Operation Manual

HP 70004A Display

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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.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

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

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THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

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.

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 instrument. Do not proceed beyond a *caution* sign until the indicated conditions are fully understood and met.

Warning

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

General Safety Considerations

Warning

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

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

Warning

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

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

Caution

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

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

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.*)

Contents

Figures

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1

Display Overview

Start Here

This manual details the operation of the HP 70004A Display front-panel controls and is designed to help you begin using the display as quickly as possible. It is not necessary to read this manual from cover to cover.

If You Are Familiar with the Display

Read this chapter, then begin using the manual as a reference. Use either Table 1-2, the "Softkey Index," or Figures 1-4 through 1-10, "Menu Key Index," to help you locate the softkeys.

If You Are Unfamiliar with the Display

Read this chapter, then read the following chapters, which discuss these functions:

- Color editor ..... **Chapter 5**
- Creating multi-instrument windows ..... **Chapter 6**
- Using the (INSTR) key ..... **Chapter 9**
- Hard-copy output capability ..... **Chapter 3**
- Using the Memory Card ..... **Chapter 4**
- Intensity adjustment ..... **Chapter 2**
- Address map ..... **Chapter 7**
- Keyboard Use ..... **Chapter 10**

Programming the Display

The HP 70004A Display is programmed by modules in a low-level language resembling the Hewlett-Packard Graphics Language (HP-GL). It also can be programmed directly via the Hewlett-Packard Interface Bus (HP-IB) in this same language. Information on the display's programming language is available in the *Display Interface Design Guide*. For more information about the display's design guide, contact your nearest Hewlett-Packard Sales and Service Office.

Introduction

The HP 70004A Display provides a graphics display and human interface for the HP 70000 Modular Measurement System. The display supports up to 16 simultaneous colors (selected from a palette of 4096 colors) with a graphics resolution of 1024 horizontal by 400 vertical pixels. The mainframe portion of the display provides the necessary power, cooling, digital interface, and EMI shielding for a maximum of four 1/8-width modules.

Notation

Throughout this operating manual, TEXT indicates softkey labels and [TEXT] indicates fixed-label keys.

Display Screen Description

The display screen is divided into several information areas, as shown in Figure 1-1.

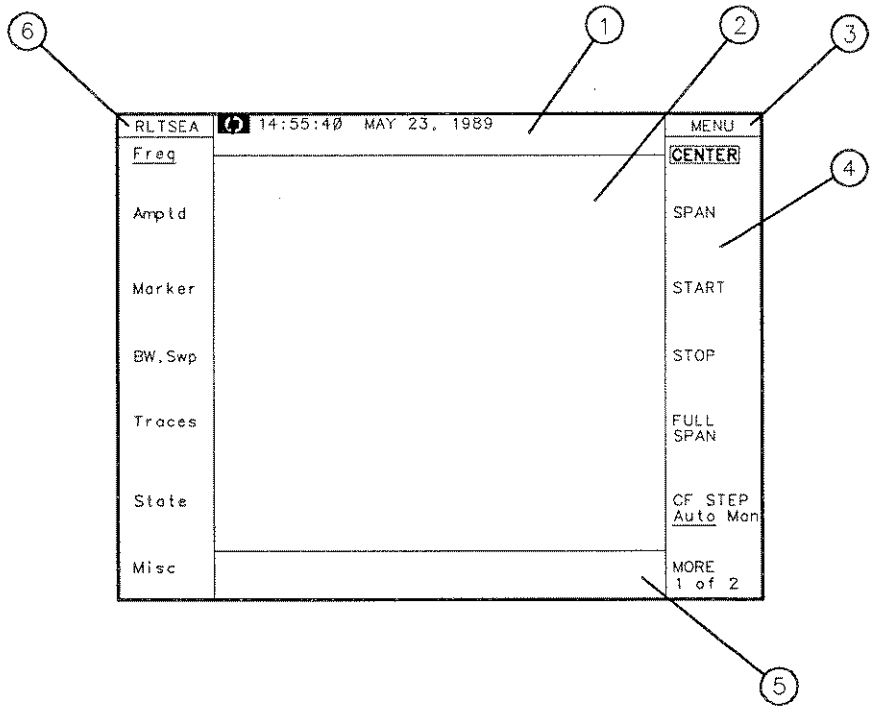


Figure 1-1. HP 70004A Display Screen

1. The display uses the **status window** to present system status information, such as the real-time clock readout and HP logo.
2. The **graphics window,** which can be subdivided into four windows, displays graphics and text.
3. The **menu status block** displays either `MENU`, `USER`, or `DISP` depending on which menu is being displayed in the softkey menu window. `INST` is displayed when the user presses the (INSTR) key.
4. The **softkey menu windows** display menus accessed through the (DISPLAY), (MENU), or (USER) keys.
5. The **character window** (or character line) is one line of text (53 characters long) used for giving prompts and other human interface information. Refer to your system's operation manual.
6. The **system status block** contains the letters `R L T S E A`. Depending on the state of the condition that generates the letters, they may or may not be lit. These letters are defined in Table 1-1.

Table 1-1. System Status Block Letters

R	HP-IB [1] Remote, on when the display is in the HP-IB remote mode.
L	HP-IB Listen, on when the display is addressed to listen on HP-IB.
T	HP-IB Talk, on when the display is addressed to talk on HP-IB.
S	HP-IB SRQ, on when the display is asserting SRQ.
E	Error (red), on when there is an error in *any* module on row 0 of the address map. Refer to chapter 7, "Address Map Menu," for more information about the address map. Also blinks if the display detects a fault on the HP-MSIB at power-up.
A	Active (green), on when the display controls the keyboard or when the display is being selected in a configuration function.

[1] HP-IB (Hewlett-Packard Interface Bus) fully complies with ANSI/IEEE Standard 488. As such, it incorporates the mechanical, electrical, and functional specifications of the Standard.

Interpreting the Front-Panel HP-MSIB Indicator

If the HP-MSIB indicator is on (upper-left corner of the display, next to the [LCL] key), and all displays and mainframes in the system are on, inspect the HP-MSIB cable connectors for tightness, then cycle power. If the HP-MSIB indicator remains on, refer to the *HP 70004A Installation and Verification Manual*

Front-Panel Controls

The display serves as the "front panel" for instruments in the HP 70000 Modular Measurement System. It is possible to use one display with multiple measurement systems, one display for a single system, or even multiple displays for the same system.

The HP 70004A Display has one screen with 14 softkeys. The softkeys are labeled by either the display or the instrument that controls the keyboard. Softkeys are used for all manual instrument control functions.

All softkeys are organized into four groups which are accessed with the following four front-panel keys:

- The [DISPLAY] key accesses all display functions.
- The [USER] key accesses a set of instrument functions, custom-made or factory-preset, which facilitate instrument functions.
- The [MENU] key accesses all instrument functions.
- The [INSTR] key moves the keyboard between instrument modules.

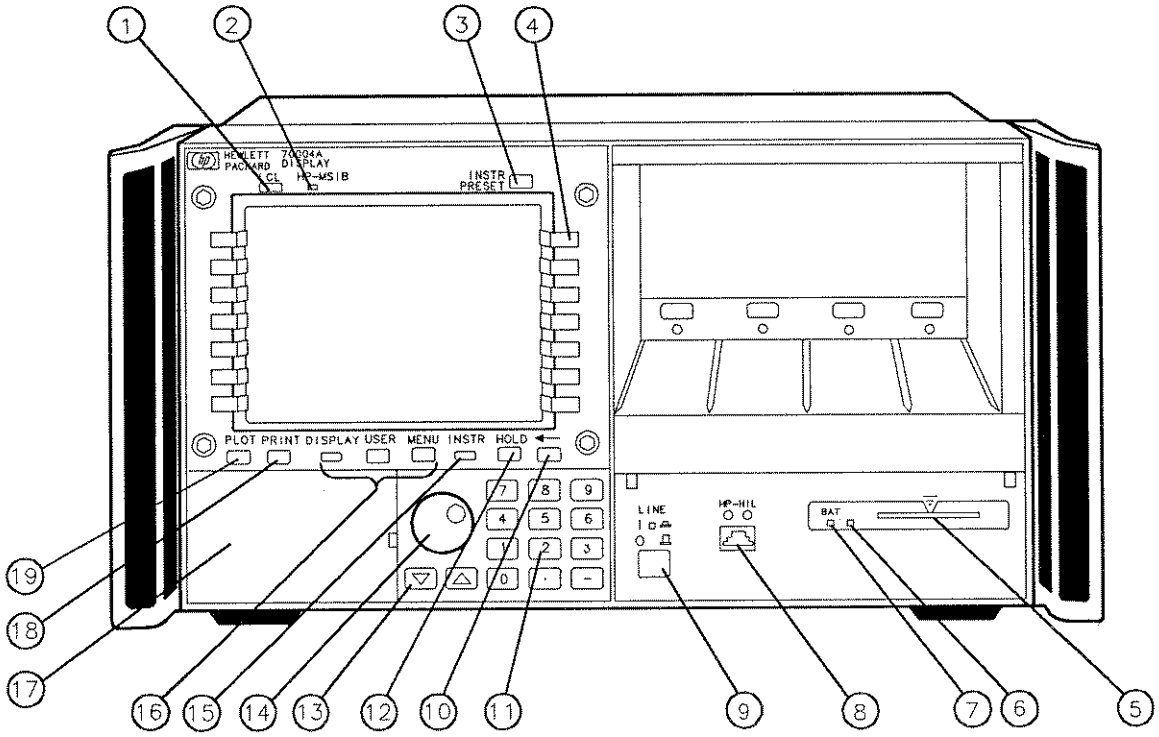


Figure 1-2. HP 70004A Display Front Panel

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. (The DISPLAY PRESET softkey in the (DISPLAY) menu performs a similar function.)
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 that the memory card is being read or data is being written on it.
7. The memory card **battery-low light** indicates a low battery condition on the memory card. The light is off if the memory card is not inserted.
8. Devices supported by **HP-HIL** include the HP 46020A and HP 98203A keyboards.

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 previous level. Use the [←] key to backspace 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 two [↑] [↓] (step) keys to change parameters up or down.
14. Use the **knob** to change parameters and select other operating values.
15. Use the [INSTR] (instrument) key to move the display keyboard between instruments in the system.
16. Use the [DISPLAY], [USER], and [MENU] keys to call the top-level softkey 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 (HP-GL) plot output of the present display screen over HP-IB.

Fixed-Label Key Functions

Use the front-panel fixed-label keys above and below the display screen to perform such functions as presetting the instrument, [INSTR PRESET], moving the keyboard between instruments in the system, [INSTR], and changing parameters with step keys, [▲] [▼].

For data entry, each display has a single knob and 24 labeled keys (such as 0 through 9, decimal point, minus sign, back-space, step-up, and step-down). In most cases, data can be entered with either the numeric keypad (0 through 9), the display knob, or the step keys.

For more information about the fixed-label keys refer to Chapter 9.

Key Functions

Pressing the keys around the perimeter of the display screen activates the softkey functions. The softkey functions are organized in levels, with a softkey menu (a set of softkey labels) for each level. The [DISPLAY], [USER], and [MENU] keys access the top-level keys. This manual describes the softkeys accessed by the [DISPLAY] key. The [USER] and [MENU] keys are described in the system's master-module documentation. Menu keys with lower-case labels access lower-level menus; those with upper-case labels access functions directly. Use the previous-menu key, `prev menu`, or backspace [←] key, to return to the previously displayed level of keys.

Multi-State Functions

Some softkeys switch between two states, such as active on or off, `ACTIVE ON/OFF`, and US or European clock, `US/EURO`. An underscore or inverse video on the key labels indicates which keys and conditions are selected.

Rear-Panel Features

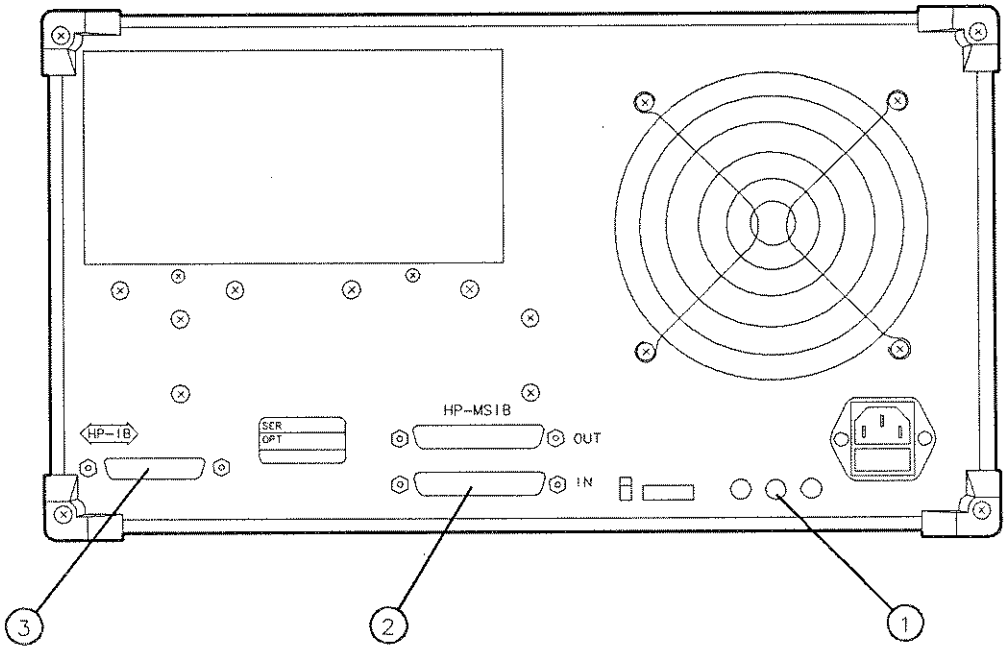


Figure 1-3. HP 70004A Display Rear Panel

1. The **RGB** monitor output provides a red, green, and blue output, with sync on green (75Ω impedance, 1 V p-p, 25 kHz horizontal, 60 Hz vertical, and 400 horizontal lines).
2. The **Hewlett-Packard Modular System Interface Bus (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 **Hewlett-Packard Interface Bus (HP-IB)** provides IEEE-488 communication between the display, controllers, other HP-IB instruments, and each module installed in the display that implements HP-IB.

Accessing (DISPLAY) Functions

The (DISPLAY) softkeys control the functions of the display, which is actually a separate instrument from, for example, a spectrum analyzer in the system. Some commonly used features are described below for your convenience.

- Adjust the color attributes on your display screen.

  (DISPLAY) `Edit Colors`

- Format and obtain hardcopy output.

  (PLOT)

  (PRINT)

  (DISPLAY) `Hard Copy`

- Configure the display screen into up to four individually assignable windows and assign them to instruments.

  (DISPLAY) `Config Display`

- Quickly access any of several instruments in the HP 71000 Modular Measurement System.

  (INSTR)

  (DISPLAY) `NEXT INSTR`

- Obtain system-wide error reports.

  (DISPLAY) `REPORT ERRORS`

- Examine addresses on the HP-MSIB (the local bus) for modular instruments.

  (DISPLAY) `Address Map`

- Alter the brightness of the display screen.

  (DISPLAY) `INTEN ADJUST`

- Clear the display screen, all errors, the HP-IB output buffer, and assign the entire display screen to the last instrument controlled by the keyboard.

  (DISPLAY) `DISPLAY PRESET`

Table 1-2. Softkey Index, Alphabetical Order

Key	Path			Page
ADJUST COLUMN	Address Map			7-6
ADJUST ROW	Address Map			7-6
ASSIGN BOTH	Address Map			7-9
ASSIGN DISPLAY	Address Map			7-7
ASSIGN KEYBD	Address Map			7-8
BACKGROUND	Adjust Colors	edit colors		5-3
BUILD 1 WINDOW	Config Display	build window		6-8
BUILD 2 WINDOWS	Config Display	build window		6-8
BUILD 4 WINDOWS	Config Display	build window		6-8
CLOCK COPY	Hard Copy	copy options		3-8
CLOCK DISPLAY	Misc	clock		8-2
COLOR 1	Adjust Color	edit colors		5-3
COLOR 2	Adjust Color	edit colors		5-3
COLOR 3	Adjust Color	edit colors		5-3
COLOR 4	Adjust Color	edit colors		5-3
COLOR 5	Adjust Color	edit colors		5-3
COLOR 6	Adjust Color	edit colors		5-3
COLOR 7	Adjust Color	edit colors		5-3
COLOR 8	Adjust Color	edit colors		5-3
COLOR 9	Adjust Color	edit colors		5-3
COLOR 10	Adjust Color	edit colors		5-3
CONFID TEST	Misc	display tests		8-5
COPY IS PRT/PLT	Hard Copy	copy options		3-9
DAY	Misc	clock	set clock	8-3
DEFAULT COLORS	Adjust Color			5-5
DEFAULT CORNERS	Config Display	build window	custom windows	6-5
DEFAULT VALUES	Hard Copy	copy options		3-9
DISPLAY ID	Misc			8-4
DISPLAY PRESET	Main			2-2
display tests	Misc			8-5
HIGH RESLN	Hard Copy	printer config		3-2

Table 1-2. Softkey Index, Alphabetical Order (continued)

Key	Path			Page
HOUR	Misc	clock	set clock	8-3
HP LOGO COPY	Hard Copy	copy options		3-8
HP LOGO DISPLAY	Misc			8-2
HP-IB	Config Display	assign window		6-9
HP-MSIB ADDRESS	Mass Storage	msi	HP-IB disk	4-7
HP-IB ADDRSET	Address Map			7-6
HP-IB disk	Mass Storage	msi		4-7
INTEN ADJUST	Main			2-6
KEY COPY	Hard Copy	copy options		3-8
KEY LABELS	Adjust Color	edit colors		5-3
KEY TEST	Misc	display tests		8-6
KNOB TEST	Misc	display tests		8-7
MEMORY CARD	Mass Storage	msi		4-3
MINUTE	Misc	clock	set clock	8-3
MONOCHROME	Adjust Color			5-5
MONTH	Misc	clock	set clock	8-3
NEXT INSTR	Main			2-2
OPTICAL FILTER	Adjust Color	special colors		5-6
PAGE EJECT	Hard Copy	copy options		3-9
PAINTJT BLACK	Hard Copy	printer config		3-2
PAINTJT COLOR	Hard Copy	printer config		3-2
PURGE ALL	Config Display	purge window		6-9
RECALL COLORS	Adjust Color			5-2
RECALL CONFIG	Config Display			6-4
REPORT ERRORS	Main			2-6
RUN STOP	Misc	clock	set clock	8-3
SAVE COLORS	Adjust Color			5-2
SAVE CONFIG	Config Display			6-4
SECOND	Misc	clock	set clock	8-3
SHOW CONFIG	Config Display			6-2
SINGLE PEN	Hard Copy	plotter config		3-5

Table 1-2. Softkey Index, Alphabetical Order (continued)

Key	Path			Page
SIX PENS	Hard Copy	plotter config		3-5
STACK 2 WINDOWS	Config Display	build window		6-8
STACK 4 WINDOWS	Config Display	build window		6-8
THINK JET	Hard Copy	printer config		3-2
TUMBLE FIGURES	Misc	display tests		8-7
UNIT NUMBER	Mass Storage	msi	HP-IB disk	4-7
US/EURO	Misc	clock		8-2
VISION ENHNC 1	Adjust Color	special colors		5-6
VISION ENHNC 2	Adjust Color	special colors		5-6
VOLUME NUMBER	Mass Storage	msi	HP-IB disk	4-7

