Service Office.	
92175A **	Black, hard surface, static control mat, 1.2 m × 1.5 m (4 ft × 5 ft)
92175B **	Brown, soft-surface, static control mat, 2.4 m × 1.2 m (8 ft × 4 ft)
92175C **	Small, black, hard surface, static control mat, 1.2 m × 0.9 m (4 ft × 3 ft)
92175T **	Tabletop static control mat, 58 cm × 76 cm (23 in × 30 in)
92176A **	Natural color anti-static carpet, 1.8 m × 1.2 m (6 ft × 4 ft)
92176C **	Russet color anti-static carpet, 1.8 m × 1.2 m (6 ft × 4 ft)
92176B **	Natural color anti-static carpet, 2.4 m × 1.2 m (8 ft × 4 ft)
92176D **	Russet color anti-static carpet, 2.4 m × 1.2 m (8 ft× 4 ft)
**Order by calling HP DIRECT Phone (800) 538 8787 or through any Hewlett Packard Sales and Service Office.	

Sales and Service Offices

Hewlett-Packard Sales and Service Offices provide complete support for Hewlett-Packard products. To obtain servicing information, or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in Table 1-4. In any correspondence, be sure to include the pertinent information about model numbers, serial numbers, and/or assembly part numbers.

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A current list of Hewlett-Packard Service Centers can be accessed on the Internet at:
`http://www.tmo.hp.com/tmo/contacts/`

If you do not have access to the Internet, one of the following Hewlett-Packard locations can direct you to your nearest Hewlett-Packard representative:

Table 1-4. HP Service Centers

United States	Hewlett-Packard Company Test and Measurement Call Center (800) 403-0801 (800) 857-8161 (FAX)
Canada	Hewlett-Packard Canada Ltd. 5150 Spectrum Way Mississauga, Ontario L4W 5G1 (905) 206-4725 (905) 206-4739 (FAX)
Europe	Hewlett-Packard European Marketing Centre Postbox 667 1180 AR Arnstelveen Netherlands (31/20) 547-6669 (31/20) 647-8706
Japan	Hewlett-Packard Japan Ltd. 27-15, Yabe 1-Chome, Sagamihara, Kanagawa 229 Japan (81426) 567 832 (81426) 567 843 (FAX)
Latin America	Hewlett-Packard Latin America Region Headquarters 5200 Blue Lagoon Drive, 9th Floor Miami, Florida 33126 U.S.A. (305) 267 4245 (305) 267 4288 (FAX)
Austrailia/New Zealand	Hewlett-Packard Calibration Services Austrailia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 Austrailia 1800 802 540 1800 681 776 (FAX)
Asia-Pacific	Hewlett-Packard Asia-Pacific Ltd. 17-21/F Shell Tower, Times Square 1 Matheson Street, Causeway Bay Hong Kong (852) 25 997 777 (852) 25 069 261 (FAX)

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Returning Instruments for Service

If a mainframe is being returned to Hewlett-Packard for servicing, fill in and attach a blue service tag. Service tags are supplied at the end of this manual. Please be as specific as possible about the nature of the problem. Include copies of error messages, data related to mainframe performance, type of system, etc., along with the mainframe being returned.

Packaging

The original shipping containers should be used. If the original materials were not retained, identical packaging materials are available through any Hewlett-Packard office.

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

Instrument Shipping Preparation Procedure.

1. Fill out a blue repair card (located at the end of this manual) and attach it to the instrument. Include any error messages or specific performance data related to the problem. If a blue repair tag is not available, the following information should be noted and sent with the instrument.
   a. Type of service required
   b. Description of the problem
   c. Is problem constant or intermittent
   d. Name and phone number of technical contact person
   e. Return address
   f. Model number of returned instrument
   g. Full serial number of returned instrument
   h. List of any accessories returned with instrument
2. Pack the instrument in the appropriate packaging materials. Original shipping materials or the equivalent should be used. If the original or equivalent materials cannot be obtained, instruments can be packaged for shipment using the following instructions.

Caution Inappropriate packaging of instruments may result in damage to the instrument during transit.

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a. Wrap the instrument in anti-static plastic to reduce the possibility of damage caused by ESD.
b. For instruments that weigh less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength.
c. The carton must be large enough to allow three to four inches on all sides of the instrument for packing material and strong enough to accommodate the weight of the instrument.
d. Surround the equipment with three to four inches of packing material, to protect the instrument and prevent it from moving in the carton.
e. If packing foam is not available, the best alternative is S.D.-240 Air Cap from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles.
f. Use the pink (anti-static) Air Cap to reduce static electricity. Wrapping the instrument several times in this material will protect the instrument and prevent it from moving in the carton.

