



HEWLETT  
PACKARD

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## **Installation and Verification Manual**

# **HP 70004A DISPLAY**

### **SERIAL NUMBERS**

This manual applies directly to HP 70004A DISPLAYS with serial numbers prefixed 2916A and below.

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1212 VALLEY HOUSE DRIVE, ROHNERT PARK, CALIFORNIA 94928-4999, USA**

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Microfiche Part Number: 70004-90006**

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## Certification

*Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.*

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

*For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.*

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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.

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### Caution



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

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### 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.

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## General Safety Considerations

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### 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.**

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### 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.**

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### 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.**

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# HP 70000 Modular Measurement System Documentation Outline

Instruments and modules of the HP 70000 Modular Measurement System are documented to varying levels of detail. Modules that serve as masters of an instrument require operation information in addition to installation and verification instructions. Modules that function as slaves in a system require only a subset of installation and verification information.

## Manuals Supplied with Module

### Installation and Verification Manual

Topics covered by this manual include installation, specifications, verification of module operation, and some troubleshooting techniques. Manuals for modules that serve as instrument masters will supply information in all these areas; manuals for slave modules will contain only information needed for slave module installation and verification. Master module documentation may also include some system-level information.

### Operation Manual

Operation Manuals usually pertain to multiple- and single-module instrument systems. Topics include preparation for module use, module functions, and softkey definitions.

### Programming Manual

Programming Manuals also pertain to multiple- and single-module instrument systems. Programming Manual topics include programming fundamentals and definitions for remote programming commands.

## Service Manual, Available Separately

This manual provides service information for a module, including module verification tests, adjustments, troubleshooting, replaceable parts lists, and replacement procedures. For ordering information, contact a Hewlett-Packard Sales and Service Office. This manual is not always immediately available for new products. (NOTE: Some earlier service manuals are titled *Technical Reference*.)

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## General Information

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### Introduction

The *HP 70004A Display Installation and Verification Manual* contains information needed to install and verify the HP 70004A Display. For information on installing and verifying HP 70000 Modular Measurement Systems, refer to the *Installation and Verification Manual* for the system master (for example, the HP 70900B Local Oscillator module).

This manual contains the following five chapters:

- Chapter 1, “General Information,” describes the display 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 display 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 display specifications and characteristics.
- Chapter 4, “Verification,” contains tests required to verify display specifications.
- Chapter 5, “Troubleshooting,” explains the probable cause(s) of faults and problems indicated by front-panel fault indicators, and provides diagnosis and problem isolation techniques to help resolve these problems.

### Notation

Throughout this manual menu-key labels are denoted as **TEXT**. Fixed-label keys are denoted as **TEXT**.

## Modular Measurement Terms Used in This Manual

Understanding the following terms is essential to understanding the structural relationship of the modular measurement system devices.

### Functional Terms

The devices of a modular system may be combined in such a way to allow them to communicate and operate as an instrument. The following terms identify the interrelationship among devices within a modular instrument.

- **Element:** Any device that communicates over the Hewlett Packard Modular System Interface Bus (HP-MSIB), for example, the HP 70902A IF Section. In contrast, the HP 70001A Mainframe controls all HP-MSIB communication, but does not communicate over the HP-MSIB and therefore is not an element.
- **Master:** A module that controls other modules.
- **Sub-Master:** An element that other elements control and simultaneously controls other elements.
- **Slave:** A module that another module controls.
- **Independent element:** An element that is neither a master nor a slave (for example, the HP 70205A Graphics Display).
- **Instrument:** A module, or group of modules, that performs an independent function (for example, the HP 71100C Spectrum Analyzer).

### Structural Terms

Modular systems consist of hardware structures dedicated to specific functions. The structural terms used in reference to these functions are described below.

- **Mainframe:** A mainframe is the device into which plug-in modules may be installed to create an instrument such as a modular measurement system.
- **Module:** Modules are devices that plug into a mainframe. They cannot function without a mainframe.
- **Stand-Alone Instrument:** An HP-MSIB element capable of performing its functions without a mainframe (for example, the HP 70206A Graphics Display).

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## Display Description

The HP 70004A Display provides a graphics display and human interface for the HP 70000 Modular Measurement System. The display section of the HP 70004A fulfills the same function as the HP 70206A System Graphics Display or the HP 70205A Graphics Display module. The mainframe section of the display also provides the structural environment for plug-in instrument modules along with cooling, power, and digital communication interface buses.

The display shows system configuration information, measurement results, text, graphics, and built-in trace and marker capabilities in up to 16 simultaneous colors (selectable from a palette of 4096 colors) at a resolution of 1024 horizontal by 400 vertical pixels. Menu keys are used to establish an interactive front panel for any modular instrument. A 7.5-inch diagonal display screen, menu keys, data and control keys, and a digital-control knob assist system operation. The display may be stacked or racked with the HP 70001A System Mainframe or located remotely away from the rest of the system.

Install plug-in modules in the mainframe section of the display to create an instrument in the modular measurement system. The display's mainframe can accommodate 1/8-, 1/4-, 3/8-, and 1/2-width modules, and has a maximum capacity of four 1/8-width modules. Standard rack compatibility is provided, and bench-top use is facilitated with retracting bails and built-in handles.

The HP-MSIB supports high-speed digital communication among instrument modules within the display and among instruments connected to the external HP-MSIB loop.

Every module in the display 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.

- 87—132 V ac, 47—66 Hz
- 174—264 V ac, 47—66 Hz
- 87—132 V ac, 356—444 Hz

The display power supply processes the ac line power to produce regulated 40 kHz ac power for the modules, 5 V dc for the HP-MSIB, dc power for the cooling fan, and a TTL-compatible line synchronization signal. The primary power output, 24.3 V ac (average voltage, not rms) at 40 kHz, provides up to 200 watts of power.

A fan provides cooling for both the display and up to four 1/8-width modules.

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## Safety Considerations

Before operating this display, familiarize yourself with any safety markings on the display and the safety instructions in this manual. The display has been manufactured and tested according to international safety standards. The cautions and warnings in this manual and on the display 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.

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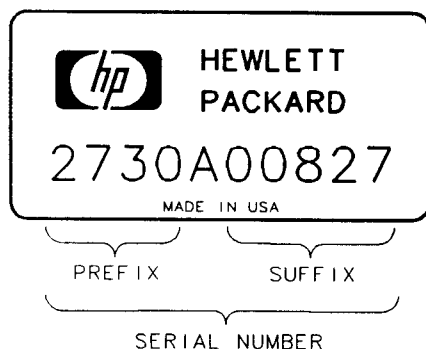
## Displays Covered by This Manual

The contents of this manual apply to the HP 70004A Display with the serial number prefix(es) listed on the manual title page.

### Serial Numbers

Attached to the rear panel of the display 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 displays; 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 display.



**Figure 1-1. Typical Serial Number Label**

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## Manual Updating Supplement

A display manufactured before or after this manual was printed may have a serial-number prefix other than that listed on the manual title page. A lower serial-number prefix means that all current changes may not have been made to this display. A higher serial-number prefix means that changes have been made to the display 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.

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## Initial Inspection

Inspect the shipping container for damage. If the shipping container or packing material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the display has been checked mechanically and electrically. Refer to Table 1-1 to determine what accessories should have been shipped with the display. 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 70004A Display 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 for the HP 70004A Display**

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 your system master's installation and verification manual for cables available for custom configurations.

**Table 1-2. Optional Accessories for the HP 70004A Display**

HP-MSIB Cables Length	HP Part Number
0.5 mm	70800A
1.0 mm	70800B
2.0 mm	70800C
6.0 mm	70800D
30.0 mm	70800E
RCA to BNC Adapter (3 required)	1250-1853

For longer HP-MSIB cables, contact your nearest Hewlett-Packard Sales and Service Office.

---

## Options

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

**Table 1-3. Options**

Option Number	Description	HP Part Number
913	Rack mount with handles	5062-4073
908	Rack mount without handles	5062-3979
010	Rack slide	92576

## Front/Rear-Panel Features

### Front-Panel Features

The HP 70004A Display front panel accesses all instrument functions using both menu-driven and fixed-label keys.