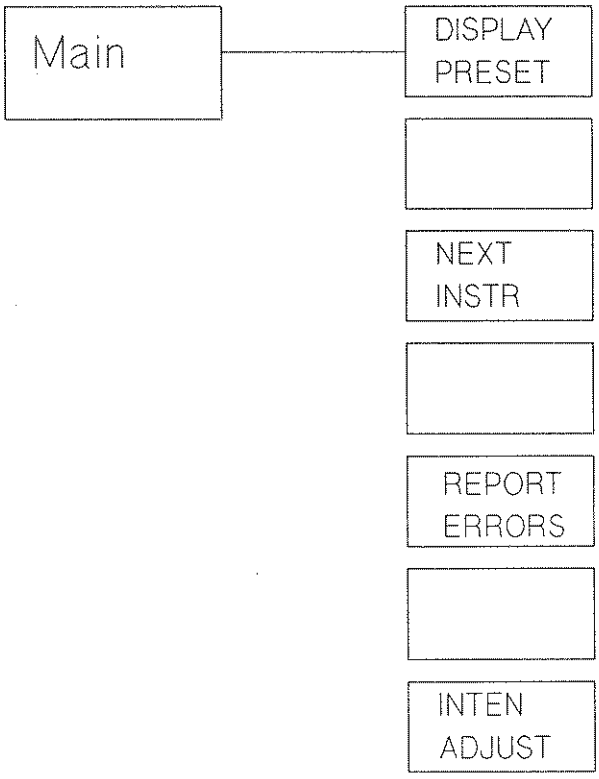


Figure 1-4. Menu Key Index, Main Keys

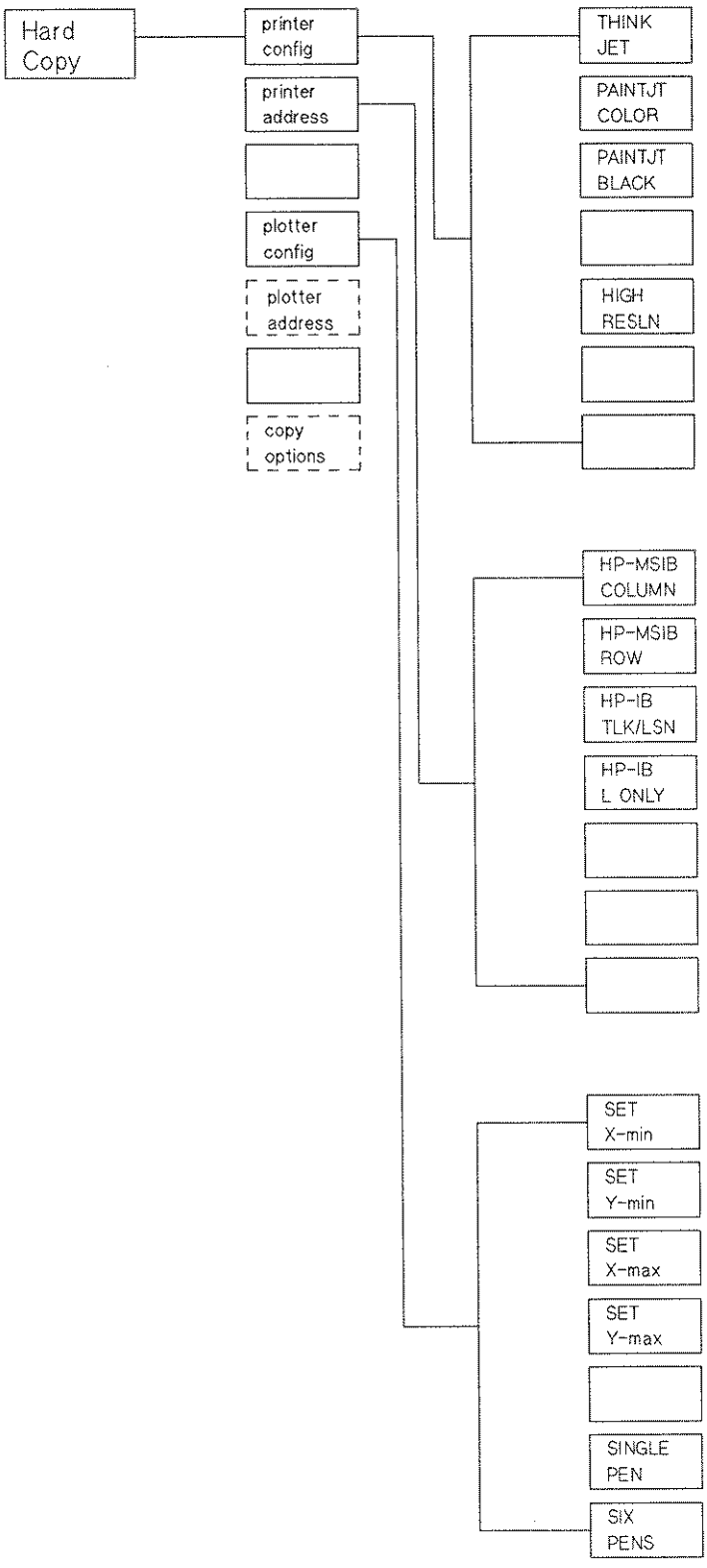


Figure 1-5. Menu Key Index, Hard Copy Keys

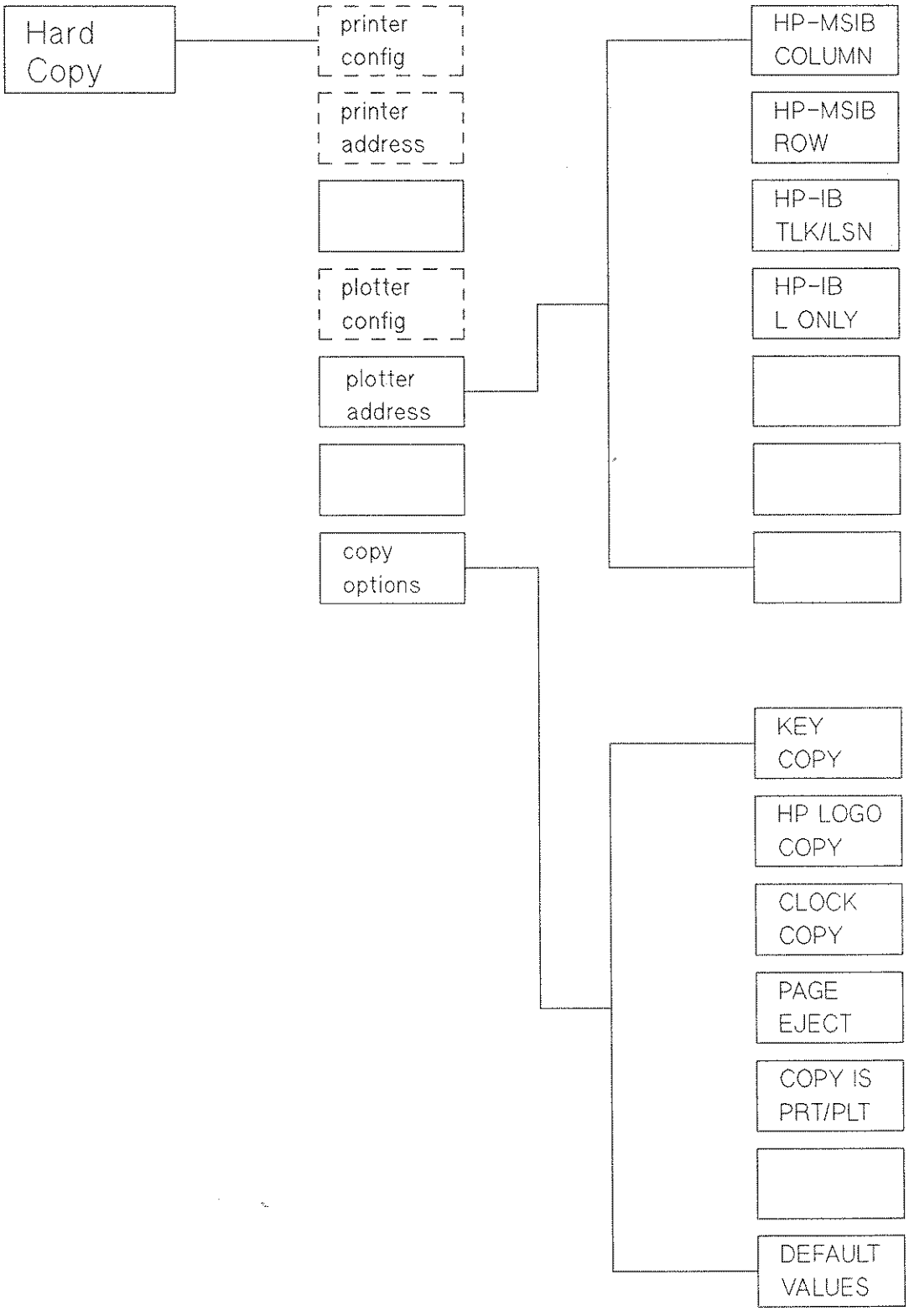


Figure 1-5. Menu Key Index, Hard Copy Keys (continued)