3. Seal the carton with strong nylon adhesive tape.
4. Mark the carton 'FRAGILE, HANDLE WITH CARE'.
5. Retain copies of all shipping papers.

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2

Installation

This chapter contains information needed to prepare a mainframe for use, and describes how instrument modules are installed to configure the HP 70001A Mainframe into an HP 70000 Series system.

The information presented is general in nature. For more detailed information on configuration and HP-MSIB addressing, refer to the installation and verification manual for the system master (e.g., HP 70900A Local Oscillator).

The HP 70001A mainframe is a rugged structure into which modules of various widths can be placed. It provides power, cooling, and a suitable environment for electromagnetic compatibility for the modules, and manages all digital communications among the system elements. LED fault indicators, on the lower front-panel, report mainframe or module problems. For specific LED fault indicator information, refer to Chapter 5 of this manual.

Unpacking

Inspect the shipping container for damage. If the container or cushioning material is damaged, check the contents of the shipment both mechanically and electrically. If the contents are damaged or defective, contact your nearest Hewlett-Packard Sales and Service Office. A list of offices is included in Chapter 1 of this manual. 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 the carrier's inspection.

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Preparation for Use

Line Voltage Selector

Set the line voltage selector to the setting corresponding to the power source used. Access to this switch is provided through a hole in the left-front bottom cover. Refer to Figure 2-1 for an illustration of the line voltage selector.

WARNING **Before turning this instrument on, 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.**

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

- 115 V position for 90 to 132 Vac line input voltages
- 230 V position for 198 to 264 Vac line input voltages

Failure to set the ac power input to the correct voltage could cause one of two things to happen when power is applied.

- If the switch is set to 115 V and the instrument is connected to 230 V, the fuse will blow.
- If the switch is set to 230 V and the instrument is connected to 115 V, the instrument will not turn on and the VOLT\TEMP fault indicator will light.

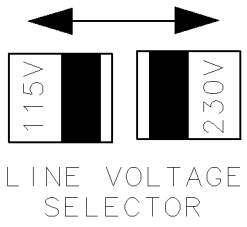


Figure 2-1. Line Voltage Selector

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400 Hz Option

The HP 70001A Mainframe is available with an option that allows it to operate on a power-line frequency of 400 Hz. The 400 Hz option comes with an external in-line 600 V-A isolation transformer that must be used when the instrument uses a 400 Hz power source.

WARNING **Never operate a 400 Hz option instrument on a 400 Hz power line without using the in-line isolation transformer supplied for this purpose. Failure to follow this precaution can create a shock hazard which may result in personal injury.**

The in-line isolation transformer must be removed from the 400 Hz option for 50/60 Hz power source operation. Failure to remove the in-line 400 Hz transformer will result in the 400 Hz transformer input fuse. When the isolation transformer is removed, a standard power cord must be used. The in-line transformer must be reinstalled when using a 400 Hz power source, in order to protect the user from electric shock hazard.

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 fuse is a 5 by 20 mm fuse rated at 6.3 A, 250 V, HP part number 2110-0703. Refer to Figure 2-2 for fuse removal and replacement.

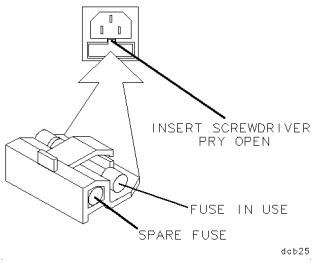


Figure 2-2. Line Fuse Removal and Replacement

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Cabling

The HP-MSIB cables are connected in a serial (daisy-chain) manner, coupling the input of one element to the output of next until the loop is completed.

Remote Operation

The use of long HP-MSIB cables to separate the mainframe and display, or other products supporting HP-MSIB, allows remote operation. Since the signals on the HP-MSIB are digital, only measurement speed is slightly degraded.

Addressing

The HP 70001A Mainframe does not have an HP-MSIB address. The mainframe acts as an HP-MSIB arbitrator, allocating time on the HP-MSIB bus to any module or device designed to work with an HP 70000 Series system that requests it.

Adjustments

The HP 70001A Mainframe has only internal service-related adjustments. These adjustments should only be attempted by qualified technical personnel.

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Module Installation and Removal

Module Installation

To install modules into a mainframe, follow these steps.

1. Turn the mainframe off.
2. Swing open (down) the front door. Note that the door will not swing down unless the line switch is off.
3. Slide the module into the mainframe.
4. Tighten the module latch using an 8 mm hex-balldriver.
5. Connect intermodule cabling.

Module Removal

The removal of modules is accomplished by following these steps.

1. Turn the mainframe off.
2. Disconnect intermodule cabling. Be sure to check the rear of the module.
3. Swing open the front door. (Power switch must be off.)
4. Loosen and disengage the module latch using an 8 mm hex-balldriver.
5. Slide the module out of the mainframe.

