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HP 150

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PRINTING HISTORY

New editions of this manual will incorporate all material updated since the previous edition. Update packages may be used between editions and contain replacement and additional pages to be merged into the manual by the user. Each updated page will be indicated by a revised date at the bottom of the page. Note that pages which are rearranged due to changes on a previous page are not considered revised.

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed (minor corrections and updates which are incorporated at a reprint do not cause a date to change).

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INTRODUCTION

1

This chapter provides an overview of this service manual as well as the HP 150, in general. Included is an outline of how this manual is organized along with a brief description of the contents of each chapter. This is followed by a description of the HP 150, including information on the HP 150 product features, structure and specifications.

MANUAL OVERVIEW

The HP 150 Service Manual provides information on fault isolation, repair and maintenance of the HP 150. This manual includes the following chapters:

Chapter I	INTRODUCTION. Provides an overview of the HP 150 Service Manual as well as the HP 150, in general.
Chapter II	INSTALLATION. Provides step-by-step instructions on how to install an HP 150. Also includes information on electrical/environmental requirements and considerations.
Chapter III	CONFIGURATION MENUS. Provides information on the HP 150 configuration menus including what they are and how to use them.
Chapter IV	SYSTEM CONFIGURATION. Covers information needed to configure peripherals and accessory boards to the HP 150.
Chapter V	PREVENTATIVE MAINTENANCE. Provides information on how to take care of and maintain the HP 150.
Chapter VI	TROUBLESHOOTING. Covers the HP 150 self-tests and fault isolation techniques.
Chapter VII	ADJUSTMENTS. Identifies and provides procedures for using the adjustments on the HP 150.
Chapter VIII	REMOVAL AND REPLACEMENT. Covers the removal and replacement procedures for field replaceable components and assemblies.
Chapter IX	PARTS. Provides assembly drawings and parts lists for HP 150 field replaceable components and assemblies.
Chapter X	FUNCTIONAL OPERATION. Provides a block diagram level description of the functional operation of the HP 150.

THE HP 150

The HP 150 Personal Office Computer, the third member of the Series 100 family, offers a complete business solution and gives the customer more power and memory space in a small, efficient package. The entire system (display, processor, keyboard, disc drive and integral thermal printer) occupies only 1.8 square feet of space, about the same footprint as an open looseleaf notebook. Several features have been added to decrease the amount of time required to learn and use the system such as a touchscreen interface and an advanced "shell" called the Personal Applications Manager (PAM) which shields the user from the "computerese" associated with many computer systems.

The HP 150 system features are summarized below.

System Architecture

- Intel 8088 microprocessor (operating at 8 MHz)
- MS-DOS 2.0 operating system
- Built-in HPTouch
- 256K bytes of main memory standard; 640K bytes maximum
- 160K bytes of ROM
- CMOS RAM with battery backup to store system configuration
- Real time clock with battery backup

Display

- Built-in high-resolution on-screen graphics display (512 x 390)
- High-resolution character display; 9 x 14 dot character cells; upper and lower case
- Display enhancements: inverse video, underline, blinking, half-bright, security and all combinations
- Up to two pages of 24 lines x 80 characters of display memory

Keyboard

- Detachable, typewriter-style
- Special editing keys
- Numeric/Graphics pad
- Eight screen-labeled function keys

Communications/Peripherals

- Two RS-232 communications ports
- One HP-IB port
- Full HP 2623 graphics terminal support.

ystem Architecture

The HP 150 uses an Intel 8088 microprocessor running at 8 MHz. The standard system contains 256K bytes of RAM memory for the operating system, applications and user workspace, and can be expanded to 640K. Touchscreen and graphics are standard with the system.

In addition to the above capabilities, the HP 150 is also a customer expandable system. There are two expansion slots, accessible through the back of the unit, which allow the customer to add accessories (such as additional memory) to the system without requiring the assistance of an HP representative or dealer. Installation of accessories is a simple operation, requiring an average of 5 to 10 minutes.

The HP 150 Personal Computer uses MS-DOS 2.0 from Microsoft Corporation as the standard operating system. MS-DOS 2.0 is a single-user, single-task operating system for which many third-party software packages have been developed. The operating system resides on disc and upon initialization MS-DOS is loaded into the processor's main memory.

A unique enhancement by Hewlett-Packard to the MS-DOS operating system has been the addition of an easy-to-understand facility to help the user execute commands. PAM (Personal Applications Manager) provides simple intuitive menus for the most frequently used system commands. Unlike other systems which require the user to learn the system "computerese", PAM through menus and HPTouch, guides the user through commands. With PAM starting applications, creating directories, deleting files and listing existing files can be as easy as touching the screen. For more advanced users the standard MS-DOS command facility is also available.

Display

The HP 150 can display both alphanumeric and graphics on the 9" diagonal screen. The alphanumeric display consists of a 27 line by 80 column format. The 25th and 26th lines are used for the screen labeling of function keys (and all are automatically "touchable" through touchscreen), and the 27th line is for system status and error messages. The screen memory stores 2 pages of text, which allows off-screen storage of the display. High resolution characters with true descenders are generated in a 9 X 14 dot cell with half-dot shift. The standard display is green character against a black background.

The graphics display has a resolution of 512 dots horizontally by 390 dots vertically. This gives a 1:1 aspect ratio guaranteeing symmetry (that is, circles look like circles). The numeric keypad also serves as the graphics keypad,

allowing the customer to turn on and off the alpha display, turn on and off the graphics display or transfer the graphics display to one of the HP graphics printers. It also display the graphics cursor and allows it to be moved around the screen.

Keyboard

The HP 150 keyboard is designed to provide a familiar interface to the system and minimize training time. The low-profile keyboard shape, the sculptured keycaps and the dished "home" keys help to make the keyboard comfortable to use. The 107-key keyboard contains the full local editing keys such as cursor control keys, display scrolling keys, "next" and "prev" keys for scrolling by pages and "insert" and "delete" keys for inserting or deleting characters or entire lines.

Series 100 function keys are screen labels used by the system and by application programs to increase the ease of use of the system. With the HP 150, this capability is enhanced by the use of HPTouch. Now, all function keys can be selected by pressing the key itself or by touching the key label on the screen.

Communications/Peripherals

Two RS-232-C ports may be used to connect the system to a remote computer or to serial devices (such as printers or plotters). Flexible protocols allow the use of either hardware or software handshaking and communicaitons speeds can range from 110 to 19,200 baud. The HP-IB enables the user to configure up to fifteen HP peripherals to one I/O port.

The HP 150 contains the HP 2623 Graphics Terminal feature set and can run any HP 3000 software which currently runs on that terminal. This includes block mode for V/3000 software and graphics applications such a HPEasychart and HPDraw as well as line-drawing and math character sets, "security" fields, transmit-only fields, edit checks and Tektronix 4014 emulation.

PRODUCT STRUCTURE

Personal Computer Systems

The standard system consists of the 45611A HP 150 CPU which contains:

- 256K memory
- two async RS-232 ports
- one HP-IB port
- green CRT
- touchscreen

and the 45612A HP 150 PC Personality Kit which contains:

- MS-DOS 2.0 Operating System
- Owner's Guide
- Terminal User's Guide
- keyboard
- keyboard cable
- power cable
- interconnect cable
- 30 cm. HP-IB cable
- interconnect power cable
- Disc Applications disc
- Demo disc
- CAI disc

PRODUCT #	DESCRIPTION
45610A	HP 150 Standard System
45650A	Standard System with Dual 3.5" Disc Drive (9121D)
45655A	Standard System with 5Mb Winchester and 3.5" Disc Drive (9133V)
45660A	Standard System with 15Mb Winchester and 3.5" Disc Drive (9133XV)

Disc Drives

9121D	3.5" Dual Micro-disc Drive
9121S	3.5" Single Micro-disc Drive*
82901M	5.25" Dual Mini-disc Drive
82902M	5.25" Single Mini-disc Drive*
9133A	5Mb Winchester + 3.5" Micro-disc Drive
9133B	10Mb Winchester + 3.5" Micro-disc Drive
9133V	5Mb Winchester + 3.5" Micro-disc Drive
9133XV	15Mb Winchester + 3.5" Micro-disc Drive
9134A	5Mb Winchester
9134B	10Mb Winchester
9134XV	15Mb Winchester
9135A	5Mb Winchester + 5.25" Mini-disc Drive

* Supported as an "add-on" drive, only. Single disc systems not supported.

Printers

	opt	
2674A		Integral Thermal Printer
2601A		Daisywheel Serial Printer
	242	RS-232 Interface
2602A		Low Cost Daisywheel Serial Printer
	Std	RS-232 Interface
	046	HP-IB Interface
82905B		Dot Matrix Serial Printer
	240	RS-232 Interface
	002	HP-IB Interface
82906A		Dot Matrix Serial Printer
	002	HP-IB Interface
2932A		Dot Matrix Serial Printer
	Std	RS-232 Interface
	046	HP-IB Interface
2934A		Dot Matrix Serial Printer
	Std	RS-232 Interface
	046	HP-IB Interface

Plotters

	opt	
7470A		Graphics Plotter - 2 pens
	001	RS-232 Interface
	002	HP-IB Interface
7475A		Graphics Plotter - 6 pens
	001	RS-232 Interface
	002	HP-IB Interface

Accessory Boards

45630A	128K RAM Memory board (US only)
45631A	256K RAM Memory board (US only)
45632A	384K RAM Memory board (US only)

Accessories

92171V	Tilt
91271W	Swivel
13269P	Carrying Case (HP 150 and 9121D)
13269T	Carrying Case (9121D/S Drive only)
92250F	Dust Cover
92171J	Keyboard Park

Cables

92220R	HP-IB (30 cm.)
45529A	HP-IB (1 meter)
45529B	HP-IB (2 meters)
45529D	HP-IB (0.5 meters)
13242G	RS-232 Printer Cable (male connector)
13242N	U.S. Modem Cable
13242M	European Modem Cable
13242X	RS-232 Cable (direct connect to 64)

Additional Documentation

45621A	Owner's Manual and Installation Guide (contains 3.5" operating system)
45622A	5.25" Operating System Disc
45623A	Terminal User's Manual

General Description

System Processor:	Intel 8088-2 microprocessor operating at 8 MHz
Main Memory:	256K bytes of RAM
Screen Size: alphanumeric graphics	9-inch diagonal 116 mm X 150 mm (4.5 in. X 5.9 in.) 120 mm X 160 mm (4.7 in. X 6.3 in.)
Screen Capacity:	24 lines X 80 columns, 25th and 26th lines for labeling of function keys, 27th line for system status/error messages
Character Generation:	7 X 10 enhanced dot matrix with 1/2 dot shifting; 9 X 14 dot character cell; noninterlaced raster scan.
Character Size:	1.3mm X 2.8mm (0.05 in. X 0.11 in.)
Character Set:	Roman8, line-drawing, math standard (also Bold and Italic usable by applications only)
Cursor:	Blinking underline or blinking square
Display Enhancements:	Inverse video, underline, blinking, half-bright, security and all combinations.
Refresh Rate:	60 Hz
Tube Phosphor:	P31 (green)
Implosion Protection:	Tension band
Keyboard:	Full ASCII code keyboard, eight screen-labeled function keys, auto-repeat, N-key rollover, cursor controls, 18-key numeric pad, detachable with a 1.83 m (6 ft.) coiled cable.

Physical Specifications

System Processor Weight:	9.82 kg (21 lbs. 1 Oz.)
Keyboard Weight:	1.82 kg (4 lbs.)
Display Monitor Dimensions:	305mm (W) X 305mm (D) X 287mm (H) [12.0 in. X 12.0 in. X 11.3 in.]
Keyboard Dimensions:	
Flat	456mm (W) X 225mm (D) X 35mm (H) [18.0 in. X 8.9 in. X 1.4 in.]
Standing	456mm (W) X 225mm (D) X 63mm (H) [18.0 in. X 8.9 in. X 2.5 in.]

Environmental Conditions

Temperature (Free Space Ambient):

Non-operating	-40 to +75 C (-40 to +167 F)
Operating	0 to +55 C (+32 to +131 F)
With 2674A	0 to +55 C (+32 to +131 F)

Humidity:	5% to 95% (noncondensing)
*Vibration:	5-55 Hz @ 0.015" displacement
*Shock:	30 g, 11ms, 1/2 sine

* Type tested to qualify for normal shipping and handling in original shipping carton.

Product Regulations

This product meets the requirements of the following agencies/ standards for EDP equipment or office equipment in the following countries,

Safety:	Canada - CSA Certification International - IEC 380/435 Compliance United States - U.L. Listing Switzerland - SEV (pending) Finland - FEI (pending)
RFI:	Germany - VDE Class B United States - FCC Level B
Datacomm:	C.C.I.T.T. V.24 interchange V.28 electrical Australia - Telecomm (pending) Belgium - PTT (pending) Finland - PTT (pending) Germany - FTZ (pending) Sweden - PTT (pending) U.K. - BT (pending)

Power Requirements

Input Voltage:	115 V (+10%, -25%) at 50/60 Hz (+-5%) 230 V (+10%, -25%) at 50/60 Hz (+-5%)

Power Consumption:

45610A	240 Volt Amp
45650A	356 Volt Amp
45655A	356 Volt Amp
45660A	356 Volt Amp

Communications

Data Channels:	1 HP-IB, 2 RS-232-C
HP-IB Channel:	Bus used only for specified HP peripherals
RS-232 Channel:	General asynchronous and synchronous communications
Data Rate (RS-232):	110, 150, 300, 600, 1200, 2400, 4800, 9600 and 19200 baud

Port 1 Asynchronous:	EIA standard RS-232-C and CCITT V.24; fully compatible with Bell 103A full duplex modems; hardware and XON/XOFF handshaking available.
Port 2 Asynchronous:	EIA standard RS-232-C and CCITT V.24; fully compatible with Bell 103a full duplex modems; hardware and XON/XOFF handshaking available.

INSTALLATION

II

INTRODUCTION

This section provides the information needed to install an HP 150. Included in this section is information on electrical requirements and considerations, environmental considerations and step by step installation procedures. Note that installation is performed by the customer.

INSTALLING THE HP 150 SYSTEM

Electrical Requirements and Considerations

When installing an HP 150 system, the only electrical requirement is that the outlets used to power the system have a third wire ground. This ensures that the system is adequately grounded (for safety reasons) and that all components on the system (disc drives, printers, plotters) are at the same ground potential.

The following is a list of guidelines to follow when installing an HP 150 system. Though not required, the items listed below are highly recommended to ensure proper and consistent operation of the system. Neglecting to follow any one of the guidelines listed below may result in intermittent system failure.

1. All devices on the system should be on the same unshared circuit breaker. No other equipment should be on the same circuit breaker as the system (ie. coffee makers, toasters).

2. In some geographical areas it may be advisable to install lightning protection for personnel and the computer. In the U.S.A. the installation of lightning arrestors on power and communication lines is described in the National Electrical Code, Article 280. The principles of lightning protection and personnel safety are given in the lightning protection code contained in the National Fire Protection Association (NFPA) Handbook.

3. Radiated interference can cause a variety of problems with a computer system. Therefore avoid installing a system in areas where possible radiated interference may occur. Some of the most common sources of radiation interference are airports (which have communications and radar installations), business two-way radio transmitters and broadcast radio/TV transmitters. Handheld tranceivers (i.e. "walkie-talkies") produce the same effect as radio stations when used near computer equipment and should therefore be prohibited from the areas in which computer equipment is installed. In addition, a microwave link is sometimes aimed from adjacent buildings which could present problems for the system if it is installed in the transmission path.

When choosing a location for installing an HP 150 system keep the following in mind:

1. Airborne contaminants and particles may scratch either the coating on the flexible disc or the disc drive head and cause premature wear on the disc, resulting in data errors. To prevent excessive wear, avoid installing the HP 150 system in areas where contaminants (such as dust, smoke, solvent vapors from liquid spirit duplicating equipment or wet process copiers) will come into contact with the computer.

2. Operating temperature and humidity requirements are shown in Figure 2-1.

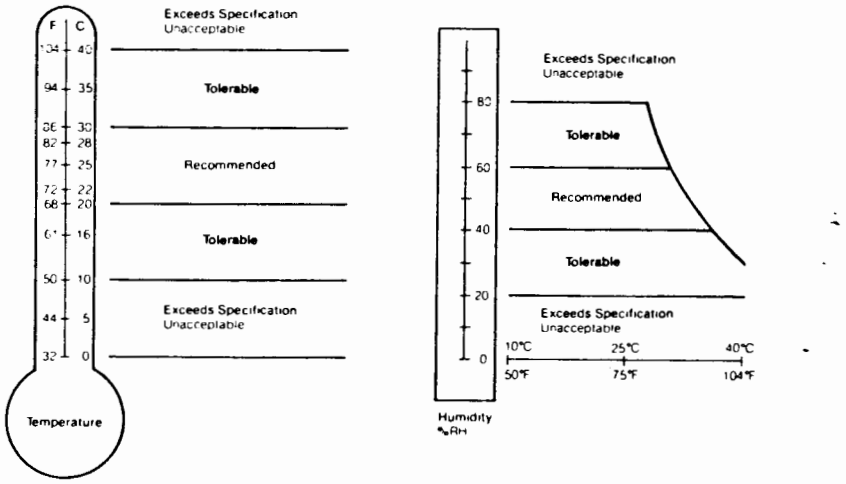

Figure 2-1. Temperature and Humidity Requirements

The system will operate most reliably if the room temperature is maintained between 20 and 30 degrees Celsius (68 to 86 degrees Fahrenheit). Higher operating temperatures increase the failure rate of electronic circuitry.

Avoid extremes in relative humidity. High humidity levels can cause improper feeding and stacking of printer paper or improper operation of disc drives. Low humidity levels aggravate problems of static electricity and cause excessive flexible disc wear.

Unpack the HP 150 from its boxes (system processor, keyboard, keyboard cable and power cable) and proceed as follows:

1. Be sure the power switch is set to the off position.

2. Connect the keyboard to the HP 150 as described in the following steps.

   a. Remove the keyboard cable cap from the rear of the keyboard (see figure 2-2).

   b. Insert the keyboard cable (the end with the longest straight section) into the connector located at the center rear of the keyboard.

   c. With the keyboard cable routed to the right (as you face the rear of the keyboard) replace the keyboard cable cap by inserting first the right side of the cap into the keyboard housing and then the left (see figure 2-3). Secure the secure the cap into place by pushing in on the center of the cap.

   d. Connect the other end of the keyboard cable to the HP 150 by lifting up the flap covering the keyboard connector (see figure 2-4) and inserting the cable into the connector.

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Figure 2-2. Removing the Keyboard Cable Cap

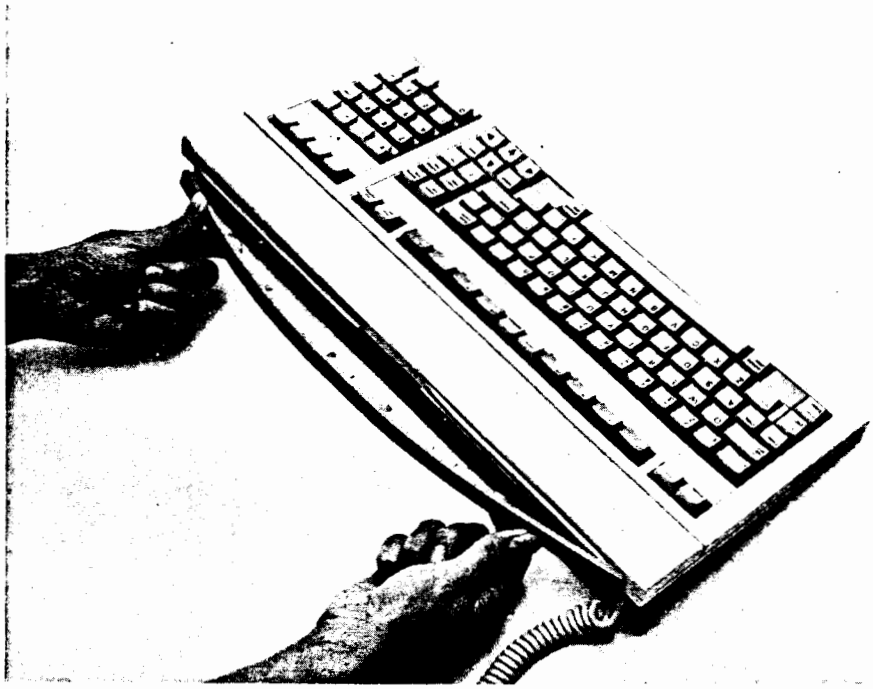


Figure 2-3. Replacing the Keyboard Cable Cap

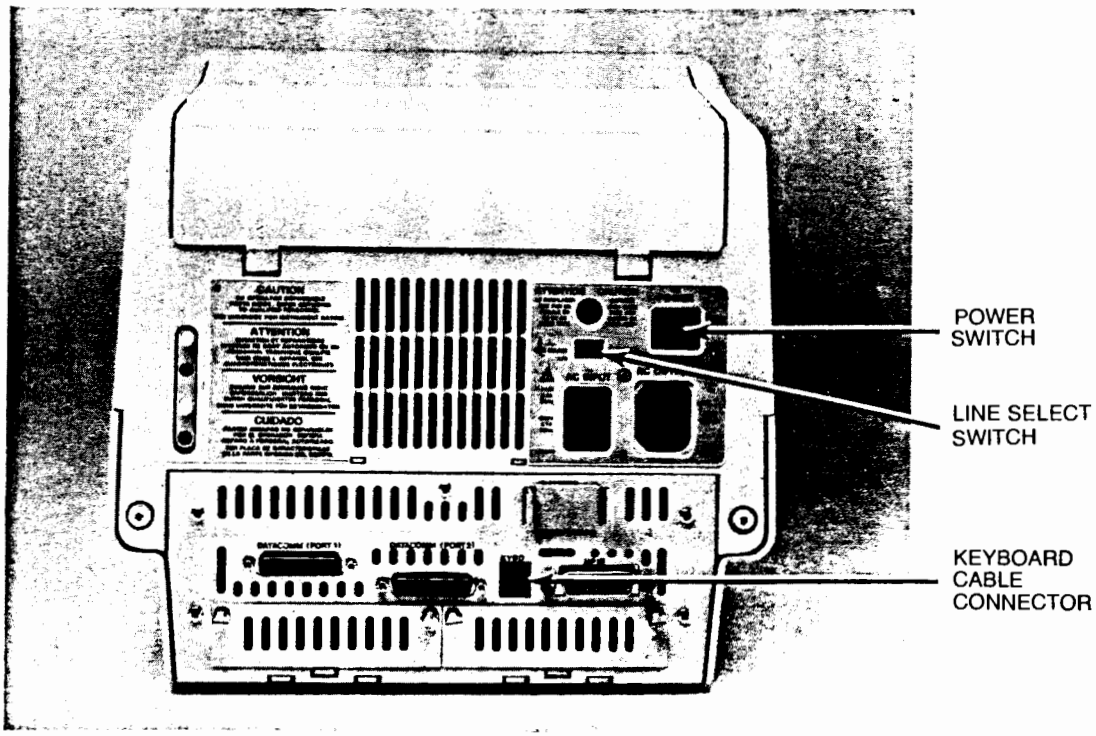
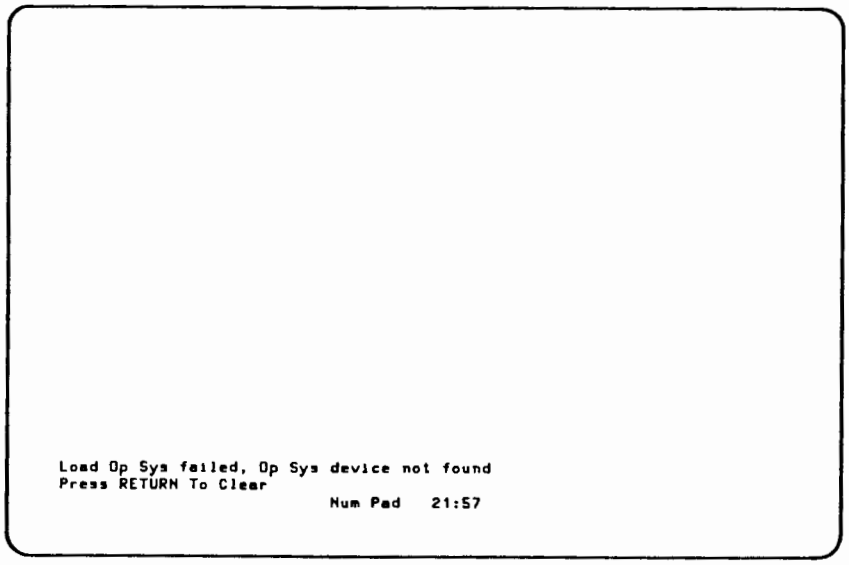


Figure 2-4. HP 150 Rear View

3. Set the line select switch, located on the rear of the HP 150, for the voltage in your area (for installations in the US, set the switch to 115V).

4. Remove the tape covering the power cord receptacle and plug in the power cord.

5. Turn on the HP 150 to verify that it is working. The unit should take about 60 seconds to run the power-on test and then come up with the following screen displayed.



Press [Return] to clear the message.

6. Check the display alignment (see Chapter VII).

7. Turn the HP 150 off. Connect and configure any peripherals or accessory boards (if available) as described in Chapter IV (System Configuration) of this manual.

CONFIGURATION MENUS

III

INTRODUCTION

Configuration of the HP 150 is accomplished through the use of configuration menus. This chapter provides information on the various configuration menus used in the HP 150 including information on how to display the menus, how to change menu entries, how to save and exit the menus and descriptions of each of the menu's fields.

The five types of configuration menus used in the HP 150 are summarized below.

GLOBAL. This menu contains configuration parameters that apply to the system at all times. Specifically this menu enables the user to define the state of the keyboard click and the operating mode of the system.

PORT 1. Two menus (Full Duplex Hardwired Port 1 and Full Duplex Modem Port 1) enable the user to define parameters governing the operation of datacomm port 1.

PORT 2. Two menus (Full Duplex Hardwired Port 2 and Full Duplex Modem Port 2) enable the user to define parameters governing the operation of datacomm port 2.

TERMINAL. This menu contains configuration parameters to allow the user to define the terminal characteristics of the system.

ACCESORY. Accessory menus enable the user to define parameters relating to the accessory boards. Note that depending on the accessory board, there may or may not be a corresponding configuration menu (e.g. the memory accessory boards do not have configuration menus associated with them).

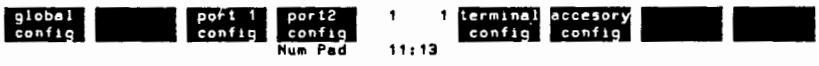
The sequence for setting or changing a configuration menu value is to display the menu, make the desired changes and then save the new menu. Each of these steps is discussed in the following sections.

How to Display the Menus

To display the various menus perform the following steps:

1. Press the [System] key twice to display the primary set of the function key labels.

2. Press the "config keys" [f8] function key to display the configuration function key labels shown below.



3. To display the desired configuration menu press the corresponding funtion key. Note that when accessing either the Port 1 or Port 2 menus, only one of the two menus will be displayed. To access the other menu press [f6] (config menus) and then press the function key corresponding to the desired menu.

How to Change Menu Entries

Each configuration menu contains a set of fields that can be altered in order to meet the needs of a specific system configuration or application. One method for changing menu field entries is to manually change each field to the desired value as described in the following steps:

1. Place the cursor in the field to be changed (use the TAB and/or the cursor control keys).

2. If the choices are restricted to a system-defined list of selections (the field is underlined), use either the NEXT CHOICE [f2] or PREVIOUS CHOICE [f3] function keys to cycle through the list of selections until the desired one is displayed.

3. If the choices are not restricted to a system-defined list (not underlined), enter the desired value from the keyboard.

An alternate method for changing values in a configuration menu is to use the system default function keys listed in table 3-2. By using the function keys the user can quickly and easily change the contents of an entire menu to a set of predefined values.

How to Save a New Menu

To save a new menu simply press the "SAVE CONFIG" [f1] function key. This will not only save the contents of the currently displayed configuration menu in non-volitale memory, but will also make the new set of values the active configuration set. The system will then exit the configuration menu and return to normal operating mode with the primary set of function key labels displayed on the screen.

How to Exit the Menus

There are two methods for exiting the configuration menus. One method, described above, is to save the menu by pressing the "SAVE CONFIG" function key. This will save the currently displayed menu and automatically exit the configuration menu.

To exit a menu without saving its contents simply press the [System] key twice. This will return the system to normal operating mode with the primary function key labels displayed on the screen.

Table 3-2. System Default Function Keys

*	HP 1000 PT-TO-PT	This function key may be used to set the TERMINAL or DATACOMM configuration menu parameters for operation on an HP 1000 system in a point-to-point environment.
*	HP 3000 PT-TO-PT	This function key may be used to set the TERMINAL or DATACOMM configuration menu parameters for operation on an HP 3000 system in a point-to-point environment.
	DEFAULT VALUES	This function key will cause the contents of the currently displayed menu to change to the menu's default values. The default values are factory defined and cannot be modified by the user.
	POWER ON VALUES	This function key will cause the contents of the currently displayed menu to change to the menu's power-on values. The power-on values represent the contents of the menu the last time it was saved.
	ACTIVE VALUES	This function key will cause the contents of the currently displayed menu to change to the menu's active values. The active values represent the contents of the menu the last time it was saved or the last time it was modified using escape sequences or the system default function keys.

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* Note that when using these function keys to change the values in a configuration menu, some of the field labels in the menu will appear half-bright while others will remain full-bright (note full-bright field labels will also be underlined). The full-bright field labels indicate those fields which may vary from system to system (e.g. baudrate field, bell field). The half-bright field labels indicate field values which are standard to that particular system configuration and should remain unchanged.

THE FIELDS

Global Configuration

The Global Configuration menu (with default values) is shown in Figure 3-1. Descriptions of each of the menu's fields follow.

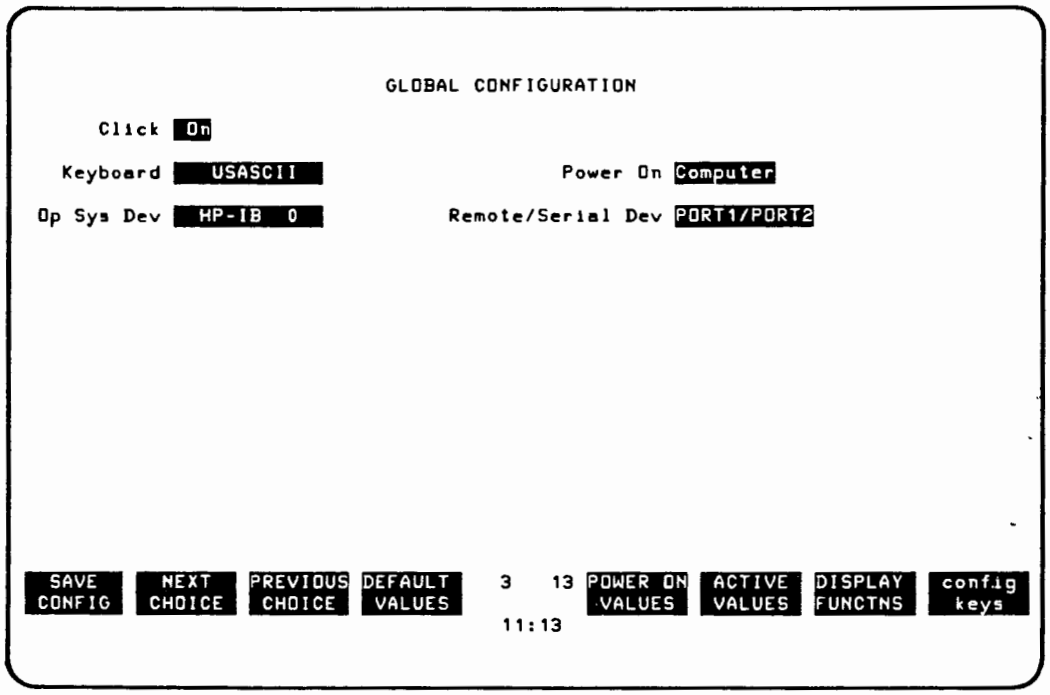

Figure 3-1. Global Configuration Menu

Click

The system is capable of producing an audible "click" as each key is pressed. This field specifies whether that feature is enabled or disabled.

VALUES: On (click enabled)
Off (click disabled)

Keyboard

This field specifies which national keyboard format is to used in interpreting keystrokes.

VALUES: USASCII

Power On

This field specifies the operating mode of the system when the unit is powered on (or a hard-reset is performed).

VALUES: Computer
Terminal

Op Sys Dev

This field specifies the physical location of the Operating System. The field choices consist of a name (HPIB or Accessory) and a number. When "HPIB" is selected the corresponding number is a HP-IB address (note that the unit number, though not shown, will always default to "0"). When "Accessory" is selected the corresponding number is an accessory slot number. For example, if "HPIB 3" is selected the system will try to load the Operating System from the HP-IB disc drive configured to HP-IB address 3, unit 0.

VALUES: HPIB 0
HPIB 1
HPIB 2
HPIB 3
HPIB 4
HPIB 5
HPIB 6
HPIB 7
Accessory 1
Accessory 2

Remote/Serial Dev — This field defines what port will be used to communicate with a host computer (remote) and what port will be used to communicate with an external device.

VALUES: PORT1/PORT2
PORT2/PORT1

The Terminal Configuration Menu (with default values) is shown in Figure 3-2. Descriptions of each of the menu's fields follow.

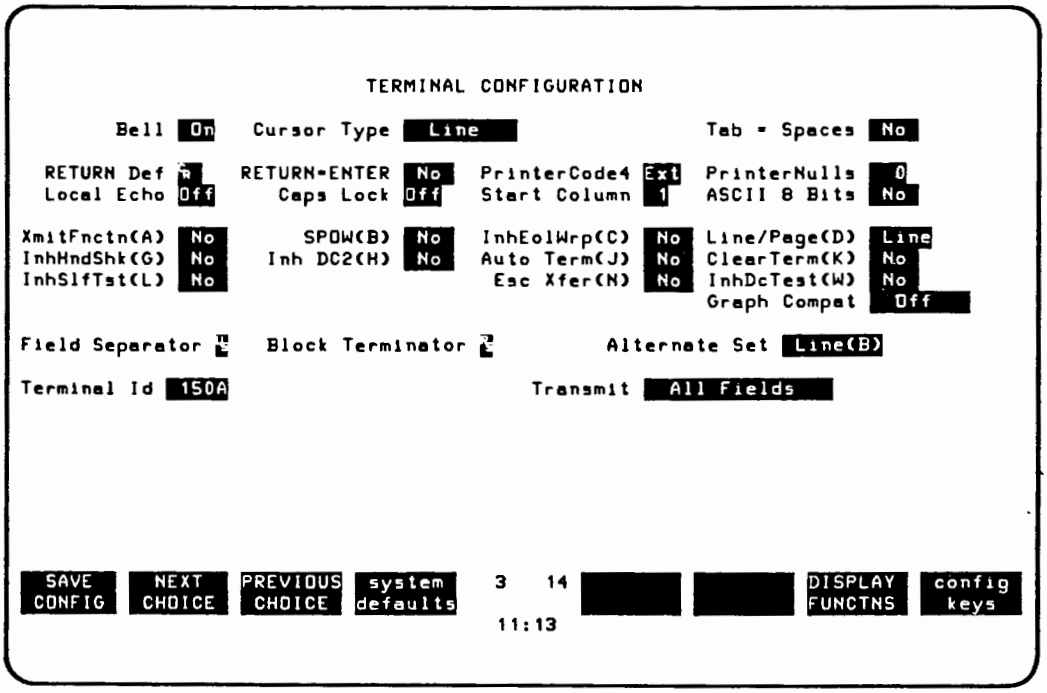

Figure 3-2. Terminal Configuration Menu

Bell

This field specifies whether the terminal's bell is enabled or disabled.

VALUES: On (bell enabled)
Off (bell disabled)

Cursor Type

Specifies the type of cursor displayed.

VALUES: Box
Line

Tab=Spaces

When this feature is enabled, pressing the [TAB>] key generates the number of ASCII space codes required to move the cursor forward to the next tab stop. If no tab stops exist between the current cursor position and the end of the line, the bell sounds and no spaces are generated. Similarly, pressing the [TAB<] key generates the number of ASCII backspace codes required to move the cursor backward to the preceding tab stop. If the cursor is already located at the left margin when the backtab is attempted, the bell sounds and no backspaces are generated.