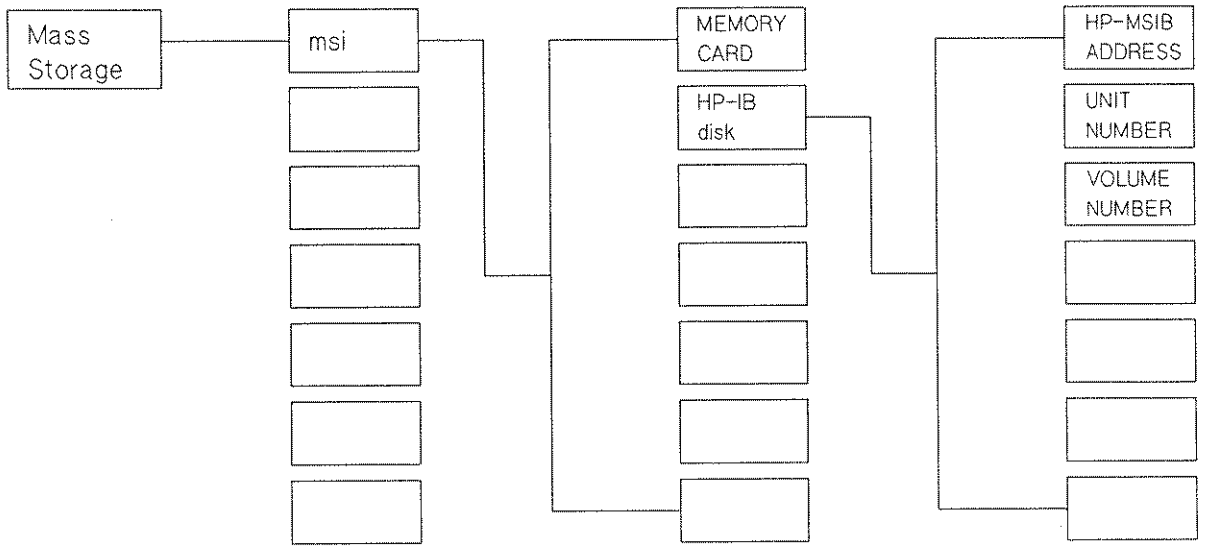


Figure 1-6. Menu Key Index, Mass Storage Keys

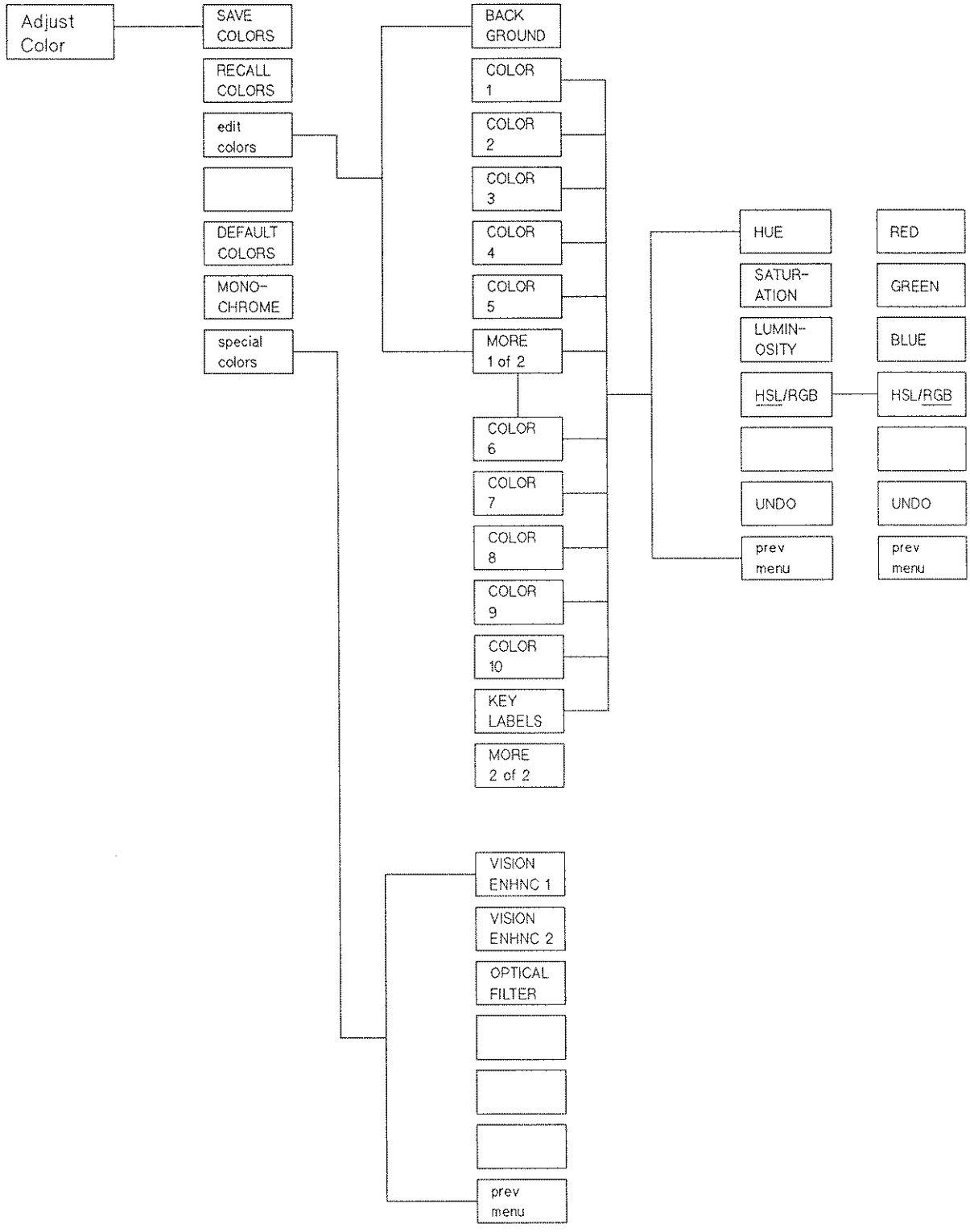


Figure 1-7. Menu Key Index, Adjust Color Keys

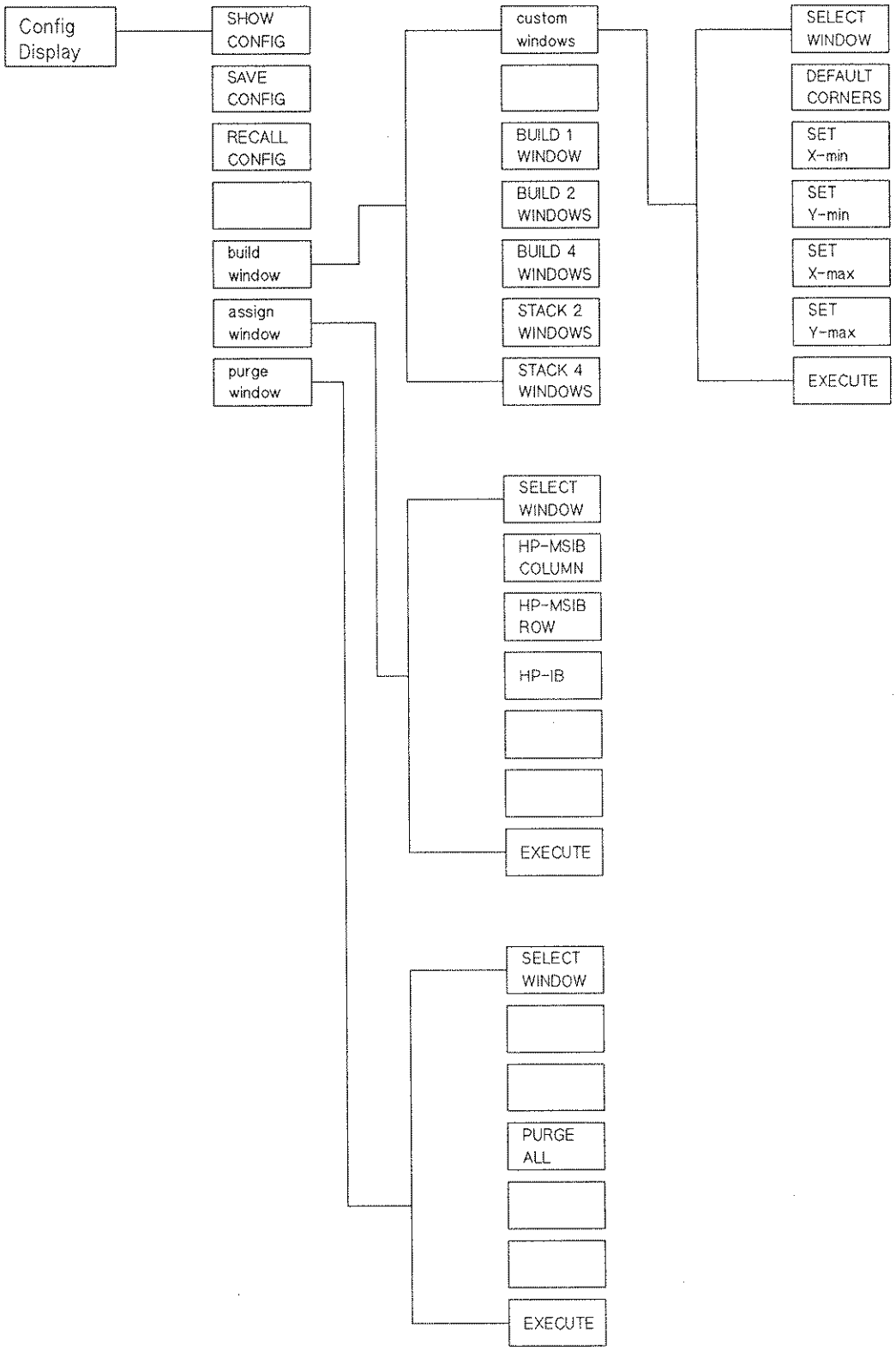


Figure 1-8. Menu Key Index, Config Display Keys

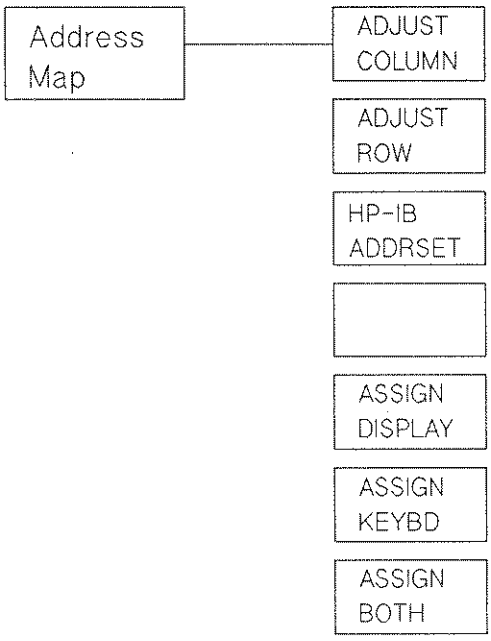


Figure 1-9. Menu Key Index, Address Map Keys

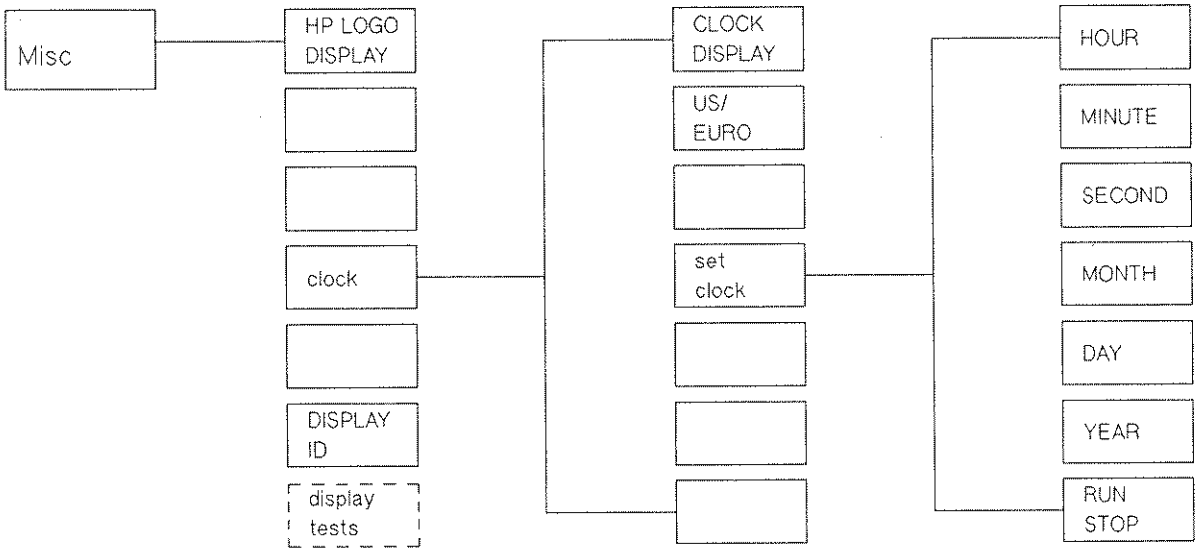


Figure 1-10. Menu Key Index, Misc Keys

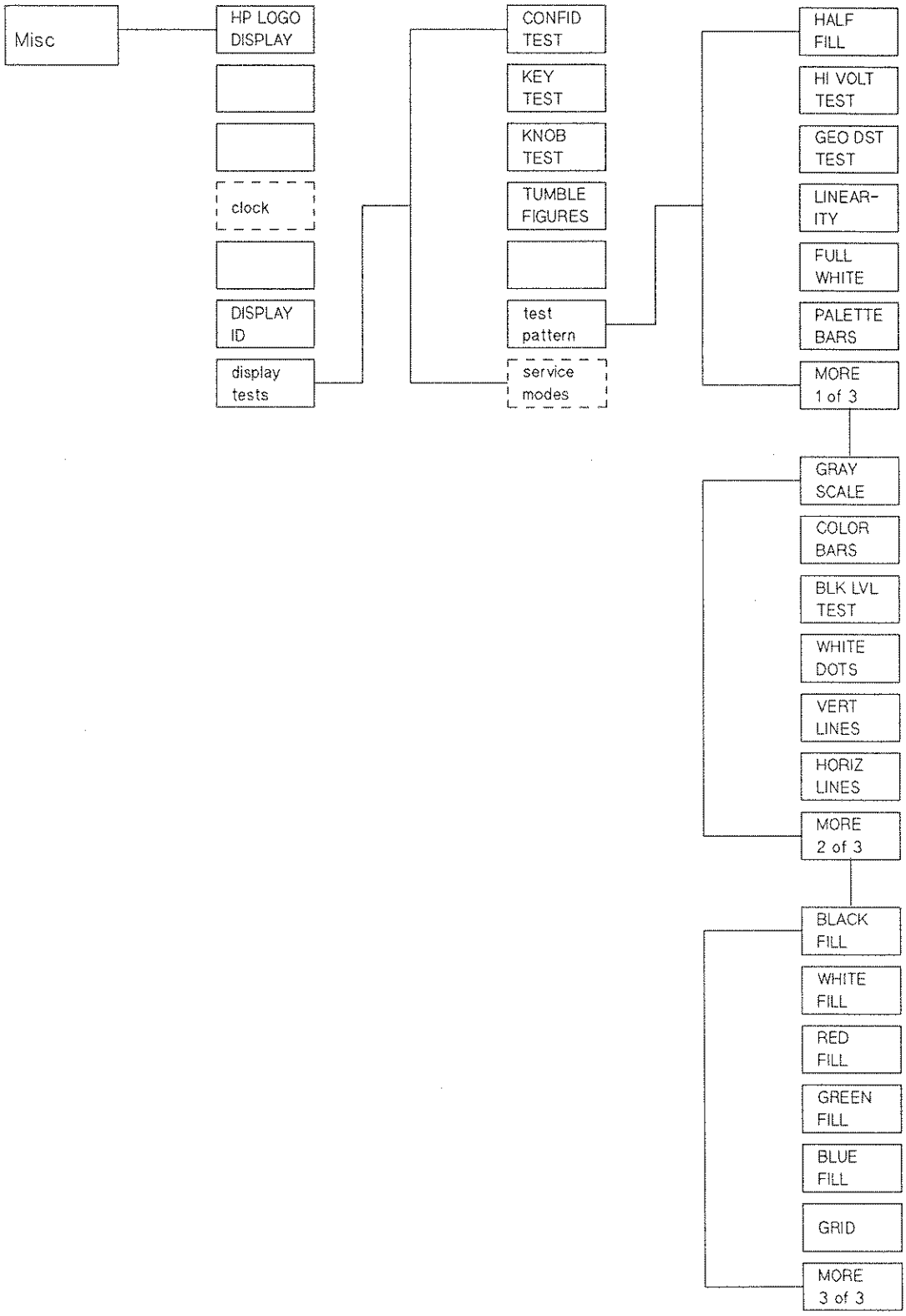


Figure 1-10. Menu Key Index, Misc Keys (continued)

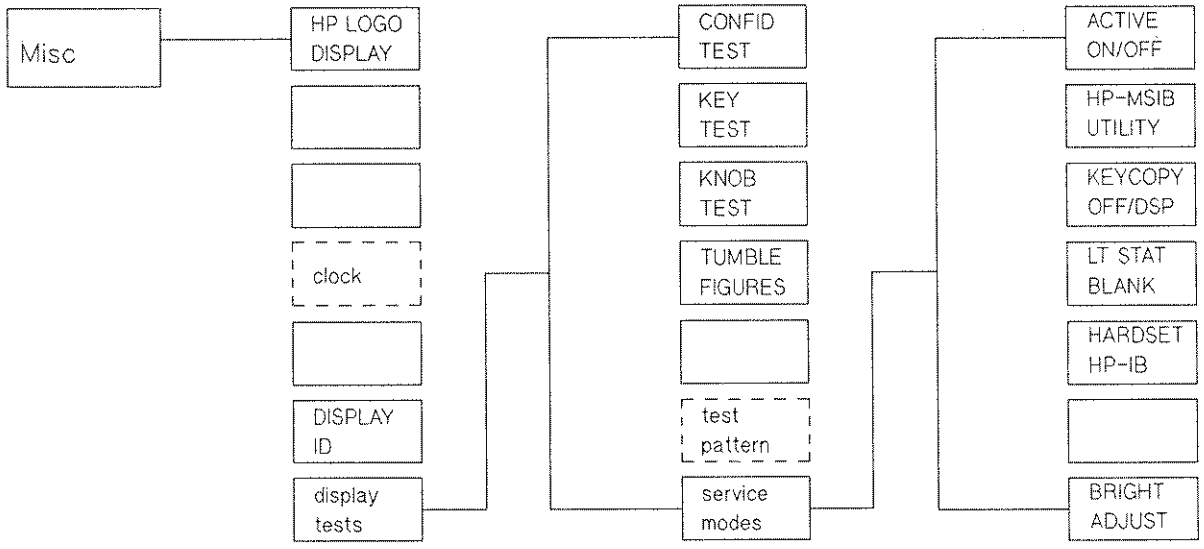


Figure 1-10. Menu Key Index, Misc Keys (continued)

2

Main Menu

Path

(DISPLAY) Main

Description

The Main softkey accesses the REPORT ERRORS, DISPLAY PRESET, NEXT INSTR, and INTEN ADJUST functions. The main menu is selected whenever the (DISPLAY) key is pressed. Softkeys included in the Main menu are:

DISPLAY PRESET

Path (DISPLAY) DISPLAY PRESET

Description

- Clears the screen.
- Resets the display to one window.
- Assigns the entire screen to the last module assigned the keyboard (if any).
- Resets the mass storage system.
- Resets the HP-IB interface (clears the input and output buffers, plus the SRQ).

The DISPLAY PRESET softkey produces one window and assigns it to the last instrument to own the keyboard. Note that (INSTR PRESET) does not preset the display since the display is a separate instrument (from a spectrum analyzer for example). Therefore, if four windows are configured and (INSTR PRESET) is pressed, the four windows will remain, whereas DISPLAY PRESET will reset the screen back to one window and but *not* reset the instrument that owns the keyboard.

NEXT INSTR

Path (DISPLAY) NEXT INSTR

Description

- Establishes initial contact between the display and a single instrument.
- Steps to the next instrument on row 0 of the address map.

The NEXT INSTR (next instrument) softkey establishes a link between the display and one instrument at a time. For example, if one instrument is being displayed on a single window and instead you want to display another instrument on that same window, NEXT INSTR may be used to step to the next window. NEXT INSTR causes the display to show measurement results and control operation of the next instrument on row 0 of the address map. If none is found higher than the current one, the display will start at column zero and work its way up to the next address containing an instrument. For more information about addressing and the address map, refer to Chapter 7, "Address Map Menu."

Pressing (⇧) or (⇩) will cause a search up or down through the address map for the next instrument.

At power-on the display prompts the user to press NEXT INSTR. If during a previous session, NEXT INSTR had been pressed and the screen is assigned to an instrument, the display will automatically attempt to re-establish a link to that instrument. In that case, as soon as the link is established, the power-up prompt will go away. In most cases, this will happen so soon after the link is offered that the prompt will flash on the screen and be gone.

To establish (or re-establish) a link to an instrument, press (DISPLAY) and NEXT INSTR. If the display does not have a link to an instrument, it will look for the instrument with the lowest column address on the HP-MSIB and allocate the entire screen and the 14 softkeys to that instrument. If a link already exists, the display will select the instrument with the next highest address (for which the sequence goes.... 28, 29, 30, 0, 1, 2....). Then the (↑) (or NEXT INSTR again) and (↓) keys can be used to select the instrument with the next highest or next lowest address.

The information displayed, once an instrument is given to an instrument, depends on the specific instrument selected. Since this key only establishes communication links between the display and the instrument, most instrument settings are not affected when an instrument is selected. However, any previously defined display windows are erased.

This key is useful for establishing "initial" contact with a single instrument. To control an instrument already on the screen and preserve existing windows, use the assign window key instead, available under Config Display. (These softkeys are described in detail in the Config Display chapter.)

EXAMPLE: Obtaining spectrum analyzer display and keyboard control.

This example describes how the user can quickly obtain a spectrum analyzer display on the screen regardless of the current screen configuration.

It begins by breaking contact with the instrument, then re-establishes contact using the NEXT INSTR key.

1. Press (DISPLAY).
2. Press the Config Display, purge window, and PURGE ALL softkeys.
3. Press (DISPLAY) again. This should result in a screen similar to Figure 2-1.

Figure 2-1.
Obtaining Spectrum Analyzer Display and Keyboard Control

If you press (MENU) or (USER) the menu-key labels disappear. No key, other than (DISPLAY), (PRINT), or (PLOT) will give a response.

(MENU) and (USER) do not call up any keys because an instrument is not currently linked to the display. All keys under (USER) and (MENU) are created by and responded to by an instrument (such as the spectrum analyzer), while all keys under (DISPLAY) are generated by the display itself.

To obtain an instrument display on the screen, press (DISPLAY), and then NEXT INSTR. To use the instrument now, simply press (USER) or (MENU) and use the appropriate softkeys. If using a spectrum analyzer, this should result in a display similar to Figure 2-2.

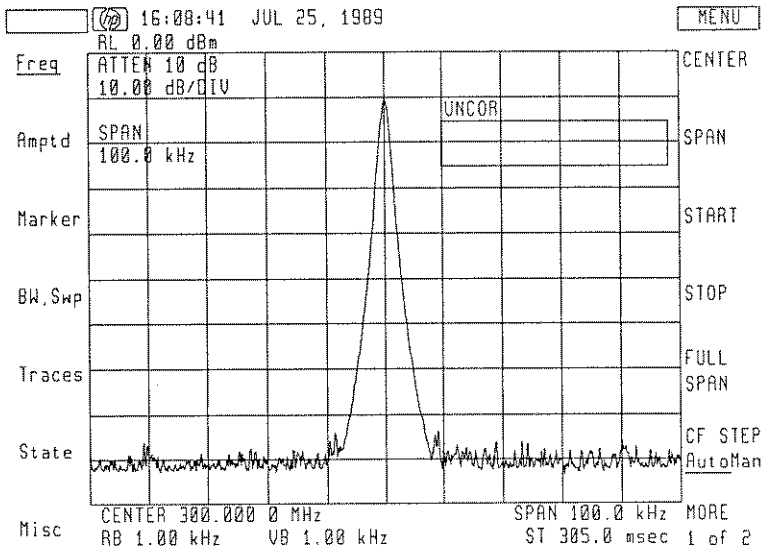


Figure 2-2. Instrument Display

REPORT ERRORS

Path DISPLAY REPORT ERRORS

Description When an instrument or module has an error, it informs every instrument that resides on row 0 of the address map. This will cause an E (the E is red on the HP 70004A) to appear in the status box of every display. When the REPORT ERRORS softkey is pressed, the display will list the description of all of the errors. If more than one instrument has reported errors, a MORE ERRORS softkey will appear. When pressed, the screen will list the next instrument's errors. This is a one-time transfer of information; there is no updating. Listing the description of an error will clear the error if it is not hardware related.

Most errors reported on the HP-MSIB system are transient errors such as those caused by illegal commands over HP-IB. These errors, once reported via REPORT ERRORS, are cleared from memory. Hence they cannot be reported or viewed a second time.

Other errors reported can be hardware errors. These are caused by hardware problems such as unconnected back panel cables (see the following example) or the failure of an internal component. These problems can affect operation of the instrument, and cannot be cleared from memory until corrected.

Note

Some transient errors can be cleared by pressing either (USER) or (MENU), or by pressing the (DISPLAY) and REPORT ERRORS keys.

INTEN ADJUST

Path (DISPLAY) INTEN ADJUST

Description The INTEN ADJUST (intensity adjustment) softkey changes the display screen's video amplitude (brightness). Intensity is incrementally adjustable (using the knob, step keys, or keypad) from 0 to 19 in steps of 1. The default intensity is set at 9.

Note

The 0 intensity setting may not be completely off.

Note

If red fringes appear to the right of some colors, the selected intensity is set too high for the current brightness setting. Lower the intensity of the brightness setting. See Chapter 8, "Misc Menu."

3

Hard Copy Menu

Path

(DISPLAY) Hard Copy

Description

The Hard Copy softkey accesses printing and plotting functions. This chapter also discusses printer and plotting definitions (addresses, plot sizes, and so on). Keys included in the Hard Copy menu are:

printer config

Path DISPLAY Hard Copy printer config

Description The printer config menu determines the type of printer output:

- Select the THINK JET softkey for the HP ThinkJet and most other Hewlett-Packard printers.
- Select the PAINTJT COLOR softkey for a color output to the HP PaintJet printer. When a high resolution (using the HIGH RESLN key) color HP PaintJet output is performed, only six colors are available. Otherwise 10 colors are available. See Table 3-1 for the HP PaintJet high- and low-resolution color mapping.

Note 

The colors printed on the PaintJet are a function of the *color number* of each item on the screen, not the *color* of each item on the screen. The PaintJet's colors do NOT change when the on-screen colors are changed using the Adjust Colors Menu. See the Copy Options section of this chapter.

Note 

PAINTJT COLOR is the default printer mode. If you are using an HP ThinkJet printer, activate the THINK JET softkey.

- Select the PAINTJT BLACK for a one-color (black) output to an HP PaintJet printer.
- Select the HIGH RESLN softkey (switched on), for a printer output that is 1024 dots wide and consists of the entire 1024 dot resolution of the display.

Table 3-1. HP PaintJet Color Map

Color * Number	PaintJet Low Resolution			Color Name	PaintJet High Resolution			Color Name
	Red	Green	Blue		Red	Green	Blue	
0	90	88	85	white (no ink)	90	88	85	white (no ink)
1	43	43	45	light gray	4	4	6	black
2	73	41	16	orange/yellow	3	26	22	green
3	2	22	64	cyan	2	22	64	cyan
4	53	5	25	magenta	53	5	25	magenta
5	10	38	22	green	3	26	22	green
6	4	4	6	black	4	4	6	black
7	11	14	18	medium gray	4	4	6	black
8	63	20	15	amber	53	8	14	Red
9	53	8	14	red	53	8	14	red
10	4	4	6	black	4	4	6	black
11	4	4	6	black	4	4	6	black
12	11	14	18	medium gray	4	4	6	black
13	53	8	14	red	53	8	14	red
14	10	38	22	green	3	26	22	green
15	4	4	29	blue	4	4	29	blue

* as in the `Adjust Color` `edit colors` menu.

More Information about `printer config`

1. It is not necessary to distinguish between `PAINTJT BLACK` and `THINK JET` printer dumps except when a `HIGH RESLN` printer dump is selected. This is because of differences in the printer control sequences that are only important for high resolution (180 dpi) printer dumps.
2. The higher resolution obtainable with `HIGH RESLN` is available only on raster (PRINT) operations. `HIGH RESLN` does not affect (PLOT) operations.
3. `HIGH RESLN` re-programs the printer to hold more dots per line. The display is 1024 dots across the screen, and in `HIGH RESLN` mode, all 1024 dots are dumped. With `HIGH RESLN` off, the 1024 dots are consolidated into 512 dots. Some information is lost this way, but the printer dumps are faster. After a high resolution dump is done, the printer is left in high resolution mode, since

the display has no way to know what mode the printer was in to begin with.

4. When making high-resolution prints the printing operation will be slower than usual. This is because the printer must place more dots on each line.
5. Although the ThinkJet and PaintJet printers can, not all raster printers can accommodate 1024 points per line. Some older printers have a line width less than 1024 points. Do *not* use `HIGH RESLN` with these printers.

`printer address`

Path (DISPLAY) `Hard Copy` `printer address`

Description The `printer address` softkey defines the HP-IB address of the output printer.

- Use the `HP-MSIB COLUMN` and `HP-MSIB ROW` softkeys if an HP-MSIB print device is configured into the system.
- Switching the `HP-IB TLK/LSN` (talk/listen) key on means the display expects the printer to be in talk/listen mode on HP-IB. When the `HP-IB TLK/LSN` mode is switched on the address may be changed using the knob or numeric-entry keys. The default HP-IB printer address is `1`.
- Switching the `HP-IB L ONLY` (listen only or listen always) key on means the display expects the printer to be in the listen-only mode on HP-IB. No attempt will be made to address the printer.

Note 

For a discussion of printer compatibility, see the `printer config` softkey description.

plotter config

Path (DISPLAY) Hard Copy plotter config

Description The plotter config softkey defines the limits used for plotter outputs when the display cannot ask the plotter what limits to use (for example, listen-only plotters). It also determines how many plotter pens the display will try to use.

- The SET X-min, SET Y-min, SET X-max, and SET Y-max keys set the P1 and P2 corner points for the plotter.
- Switching the SINGLE PEN softkey on tells the display to plot using only plotter PEN 1. This function is useful if photocopying the plots, for one pen plotters, or for faster plotting.
- Switching the SIX PENS softkey on tells the display to plot using 6 plotter pens. The internal pen numbers (1—15) are mapped to six pens (1—6) as shown in Table 3-2.

Table 3-2. Mapping of Display Pens to Plotter Pens

Onscreen Pen	Default Colors	Plotter Pen	Recommended Pen Color	Spectrum Analyzer
1	Dim Gray	4	Blue	Graticule
2	Yellow	1	Black	Trace A
3	Cyan	6	Brown	Trace B
4	Pink	5	Violet	Trace C
5	Green	3	Green	Limit Lines
6	White	1	Black	Active Parameter
7	Half Bright	3	Green	Annotation
8	Amber	2	Red	Advisory Messages
9	Red	2	Red	Errors
10	White	1	Black	Markers
11	Bright Gray	1	Black	Key Labels
12	Half Bright	1	Black	System Status
13	Red	2	Red	
14	Green	3	Green	
15	Blue	4	Blue	

The `plotter config` softkey alters the physical size of hardcopy output plots. On HP Plotters, the physical size and shape of output plots are determined by the locations of the *Scaling Points,* P1 and P2. These locations are given in Cartesian coordinates; for example, P1 = 100, 100 and P2 = 10100, 7600. The actual size of these units depends on the specific plotter used. Typical unit size is 0.025 mm, or about 0.001 inch. The units are referenced from the lower-left corner of the available plotting surface.