Note Care should be taken when installing and removing modules. The front panels of adjacent modules can easily be scratched and dented if the module being moved is not carefully guided into or out of its slot.

CAUTION Modules must be slid straight into and out of the mainframe slots or the sharp edges of the module covers may contact and abrade the covers of adjacent modules and mainframe guides.
If extreme environmental conditions exist where dust and debris may be drawn into the air flow and distributed throughout the instrument, a Frame-Fine Filter (HP part number 70000-40017) can be ordered from the nearest HP Sales and Service Office.

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3

Specifications

The following specifications apply to the HP 70001A mainframe. For system specifications, refer to the "Specifications" chapter of the installation and verification manual for the system master.

Specifications

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

Nominal Values

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

General Specifications

Temperature	**Operation** 0° C to +55°C	**Storage** −40° C to +75° C
EMI	Radiated interference is within the requirements of MIL-STD 461B, Class A1c RE02	
Warm-up time	One hour from a cold start[1] (0° to 55° C)	
Weight (nominal value)	14.5 kg (32 lb)	(mainframe only)
Dimensions	Height Width Length	177 mm (6.97in) 425 mm (16.75 in) 526 mm (20.7 in)
AC Power Input Line Ranges	90—132 Vac 198—264 Vac 103—132 Vac	47—66 Hz 47—66 Hz 365—444 Hz (with Option 400)
VA Rating	310 W maximum 570 VA maximum	

[1] The mainframe requires a maximum of 5 minutes warm-up time; however, when configured into an instrument, the other elements may require 1 hour warm-up time.

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4

Verification

This chapter normally contains unit performance-verification tests, which evaluate the electrical performance of the unit against its specifications. There are no performance-verification tests that apply to the HP 70001A mainframe specifications.

Power-On Self-Test

The act of turning on an HP 70000 Series system causes any modules installed in the system to execute a power-on self-test. The mainframe is not involved in these tests except in supplying power and communication for the modules.

For a detailed explanation of the power-on self-tests, refer to the "Troubleshooting" chapter of the installation and verification manual for the system master.

Fault Indicators

The HP 70001A Mainframe has VOLT/TEMP, CURRENT, and I/O fault indicators. If any of these indicate a fault, the condition must be cleared before the mainframe will operate. Refer to Chapter 5, "Troubleshooting."

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5

Troubleshooting

This chapter provides troubleshooting information on the HP 70001A mainframe. Problem isolation and diagnosis related to the front-panel fault indicator lights, fan operation, fuse replacement, and power-on light are discussed as operator-level repairs.

Turn On

When the HP 70001A as part of an HP 70000 Modular Measurement System is turned on, the mainframe monitors its condition as it brings power and cooling air up to specification. Once power and cooling is established, the modules begin their self-test sequences.

The power ON light should come on and stay on.

The VOLT/TEMP and I/O fault indicators should blink on and then turn off.

The CURRENT fault indicator should not light.

The fan noise will be noticeable.

During this self-test, the module ACT and ERR lights of all the modules in the instrument will be turning on and off. After about a minute these lights should settle down to a steady state.

After the module self-test is complete, the power ON indicator is the only mainframe light that should remain on.

Note Some older models may have a fourth fault-indicator labeled AIR FLOW. This indicator should not light. The circuitry for this function should be disabled.

Line Fuse

A 6.3 A, 250 V line fuse is located inside the power receptacle on the back of the instrument.

The most common reason for an open fuse is improper setting of the line voltage selector, however, internal problems can also cause a fuse to open.

See Figure 2-2 for fuse removal and replacement information. Refer to the *HP 70001A Service Manual* for troubleshooting information.

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Fault Indicators

The HP 70001A has three fault indicators. While these indicators are located in the mainframe, problems external to the mainframe can cause the indicators to turn on. External problems should be investigated before troubleshooting the mainframe.

VOLT/TEMP — If this fault indicator is on steady, check for the following problems before deciding the mainframe needs repair.

Temperature limits — Excessive ambient temperature, exceeding 55°C will cause the VOLT/TEMP fault indicator to come on and stay on. Move the mainframe to a cooler environment and wait for the temperature to decrease to the normal operation range.[1] When the temperature decreases the mainframe will restart itself. If the indicator goes out after the mainframe has cooled the mainframe is probably not at fault.

If the problem persists; when the mainframe attempts to restart itself, verify that both cooling fans are operating by checking the airflow into both of the rear-panel fan-intake openings of the mainframe.

Low input voltage — If the line voltage is low or the voltage selector setting does not agree with the input voltage, the VOLT/TEMP fault indicator will come on. Check the ac input voltage and set the voltage selector switch as follows.

115 V — position for 90—132 Vac line input voltage.

230 V — position for 198—264 Vac line input voltage.

If the low voltage condition is corrected, the unit will restart itself.