VALUES: Yes (enabled)
No (disabled)

RETURN Def

This field specifies the definition of the [RETURN] key. The definition may consist of up to two characters. If the second character is a space it is ignored.

VALUES: Any ASCII character

RETURN=ENTER

This field specifies whether or not the user wants the [RETURN] key to function as though it were the [ENTER] key. The value "Yes" causes the return key to function

as the enter key. A "No" value causes the return key to function as defined in the RETURN Def field above.

VALUES: Yes
No

PrinterCode4

This field specifies which printer will respond to device code "4" when the system receives a device control escape sequence from the host computer.

VALUES: Ext
Int

PrinterNulls — This field specifies the number of ASCII null codes to be transmitted to an external printer after each ASCII control code.

VALUES: 0-255

Local Echo — This field specifies whether or not the terminal should display characters on the screen as they are typed. When this field is "On" characters entered through the keyboard are displayed on the screen and transmitted to the host (half duplex). When "Off" characters entered through the keyboard are transmitted to the host only (full duplex).

VALUES: On
Off

Caps Lock — This field specifies whether the terminal generates the full 128-character ASCII set or only Teletype-compatible codes. If this field is set "On" the terminal generates only Teletype-compatible codes: uppercase ASCII and DEL. Unshifted alphabetic keys generate the codes for their uppercase equivalents. The The {, | and } keys generate the codes for [, \ and], respectively.

When set "Off" the terminal generates the full 128-character ASCII set of codes.

VALUES: On
Off

Start Col — This field determines the beginning column for data transfer. This setting affects Modify Line or Modify All mode.

VALUES: 1-80

ASCII 8 bits — When this field is enabled (Yes) the terminal transmits 8-bit ASCII codes in which the eighth (high-order) bit, when set (=1), indicates that the character is from the alternate character set.

VALUES: Yes (8-bit codes)
No (standard 7-bit codes)

Bell

This field specifies whether the terminal's bell is enabled or disabled.

VALUES: On (bell enabled)
Off (bell disabled)

Cursor Type

Specifies the type of cursor displayed.

VALUES: Box
Line

Tab=Spaces

When this feature is enabled, pressing the [TAB>] key generates the number of ASCII space codes required to move the cursor forward to the next tab stop. If no tab stops exist between the current cursor position and the end of the line, the bell sounds and no spaces are generated. Similarly, pressing the [TAB<] key generates the number of ASCII backspace codes required to move the cursor backward to the preceding tab stop. If the cursor is already located at the left margin when the backtab is attempted, the bell sounds and no backspaces are generated.

VALUES: Yes (enabled)
No (disabled)

RETURN Def

This field specifies the definition of the [RETURN] key. The definition may consist of up to two characters. If the second character is a space it is ignored.

VALUES: Any ASCII character

RETURN=ENTER

This field specifies whether or not the user wants the [RETURN] key to function as though it were the [ENTER] key. The value "Yes" causes the return key to function

as the enter key. A "No" value causes the return key to function as defined in the RETURN Def field above.

VALUES: Yes
No

PrinterCode4

This field specifies which printer will respond to device code "4" when the system receives a device control escape sequence from the host computer.

VALUES: Ext
Int

Xmitfnctn(A) When this field is "Yes" any keyboard generated escape sequence (cursor movements, etc) are passed through to the host system and not executed. When "No" the keyboard generated escape sequence is executed locally and no information is given to the host system.

VALUES: Yes
No

SPOW(B) When this field is "Yes" the Space Overwrite latch (SPOW) can be turned on by the RETURN key and turned off by either the cursor home up, linefeed or tab keys. When turned on the SPOW latch causes the cursor to move to the right along the current line without overwriting existing characters. When disabled the space bar causes an overwrite of blank (space) characters as the cursor moves along the current line.

When this field is "No" the SPOW latch is not accessible.

VALUES: Yes (enabled)
No (disabled)

InhEolWrp(C) When this field (End-of-Line Wrap-around) is "No" the cursor is wrappped around to the beginning of the next line on the display whenever column 80 of any line is passed. The terminal generates a return and a linefeed character to accomplish this.

When "Yes", no return or linefeed is generated at the end of a line. The cursor remains in column 80 and the character there is overwritten.

VALUES: Yes
No

Line/Page(D) This field specifies the type of data transmission when operating in BLOCK MODE.

VALUES: Line (data transmitted a line at a time)
Page (data transmitted a page at a time)

InhHndShk(G) and InhDC2(H)

Together these two straps determine what type of handshaking is to be used when transferring blocks of data from the system to the host computer.

The HP 150 provides three kinds of data transfer operations: 1) Short Transfer Mode, 2) Long Transfer in Line Mode and 3) Long Transfer in Character Mode. These are defined as follows:

Short Transfer - A data transfer involving:
* cursor sensing
* terminal status
* f1 - f8 functions
* escape code response

Long Transfer Line Mode - A data transfer initiated via the [RETURN] or [ENTER] keys while one of the Modify Modes is on.

Long Transfer Charater Mode - A data transfer initiated via the [ENTER] key while both the Modify Modes are off.

Also provided are three handshake protocols.

TYPE 1 - no handshake

```
HOST                TERM.

 <----------------<data>  Terminal transmits data.
```

TYPE 2 - DC1 trigger handshake

```
HOST                TERM.

 DC1----trigger-------->  Host enables transfer.

 <-----transfer---<data>  Terminal transmits data.
```

TYPE 3 - DC1/DC2/DC1 warning handshake

```
HOST                TERM.

 DC1----trigger-------->   Host enables data transfer.

 <------warning------DC2   Terminal signals ready.

 DC1----trigger-------->   Host enables data transfer.

 <-----transfer---<data>   Terminal transmits data.
```

InhHndShk(G) and InhDC2(H) (cont'd)

The effect of the various G and H strap states is shown below.

G	H	Short	Long (Line)	Long (Charc)
yes	yes	TYPE 2	TYPE 3	TYPE 1
yes	no	TYPE 2	TYPE 1	TYPE 1
no	yes	TYPE 3	TYPE 3	TYPE 3
no	no	TYPE 1	TYPE 1	TYPE 1

AutoTerm(J)

When this field is "Yes", pressing the enter key causes a non-displaying terminator at the current cursor position and then moves the cursor backward to the previous displaying or non-displaying terminator (if none is found, the cursor moves back to the "home" positon).

When this field is "No" pressing the [ENTER] key will not insert a terminator and will not move the cursor backwards.

VALUES: Yes
No

CLearTerm(K)

When this field is "Yes" and the terminal is operating in block mode, any display transfer operation terminated by encountering a non-displaying terminator will cause the terminator to be cleared.

When this field is "No" non-displaying terminators will not be cleared.

VALUES: Yes
No

InhSlfTst(L)

When this field (Inhibit Self Test) is "Yes", the power-on test, datacomm test and terminal test are not accessible from the keyboard. Any attempt to initiate the tests results in an error message. To clear the message press return.

When "No", these tests are accessible through the keyboard.

VALUES: Yes

No

Esc Xfer(N)

When this field is "Yes" and data is being transferred to an external printer, escape sequences relating to the display are sent to the printer if encountered in the data.

When "No" escape sequences relating to the display are not sent.

VALUES: Yes
No

InhDcTst(W)

When this field is "Yes" the Datacomm self-test is not accesible through the keyboard.

When this field is "No" the Datacomm self-test is accesible through the keyboard.

VALUES: Yes
No

GraphCompat

This field defines Tektronix 4010/4014 compatibility. Tektronix values which are in the 4K address range are divided by 8 if this field is set to Scaled (scaled 4010) or Scl 4014 (scaled 4014) and divided by 4 if set to Unscaled (unscaled 4010) or Uns 4014 (unscaled 4014).

VALUES: Off
Unscaled
Scaled
Uns 4014
Scl 4014

FldSeparator

When the [ENTER] key is pressed while the system is in block mode and display is formatted, the system automatically transmits the specified field separator character at the end of each unprotected field.

VALUES: Any ASCII character

BlkTerminator

This field specifies the character which when encountered in display memory terminates a data transfer.

VALUES: Any ASCII character

Alternate Set — This field specifies which logical character set is currently the alternate character set. The alternate character set may be enabled by pressing CNTL N and disabled by pressing CNTL O.

VALUES: Line(B)
Base(@)
Math(A)

Terminal ID — Defines the ID string generated by the the terminal when a Terminal ID Request is received from the host computer.

VALUES: 150A
2623A

Transmit — This field controls whether all fields will be transmitted or only those which have been user modified while in format mode.

VALUES: All Fields
Modified Fields

The Full Duplex Hardwired and Full Duplex Modem configuration menus (with default values) are shown in Figures 3-3 and 3-4, respectively. Descriptions of each of the menu's fields follow.

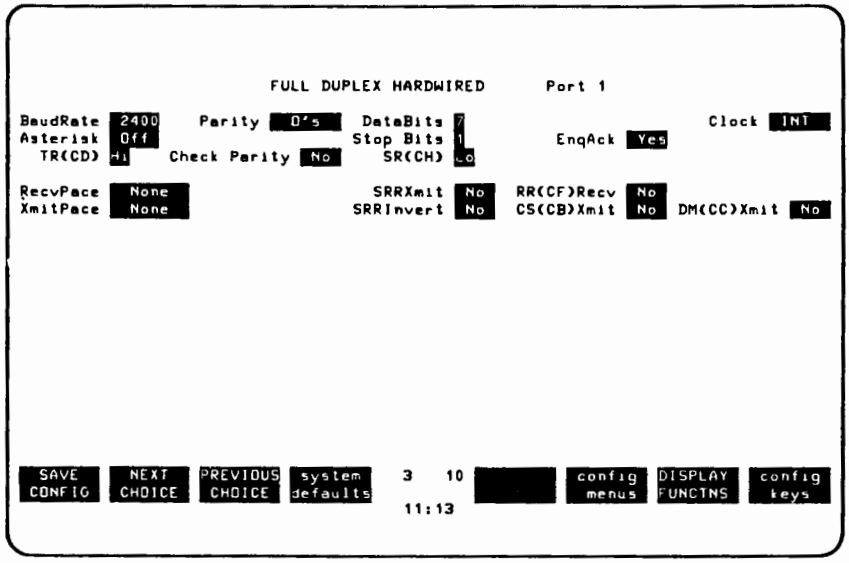

Figure 3-3. Full Duplex Hardwired Port 1 Configuration Menu

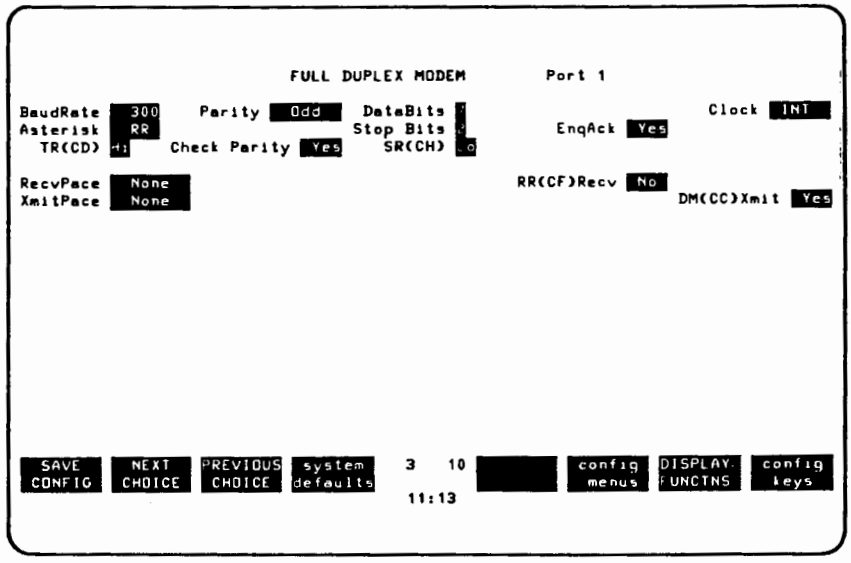

Figure 3-4. Full Duplex Modem Port 1 Configuration Menu

BaudRate — This field specifies at what speed you want the data transmission to take place (in bits per second).

VALUES:

110	600	4800
150	1200	9600
300	2400	19.2K

Parity — This field specifies what type of parity generation and checking you wish used with each data character.

VALUES:
- None (no parity bit)
- 0's (parity bit always zero)
- Odd (odd parity)
- 1's (parity bit always one)
- Even (even parity)

DataBits — This field specifies what number of data bits you want in each character. ASCII characters are normally passed as 7-bit data codes.

VALUES:
- 7
- 8

Clock — This field specifies whether the datacomm clock source is to be generated by the terminal or by the external device. If the external clock source is selected, this field also specifies whether the clock being supported has 1 or 16 clock pulses per bit.

VALUES:
- INT
- EXTx1
- EXTx16

Asterisk — This field specifies whether the transmit indicator should be enabled or disabled and, if enabled, which RS-232-C control line it should reflect.

The value "off" disables the transmit indicator. All other values specify a particular RS-232-C control line, where an asterisk reflects a HI state of the line and no asterisk reflects a LO state.

VALUES:
- Off
- RR (RS-232C Receive Ready)
- DM (RS-232C Data Mode)
- CS (RS-232C Clear to Send)

Stopbits

This field specifies the number of "stop bits" appended to each data character transmitted by the terminal.

VALUES: 1
2

EnqAck

This field enables or disables the use of the Hewlett Packard ENQ-ACK handshake.

VALUES: Yes (enabled)
No (disabled)

TR(CD)

This field specifies the desired state of the RS-232 TR line after the SAVE CONFIG [f1] function key is pressed.

VALUE: Hi
Lo

ChkParity

This field is used for enabling or disabling the parity check feature for data characters received over the datacomm line. Note that if the Parity field (on previous page) is set to None then this field is ignored.

VALUES: Yes (enabled)
No (disabled)

SR(CH)

This field specifies the desired state of the RS-232C SR line after the SAVE CONFIG [f1] function key is pressed. The SR line, RS-232-C pin number 23, is defined as the Data Signal Rate Detector (DTE Source). It is normally used on dual speed modems to select the appropriate speed (single speed modems ignore this line).

VALUES: Hi
Lo

RecvPace — This field specifies the type of receive pacing the system uses to control the transmission of data from the remote device.

VALUES: None
TR(CD)
XonXoff

SRRXmit — This field specifies whether or not a true state (-12 V) on the RS-232C Secondary Receiver Ready (SRR) or Secondary Carrier Detect (SCF) control line is a required condition for transmitting data.

VALUES: Yes
No

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RR(CF)Recv — This field specifies whether or not a true state (-12 V) on the RS-232C Receiver Ready (RR) or Data Carrier Detect (CF) control line is a required condition for receiving data.

VALUES: Yes
No

XmitPace — This field specifies the type of transmit pacing used by the remote device to control data transmission from the system.

VALUES: None
XonXoff

SRRInvert — This field applies only when the SRRXmit field is set to "Yes". When both the SRRXmit and SRRInvert fields are set to "Yes" the true state of the SRR and SCF control lines is inverted from -12 V to +12 V.

VALUES: Yes
No

CS(CB)Xmit — This field specifies whether or not a true state (-12 V) on the RS-232C Clear to Send (CS/CB) control line is a required condition for transmitting data. For a modem configuration it is recommended that you set this field to "Yes".

VALUES: Yes
No

DM(CC)Xmit — When this field is "Yes" the Data Set Ready (CC) line (pin 6) must be active in order to transmit data. When this field is "No" the state of pin 6 is ignored.

VALUES: Yes
No

Data Communication Port 2

The Full Duplex Hardwired and Full Duplex Modem configuration menus (with default values) are shown in Figures 3-5 and 3-6, respectively. Descriptions of the fields in these menus are identical to those listed for the DATACOMM Port 1 menus.

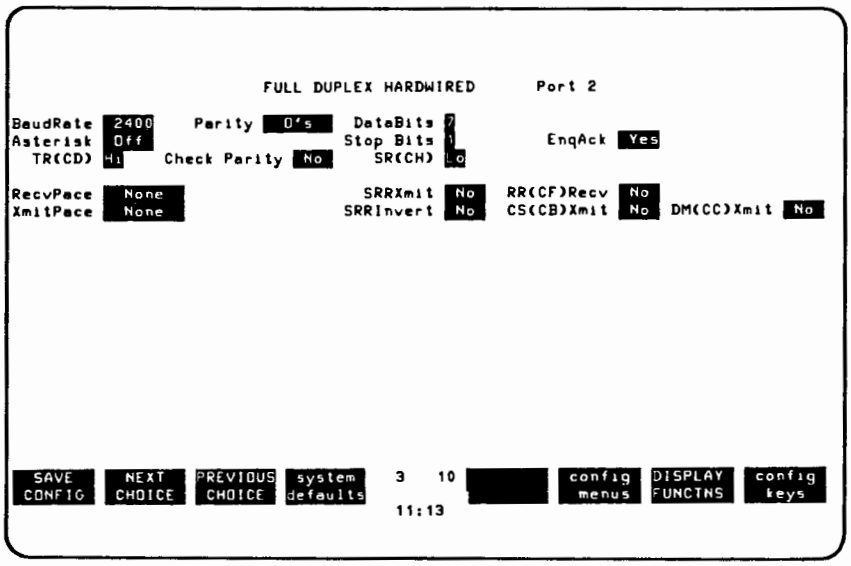


Figure 3-5. Full Duplex Hardwired Port 2 Configuration Menu

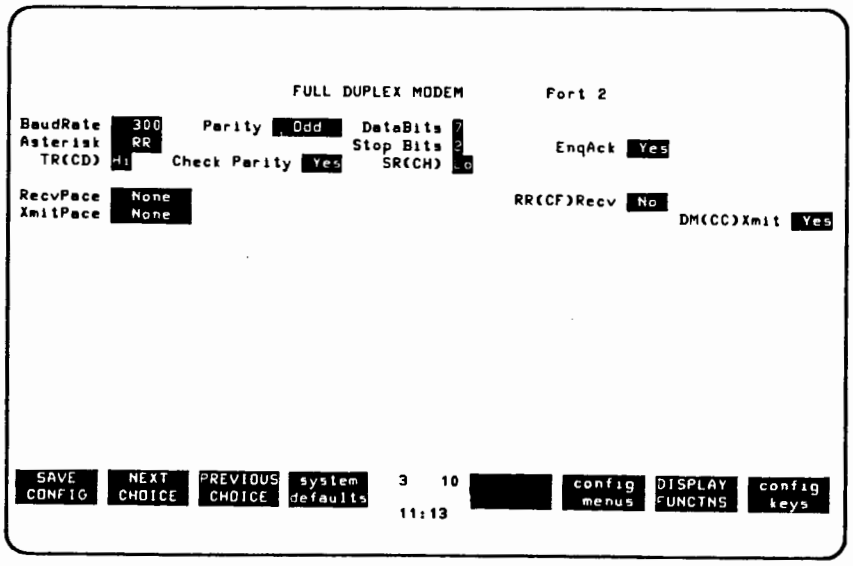


Figure 3-6. Full Duplex Modem Port 2 Configuration Menu

SYSTEM CONFIGURATION IV

INTRODUCTION

This chapter provides the information needed to configure supported peripherals and accesory boards to a HP 150.

When configuring any of the supported devices to a HP 150 the following items should be taken into consideration:

1. MS-DOS device configuration
2. Cable and cable requirements
3. Strapping of the HP 150 and of the device

MS-DOS device configuration is discussed in the following section. The remaining items are covered as they apply in the sections on HP-IB devices, RS-232 devices, internal printer and accessory boards.

Note that configuration information presented on HP-IB and RS-232 devices represents one way to connect the device to the HP 150. It should not be taken to mean that the described configuration is the only way that the device can be connected to the HP 150. Refer to the installation manuals for each device for the method of physically setting the hardware strapping on the device.

MS-DOS DEVICE CONFIGURATION

MS-DOS device configuration is accomplished using a utility (the MS-DOS Device Configuration Utility located on the operating system disc) which maps logical MS-DOS devices to physical locations. To access this utility, first load MS-DOS. When P.A.M (Personal Applications Manager) is displayed on the screen, select "Device Config." (e.g. either touch the "Device Config" label on the screen or use the tab key to move the selection bar to the "Device Config" label and then press [Select]) and then press [f1] (Start Applic). The MS-DOS Device Configuration menu (with default values) is shown below in figure 4-1.

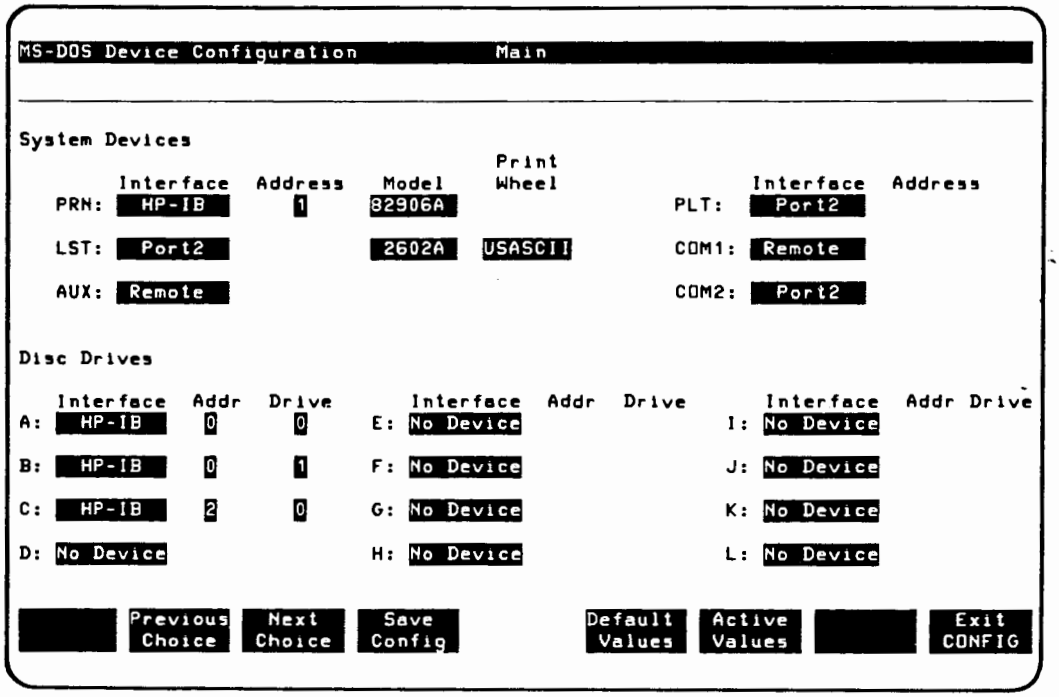


Figure 4-1. MS-DOS Device Configuration Menu

The MS-DOS Device Configuration menu is divided into two sections: System Devices and Disc Drives.

The System Devices section of the menu enables the user to configure MS-DOS to reserve specific device locations (e.g. Port 1, Port 2, HP-IB) for specific devices. This provides the user with the flexibility to customize peripheral configuration. Table 4-1 contains descriptions of the fields in this section of the menu.

The Disc Drives section allows the user to define the HP-IB address and unit numbers MS-DOS will reserve for the system's disc drives. Up to 12 disc drives may be connected to a HP 150, the logical device identifier (e.g. A, B, C,...) of each disc drive being defined by the contents of this section of the menu.

For most HP 150 system configurations the default configuration menu (shown in figure 4-1) is adequate. In the default configuration MS-DOS is configured to reserve the following:

- HP-IB addresses "0" and "2" for the primary and secondary disc drive controllers, respectively.
- HP-IB address "1" for the primary system printer (PRN).
- Port 2 for the primary system plotter (PLT), the secondary system printer (LST) or the secondary host computer (COM2).
- "Remote" (as defined by the Global configuration menu) for the primary host computer (COM1) or auxilary device (AUX).

If the default configuration does not meet the needs of a particular HP 150 system configuration the values can be altered by positioning the selection bar at the field to be changed and scrolling through the field choices (using the Next Choice [f3] or Previous Choice [f2] function keys) until the desired value is displayed. Once all changes have been made save the menu by pressing [f4] (Save Config) and then exit the menu by pressing [f8] (Exit Config).

Table 4-1. System Device Configuration Fields

PRN	This field defines the location MS-DOS reserve for the system's primary printer.		
	VALUES:	HP-IB	Internal
		Port1	Serial *
		Port2	No device
PLT	This field defines the location MS-DOS will reserve for the system's plotter.		
	VALUES:	HP-IB	Serial *
		Port1	No device
		Port2	
LST	This field defines the location MS-DOS will reserve for the system's secondary printer.		
	VALUES:	HP-IB	Internal
		Port1	Serial *
		Port2	No device
COM1, COM2	These two fields define the locations MS-DOS will reserve for the system's primary host computer (COM1) and secondary host computer (COM2).		
	VALUES:	Port1	Remote *
		Port2	No device
AUX	This field defines the location MS-DOS will reserve for an auxilary device. This field is provided to allow access to additional devices.		
	VALUES:	HP-IB	Serial *
		Port1	Remote *
		Port2	No device
		Internal	

* The physical location indicated by "Serial" and "Remote" is defined by the contents of the Remote/Serial Dev field in the Global Configuration menu (the default being Port1/Port2).

HP-IB DEVICES

The HP 150 has one HP-IB connector located at the back of the unit which may be used to communicate with any of the HP 150 supported HP-IB disc drives, printers or plotters. Note that the HP-IB protocol used in the HP 150 is a specific subset of the IEEE 488-1978 specification. Only POD specified devices can be attached to the HP-IB on the HP 150.

Cables

HP-IB devices must be connected using shielded HP-IB cables (HP Product No. 45529A/B/D or equivalent). The 45529A cable is 1 meter in length, the 45529B is 2 meters in length and the 45529D is a 0.5 meters in length. The total length of all cables on the HP 150 system may not exceed one meter plus one meter per device (for example, a HP 150 with 1 disc and 1 plotter may have up to 3 meters of HP-IB cable).

Strapping

When configuring HP-IB devices to the HP 150, configuration of the following HP 150 menus may be necessary (note no hardware strapping of the HP 150 is required):

- the "Op Sys Dev" field in the Global configuration menu (see Chapter III in this manual for more information)

- the MS-DOS Device Configuration Utility menu (see the appropriate section in this chapter for more information)

Note that if printing is to be initiated through the function keys (i.e. in Local mode), the "HP-IB DEVICE" function key must also be configured. To do this press the [System] key twice, [f1] (device control) and then [f3] ("to" devices"). If there is an asterisk in the "HP-IB DEVICE" function key label, then it is already enabled. Otherwise, press [f5] (HP-IB DEVICE) and an asterisk will appear.

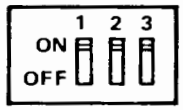
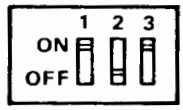
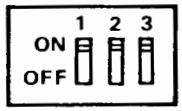
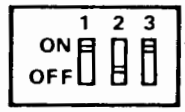
All HP-IB devices are configured by setting the device address on the device itself. The following tables provides samples of HP-IB address switch settings for all of the HP 150 supported HP-IB peripherals. The information presented assumes the MS-DOS Device Configuration Utility menu has been configured to the following values:

- HP-IB address "0" and "2" reserved for the system's primary and secondary disc drives.

- HP-IB address "1" reserved for HP-IB printers.

- HP-IB address "5" reserved for HP-IB plotters.

Table 4-4. HP-IB Disc Drive Address Settings

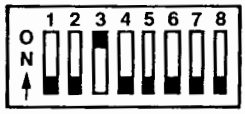
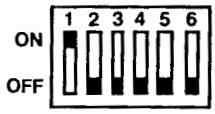
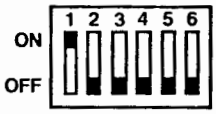
DISC DRIVE	DESCRIPTION	DISC DRIVE ADDRESS SWITCH SETTING "0" 1st Contr	DISC DRIVE ADDRESS SWITCH SETTING "2" 2nd Contr
9121D	3.5" Dual Drive		
9121S	3.5" Single Drive *		
82901M	5.25" Dual Drive		
82902M	5.25" Single Drive *		
9133A	5 Mb Winchester + 3.5" Micro-disc Drive		
9133B	10 Mb Winchester + 3.5" Micro-disc Drive		
9133V	5 Mb Winchester + 3.5" Micro-disc Drive		
9133XV	15 Mb Winchester + 3.5" Micro-disc Drive		

* Supported as an "add-on" drive, only. Single disc systems not supported.

Table 4-4 (cont'd). HP-IB Disc Drive Address Settings

DISC DRIVE	DESCRIPTION	DISC DRIVE ADDRESS SWITCH SETTING	
		"0" 1st Contr	"2" 2nd Contr
9134A	5 Mb Winchester		
9134B	10 Mb Winchester		
9134XV	15 Mb Winchester		
9135A	5 Mb Winchester + 5.25" Mini-disc Drive		

Table 4-5. HP-IB Printer Address Settings

HP-IB PRINTER	DESCRIPTION	HP-IB PRINTER ADDRESS SWITCH SETTING "1"
2602A	Low Cost Daisywheel Serial Printer	
2932A	Dot Matrix Serial Printer	**
2934A	Dot Matrix Serial Printer	**
82905B	Dot Matrix Serial Printer	
82906A	Dot Matrix Serial Printer	

** Configuration of the HP-IB address on the 2932A and 2934A is accomplished using a HP-IB interface configuration menu. This menu should be configured as follows (refer to the HP 293X Series Owner's/Reference manual for information on how to access and configure the menu).

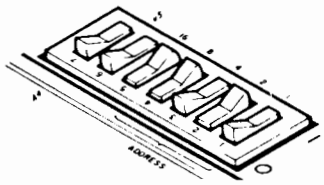
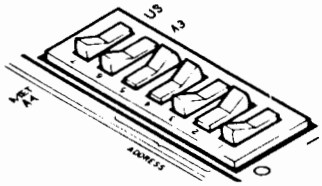
```
*****  LIST INTERFACE  *****

******  HP-IB  ******

SECONDARY COMMANDS   LISTEN ALWAYS   SERVICE REQUEST   ADDRESS   SET DEFAULTS
      off                off               off            1

*****  END OF SETTINGS  *****
```

Table 4-6. HP-IB Plotter Address Settings

HP-IB PLOTTER	DESCRIPTION	HP-IB PLOTTER ADDRESS SWITCH SETTING "5"
7470A	2-Pen Plotter	
7475A	6-Pen Plotter	

The HP 150 has two 25 pin RS-232 communications port (refer to Table 4-1 for Port 1 and Port 2 connector pinouts). These ports may be used to communicate with a host computer (via a modem or hardwired connection) or any of the HP supported RS-232 devices.

Table 4-1. Port 1 and Port 2 Connector Pinouts

PIN #	RS-232 (RS-449)	DESCRIPTION
1	AA (SHIELD)	Protective Ground
2	BA (SD)	Transmitted Data
3	BB (RD)	Received Data
4	CA (RS)	Request to Send
5	CB (CS)	Clear to Send
6	CC (DM)	Data Set Ready
7	AB (SG)	Signal Ground
8	CF (RR)	Received Line Signal Detector
12	SCF (OCR2)	Secondary Receive Line Signal Detector
15	* DB (ST)	Transmission Signal Element Timing
17	* DD (RT)	Receiver Signal Element Timing
19	SCA (OCD2)	Secondary Request to Send
20	CD (TR)	Data Terminal Ready
22	CE (OCR1)	Ring Indicator
23	CH (OCD1)	Data Signal Rate Detector
24	* DA (TT)	Transmit Signal Element Timing

* Used by Port 1 only.

Cables

The cables available from Hewlett-Packard which can be used to connect RS-232 devices to an HP 150 are listed below.

13242G	RS-232 Printer Cable (male)
13242M	European Modem Cable
13242N	US Modem Cable
13242X	RS-232 Interface Cable for HP 3000

The pin-to-pin wiring for each of the above cables is shown on the following pages, in figures 4-2 to 4-5.