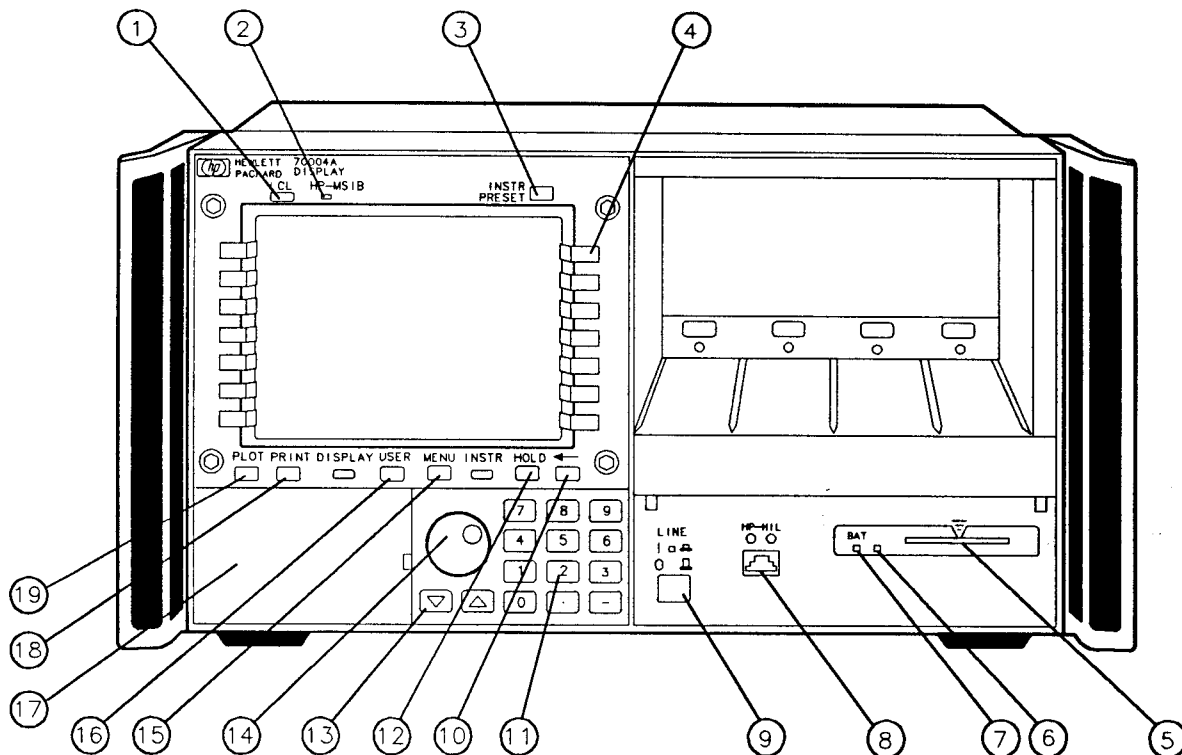


Figure 1-2. Display Front-Panel Features

1. Use the **LCL** (Local) key to return the instrument from HP-IB remote control to local control.
2. The **HP-MSIB fault indicator light** indicates the status of the HP-MSIB. If the light is on, there is an HP-MSIB problem.
3. Use the **INSTR PRESET** (instrument preset) key to activate all the preset conditions of the instrument presently controlled by the keyboard.
4. Use the **menu** keys to activate most instrument and system control operations.
5. The **Memory card slot** provides additional memory for saving and recalling instrument states, data, user keys, traces, and programs.
6. The **Memory card access light** indicates the memory card is being read or data is being written to it.



7. The Memory Card **Battery Low** light indicates a low battery condition on the memory card. The light is off unless the memory card is inserted.
8. Devices supported by **HP-HIL** include the HP 46020A and HP 98203A keyboards, and most relative locator devices (Mouse and Trackball).
9. The **LINE** key switches the display on and off.
10. Use the **←** (backspace) key to move from a lower level of menu keys to the next higher level. Use the **⇐** key to move the cursor while entering text.
11. Use the **numeric keypad** to enter numeric values.
12. Use the **HOLD** key to deactivate an active function to prevent further control setting changes.
13. Use the **knob** to change parameter values, and to select alpha characters.
14. Use the two **↑** **↓** (step) keys to change parameters up or down.
15. Use the **INSTR** (instrument) key to move the display keyboard between modules in the system.
16. Use the **DISPLAY**, **USER**, and **MENU** keys to call the top-level menu key menus to the screen.
17. The **custom instrument keypad** provides up to 15 instrument-specific “keys” on a snap-in panel.
18. Use the **PRINT** key to start a raster-print output of the present display screen over HP-IB.
19. Use the **PLOT** key to start a vector-plot output of the present display screen over HP-IB.

## Display/Module Interconnect

The mainframe portion of the display has slots to accommodate four 1/8-width modules. Each of the slots has air holes to deliver cooling air and a multiple-pin connector that provides power-supply and HP-MSIB connections for module communication and control.

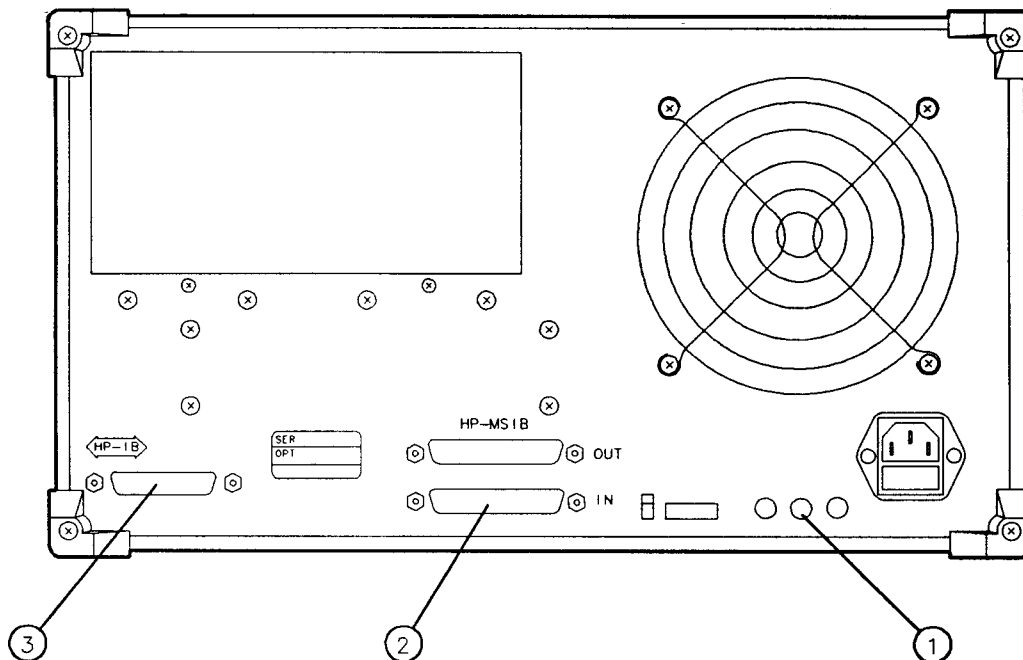
## Module Latch

The module hex-nut latch secures a module in the mainframe portion of the display. When a module is being installed into or removed from the display, an 8 mm hex-ball driver is used to turn the module latch screw. Refer to Chapter 2, “Installation,” for more information about installing modules in the display.

## Display Screen Cleaning

To avoid damaging the coating on the display screen, use a thin-film cleaner such as Hewlett-Packard Video Clean Kit (HP part number 92193). The kit includes an abrasion-free cleaning cloth.

## Rear-Panel Features



**Figure 1-3. Display Rear-Panel Features**

1. The **RGB monitor output** provides a red (R), green (G), and blue (B) output with sync on green (75 $\Omega$  impedance, 1 V p-p).
2. The **HP-MSIB** is the high-speed digital bus used by master and slave modules and other elements for exchanging control information and data.
3. The **HP-IB** provides communication among controllers, other HP-IB instruments, and with each module installed in the display.

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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 1-4 shows an example of a static-safe work station using two types of ESD protection:

1. Wrist-strap (with greater than 1 m $\Omega$  isolation to ground) and table-mat combination.
2. Heel-strap (with greater than 1 m $\Omega$  isolation to ground) and conductive floor-mat combination.

Both types must be used together to ensure adequate ESD protection. Isolation to ground must be provided for personnel protection. Refer to Table 1-4 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 1 m $\Omega$  isolation to ground.

---

## Hazards of Internal Repair and Adjustment

If the HP 70004A outside cover is removed for any reason, the following precautions must be observed.

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### Warning



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

The display's 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.

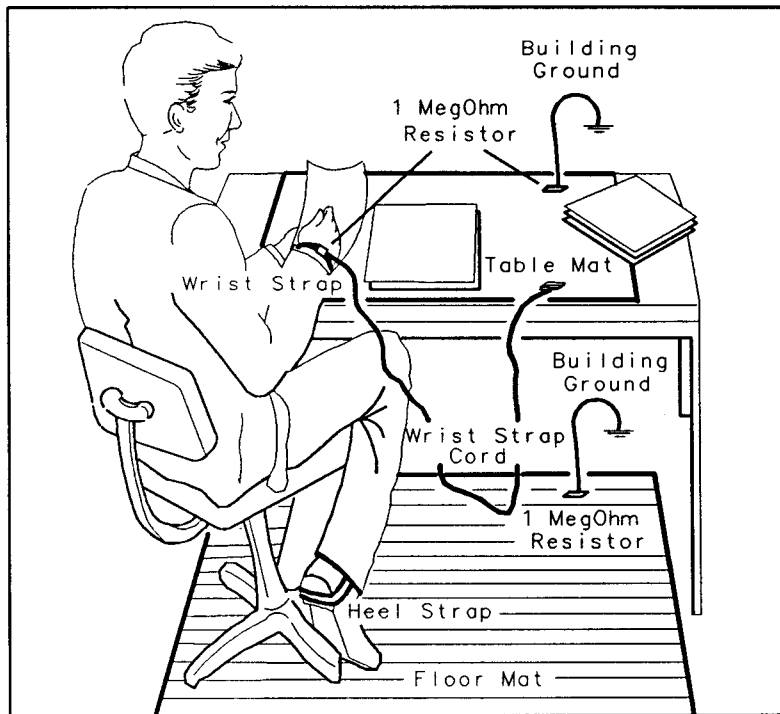


Figure 1-4. Example of a Static-Safe Work Station

## Static-Safe Accessories

**Table 1-4. Static-Safe Accessories**

HP Part Number	Description
Order the following through any Hewlett-Packard Sales and Service Office	
9300-0797	Set includes: 3M static control mat 0.6 m × 1.2 m (2 ft × 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169	ESD heel-strap (reusable 6 to 12 months).
Order the following by calling HP DIRECT at (800) 538-8787 or 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 antistatic carpet, 1.8 m × 1.2 m (6 ft × 4 ft)
92176C	Russet color antistatic carpet, 1.8 m × 1.2 m (6 ft × 4 ft)
92176B	Natural color antistatic carpet, 2.4 m × 1.2 m (8 ft × 4 ft)
92176D	Russet color antistatic carpet, 2.4 m × 1.2 m (8 ft × 4 ft)

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## 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 1-5. In any correspondence, be sure to include the pertinent information about model numbers, serial numbers, assembly part numbers.