Note Very long ac wiring runs may cause the ac power voltage at the mainframe to drop below an acceptable limit, when the mainframe applies its load to the ac line. This will cause the mainframe to cycle on and off. No damage will occur as a result. The cure is to correct the power wiring or voltage.

A flashing VOLT/TEMP fault indicator can be caused by an impedance mismatch between the ac line and the mainframe input. This usually occurs only at extremely low temperatures (below 0°C). The cold input thermistors (now a high impedance) reduce the line voltage. An under voltage condition is sensed and the mainframe shuts off. The reduced load allows the sensed line voltage to rise and the unit turns back on.

[1] Keep in mind that the internal temperature of the instrument will change with a corresponding change in the ambient room temperature, and that there is a delay between a change in ambient temperature and a change in internal temperature. It can take 20 minutes or more for an overheated mainframe to cool internally to an acceptable temperature, since no cooling air is being moved by the fans when the supply is shut down.

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This cycling will continue until the input thermistors warm up to a point where the sensed voltage is within tolerance. At this point the fault indicator stops flashing, the mainframe is operational.

If the condition does not go away after several minutes, check the input line voltage under load or change the ambient operating temperature.

High output voltage and Fan voltage failure

These two conditions will also cause the the VOLT/TEMP fault indicator to come on and the instrument will latch in a fault condition. The mainframe is in need of internal repair or adjustment. It will shut down and not attempt to restart until ac line power is cycled.

CURRENT

This circuitry senses and indicates if the load on the mainframe power supply is too high. Upon sensing an over-current condition, the power supply is shut down and latched. It will not attempt to restart until ac line power is cycled.

If a CURRENT fault indicator is on, check for a faulty module before attempting to repair the mainframe. The following steps will help isolate the problem.

1. Turn the mainframe off.
2. Remove all the modules from the mainframe.
3. Cycle the power. Is the CURRENT indicator still on?

   NO Turn off the mainframe and one by one replace the modules (cycling power each time) until the faulty module is identified. Refer to the repair procedures in the installation and verification manual for the system master or the service manual related to the faulty module for repair alternatives.

   YES If the CURRENT indicator is still on when all of the modules have been removed from the mainframe, the mainframe probably has an internal problem. Check to ensure that the grounding springs on the 50 pin module connectors are not shorting the 40 KHz to ground. Refer to the *HP 70001A Service Manual* for additional troubleshooting information.

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I/O

This circuitry senses the readiness of the external HP-MSIB. If the indicator is on, HP-MSIB communications are inhibited. The I/O fault indicator light will be on if one of the following conditions is true.

- The external HP-MSIB loop is not complete. Check that both ends of all HP-MSIB cables are securely connected.[2]
- Not all the elements on the external HP-MSIB loop have the power turned on. Verify that the power is on to all mainframes and stand-alone instruments on the external HP-MSIB.
- The mainframe is in need of repair.

HP-MSIB communication will resume as soon as the problem is corrected.

If an I/O light fault is indicated, the following steps will help isolate the problem.

Disconnect both HP-MSIB cables from the mainframe at the mainframe connectors. Is the I/O fault indicator still on?

NO The problem is either with the cables, or the element that was connected to the mainframe with the cables.

Loop each cable "IN" to "OUT" to the mainframe HP-MSIB connectors. If the I/O light comes on, that cable is faulty. If the light does not come on for either cable, then the element connected with these cables is faulty. Refer to the service manual for that element for troubleshooting information.

YES The HP 70001A Mainframe or one of the installed modules is probably faulty. Remove all the modules. Does the light still come on?

Yes The mainframe is faulty. Refer to the *HP 70001A Service Manual* for troubleshooting information.

No Replace the modules one at a time until a faulty module or slot is located. Try the module in a different slot. If the problem only occurs in one slot the mainframe or connector is faulty. If the problem follows the module the module is faulty. Refer to the faulty module service manual for repair instructions.

Note It is possible that a module may disrupt all HP-MSIB communication with no mainframe fault or no module error lamp turned on.

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[2] If more than one mainframe is used, or if other elements are connected to the HP-MSIB, all cables must be connected otherwise; the HP-MSIB will not operate. If a single mainframe with no external elements is used, there should be no HP-MSIB cables connected to the external HP-MSIB connectors of that mainframe, although a single cable looped from the input connector to the output connector will allow the mainframe to operate.

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If problems persist, refer to the installation and verification manual for the system master or the *HP 70001A Service Manual* for additional troubleshooting information.

Keep in mind that mainframe internal adjustments or repairs should only be attempted by qualified technical personnel. Review the "Hazards of Internal Repair or Adjustment" and associated warning notice in Chapter 1, "General Information."

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