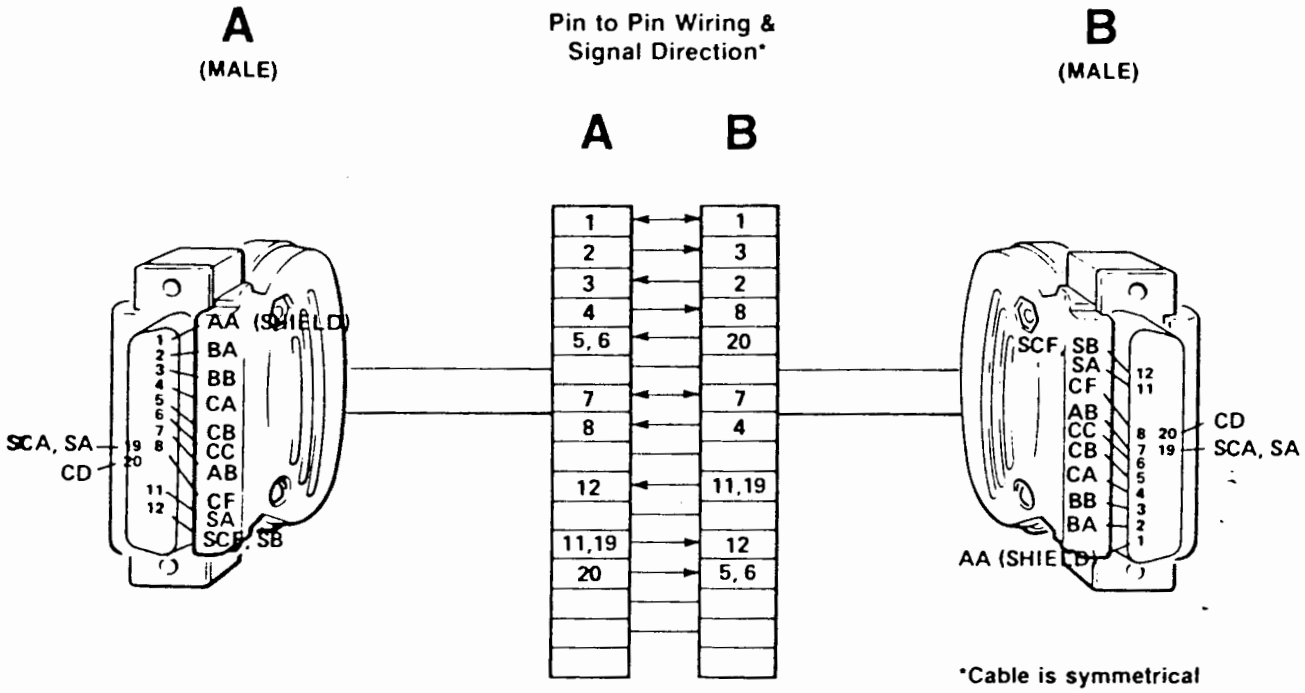


Figure 4-2. 13242G (RS-232 Printer) Cable Wiring

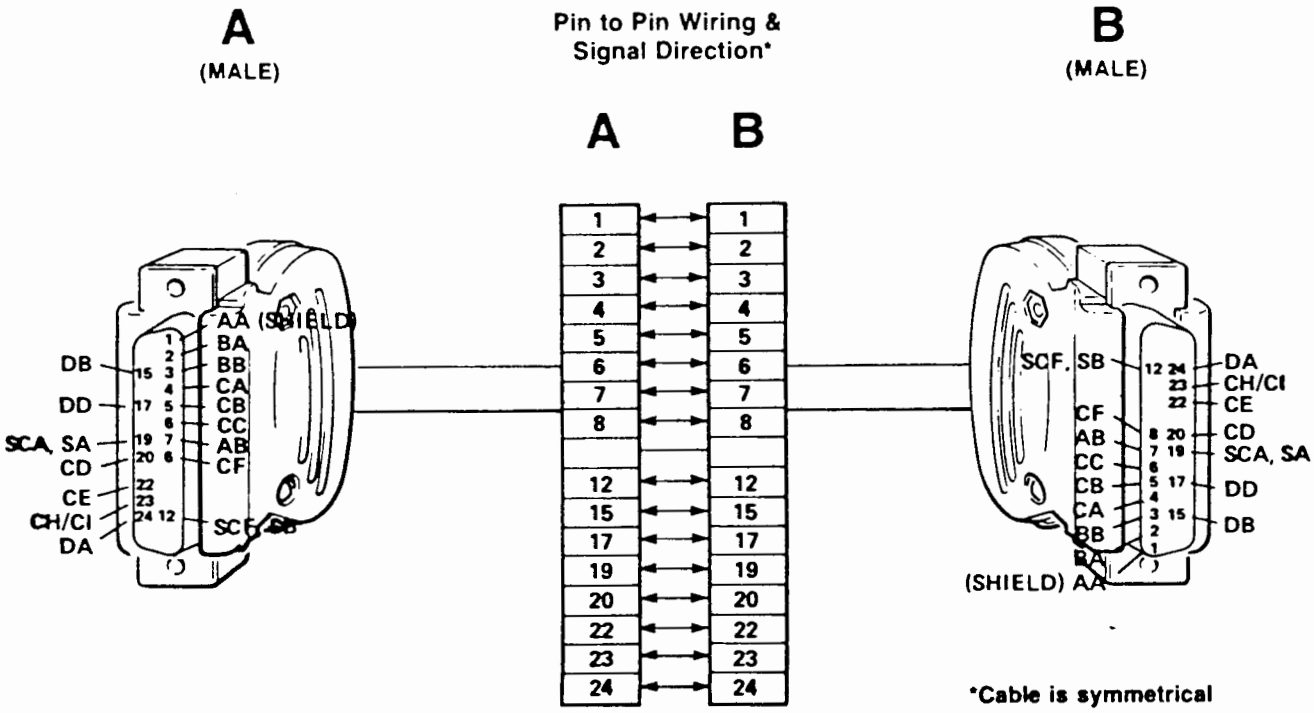


Figure 4-3. 13242M (European Modem) Cable Wiring

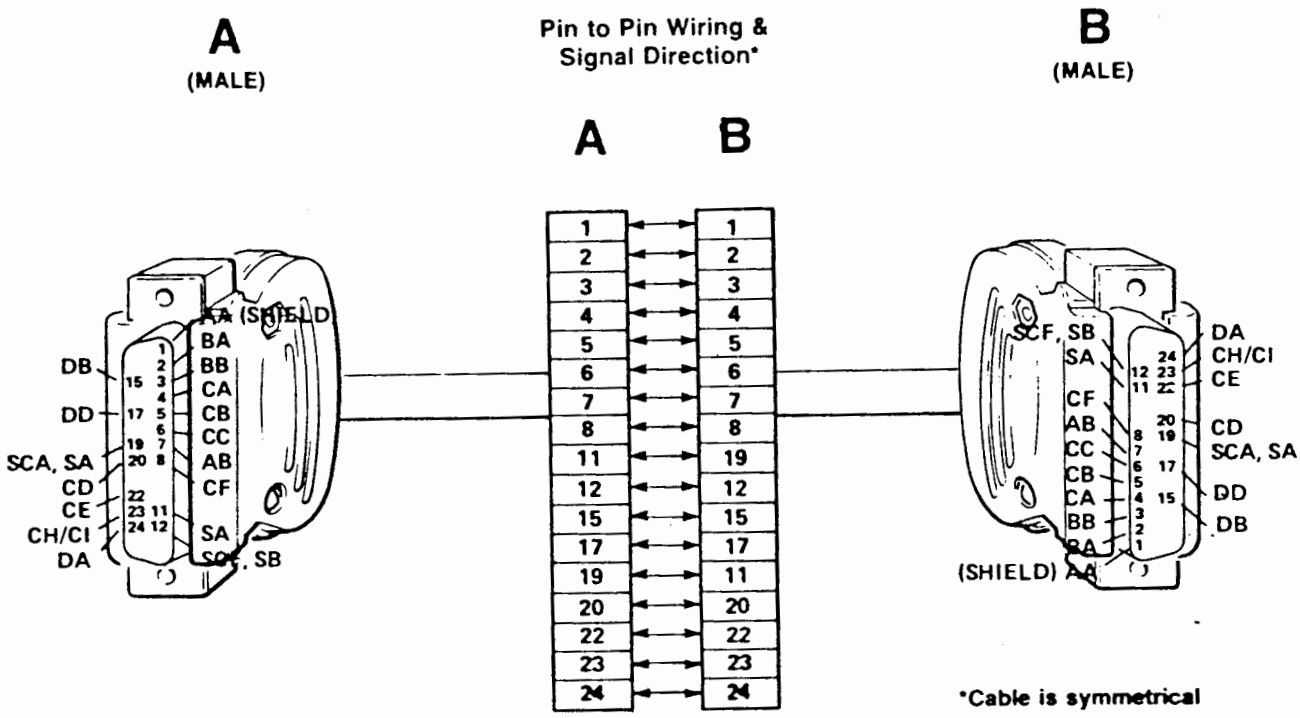


Figure 4-4. 13242N (US Modem) Cable Wiring

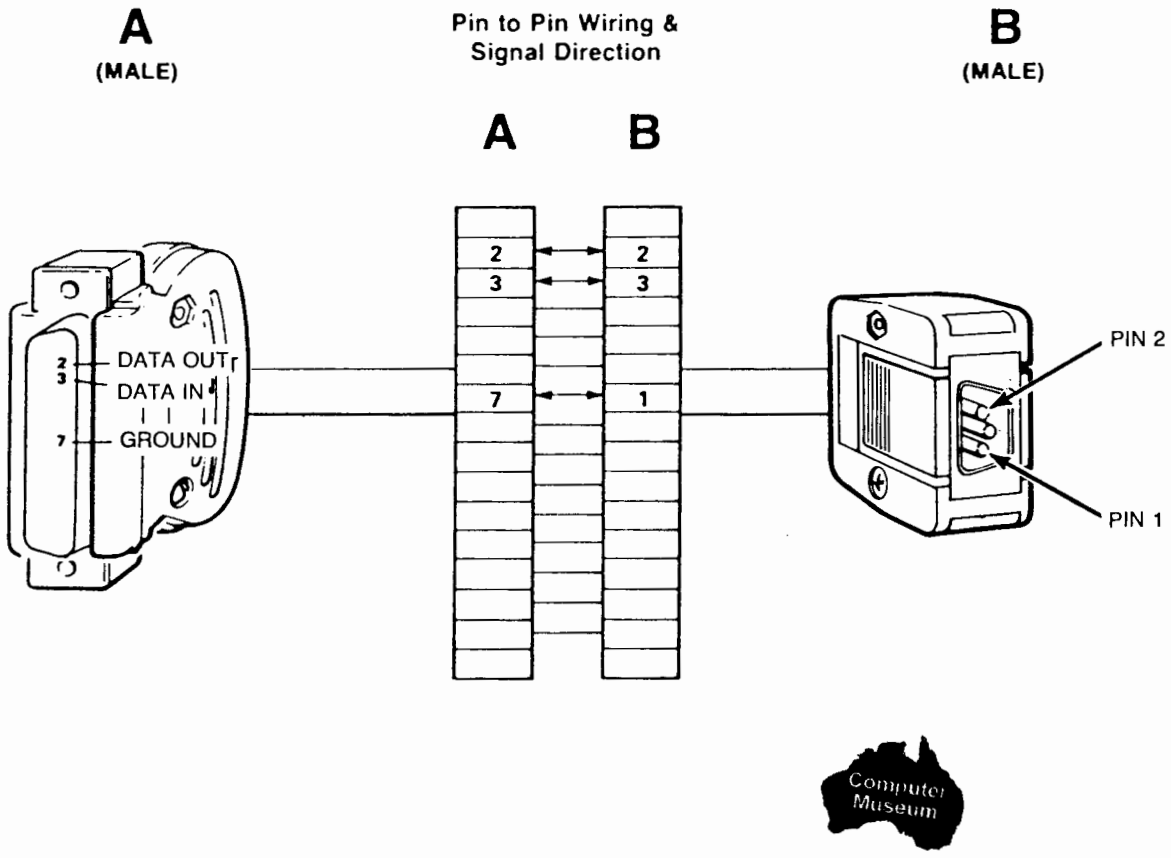


Figure 4-5. 13242X (RS-232 to HP 3000) Cable Wiring

Strapping

When configuring RS-232 devices to the HP 150, configuration of the following menus may be necessary (no hardware strapping of the HP 150 is required):

- the Port 1 and/or Port 2 configuration menus, depending on the port or ports used (see Chapter III in this manual for more information)

- the "Remote/Serial Dev" field in the Global configuration menu (see Chapter III in this manual for more information)

- the MS-DOS Device Configuration Utility menu (see the appropriate section in this chapter for more information)

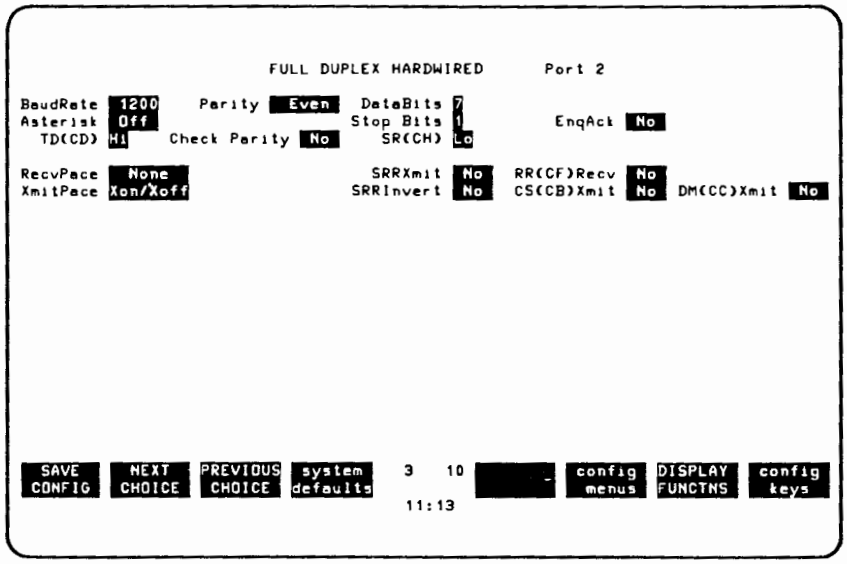
Note that if printing is to be initiated through the function keys (i.e. Local mode), the "SERIAL DEVICE" function key must also be configured. To do this press the [System] key twice, [f1] (device control) and then [f3] ("to" device). If there is an asterisk in the "SERIAL DEVICE" function key label, then it is already enabled. Otherwise press [f1] (SERIAL DEVICE) and an asterisk will appear.

Hardware and/or software strapping of the RS-232 device connected to the HP 150 may also be necessay. The following pages contain sample configurations (including cable requirements, HP 150 configuration menu settings and device strapping) for all the HP 150 supported RS-232 devices. The configuration information provided assumes that the MS-DOS Device Configuration menu and the "Remote/Serial Dev" field in the Global configuration menu have been configured to recognize a host computer on Port 1 and a RS-232 device on Port 2.

CABLE:

13242G (13242-60010)

HP 150 CONFIGURATION:



HP 2601A CONFIGURATION:

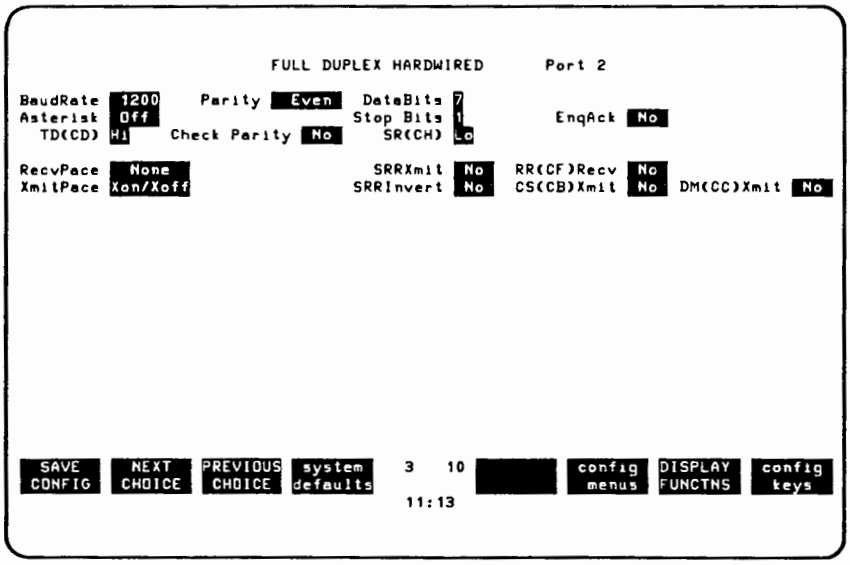
Switches are located under printer's front access cover.

SWITCH	DESCRIPTION	SETTING
Left Switch		
1	Double Linefeed	OFF
2	Unused	OFF
3	Auto Linefeed	OFF
4	Unused	OFF
5	Unused	OFF
6	Unused	OFF
7	Message Load (Unused)	OFF
8	Unused	OFF
Right Switch		
1	Full Duplex	ON
2	Parity Enable	ON
3	Baud Rate Selection	OFF
4	Unused	OFF
5	Baud Rate Selection	ON
6	Even Parity	ON
7	Paper Out Defeat	OFF
8	Unused	OFF

CABLE:

13242G (13242-60010)

HP 150 CONFIGURATION:



HP 2602A CONFIGURATION:

Switches are located under printer's front access cover.

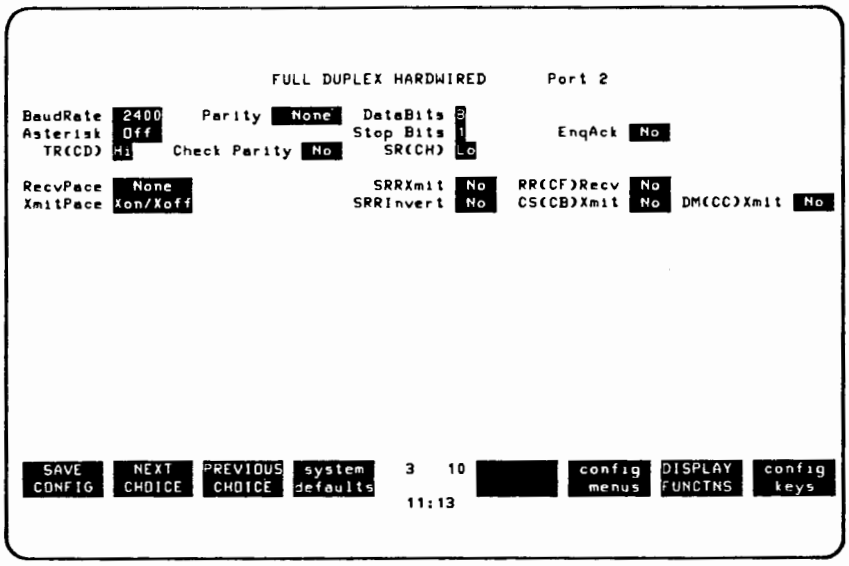
FRONT PANEL SWITCHES	DESCRIPTION	SETTING	
1	Baud Rate	off	(1200)
2	Unused	off	
3	Parity	off	(even)
4	Parity Enable	on	(enabled)
5	Handshake	off	(Xon/Xoff)
6	Self-test	off	(disabled)
7	Page Length	off	(11.0 inches)
8	Ribbon Type	off	(Multi-strick)

Computer Museum

CABLE:

13242G (13242-60010)

HP 150 CONFIGURATION:



HP 2932A CONFIGURATION:

Configuration of a RS-232 version of a HP 2932A is accomplished using a RS-232 interface configuration menu. This menu should be configured as follows (refer to the HP 293X Series Owner's/Reference manual for information on how to access and configure the menu).

****** LIST INTERFACE ******

****** SERIAL ******

DATA SETTINGS CONTROL SETTINGS SET DEFAULTS

***** DATA SETTINGS *****

BAUD RATE	PARITY	PARITY CHECK	DATA BITS	STRIP NULL/DEL	ALL
2400	none	off	8	off	

***** CONTROL SETTINGS *****

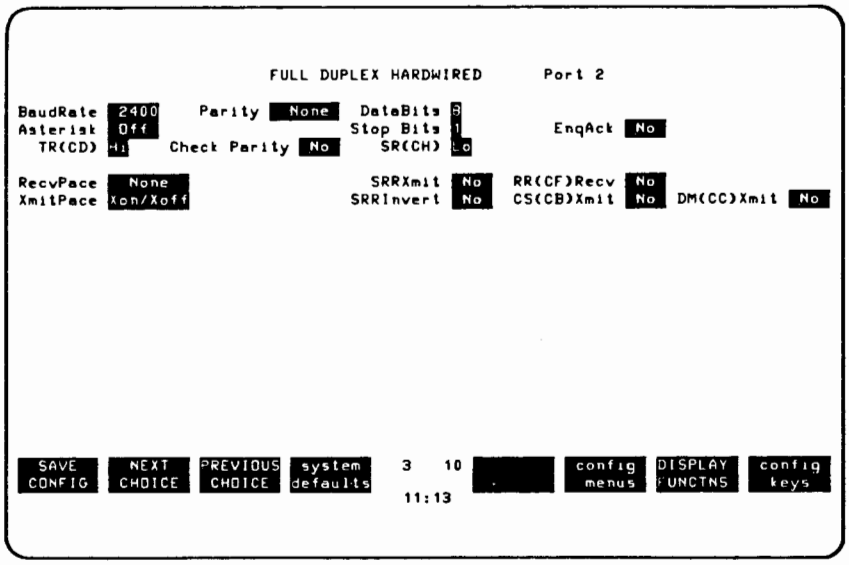
ENQ/ACK	XON/XOFF	BINARY ENQ/ACK	DTR/CD	(S)RTS/SCA	CTS/CB	RS/CH
off	on	off	High	Low	Ignore	Low

****** END OF SETTINGS ******

CABLE:

13242G (13242-60010)

HP 150 CONFIGURATION:



HP 2934A CONFIGURATION:

Configuration of a RS-232 version of a HP 2934A is accomplished using a RS-232 interface configuration menu. This menu should be configured as follows (refer to the HP 293X Series Owner's/Reference manual for information on how to access and configure the menu).

****** LIST INTERFACE ******

****** SERIAL ******

DATA SETTINGS CONTROL SETTINGS SET DEFAULTS

***** DATA SETTINGS *****

BAUD RATE	PARITY	PARITY CHECK	DATA BITS	STRIP NULL/DEL	ALL
2400	none	off	8	off	

***** CONTROL SETTINGS *****

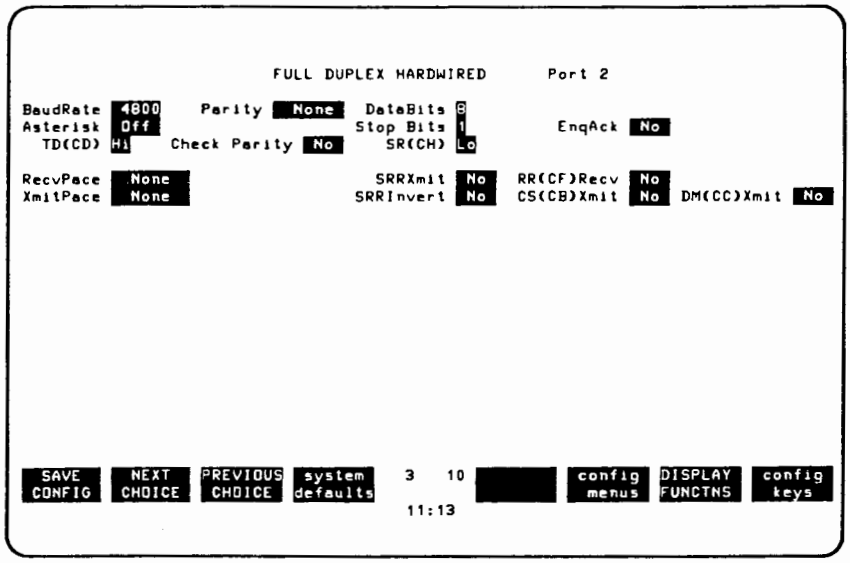
ENQ/ACK	XON/XOFF	BINARY ENQ/ACK	DTR/CD	(S)RTS/SCA	CTS/CB	RS/CH
off	on	off	High	Low	Ignore	Low

****** END OF SETTINGS ******

CABLE:

13242G (13242-60010)

HP 150 CONFIGURATION:



HP 82905B CONFIGURATION:

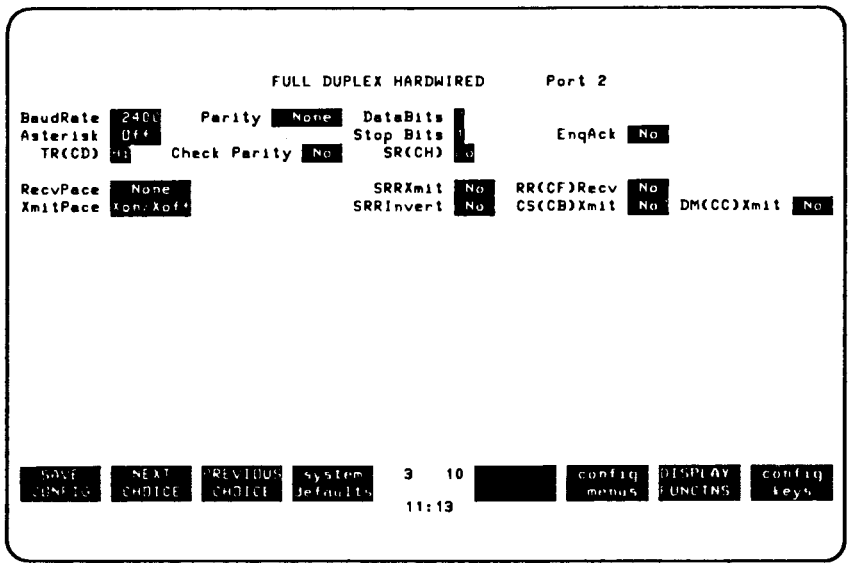
Switches located on printer's RS-232 interface PCA.

SWITCH	DESCRIPTION	SETTING
DIP 1		
1	Baud Rate Selection	off (4800)
2	"	on
3	"	off
4	"	off
5	Unused	on
6	Unused	on
7	Parity Check Disabled	on
8	Unused	on
DIP 2		
1	8 Bit Word Length	off
2	Printer Busy	on
3	"	off
4	Enable Printer Busy Line	on

CABLE:

13242G (13242-60010)

HP 150 CONFIGURATION:



HP 7470 CONFIGURATION:

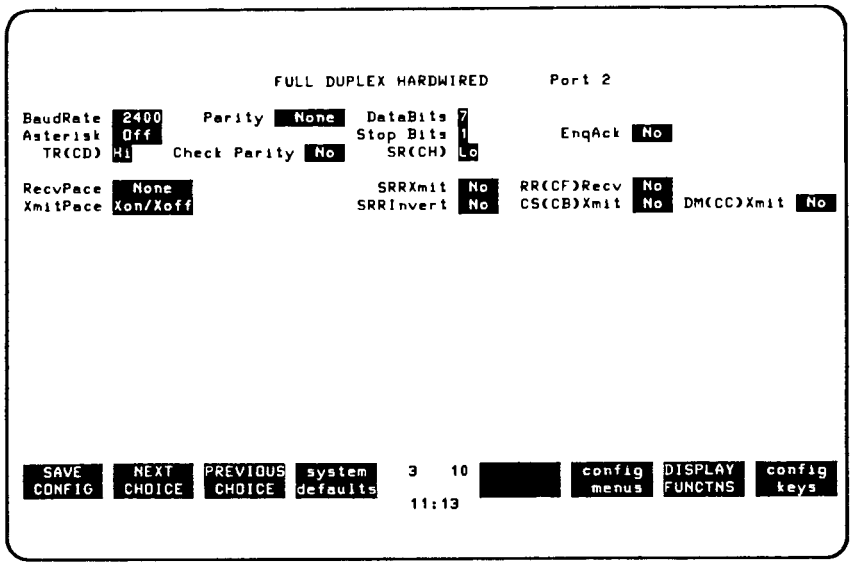
Switches located at the rear of the plotter near the RS-232 connector.

SWITCH	DESCRIPTION	SETTING
1	Baud Rate Selection	0 (2400)
2	"	0
3	"	0
4	"	1
5	Plotting Limits	1 (8.5 X 11 inch)
6	Programmed Operation	0 (on)
7	Parity Enable	0 (disabled)
8	Parity Select	0 (N/A)

CABLE:

13242G (13242-60010)

HP 150 CONFIGURATION:



HP 7475A CONFIGURATION:

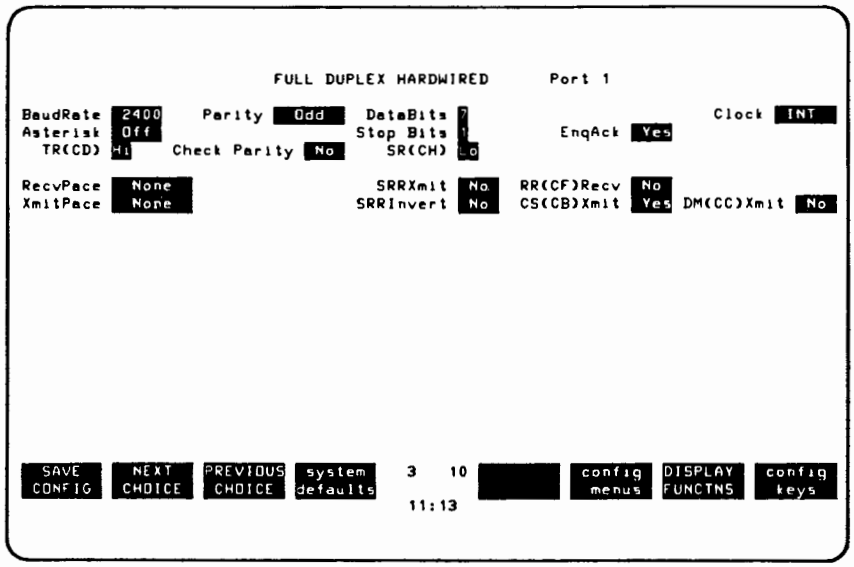
Switches located at the rear of the plotter near the RS-232 connector.

SWITCH	DESCRIPTION	SETTING
1	Baud Rate Selection	0 (2400)
2	"	0
3	"	0
4	"	1
5	Paper Size	0 (A size)
6	Plotting Limits	1 (8 X 11 inch)
7	Programmed Operation	0 (on)
8	Parity Enable	0 (disabled)
9	Parity Select	0 (N/A)

CABLE:

13242N (13242-60001)

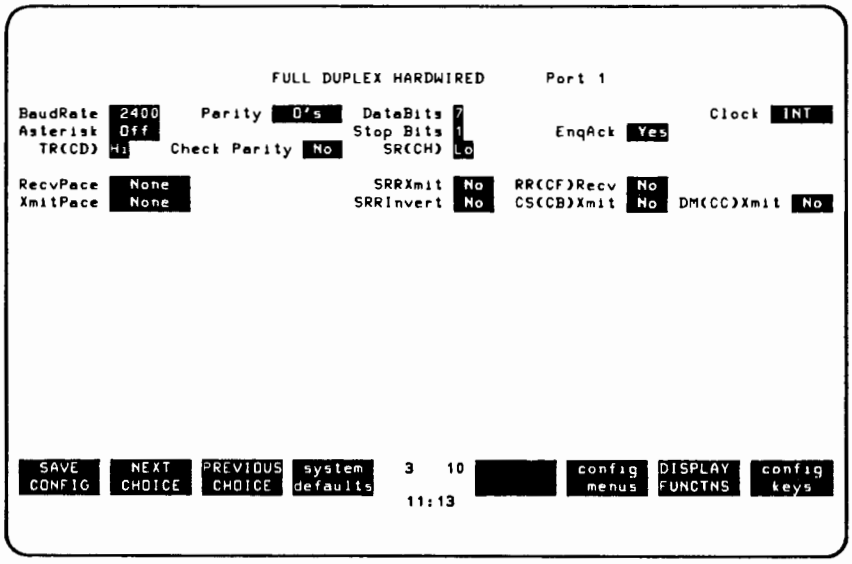
HP 150 CONFIGURATION:



CABLE:

13242N (13242-60001)

HP 150 CONFIGURATION:



INTERNAL PRINTER

The internal printer supported on the HP 150 is a HP 2674 Integral Thermal Printer. This user installable printer easily mounts to the top of the HP 150.

Cables

No special cables or equipment are required to connect the HP 2674 to a HP 150. To install the printer simply follow the procedures listed below.

1. Power-off the HP 150.

2. Remove the printer cover from the HP 150.

3. Open the access door by tilting the door backwards.

4. Tilt the printer downward and slide it forward into the printer compartment in the HP 150 (see figure 4-6).

5. Push down on the black snap-fasteners located on each side of the paper tray.

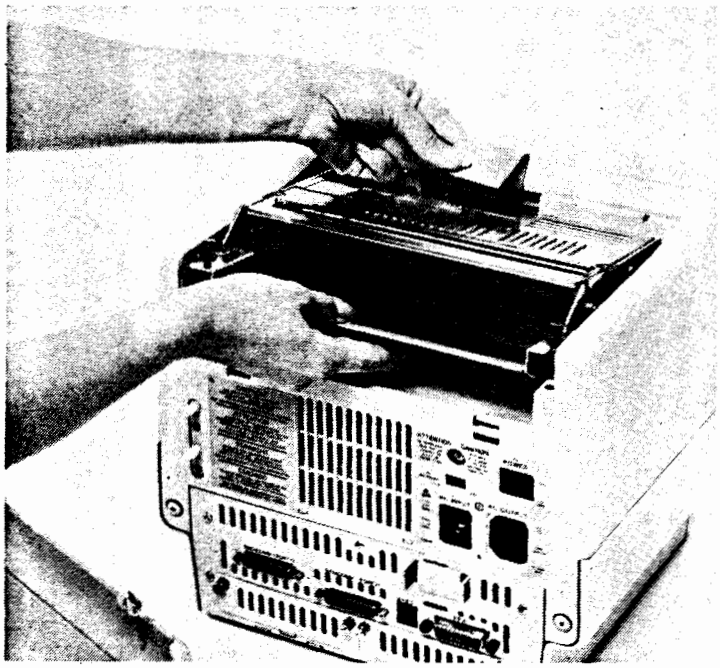


Figure 4-6. Installing the HP 2674

6. Connect the HP 150 printer cable to the connector on the HP 2674.

7. Install the printer paper.

8. Remove the filler plate from the printer cover (see figure 4-7) and replace the cover on the HP 150.

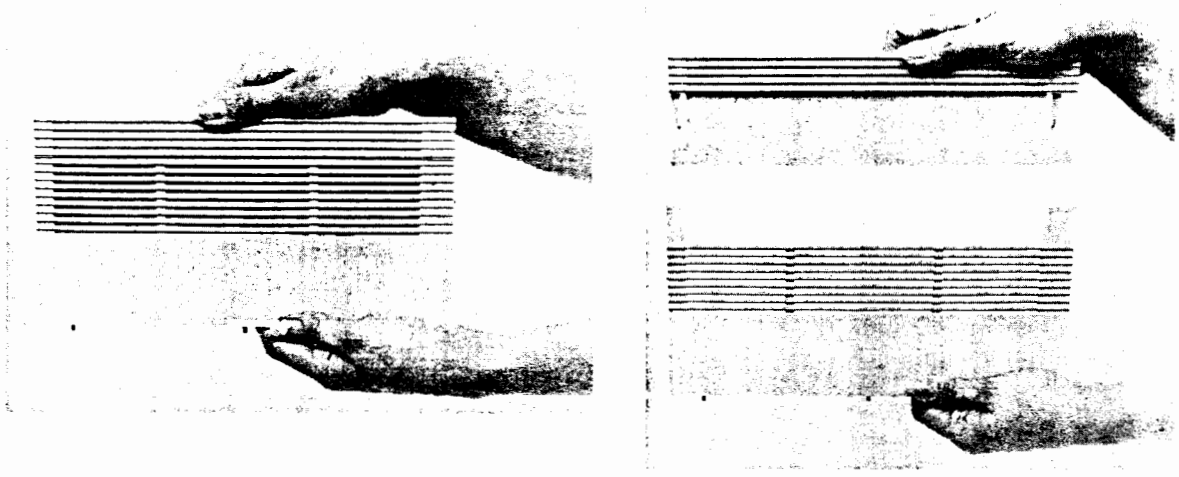


Figure 4-7. Removing the Filler Plate

9. Close the printer access door.

Strapping

Configuration of the HP 150 depends upon how the printer is going to be used (note no hardware strapping of the HP 150 is necessary). To use the HP 2674A to print from applications one of the printer fields in the MS-DOS Device Configuration Utility (depending on whether the HP 2674A is the primary or secondary system printer) should be set to "Internal". If printing is to be initiated via the function keys (i.e. in Locol mode), the "INTERNAL PRINTER" function key must be configured (press the [System] key twice, [f1] (device control), [f3] ("to" devices) and check to see that an asterisk appears in the "INTERNAL PRINTER" function key label).

No strapping of the HP 2674A is required.

ACCESSORY BOARDS

There are two slots available on the HP 150 for user installable accessory boards. The accessory boards currently supplied by Hewlett-Packard for use in the HP 150 are listed below.

45630A	128K RAM Memory
45631A	256K RAM Memory
45632A	384K RAM Memory

Cables

No cables are required to install an accessory board into a HP 150. To install an accessory board listed above, follow the instructions listed below.

1. Power-off the HP 150.

2. Remove the accessory slot cover plate located at the back of the HP 150.

********** NOTE **********

Memory accessory boards must be located in accessory slot #1.

****

3. Slide the accessory board (component side up) into the accessory slot, making sure to align the board in the guides provided. Push the board completely into the unit until it fits securely in the front plane edge connector.

4. Replace accessory slot cover plate.

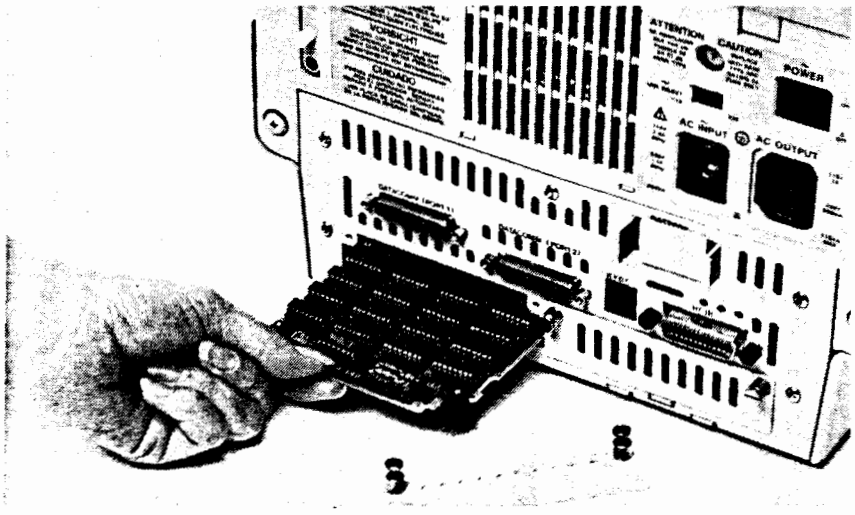


Figure 4-8. Installing an Accessory Board

Strapping

No strapping of the HP 150 or the board itself is required with the currently supplied accessory boards.

PREVENTATIVE MAINTENANCE V

INTRODUCTION

This chapter provides information on preventative maintenance for the HP 150. Preventative maintenance consists of replacing the battery, cleaning the screen and keyboard and adjusting the display. Note that preventative maintenance on the HP 150 is performed by the customer.

BATTERY

The batteries used in the HP 150 are two 1.5 volt, size N batteries. An indication that the batteries need to be replaced is when the "Default configs used" message is displayed on the screen after the unit has been powered on or a hard reset has been performed.

Refer to Chapter VIII for the battery removal and replacement procedures.

CLEANING THE SCREEN AND KEYBOARD

The display screen and the keyboard should be cleaned regularly to remove dust and grease. Lightly dust the entire unit using a damp, lint-free cloth. The cloth should be damp enough to pick up any dust but should not be wet. Avoid wiping dust or lint into the key area of the keyboard or into the Touchscreen holes. Greasy smudges and fingerprints can be removed using most conventional spray cleaners. Avoid spraying between the keys or in the Touchscreen holes by spraying the cloth instead of directly on the unit.