**Table 1-5. Hewlett-Packard Sales and Service Offices**

<b>IN THE UNITED STATES</b>	<b>IN AUSTRALIA</b>	<b>IN JAPAN</b>
<b>California</b>	Hewlett-Packard Australia Ltd.	Yokogawa-Hewlett-Packard Ltd.
Hewlett-Packard Co.	31-41 Joseph Street	29-21 Takaido-Higashi, 3 Chome
1421 South Manhattan Ave.	Blackburn, Victoria 3130	Suginami-ku Tokyo 168
P.O. Box 4230	895-2895	(03) 331-6111
Fullerton, CA 92631		
(714) 999-6700	<b>IN CANADA</b>	<b>IN PEOPLE'S REPUBLIC</b>
	Hewlett-Packard (Canada) Ltd.	<b>OF CHINA</b>
Hewlett-Packard Co.	17500 South Service Road	China Hewlett-Packard, Ltd.
301 E. Evelyn	Trans-Canada Highway	P.O. Box 9610, Beijing
Mountain View, CA 94039	Kirkland, Quebec H9J 2X8	4th Floor, 2nd Watch Factory
(415) 694-2000	(514) 697-4232	Main Bldg.
		Shuang Yu Shu, Bei San Huan Rd.
<b>Colorado</b>	<b>IN FRANCE</b>	Beijing, PRC
Hewlett-Packard Co.	Hewlett-Packard France	256-6888
24 Inverness Place, East	F-91947 Les Ulis Cedex	
Englewood, CO 80112	Orsay	
(303) 649-5000	(6) 907-78-25	
		<b>IN SINGAPORE</b>
<b>Georgia</b>	<b>IN GERMAN FEDERAL</b>	Hewlett-Packard Singapore
Hewlett-Packard Co.	<b>REPUBLIC</b>	Pte. Ltd.
2000 South Park Place	Hewlett-Packard GmbH	1150 Depot Road
P.O. Box 105005	Vertriebszentrale Frankfurt	Singapore 0410
Atlanta, GA 30339	Berner Strasse 117	273 7388
(404) 955-1500	Postfach 560 140	Telex HPSGSO RS34209
	D-6000 Frankfurt 56	Fax (65) 2788990
<b>Illinois</b>	(0611) 50-04-1	
Hewlett-Packard Co.	<b>IN GREAT BRITAIN</b>	<b>IN TAIWAN</b>
5201 Tollview Drive	Hewlett-Packard Ltd.	Hewlett-Packard Taiwan
Rolling Meadows, IL 60008	King Street Lane	8th Floor, Hewlett-Packard
(312) 255-9800	Winnersh, Wokingham	Building
	Berkshire RG11 5AR	337 Fu Hsing North Road
<b>New Jersey</b>	0734 784774	Taipei
Hewlett-Packard Co.		(02) 712-0404
120 W. Century Road	<b>IN OTHER EUROPEAN</b>	
Paramus, NJ 07653	<b>COUNTRIES</b>	<b>IN ALL OTHER LOCATIONS</b>
(201) 265-5000	Hewlett-Packard (Schweiz) AG	Hewlett-Packard Inter-Americas
	Allmend 2	3495 Deer Creek Rd.
<b>Texas</b>	CH-8967 Widen (Zurich)	Palo Alto, California 94304
Hewlett-Packard Co.	(0041) 57 31 21 11	
930 E. Campbell Rd.		
Richardson, TX 75081		
(214) 231-6101		

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## Returning Instruments for Service

If a display 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 display performance, type of system, and any other pertinent information.

### Packaging

When possible use the original shipping containers. If the original materials were not retained, identical packaging materials are available through any Hewlett-Packard office.

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#### 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.

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#### 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.

---

- 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 3 to 4 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.



## Installation

---

### Introduction

This chapter contains information needed to prepare an HP 70004A Display with internal mainframe for use, and describes how to configure the color display/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 (for example, the HP 70900B Local Oscillator).

The HP 70004A Display is a rugged structure into which modules of various widths can be placed. The display provides a menu-driven human interface for the system, in addition to power, cooling, and a suitable environment for electromagnetic compatibility of the modules. The display's internal mainframe manages all digital communications between system elements and uses front-panel fault indicators to report display/mainframe or module problems. For specific 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.

---

### 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 an opening in the left-front side 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.

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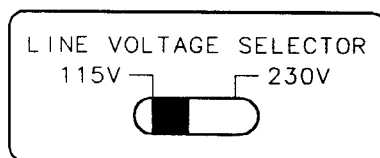
**Caution**

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 V ac line input voltages at 50/60/400 Hz.
- 230 V position for 198 to 264 V ac line input voltages at 50/60 Hz.

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

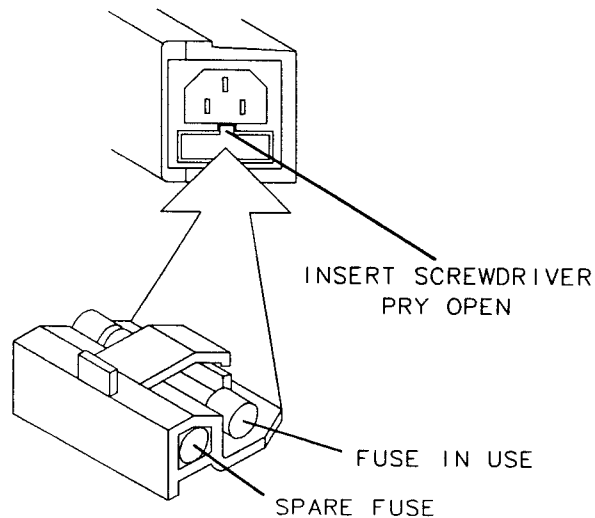
- If the switch is set to 115 V and the instrument is connected to 230 V, the fuse will blow.
  - If the switch is set to 230 V and the instrument is connected to 115 V, the instrument will not turn on.
- 



**Figure 2-1. Line-Voltage Selector (Shown in 115 V Position)**

## 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). See Figure 2-2 for fuse removal and replacement.



**Figure 2-2. Fuse Removal and Replacement**

### Setting the HP 70004A Display Address

The HP 70004A Display needs an appropriate HP-MSIB address to allow communication with other modules on HP-IB. Use the display's COLUMN address switch to set the HP-MSIB address.

---

**Note** The HP 70004A Display's ROW address is always 0

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### Determining the HP-MSIB Address

The HP 70004A has a factory-preset HP-MSIB column address of 4. Figure 2-3 shows an HP 70004A Display in the system's address map. The addresses in this figure are factory-preset for the display.

To access the address map:

1. Press the **DISPLAY** key.
2. Press the **address map** menu key.

Refer to *HP 70004A Display Front-Panel Reference Manual* for more information about interpreting the address map.

T A		16:32:14 JUL 5, 1989				DISP
Main	7					ADJUST COLUMN
Hard Copy	6					ADJUST ROW
Mass Storage R	5					HP-IB ADDRESS
Adjust Color	4					CONTROL COLORS
Config Display	3					ASSIGN DISPLAY
Address Map	2					ASSIGN KEYBD
Misc	1					ASSIGN BOTH

70004A  
DISPLAY  
HP-IB 4

COLUMN: 4

## Setting the HP-MSIB Address Switches

**Note** The display's ROW address is permanently set to row 0.

### Table 2-1. Decimal Equivalent of Display Default Binary Address

An address change requires the following steps:

**Note**

Changing HP-MSIB addresses requires an understanding of HP-MSIB addressing rules. If you use a custom addressing configuration, refer to the Installation and Verification Manual for your instrument (for example, HP 70900B Local Oscillator) for information about assigning HP-MSIB addresses.

**Setting the HP-IB Switch**

When you set the HP-IB switch to 0 (OFF), the HP-IB interface for the *display section only* is turned off. Modules plugged into the display are unaffected and may still talk to each other via HP-IB or communicate over the rear-panel HP-IB connector. The HP-IB switch does not disrupt instrument operation. Refer to Figure 2-4 for the location of the HP-IB switch.

**Display Address Switches**

A display is an independent element. You may assign the display both HP-MSIB and HP-IB addresses. Figure 2-4 illustrates the display's address switches. The address switches are a group of two-position toggle switches, which can be set to either 1 or 0.