In Figure 3-1, the default plotting area for the HP 7475A 6-Pen Graphics Plotter is outlined. P1 is the lower-left corner, P2 is the upper right corner.

p2

Default Plotter Parameters
(as set by the display)
X-min = 100
Y-min = 100
X-max = 10,100
Y-max = 7,600

p1

Figure 3-1. Plotter Parameters as Set by the Display

The plotter parameters are stored in a continuous-memory register; they will be retained even after the power has been turned off. Turning the system off and then on (or pressing the `DISPLAY PRESET` softkey) will not reset the plotter parameters to their default values. The display uses these stored values if it cannot interrogate the plotter, otherwise it simply gets them from the plotter. The display cannot interrogate the plotter if the plotter is a listen-only device. The display also cannot interrogate a talk/listen plotter if the output is initiated by remote control, over HP-IB, or from a module using the display's `CY 1` command.

plotter address

Path (DISPLAY) Hard Copy plotter address

Description The plotter address softkey defines the HP-IB address of the hardcopy output plotter.

- Use the HP-MSIB COLUMN and HP-MSIB ROW softkeys if an HP-MSIB plot device is configured into the system.
- Switching the HP-IB TLK/LSN key on means the display expects the plotter to be in the talk/listen mode on HP-IB. When the HP-IB TLK/LSN mode is switched on the address may be changed using the knob or numeric-entry keys. The default HP-IB plotter address is 5.
- Switching the HP-IB L ONLY (listen only or listen always) key on means the display expects the plotter to be in listen-only mode on HP-IB. Note that a listen-only plotter cannot tell the display where its corner points (P1, P2) are located. With a listen- only plotter the display will always use the P1 and P2 corner points stored under the plotter config softkey, since it cannot determine the plotter's actual P1, P2 configuration.

copy options

Path (DISPLAY) Hard Copy copy options

Description The copy options softkey offers the user a variety of plot and print options, which are described below.

- Switching the KEY COPY softkey on prints or plots the key labels, system annunciator block, and the menu annunciator block during hardcopy outputs. The default state is off.
- Switching the HP LOGO COPY softkey on print or plots the HP logo in the status window during hardcopy outputs, independent of the state of the HP LOGO DISPLAY softkey in the Misc menu.

Note 

If the HP LOGO COPY softkey is off and the HP LOGO DISPLAY softkey is on, the HP logo is still output. HP LOGO COPY only overrides if the HP LOGO DISPLAY is off.

- Switching the CLOCK COPY softkey on prints or plots the real-time clock readout in the status window during hardcopy outputs,

independent of the state of the CLOCK DISPLAY softkey in the Misc menu.

Note

If the CLOCK COPY softkey is off and the CLOCK DISPLAY softkey is on, the clock is still output. CLOCK COPY only overrides if CLOCK DISPLAY is off.

- Switching the PAGE EJECT softkey on form feeds the printer at the end of the printer output and ejects a page at the end of plotter outputs.

Note

Many plotters do not implement a page eject feature. Some of these plotters report an error on PAGE EJECT so leave it off if using such a plotter.

- The COPY IS PRT/PLT softkey determines whether the printer or plotter will be the destination when the copy (CY) display command is sent via HP-IB or HP-MSIB during remote controlled applications. For example, when the PLOT command is sent to the HP 70900B Local Oscillator over HP-IB, the HP 70900B sends a CY command to the display over HP-MSIB.
- The DEFAULT VALUES softkey sets each of the other functions in this menu to the following default settings:

Table 3-3. Default Values

PRINTER IS:	HP-IB Talk/Listen at address 1.
PLOTTER IS:	HP-IB Talk/Listen at address 5.
KEYCOPY:	OFF
HP LOGO COPY:	ON
CLOCK COPY:	ON
PAGE EJECT:	ON
COPY IS:	PRINTER
PLOTTER PARAMS:	Plot limits of X-min, Y-min = 100, 100 Plot limits of X-max, Y-max = 10100, 7600

Note

The default plotter limits are those of the HP 7470A and the HP 7475A Plotters. These allow 0.5 inch margins on standard A-size paper (8.5 by 11 inches).

Note

Printer and plotter outputs can't be produced if an HP-IB controller (computer) is connected to the same HP-IB connector as the output device.

Note

Printer or plotter outputs initiated remotely (for example, using the PLOT command in the Spectrum Analyzer) depend on the setting of the SYSTEM CONTROLLER switch on the rear of the display. If the switch is on (up), the display will address the printer or plotter and handle their output. If the switch is off (down), the display will output the data only when addressed to talk by the system controller (computer).

Note

The display buffers plotter output data for one plot. Thus when PLOT is pressed, the screen freezes for a moment (longer, if there is too much plot data to fit in the buffer), then resumes displaying data while simultaneously plotting.

Pressing PLOT again while the data is being output terminates the plot, it does *not* start another one.

4

Mass Storage Menu

Path

(DISPLAY) Mass Storage

Description

The Mass Storage softkey accesses two separate memory devices for saving and recalling instrument states, data, traces, user keys, limit lines, and programs (DLP's). The devices are:

- An internal **Memory Card**
- An external **HP-IB disk drive.**

Note To avoid corrupting the mass storage medium, do *not* press any display front-panel keys while a mass storage operation is in progress.

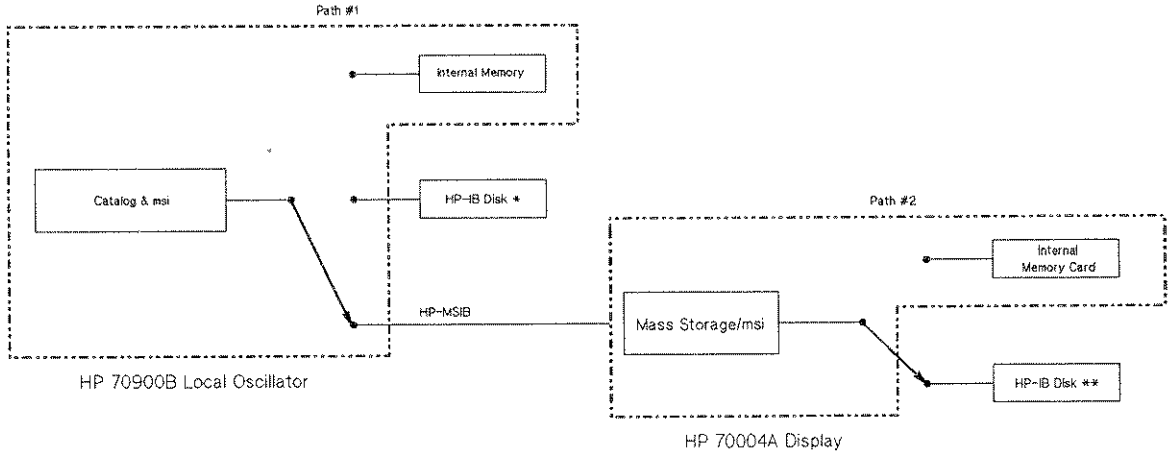
Note Some instruments (for example, the spectrum analyzer) can access their own internal memory or external HP-IB disk drives. For more information refer to your instrument's operation manual.

Path

(DISPLAY) Mass Storage msi

Description

msi sets the HP 70004A Display's current mass memory device. Once msi (mass storage is) is set, instruments may access the memory device (for example, an HP-IB disk drive) through the display without the need of an external controller for saving and recalling instrument states, user keys, limit lines, traces, and programs. The data is stored in logical interchange format (LIF) files. The example in Figure 4-1 and Figure 4-2 shows an instrument module (for example, an HP 70900B) at a remote antenna site using an HP-IB disk attached to the HP 70004A Display.



* HP-IB connector on the mainframe that contains the instrument module (can be the mainframe portion of the HP 70004A Display).

** The HP 70004A Display's HP-IB Interface

Figure 4-1. Example of an HP 70900B Accessing an HP-IB Disk Drive

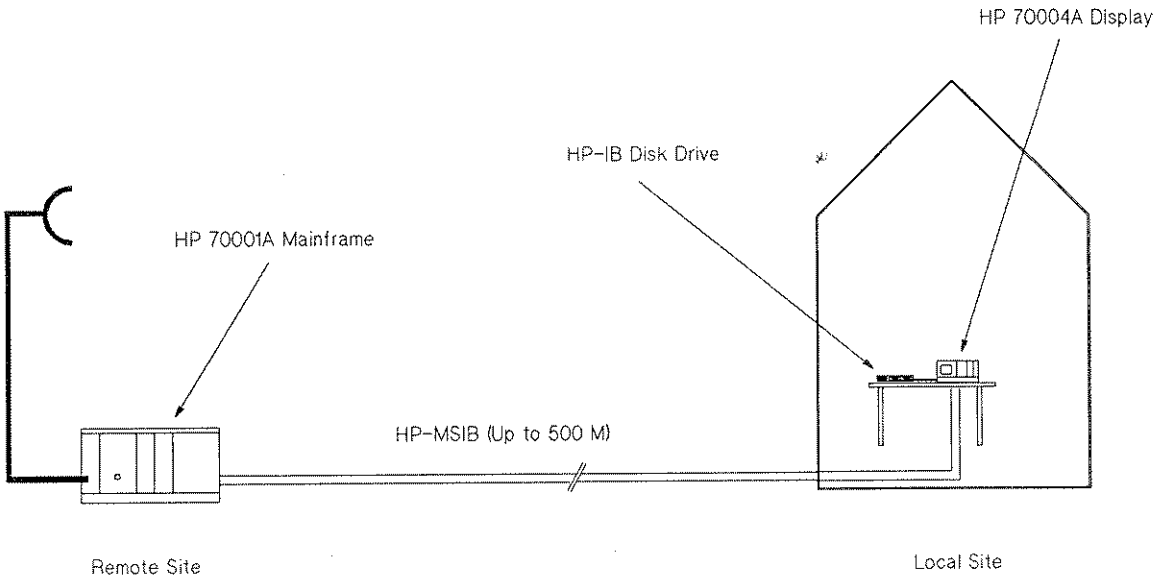


Figure 4-2. Using HP-MSIB to Connect the Display to a Remote Antenna Site

MEMORY CARD

Path (DISPLAY) Mass Storage msi MEMORY CARD

Description This function sets memory card as the mass storage device. Data can be stored directly on the memory card by instrument modules without the use of an external disk drive.

Installing 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, and may damage the card or instrument. Care must be taken 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 4-3.
3. Press the card into the slot. When correctly inserted, approximately 19 mm (0.75 in.) of the card is exposed.

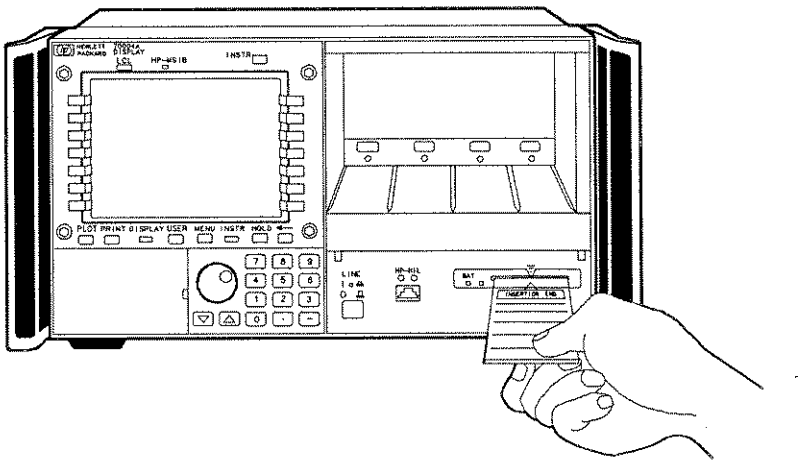


Figure 4-3. Inserting the Memory Card

Changing the Memory Card Battery

It is *recommended* that the memory card battery (HP part number 1420-0383) be changed every two years.

Note

The typical battery lifetime (under normal conditions) is more than 2 years.

The date that the memory card battery was installed 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 date that the battery was installed, use the date code engraved on the side of the memory card. The date code engraved on the memory card consists of numbers and letters engraved in the black plastic on the side of the memory card. See Figure 4-4. The first number indicates the year, the following two characters indicate the month, and following number indicates the week in the month that the memory card battery was installed. For example, 9JA2 indicates the battery was installed on the second week in January, 1989.

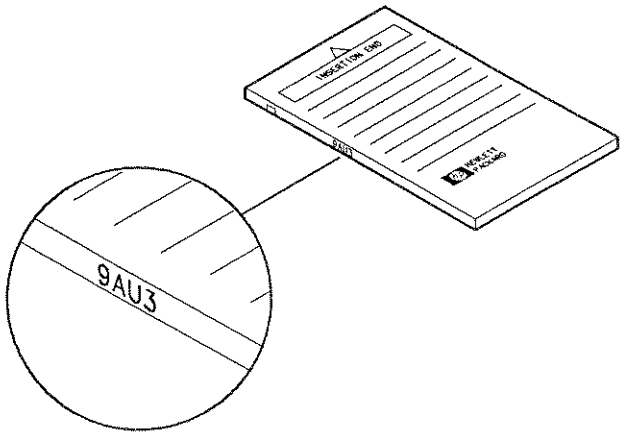


Figure 4-4. Memory Card Date Code Location

Battery Replacement Procedure

The battery is located beside the memory card's write-protect switch on the opposite end of the connector.

Caution

The memory card requires power. The display provides power to the card when it is installed in the card reader. When the card is removed, power is provided by the battery. 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, back up the memory card data on some other medium before beginning the following battery replacement procedure.

1. Install the memory card into the display's card reader slot.
2. Locate the groove along the edge of the battery clip. See Figure 4-5.
3. Gently pry the battery clip out of the card. The battery fits within this clip. The red BAT LED on the display front-panel should turn on.
4. Replace the battery, making sure the plus (+) sign on the battery is on the same side as the plus (+) sign on the clip.
5. Insert the battery clip into the memory card, holding the clip as oriented in Figure 4-5 (face the open edge of the clip toward the write-protect switch on the memory card). The red BAT LED should turn off.
6. Write the battery replacement date on the memory card label, to remind you when to replace the battery.

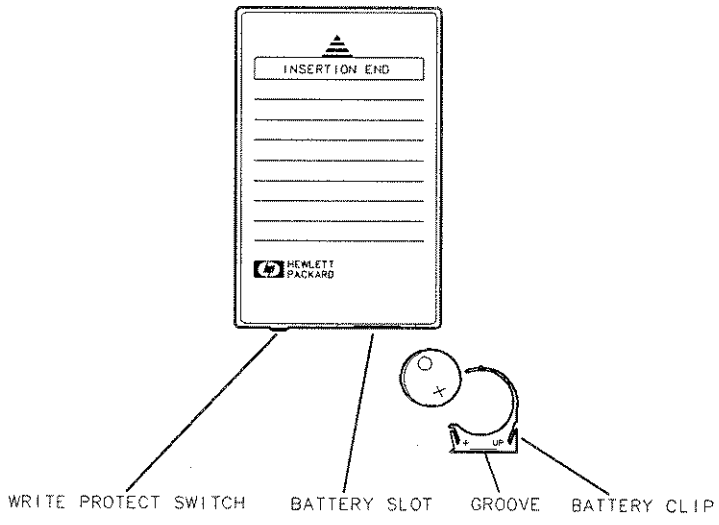


Figure 4-5. Memory Card Battery Replacement

HP-IB disk

Path

(DISPLAY) Mass Storage msi HP-IB disk

Description

This function sets the mass storage device to the external HP-IB disk drive. Data can be stored on the disk by instrument modules using the display. Once the disk drive is connected to the display's HP-IB connector, you need a way of specifying which disk is to be accessed. Three parameters need to be entered:

- HP-IB ADDRESS
- UNIT NUMBER
- VOLUME NUMBER

HP-IB ADDRESS

Path

(DISPLAY) Mass Storage msi HP-IB disk HP-IB ADDRESS

Description

The HP-IB ADDRESS softkey specifies the HP-IB address of the disk drive.

UNIT NUMBER

Path

(DISPLAY) Mass Storage msi HP-IB disk UNIT NUMBER

Description

The UNIT NUMBER softkey specifies which disk-drive unit to access. For example, for an HP 9133H disk drive, unit number 0 is the hard disk and unit number 1 is the floppy disk.

VOLUME NUMBER

Path

(DISPLAY) Mass Storage msi HP-IB disk VOLUME NUMBER

Description

If the disk drive is divided into several volumes, the VOLUME NUMBER softkey specifies which disk drive volume to access. Normally this is number 0 for a floppy disk.

py disk.

5

Adjust Color Menu

Path

(DISPLAY) Adjust Color

Description

This chapter explains how to adjust the color attributes on your display screen. The HP 70004A Display can display text and graphics in up to 16 simultaneous colors, selectable from a palette of 4096 colors.

The display's default colors have been chosen to maximize your ability to comfortably discern the difference between on-screen colors. We recommend these colors for normal use. They provide a suitable contrast that is easy to view for long periods of time.

You may choose to change the default colors to suit environmental needs, individual preferences, or to accommodate color-deficient vision. You can change the CRT color attributes to suit personnel preferences.

Keys included in the Adjust Color menu are:

SAVE COLORS

Path (DISPLAY) Adjust Color SAVE COLORS 1—4 ENTER

Description Pressing the SAVE COLORS softkey saves the on-screen display colors in one of four color-save registers.

Note

In Display ROM Version 7.0 the Save Colors function uses *volatile* memory. Colors saved will be lost when the power is turned off.

In ROM Version 7.01 and greater the Save Colors function uses *non-volatile* memory and colors saved will be retained when the power is turned off.

RECALL COLORS

Path (DISPLAY) Adjust Color RECALL COLORS 1—4 ENTER

Description Pressing the RECALL COLORS softkey recalls the display colors saved with SAVE COLORS.

More Information about Save and Recall Colors

Sometimes an instrument module will modify the colors on the screen to enhance a measurement. An example of this can be seen in the HP 70900B's Persist On/Off menu. When the screen is in this state, and the user enters the Edit Colors menu, the screen will return to the user's color palette, cancelling the module's colors. If you wish to edit one of these module-modified color palettes you must first SAVE it, then RECALL it. This enters it into the user's palette and then it may be edited.

edit colors

Path (DISPLAY) Adjust Color edit colors

Description

The edit colors softkey changes the display screen colors. The BACKGROUND and KEY LABELS softkeys always appear in the edit colors menu, the instrument that owns the display's keyboard may generate all other key labels. In those cases when an instrument does not generate key labels, COLOR 1 through COLOR 10 will appear on the menu. Each key in the edit colors menu reflects the element color assigned that key. Keys whose associated colors are very dim appear surrounded by an inverse video block. See Color Plate 4 on the foldout between Chapters 5 and 6.

For example, to change the background element color:

1. Press the BACKGROUND softkey
2. Rotate the knob clockwise to change the hue.
3. Press the RGB softkey.
4. Press the GREEN softkey and use the (⇧) and (⇩) keys to change the color.
5. Press the BLUE (6) ENTER keys to change the color.
6. Press the UNDO softkey. (The colors will return to the default setting.)
7. Experiment.

For more information about RGB and HSL, read the descriptions below. Table 5-1 lists the default colors.

HSL (Hue, Saturation, and Luminosity)

The HSL menu allows the user to turn the knob to change the three parameters that represent hue (the pure color), saturation (the ratio of the pure color mixed with white), and luminosity (the brightness-per-unit area).

RGB (Red, Green, Blue)

The RGB menu allows the user to turn the knob to change the output of the three primary light sources (one each of red, green, and blue) that make up any color. The parameters specify the intensity of each of the light sources.

Table 5-1. Default Color Values for the Edit Colors Menu

		RGB			HSL			Spectrum Analyzers
Color	Default Colors	Red	Green	Blue	Hue	Saturation	Luminosity	Key Labels
0	Background	1	0	2	75	100	13	Background
1	Dim Gray	4	4	4	0	0	27	Graticule
2	Yellow	13	11	2	13	80	100	Trace A
3	Cyan	0	11	13	52	100	100	Trace B
4	Pink	13	4	7	93	73	000	Trace C
5	Green	0	13	0	33	100	100	Limit Lines, Trace D
6	White	15	15	15	0	0	100	Active Parameter
7	Half Bright	8	8	8	0	0	53	Annotation
8	Amber	15	8	0	9	100	100	Advisory Messages
9	Red	15	0	0	0	100	100	Errors
10	White	15	15	15	0	0	100	Markers
11	Bright Gray	12	12	12	0	0	80	Key Labels

Play with both the HSL and RGB edit modes to get a feel for how hue, saturation, and luminosity affect the on-screen color.