DO NOT use petroleum based cleaners (such as lighter fluid) or cleaners containing benzene, trichlorethylene, ammonia, dilute ammonia or acetone as these chemicals could damage the system's plastic surfaces.

DISPLAY ALIGNMENT

The display alignment should be checked at installation and whenever the system is moved. Proper display alignment is not only necessary for display clarity but is also essential for proper operation of the Touchscreen. Using the Touchscreen with an unaligned display will cause erroneous data to be input to the system.

Procedures

1. Clear both the alpha and graphics display. The alpha display is cleared by pressing the home cursor key, and then [Clear Display]. The graphics display can be cleared by pressing [CTRL], [Shift] and [Clear Display] all at the same time.

2. Display the alignment grid by pressing the [System] key twice, [f3] service keys, [f3] TOUCHSCN ALIGNMNT.

3. Using the Focus adjustment, located at the rear of the HP 150 (see Figure 5-1), adjust the focus of the display.

4. Using the BRIGHT adjustment, located at the rear of the HP 150 (see Figure 5-1), adjust the display to desired brightness.

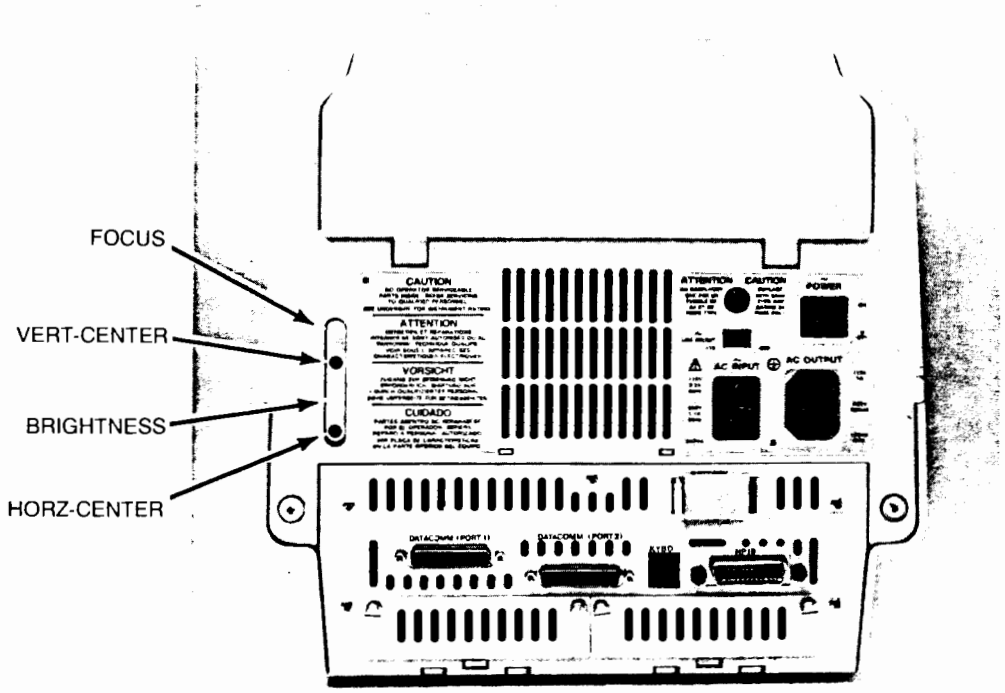


Figure 5-1. HP 150 Rear View

5. Using the alignment tool to turn the HORIZ. CENTER adjustment at the rear of the unit, center the display horizontally on the screen. Do this by lining up the outer left and right hand vertical grid lines with the outer left and right hand Touchscreen holes (see figure 5-2).

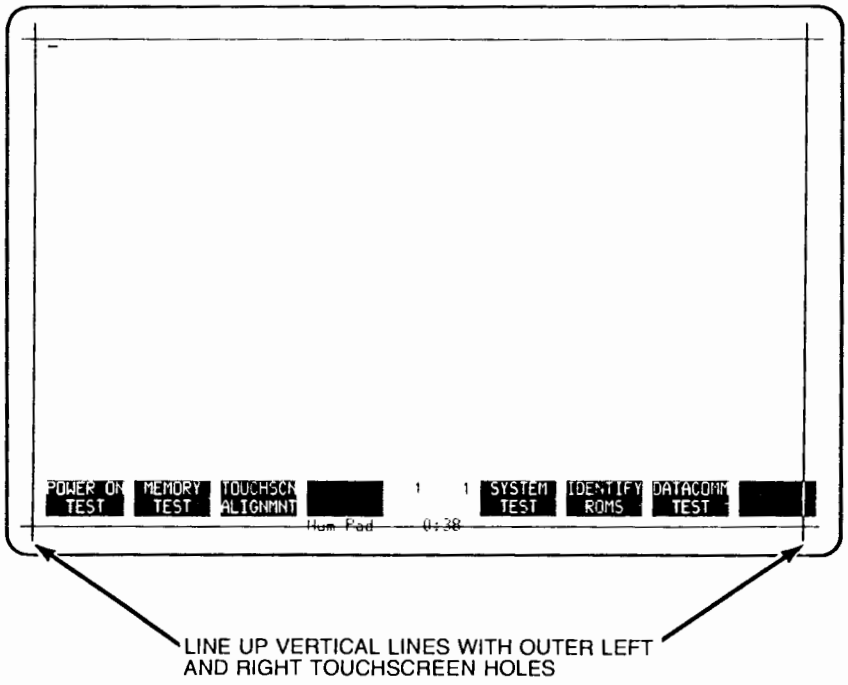


Figure 5-2. Horizontal Display Alignment

6. Using the alignment tool to turn the VERT. CENTER adjustment at the rear of the unit, center the display vertically on the screen. Do this by lining up the top and bottom horizontal grid lines with the top and bottom Touchscreen holes (see figure 5-3).

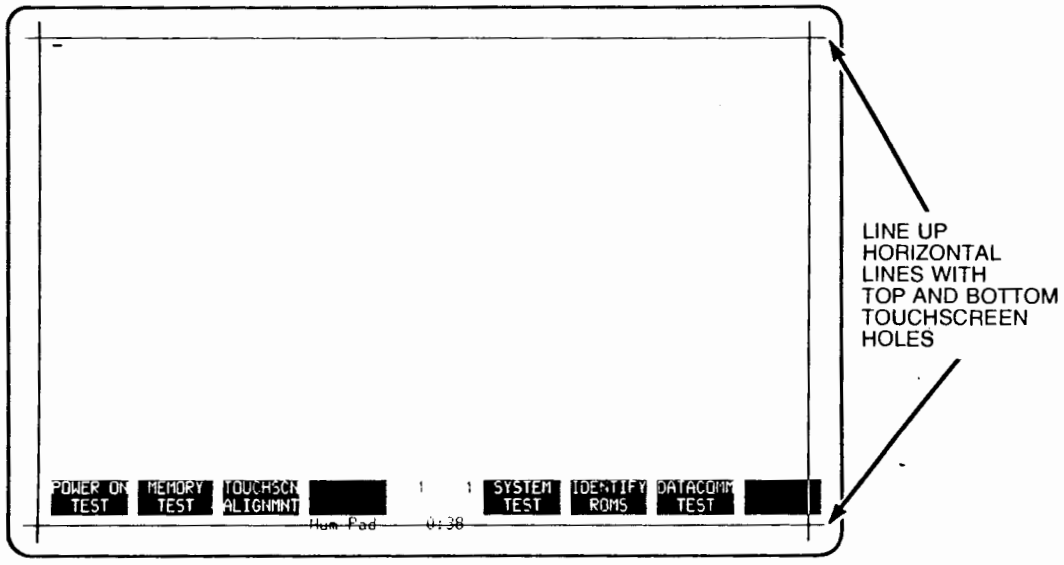


Figure 5-3. Vertical Display Alignment

7. When the above procedures are complete, clear the graphics display to remove the alignment grid from the screen.

TROUBLESHOOTING VI

INTRODUCTION

This chapter covers various techniques of fault isolation and repair of the HP 150. The information contained in this chapter is of two major types. The first portion of the chapter describes in detail the built-in tests. The final portion of the chapter deals with troubleshooting procedures.

The portion on built-in tests describes the Power-On Test, System Test, Datacomm Test, Manufacturing Test, Memory Test, TPM Test, and Identify ROMs function. For each test, a description is given along with the procedure for initiating the test and how to interpret the test results.

The built-in tests should be used first when troubleshooting the HP 150. Any errors reported when running one of these tests should be corrected before continuing. If the built-in tests do not isolate the problem, or if the problem persists, proceed to the troubleshooting procedures portion of this chapter.

The troubleshooting procedures portion starts with the System Troubleshooting section which helps isolate a problem down to a subsystem. This is followed by specific troubleshooting procedures which provide step by step procedures for repairing problems with the LED's, screen (video), touchscreen, keyboard, datacomm, HP-IB, internal printer, external power/environment, power distribution and accessory boards. Finally there is a Test Points and Voltage Specifications section which shows the location of all voltage test points on each PCA and what the specifications are for each voltage.

Test Description

The power-on test is a set of extensive diagnostic tests which occur while the tube is warming up each time the unit is turned on. Around 70-80% of the Processor PCA, Video PCA, and Memory PCA(s) electronics are tested during this period. This built in tool should allow you to quickly isolate the majority of failures.

The flowchart (figure 6-1) describes the tests run during the power-on test as well as the order in which they are run. A more detailed description of each test follows.

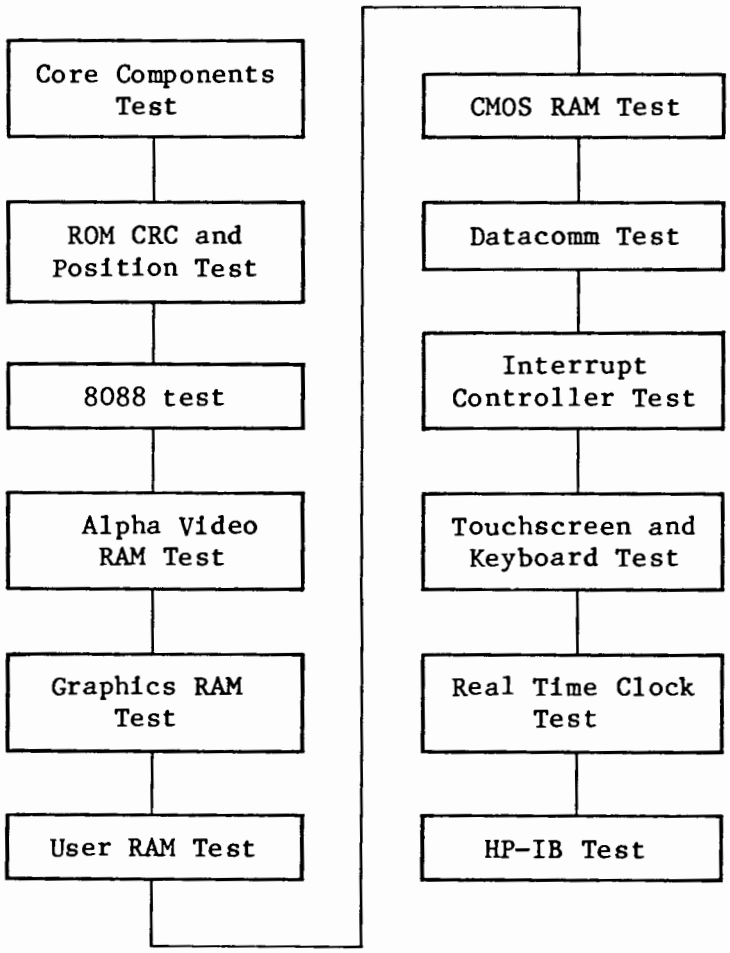


Figure 6-1. Power-on Test Flowchart

CORE COMPONENTS TEST. The 'core components' are those components required to make the power-on test function in its most basic form. The core components consist of the 8088 (U211 on the Processor PCA) ROM 5 (U61 on the Mezzanine Memory PCA) and the six LEDs (located on the Mezzanine Memory board). The 8088, ROM 5 and LEDs are central to the testing of all modules since combined they are responsible for executing the instructions of all the tests run and reporting the hardware failures that occur.

The core components test checks the functionality of the core components. This is done in the following way. When the unit is powered on, the power-on reset signal (PON) from the power supply turns on all LEDs. The first few instructions from ROM 5 turns off all the LEDs and then turns them on and off one at a time (refered to as scanning the LEDs or the walking 1s pattern). This verifies that all LEDs work and work independently as well as verifying partial functioning of ROM 5 and the 8088.

ROM CRC and POSITION TEST. This does a more complete verification of ROM U61 (on the Mezzanine Memory PCA) than in the core components test and also tests all of the remaining ROMs, U62, U63, U64 and U65 (on the Mezzanine Memory PCA). This portion of the power-on test also checks to make sure that all the ROMs are inserted in the correct order.

8088 TEST. This tests some additional functions of the 8088 (U211 on the Processor PCA) not directly checked in the core components test.

ALPHA VIDEO RAM TEST. Performs the following tests on the alpha video RAMs (located on the Video PCA):

1) Marching 1s test. This test fills the memory with a pattern. It reads the first location in memory, verifies the pattern, writes the compliment of the pattern back into the location and goes on to the next location. These steps are repeated throughout the entire alpha video memory. Once this is completed it starts at the last location in memory, verifies the compliment, fills the location with the original pattern and verifies the pattern. It continues these steps until it reaches the first location in memory. If at any time an error is encountered, the test is stopped, the error is reported to the LEDs, and the remainder of the test is not completed.

2) Traveling 1s test. This test writes 80H into the byte under test, writes the compliment to the next byte, and then reads and verifies that 80H is in the byte under test. It repeats these steps with the test byte loaded with 40H, 20H, 10H, 08H 04H, 02H, and 01H. In a similar fashion the test then shifts a zero through the test byte by loading the test byte with 7FH, BFH, DFH, EFH, F7H, FBH, FDH, and FEH. This test is only performed on one byte in each 64K bank of memory.

USER RAM TEST. Performs the following tests on the user RAMs (located on the Mezzanine and Expansion Memory PCA if present):

1) RAM Position test. The user RAM is the RAM located on the Mezzanine Memory PCA and the Memory Expansion PCA. The minimum configuration for user RAM is 256K bytes comprised of 4 64K banks (each bank is 8 bits wide). User RAM can be added in increments of 128K resulting in possible configurations of 256K, 384K, 512K and 640K. This test runs a variety of reads and writes to user memory to determine which banks are present and indicates an error if expected banks are not present.

2) Marching 1s test. This test is identical to the alpha video RAM marching 1s test. It tests all banks found to be present during the RAM position test. Upon finding a failure this test reports which bank is bad. Banks 0-3 reside on the Memory Mezzanine PCA and banks 4-9 reside on the Expansion Memory PCA (if present).

3) RAM integrity test. This test performs a marching 1s test across banks to insure that each bank operates independently of the other banks.

4) Traveling 1s test. This test is identical to the alpha video RAM traveling 1s test. It tests all banks found to be present during the RAM position test and indicates if a bank is bad.

5) RAM refresh test. Since the user RAM is dynamic, it must be refreshed periodically to maintain the data stored in the RAM. This test makes sure that the RAM is being refreshed properly by writing a pattern into RAM and later, after the HP-IB test, checking to make sure that that pattern is still there.

CMOS RAM TESTS. Performs a non-destructive read/compliment/write/read/compliment/write/read on the CMOS RAM chip (U56 located on the Mezzanine Memory PCA). This is the non-volatile (battery backed-up) memory which holds configuration information.

DATACOMM CHIP TEST. Performs partial testing of the data communication USART (U54 on the Processor PCA for port 1 and port 2).

INTERRUPT CONTROLLER TEST. Performs partial testing of the interrupt controller chip (U66 on the Processor PCA) used to control and prioritize any interrupts to the 8088.

GRAPHICS RAM TEST. Performs the following tests on the graphics RAM located on the Video PCA:

1) Marching 1s test. This test is identical to the alpha video marching 1s test.

2) Traveling 1s test. This test is identical to the alpha video traveling 1s test.

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3) RAM refresh test. This test is identical to the RAM refresh test done during the user RAM test.

VIDEO SUBSYSTEM TESTS. Performs partial testing of the video controller chip (U315 on the Video PCA) and other hardware responsible for generating a video display.

KEYBOARD/TOUCHSCREEN CONTROLLER TESTS. Performs partial testing of the keyboard/touchscreen controller chip (U510 on the Processor PCA) used for interfacing the keyboard and touchscreen to the Processor PCA.

REAL TIME CLOCK (RTC) TEST. Performs partial testing on the RTC (U67 on the Processor PCA).

HP-IB CONTROLLER TEST. Performs partial functionality test of the HP-IB Controller chip (U511 on the Processor PCA).

Initiating the Test

The power-on self test can be initiated by any of the following methods:

- Powering on the unit
- Pressing the [System] key twice, [f3] (service keys), [f1] (POWER ON TEST) in sequence

********** CAUTION **********

THE POWER-ON TEST IS A DESTRUCTIVE TEST. Running this test will result in the loss of all data that resides in RAM.

****

Test Results

The power-on test shows its results in two ways. One way is with display messages on the screen (if possible). The messages on the screen describe the general nature and location of a fault. This can be used by a customer to determine if a call is necessary for service.

The second way is with LED codes. During the test, if any faults are detected, the code describing the fault is displayed on the six LEDs located on the Mezzanine Memory PCA. They can be viewed from the back of the unit looking through the grill in the back plate.

Self-test LEDs are controlled by the 8088 and are quite specific. If the power-on test fails, then the LEDs on the Mezzanine Memory PCA display a code which identifies the problem down to a component level.

The power-on test will try to run to completion. If multiple failures occur, each failure code will be displayed in succession. Note that the first failure should be corrected and then the test re-run since subsequent failures can be caused by the first failure.

Power-on Display Messages

"Power-on test failed XXXX"

A Power-on Test has failed. The XXXX code indicates the functional area of the detected fault. The code is a sixteen bit code shown as four hexadecimal digits. Each bit is the status for a test section with a '0' representing passing the test and a '1' representing failure of the test section.

Figure 6-2 shows the four hex digits expanded into a sixteen bit code and explains the meaning of each bit (note that bits 7 and 11 are not used). For example, the code C011 would translate to the sixteen bit pattern 1100 0000 0001 0001. Figure 6-2 shows that this code is a result of a combination of datacomm, HP-IB, ROM and CMOS problems.

"Default configs used"

The configuration information should be retained within the system even while the power is switched off. The above message means that the configuration was lost when the unit was switched off. The system may or may not be able to hold any changes made to the default settings of the configuration menus while the power is on. To correct the problem, replace the battery on the unit. If the failure continues, refer to the next level of support. All other parts of the system should operate correctly.

"Load Op Sys failed, device not found"

This error message appears when the HP 150 tries to load the operating system and cannot because of one of the following reasons:

1. Power on the disc drive is off.
2. There is no disc drive connected.
3. The disc drive is configured to the wrong HP-IB address.

Check to make sure that the drive is plugged in and the power is on. Also be sure that the drive is configured to the proper address and that the HP-IB cable is securely attached. If the problem persists, refer to the HP-IB Problems section of this chapter.

"Load Op Sys failed, Op Sys disc not found"

This error message appears when the HP 150 tries to load the operating system and cannot because no disc was found in the specified disc drive. Check to make sure that the "Op Sys Dev" field of the Global configuration menu corresponds to the drive which contains the operating system. If the problem persists, refer to the HP-IB Problem section in this chapter.

"Load Op Sys failed, no Op Sys on disc"

This error message appears when the HP 150 tries to load the operating system and cannot because the disc in the specified drive does not contain a valid operating system. Check the disc in the specified drive to verify that it has a valid operating system. If possible, try another disc that has an operating system. If the problem continues, refer to the HP-IB Problems section in this chapter.

"Load Op Sys failed, not enough memory"

This error message appears when the HP 150 tries to load the operating system and cannot because their is insufficient memory in the system. If this occurs, run the run the power-on test and fix any problems pointed out via the LED codes (refer to the LED Codes section of this chapter). If the problem continues replace the Mezzanine Memory board. If the problem persists refer service to the next level of support.

"Load Op Sys failed"

This error message appears when the HP 150 tries to load the operating system and cannot because of some unknown reason such as an HP-IB error or a garbled disc sector. Try loading the operating system from a known good disc. If the problem persists refer to the HP-IB Problems section of this chapter.

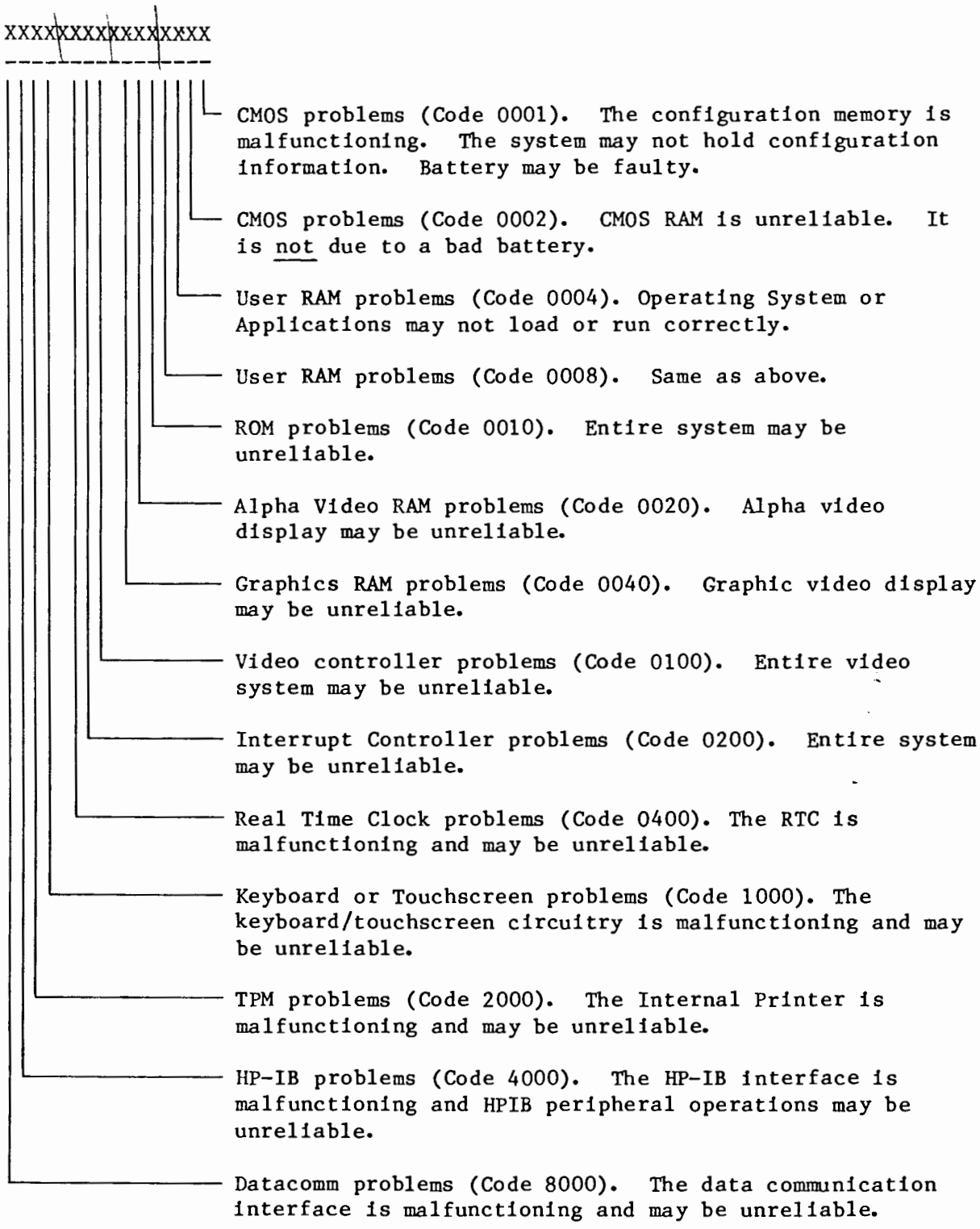


Figure 6-2. Power-on Test Failure Display Codes

LED Codes

When the unit is powered up, the reset signal from the power supply turns the LEDs on. This confirms that the LEDs have power to them and that all the LEDs work. The first instructions executed from ROM turns off the LEDs and then turns them on one at a time (scans the LEDs). The scan (also called the walking 1s pattern) verifies that the core components are at least partially functional and capable of being used to test the remaining hardware.

If during power up this sequence does not take place (e.g. LEDs come on but don't go off, two or more LEDs come on at the same time during the scan etc.), then the LED codes throughout the remainder of the test are unreliable. Refer to LED Code Problems section of this chapter for further information.

As the test proceeds, failure codes are displayed in a four segment code on the LEDs each time faulty hardware is found. Each segment will flash on for about four seconds. In addition, all LEDs will be off for about one second in between segments. The first two LEDs tell which segment of the code is being displayed and the other four LED's display the code (see figure 6-3). Therefore, each hardware failure will result in a 16 bit code displayed in four segments. For example, the failure code 1111000011110000 (F0F0 in hex) would be displayed as follows:

First LED code -------> 001111
Second LED code -------> 010000
Third LED code -------> 101111
Fourth LED code -------> 110000

The failure codes will identify either the socketed component(s) to be replaced or indicate a 'non-socketed component problem' which indicates that the PCA cannot be serviced at the replaceable component level and the PCA must be replaced.

LED Code	Segment of Code	Resulting Failure Code
00aaaa	First	aaaabbbbccccdddd
01bbbb	Second	
10cccc	Third	
11dddd	Fourth	

Note: a,b,c,d represent any combinition of 1s and 0's

Figure 6-3. Reading the LED Codes

The first LED code displayed following the LED scan is usually correct. Use it first when troubleshooting power-on test failures. Any codes displayed after this may be invalid.

Replacement of a component will not always solve the problem; the LED code is only a good estimation of what is wrong. It merely gives you the best opportunity to diagnose a problem without sophisticated test equipment. For example, it is impossible for the test to differentiate between a faulty component and a faulty socket, or a poor solder joint at the socket.

Appendix B lists the failure codes, in hex, for the power-on, datacomm, manufacturing, and memory self-test along with a description of the test that failed and the appropriate method of repair. Refer to it for interpretation of the LED codes. Notice that as a rule the last two hex digits are don't care digits (denoted by an "x"). This portion of the code tells in more detail the nature of the failure but is not useful for board level repair.

The LED codes can be read from the back of the unit through the back plate. The location of the LED's and their order is shown in figure 6-4.

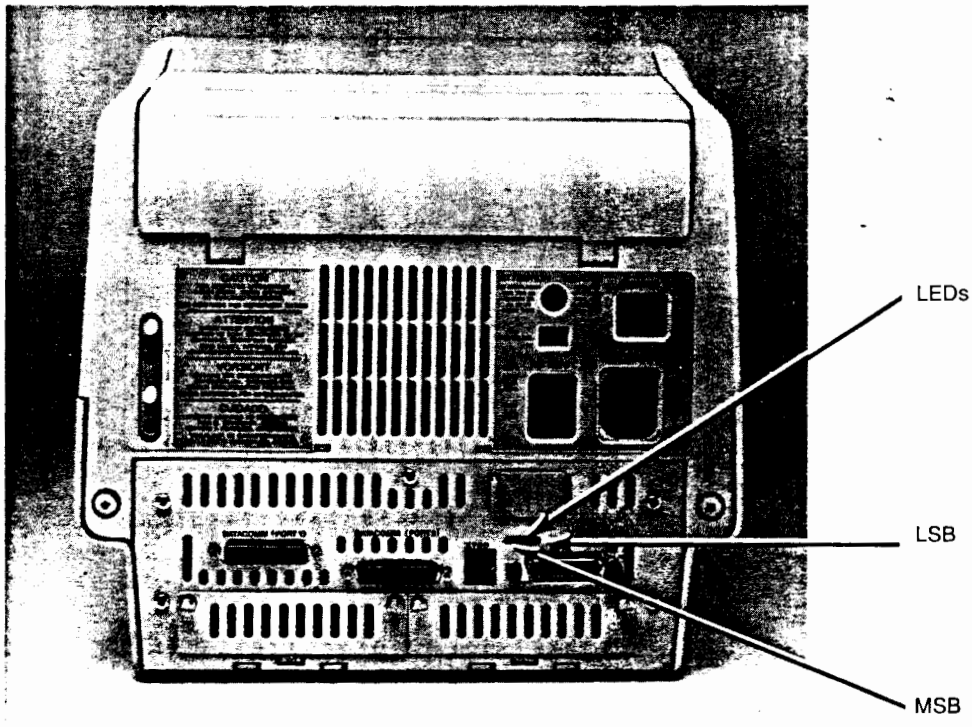


Figure 6-4. Reading the LEDs

Test Description

The system test consists of a number of separate tests run one after another. It is identical to the power-on test except for the following differences:

- The core components test is not performed. Therefore the LEDs are not scanned.
- All RAM tests (user, alpha, and graphics) performed are non destructive tests. The tests that are run include the RAM position test, the RAM integrity test, and the traveling 1s test. Therefore, running the system test will not result in the loss of data in RAM.
- The interrupt controller, HP-IB and datacomm tests are not performed.
- A Character ROM test is performed which displays the contents of the Character ROM on the screen.

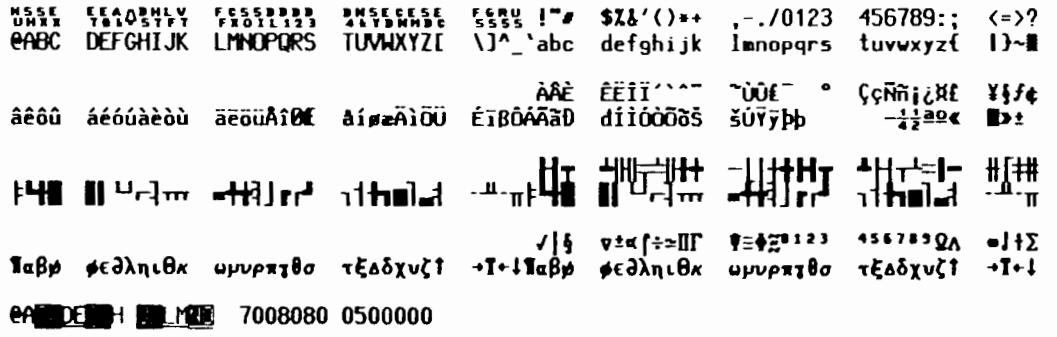
Initiating The Test

The system test can be initiated by pressing the following keys in sequence:

- [System] key twice, [f3] (service keys), [f5] (SYSTEM TEST) .

Test Results

Upon completion of the system test the following test pattern will be displayed on the screen:



If an error occurs during the system test the following message will also be displayed at the bottom of the screen:

System test failed XXXX
Press RETURN to clear

The XXXX code is a four digit hex code telling which test failed. This code is identical to the code described in the Power-on Display Messages. Refer to figure 6-2 for interpretation of the failure code.

DATACOMM TEST

Test Description

The datacomm test does an extensive set of tests on both datacomm port 1 and datacomm port 2. The datacomm test assumes that there is a datacomm test hood present (part number 02620-60062) on both ports. If the test hood is not present, the test will result in the error message:

```
Datacomm test failed  A2xx
Press RETURN to clear
```

for Port 1 and:

```
Datacomm test failed  B2xx
Press RETURN to clear
```

for Port 2. Note that the xx portion of the code represents don't care states and therefore can be any combination of hex digits.

During the datacomm test the following tests are performed:

DATA LOOP-BACK TEST. This tests for data integrity by sending data out and ensuring that the same data is looped back. This test assumes a loop-back test hood is in place on the datacomm back panel connectors linking the following signals together:

RS-449 Protocol:	RS-232 Protocol:
OCD1 - OCR1	CH - CE
OCD2 - OCR2	SCA - SCF
RS - RR	CA - CF
RS - CS	CA - CB
TR - DM	CD - CC
SD - RD	BA - BB

CONTROL LINE LOOP-BACK TEST. This test checks for the integrity of the datacomm control lines by toggling a control line on the output, looping that line back to the corresponding control line input and ensuring that the input line was toggled as well. This test also assumes the presence of a loopback hood as described above.

BAUD RATE TEST. This tests the integrity of the USART's baud rate generator. The only baud rate that is tested however is the baud rate that the port is configured for.

Initiating the Test

The datacomm test can be initiated by pressing the following keys in sequence:

- [System] key twice, [f3] (service keys), [f7] (DATACOMM TEST)

Test Results

If an error ocurrs, the failure code is displayed at the bottom of the screen as follows:

```
Datacomm test failed  XXXX
Press RETURN to clear
```

The XXXX code is a four digit hex code that describes in detail the test that failed. Refer to Appendix B for interpretation of the failure code.

MEMORY TEST

Test Description

The memory test is an extensive test of the user RAM only. The test runs all the user RAM tests run during the power-on test. In addition there is an extensive user RAM test that is run. This test does a traveling 1s test in every location of RAM (rather than in one location for every 64K bank) and a series of marching 1s tests with several different patterns. Because the memory test is so extensive, it takes about 5 minutes to complete. Aborting the test before completion can be accomplished by performing a hard reset.

Initiating the Test

The memory test can be initiated by pressing the following keys in sequence:

- [System] key twice, [f3] (service keys), [f2] (MEMORY TEST)

********** CAUTION **********

MEMORY TEST IS A DESTRUCTIVE TEST! Running the memory test will result in the loss of all data that resides in user RAM.

****

Test Results

When the test is initiated the screen is cleared and a string of numbers appear across the screen starting with 0 and ending somewhere between 3 and 9. The numbers represent the banks of memory present. For example, a system with a minimum memory configuration of 256K (4 banks) will display the numbers 0 to 3 while a system with 640K of memory (10 banks) will display the numbers 0 through 9. As the test proceeds, the number representing the bank that is being tested will be highlighted in inverse video. If an error ocurrs during memory test, the test is aborted and the following error message will appear on the bottom of the screen:

Memory test failed XXXX
Press RETURN to clear

The XXXX code is a four digit hex number that describes the nature of the failure. Refer to Appendix B for interpretation of the failure codes.

TPM TEST

Test Description

The TPM test is a basic functionality test of the internal printer. In this test the TPM's ability to print data is tested by sending the TPM an Esc z which initiates the TPM's self-test. This causes the TPM to print two lines of data. If the lines are printed, the test passes. If the lines do not print, refer to the Internal Printer Problems section of this chapter.

Initiating the Test

The internal printer test can be initiated by pressing the following keys in sequence:

- [System] key twice, [f3] (service keys), [f8] (INT PTR TEST)

Test Results

If the test passes, the following ASCII string is printed by the internal printer:

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~■
PROM CODE DATE:  05/09/83
```

If this is not printed or if any variations occur, refer to the Internal Printer Problems section of this chapter.

MANUFACTURING TEST

Test Description

The Manufacturing Test is a series of tests that, once initiated, will run until a hard reset is performed. The tests run during the manufacturing test include the same tests run during the power-on (except for the tests involving the keyboard thus allowing the keyboard to be unattached during the manufacturing test), memory, datacomm and system self-tests. In addition there is a graphics screen test which tests the ability to display graphics characters by displaying various graphics patterns on the screen. These tests run in a continuous loop until the manufacturing test is exited by one of the methods described above. This allows the system hardware to be exercised over an extended period of time.

Note: since the datacomm test is run during manufacturing test, datacomm test hoods are needed to complete the test.

Initiating The Test

The manufacturing test can be initiated by pressing the following keys ALL AT ONCE:

- right [Shift], [CTRL], left [Shift], [Enter]

Test Results

ALIGNMENT SCREEN. The first screen to come up after the test has been initiated is a video alignment screen (similar to the touchscreen alignment screen described in the Adjustment Chapter but in inverse video). This will remain on the screen until [Return] is pressed to continue or a [CTRL] [Shift] [Reset] combination is pressed to reset the unit.

NORMAL VIDEO @. The alignment screen is replaced with normal video @ until the [Return] key is hit to continue or the unit is reset.

INVERSE VIDEO @. The normal video @ screen is replaced with an inverse video @ screen until the [Return] key is hit to continue or the unit is reset.

MANUFACTURING TEST SCREEN. The alignment screen is replaced with the manufacturing test screen which stays on the screen for the remainder of the manufacturing test (except during the graphics display test). The top part of the screen (the first 16 lines) displays the contents of the Character ROM. Then, on line 18, all the terminal's video enhancements (except blinking) are displayed. On line 20 is the "Cycle Count" field. This field displays the number of times the manufacturing test has cycled completely through all of the tests. On line 22, is the "Test #" field which displays the test that is being performed. Finally, on line 26 is the memory bank field which displays the banks of memory contained in the system and which bank

displays the banks of memory contained in the system and which bank is currently being tested. Refer to the Memory Test section for a more complete description of this field. During manufacturing test, if an error ocurrs, the following error message will be displayed at the bottom of the screen:

"Mfg Test Error TXXXX"
Press RETURN to clear

The XXXX portion of the code is a four digit hex code that describes in detail the test that failed. Refer to appendix B for interpretation of these codes.

IDENTIFY ROMS

Test Description

The Identify ROMs is more of a status check of the ROMs than an actual test. When this "test" is initiated, the screen displays the identifying part number and datecode of each ROM. The printout form and a description of the fields is shown below (U numbers shown correspond to the U numbers on the Mezzanine Memory PCA).