**HP-IB ON/OFF**

The HP-IB ON/OFF switch switches the display on or off the HP-IB without disrupting instrument operation.

**A6—A8**

The graphical representation of these switches indicates that the displays HP-MSIB row address is always 0.

**A1—A5**

These address switches set the HP-MSIB column address, which is also the default HP-IB address. Setting the HP-IB address from the front panel overrides the rear-panel HP-IB address switch setting.

**TALK ONLY**

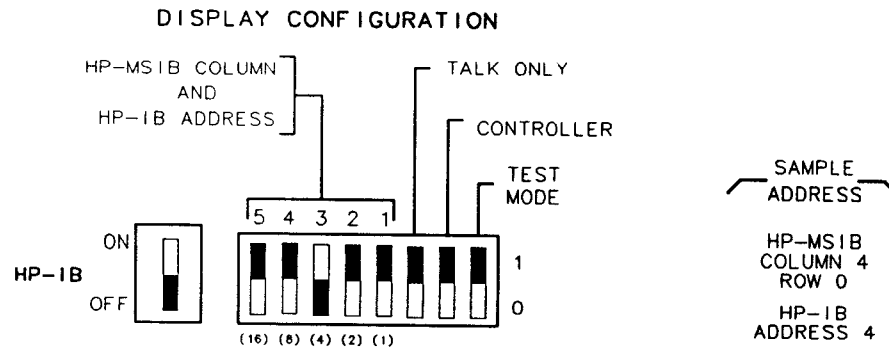
When you set the Talk Only switch to 1 (ON), the display can talk on HP-IB without requiring a reply. This accommodates, for example, listen-only plotters. For normal operation, set switch to 0 (OFF).

**SYSTEM CONTROLLER**

When you set the System Controller switch to 1 (ON) the display may function as a system controller on HP-IB during printer or plotter dumps.

**TEST MODE**

When you set the Test Mode switch to 1 (ON), the display goes into a special test mode at power-up. For normal operation, set this to 0 (OFF).



**Figure 2-4. Display Address Switches**

### **Connecting the Display to Another Display or Mainframe**

Connect the HP-MSIB cables serially, coupling the input of one element to the output of next until the loop is completed. Figure 2-5 shows an example of display-to-mainframe cabling. The same example applies to other products supporting HP-MSIB.

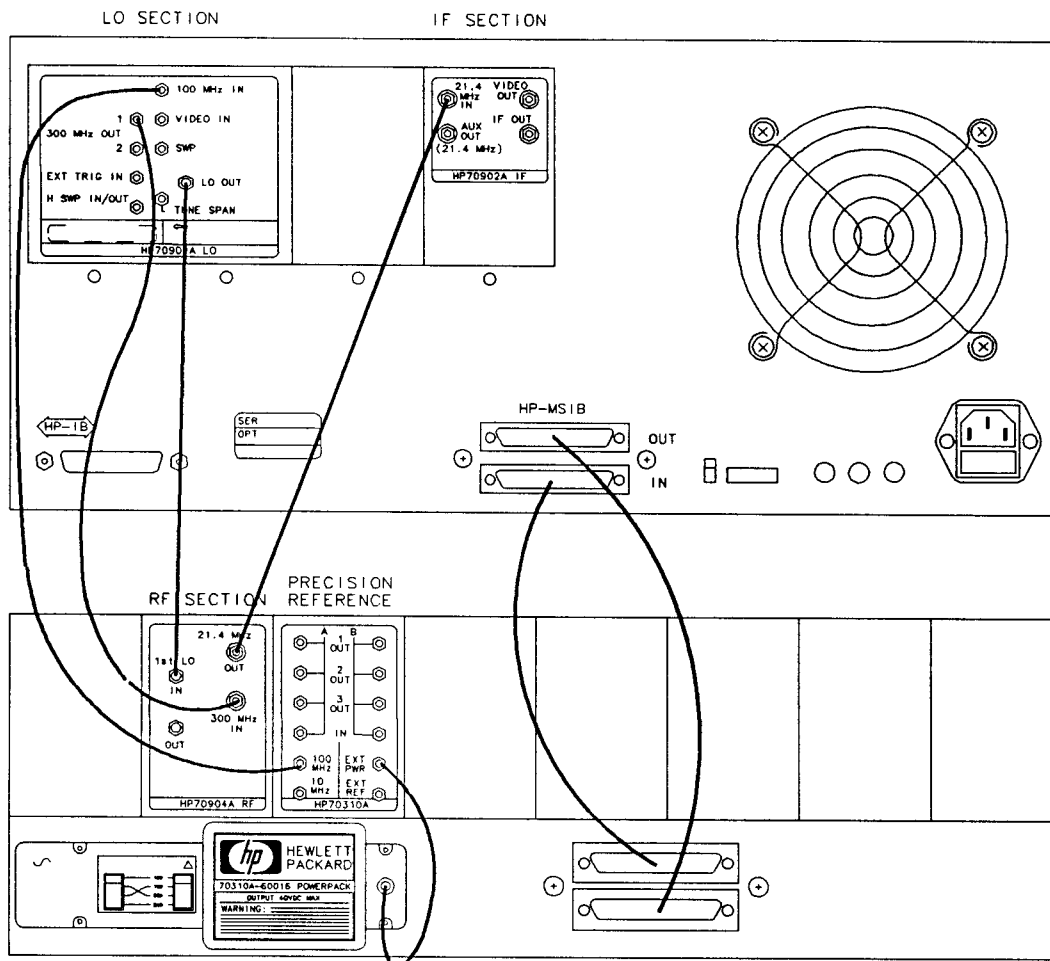


Figure 2-5. HP-MSIB Cabling Example

### Remote Operation

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

---

## Inserting the Memory Card

Use the following information to ensure that the memory card is correctly inserted into the card reader. Improper card insertion can cause error messages to occur, but generally does not damage the card or instrument. Care must be taken, however, not to force the card into the card reader slot.

1. Locate the arrow printed on the card label.
2. Insert the card with the arrow on the card matching the arrow above the card-reader slot. See Figure 2-6.
3. Press the card into the slot. When correctly inserted, approximately 19 mm (0.75 in) of the card is exposed.