Note

A saturation of 0 (zero) means white, or no color. White can also appear as gray at low lumninosities. Hue is meaningless for a saturation of 0, hence it cannot be adjusted when there is no color.

DEFAULT COLORS

Path (DISPLAY) Adjust Color DEFAULT COLORS

Description Sets all the display screen attributes to the factory-defined colors. For a listing of the default colors, see Table 5-1. To change the color elements, refer to the "Edit Colors" section of this chapter. See Color Plate 3 on the foldout between Chapters 5 and 6.

MONOCHROME

Path (DISPLAY) Adjust Color MONOCHROME

Description The MONOCHROME softkey sets the display screen to green monochrome. The monochrome display uses different shades of green for each green value. This is especially useful for driving external monochrome monitors from the green video output. To change the monochrome color elements, refer to the "Edit Colors" section of this chapter.

Table 5-2. Default Values for the Monochrome Display

Color	Default Colors	Green Value	Spectrum Analyzer
1	Dim Gray	4	Graticule
2	Yellow	10	Trace A
3	Cyan	7	Trace B
4	Pink	5	Trace C
5	Green	12	Limit Lines, Trace D
6	White	15	Active Parm
7	Half Bright	7	Annotation
8	Amber	12	Advisory Messages
9	Red	15	Errors
10	White	15	Markers
11	Bright Gray	12	Key Labels

special colors

Path (DISPLAY) Adjust Color special colors VISION ENHNC 1, or VISION ENHNC 2, or OPTICAL FILTER

Description The special colors built into vision-enhanced displays 1 and 2 accommodate most color-deficient vision problems. We designed the optical filter to accommodate the use of protective goggles while viewing lasers. To change the special color elements, refer to the "Edit Colors" section of this chapter.

Table 5-3.
Red, Green, and Blue Values for Vision Enhnc 1

		RGB			Spectrum Analyzers
Color	Default Colors	Red	Green	Blue	Key Labels
0	Background	1	0	2	Background
1	Dim Gray	4	5	0	Graticule
2	Yellow	8	6	12	Trace A
3	Cyan	0	11	13	Trace B
4	Pink	13	4	7	Trace C
5	Green	0	13	0	Limit Lines, Trace D
6	White	15	15	15	Active Parm
7	Half Bright	8	8	8	Annotation
8	Amber	15	8	0	Advisory Messages
9	Red	15	0	0	Errors
10	White	15	15	15	Markers
11	Bright Gray	12	12	12	Key Labels

Table 5-4.
Red, Green, and Blue Values for Vision Enhnc 2

		RGB			Spectrum Analyzers
Color	**Default Colors**	**Red**	**Green**	**Blue**	**Key Labels**
0	Background	1	0	2	Background
1	Dim Gray	6	3	4	Graticule
2	Yellow	8	6	12	Trace A
3	Cyan	4	4	13	Trace B
4	Pink	7	4	13	Trace C
5	Green	0	13	0	Limit Lines, Trace D
6	White	15	15	15	Active Parm
7	Half Bright	8	8	8	Annotation
8	Amber	15	8	0	Advisory Messages
9	Red	15	0	0	Errors
10	White	15	15	15	Markers
11	Bright Gray	12	12	12	Key Labels

Table 5-5.
Red, Green, and Blue Values for the Optical Filter

		RGB			Spectrum Analyzers
Color	**Default Colors**	**Red**	**Green**	**Blue**	**Key Labels**
0	Background	0	1	2	Background
1	Dim Gray	0	4	5	Graticule
2	Yellow	0	6	7	Trace A
3	Cyan	0	11	13	Trace B
4	Pink	0	4	13	Trace C
5	Green	0	13	0	Limit Lines, Trace D
6	White	15	15	15	Active Parm
7	Half Bright	0	8	8	Annotation
8	Amber	0	8	0	Advisory Messages
9	Red	15	15	15	Errors
10	White	15	15	15	Markers
11	Bright Gray	12	12	12	Key Labels

Information About Color Theory

While it is beyond the scope of this manual to provide an exhaustive guide to color use, a few comments can be made on using color effectively.

The RGB Model (Red, Green, Blue)

The RGB model can be thought of as mixing the output of three colored light sources (one each or red, green, and blue). The parameters in the model specify the intensity of each of the light sources. See Color Plate 1 on the foldout between Chapters 5 and 6.

The HSL Model (Hue, Saturation, and Luminosity)

The HSL model is closer to the intuitive model of color used by artists, and is very effective for interactive color selection. The three parameters represent hue (the pure color), saturation (the ratio of the pure color mixed with white), and luminosity (the brightness-per-unit area). The hue parameter rotates a color wheel to select a "pure" color to use. This pure color is then mixed with white light. The saturation slider controls the ratio of the pure colored light to white light. Finally, the output passes through the luminosity iris (think of the iris as an adjustable hole) that controls the brightness of the output. See Color Plate 2 on the foldout between Chapters 5 and 6.

Seeing Color

The human eye responds to wavelengths of electromagnetic radiation from about 400 nm to about 700 nm (4000 to 7000 angstrom). We call this visible light. Visible light ranges from violet (400 nm) to red (700 nm). If all the frequencies of visible light are equally mixed, the result is called white light.

The eye's ability to discriminate color is reduced as the light level is reduced. This means that the variety of colors perceivable at low light levels is smaller than the variety at higher light levels.

The eye is most sensitive to colors in the middle of the visible spectrum, a yellow-green color. The eye is least sensitive to the shorter wavelengths at the blue end of the spectrum. Sensitivity to red is between that of yellow-green and blue. Two things seem to be associated with the sensitivity of the eye to various colors:

- The eye can distinguish the widest range of colors in the yellow-green region, and the smallest variety of colors in the blue region.
- The eye is most sensitive to detail in the yellow-green region.

It's All Subjective, Anyway

One of the reasons that there are so many color theories is that no two people seem to perceive color the same way. In fact, the same person may perceive color differently at different times. In addition to the physiological and psychological variables in color perception, many environmental factors are important. Ambient light and surrounding color affect the perceived color tremendously.

At this point, it will be well worth your time to try the following example. Try setting the background color to different settings, and see how different the foreground colors look against the different

background colors. The only way to insure a set of colors works well together is to try them and see.

EXAMPLE: Change the background element color:

1. Press the (DISPLAY), Adjust Color, edit colors, BACKGROUND, then the RGB keys.
2. Rotate the RPG clockwise.
3. Press the GREEN softkey and use the (↑) and (↓) keys to change the color.
4. Press the BLUE (6) ENTER keys to change the color.
5. Press the HSL softkey and rotate the RPG in either direction.
6. Press the UNDO softkey. (The colors will return to the default setting.)
7. Experiment.

Mixing Colors

If two distinct audio tones are played simultaneously, you will hear both of them. If an object is illuminated by two or more different colors of light, you will not perceive the original colors of light, but rather a single color, and it will not be one of the original colors. What you perceive is called the *dominant wavelength.*

The display screen uses three different colored phosphors (red, green, and blue) and mixes various intensities of the resulting lights to produce one of the 4096 colors at any point on the display. What you actually see is the resulting dominant wavelength. This is an additive color system.

Mixing pigments is a little different. The pigments in ink and paint absorb light. The idea with pigments is to subtract all but the color you want out of a white light source. This is a subtractive color system, and the primary colors are cyan, magenta, and yellow.

The different mechanisms for mixing additive and subtractive colors makes it difficult to reproduce images created with additive colors (CRT) in a subtractive medium (a plotted or printed page). A more in-depth discussion of this issue is found under "Color Hard Copy."

Color Gamuts

The range of colors a physical system can represent is called its *color gamut.* Color gamuts are important when you want to convert between different physical systems, because the source system may be able to produce colors the destination system cannot reproduce. An exhaustive treatment of color gamuts is beyond the scope of this manual. However, here are some rules of thumb:

- The color gamuts for CRT's and photographic film are not the same, but are fairly close. If you are lucky, you can photograph the CRT and catch it on film. It may take more than one exposure, so be careful and bracket everything with several exposures.

- The color gamut for printing is significantly smaller that of either photographic film or of a CRT. The fact that you have a picture of a CRT does not mean you can hand it to a printer and get a faithful reproduction of it.
- The color gamut of a plotter or color printer is much smaller than that of a CRT. You have to create images with limitations of a plotter (or printer) in mind if you intend to reproduce them on a plotter or printer. See "Plotting and the CRT" below.

If you have to reproduce CRT images, keep these differences in mind.

Objective Color Use

In spite of the subjectivity of color, there are some fairly objective things that you should know about color. Some of the things that can be done with color don't depend heavily on subjective interpretation.

Color Blindness

Two enhanced color palettes in the `special colors` menu deal with the most common form of color blindness, the inability to distinguish red and green. These palettes avoid encoding information using red-green discrimination.

Viewing Red Lasers

We designed the optical filter option to accommodate the use of protective goggles while viewing lasers.

Color Hard Copy

Color hard copy is a translation between two different color systems. The color gamuts available to the CRT and the hard copy device are different. See "Color Gamuts" above.

There are three ways to get a color hard copy of information displayed on the HP 70004A:

- Take a picture of the CRT.
- Generate an image of the CRT with an external plotter.
- Generate an image of the CRT with an external printer.

The first method can usually capture whatever is on the CRT, regardless of what colors are used. The last two are the easiest, but are not likely to capture exactly what you see on the screen. All three methods are discussed below.

Photographing the CRT

Photography is an art, not a science. Capturing images off a CRT is relatively straightforward, but sometimes unpredictable due to the different color gamuts available on film and the CRT. The following suggested guidelines will provide a starting point. You may need to experiment with photographing the CRT. If your images don't turn out as expected, you may have to go back and re-photograph them.

- Use ISO 64 Color film.
- Set up your equipment in a room that can be darkened. It will have to be darkened for the one-second exposure.
- Use a telephoto lens (the longer the better, up to about 500 mm). This minimizes the effects of the curvature of the CRT.
- Use a tripod.
- Darken the room and take a one-second exposure.
- Bracket the aperture around f5.6. (One stop above and below.)

Plotting/Color Printing and the CRT

There are two basic reasons the CRT is hard to capture on a plotter or color printer.

- The CRT is an additive color device and both the plotter and printer are subtractive color devices.
- The color gamut of the CRT is much larger than that of either the plotter or printer.

The conversion from additive to subtractive colors is not a huge problem if the plot is a simple line drawing with few intersections. If the plot is complex, especially with lots of intersection, the plot is much less likely to capture the display image accurately.

While it is possible to get some idea of the picture that will be produced on the plotter or the printer, don't be surprised if they don't look exactly the same. Colors on a CRT are different in source and form from colors on either the plotter or printer, as described under "Seeing Colors" above. The colors available on the external devices are very limited. Refer to Chapter 3, Sections "Printer Config" and "Plotter Config" for information about what colors are available on your plotter or printer.

Note

The colors printed on the PaintJet are a function of the *color number* of each item on the screen, not the *color* of each item on the screen. The PaintJet's colors do NOT change when on-screen colors are changed using the Adjust Colors Menu.

Subjective Color Use

Choosing appropriate colors for the display screen can be tricky. We at Hewlett-Packard have spent considerable effort selecting a palette for your use. This palette is based in large part on the results of research into color perception. In the final analysis, however, it is also a matter of trying combinations until you come up with a set of colors that look good together. There are a few fundamental things to remember in choosing your colors.

Choosing Colors

- Try varying the luminosity or saturation of a color.
- Pastels (less than fully-saturated colors) tend not to clash.
- Give careful attention to your background color.
  - If you are using a small number of colors, use the complement of one of them for the background.
  - If you are using a large number of colors, try a gray background.
- Avoid large values of contrast, that is, greatly varying luminosity levels. Instead achieve contrast through hue.
- Avoid colors difficult to display or difficult to focus (like magenta) for primary instrument displays.

Color References

The following references deal with color and vision. Texts that serve as useful introductions to the topic are starred.

Cornsweet, T., *Visual Perception.* New York: Academic Press, 1970.*

Farrell, R.J. and J.M Booth, *Design Handbook for Imagery Interpretation Equipment.* (AD/A-025453) Seattle, WA: Boeing Aerospace Co., 1975.

Graham, C. H., (Ed.) *Vision and Visual Perception* New York: J. Wiley & Sons Inc., 1965.

Hurvich, L.M., *Color Vision: An Introduction.* Sunderland, MA; Sinauer Assoc., 1980.*

Judd, D.B., *Contributions to Color Science.* Edited by D. MacAdam; 545 NBS Special Publication. Washington, DC: U.S. Government Printing Office, 1979.

Rose, A,. *Vision: Human and Electronic.* New York: Plenum, 1973.*

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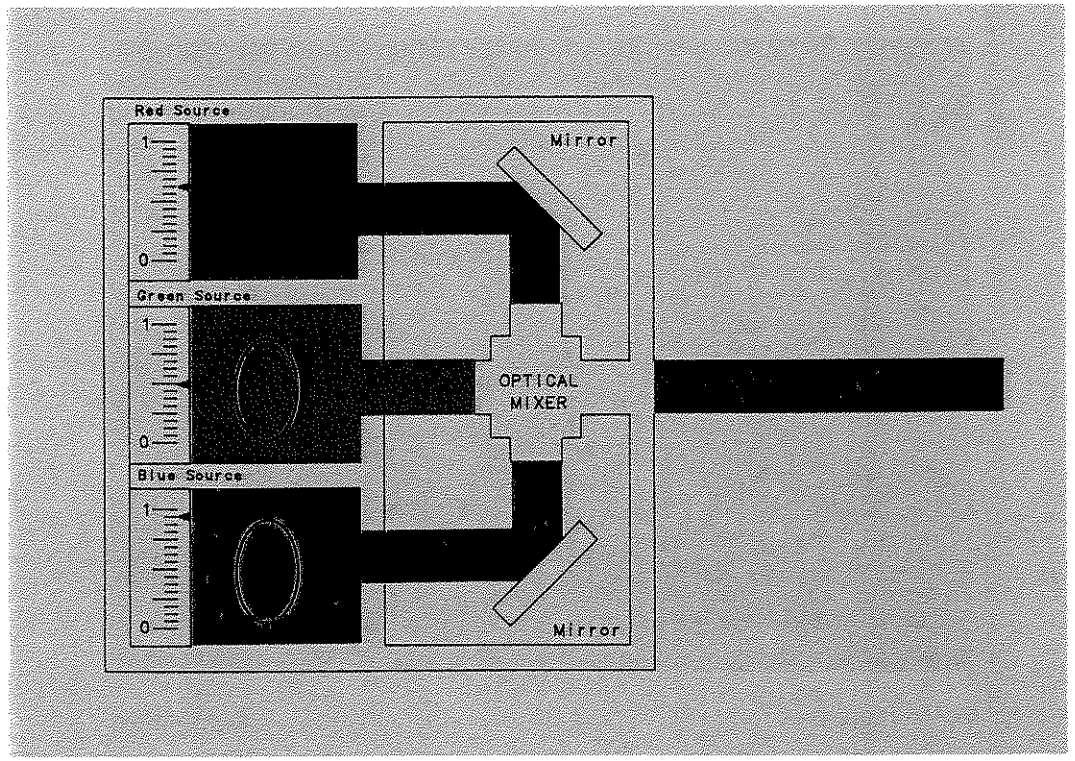
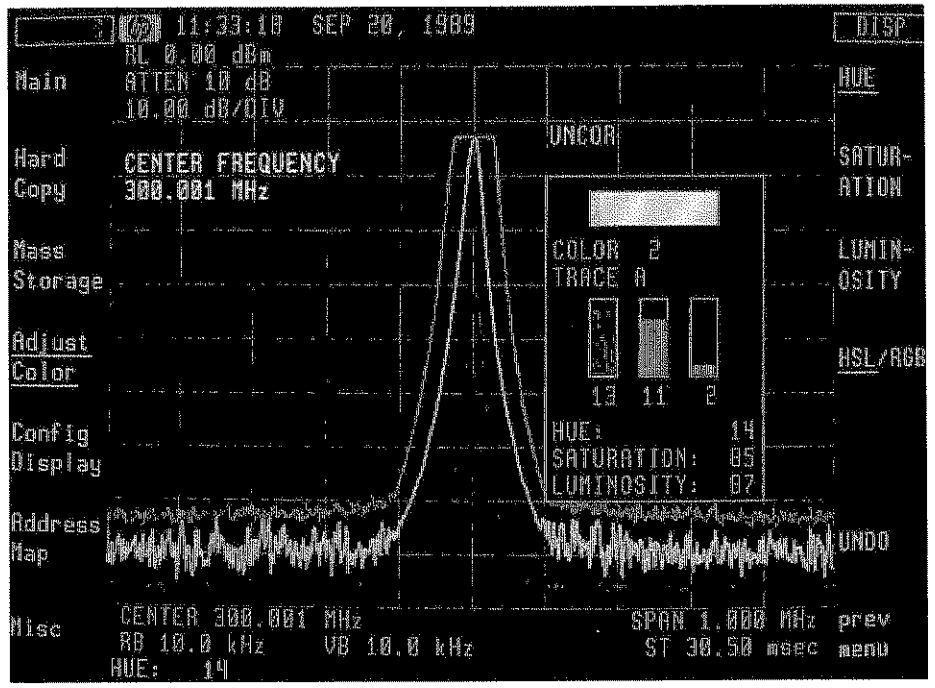
* These texts serve as good introductions to the topic.