```
Firmware IDs:
-------------
xxxx-xxxx xxxx      <-- U65    ROM 1
xxxx-xxxx xxxx      <-- U64    ROM 2
xxxx-xxxx xxxx      <-- U63    ROM 3
xxxx-xxxx xxxx      <-- U62    ROM 4
xxxx-xxxx xxxx      <-- U61    ROM 5
      |       |
      |       └── ROM Datecode
      |
      └────── ROM Part number
```

Initiating The Test

This test is initiated by pressing the following keys in sequence:

- [System] key twice, [f3] (service keys), [f6] (Identify ROMS)

This section describes some general classes of faults at the system level and gives some insight as to the possible causes and isolation techniques for the faults.

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Error message displayed on the screen:

1. If it is a self-test message, refer to the appropriate self-test section in this chapter.
2. If it is a message issued by an application, refer to the appropriate application manual.
3. If it is a message issued by MS DOS or the terminal (preceded by one or two asterisks, "*" or "**"), refer to Appendix A at the back of this manual.

LED value(s) displayed on the Mezzanine Memory PCA:

1. Refer to the Power-On Test section in this chapter.
2. If the LEDs do not perform as described in the Power-On Test section, refer to the LED Code Problems section in this chapter.

Missing, incomplete, or improper display:

1. Refer to the Screen (Video) Problems section in this chapter.

Touchscreen is not working correctly:

1. Refer to the Touchscreen Problems section in this chapter.

Keyboard not responding as expected:

1. Refer to the Keyboard Problems section in this chapter.

Disc, HP-IB plotter, or HP-IB printer not working as expected:

1. Refer to the HP-IB Problems section in this chapter.

Serial printer or host computer communication not working as expected:

1. Refer to the Datacomm Problems section in this chapter.

Internal printer is not working correctly

1. Refer to the Internal Printer Problems section in this chapter.

Power or Environment suspected as a source of a problem:

1. Refer to the External Power/Environment Problems section in this chapter.

2. Refer to the Power Distribution Problems section in this chapter.

Operating System does not load:

1. Be sure the system is configured as a personal computer (refer to the Configuration Menu chapter of this manual).

2. Be sure the disc drive containing the operating system is the same one configured in the "Op Sys Dev" field of the global configuration menu (see the Configuration chapter).

3. Run the memory test to ensure full functionality of user RAM. If an error occurs, refer to the Memory Test section of this chapter.

4. Refer to the HP-IB Problems section in this chapter.

The LEDs on the Mezzanine Memory PCA are used by the power-on test to report hardware failures found during power up. It is therefore important that the LEDs be reliable. The reliability of the LEDs (and core components) is checked during the core components section of the power-on test and include the LEDs coming on all at once, shutting off all at once, and then turning on one at a time (walking 1s pattern). Possible variations of this sequence include:

- LEDs never come on
- LEDs come on but never shut off or shut off but don't perform the walking 1s pattern.
- During the walking 1s pattern, two or more LEDs come on at the same time.

Possible Reasons for Core Components Test Failure:

- Failure of an external device (e.g. keyboard) is preventing the Processor or Mezzanine Memory PCA operation.
- Failure of one of the other PCAs such as an accessory PCA, Video PCA, or Touchscreen PCA.
- Logic power supply levels on a PCA are out of specifications.
- A 'core component' has failed.
- A non-core component has failed and is preventing correct operation of the core components.

Troubleshooting Procedure:

If any variations to the core components test occur, follow this procedure step by step checking for proper operation at every stage:

1. Disconnect all external devices from the HP 150, including the keyboard, HP-IB cable(s), and datacomm cables. Also take out all accessory boards. Perform the power-on test again. If the LEDs pass the core components test, fix any problems reported by the LEDs during the remainder of the power-on test (notice that the keyboard test should fail since the keyboard is not connected). Next, add the accessory boards and then the external devices one at a time until the unit or cable causing the problem is isolated.
2. Replace ROM 5 (U61 on the Mezzanine Memory PCA)

3. If the problem persists, check for power distribution problems. Refer to the Power Distribution Problems section of this chapter.

4. Check for an excessively hot or burnt out component anywhere on the PCAs. Replace the PCA.

5. Remove all the ROMs except ROM 5. If the LEDs scan, replace the ROMs one at a time, powering up the unit after each component is re-inserted, to isolate the faulty ROM.

6. If the LEDs still do not scan, replace the Mezzanine Memory, Processor and Video PCA one at a time.

7. If the problem persists, refer service to the next level of support.

SCREEN (VIDEO) PROBLEMS

Screen Content or Screen Quality

Screen Content Problems:

Examples:
- The letter "X" is displayed everywhere there should be an "H"
- Every character on the the line is the same
- The letter "X" always appears in column 5 line 10.

Likely causes:
- Component on the Video PCA
- It is NOT due to the Sweep PCA

Screen Quality Problems:

Examples:
- No display
- Characters out of focus
- Width or height of characters wrong

Likely causes:
- Raster alignments
- Sweep PCA
- CRT/Yoke
- Power Supply
- Processor PCA

Troubleshooting Procedure:

When screen (video) problems occur, follow this procedure step by step checking for proper operation at every stage:

1. Press [CTRL] [Shift] [Reset] simultaneously to reset the unit and clear the screen.

2. Be sure that the cable from the Front Plane to the Sweep PCA is securely connected. Be sure that all PCAs and all socketed components are seated properly.

3. Determine if the problem is a "screen content" or "screen quality" problem.

4. If the problem is screen content, then replace the Video PCA.

5. If the problem is that there is no display, then:

   a. Check the brightness adjustment on the back of the unit (refer to Chapter VII).

   b. Check to make sure that the voltage option switch at the back of the unit is configured for the proper voltage.

   c. Check the +5 volts on the Power Supply. If the voltage is out of specification, replace the Power Supply. If it is

still out of specification, follow the procedures outlined in the Power Distribution Problems section of this chapter.

d. Check the +5 volts on the Sweep PCA. If it is out of specifications, replace the Sweep PCA.

e. Replace the Video PCA.

f. Change the Sweep PCA and/or cable from the Sweep PCA to the Front Plane.

g. Change the CRT/Yoke Assembly.

6. If the problem appears to be with the quality of the characters on the screen, then:

a. Check all display alignments (refer to Chapter VII). If there is no display, turn the brightness up and see if raster scan lines are displayed.

b. Change the Sweep PCA and/or the cable from the Sweep PCA to the Front Plane.

c. Replace the Video PCA.

d. Change the CRT/Yoke assembly.

7. If none of the above steps resolves the problem, refer service to the next level of support.

TOUCHSCREEN PROBLEMS

Alignment vs Malfunction

Alignment Problems:

Examples:
- Pointing to a screen function key causes the adjacent function key to be activated
- In order to activate the area shown on the screen, you must always touch off to the left of that area

Likely causes:
- Display is out of alignment.

Malfunction Problems:

Examples:
- Screen doesn't respond at all
- Certain areas of the screen don't respond

Likely causes:
- Component on Processor PCA
- Component on Touchscreen PCA
- LED emitter pair(s) is(are) blocked

Troubleshooting Procedures:

When touchscreen problems occur, follow this procedure step by step checking for proper operation at every stage:

1. Determine if the problem is an "alignment" or "malfunction" problem. If it is an alignment problem, refer to the Adjustments chapter of this manual.

2. If only certain areas of the screen respond, it may indicate that some of the LED emitter pairs are blocked. To correct this problem, remove the bezel from the mainframe as described in the Touchscreen section of the Removal and Replacement chapter of this manual. Make sure that the touchscreen grid holes in the bezel are clear of dust and debris. Also be sure that the light tubes mounted over the LEDs are clear of dust and debris.

3. Ensure that the touchscreen cable is securely attached at the Processor PCA and the Touchscreen PCA.

4. Replace the Touchscreen PCA.

5. Replace the touchscreen cable.

6. If these steps fail to resolve the problem, refer service to the next level of support.

KEYBOARD PROBLEMS

Troubleshooting Procedure:

When keyboard problems occur, follow this step by step procedure checking for proper operation at every stage:

1. Press the [System] and [Shift] [System] keys to ensure that the keyboard is not responding. The function key labels should change if the keyboard is working properly. If only a beep is heard, the keyboard is responding but is logically locked by software.

2. Press [CTRL], [Shift], and [Reset] all at the same time to hard-reset the unit. This should unlock any logical keyboard lockouts. There should be a beep at the end of the reset operation. Check all keys.

3. Power-off and then power-on the unit to reset it. The keyboard controller should cause a beep to be heard indicating that it is functioning and has power. Resolve any LED codes or screen messages that may occur before continuing. Check all keys.

4. Ensure the keyboard cable is securely attached to both the HP 150 and the keyboard.

5. Replace the keyboard.

6. If these steps fail to resolve the problem, refer service to the next level of support.

DATACOMM PROBLEMS

Troubleshooting Procedure:

When datacomm problems occur, follow this procedure step by step checking for proper operation at every step:

1. Ensure your configuration is correct in the configuration menu and in the host computer/peripheral. Refer to Chapter IV for proper device configuration.

2. Ensure that the datacomm cable is connected securely to the rear panel and host computer/peripheral, and that it is the correct cable for your application. For more information, refer to Chapter IV.

3. Disconnect all datacomm cables from the rear panel, install the datacomm test hoods (part number 02620-60062) and run the datacomm test. Note that both ports 1 and 2 are tested and thus require a test hood. Fix all problems reported during the datacomm test before continuing.

5. If the test passed, the HP 150 hardware is indicated to be functional. Check that the cable is functional (use a continuity tester).

6. If the problem persists, check that all PCAs are seated properly and cables to the Front Plane are installed securely.

7. If the problem still exists, then replace the Processor PCA (for a port 2 failure) or the Mezzanine Datacomm PCA (for a port 1 failure).

8. If the problem persists, refer service to the next level of support.

HP-IB PROBLEMS

HP-IB problems are problems which seem to affect more than one device on the HP-IB bus. If only one device is involved, the procedures outlined here may not be appropriate.

Troubleshooting Procedure:

When HP-IB problems occur, follow this step by step procedure, checking for proper operation at every stage:

1. Ensure all HP-IB cables are securely attached including the unit rear panel connection.

2. Do not have any cables connected to the HP-IB which are not connected at both ends (no cables hanging free).

3. Be sure that the total HP-IB cable lengths do not sum to more than one meter plus one meter per device. (Three meters for a system with a disc and a printer on the HP-IB).

4. Be sure that every device connected to the HP-IB is powered-on and is connected by some chain to the HP 150.

5. Be sure that all devices on the HP-IB bus are configured to their proper device numbers and that no two devices are configured to the same address. Power off and on any device which has been re-configured. Refer to Chapter IV for proper device configurations.

6. Be sure the system power is good and that all devices share a common ground.

7. Power off and then power on all devices on the HP-IB. Sometimes a device other than the one that is reporting a problem will hang-up the bus. (e.g. The disc could be reporting an error when the printer is actually causing the problem.)

8. Disconnect all HP-IB devices from the HP 150 and add them one at a time until a failure occurs either with the HP 150 or with the device. The last device added or its HP-IB cable is probably the cause of the fault. If replacing the device and/or the cable does not solve the problem then the fault most likely resides on the Processor PCA.

9. If the problem appears to be on the Processor PCA then replace the Processor PCA.

10. If these steps fail to resolve the problem, refer service to the next level of support.

INTERNAL PRINTER PROBLEMS

Troubleshooting Procedure:

When internal printer problems occur, follow this step by step procedure checking for proper operation at every stage.

1. Turn off the HP 150 and ensure that the cable is securely attached to the printer and that paper is installed.

2. Turn on the unit. The printer should perform two line feeds and then sweep the print head across the page and back. If this does not happen then check the state of the green PWR LED located near the input connector:

   a. If the LED is on, the problem is in the printer.

   b. If the LED is off, make sure that the printer cable is securely attached to the to the Power Supply PCA. Also check for proper power distribution (refer to the Power Distribution section of this chapter). Replace any cable or PCA isolated during the power distribution check.

3. If the print head did sweep, push the TEST switch located to the left of the connector. The printer should print the following two lines of data:

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~■
PROM CODE DATE:  05/09/83
```

   If this does not occur, the problem is with the printer.

4. If the test passes, try sending some data to the printer (e.g from the screen using the COPY ALL function key) while observing the DATA LED near the connector:

   a. If the LED blinks off and on during data transmission but no printing occurs or if the LED comes on and stays on then the problem is with the printer.

   b. If the LED remains off check the cable connecting the Front Plane to the printer for proper operation (use a continuity tester). If the problem persists, replace the Processor PCA. If the problem still persists, replace the Front Plane.

5. If the problem persists, refer service to the next level of support.

Computer Museum

Troubleshooting Procedure:

Most power problems tend to be either in connecting the power or problems with the power supplied by the power company. Power conditioners and isolation transformers can be used to help at solving problems which originate locally.

1. Be certain that all power cords are plugged into working sockets.

2. All the devices on the system should have the same circuit breaker and the system should be the only equipment on the breaker (no toasters or coffee makers). Be sure the breaker is not tripped.

3. It is highly recommended that the required third-wire ground be isolated from other third-wire grounds. Data transfers will fail if all HP-IB devices are not properly grounded and are not all on the same circuit.

4. Be sure that all of the devices are configured for the local voltage and frequency. Check the fuses.

Environment problems include radiated interference, airborne contaminants, temperature, and humidity. The outline below describes each of these areas.

1. Radiated Interference - Disc errors are the most common symptom. Sources include communications and radar installations (such as at airports), business two-way radio transmitters, and broadcast radio/TV transmitters. Hand-held transceivers ("walkie-talkies") and microwave links can also cause problems.

2. Airborne Contaminants - Damage to disc media and the disc drive heads resulting in disc errors is the most common problem. Sources include dust, smoke, ashes, eraser crumbs, and bread crumbs. Solvent vapors, such as those from liquid spirit duplicating equipment and wet process copiers, can soften disc coatings over a period of time resulting in intermittent disc errors.

3. Temperature and Humidity - Be sure the system is in an environment within the specifications listed in the Data Sheet for the HP 150. Be sure heated air is allowed to exhaust from the HP 150 and its peripherals. In dry and cold climates, static electricity from carpets can cause problems.

POWER DISTRIBUTION PROBLEMS

Troubleshooting Procedure:

When power distribution problems occur inside the HP 150, follow this step by step procedure checking for proper operation at every step:

1. Ensure that the incoming power to the HP 150 is within specifications (refer to the Data Sheets in Chapter 1).

2. Check that the fuse is installed properly, is not blown, and is of the proper rating. Also check that the voltage option switch is set at the proper voltage.

3. Check that all internal cables are securely attached and that all PCAs/components are seated properly.

4. Check the voltages on the Power Supply. If there is no output on the +5 and +12 volt line, shut off the unit and short the two pads labeled RESET on the non-component side of the Power Supply PCA. This will reset the supply if an over voltage/current condition had caused the supply to shut down (see Functional Operation).

4. If the problem continues or if the problem is of a different nature (e.g. the voltages are there but are out of specifications), replace the Power Supply PCA.

5. If the problem continues, remove all the PCAs (including the Sweep and the Touchscreen PCAs) except the Video PCA and measure the Power Supply voltages. (The Video PCA must remain to load the Power Supply. Without a minimum load the supply voltages will not be reliable.) If the problem persists, replace the Video PCA. If that does not solve the problem, check the Power Panel.

6. If the Power Supply by itself is within specifications, but not when connected to the other PCAs, isolate the PCA or cable that is causing the problem by adding the PCAs and/or cables one at a time, measuring voltages on the Power Supply at each stage. When one or more voltages go out of specifications, change the last PCA or cable added.

5. If all voltages on the Power Supply are within specifications when it is supplying power to the entire HP 150, check voltages at the test points on the other PCAs (see Test Points and Voltage Specifications section at the end of this chapter). If one or more voltages are out of specifications, replace the appropriate PCA or connecting cable.

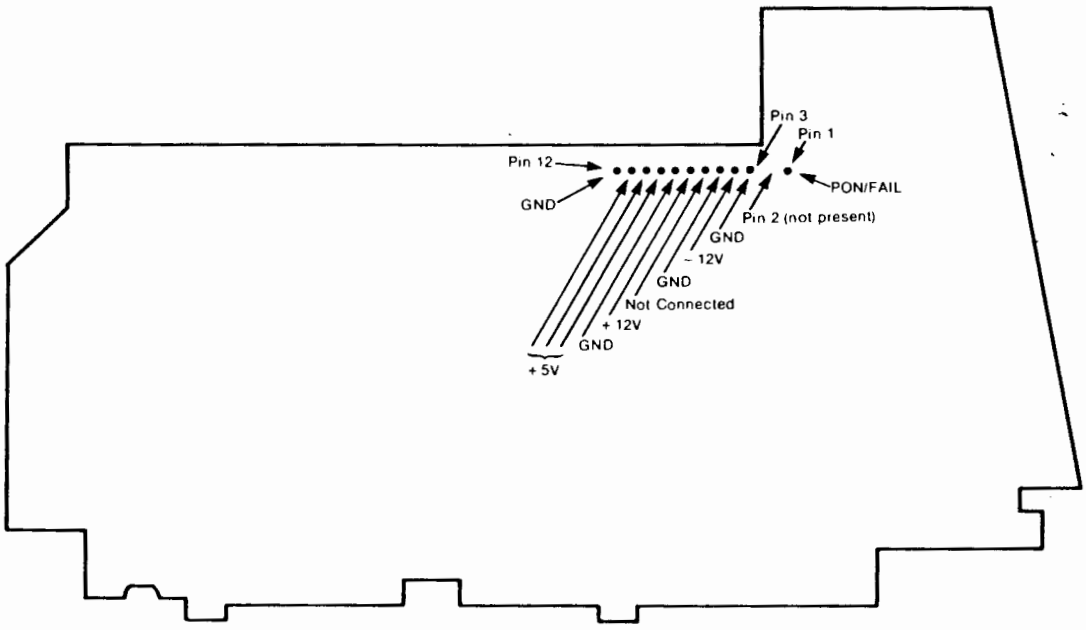
TEST POINTS AND VOLTAGE SPECIFICATIONS

The operating voltages supplied by the HP 150 Power Supply include +12 volts, +5 volts, and -12 volts. These voltages must be within the following tolerances for proper operation:

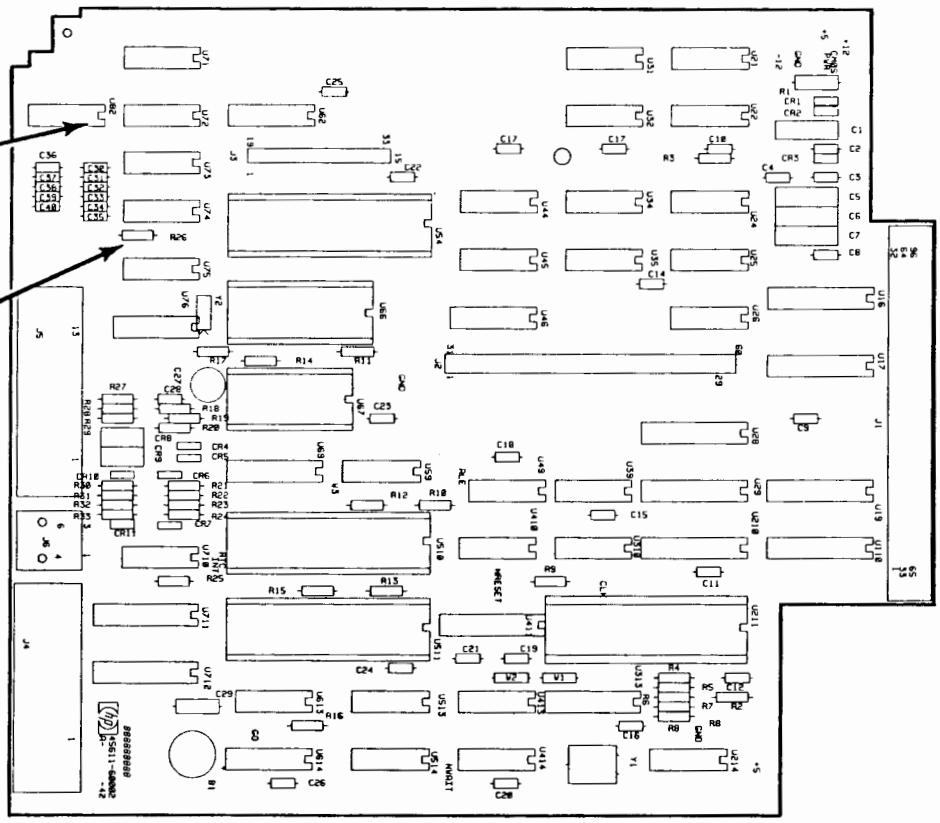
$$+11.6 < +12 < +12.4$$
$$+4.8 < +5 < +5.2$$
$$-12.8 < -12 < -11.2$$

The following diagrams illustrate points where these voltages can be measured when checking for proper power distribution. Notice that ground can be taken on any exposed metal portion of the chassis.

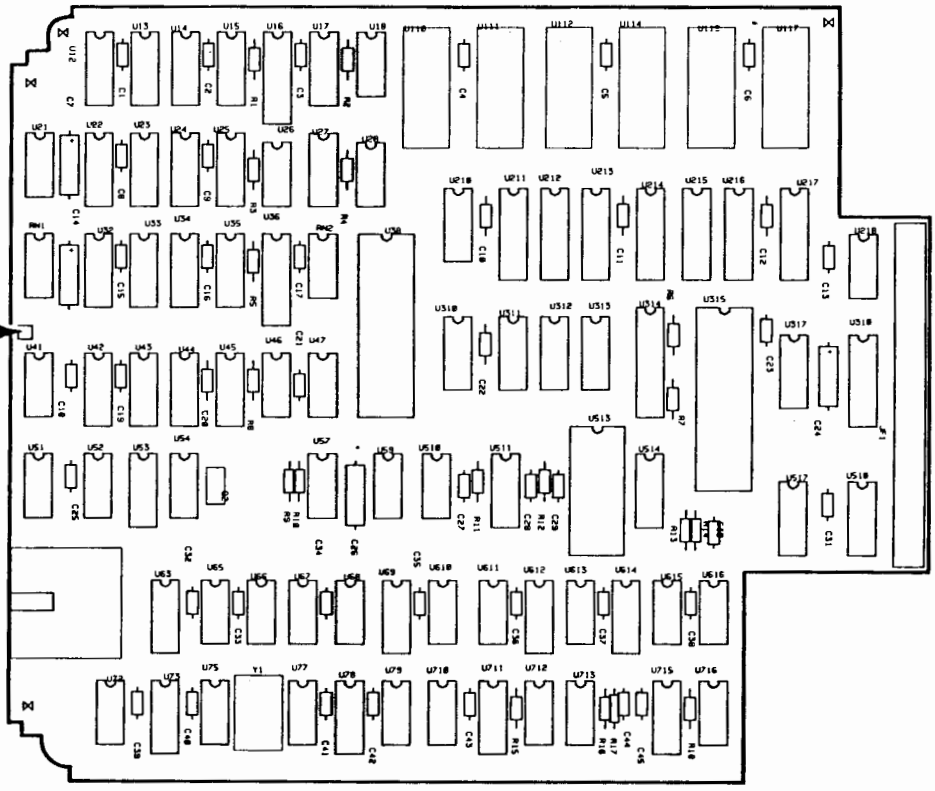
Power Supply PCA
(non-component side)



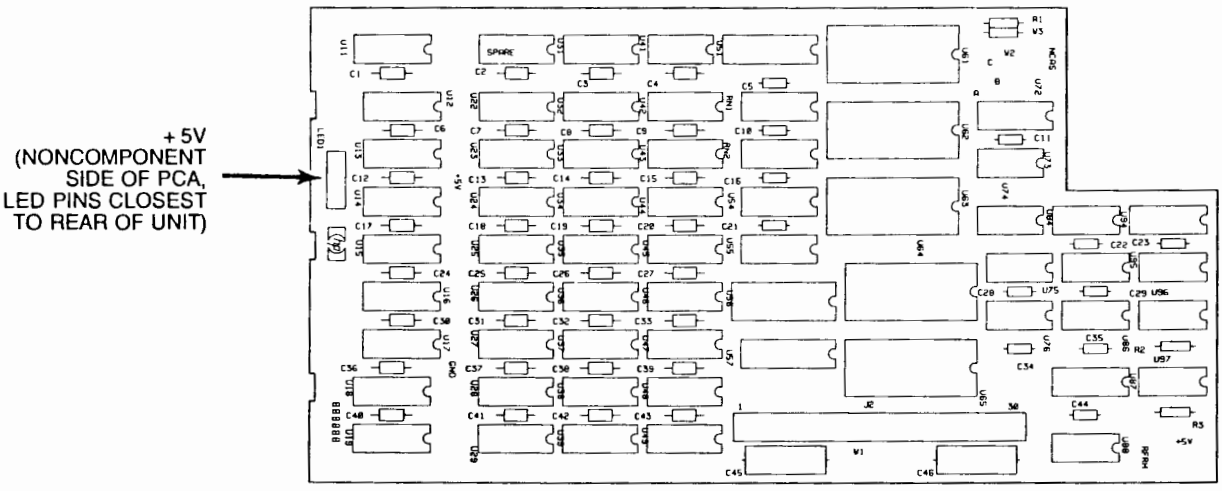
Processor PCA



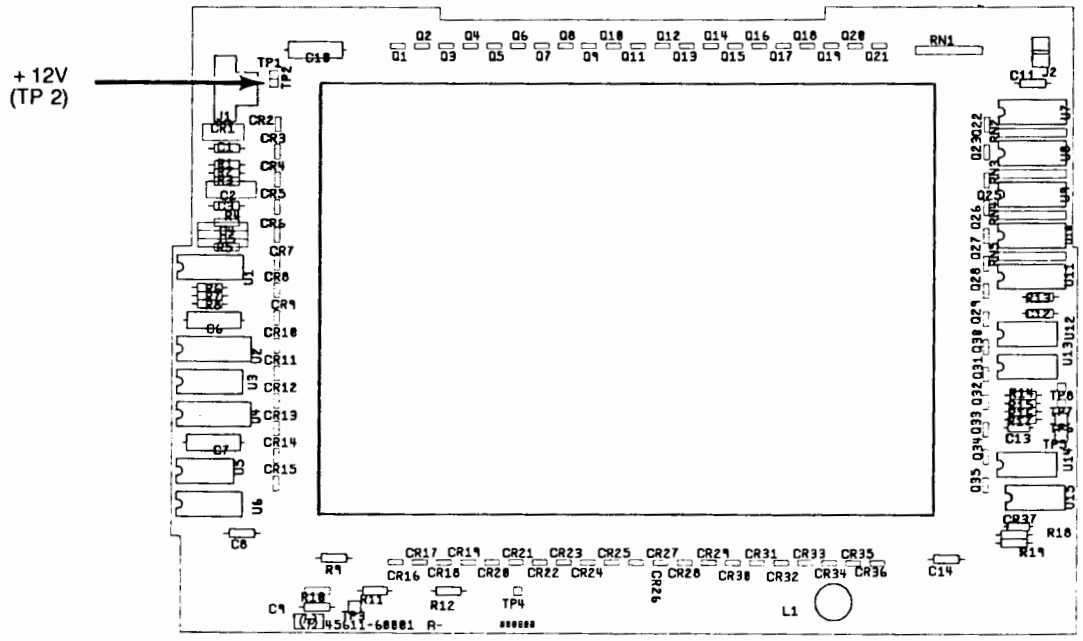
Video PCA

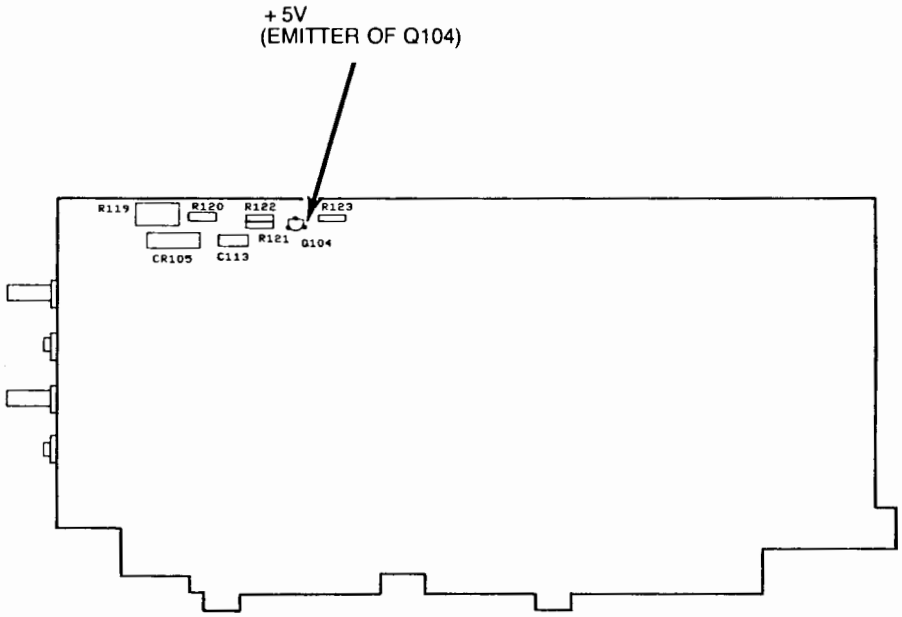


Mezzanine Memory PCA



Touchscreen PCA




+5V
(EMITTER OF Q104)
R119
R120
R122
R123
R121
Q104
CR105
C113

ADJUSTMENTS

VII

INTRODUCTION

This chapter provides the information necessary to perform all the adjustments on the HP 150. The adjustments on the HP 150 include only those provided for display alignment.

DISPLAY ALIGNMENT

Display alignment should be checked whenever an HP 150 is installed or moved and whenever the Sweep PCA or the CRT/yoke assembly is replaced. Proper display alignment is not only necessary for display clarity but is also essential for proper operation of the Touchscreen. Using the Touchscreen with an unaligned display will cause erroneous data to be input to the system.

Equipment

1. A small Phillips-head screwdriver.
2. Alignment tool (HP part no. 8710-1355).

Alignment Procedures

********** WARNING **********

Hazardous voltages are present inside the unit. If while performing these procedures you remove the top cover take caution. High voltages, sufficient enough to cause serious injury, are present on exposed portions of the yoke and CRT.

****

1. Clear both the alpha and graphics display. The alpha display is cleared by pressing the home cursor key, and then [Clear Display]. The graphics display can be cleared by pressing [CTRL], [Shift] and [Clear Display] all at the same time.

2. Display the alignment grid by pressing the [System] key twice, [f3] service keys, [f3] TOUCHSCN ALIGNMNT.

3. Using the FOCUS adjustment, located at the rear of the HP 150 (see Figure 7-1), adjust the focus of the display.

4. Using the BRIGHT adjustment, located at the rear of the HP 150 (see Figure 7-1), adjust the display to desired brightness.

   If unable to adjust the screen to the desired brightness using the rear BRIGHT adjust, remove the top cover (see top cover removal procedures in Chapter VIII) and use the alignment tool to adjust the brightness limiting pot located on the Sweep PCA (see Figure 7-2). CAUTION! Do not over adjust the brightness on the screen. Damage to the CRT will result if the brightness os the screen is adjusted to high.

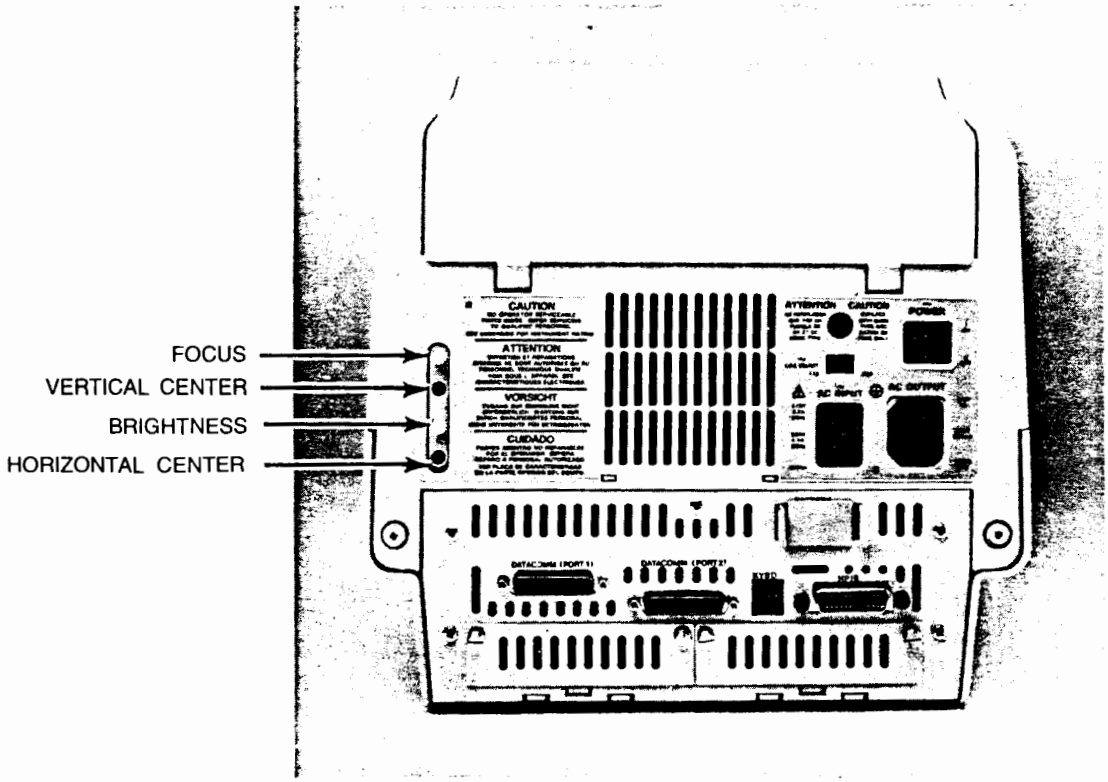


Figure 7-1. HP 150 Rear View

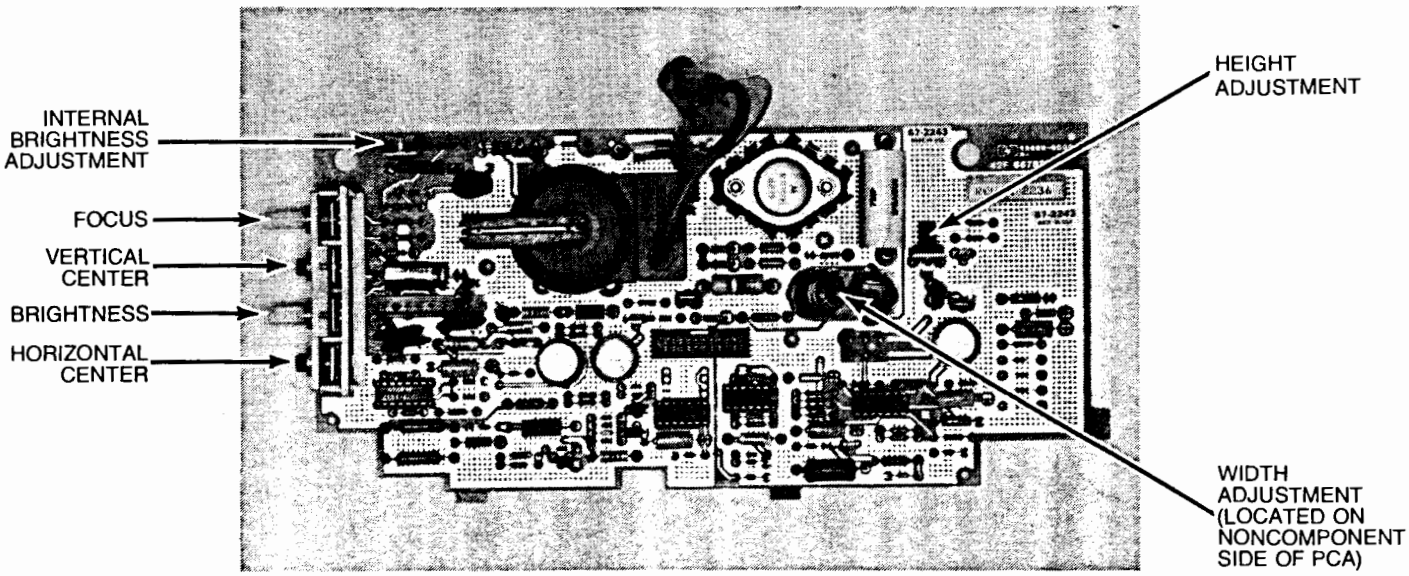


Figure 7-2. HP 150 Sweep PCA

5. Using the alignment tool to turn the HORIZ. CENTER adjustment at the rear of the unit (see Figure 7-1), center the display horizontally on the screen. Do this by lining up the outer left and right hand vertical grid lines with the outer left and right hand Touchscreen holes (see figure 7-3).