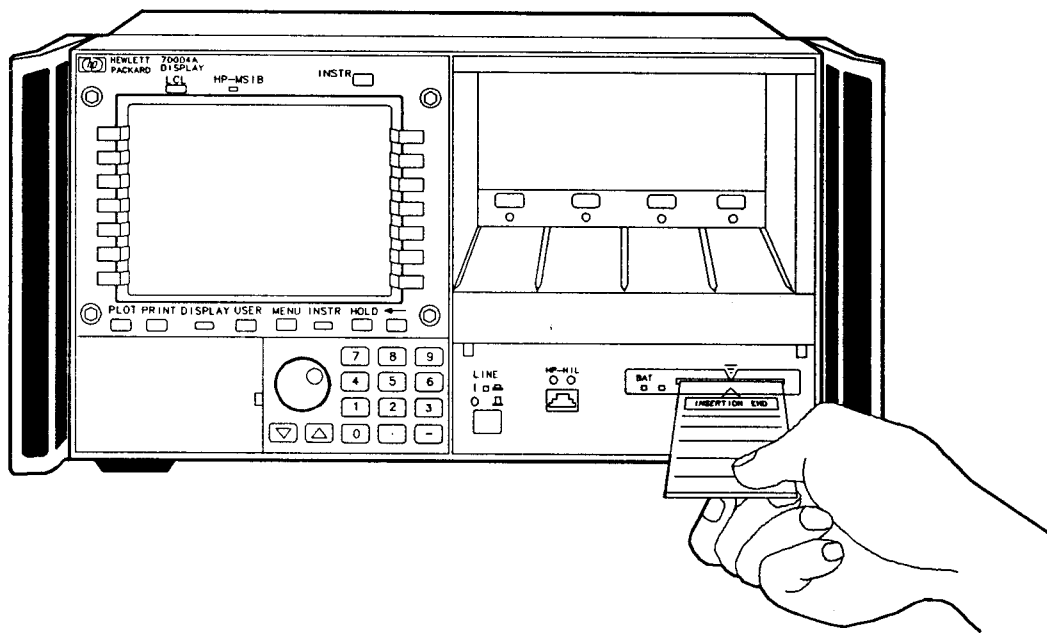


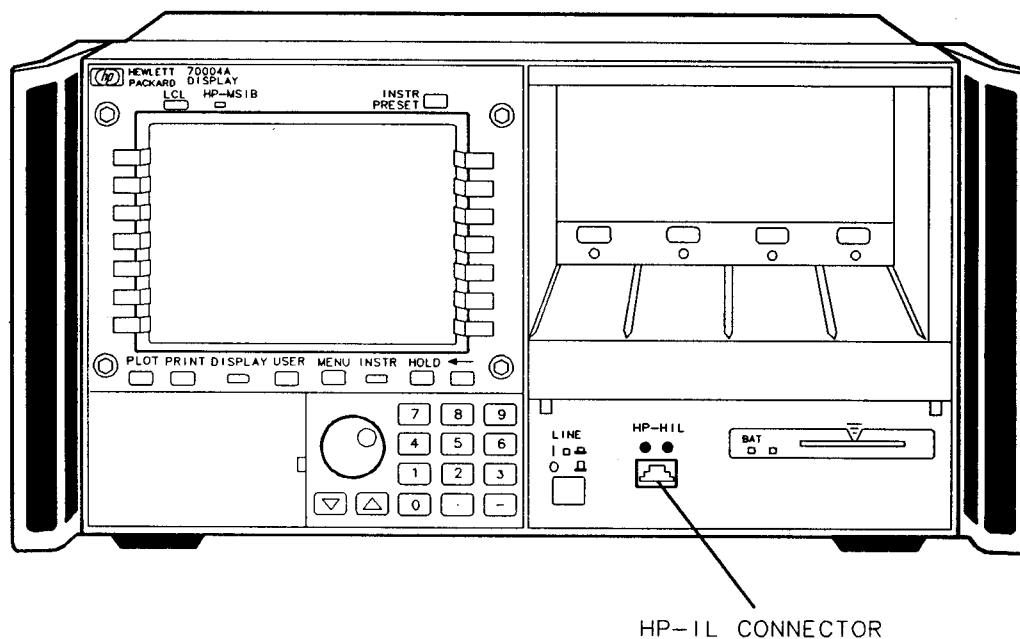
Figure 2-6. Inserting the Memory Card



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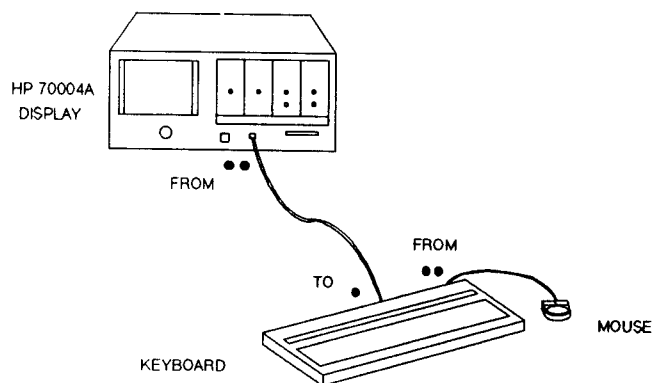
## Installing HP-HIL Devices

The HP-HIL interface supports the HP 98203C Keyboard with rotary knob, the HP 46020A Keyboard, and most relative locator devices (including the HP mouse and trackball). To install the keyboard or relative locator device, plug the connector into the HP-HIL connector on the display front-panel. The HP-HIL connector is coded with two “dots.” See Figure 2-7.



**Figure 2-7. HP-HIL Connector**

HP-HIL devices must be connected in a link. Inspect the two ends of an HP-HIL cable and you will find an end with one black dot and an end with two black dots. The two-dot end is always plugged into the two-dot connector of the device you are linking from, while the one dot end is always plugged into the one-dot connector of the device you are linking to. Figure 2-8 shows several HP-HIL devices linked together in a typical fashion.



**Figure 2-8. Linking HP-HIL Devices**

To connect an HP-HIL device (for example, a mouse or trackball), do the following:

1. Plug the two-dot end of the cable that came with the mouse or trackball into the two-dot connector of the display.

To connect more than one HP-HIL device (the example given here is connecting a keyboard and mouse to the HP 70004A Display), do the following:

1. Plug the two-dot end of the cable into the display's two-dot connector.
2. Plug the one dot end of the cable into the one-dot connector on the keyboard.
3. Plug the two-dot end of the cable that came with the mouse into the keyboard's two-dot connector.

---

**Note**



The mouse has only a two-dot end on its cable. Therefore it must be the last device in the link.

---

## Installing the Instrument Keypad

### Removing the Instrument Keypad

1. Insert a bladed screwdriver into the keypad's slot (1). See Figure 2-9.
2. Gently pry the screwdriver's handle to the left. The keypad (2) will snap out of the front panel.

### Installing the Custom Instrument Keypad

1. Insert the left side of the keypad (2) into the front panel.
2. Press the right side of the keypad until it snaps into the front panel.

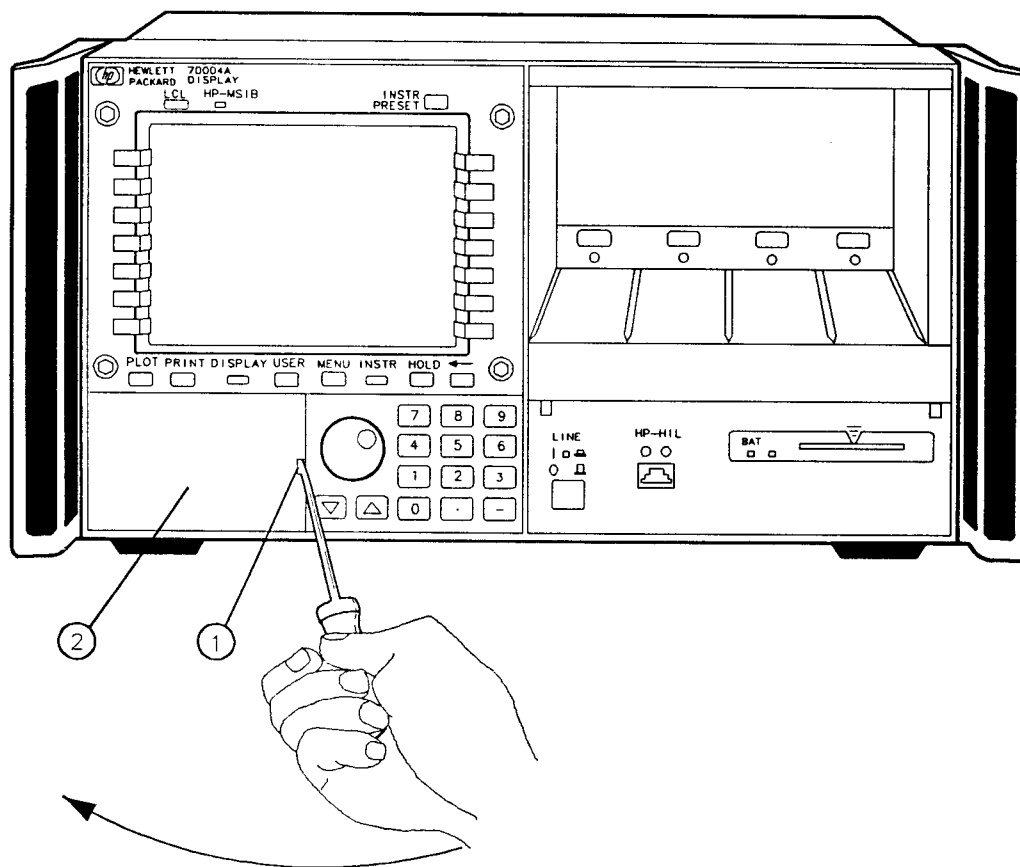


Figure 2-9. Installing the Instrument Keypad

---

## Intensity Adjustments

**INTEN ADJUST** allows the user to change the intensity of the display screen. Intensity is incrementally adjustable from 0 to 19 in steps of 1.

---

### Note



The 0 intensity setting may not be completely OFF. If the display is turned OFF with the intensity set to less than 9, the intensity will be set to 9 at power-up to ensure that the screen will not be too dim to see.

---

## Specifications

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### Specifications

Specifications describe warranted performance over a temperature range of 0° to +50°C after one hour of continuous operation, unless otherwise noted. Specifications apply after system temperatures have stabilized and the self-calibration routines have run.

Unless otherwise noted, corrected limits are given when specification range is improved with error-correction routines. All specifications qualified by an output power setting refer to that setting.

**Typical performance**, where listed, is *not warranted*, but indicates performance which most units will meet.

---

### Characteristics

Characteristics provide useful, but *non-warranted* functional and performance information.

---

### Nominal Values

Nominal Values indicate the expected, but *non-warranted* value of the denoted parameter.

## General Specifications

**Table 3-1.**

<b>Temperature</b>	Operation .....	0° C to +55° C
	Storage .....	-40° C to +75° C
<b>EMI</b>	Radiated interference is within the requirements of MIL-STD 461B, Class A1c RE02, CE03	
<b>RGB Outputs</b>	75Ω impedance (sync on green)	
	Signal Level .....	White Positive-into 75Ω 1 V p-p ±10%
	Bandwidth .....	Approx 25 MHz
<b>Fan Noise</b>	5.0 Bels SPL	
<b>Warm-up Time</b>	15 minutes from a cold start (0° to 55° C)	
<b>Weight (nominal value)</b>	19.5 kg (43 lb)	
<b>Dimensions</b>	Height .....	221.5 mm (8.72 in)
	Width .....	421.2 mm (16.58 in)
	Length .....	523 mm (20.6 in)
	Length (w/handles) .....	566 mm (22.3 in)
<b>AC Power Input, Line Ranges</b>	87—132 V ac .....	50/60/400 Hz
	174—264 V ac .....	50/60 Hz
<b>VA Rating</b>	260 W maximum	
	350 VA maximum	

## 3-2 Specifications

## Verification

---

### Introduction

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 70004A Display specifications.

---

### Power-On Self-Test

The display executes a power-on self-test when power is applied. If the test fails, the display terminates the sequence and displays an error on the screen in large block letters.