Color Plate 1



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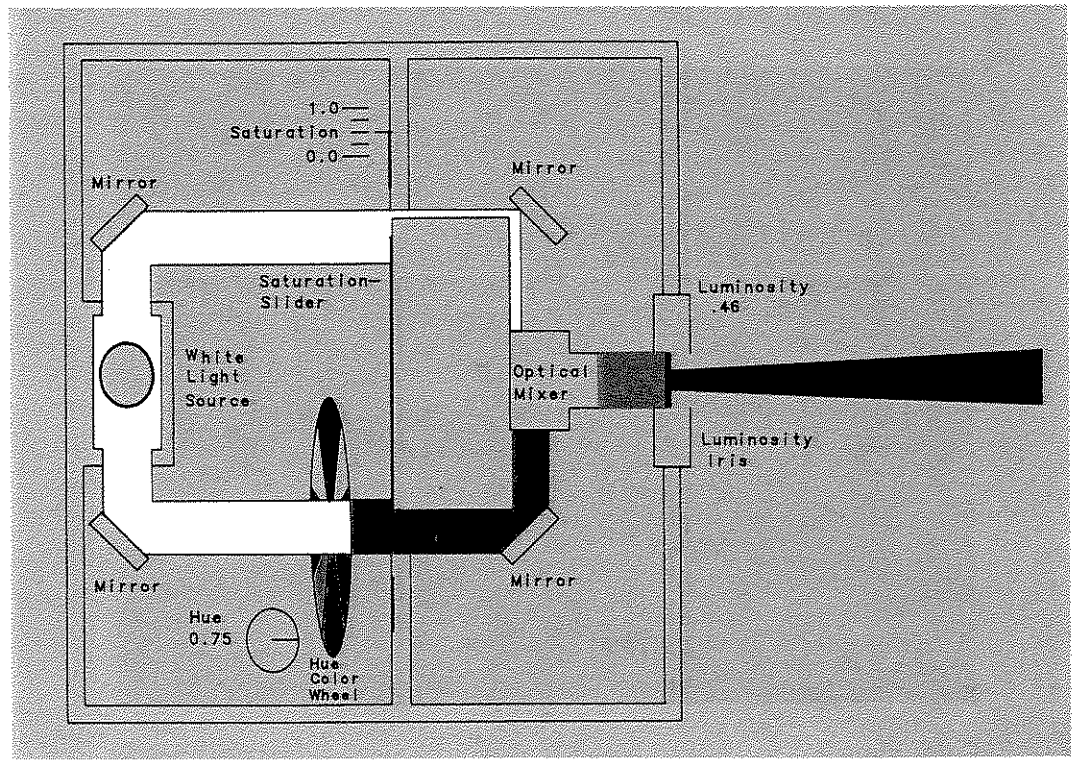
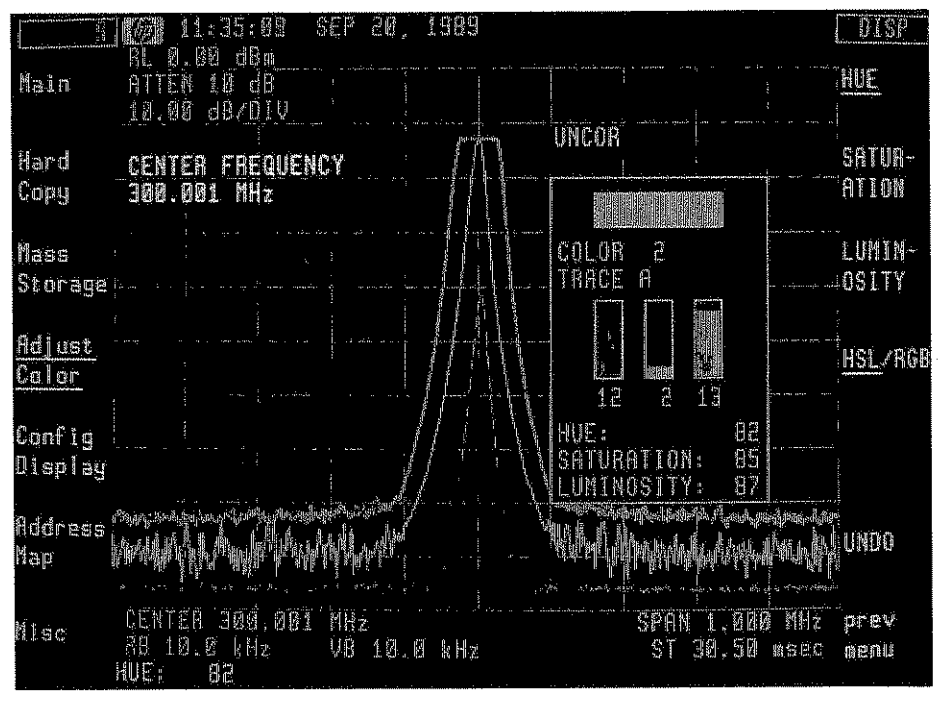
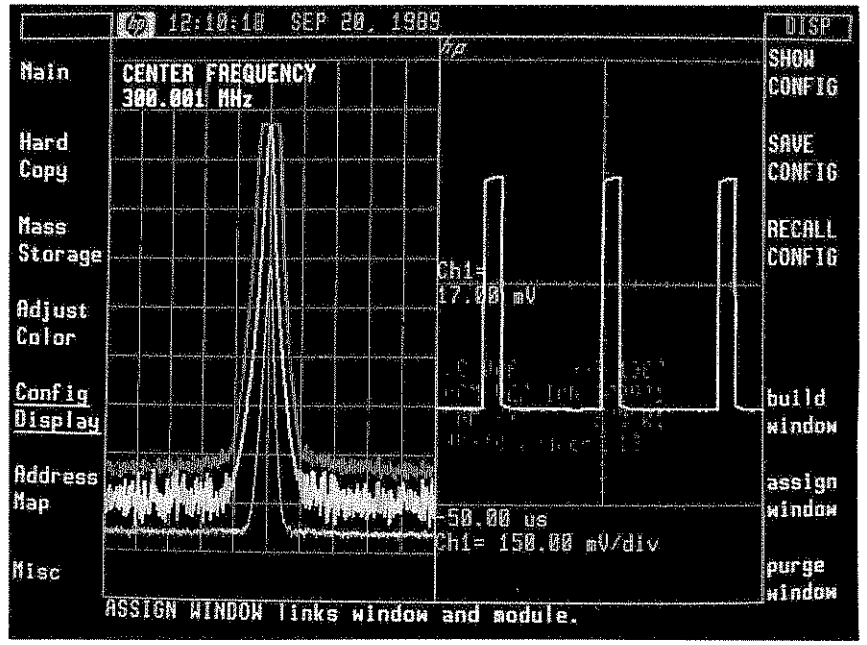


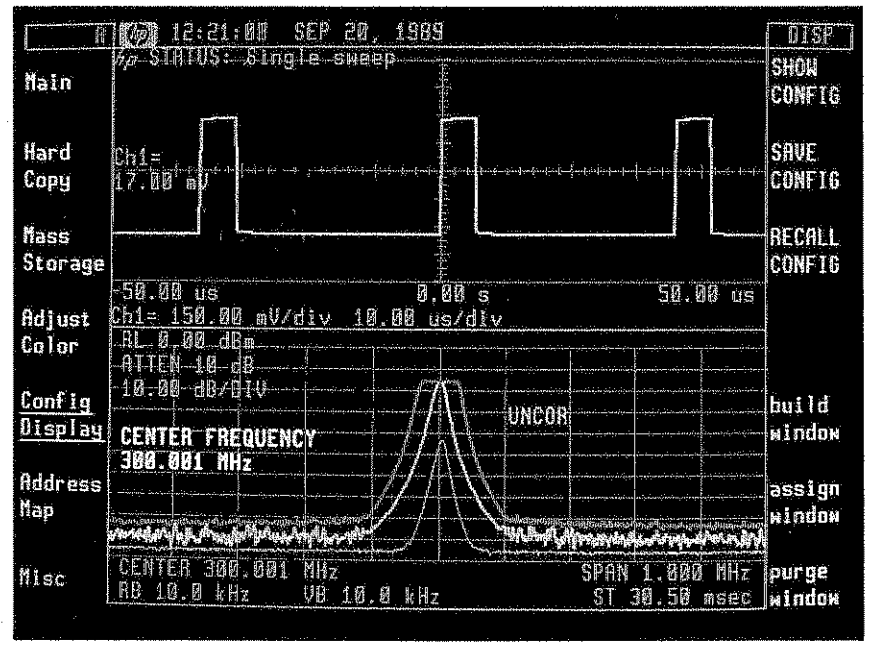
Color Plate 2



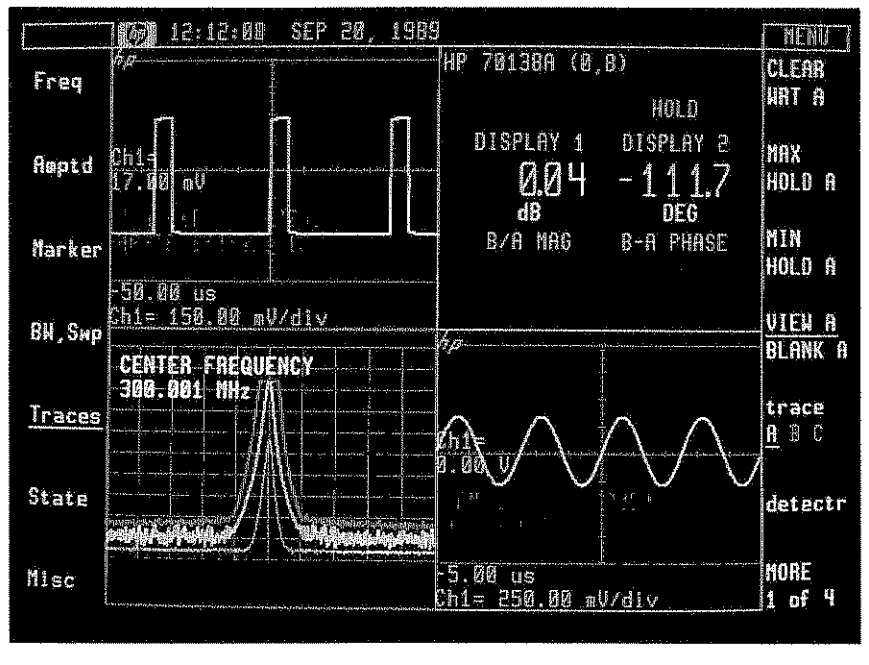
Color Plate 4



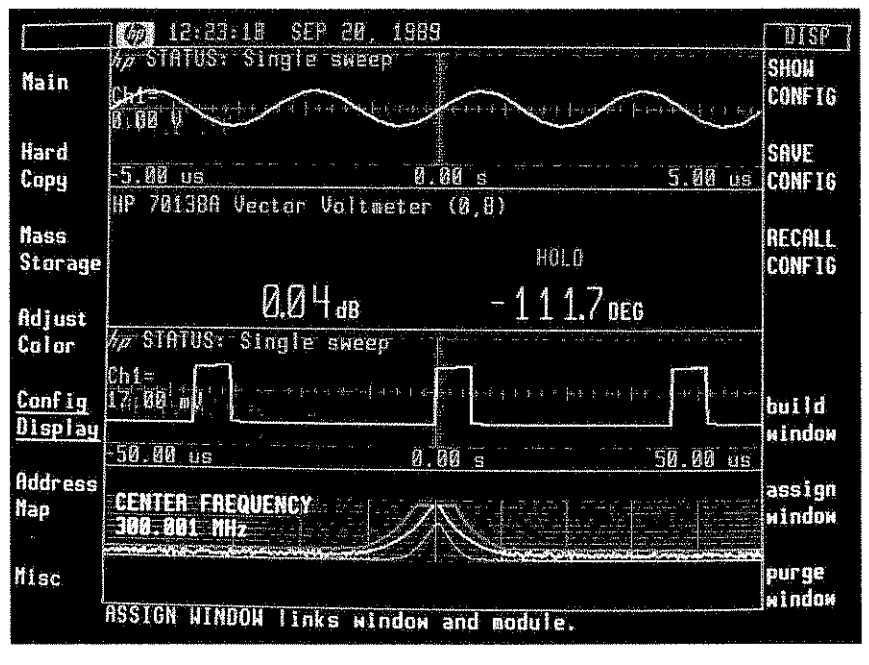
Color Plate 6



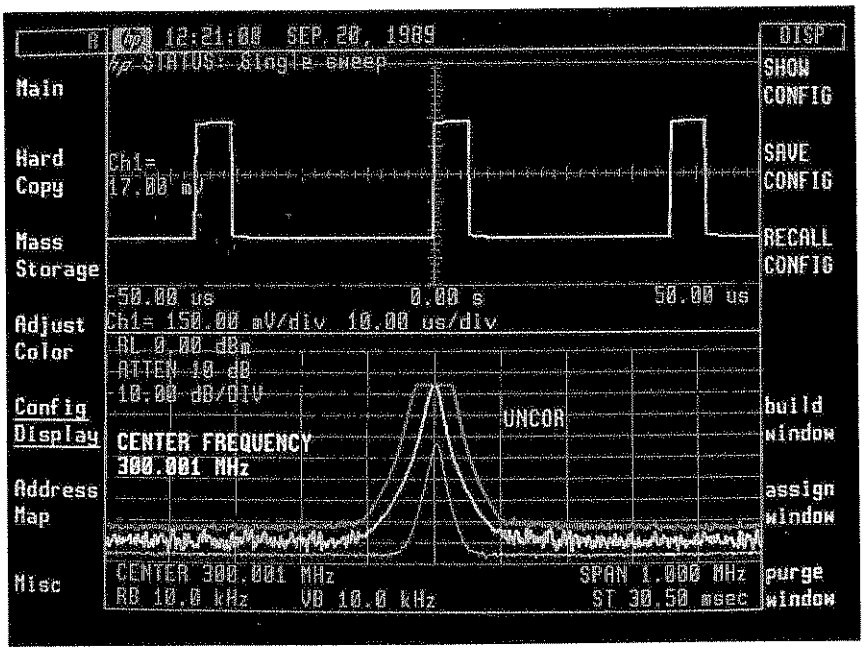
Color Plate 8



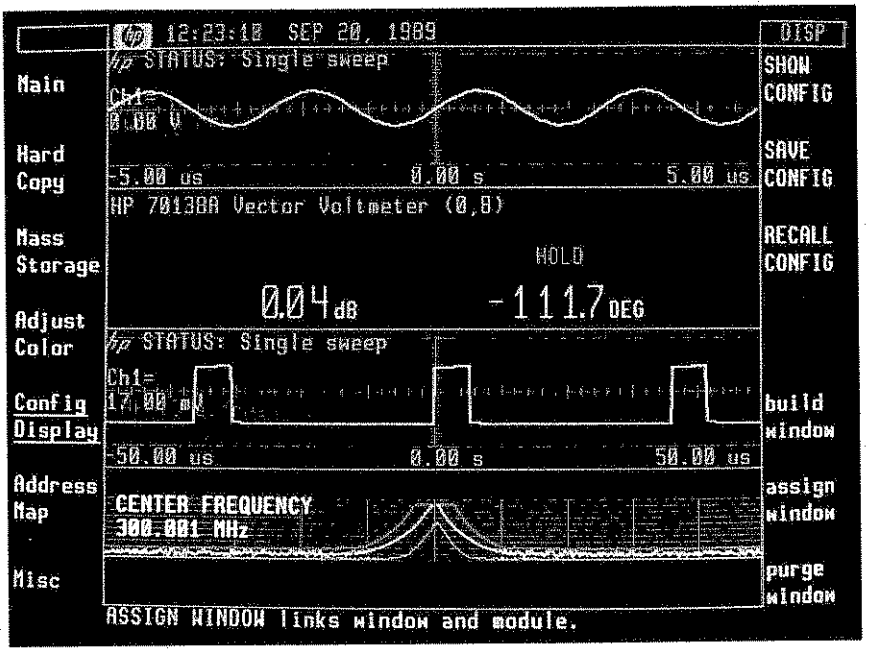
Color Plate 7



Color Plate 9



Color Plate 8



Color Plate 9

6

Config Display Menu

Path

(DISPLAY) Config Display

Description

The Config Display softkey allows flexible display formatting of the HP 71000 system. Up to four windows can be configured to display the traces, annotation, graticule, and measurement results of four different instruments on a single display. Keys included in the Config Display menu are:

SHOW CONFIG

Path (DISPLAY) Config Display SHOW CONFIG

Description The SHOW CONFIG softkey displays a summary of current and stored display screen configurations. Use the ↑ and ↓ keys to view all configurations. The display has six resources that it can allocate or assign to any of several HP 70000 System elements: these resources consist of a screen composed of up to four windows, plus a fifth window reserved for a controller on HP-IB, and one keyboard. The fifth window is invisible in that it does not show up in SHOW CONFIG.

Press the Config Display and SHOW CONFIG softkeys to show the following:

- Which windows are defined (1 through 4).
- The dimensions of each window.
- The instrument or module to which each window is allocated (that is, which module can write to a given window).
- Which module the keyboard is assigned to.

SHOW CONFIG not only brings up the current configuration of the display but also shows four other complete display configurations. These configurations reside in continuous-memory registers, so they will be recalled even if the power had been turned off.

For example, Configuration Register 1 shown in Figure 6-1 describes the layout of the screen shown in Figure 6-2. The softkeys shown in Figure 6-1 are assigned to the analyzer writing to the bottom window in Figure 6-2. This can be inferred from `Keyboard` appearing below `Window 1` in Figure 6-1. Users can determine that window 1 is the bottom window by comparing the Y-min and Y-max values for the two windows. See build window key description.

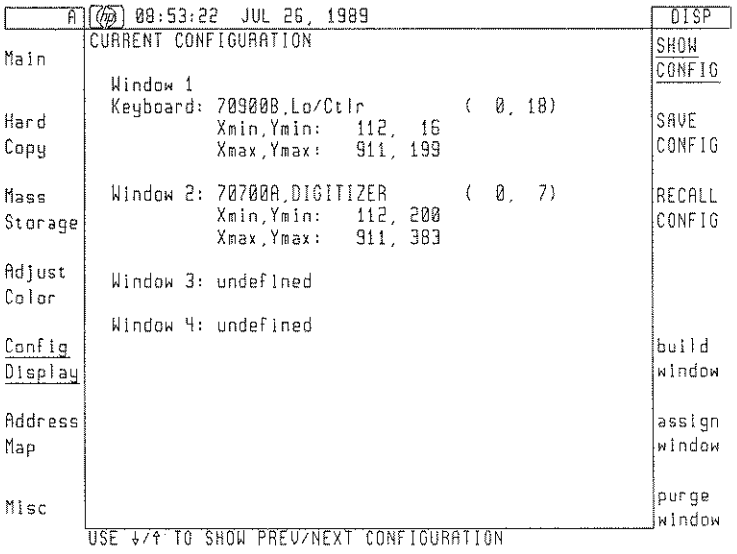


Figure 6-1. Current Configuration

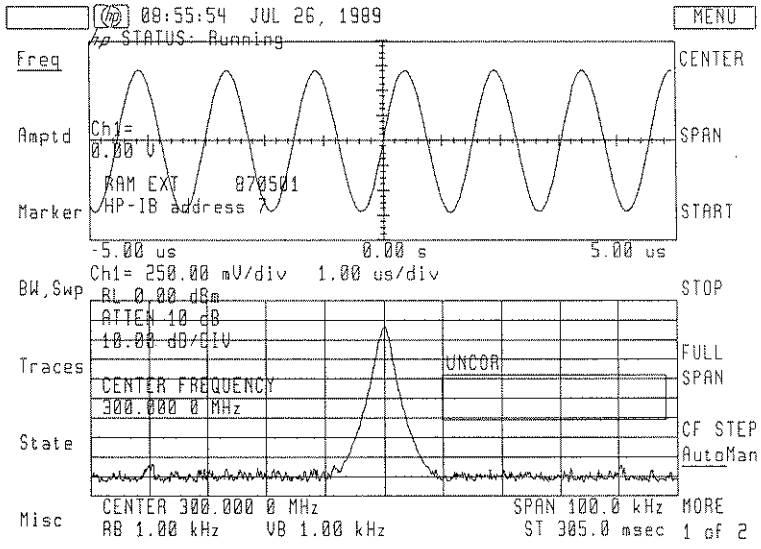


Figure 6-2. Configuration Register 1

SAVE CONFIG
RECALL CONFIG

Paths (DISPLAY) Config Display SAVE CONFIG or RECALL CONFIG

Description The SAVE CONFIG softkey saves the current screen in one of four configuration registers (with up to four windows per configuration).

Note 

The current configuration will be retained in battery-backed RAM if the power is turned off.

The RECALL CONFIG softkey recalls the windows to the display as they originally appeared when the windows were saved.

build window

Path

DISPLAY Config Display build window

Description

The build window softkey allows measurement displays in up to four predefined windows or selects the custom windows softkey to define your own windows.

custom windows

Path

DISPLAY Config Display build window custom windows

Description

The custom window softkey allows you to define your own windows with dimensions specified by the X-min, Y-min, X-max, and Y-max keys. The window being defined has a green border, the old window has a gray border, and the default window (selected by DEFAULT CORNERS) has a red border.

- The SELECT WINDOW softkey activates the window you wish to apply the SET X-min, SET Y-min, SET X-max, and SET Y-max keys to.
- The DEFAULT CORNERS softkey sets the window to the following dimensions: X-min = 112, Y-min = 16, X-max = 911, and Y-max = 383.
- The EXECUTE softkey finishes the building of a custom window by entering the new window into the current configuration.

The custom windows softkey displays up to four custom defined windows and assigns instruments to them. The build window softkey constructs up to four separate windows on the screen. A window is a user-defined portion of the screen that is set aside for a single instrument to display information.

EXAMPLE: Building two custom windows.

Press DISPLAY.

Press the Config Display, build window, and custom windows keys.

The custom windows submenu appears with SELECT WINDOW automatically underlined as in Figure 6-3. The underline indicates that this function is active. Select a window, numbered 1 through 4, by using any data entry method (step-keys, display knob, numeric

keypad, or softkey). If the keypad is used to enter the window number, the user must press ENTRY to finish the entry.

For this example, build window 1.

Note

The window selected, if currently defined, is highlighted with a green border.