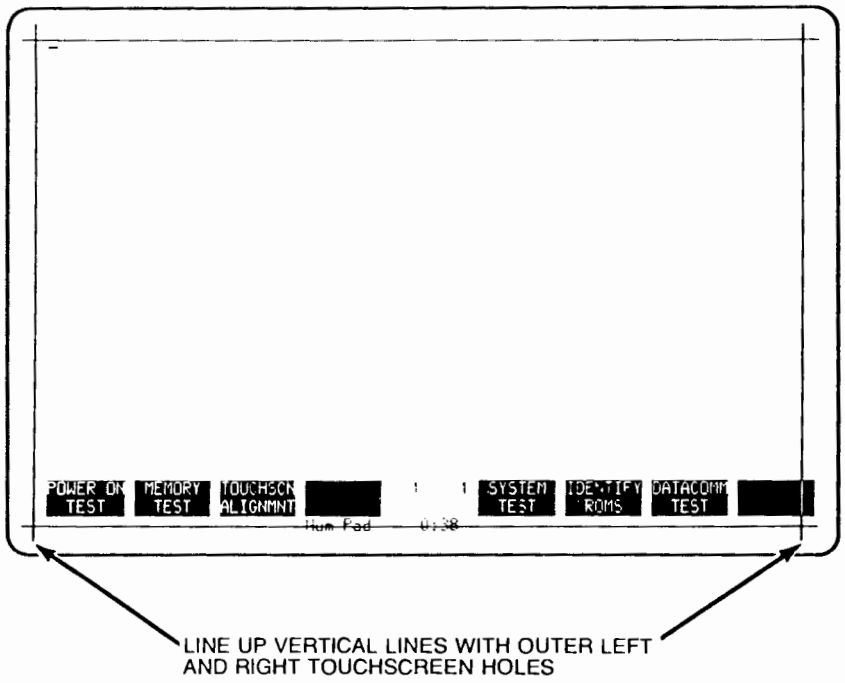


Figure 7-3. Horizontal Display Alignment

If necessary, remove the top cover (see top cover removal procedures in Chapter VIII) and use the alignment tool to turn the width adjustment on the Sweep PCA (see figure 7-2) to expand or contract the display horizontally.

6. Using the alignment tool to turn the VERT. CENTER adjustment at the rear of the unit (see Figure 7-1), center the display vertically on the screen. Do this by lining up the top and bottom horizontal grid lines with the top and bottom Touchscreen holes (see figure 7-4).

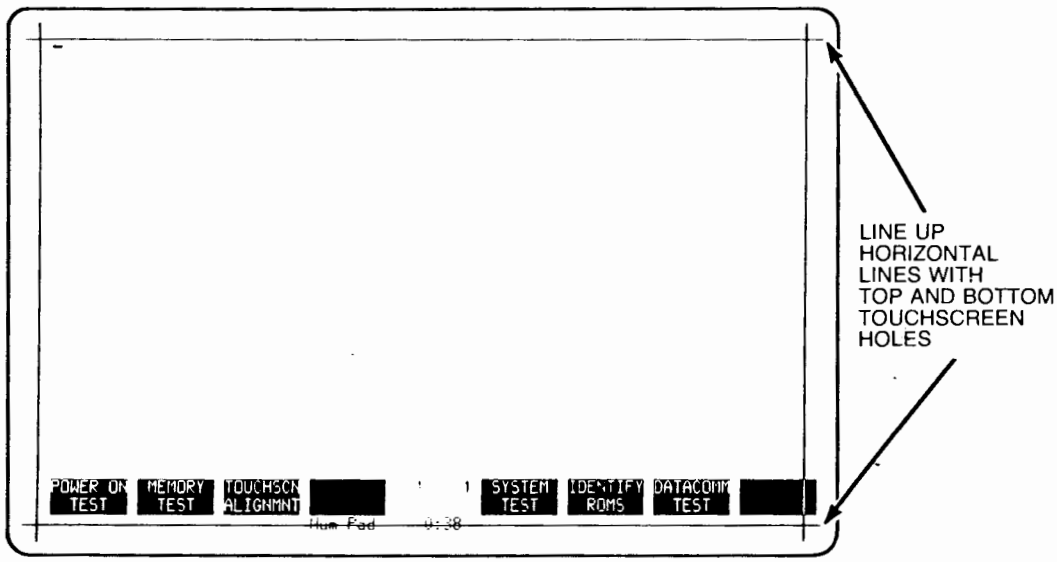


Figure 7-4. Vertical Display Alignment

If necessary, remove the top cover (see top cover removal procedures in Chapter VIII) and use the alignment tool to turn the height adjustment on the Sweep PCA (see figure 7-2) to expand or contract the display vertically.

7. When the above procedures are completed, clear the graphics display to remove the alignment grid from the screen.

REMOVAL AND REPLACEMENT VIII

INTRODUCTION

This section provides instructions for removing and replacing the HP 150 field replaceable assemblies and components.

```
********************** WARNING **********************
*                                                   *
*    Hazardous voltages are present inside the unit.    *
*    Always remove AC power when working inside.        *
*    Removal and replacement procedures contained in    *
*    this section shall be performed by qualified       *
*    personnel only.                                    *
*                                                   *
*****************************************************
```

ACCESSORY BOARDS

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove the accessory cover plate at the rear panel of the HP 150 by unscrewing the cover's captivated fasteners (see figure 8-1).

********** CAUTION **********

The PCAs in the HP 150 are static sensitive. Take proper static precautions while performing the following steps (anti-static pad with wrist strap).

****

2. Remove the accessory board by pushing the two extractors outward (to free the board from the front plane edge connector) and then carefully pulling the board out of the unit (see figure 8-2).

Replacement

Replace the accessory board as follows:

1. Slide the board into the circuit board guides and push the board completely back into the unit until it fits securely in the front plane edge connector.

2. Replace the accessory cover plate.

3. Reconnect all external cables to the back of the HP 150.

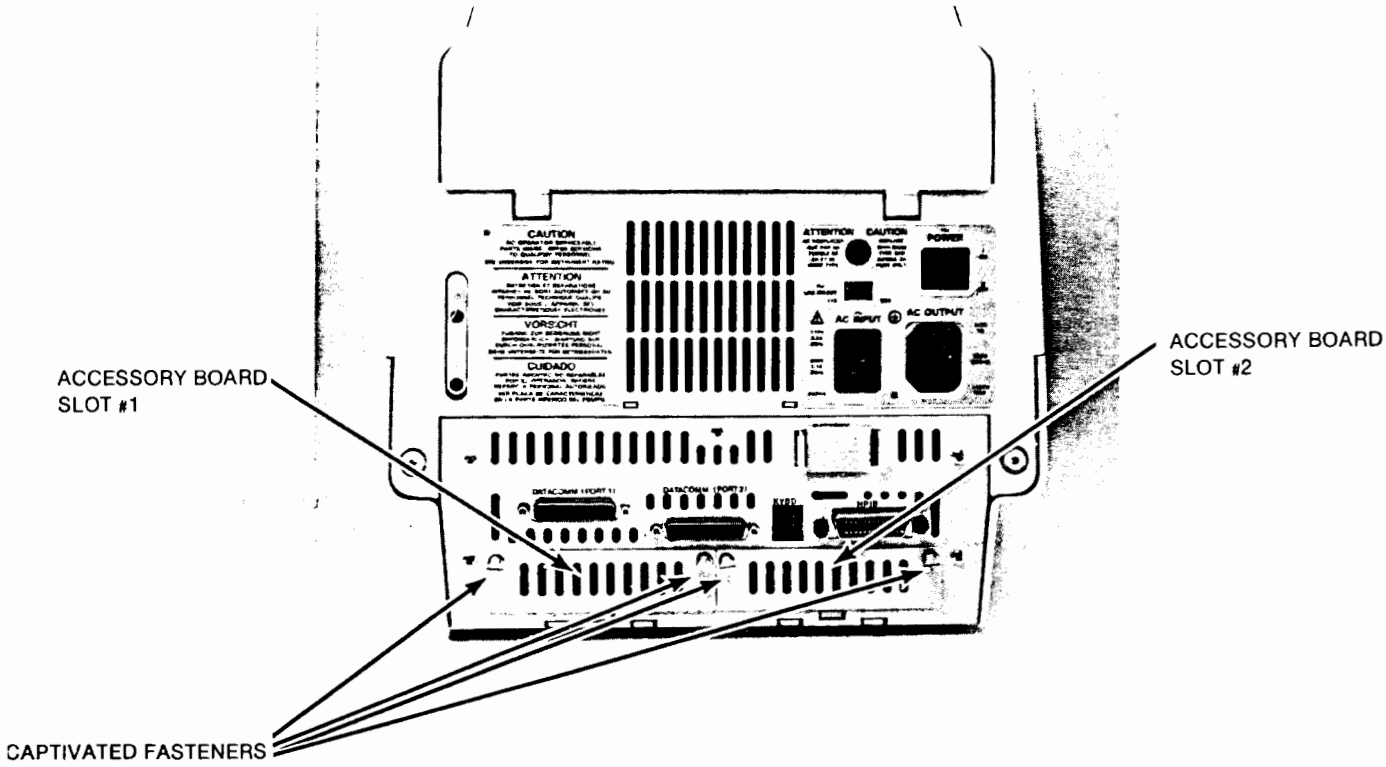


Figure 8-1. HP 150 Rear View

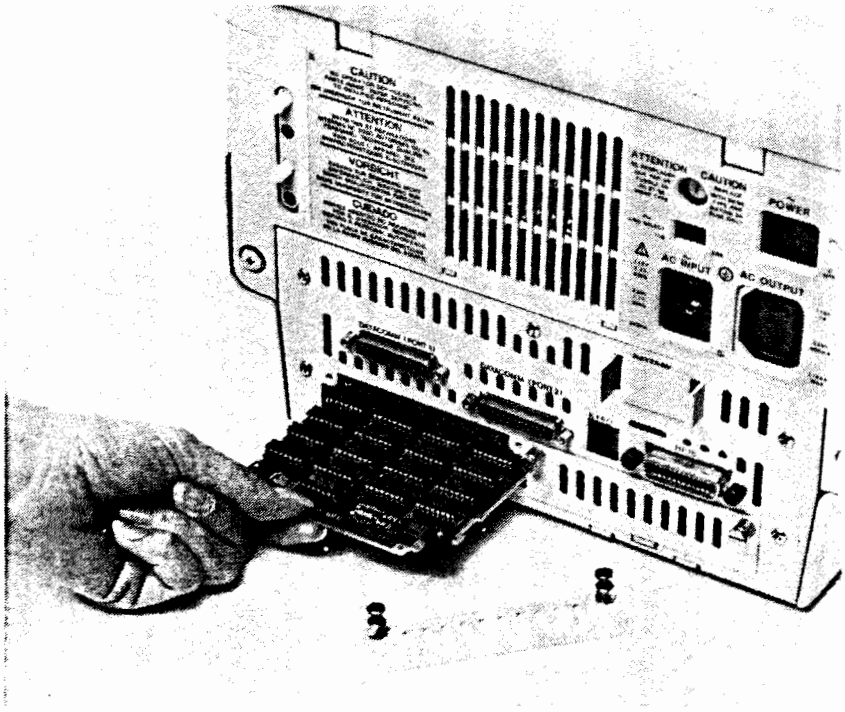


Figure 8-2. Removing Accessory Board

BACK PLATE

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Using a 3/16 hex nut driver, remove the mounting screws from the port 1 and port 2 datacomm connectors. Using a 9/32 hex nut driver, remove the mounting screws from the HP-IB connector (see figure 8-3).

2. Using a Phillips-head screwdriver, remove the five screws securing the back plate to the mainframe.

3. Remove the back plate from the mainframe.

Replacement

Replace the back plate as follows:

1. Position the RS-232 and the HP-IB slots in the back plate over their respective connectors.

2. Using a Phillips-head screwdriver, secure the back plate to the mainframe with the five screws removed earlier.

3. Replace the mounting screws for the port 1 and port 2 datacomm connector (use a 3/16 hex nut driver) and the HP-IB connector (use a 9/32 hex nut driver).

4. Reconnect all external cables to the back of the HP 150

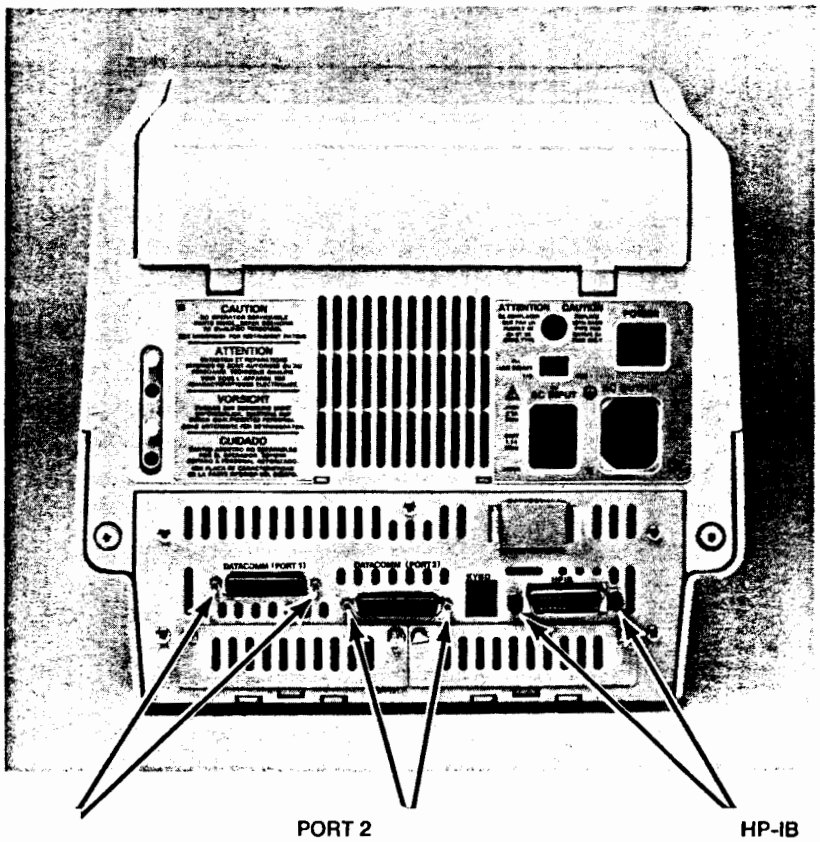


Figure 8-3. Rear View of HP 150

CARD CAGE PCAs

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove the back plate (see back plate removal procedure).

********** CAUTION **********

The PCAs in the HP 150 are static sensitive. Take proper static precautions while performing the following steps (anti-static pad with wrist strap).

****

2. The boards are located in the card cage as follows (see figure 8-4):

Video PCA	= top board
Processor PCA	= 2nd from the top
Mezzanine Memory PCA	= mounted on and connected directly to Processor PCA.
Mezzanine Datacomm PCA	= mounted on and connected directly to Processor PCA.
*Accessory Boards	= bottom two slots

3. Remove the PCA by pushing outward on the two extractors (to free the board from the front plane edge connector) and then carefully slide the PCA out of the card cage (figure 8-5). Note that in the case of the Mezzanine Memory and/or Mezzanine Datacomm PCAs the Processor PCA must be removed from the card cage first and then the mezzanine boards removed from the Processor PCA.

Replacement

Replace the PCAs as follows:

1. Slide the PCA into the printed circuit board guides in the card cage and push the PCA completely back into the unit until it fits securely into the front plane edge connector (in the case of the mezzanine PCAs, connect/mount them to the Processor PCA first).

2. Replace the back plate (see back plate replacement procedure).

3. Reconnect all the external cables to the back of the HP 150.

* NOTE: Accessory boards may or may not be present.

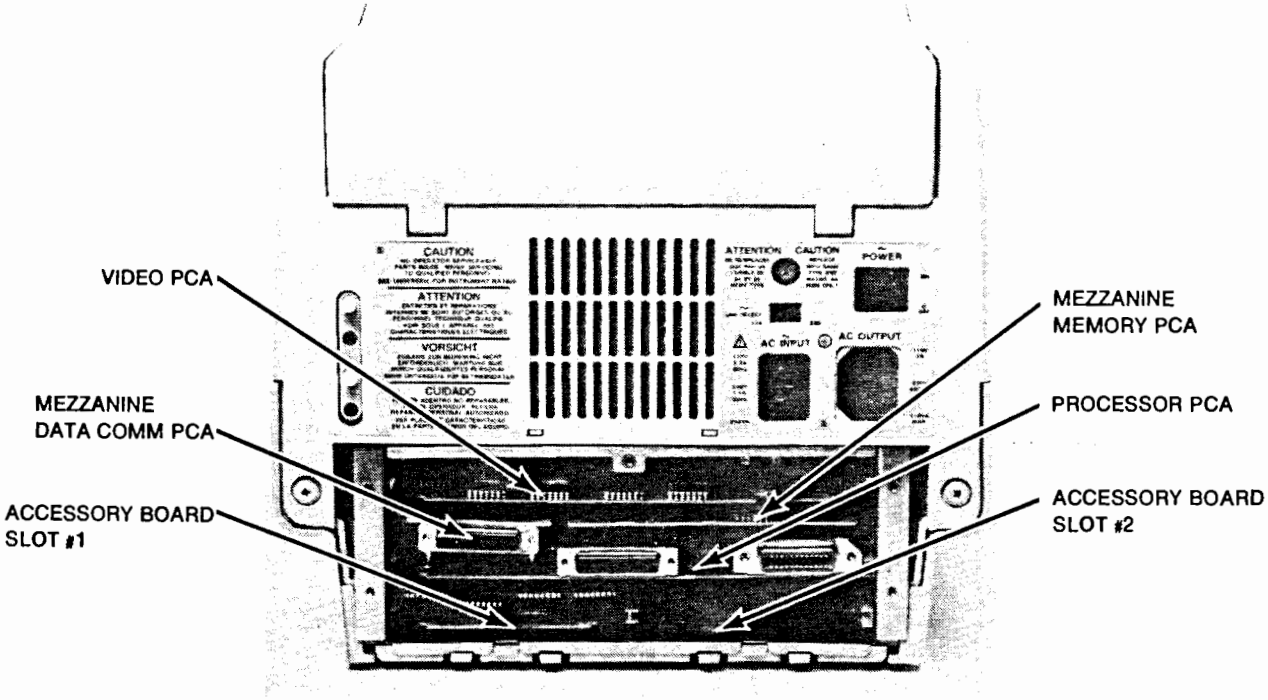


Figure 8-4. Card Cage Board Organization

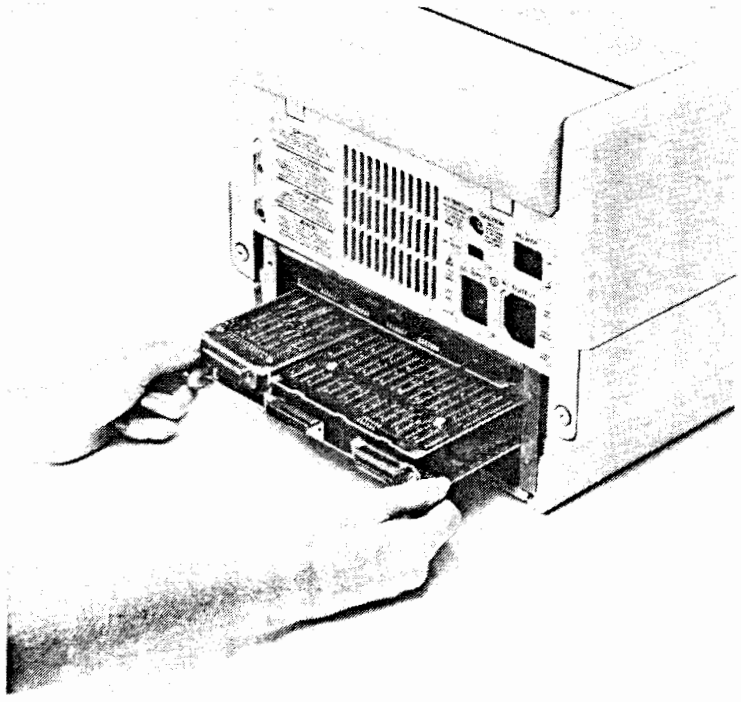


Figure 8-5. Removing PCA from Card Cage

SOCKETED INTEGRATED CIRCUIT

Removal

Power off the HP 150 and proceed as follows:

```
********************** CAUTION **********************
*                                                   *
*    Integrated circuits can be damaged by electro- *
*    static discharge.  Use the following precautions:*
*                                                   *
*    USE an anti-static ground pad.                 *
*                                                   *
*    ENSURE that you, the PCA, and the anti-static  *
*    pad are at the same potential.                 *
*                                                   *
*    DO NOT wear clothing subject to static charge  *
*    buildup, such as wool or synthetic materials.  *
*                                                   *
*    DO NOT handle ICs in carpeted areas.           *
*                                                   *
*    DO NOT remove the IC from its conductive foam  *
*    pad until you are ready to install it.         *
*                                                   *
*    AVOID touching the circuit leads.  Handle ICs  *
*    by the package only.                           *
*                                                   *
*****************************************************
```

1. Remove the PCA with the defective IC. Locate the defective IC (see Chapter IX for socketed component locations).

2. Using an IC removal tool, remove the defective IC from its socket.

Replacement

Replace the IC as follows:

1. Insert the IC in the socket. Be sure of proper chip orientation in the socket. Pin 1 on the chip (identified by a notch and/or a dot) should line up with pin 1 on the socket (identified by a notch and/or a square pin hole (see figure 8-6).

2. Replace the PCA.

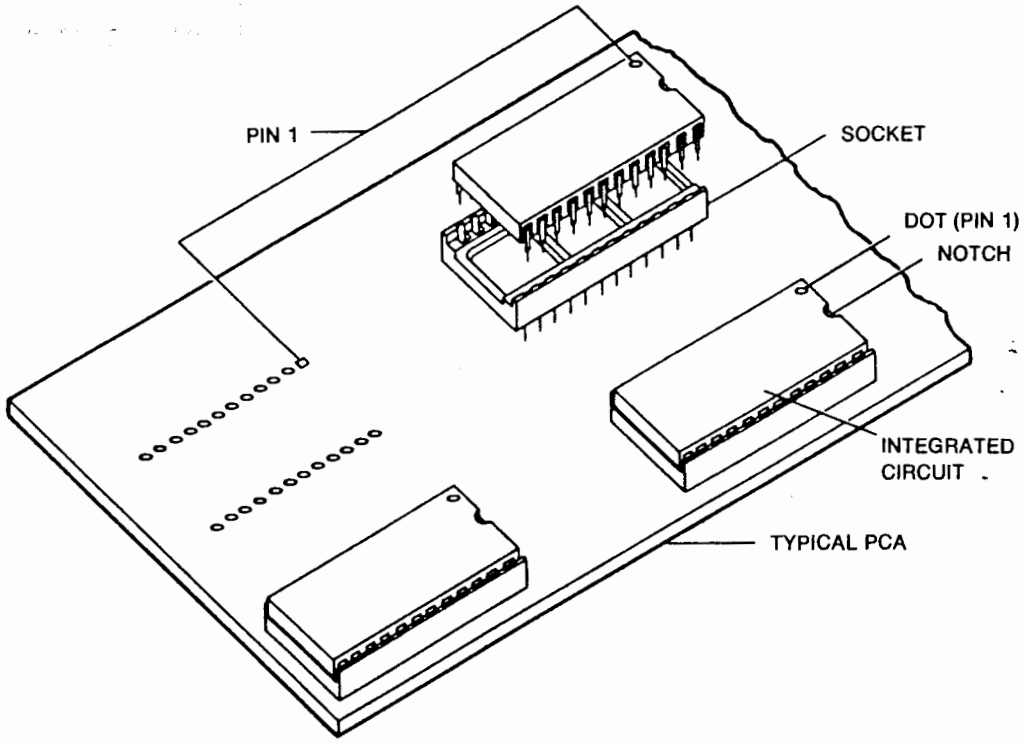


Figure 8-6. Socketed IC Insertion

FRONT PLANE

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove the back plate (see back plate removal procedure).

2. Remove all PCAs from the card cage (see card cage PCAs removal procedure).

3. Looking inside the unit from the back, disconnect the two flat ribbon cables on the left from their respective connectors (JF5 and JF6) on the Front Plane (see figure 8-7). Next, disconnect the flat ribbon cable and the cable assembly on the right from their respective connectors (JF7 and JF8).

4. Using a Phillips-head screwdriver, remove the screws that secure the Front Plane to the mainframe.

5. Pull the Front Plane free of the metal card cage and out the back of the unit.

Replacement

Replace the front plane as follows:

1. Install the Front Plane into the card cage by sliding the right end in first (behind the cables on the right) and then pushing the Front Plane firmly against the front of the mainframe.

2. Using a Phillips-head screwdriver, secure the Front Plane to the mainframe with the screws removed earlier.

3. Pull the flat wire cables on the left into the card cage and reconnect them to the Front Plane. Reconnect the two cables on the right to the Front Plane.

4. Reinstall all PCAs in the card cage (see Card Cage PCAs replacement procedure).

5. Replace the back plate (see back plate replacement procedure).

6. Reconnect all external cables to the back of the HP 150.

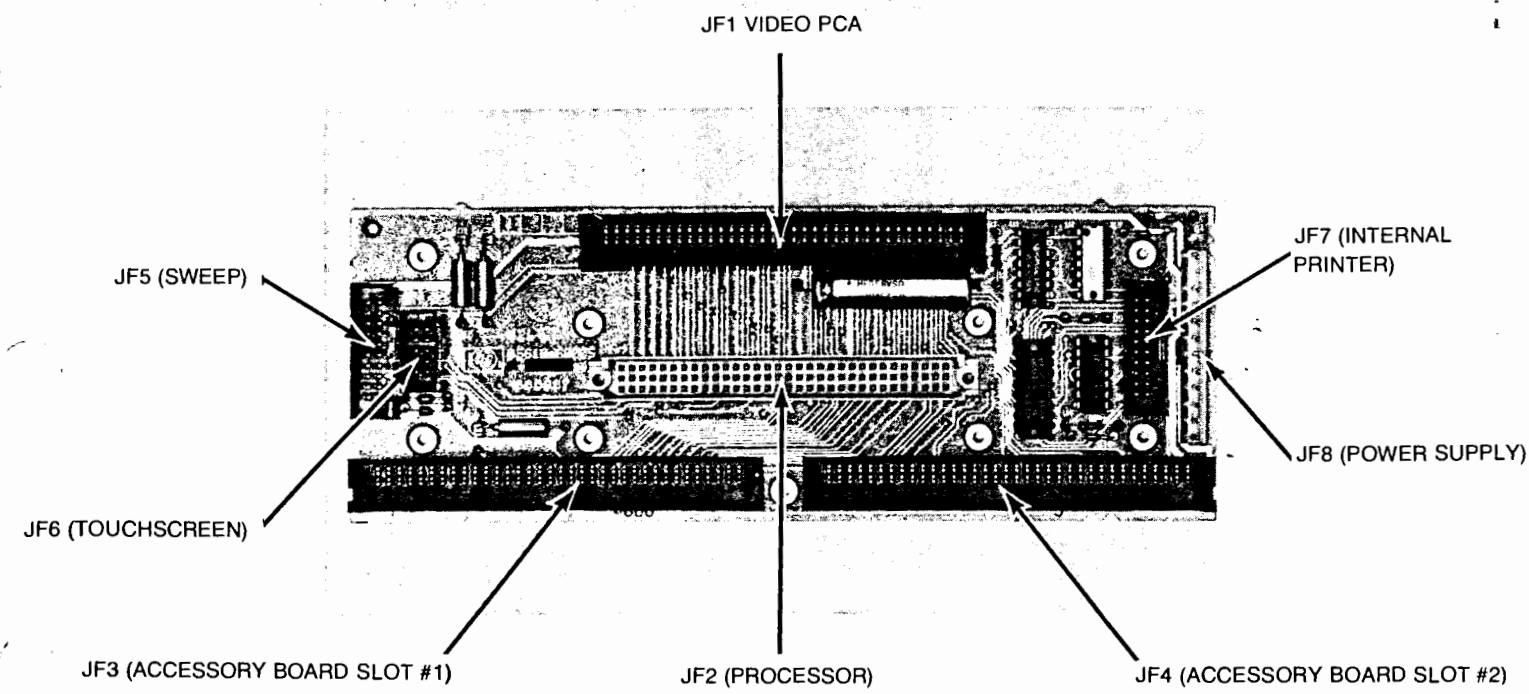


Figure 8-7. HP 150 Front Plane

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

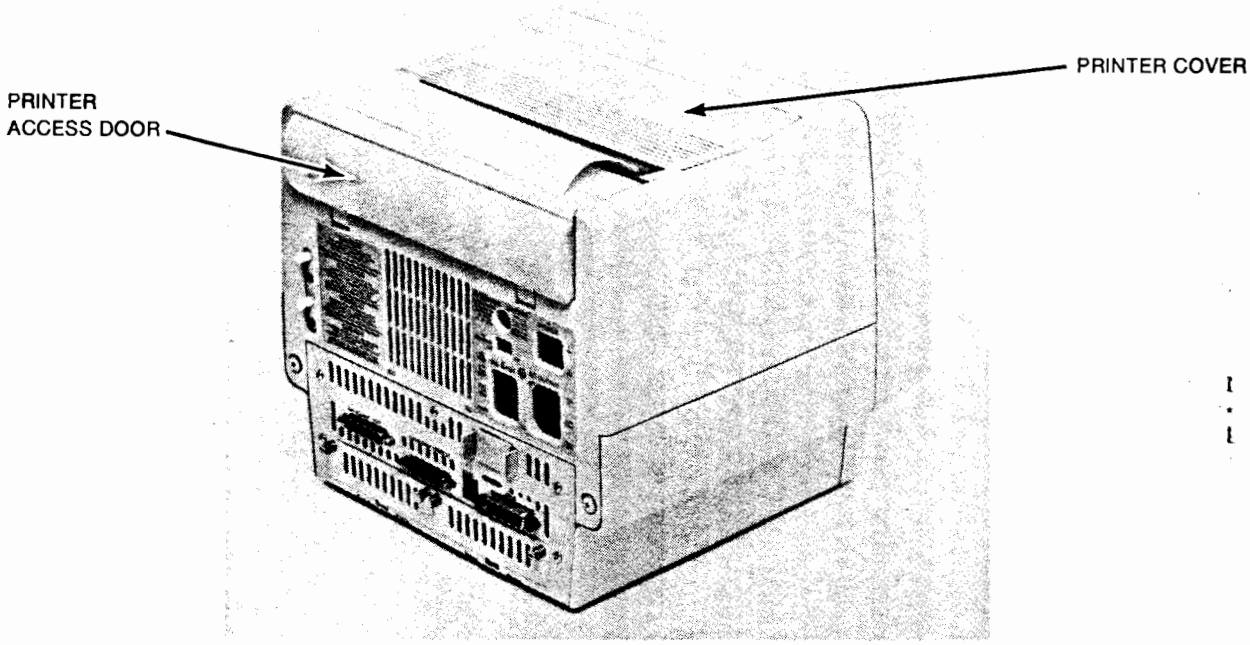
1. Remove the printer cover and rotate the printer access door backward (see figure 8-8).
2. Disconnect the printer cable and pull up on the two snap fasteners.
3. Carefully lift the printer out of the printer bucket.

Replacement

Computer Museum

Replace the printer as follows:

1. While tilting the printer forward, carefully lower it into position within the printer bucket.
2. Push down on the two snap fasteners and reconnect the printer cable (see figure 8-9).
3. Close the printer access door and replace the printer cover.
4. Reconnect all external cables to the back of the HP 150.



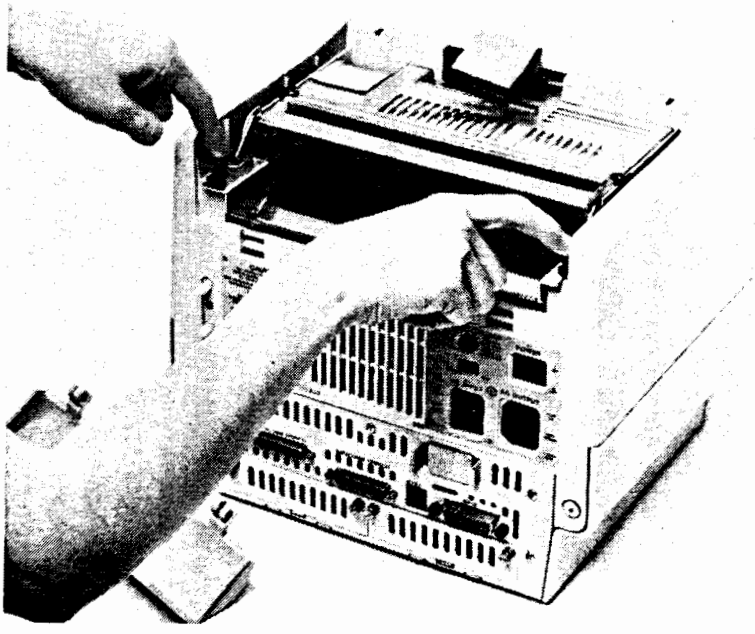


Figure 8-9. Replacing the Internal Printer

TOP COVER

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove the internal printer if present (see the internal printer removal procedure).

2. Using a small Phillips-head screwdriver, loosen the two quarter turn fasteners at the rear of the HP 150 by turning them a quarter turn counter-clockwise (figure 8-10).

3. With one hand on each side of the HP 150, carefully pull backwards and up until the cover is free from the bezel (note fan cable will still be connected).

4. Disconnect the fan cable from connector J4 on the Power Supply PCA and then lift the top cover completely off the HP 150.

Replacement

Replace the top cover as follows:

1. Reconnect the fan cable to connector J4 on the Power Supply PCA.

2. Place the top cover over the guides on the sides of the chassis. Remove the printer cover and feed the printer cable through the openning in the top cover. Replace the printer cover.

3. Slide the top cover forward along the guides until it fits tightly up against the bezel.

4. Make sure that the top cover is properly aligned and fits securely.

5. Use a small Phillips-head screwdriver to tighten the quarter turn fasteners at the rear of the terminal. Do not overtighten the quarter turn fasteners (the fasteners will stick out if not fastened properly).