One of the instrument functions tested is the ability of the display section to communicate on the system bus (HP-MSIB). The results of the test can be determined by examining the status box in the upper left-hand corner of the display screen. If the power-on test fails, a blinking E will appear in the status box.

If either error is indicated (large block letters or blinking E), refer to chapter 5, "Troubleshooting."

---

### Confidence Test (CONFID TEST Menu Key)

The display Confidence Test checks the operation of about 90% of the display. For more information about the Confidence Test refer to Chapter 5.

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## HP 70004A Display Fault Indicators

### HP-MSIB Fault Indicator

The HP 70004A Display has an HP-MSIB system fault indicator in the upper-left corner of the front panel. This indicator applies to the I/O backplane and all modules in the system, not just the display system.

- The HP-MSIB indicator should be OFF

If a fault is indicated, the condition must be cleared before the display will operate. Refer to chapter 5 for more information about troubleshooting the HP-MSIB.

## **Memory Card Battery Low-Indicator**

The display has a memory card battery low fault indicator near the memory-card slot in the lower-right corner of front panel.

- The battery low indicator will indicate on if the battery voltage is too low. The battery low indicator will be off if there is no memory card in the slot.

If a fault is indicated, refer to chapter 5 for more information about memory card battery replacement.



## Troubleshooting

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### Introduction

This chapter provides HP 70004A Display troubleshooting information. Problem isolation and diagnosis related to the front-panel fault indicator lights, fan operation, fuse replacement, Key Test, and Confidence Test are discussed. Figures 5-1 and 5-2 show the location of the front-panel fault indicators.

---

### Turn On

The following conditions should exist at display turn-on:

- The HP-MSIB fault indicator should be off.
- The display's fan noise will be scarcely noticeable.

If you detect an error at turn-on, run the Confidence Test. Refer to the "Confidence Test" in this chapter. If the Confidence Test runs successfully, the first error was probably a system failure, not a display failure.

---

### Line Fuse

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

---

## Front-Panel Fault Indicators

The HP 70004A has four fault indicators:

- A blinking red E in the status box in the upper-left corner of the display.
- A steady red E in the status box in the upper-left corner of the display.
- An HP-MSIB indicator on the upper-left corner of the front panel.
- A red battery-low indicator next to the memory card access slot.

See Figure 5-1. Problems external to the display can cause the indicators to turn on.

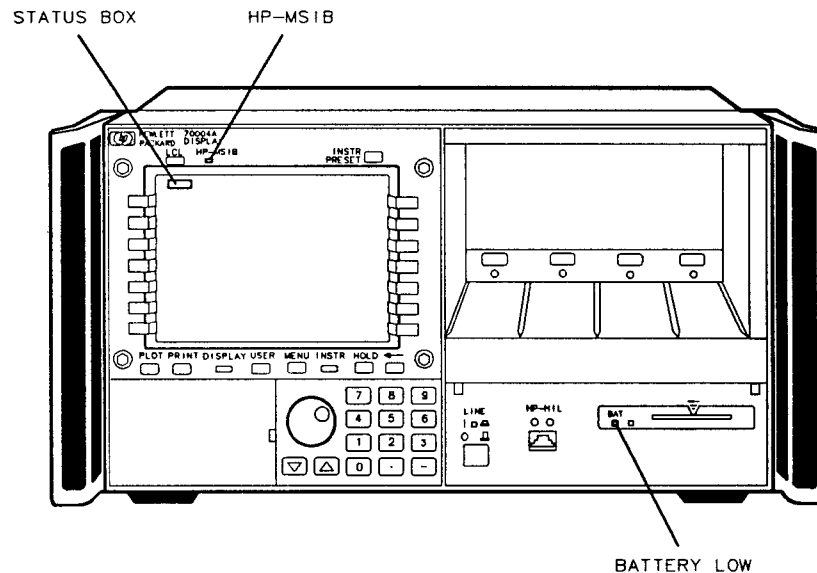


Figure 5-1. HP 70004A Front-Panel Fault Indicators

### Blinking E Indicator

The E indicator in the status box in the lower-right corner of the display is the same as the red LED marked "ERR" on other HP 70000 Series modules. Its purpose is to indicate an error detected in the system on HP-MSIB row 0 of the address map. A blinking E or ERR LED has a special meaning: it signifies that a problem on the HP-MSIB backplane has been detected during system power-up which may prevent normal communication between any modules (and hence, normal error reporting). Such a problem *must* be troubleshot before any predictable system operation can take place.

Remove all HP-MSIB cables from the display's rear panel, all modules from the mainframe section, and cycle power.

1. If the red E indicator on the display still blinks, then contact your nearest Hewlett-Packard Service Office listed in Table 1-5 for repair.
2. If the E indicator does not blink, then connect a known good HP-MSIB cable between the rear panel HP-MSIB IN and OUT connectors and cycle power. If the E now blinks, contact your nearest Hewlett-Packard Service Office for repair.

## 5-2 Troubleshooting

3. If the red E indicator stops blinking, insert the modules one by one until the E starts blinking. When the indicator starts blinking, check the modules for the same HP-MSIB address.
4. If the E indicator doesn't blink, the problem is probably in another display or mainframe, refer to either the *HP 70001A Mainframe Installation and Verification Manual* or the *HP 70205A and HP 70206A Graphics Displays Installation and Verification Manual* for more information about mainframe troubleshooting.

## Steady E Indicator

A module (or the display) has detected an error. Press **DISPLAY** and **REPORT ERRORS** to identify the module(s) reporting errors. Refer to the *HP 70004A Operation Manual* for more information about the **REPORT ERRORS** key.

## HP-MSIB Indicator Light

This circuitry senses the readiness of the external HP-MSIB. If the HP-MSIB indicator light is on, HP-MSIB communications are inhibited. The HP-MSIB 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.<sup>1</sup>
- Not all the elements on the external HP-MSIB loop have the power turned on. Verify that the power is on to the display, all mainframes and stand-alone instruments on the external HP-MSIB.

If the HP-MSIB light is still on, the following steps will help isolate the problem.

- Disconnect both HP-MSIB cables from the display rear panel. Is the HP-MSIB indicator light still on?

**NO** The problem is either with the cables or an element that was connected to the display with the cables.

Loop each cable (one at a time) from the display HP-MSIBIN to OUT connectors. If the HP-MSIB indicator comes on, that cable has probably failed. If the light does not come on for any of the cables, then an element connected with these cables is faulty. If an element is determined to be at fault, contact your nearest Hewlett-Packard Service Office for repair.

**YES** The HP 70004A Display is probably faulty. Contact your nearest Hewlett-Packard Service Office for repair.

<sup>1</sup> 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.

## Memory Card Battery-Low Indicator Light

If the battery-low LED indicator light is ON, replace the memory card battery. See Figure 5-2 for the location of the battery light.

## Changing the Memory Card Battery

It is recommended that the memory card battery be changed every 2 years.

---

**Note** The average battery lifetime (under normal conditions) is more than 2 years.

---



The memory card battery installation date is either engraved on the side of the memory card or written on a label on the memory card.

If the memory card does not have a label with the battery installation date, use the date code engraved on the side of the memory card. The date code consists of numbers and letters engraved in the black plastic on the side of the memory card (see Figure 5-2). The first number indicates the year, the following two characters indicate the month, and the last number indicates the week in the month the memory card battery was installed. For example, 9AU3 indicates the battery was installed on the third week in August, 1989.

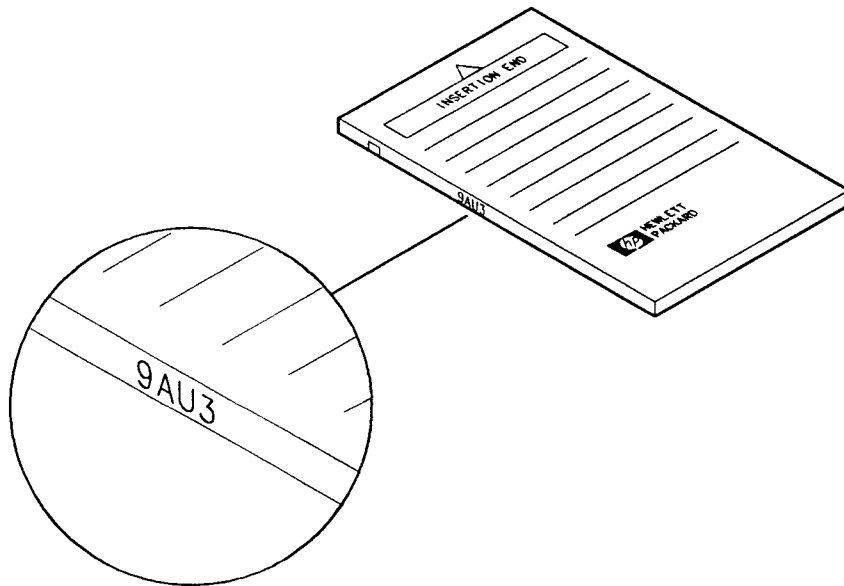


Figure 5-2. Memory Card Date Code Location

## Battery Replacement Procedure

The battery is located next to the memory card's write-protect switch on the opposite end from the connector.