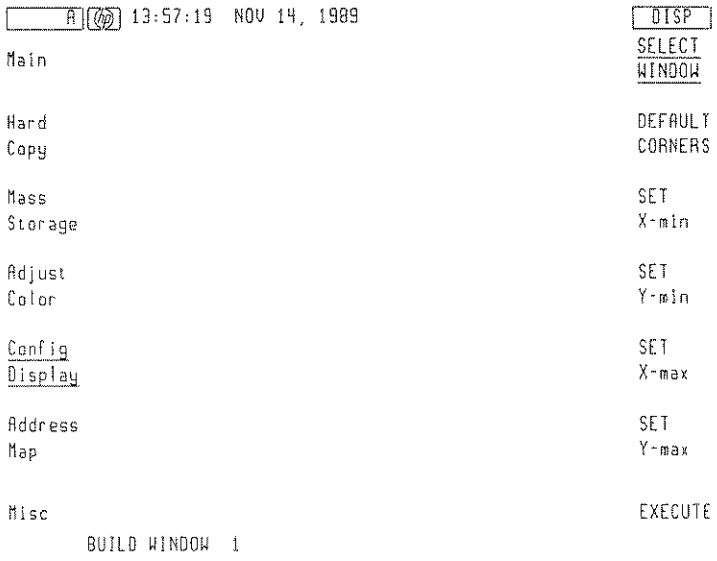


Figure 6-3. Softkeys Available Under custom windows

Select window 1. Press SET Y-min, then turn the knob counterclockwise to bring the top line to a point just above the middle of the screen. At the bottom of the screen a Y-min value will be displayed and will change as the display knob is turned. Set Y-max at approximately 205. Press EXECUTE. Window 1 has now been redefined. To assign an instrument to window 1, do the following:

1. Press ←.
2. Press the assign window and HP-MSIB COLUMN keys.
3. Assign window 1 to an instrument.
4. Rotate the front-panel knob (or use the ↑ or ↓ keys, or the numeric keypad) to enter the column number of the instrument you are interested in assigning to the current window.
5. Press the EXECUTE softkey.

To build the second window:

1. Press build window.

2. Press the custom windows, SELECT WINDOW, (2), and ENTER keys.
3. Press the DEFAULT WINDOW and SET Y-max keys.
4. Using the display knob, move the bottom line to a position just below the other window (Y-max = 195).
5. Press EXECUTE.

Two windows are now defined as in Figure 6-4. Each window could be assigned to different instruments if desired. See the assign window description. See the purge window description to remove the windows.

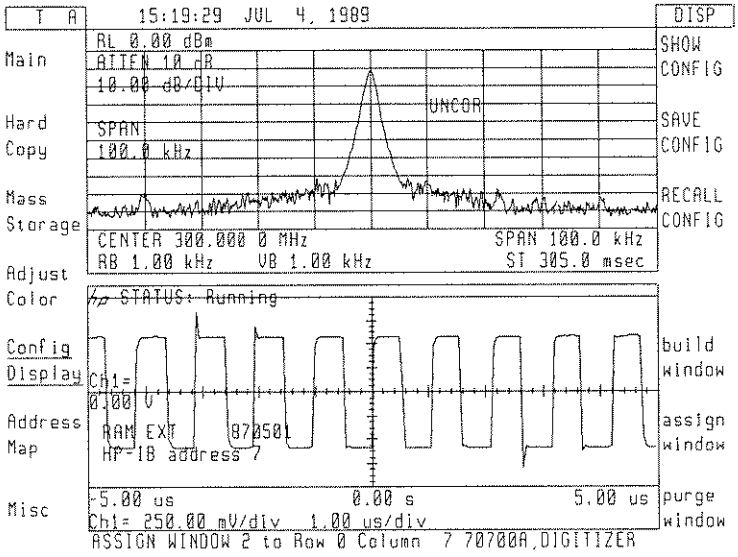


Figure 6-4. Custom Windows 1 (top) and 2 (bottom)

The values of X-min, Y-min, X-max, Y-max represent the distances of the lines from the origin. The origin (X = 0, Y = 0) is located at the lower-left corner of the screen. The top-right corner of the screen is X = 1023, Y = 399. These dimensions are in display units (units of dots on the screen).

The standard-size window, available via DEFAULT WINDOW, has the following dimensions:

X-min = 112

Y-min = 16

X-max = 911

Y-max = 383

The default window is the window which is created by SELECT INSTR, ASSIGN DISPLAY, DISPLAY PRESET, and BUILD 1 WINDOW.

1. Any window can be changed in size or shape by re-building. Up to four windows may be defined and written to simultaneously by different instruments; thus, four different instruments can *talk* to the display simultaneously. The screen annotation (usually present with one or two large windows) may not appear on smaller windows.
2. The BUILD 1 WINDOW, BUILD 2 WINDOWS, BUILD 4 WINDOWS, STACK 2, and STACK 4 softkeys can be used to construct multiple windows with a single keystroke.
3. The DISPLAY PRESET or NEXT INSTR keys will return the display to a single full-screen window.

BUILD (#) WINDOW(S)
Build 1, 2, or 4 Windows

Path

(DISPLAY) Config Display build window BUILD (#) WINDOW(S)

Description

The BUILD (#) WINDOW(S) softkeys display one, two, or four predefined windows and assign instruments to them. Any instrument(s) already assigned windows will stay in those windows, if those windows remain on screen. See Color Plates 6 and 7 on the foldout between Chapters 5 and 6.

STACK (#) WINDOW(S)
Stack 2 or 4 Windows

Path

(DISPLAY) Config Display build window STACK (#) WINDOW(S)

Description

The STACK (#) WINDOW(S) softkeys display two or four predefined horizontal windows and assign instruments to them. Any instrument(s) already assigned windows will stay in those windows, if those windows remain on screen. See Color Plates 8 and 9 on the foldout between Chapters 5 and 6.

Note

In both *build* and *stack* functions, if windows remain unfilled, the display will search the address map for other instruments on row 0 to fill the windows. The windows are filled in order (1-4) and the modules are assigned in order of address (0-30).

There is an exception to this rule. If a window has been assigned to a module and that module has been removed from the system, no attempt will be made to find another module for that window

unless that window has first been purged using purge window or PURGE ALL.

assign window

Path (DISPLAY) Config Display assign window

Description The assign window softkey selects the instrument that will be assigned to a chosen window. Any instrument on row 0 of the address map (or an HP-IB controller) can be assigned or re-assigned a window on the screen.

- The SELECT WINDOW softkey activates the window you wish to assign an instrument to.
- The user can select a module on HP-MSIB by using the HP-MSIB COLUMN, HP-MSIB ROW, and EXECUTE softkeys.
- The user can access a window over HP-IB by using the HP-IB and EXECUTE softkeys.
- Use the assign window softkey to transfer a module from one window to another.

Note 

Use the (INSTR) key as the primary way of transferring the keyboard between instruments once they are assigned to windows. When the (INSTR) key is pressed, the display assigns colored borders to the currently defined windows. Near each window a softkey containing the first seven characters in the module's model number and address (row and column) are displayed in inverse video in the same color as the border. If a labeled softkey is pressed, the keyboard is offered to that window's instrument. If the instrument accepts the keyboard it will put up its menu keys, as though the (MENU) key had been pressed. For more information about address rows and columns, refer to Chapter 7, "Address Map Menu."

A window on the screen can be written to by any HP-MSIB master module (for example, the HP 70900B) or by an HP-IB controller. assign window lets the user select the instrument that will write to a chosen window. The user can select a module on HP-MSIB by using HP-MSIB COLUMN, HP-MSIB ROW, and EXECUTE (see following example).

Alternatively, a window may be accessed over HP-IB. To do this, press assign window, select the window, then press HP-IB and EXECUTE. The window will then have the HP-IB address of the

display. (See Address Map to determine the HP-IB address of the display.) Only one display window can be assigned to HP-IB at a time. HP-IB can also operate without an explicitly defined window, since it automatically receives window 5 at power-up, if not assigned one, in which case no HP-IB window shows up in SHOW CONFIG).

purge window

Path (DISPLAY) Config Display purge window

Description The purge window softkey removes a previously-defined window from the display screen. The PURGE ALL softkey removes all windows from the display screen, otherwise upon pressing EXECUTE, the window selected is destroyed, and any link with an instrument is broken. Trace information displayed in the window disappears from the screen.

- The SELECT WINDOW softkey activates the window you wish to apply the purge window softkey to.

7

Address Map Menu

Path

(DISPLAY) Address Map

Description

The Address Map softkey accesses the HP-MSIB (Hewlett-Packard Modular System Interface Bus) address map. The address map is a real-time graphical representation of the HP 70000 Modular Measurement System instruments and displays that are on the Hewlett-Packard Modular System Interface Bus (HP-MSIB). Keys included in the address map menu are:

Note

If, upon entering or after adjusting the address map, a red border appears within one of the address map boxes, an HP-MSIB problem exists. The problem must be corrected before proceeding. The problem may exist in the module whose address resides in the red box or on that column. For more information about troubleshooting HP-MSIB problems, refer to the *HP 70004A Installation and Verification Manual.*

The operation of individual menu keys under address map is described in the following pages. In this subsection we will briefly discuss the concept of the HP 70000 Modular Measurement System address map, HP-MSIB, and the capabilities accessible via the address map menu key. More information about the HP-MSIB is available in the Installation and Verification Manual for your instrument's system-master module.

The HP-MSIB has a two-dimensional addressing scheme. Each system element such as the HP 70900B Local Oscillator module or the HP 70004A Display has a two-part bus address. The address consists of a row number and a column number; for example, 0, 18

(row, column). This unique address serves as an identifier so that any element can talk with any other element on HP-MSIB, regardless of physical proximity or other bus traffic.

The address map is designed so that each element can be located by its unique address. The row address (first number) specifies the horizontal row of the grid where the element is located, and the column address specifies the vertical column. Rows have numbers 0 through 7 (0 is at the bottom of the screen) and columns are numbered 0 through 31 (0 at the left edge of the map). The address 0, 31 is not available for use; hence, there are 255 available addresses.

Each modular measuring instrument (composed of one or more modules) occupying all or part of a single column. (The exception to this is multi-column instruments. See the Installation and Verification Manual for your instrument. Note that the display elements (HP 70205A/HP 70206A, and HP 70004A) are not explicitly part of any measuring instrument. Each display serves as a general-purpose human-machine interface, providing a screen for the instruments and keys that enables the user to control the system. Since the displays are not part of any particular instrument, each will occupy its own column in the address map.

Note

A more detailed description of HP-MSIB addressing conventions is given in the Installation and Verification Manual for your instrument's system-master module.

HP-MSIB addresses are set only by switches located on each module or display. All elements, modules and displays, have adjustable column addresses. All elements *except* the displays have adjustable row addresses. (The displays are confined to row 0.)

An appropriate element, when located in row 0, acts as a master to all modules above and to the right of it; this master has control as far as the column of the next master, which supersedes the first. The master module is able to control another module by ordering it to perform tasks and by controlling the flow of information to and from that module. For example, an error detected in an IF section will be reported to the master module, which will in turn report it to the user via the display. In 70000 Modular Measurement Systems configured as spectrum analyzers, the master module is the HP 70900B Local Oscillator. Displays are not masters; they do not control modules, although they allow users to.

The modules controlled by a master are referred to as slaves. Slave modules are addressed above the master; that is, slaves have higher row addresses than their master. A measuring instrument such as a spectrum analyzer will typically consist of one master (local oscillator module) and several slaves (IF sections, RF front-end sections, tracking generators, and so on). While a master module must be located in row 0, slave modules can be addressed in any of several rows.

HP-MSIB addresses must be unique. Setting two HP 70000 elements to the same address will create an error and make the system bus (HP-MSIB) inoperative. If the cursor cannot be moved about within the address map after a module has been re-addressed, check to see if two modules have the same row and column address. If so, removal of the modules is required. See the Installation and Verification Manual for your instrument for instructions. If the HP-MSIB is inoperative at power-up some or all modules will indicate this by blinking their error LED (the display blinks its E annunciator). To test for an inoperative HP-MSIB, cycle power and check the E annunciator or annunciators.

HP-IB, HP-MSIB, and the Address Map

Although HP-IB and HP-MSIB are different buses, some elements on HP-MSIB are accessible via HP-IB. Specifically, certain elements that have an HP-MSIB row address of 0 may be addressed over HP-IB with the proper configuration.

A brief discussion of HP-IB usage with HP 70000 systems will be presented here, but a more detailed coverage is given in the Installation and Verification Manual for your instrument.

Between mainframes (for example, the HP 70004A and HP 70001A) HP-IB and HP-MSIB are completely separate and are carried on separate cables. HP-IB is a parallel-connected single cable bus; HP-MSIB is a series-connected dual-cable bus. Two HP 70000 mainframes are connected to the same HP-IB network only if each is connected to it individually, or if there is an HP-IB cable linking the two. The HP 70206A System Graphics Display also connects to the system over separate HP-IB and HP-MSIB cables.

Within a single mainframe, HP-IB and HP-MSIB connections are carried along the backplane bus and are provided at the back of each 1/8-width module slot. A mainframe has one HP-IB port (one connector) and one HP-MSIB port (two connectors: one in and one out). Hence, all modules in a particular mainframe have access to both the HP-IB lines and the HP-MSIB lines.

All modules can communicate over HP-MSIB, but, as previously mentioned, only certain modules or elements can talk over HP-IB. Therefore, while every HP 70000 series element takes up an HP-MSIB address, only the row 0 modules can occupy HP-IB addresses. Among the HP 70000 series elements that can use HP-IB are the HP 70900B Local Oscillator, HP 70004A Display, and HP 70205A/70206A Graphics Displays.

Each system element that can talk over HP-IB can also be removed from HP-IB by positioning the HP-IB ON/OFF switch in the off position. (Some modules indicate by this putting a `NO` in the address map in place of their HP-IB address.) On the displays, this switch is readily accessible from the back panel. On the HP 70900B Local Oscillator, the switch is located on the top of the module, along with the other HP-IB and HP-MSIB switches. Changing any of these switches on the local oscillator requires removal of the module from the mainframe. See the Installation and Verification Manual for your instrument for more information.

Note

The HP-IB address and the HP-MSIB address of a system element are not necessarily related.

The HP-MSIB address is determined solely by the setting of the address switches on the module. Refer to the Installation and Verification Manual for your instrument. When applicable, the HP-IB address of each module defaults to the HP-MSIB column address. For example, the HP-MSIB address 0, 18 has a default HP-IB address of 18. Note, however, that the HP-IB address of the

local oscillator and of both displays may be set to any valid address using the HP-IB ADDRSET menu key, which is available through the address map menu key. See the HP-IB ADDRSET menu key description in this chapter for instructions.

ADJUST COLUMN
ADJUST ROW

Path (DISPLAY) Address Map ADJUST ROW or ADJUST COLUMN

Description The ADJUST COLUMN and ADJUST ROW softkeys, available directly under Address Map, move the highlighted box within the address map.

1. Press (DISPLAY) address map ADJUST COLUMN.
2. Turn the knob until the box rests around an instrument on row 0.
3. Press ADJUST ROW.
4. Use the (↑) key to place the box around the module of interest.

The ADJUST COLUMN and ADJUST ROW softkeys accept data entry from the display knob, from the (↑) and (↓) keys, and from the numeric keypad.

The module currently highlighted in the address map will have a front-panel green active light on. (The display represents its active light as a green A in the status box in the upper left-hand corner of the display screen.) This light enables you to correlate the specific HP 70000 Modular Measurement System modules to their locations in the address map.

HP-IB ADDRSET

Path (DISPLAY) Address Map HP-IB ADDRSET

Description The HP-IB ADDRSET softkey changes the HP-IB address of any instrument currently on HP-IB if that instrument will permit it.

1. Press the (DISPLAY) key.
2. Press the address map and ADJUST COLUMN softkeys.
3. Turn the knob so the box stops on the display.
4. Press the HP-IB ADDRSET, (2), (0), and ENTER keys. The HP-IB address of the display should immediately change to 20.

Note 

Note that some modules show HP-IB NO. This usually means that their HP-IB enable switch is in the off position.

More Information About HP-IB ADDRSET

- Some HP 70000 series elements show an HP-IB address on the address map even though the element is disabled (by the HP-IB hardswitch) and cannot communicate on HP-IB. (See HP-MSIB earlier description in this section, or see the Installation and Verification Manual for your instrument). Modules, however show that they are disabled by replacing their HP-IB address with the word NO in the address map.
- Upon power-up, the HP-IB addressing is handled differently by different elements. The display can be configured to have a power-up HP-IB address of either the HP-MSIB column address or the most recent HP-IB address given to the display with the HP-IB ADDRSET key. This option (for displays only) is discussed in the HARDSET/SOFTSET HP-IB section of Chapter 8, "Misc Menu."

ASSIGN DISPLAY

Path (DISPLAY) Address Map ASSIGN DISPLAY

Description The two display resources, the keyboard and the display screen, can be allocated separately. ASSIGN DISPLAY assigns the whole screen to a particular instrument, even though the keyboard may be assigned elsewhere. This allows the user to view the trace output from one instrument on the display, while controlling a different instrument with the keyboard.

1. Press the (DISPLAY) and Address Map keys.
2. Move the box to the module or instrument desired.
3. Press the ASSIGN DISPLAY softkey. The screen will be immediately allocated to that module. If the module is ready to put out trace information, the information will be displayed.

ASSIGN KEYBD

Path (DISPLAY) Address Map ASSIGN KEYBD

Description The ASSIGN KEYBD softkey is used to allocate the keyboard to a specific module. The keyboard can then be used to control the instrument settings.

1. Press the (DISPLAY) and Address Map softkeys.
2. Move the box to the module desired.
3. Press the ASSIGN KEYBD softkey.
4. Press the (MENU) key.

More Information About ASSIGN KEYBD

1. The keyboard and the screen can be allocated separately. ASSIGN KEYBD links the keyboard with an instrument, but does not necessarily display any trace data from that instrument. Hence, the menu keys may not correspond to the instrument display shown.
2. Only a master module such as the HP 70900B can receive the keyboard. Attempts to allocate the keyboard to slave modules will result in an error.
3. ASSIGN KEYBD lets the user link the keyboard with any master module by way of the address map.
4. Use the (INSTR) key as the primary way of transferring the keyboard between instruments once they are assigned to windows. When the (INSTR) key is pressed, the display assigns colored borders to the currently defined windows. Near each window a softkey containing the first seven characters in the module's model number and address (row and column) are displayed in inverse video in the same color as the border. If a labeled softkey is pressed, the keyboard is offered to that window's instrument. If the instrument accepts the keyboard it will put up its menu keys, as though the (MENU) key had been pressed.

ASSIGN BOTH

Path (DISPLAY) Address Map ASSIGN BOTH

Description The key ASSIGN BOTH establishes contact between the display and a specific instrument. ASSIGN BOTH allocates the screen and keys to the module currently highlighted by the box in the address map.

1. Break contact with the instrument by pressing the (DISPLAY), Address Map, and ADJUST COLUMN softkeys.
2. Use the display knob to place the box around an empty address.
3. Press the ASSIGN BOTH softkeys. This breaks all links with the existing instrument and attempts to establish a link between the display and a nonexistent instrument. This results in a blank screen.
4. Re-establish contact with the instrument by pressing address map and ADJUST COLUMN.
5. Turn the knob to position the box around any instrument (module) in row 0.
6. Press the ASSIGN BOTH and (MENU) keys.

In summary, ASSIGN BOTH establishes contact between the display (the user interface) and an HP 70000 instrument, but differs from NEXT INSTR. ASSIGN BOTH, used in the address map, requires that a particular module (element) be specified. NEXT INSTR selects an instrument on its own. Both, however, disconnect any links between the display and any other instruments. Both destroy any existing windows in the display.

8

Misc Menu

Path

(DISPLAY) Misc

Description

The Misc (miscellaneous) softkey accesses a variety of functions, including: setting and removing the clock, removing the HP logo from the status window, and running service-related tests used to help troubleshoot the display.

Keys included in the misc menu are:

HP LOGO DISPLAY

Path (DISPLAY) Misc HP LOGO DISPLAY

Description The HP LOGO DISPLAY softkey switches on (indicated by the underlined key label) or off. When on (default) the HP logo in the status window appears on the display screen.

clock

Path (DISPLAY) Misc clock

Description The display has a real-time clock you can set that includes the time of day and date. The clock keeps time even when the power is removed from the display. The clock can be set in either US or European format. The following key functions can be accessed from the clock softkey. All inputs are numerical.

CLOCK DISPLAY

Path

(DISPLAY) Misc clock CLOCK DISPLAY

Description

The CLOCK DISPLAY softkey switches on (indicated by the underlined key label) or off. When on (default), the real-time clock readout appears in the CRT status window.

US/EURO

Path

(DISPLAY) Misc clock US/EURO

Description

The US/EURO softkey allows the user to set the clock in either US or European format:

- US Format: JUL 6, 1989 (Month-Day-Year)
- European Format: 06.07.1989 (Day-Month-Year)

Set Clock

Path

(DISPLAY) Misc Clock Set Clock

Description

The Set Clock softkey sets the time and date. The display automatically keeps track of the current date and time, even while the display is turned off. *All clock inputs are numerical.* Enter the numbers with either the knob, step keys, or numerical keypad. Exit by pressing the (←) key or any other key. The RUN/STOP softkey switches the clock between stopped and running to aid in synchronizing the clock.