6. Replace the internal printer, if present (see the internal printer replacement procedure).

7. Reconnect all external cables to the back of the HP 150.

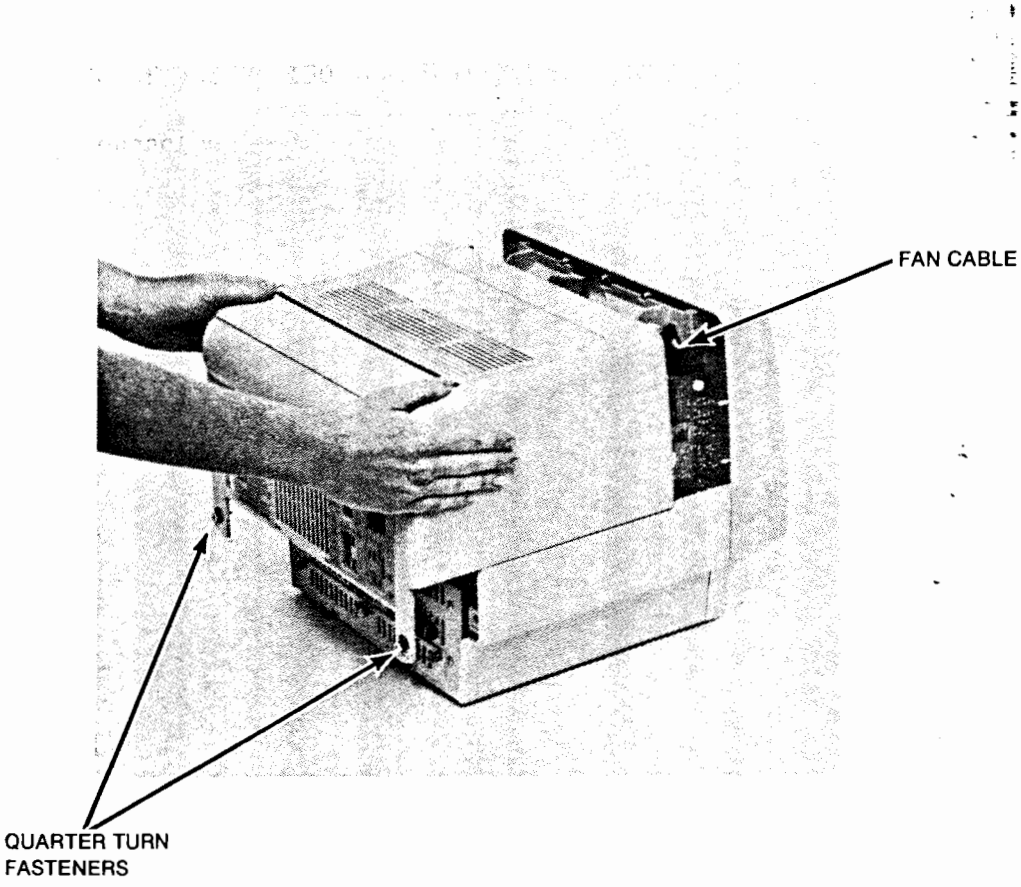


Figure 8-10. Removing the Top Cover

VENTILATING FAN

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove the top cover (see top cover removal procedure).

2. Disengage the fan bracket from the top cover by pushing in on both sides of the bracket with your thumb and forefinger until it comes free. Lift the bracket from around the fan (see figure 8-11).

3. Slide the fan assembly (with rubber boot attached) out of its bracketed position on the shroud.

4. Remove the rubber boot from around the fan assembly.

Replacement

Replace the ventilating fan as follows:

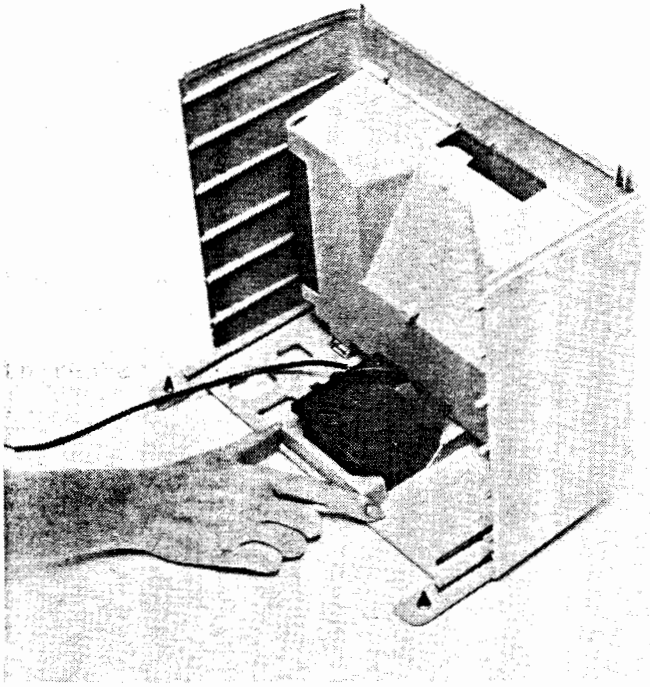
1. Orient the fan assembly so that the airflow arrow is at the bottom of the fan and pointing out towards the back of the terminal (see figure 8-12).

2. Position the boot on the fan so that the open ends meet on the left side, and the wide section of the boot is against the top cover (see figure 8-12).

3. Mount the fan assembly (boot attached) to the top cover with the fan bracket. Secure the fan bracket to the top cover by pinching in on the bracket with your thumb and forefinger until the bracket pops into place.

4. Replace the top cover (see top cover replacement procedure). Remember to reconnect the fan cable to connector J4 on the Power Supply PCA.

5. Reconnect all external cables to the back fo the HP 150.



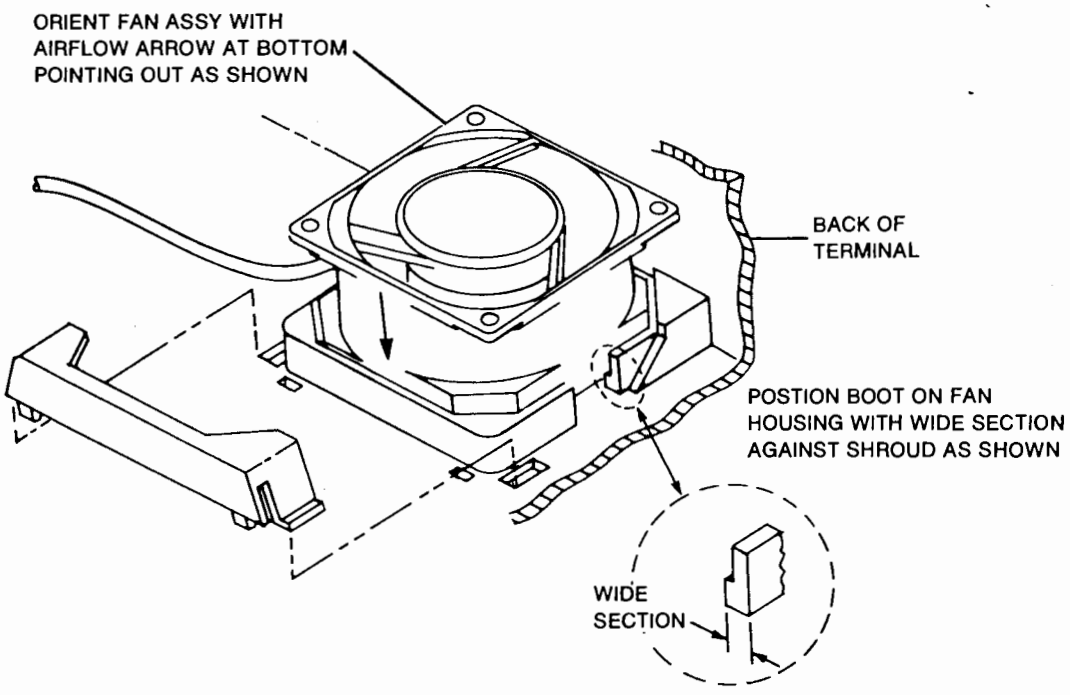


Figure 8-12. Fan and Fan Boot Position

SWEEP PCA

Removal

Power off the HP 150, disconnect all external cables from the back of the unit and proceed as follows:

1. Remove the top cover (see top cover removal procedure).

```
********************** WARNING **********************
*                                                   *
*   Hazardous voltages are present inside the HP 150.   *
*   When removing the Sweep PCA always discharge the    *
*   CRT as described in the following step.             *
*                                                   *
*   SERIOUS INJURY CAN RESULT IF THIS WARNING IS NOT    *
*   OBSERVED.                                       *
*                                                   *
*****************************************************
```

2. Carefully discharge the CRT by attaching one end of a grounding wire to the ground lug on the upper right hand corner of the CRT and the other end of the grounding wire to a screwdriver with an insulated handle. Then stick the tip of the screwdriver under the insulated connector which connects the high voltage CRT cable assembly to the CRT (see figure 8-13). The insulated connector consists of two metal prongs. Touch the tip of the screwdriver to one of the prongs and then to the other. An electric spark may result from each touch.

3. Carefully disconnect the high voltage cable from the hole in the CRT by squeezing the insulated connector. This brings the two prongs at the end of the cable together slightly so that the cable can be removed from the hole.

4. Disconnect the CRT base cable from connector J3 on the Sweep PCA (see figure 8-14).

5. Pull on each of the two snap-fasteners securing the Sweep PCA to the mainframe.

6. Pivot the metal arm holding the rear snap-fastener away from the Sweep PCA.

7. Carefuly pull the Sweep PCA free of the chassis. Be careful not to pull the board completely away from the mainframe as there are still two cables connected.

8. Disconnect the flat wire cable and the yoke cable from connectors J1 and J2 on the Sweep PCA and pull the Sweep completely free of the chassis.

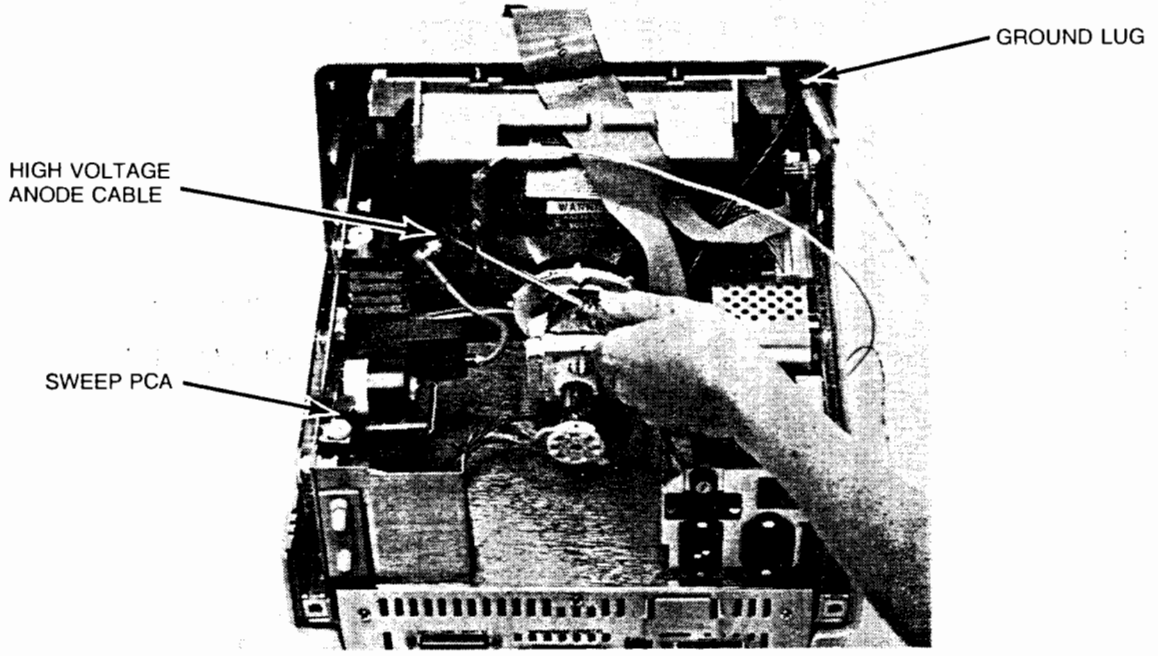
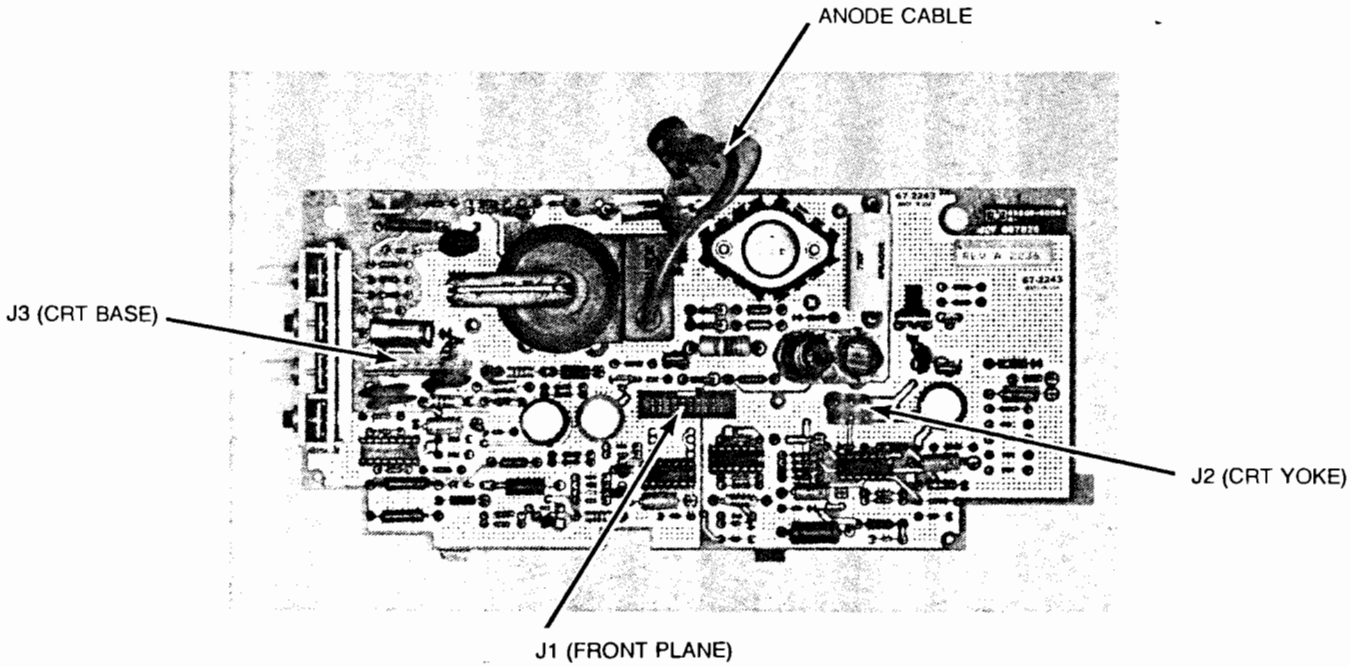


Figure 8-13. Discharging the CRT



Replacement

Replace the Sweep PCA as follows:

1. Attach the flat cable (from the front plane) and the yoke cable to connectors J1 and J2 on the Sweep PCA (see figure 8-14).

2. Carefully install the Sweep PCA by placing the tabs at the bottom of the PCA into the slots in the chassis and lining up the snap-fastener hole in the PCA with the snap-fastener on the frame.

3. Pivot the metal arm holding the rear snap-fastener so that the snap-fastener and the snap-fastener hole in the PCA line up.

4. Insert the two snap-fasteners into the holes and press inwardly until they lock in place.

5. Reconnect the high voltage cable from the Sweep to the CRT.

7. Attach the CRT base cable to connector J3 on the Sweep PCA (see figure 8-14).

8. Replace the top cover (see top cover replacement procedure).

9. Reconnect all external cables to the back of the HP 150.

CRT/YOKE ASSEMBLY

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove top cover (see top cover removal procedure).

```
********************** WARNING ************************
*                                                     *
*    Hazardous voltages are present inside the HP 150. *
*    When removing the CRT/yoke assembly always       *
*    discharge the CRT as described in the following  *
*    step.                                            *
*                                                     *
*    SERIOUS INJURY CAN RESULT IF THIS WARNING IS     *
*    NOT OBSERVED.                                    *
*                                                     *
*******************************************************
```

2. Carefully discharge the CRT tube by attaching one end of a grounding wire to the ground lug on the upper right hand corner of the CRT and the other end of the grounding wire to a screwdriver with an insulated handle. Then stick the tip of the screwdriver under the insulated connector which connects the high voltage CRT cable assembly to the CRT (see figure 8-13). The insulated connector consists of two metal prongs. Touch the tip of the screwdriver to one of the prongs and then to the other. An electric spark may result from each touch.

3. Carefully disconnect the high voltage cable from the hole in the CRT by squeezing on the insulated connector. This brings the two prongs at the end of the cable together slightly so that the cable can be removed from the hole.

4. Disconnect the CRT yoke cable from connector J2 on the Sweep PCA (see Figure 8-14).

5. Remove the CRT base cable assembly from the end of the CRT.

6. Remove the bezel (with Touchscreen) from the mainframe by using a flat-blade screwdriver to unhook the bezel's locking tabs, located on the bottom of the unit (see figure 8-15), to free it from the mainframe. Disconnect the Touchscreen cable before pulling the bezel completely away from the mainframe.

7. Using a phillips head screwdriver remove the four screws that secure the CRT to the mainframe.

8. Carefully pull the CRT forward and away from the unit.

```
********************** CAUTION ************************
*                                                     *
*    Be careful not to scratch the front of the tube  *
*    while it is out of the mainframe.  Be sure to    *
*    place the tube face down on a non-abrasive padded *
*    surface when not holding it.                     *
*                                                     *
*******************************************************
```

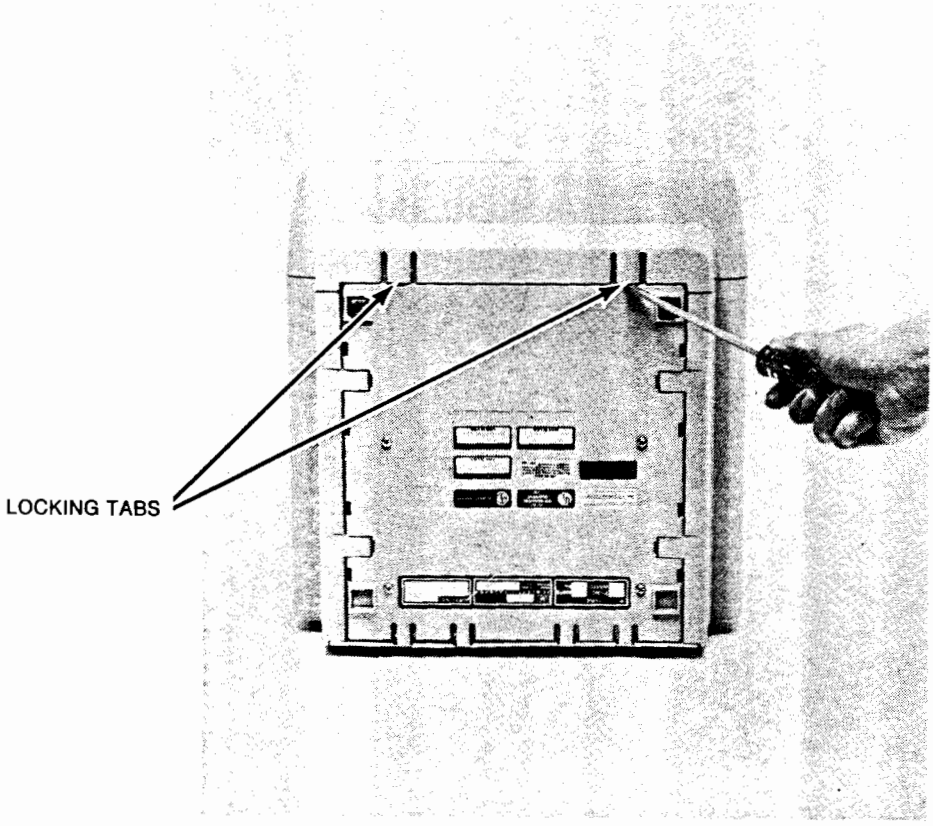


Figure 8-15. Removing the Bezel

Replacement

Replace the CRT as follows:

1. Insert the CRT through the front of the unit and slide it back into place. Be sure that the CRT is inserted such that the warning label is visible from the top and the high voltage connector on the CRT is facing the Sweep Board.

2. Beginning with the upper left screw and continuing clockwise, secure the CRT to the HP 150 chassis with the four Phillips-head screws removed earlier. Be sure that the lug from the ground wire is between the tube and the screw head on the upper left screw.

3. Replace the bezel, remembering to reconnect the Touchscreen cable to the Touchscreen PCA.

4. Reconnect the high voltage cable from the Sweep PCA to the CRT.

5. Reconnect the base cable assembly to the end of the CRT.

6. Reconnect the CRT yoke cable to connector J2 on the Sweep PCA (see Figure 8-14).

7. Replace the top cover (see top cover replacement procedure).

8. Reconnect all external cables to the back of the HP 150.

POWER SUPPLY PCA

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove top cover (see top cover removal procedure).

2. Disconnect the AC power cable, front plane cable and printer cable from their respective connectors (J1, J2 and J3) on the Power Supply PCA (see figure 8-16).

3. Pull outward on each of the two snap fasteners securing the Power Supply PCA to the mainframe.

4. Carefully pull Power Supply PCA free of the chassis.

Replacement

Replace the Power Supply PCA as follows:

1. Carefully install the Power Supply PCA by placing the tabs at the bottom of the PCA into the slots in the chassis and lining up the snap-fastener holes in the PCA with the snap-fasteners on the mainframe.

2. Insert the two snap-fasteners into the holes and press inward until they lock in place.

3. Reconnect the AC power cable, front plane cable and printer cable to their respective connectors (J1, J2 and J3) on the Power Supply PCA (see figure 8-16).

4. Replace the top cover (see top cover replacement procedure).

5. Reconnect all external cables to the back of the HP 150.

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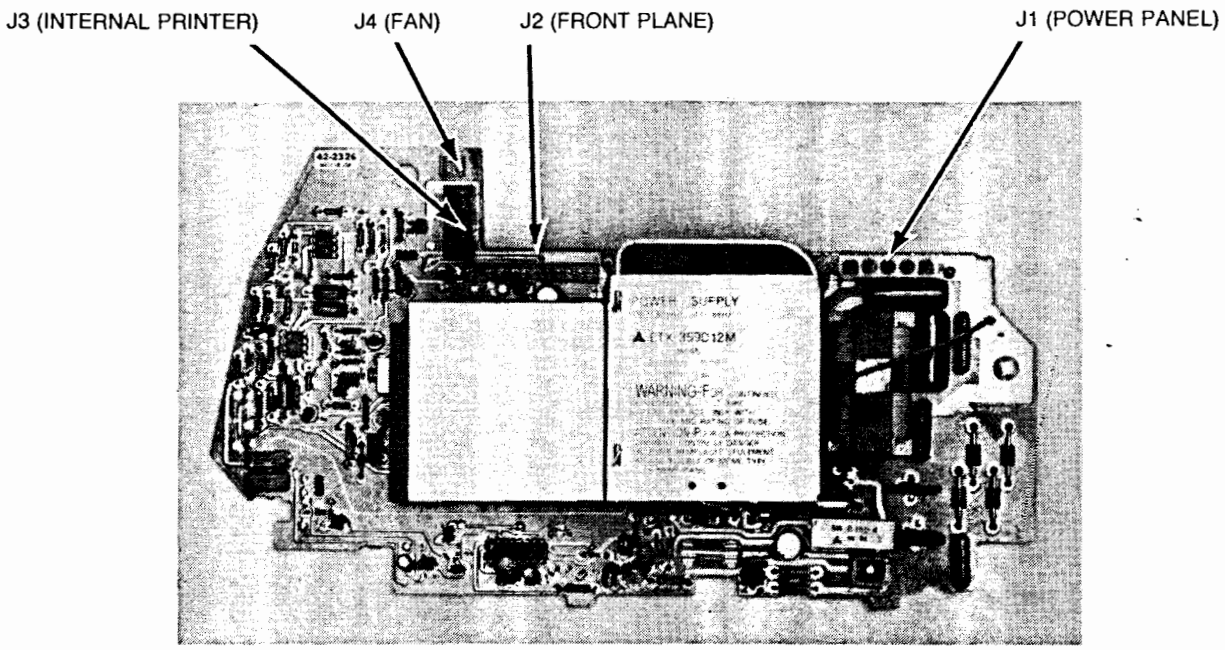

Figure 8-16. HP 150 Power Supply PCA

POWER PANEL

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove the top cover (see top cover removal procedure).

2. Disconnect the cable from connector J1 on the Power Supply PCA. Pull on the snap-fastener holding the Power Supply PCA to the power panel to free it from the power panel.

3. Using a Phillips-head screwdriver, remove the four screws securing the power panel to the card cage (see figure 8-17). Remove the screw securing the three ground wires to the card cage.

4. Lift the power panel away from the mainframe.

Replacement

Replace the Power Panel as follows:

1. Place the power panel on the card cage and secure with the four screws removed earlier.

2. Secure the three ground wires to the card cage.

3. Insert the Power Supply snap-fastener into its hole on the power panel and push in to snap in place.

4. Reconnect the cable from the power panel to connect J1 on the Power Supply PCA.

5. Replace the top cover (see top cover replacement procedure).

6. Reconnect all external cables to the back of the HP 150.

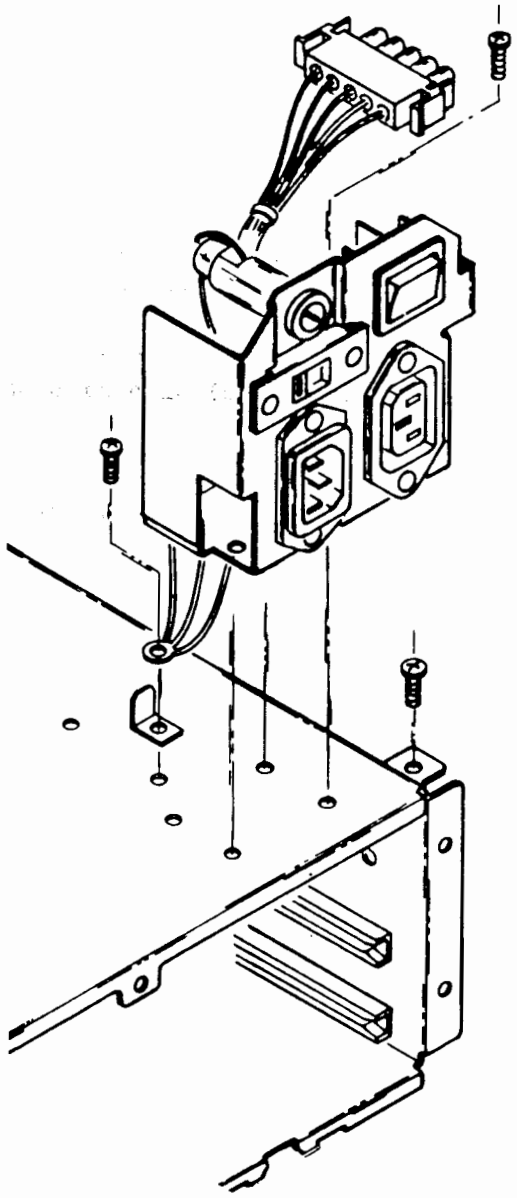

Figure 8-17. Removing the Power Panel

TOUCHSCREEN PCA

Removal

Power off the HP 150, disconnect all cables from the back of the unit and proceed as follows:

1. Remove the bezel (with Touchscreen) from the mainframe by using a flatblade screwdriver to unhook the bezel's locking tabs, located on the bottom of the unit, from the mainframe (see figure 8-18).

2. Disconnect the Touchscreen cable from its connector on the Touchscreen PCA.

3. Remove the four screws holding the Touch Screen PCA to bezel.

4. Remove the Touchscreen PCA.

Replacement

Replace the Touchscreen PCA as follows:

1. Place the Touchscreen PCA in the bezel, component side up.

2. Replace the four screws which secure the Touchscreen PCA to the bezel.

3. Reconnect the Touchscreen cable to its connector on the Touchscreen PCA.

4. Replace the bezel.

6. Reconnect all external cables to the back of the HP 150.

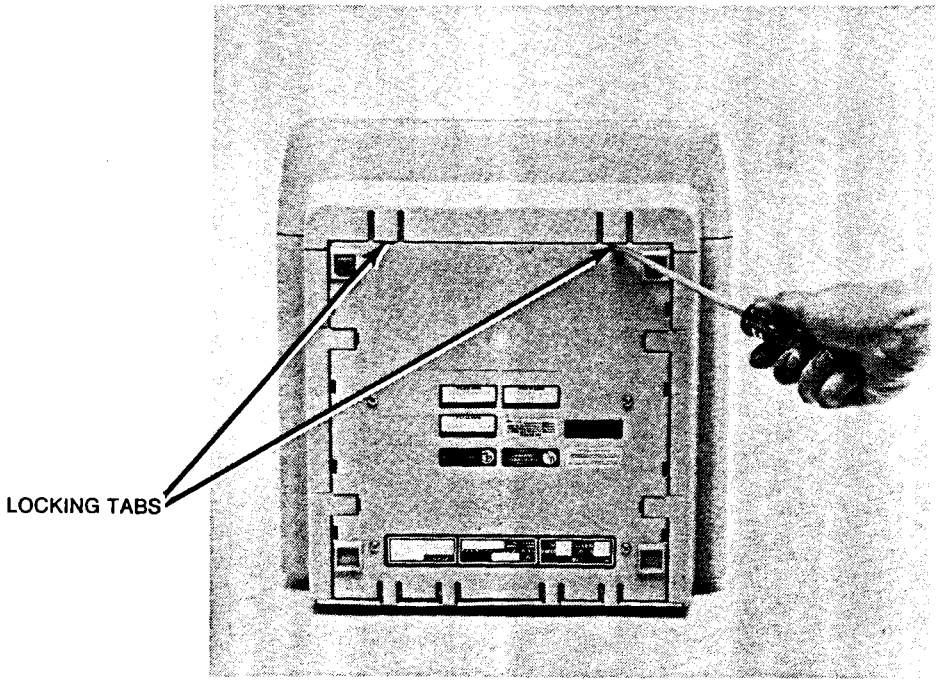

Figure 8-18. Removing the Bezel

FUSE

Removal

Power off the HP 150 and proceed as follows:

1. Using a flatblade screwdriver, remove the fuse holder (located on the power panel) by pushing in and turning the holder a quarter turn counter clockwise.

2. Pull the fuse holder straight back until it is clear of the chassis.

3. Remove the fuse from the fuse holder.

Replacement

Replace the fuse as follows:

1. Place the fuse into the fuse holder.

2. Insert the fuse holder into the fuse mount located on the back of the unit.

3. Lock the fuse holder in place by pushing it tightly against the chassis and turning a quarter turn clockwise.

BATTERIES

Removal

With the HP 150 power on remove the batteries as follows:

1. Push inward on each of the locking tabs at the side of the battery holder located at the rear of the HP 150.

2. Pull the battery holder straight back until it is clear of the mainframe.

3. Remove the two batteries from the holder.

Replacement

Replace the batteries as follows:

1. Insert the two batteries into the battery holder taking care to ensure proper orientation of the batteries in the holder (see the top of the battery holder).

2. Line up the guiding tab on the bottom of the battery holder with the groove at the base of the battery mount on the mainframe.

3. Push the battery holder forward until it locks into place.

KEYBOARD ASSEMBLY

Removal

Power off the HP 150 and proceed as follows:

1. Disconnect the keyboard cable from the HP 150 by lifting up the flap covering the keyboard connector at the rear of the HP 150 and pulling up on the connector's locking tab while pulling away from the HP 150.

2. Remove the keyboard cable cap from the rear of the keyboard by grasping it in the middle and gently twisting up and out (see figure 8-19).

3. Disconnect the keyboard cable from the keyboard by pulling up on the connector's locking tab while pulling away from the keyboard.

Replacement

Replace Keyboard Assembly as follows:

1. Connect the keyboard cable (the end with the longer straight section) to the keyboard by inserting it into the connector located at the center rear of the keyboard (if this is a new keyboard assembly remove the keyboard cable cap first).

2. With the keyboard cable routed to the right (as you face the rear of the keyboard) replace the keyboard cable cap by inserting first the right side of the cap into the keyboard housing and then the left (see figure 8-20). Secure the cap into place by pushing in on the center of the cap.

3. Connect the other end of the keyboard cable to the HP 150 by lifting up the flap covering the keyboard cable connector at the rear of the HP 150 and inserting the cable into the connector.

Figure 8-19. Removing the Keyboard Cable Cap

Figure 8-20. Replacing the Keyboard Cable Cap

PARTS IX

INTRODUCTION

This section provides the part numbers for the HP 150 field replaceable components and assemblies. Included are parts lists for the HP 150 mainframe primary assembly, mainframe secondary assembly, shroud assembly, exchange boards, socketed components, and keyboards. Each parts list has a figure associated with it containing an assembly level drawing or component layout to help identify and locate each part.