### Caution



The battery ensures that memory card data is retained. Removing the battery can cause the card to lose data. Install the card into a powered-up instrument before replacing the battery. To be safe, save all copies of files on some other media before beginning the following battery replacement procedure.

1. Locate the groove along the edge of the battery clip. See Figure 5-3.
2. Gently pry the battery clip out of the card. The battery fits within this clip.
3. Replace the battery, making sure the plus (+) sign on the battery is on the same side as the plus (+) sign on the clip.
4. Insert the battery clip into the memory card, holding the clip as oriented in Figure 5-3 (face the "open" edge of the clip toward the write-protect switch on the memory card).
5. Write the battery replacement date on the memory card label, to remind you when to replace the battery.

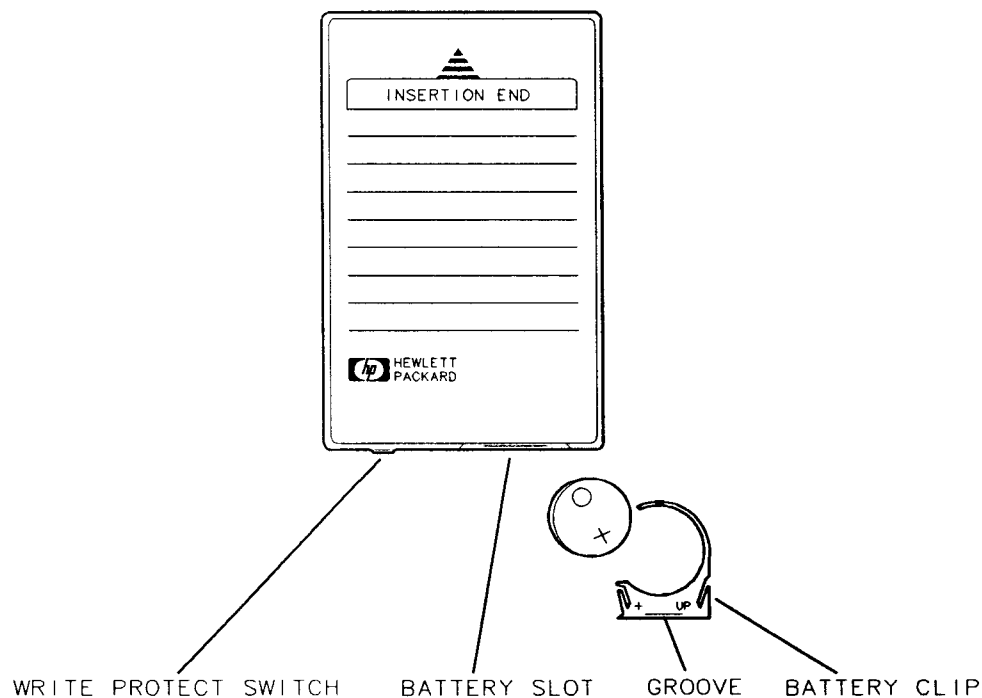


Figure 5-3. Memory Card Battery Replacement

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## Blank or Distorted Display

If the display is either blank or distorted, contact your nearest Hewlett-Packard Service Office listed in Table 1-5.

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## Display Tests

The Display Tests are the display diagnostic and adjustment routines. The Display Tests screen is accessed by pressing **DISPLAY**, **Misc**, then **display tests**. (See Figure 5-4.)

---

### Note



Keep in mind that display internal adjustments or repairs should only be attempted by qualified technical personnel. Review the “Hazards of Internal Repair and Adjustment” and associated warning notice in Chapter 1.

---

The Display Tests menu keys are shown in Figure 5-4 and explained in the following pages.

<b>T A</b>	13:29:50 09 07 1989	<b>DISP</b>
Main		CONFID TEST
Hard Copy		KEY TEST
Mass Storage		KNOB TEST
Adjust Color		TUMBLE FIGURES
Config Display		
Address Map		test pattern
		service

Figure 5-4. **display tests** Menu Keys

### Test Pattern Menu Keys

This key provides a menu of test patterns which are used to adjust the display. For explanations of the test patterns and related adjustments, refer to the *HP 70004A Display Service Manual*.

Display ID Menu Key

When the **DISPLAY**, **Misc**, and **DISPLAY ID** keys are pressed, the screen shows the following information (see Figure 5-5):

- 16 squares with each of the current colors
- HP model number.
- Firmware version.
- HP-MSIB address.
- HP-IB address (OFF if disabled with the rear panel switch).
- Custom Keypad ID Code.

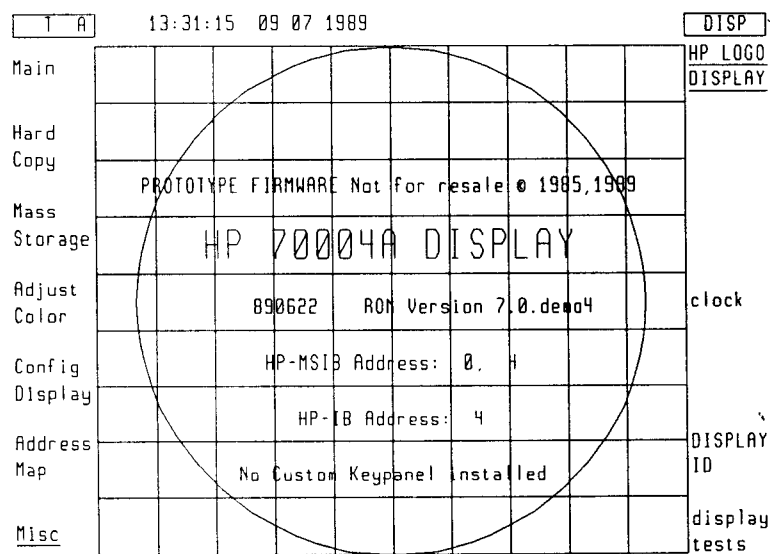



Figure 5-5. Display ID

## Knob Test Menu Key

The **KNOB TEST** menu key allows the user to test the front-panel knob on the display. The following example demonstrates the use of the **KNOB TEST** key:

1. Press the **DISPLAY** key.
2. Press the **Misc**, **display tests**, and **KNOB TEST** menu keys. See Figure 5-6.
3. Turn the front-panel knob clockwise slowly. The numbers in the center of the Knob Test display should increase one by one (from 00 to 39).
4. Turn the front-panel analog knob counterclockwise slowly. The numbers in the center of the Knob Test display should decrease.  
If the knob is turned swiftly, the numbers in the center of the display should increase and decrease swiftly. The numbers will change too quickly for you to follow the one-by-one count.
5. Press the back-arrow key  to exit the Knob Test.

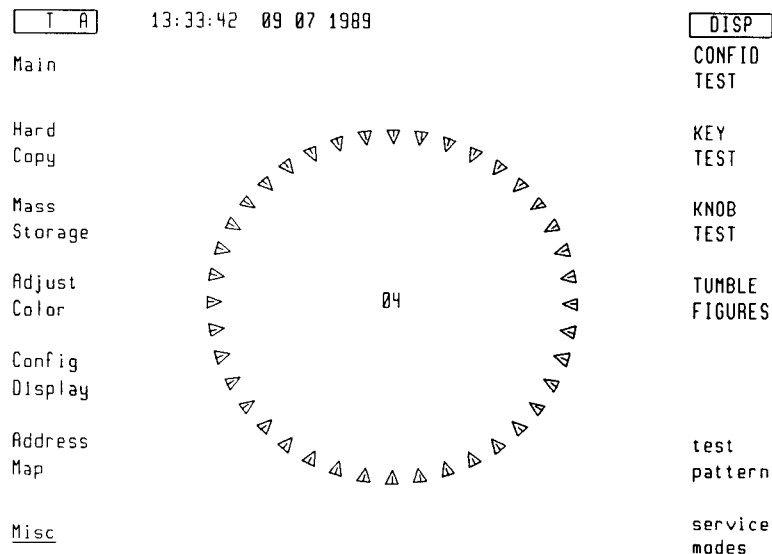


Figure 5-6. Knob Test Display



Key Test Menu Key

The **KEY TEST** menu key allows the user to check the mechanical and electrical operation of every front-panel key on the display. The following example demonstrates the use of the **KEY TEST** key:

- 1. Press the **DISPLAY** key.
- 2. Press the **Misc**, **display tests**, and **KEY TEST** menu keys.
- 3. Press any key on the display's front panel. The pressed key will be *echoed* on the screen if the key is working properly. See Figure 5-7.
- 4. Press the back-arrow key **←** to exit the Key Test.

If an error is detected, contact your nearest Hewlett-Packard service office listed in Table 1-5.