EXAMPLE: Setting the time and date.

1. Press (DISPLAY).
2. Press the Misc, clock, and set clock keys.

The following menu keys will appear on the right side of the display.

HOUR

MINUTE

SECOND

MONTH

DAY

YEAR

RUN/STOP

EXAMPLE: Change the time to 7:35:21 AM.

1. Press the HOUR, (7), and ENTER keys, then,
2. Press the MINUTE, (3), (5), and ENTER keys, then,
3. Press the SECOND, (2), (1), and ENTER keys

Notice as you press the HOUR, MINUTE, and SECOND keys, the key is underlined, indicating that portion of the clock readout may be changed. The same process is followed to change the date.

EXAMPLE: Change the date to DEC 25, 1990.

1. First, press the MONTH, 1, 2, and ENTER keys.
2. Next press the DAY, 2, 5, and ENTER keys.
3. Then press the YEAR, 1, 9, 9, 0, and ENTER keys

Again, notice as you press each date key, the key is underlined, indicating that the date portion of the clock readout may be changed.

DISPLAY ID

Path DISPLAY Misc DISPLAY ID

Description The DISPLAY ID softkey displays the following information:

- Color Palette.

  (In 16 boxes centered on the top two rows. Colors 0—7 are on the top row, and 8—15 on the next row down.)
- Copyright notice.
- HP model number.
- Firmware version.
- HP-MSIB address.
- HP-IB address.

  (Displays `HP-IB Address: OFF` if the rear-panel HP-IB switch is off.)
- Custom key-panel ID code

  (Refer to the *HP 70004A Display Installation and Verification Manual* for more information.)

Note The DISPLAY ID does not provide the ROM version of other instruments in the system. For that information, see the appropriate section of the operating instructions for your instrument. The display's HP-MSIB address can only have a row address of zero. The factory-shipped default address is row 0, column 4 (0, 4).

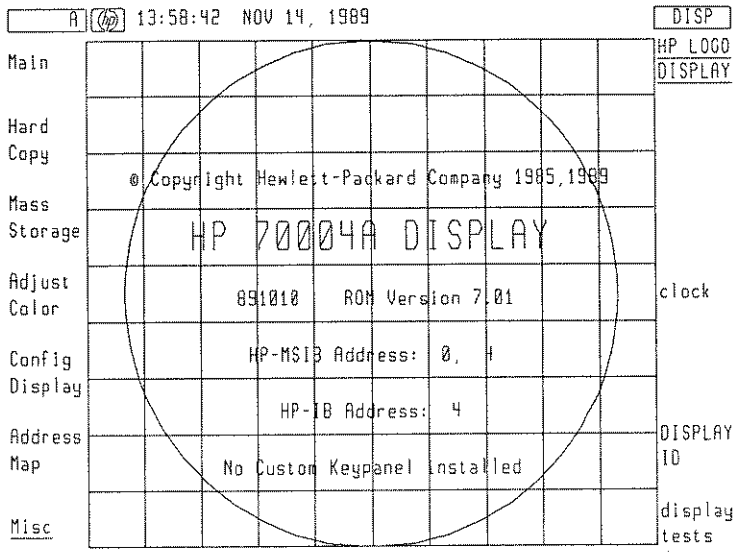


Figure 8-1. Display ID Screen

display tests

Path (DISPLAY) Misc display tests

Description Service personnel use the display tests to troubleshoot and repair the display. Most of these tests are fully documented in the service manual. Here is a brief description of the tests:

CONFID TEST

Path

(DISPLAY) Misc display tests CONFID TEST

Description

The Display Confidence test, initiated by pressing the CONFID TEST menu key, checks the operation of roughly 90% of the display unit. 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` appears. If an error is detected, refer to the Installation and Verification Manual for your instrument.

KEY TEST

Path

(DISPLAY) Misc display tests KEY TEST

Description

The KEY TEST menu key checks the mechanical and electrical operation of every front-panel key on the display.

EXAMPLE: Use of KEY TEST.

1. Press the (DISPLAY), Misc, display tests, and KEY TEST keys.
2. Press any key on the display's front panel and it will be "echoed" on the screen if it is working properly.
3. Press the back space (←) key to exit this function.

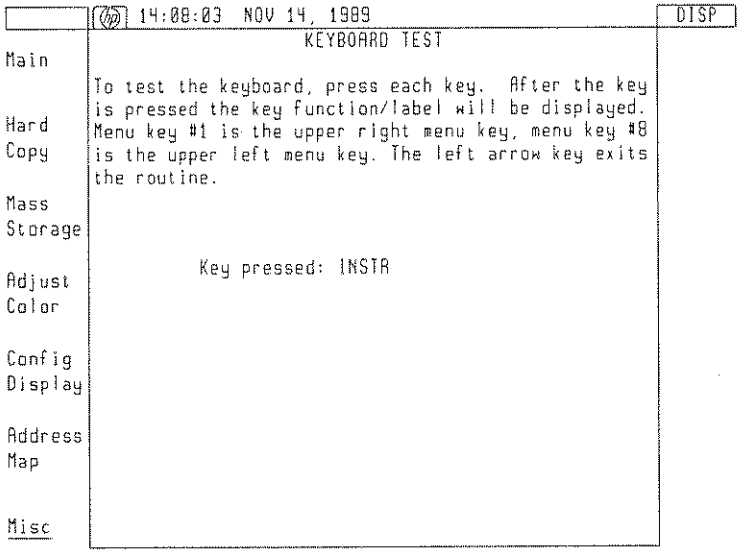


Figure 8-2. Key Tests

KNOB TEST

Path

(DISPLAY) Misc display tests KNOB TEST

Description

The KNOB TEST menu key brings up a test pattern similar to the one shown in Figure 8-3.

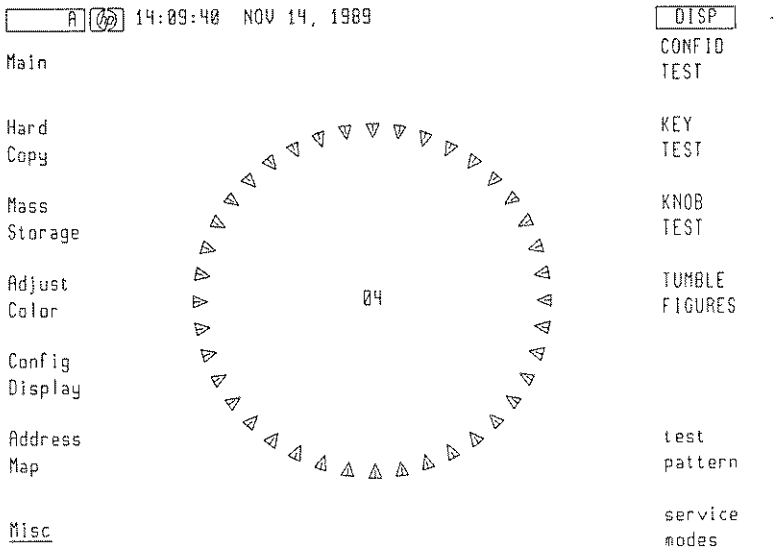


Figure 8-3. Knob Test

As the knob is turned, the test pattern rotates in a digital fashion. This provides a test of the mechanical and electrical operation of the display knob. Note that the step keys will rotate the pattern but the numeric entry keypad will not.

TUMBLE FIGURES

Path

(DISPLAY) Misc display tests TUMBLE FIGURES

Description

Note

The following demonstrations may inhibit normal system operation. Use the (←) hardkey to exit.

The tumble figure choices are:

CUBE

BALL

SLAB

ROD

HALF

While in tumble figures, pressing numbers on the display's front panel will affect the speed of rotation in each dimension. For example, 0, 0, 0 stops the rotation.

test pattern

Path

(DISPLAY) Misc display tests test pattern

Description

The test pattern menu key produces 18 test patterns used in display-troubleshooting and screen-alignment procedures. For more information about the tests, refer to the *HP 70004A Display Service Manual.* The following is a list of test pattern menu keys:

HALF FILL

HI VOLT TEST

GEO DST TEST

LINEARITY

FULL WHITE

PALETTE BARS

GRAY SCALE

COLOR BARS

BLK LVL TEST

WHITE DOTS

VERT LINES

HORIZ LINE

BLACK FILL

WHITE FILL

RED FILL

GREEN FILL

BLUE FILL

GRID

service modes

Path

(DISPLAY) Misc display tests service modes

Description

These functions are used primarily for servicing the instrument. For more information about these functions, refer to the *HP 70004A Display Service Manual.* The BRIGHT ADJUST softkey is described here because it interacts with INTEN ADJUST.

BRIGHT ADJUST

This BRIGHT ADJUST adjusts the offset voltage on the video signal and hence the background brightness of the screen. The normal setting is 8 and generally that is where it should be left.

Note

If red fringes appear to the right of some colors, the selected intensity is set too high for the current brightness setting. Lower the intensity of the brightness setting.

Use the knob or numeric keypad to lower the brightness level if the red fringes appear.

9

Front-Panel Fixed-Label Keys

The 24 front-panel fixed-label (non-menu) keys access such functions as data entry, moving the display between instruments, printing, and plotting. Fixed-label keys included in this chapter are:

(LCL)

The (LCL) (local) key reinstates front-panel operation if the instrument has been under remote control.

(INSTR PRESET)

The (INSTR PRESET) (instrument preset) key is the green key located on the upper-right corner of the display. It is used to quickly reset the control settings of the instrument to a known preset state.

(←)

The (←) (backspace arrow) key is a very useful function. Its most obvious use is that of a backspace key when a mistake is made entering numbers from the keypad. In the context of the (DISPLAY), (MENU), and (USER) functions, the backspace key is used to return to the next highest level of menu functions. A very useful function of the arrow key is to move from the (USER) keys to the last set of (MENU) keys accessed. This eliminates the need to access the (MENU) key and each subsequent level of keys to get to the desired function which you last accessed. The arrow key is also used to exit some of the `display tests` functions.

(HOLD)

The (HOLD) key deactivates an active function to prevent further control setting changes. For example, on a spectrum analyzer, if `SPAN` menu key has just been set to 1 MHz, it remains the active function. So if the knob is turned or the step keys are pressed accidentally, the span will change to a new value. (HOLD) also removes the active function from the display, and it turns off the inverse video of an active softkey.

If (HOLD) is pressed twice, the menu keys, on the right-hand side of the display (while in (MENU)) will be blanked. (INSTR PRESET) also blanks the right-hand menu keys.

INSTR

The INSTR (instrument) key is used to move the keyboard between modules in the system. When the INSTR key is pressed, the display puts colored boarders around the currently defined windows. Window location, pen number, and the normal colors assigned to those windows are defined in Table 9-1.

Table 9-1. INSTR Key Window Assignments

Window	Location	Pen Number	Normal Color
1	Lower Left	2	Yellow
2	Upper Left	3	Cyan
3	Upper Right	4	Pink
4	Lower Right	5	Green

In the softkey location nearest each of these windows is a menu key containing the first seven characters in the instrument's model number on the first line, and the module's HP-MSIB address [row and column (#,#)] on the second. See Figure 9-1. The menu key is displayed in reverse video in the same color as the associated window border. If any of the menu keys is pressed, the keyboard is offered to that window's instrument. If the instrument accepts the keyboard, it will display its menu keys, as if the MENU key had been pressed. See Color Plate 5 on the foldout between Chapters 5 and 6.

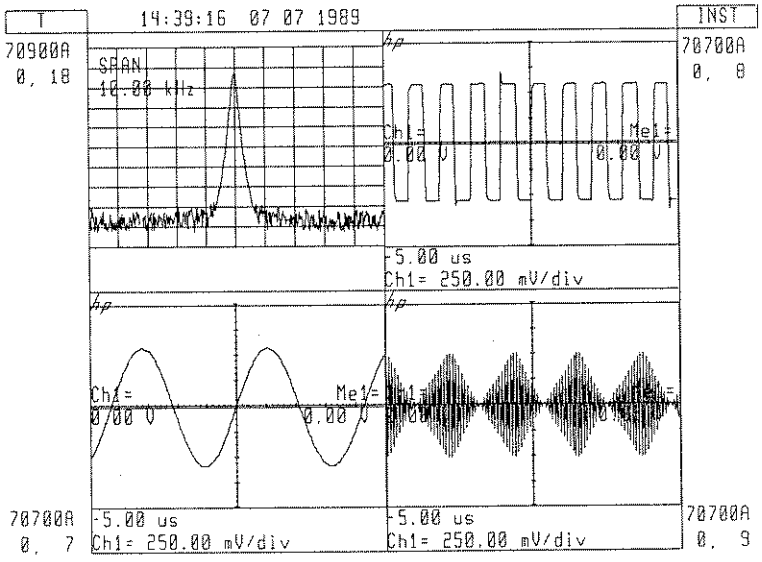


Figure 9-1. The INSTR Key Display Screen

(MENU)

A multitude of instrument functions are available under the (MENU) key. For example, there are over 150 instrument functions available for the modular spectrum analyzer using the (MENU) key. The exact number depends on the modules present. A different set of (MENU) functions appear for each instrument in your system. For more information about the (MENU) key, refer to your instruments Operation Manual.

(USER)

The (USER) key creates a custom menu containing only the function you use for a particular measurement. In addition the (USER) key is used to access downloadable programs (DLPs). DLPs are one-button measurement routines capable of performing complex measurement sequences without a controller. Refer to you instruments Operation Manual for information about transferring functions from the (MENU) key to the (USER) key area.

(DISPLAY)

The (DISPLAY) key acesses all of the system and display functions on the HP 70000 system, whereas the (MENU) key accesses instrument functions. The (DISPLAY) key controls the addressing, communication, and configuration of the instruments in the system. The (DISPLAY) key is documented in this manual.

(0)—(9)

(0)—(9) (the numeric keypad) are used to enter numbers. The number is entered upon pressing the ENTER menu key.

(↑) (↓)

The (↑) (↓) (step) keys change parameters up or down.

(PRINT)

The (PRINT) key initiates a raster print dump of the screen and of the instrument's menu keys if configured to do so.

EXAMPLE: Print a copy of the instrument display.

Note

To follow this example, you may need to enter the address of your printer into the Hard Copy Menu and specify whether the menu keys are to be printed. (See `printer address` and `KEY COPY` under `Hard Copy`.)

1. Enter the address of your HP-IB printer via the `printer address` key, available under `Hard Copy`. Select `KEY COPY` on or off if desired.
2. Obtain the instrument display you want to print by using the menu keys in the (MENU) or (USER) menus.
3. Press the (PRINT) key. The printing process will begin immediately. It can be halted by pressing any front-panel key on the display during the print sequence. The screen will be frozen until the data transfer to the printer is complete.

More Information About (PRINT)

- When (PRINT) is pressed, the screen displayed will be printed.
- If `KEY COPY` is selected, the menu keys printed are the last ones displayed that were associated with the instrument, not the display element. Menu keys available under (DISPLAY) can be printed using the `KEYCOPY OFF/DSP` key in the `service modes` menu.
- Compatibility: the raster print-dump process works with HP raster-format printers (dot-matrix) that can accept printer dumps of at least 384 lines by 512 points; for example, the HP 2673A printer and the HP 2225A Thinkjet Printer have this capability. (The `HI RES ON/OFF` function, described in `Hard Copy`, requires a capability of 384 lines by 1024 points.) Most of the printers that work with the HP 200/300 series computers will work with the HP 70000 system.
- Direct hardcopy output from the HP 70000 system without a controller requires a display element.

PLOT

Pressing PLOT key initiates a vector plot dump over HP-IB to the plotter specified under `Hard Copy`. The operation of this key is almost identical to the operation of the PRINT, but the HP-IB output address of the plotter is set using `plotter address` rather than `printer address`.

See the `plotter address` menu key description to set the plotter parameters, including HP-IB address. Refer to Chapter 3, "Hard Copy Menu," "Copy Options" section for more information about plotter and printer outputs.

10

Hewlett-Packard Human Interface Link

The Keyboard Interface

The Hewlett-Packard Human Interface Link (HP-HIL) provides an interface to the system by means of an HP 46020A or HP 98203C keyboard.

This chapter describes how the keys of an HP-HIL keyboard correspond to the functional softkeys of a Modular Measurement "C" System Spectrum Analyzer.

The keyboard cable is plugged into the HP-HIL connector located on the front of the HP 70004A Display. See Figure 10-1.

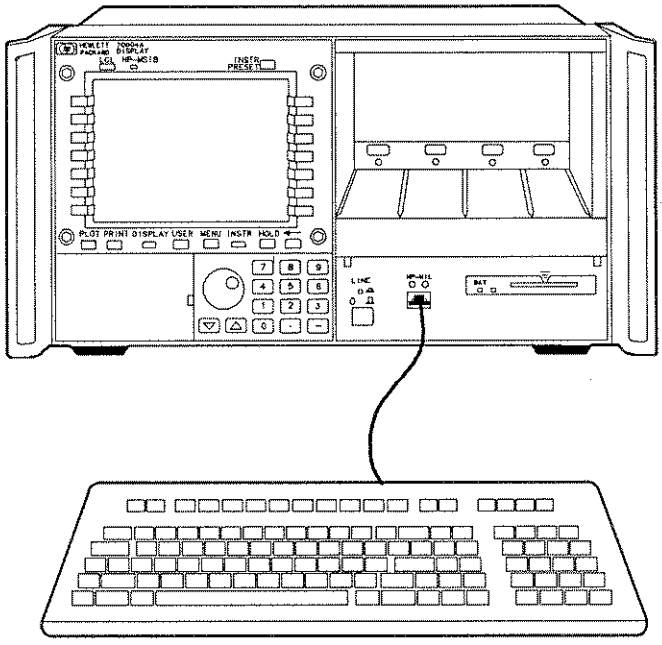


Figure 10-1. Keyboard Connection

Functional Keycodes

HP 46020A Keyboard

This keyboard has eight function keys along the top row.

The function keys (f1) through (f7) on the keyboard correspond to the right-hand softkeys on the display from top to bottom, respectively.

When the (SHIFT) key is pressed at the same time a function key is pressed, (f1) through (f7) on the keyboard correspond to the left-hand softkeys on the display from top to bottom, respectively.

Function key (f8) on the keyboard, either shifted or not shifted, corresponds to the USER softkey on the display.

The following keys on the HP 46020A keyboard correspond to the indicated spectrum analyzer functions.

Keyboard Function Key	Spectrum Analyzer Function
(Menu)	MENU
(Shift User)	USER
(System)	DISPLAY
(Shift) (Reset)	I-P
(Shift) (Print)	PRINT
(CTRL) (Shift) (Print)	PLOT
(Break)	LOCAL
(Shift) (Clear Line)	CLEAR to END

HP 98203C Keyboard

This keyboard has 10 function keys in a cluster.

The function keys (k1) through (k7) on the keyboard correspond to the right-hand softkeys on the display from top to bottom, respectively.

When the (SHIFT) key is pressed at the same time a function key is pressed, (k1) through (k7) on the keyboard correspond to the left-hand softkeys on the display from top to bottom, respectively.

The softkeys (k8), (k9), and (k10) on the keyboard, either shifted or not shifted, correspond to the (USER) ((k8)), (MENU) ((k9)), and (DISPLAY) ((k10)) keys on the HP 70004A.

The following keys on the HP 98203C keyboard correspond to the indicated spectrum analyzer functions.

Keyboard Function Key	Spectrum Analyzer Function
(SHIFT) (PAUSE)	I-P
(SHIFT) (ALPHA)	PRINT
(SHIFT) (GRAPHICS)	PLOT
(SHIFT) (CLR->END)	CLEAR LINE
(CLR I/O)	LOCAL

After a function is selected, the knob on the HP 98203C keyboard can be used to scroll through the available parameters.

Alpha keys

On either keyboard, after the TITLE or COMMAND mode softkeys have been selected, A-Z, a-z, punctuation, Ins and DEL are used to insert or delete characters into a title or command.

When these keys are pressed, the response is the same as with the TITLE or COMMAND mode menu blocks.

A title or command can be typed using the HP-HIL keyboard. Pressing Return or Enter will terminate the title or command, and the HP 70900A/B will respond.

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