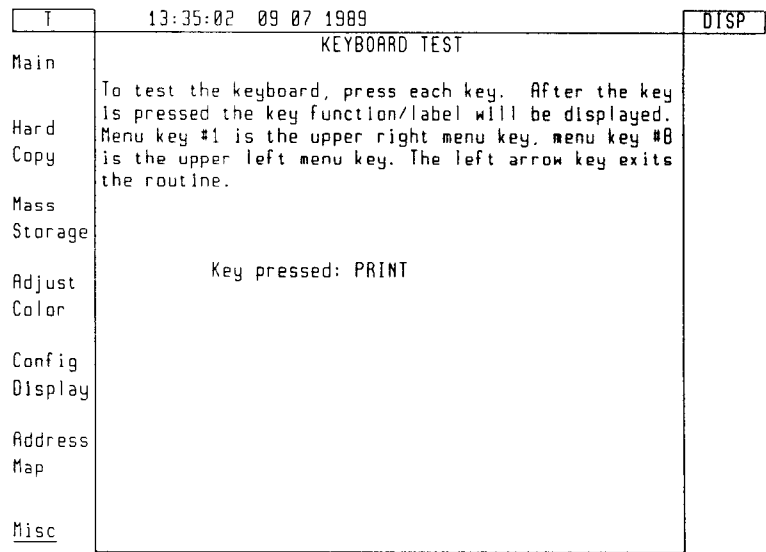


Figure 5-7. Key Test

## Confidence Test ( CONFID TEST Menu Key)

Initiate the Display Confidence Test by pressing the **CONFID TEST** menu key. The Confidence Test checks the operation of roughly 90% of the display. If no fault is found, 6001 confidence test passed appears in the lower-left corner of the screen. If a fault is found, 6008 confidence test failed is displayed. See Figure 5-8. The following example demonstrates the use of the **CONFID TEST** key.

1. Press the **DISPLAY** key.
2. Press the **Misc**, **display tests**, and **CONFID TEST** menu keys.

If an error is detected, contact your nearest Hewlett-Packard service office listed in Table 1-5.

If the display passes the Confidence Test, and the display screen shows no visible distortion, there is a high level of probability that the display is functioning correctly. If the display fails the Confidence Test, it attempts to write E (error) in the display status block.

If the HP-MSIB is working, any error messages produced by the Confidence Test can be viewed by pressing the **DISPLAY** and **REPORT ERRORS**.

At power-on, a set of tests that is different from the Confidence Test is run. The set of tests run at power-on includes tests for the HP-MSIB capability of the display. The display indicates whether any of these tests fail, but does not indicate if they pass. An HP-MSIB failure is indicated by a blinking E (error) indicator in the status block.

```

A      13:40:26 JUL  9, 1989      DISP
Main      CONFID
          TEST

Hard      KEY
Copy      TEST

Mass      KNOB
Storage   TEST

Adjust    TUMBLE
Color     FIGURES

Config    g a B r d c e n t k x u y e o n p o r u o x w Q x x < E > f
Display   + 4 A v L = T F N Y O f f E e C c n n 0 f i z = + i z A
          E i o u a e i o u A e i o u a e i o u A e i o u a e i o u . o

Address   test
Map       pattern

Misc      service
          modes


6001 Confidence test passed
```

Figure 5-8. Confidence Test


## Tumble Figures Menu Key

### Note



While the tumble figures are running, the display cannot communicate on either HP-IB or HP-MSIB. Nor can the display respond to any front-panel keys except the back-arrow key  and the **TUMBLE FIGURES** menu keys used to select the various demonstration figures.

The **TUMBLE FIGURES** key allows the user to choose five different demonstration routines:

1. Press the **DISPLAY** key.
2. Press the **Misc**, **display tests**, and **TUMBLE FIGURES** menu keys.
3. Press one of the following menu keys: **CUBE**, **BALL**, **SLAB**, **ROD**, or **HALF**.
4. To exit the tumble figures, press the  key.

---

## Error Codes and Messages

---

### Note



Before taking any action based on these error messages, make sure all the boards are firmly seated and all cables are securely fastened.

---

HP 70004A Display error code information is provided in this section. Errors may result when the display module is configured normally or is on the module service extender. Numerical error codes and brief error messages are reported on the display. Error codes fall into four categories:

- 2000—2999 Usage Errors
- Display—Disruptive Errors
- 6000—6999 Hardware-Warning Errors
- 7000—7999 Hardware-Broken Errors
- 9000—9999 Factory Use Only

### 2000—2999 Usage Errors

Usage errors are those that occur during normal display operation and usually indicate an error elsewhere in the system.

#### 2001 Illegal command

The display has been sent a command it does not recognize. For example in HP BASIC, the command `OUTPUT @Display;"XX"` would generate this error.

#### 2002 Illegal parameter

An item has been sent a command that does not match (for example, sending **LB** to a **PA** type item), a **CL** command has been sent in **GP0**, or a bad learnstring has been sent.

#### 2005 Illegal character set

An attempt has been made to specify a character set (using **CA** or **CS**) that is not available in the display.

#### 2006 Parm out of range

A parameter that violates the range specification for a given command has been sent.

#### 2007 Missing terminator

A command has been sent to the display without a valid terminator.

#### 2009 Protocol error

A command has been sent to the display that requires a link type that is not currently established between the sender and the display.

## **2011 Memory overflow**

An attempt has been made to allocate more vector list memory than the display contains. Usually this means that the user is trying to display more traces than the display's memory can support, or that too many strokes have been sent in non-referenced graphics.

## **Display-Disruptive Error Messages**

Display-disruptive errors are those that interfere with normal display operation and error reporting. The associated error messages indicate faulty display hardware. The error messages are shown in two ways:

- The error message in large block letters on an otherwise blank display.
- An LED pattern on the A6 Host Board Assembly.

### **RAM ADDR ERROR**

A test of CMOS RAM has failed. The data in CMOS RAM is read, saved, and complemented. Every other address is then tested to see if the data is unchanged. The test failed.

### **RAM DATA ERROR (U19)**

### **RAM DATA ERROR (U20)**

A test of CMOS RAM has failed. Data is cycled through all the address locations on the data bus. Each time data is written, it is read back and compared with the written data. At least one comparison failed.

### **ROM 23 CHECKSUM**

### **ROM 24 CHECKSUM**

### **ROM 25 CHECKSUM**

### **ROM 26 CHECKSUM**

A checksum was calculated on all ROMs and one or more ROMs failed.

### **A5 8041 INTERFACE**

Communications failed between the 8041 processor chip and the host processor chip. The 8041 processor chip is instructed to send a data sequence to the host processor chip, which if received correctly should verify the 8041 and the link to it.

### **A5 Graphics VRAM**

A test of the VIDEO RAM failed. The host processor has attempted to write a decrementing data pattern to incrementing addresses and then read and verify each location.

### **A5 GRAPHICS DRAM**

A test of the DRAM RAM failed. The host processor has attempted to write a decrementing data pattern to incrementing addresses and then read and verify each location.

## **A5 GRAPHICS PROCESSOR**

A test of the graphics processor system has failed. The host processor chip has attempted to read and verify the contents of a location in the graphics system DRAM. The graphics system processor loads this location with a known pattern during its initialization.

### **6000—6999 Hardware-Warning Errors**

The following error codes are generated by faults that may impair measurement accuracy. These errors will be noted by the E in the lower-right of the CRT. The errors may be viewed by pressing the **DISPLAY** key then the **REPORT ERRORS** menu key.

#### **6002 A5 nonvolatile RAM (battery?)**

A5 RAM memory failed a checksum test. If cycling LINE power does not clear the error, replace the battery in the rear-panel battery compartment.

#### **6008 Confidence Test Failed**

A display self-test has failed. Confidence Test Failed appears on the bottom of the screen at power-up (if an error was detected) or after a confidence test **CONFID TEST**. The same test sequence can be invoked remotely with the TE command. If any test fails, the bus which sent the TE command will be notified. If this occurs because of a TE command, cycle power; a display-disruptive error should be displayed, which will indicate the problem. If this occurs at power-up, press **DISPLAY** and **REPORT ERRORS** will identify the problem.

### **7000—7999 Hardware-Broken Errors**

The following error codes are generated by faults within the instrument. These errors will be noted by the E in the lower-right of the CRT. The errors may be viewed by pressing the **DISPLAY** key and then the **REPORT ERRORS** menu key.

#### **7038 A5 Error in 8041**

Communications failed between the 8041 processor and the host processor. The 8041 processor is instructed to send a data sequence to the host processor, which if received correctly should verify the 8041 and the link to it.

#### **7040 A5 GSP Checksum error**

A test of the graphics system processor has failed. A test pattern was loaded into the video ram by the graphics processor. A checksum of the video ram was calculated by the host processor.

#### **7060 A5 RAM Data (U20)**

#### **7061 A5 RAM Data (U19)**

A test of CMOS RAM has failed. Data is cycled through all the address locations on the data bus. Each time data is written, it is read back and compared with the written data. At least one test failed.

#### **7062 A5 RAM Address**

A test of CMOS RAM has failed. The data in CMOS RAM is read, saved, and complemented. Every other address is then tested to see if the data is unchanged.

#### **7063 A5 ROM U24 Checksum**

#### **7064 A5 ROM U26 Checksum**

#### **7065 A5 ROM U23 Checksum**

#### **7066 A5 ROM U25 Checksum**

A checksum is calculated on all ROMs.

#### **7092 A5 Graphics processor**

A test of the graphics processor system has failed. The host processor chip has attempted to read and verify the contents of a location in the graphics system DRAM. The graphics system processor loads this location with a known pattern during its initialization.

### **9000—9999 Factory Use Errors**

---

**Note**

The 9000—9999 series error messages are rare and generally not seen. If error messages in this series are encountered, record all possible information and contact the nearest Hewlett-Packard Sales and Service Office.

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