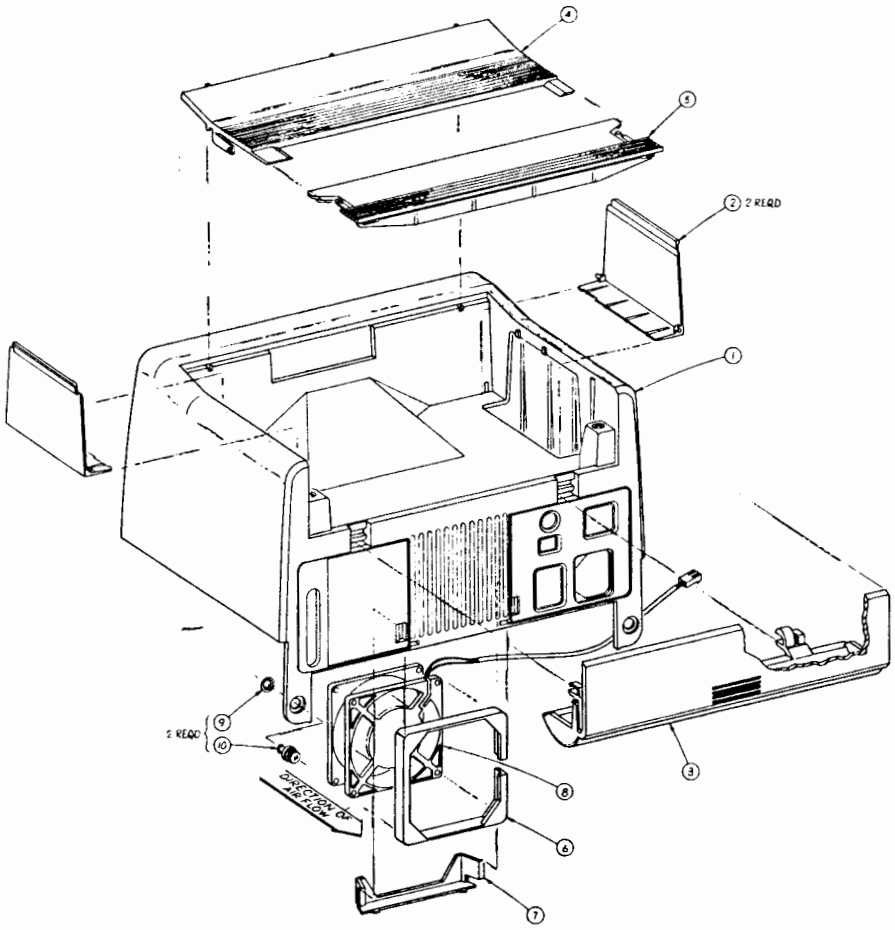

Figure 9-1. Shroud Assembly

Table 9-1. Parts List for Shroud Assembly

ITEM	QTY	HP PART NUMBER	DESCRIPTION
1	1	45611-40011	Shroud
2	2	45611-40012	Shroud Insert
3	1	45611-40013	Door
4	1	45611-40014	Cover
5	1	45611-40015	Butch Plate
6	1	3160-0400	Fan Boot
7	1	45611-40020	Fan Bracket
8	1	3160-0403	Fan Assembly, 12V DC
9	2	1390-0427	1/4-Turn Retainer
10	2	02620-60080	1/4-Turn Assembly

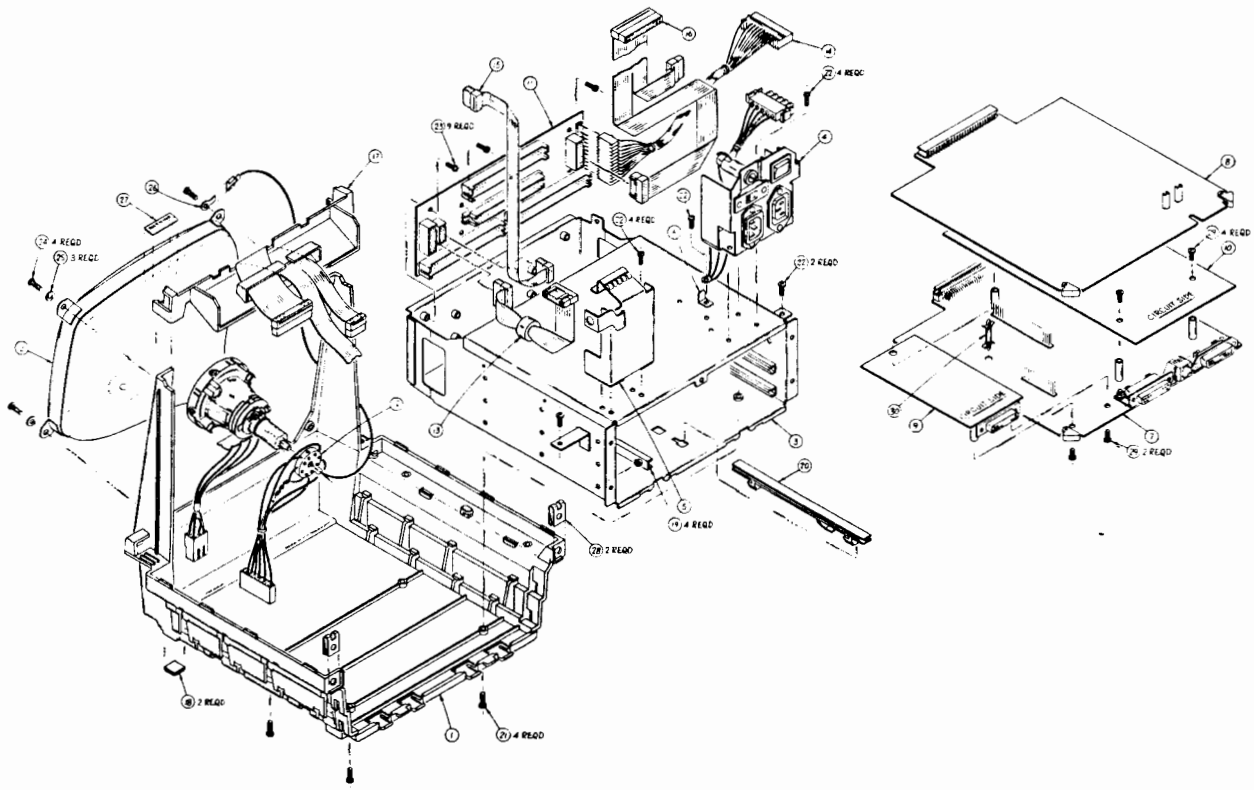

Figure 9-2. Mainframe Primary Assembly

Table 9-2a. Parts List for Mainframe Primary Assembly

ITEM	QTY	HP PART NUMBER	DESCRIPTION
1	1	45611-40016	Chassis
2	1	45600-63002	CRT/Yoke Assembly
3	1	45611-00002	Card Cage
4	1	45600-60006	Power Panel Assembly
5	1	45611-00008	Sweep Bracket
6	1	0360-1685	Q-Disc 90 Degree Male Conn.
7	1	45611-60002	Processor PCA
8	1	45611-60003	Video PCA
9	1	45611-60015	Mezzanine Datacomm PCA
10	1	45611-60006	Mezzanine Memory PCA (with ROMs)
-	-	45611-60066	Mezzanine Memory PCA (without ROMs)
11	1	45611-60005	Front Plane
12	1	8120-4059	CRT Base Cable Assembly
13	1	5061-6730	Video Cable Assembly
14	1	8120-4060	Power Cable Assembly
15	1	45611-60200	Logic Cable Assembly
16	1	45611-60201	Printer Cable Assembly
17	1	45611-40010	Printer Cable Bracket
18	2	0403-0285	Bumper Foot
19	4	0403-0472	Card Guide
20	1	45611-40003	Center Card Guide
21	4	0515-0357	Screw, M3.5 X 0.6 X 12.0L
22	12	0515-0506	Screw, M3.5 X 0.6 X 6.0L
23	9	2200-0105	Screw, 4-40 X .31L
24	4	0624-0540	Screw, 6-20 X .63L TAP
25	3	3050-0100	Washer, no. 6 Flat
26	1	0362-0695	Q-Disc Male Connector
27	1	7120-4626	CRT Warning Label
28	2	1390-0464	1/4 Turn Receptacle
29	6	2360-0117	Screw, 6-32 X .38L
30	1	0380-1650	Plasctic .88INL Spacer

Table 9-2b. Exchange PCAs*

ITEM	QTY	HP PART NUMBER	DESCRIPTION
7	1	45611-69002	Processor PCA
8	1	45611-69003	Video PCA
10	1	45611-69006	Mezzanine Memory PCA (without ROMs)
-	-	45631-69001	256K RAM Accessory Board
-	-	45632-69001	384K RAM Accessory Board

* PCAs not listed in this table are scrap-on-fail.

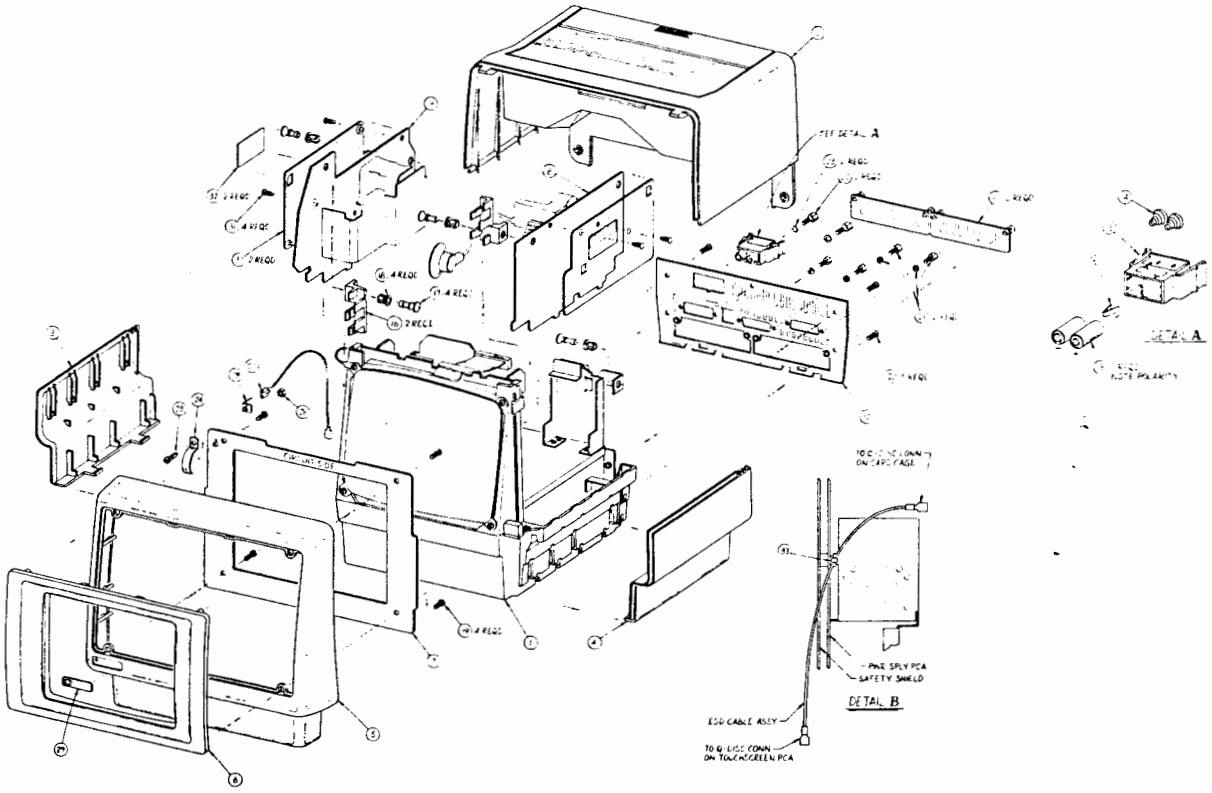

Figure 9-3. Mainframe Secondary Assembly

Table 9-3. Parts List for Mainframe Secondary Assembly

ITEM	QTY	HP PART NUMBER	DESCRIPTION
1	1	-	Primary Assembly
2	1	-	Shroud Assembly
3	1	45611-40017	Left Side Panel
4	1	45611-40018	Right Side Panel
5	1	45611-40001	Bezel
6	1	45611-40005	Bezel Insert
7	1	45611-60001	Touchscreen PCA
8	1	45600-00004	Sweep PCA
9	1	45611-80214	Power Supply PCA
10	1	45611-00001	Back Plate
11	2	45611-00007	Accessory Cover Plate
12	1	1400-0967	Battery Retainer
13	2	1420-0255	Battery, 1.5V "N"
14	1	1460-1695	Battery Spring
15	1	45611-40019	Battery Holder
16	2	4040-2136	PCA Front Mount
17	4	1390-0634	Nylatch Fastner
18	4	1390-0635	Nylatch Grommet
19	4	0624-0005	Screw, 4-24 X .25 TAP
20	5	0515-0066	Screw, M3.5 X 0.6 X 6.0
21	2	1251-2942	Spacer, Hex/Wash Pair
22	2	0380-0643	Hex Stand-Off
23	2	2190-0017	Hel Lock Washer
24	1	45611-00010	Gnd Spring
25	1	0515-0353	Screw, M3.0 X 0.5 X 10.0
26	1	0535-0031	Nut, M3.0 X 0.5 Hex
27	1	45611-60202	ESD Cable Assembly
28	1	0360-1685	Q-Disc 90 Degree Male Conn.
29	1	45611-80217	HP Logo
30	2	4040-2180	Safety Shield
31	4	0361-1138	Push-In Fastener
32	2	7120-7038	Warning High Voltage Label
33	1	1400-0249	Cable Tie, 3.6 in.

Table 9-4. Mezzanine Memory PCA Socketed Components

DESCRIPTION	HP PART NUMBER	QTY	U NUMBER
ROM 1	1818-3292	1	U65
ROM 2	1818-3293	1	U64
ROM 3	1818-3294	1	U63
ROM 4	1818-3295	1	U62
ROM 5	1818-3296	1	U61

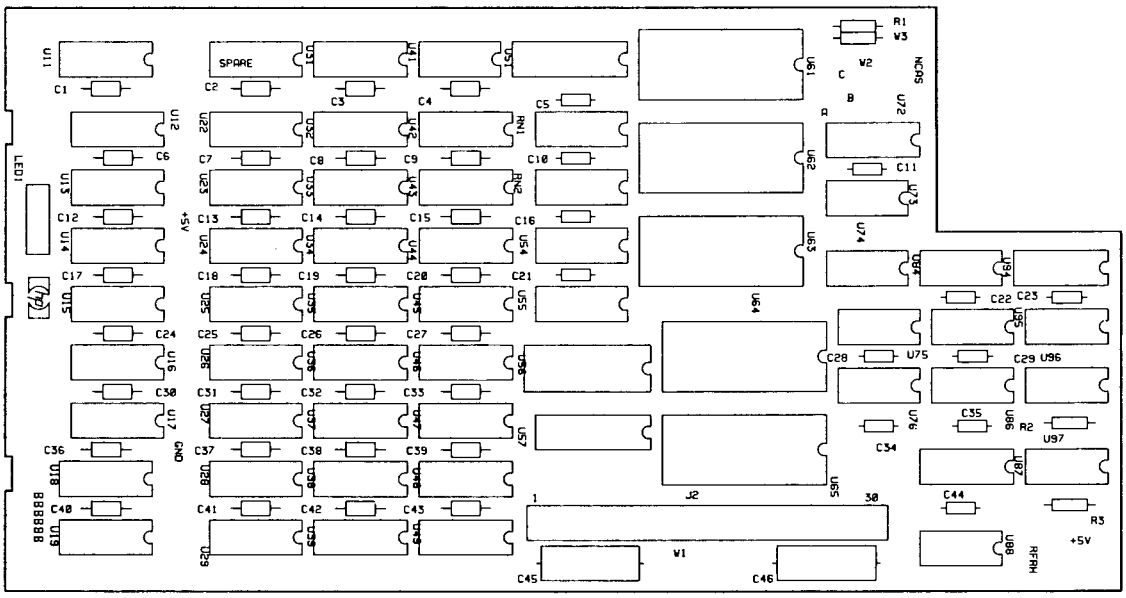

Figure 9-4. Mezzanine Memory PCA

The following figure contains the keyboard layout and HP part number for the HP 150 keyboard assembly. When a failure of a HP 150 keyboard occurs, replace the entire keyboard assembly (note that the keyboard cable is not included with the assembly).

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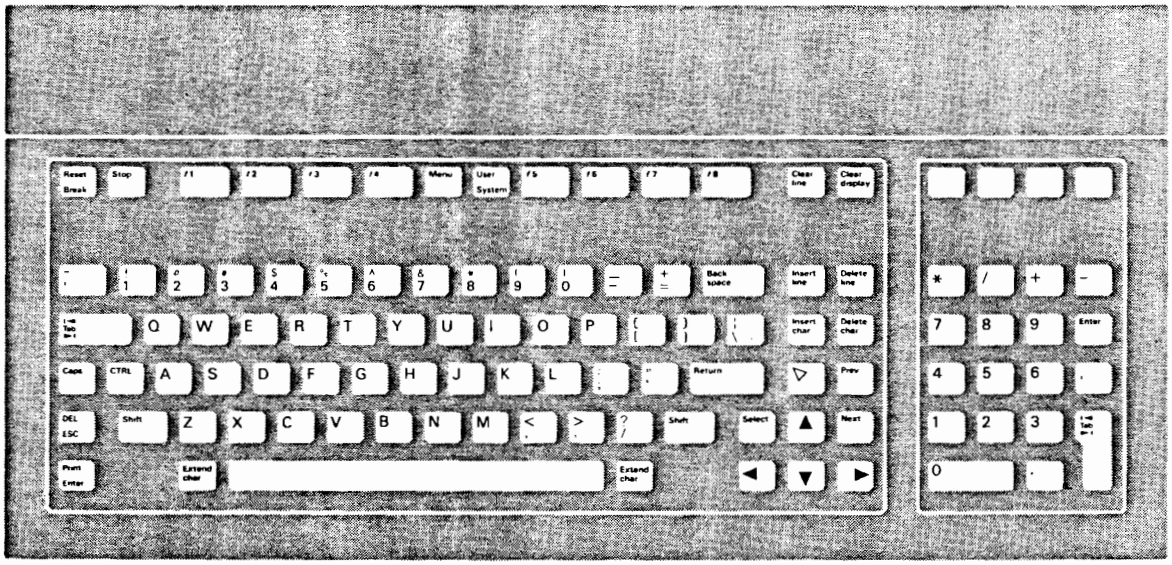


Figure 9-5. US Keyboard Assembly (HP Part No. 5061-3250)

FUNCTIONAL OPERATION X

INTRODUCTION

This chapter covers the functional operation of the HP 150. The chapter begins by presenting a brief overview of the HP 150, which includes identifying each of its modules. This is followed by a more detailed functional description as well as, in some cases, physical description of each of the modules.

HP 150 SYSTEM OVERVIEW

The HP 150, in its standard configuration consists of seven modules. They are the Processor, Video, Sweep/CRT, Touchscreen, Keyboard, Power Supply and Front Plane. Below is a block diagram of the HP 150 system showing each of the 150 modules and how they interact with each other. The sections that follow will describe each of the modules in more detail.

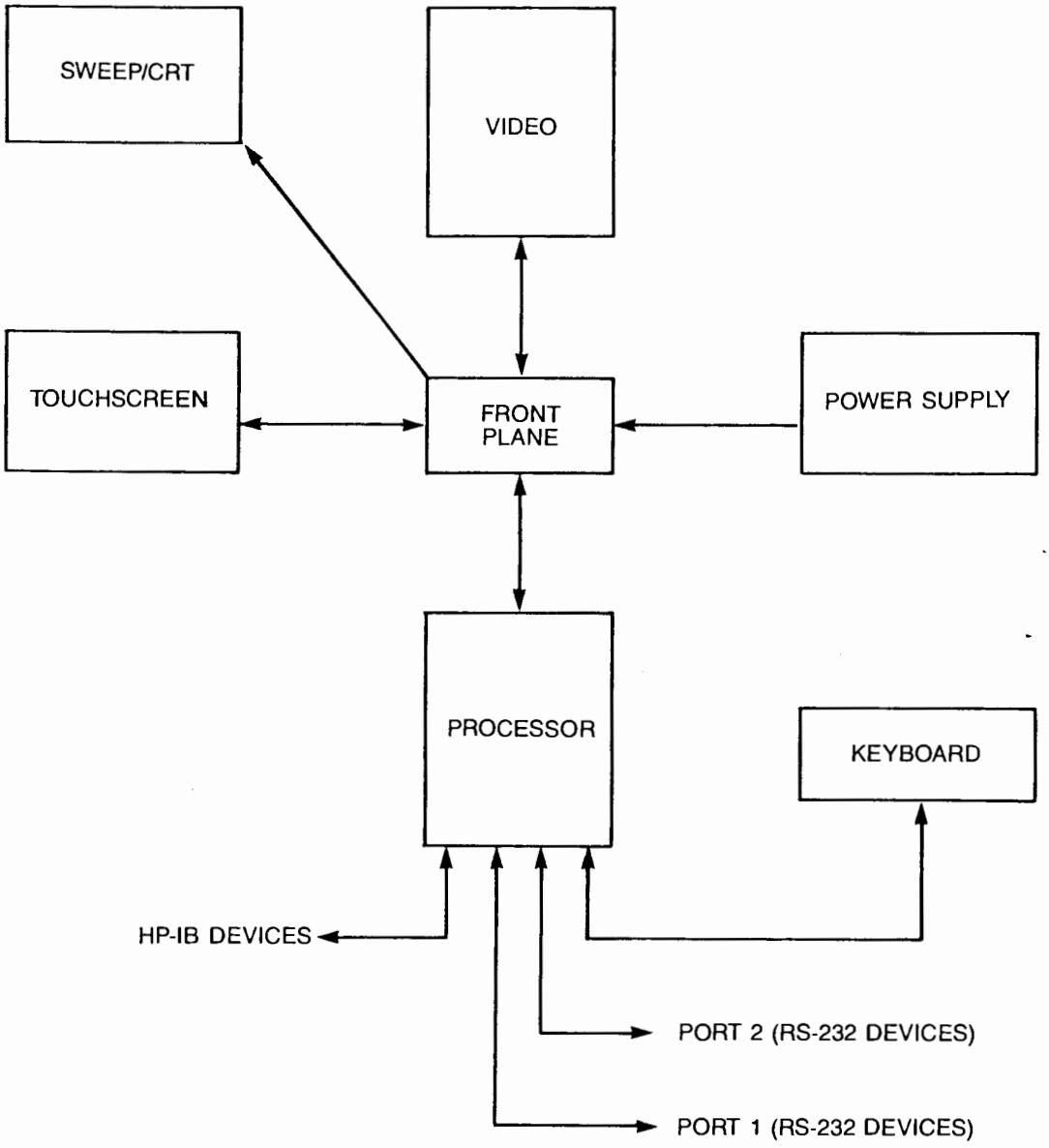


Figure 10-1. HP 150 Block Diagram

PROCESSOR

The Processor module is the "heart" of the HP 150 and is responsible for the transfer and processing of data throughout the system. The main components of the Processor module are the microprocessor, memory and I/O (see figure 10-2).

Note that the components of the Processor module are physically laid out on three seperate boards. One board (the Processor PCA) contains the microprocessor and most of the I/O circuitry. The other two boards, which are mounted on and connected directly to the Processor PCA, contain the system's dynamic RAM, ROM and CMOS (the Mezzanine Memory PCA) and the remaining I/O circuitry (the Mezzanine Datacomm PCA).

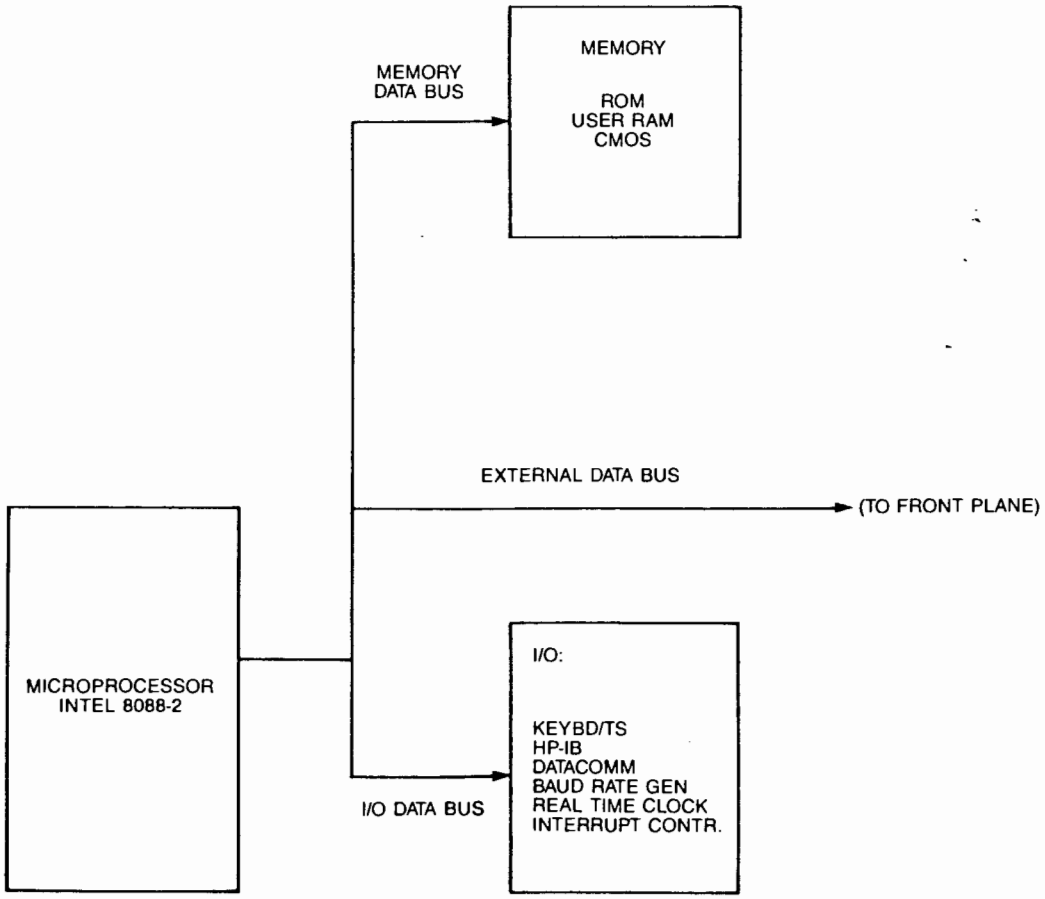


Figure 10-2. Processor Module Block Diagram

Microprocessor

The Processor board design is based on the Intel 8088-2 microprocessor configured for operation in minimum mode. The 8088-2 is a 16-bit internal, 8-bit external microprocessor which runs at an 8 MHz clock speed. The 8088's twenty address lines provide a direct addressing capability of 1 Mbyte of memory.

Memory

The system's ROM and dynamic RAM are located on a small mezzanine memory board mounted directly on the Processor PCA. As well as the system's ROM and RAM, this board (the Mezzanine Memory PCA) also contains 256 X 4 bits of CMOS RAM (with battery back-up), decode logic to enable the ROM, RAM and accessory board select signals, 6 self-tests LEDs, a data bus transceiver and control logic for the dynamic RAM.

As can be seen from the HP 150 memory map shown in figure 10-3, the lower 256K (00000 through 3FFFF) has been reserved for the HP 150's standard configuration of 256 Kbytes of user dynamic RAM. This physically consists of four banks of eight 64K X 1 150ns RAMs. Memory address space has been allocated for up to 384K of additional RAM (40000 through 9FFFF), providing a maximum RAM configuration of 640K. Additional memory is configured into the system via the user installable accessory boards (note that in order to maintain contiguous memory, any additional memory must be located in accessory card slot #1).

Memory address space for 160K (B0000 through B7FFF and E0000 through FFFFF) has been allocated for the the system's read only memory consisting of five 32K X 8 socketed ROMs. These five ROMs contain the firmware which controls the HP 150's terminal characteristics, configuration menus, self-tests, etc.

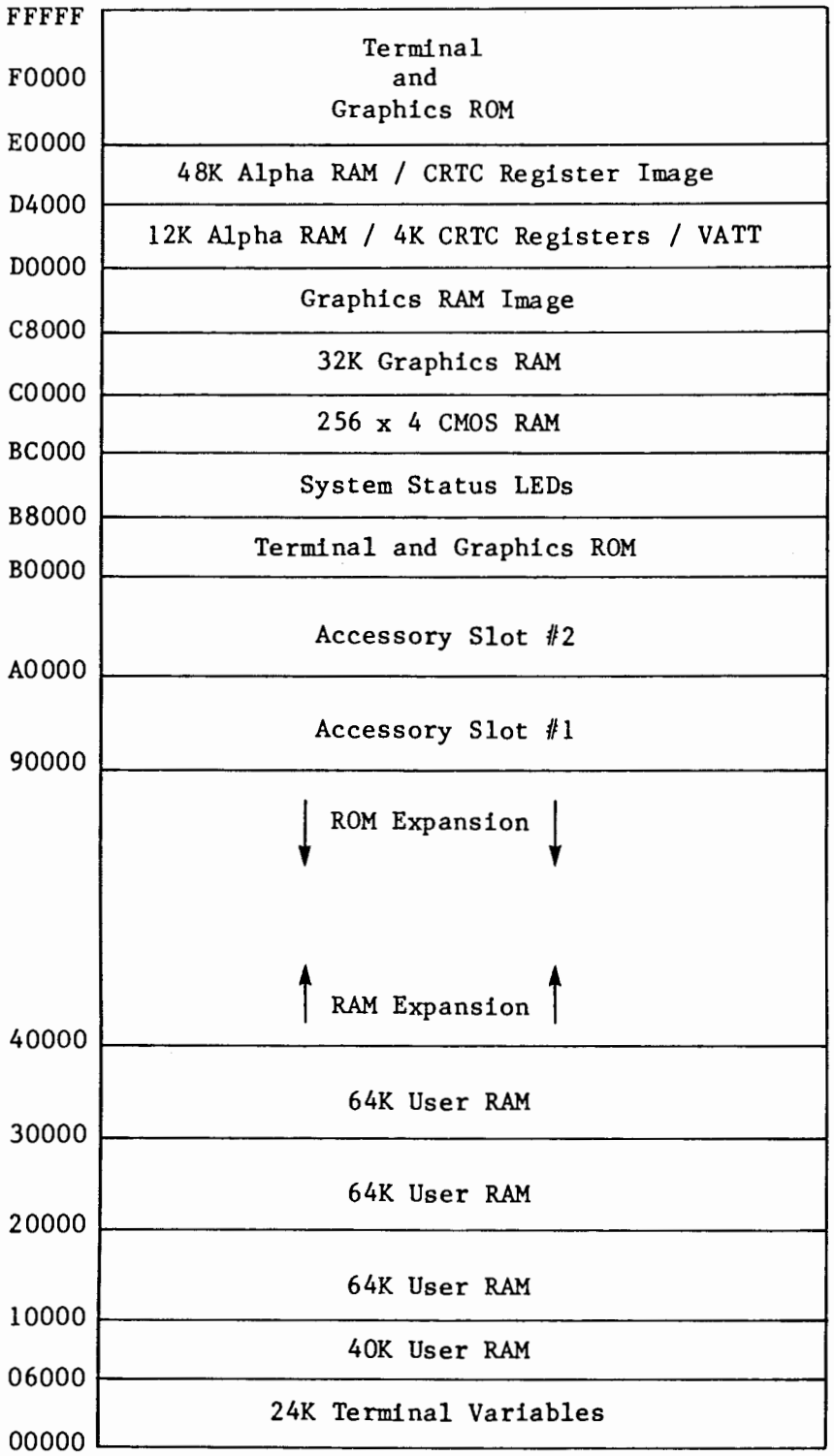


Figure 10-3. HP 150 Memory Map

There are six peripheral components which reside on the I/O data bus. They are the keyboard/touchscreen controller, HP-IB controller, baud rate generator, datacomm controller, real time clock and interrupt controller. The HP 150 I/O map is shown below.

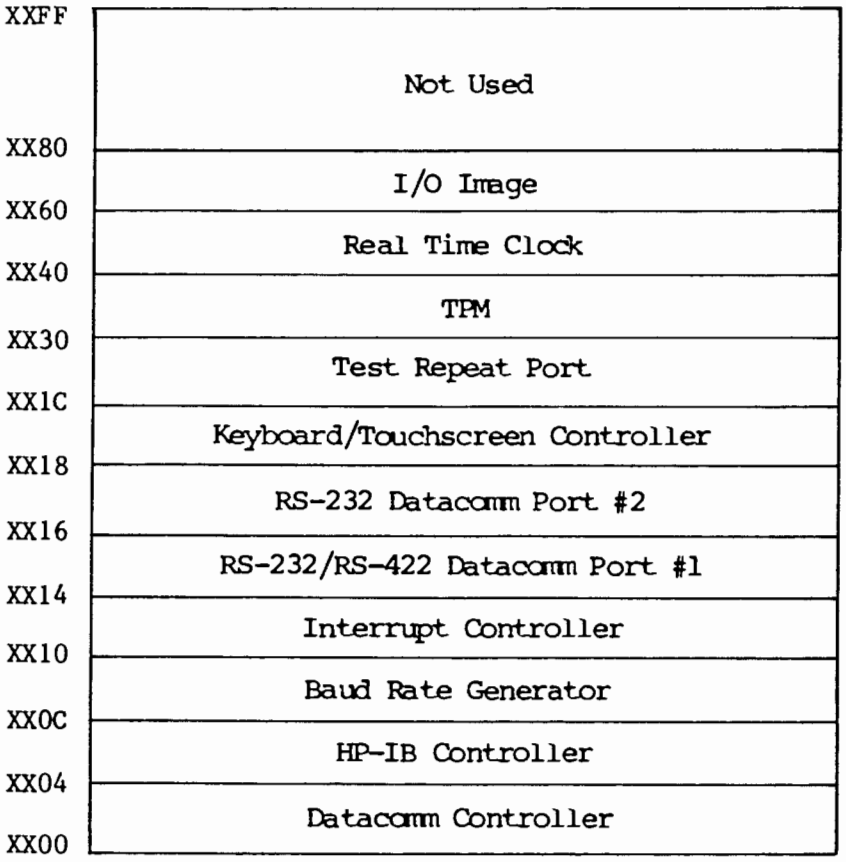


Figure 10-4. HP 150 I/O Map

KEYBOARD/TOUCHSCREEN CONTROLLER. The Keyboard/Touchscreen Controller is an Intel 8041A Peripheral Controller chip. The 8041 serves as an interface between the HP 150's input devices (Keyboard and Touchscreen) and the 8088. When a key is pressed or the screen is touched the input device signals the 8041, which in turn sends the data to the 8088 for processing (for more information refer to the Touchscreen and/or Keyboard sections of this chapter). Both the Touchscreen and Keyboard are serial devices and are interfaced to the 8041 via a clock, sync and data detect lines.

HP-IB CONTROLLER. The TI 9914A General Purpose Interface Bus Controller is used to perform the interface function between the IEEE 488-1975/78 bus (HP-IB) and the 8088 microprocessor. The 9914 handles the talker, listener, handshake and control functions required to implement the HP-IB standard protocol. The SN 75160 and SN 75161 bus transceivers are used to interface the 9914 to the HP-IB bus.

DATACOMM CONTROLLER. The Intel 8274 Multiprotocol Serial Communications Controller (MSCC) is used to provide a base for a variety of communicaitons protocols. The 8274 contains two independent channels for communications and is capable of handling asynchronous, character sychronous and bit sychronous protocols. Error checking facilites are also incorporated on the chip to help minimize the software overhead. Channel A is used for port 1 while channel B is used for port 2. Note that though the 8274 is physically located on the Processor PCA, portions of port 1's drive circuitry is located on the Mezzanine Datacomm PCA which is mounted on the Processor PCA.

BAUD RATE GENERATOR. The SMC COM8116T Dual Baud Rate Generator is used to provide two independent 16X clock frequency sources for serial datacomm purposes. A 4MHz clock from the 8088 clock generator drives the 8116. The 8088 addresses the 8116 as an I/O device and writes a byte to it which specifies the desired baud rate. One of 16 X 50 Hz to 16 X 19.2 KHz can be selected from either channel at any time.

REAL TIME CLOCK. The National MM58167A Real Time Clock (RTC) is used to keep track of the time and provide alarm clock features within the HP 150. The battery backed-up RTC keeps track of time in months, days of the month, days of the week, hours, minutes, seconds, tenths of seconds, hundredths of seconds and ten thousandths of seconds. The RTC can also provide repeated interrupts at the rates of 1/month, 1/week, 1/day, 1/hour, 1/minute, 1/second and 1/10th of a second as well as at user specified times.

INTERRUPT CONTROLLER. A number of interrupts will be generated in the system by different components. The 8259A Interrupt Controller is responsible for prioritizing these interrupts and providing the appropriate interrupt vector to the 8088. The 8259 has eight maskable prioritized interrupt request inputs that can be set for either edge or level triggering. The priorities, within constraints, can be altered dynamically by the processor. The priority scheme for the HP 150 is as follows,

HIGHEST:	IR0	Video
	IR1	Datacomm
	IR2	+ 5 Volts (Video second level tasks)
	IR3	Keyboard/Touchscreen
	IR4	NOCINT (TPM)
	IR5	HP-IB
	IR6	Unused
LOWEST:	IR7	Real Time Clock

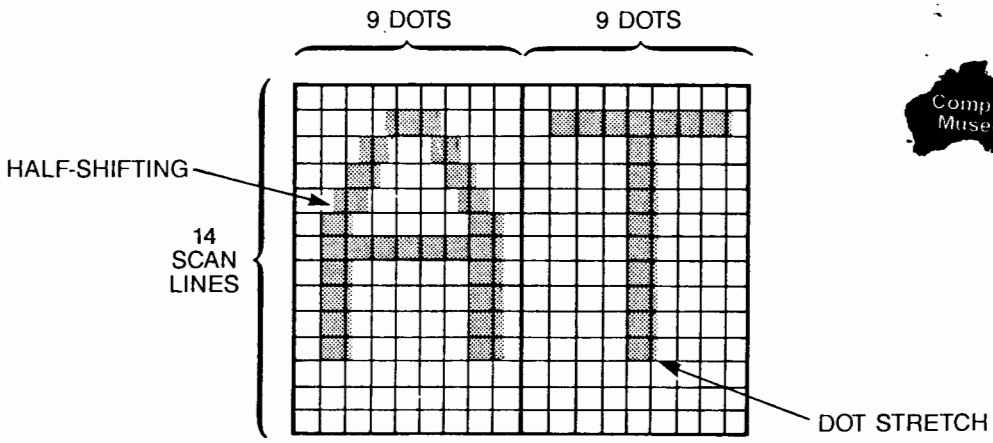
VIDEO

The Video module is responsible for converting display information, received from the Processor module, to control signals used by the Sweep/CRT module to generate the alpha and graphics display. The video display, in general, is generated by scanning the face of the CRT with an electron beam. The beam scans horizontally from left to right (as the user sees the screen) moving progressively downward, from top to bottom. The Video module, which consists of one board (the Video PCA), generates the signals which control the horizontal and vertical motions of the electron beam as well as the on/off state of the beam as it scans horizontally across the CRT.

Specific information on the alpha and graphics display/hardware is presented in the following sections.

Alpha Video

The alpha video display is partitioned into 2160 character cells (27 rows by 80 character columns). Each character cell is further subdivided into 9 dots horizontally by 14 dots or scan lines vertically. The diagram below shows this 9 X 14 structure of the character cell and how, as an example, the word "AT" would be displayed on the screen.



Computer Museum

Two things to note about the characters above and about the HP 150 display in general, is the shifting and stretching of the dots to improve the quality of the display. Half-shifting (indicated in the letter "A", above) is the mechanism by which dots are shifted by one half of a dot position to improve the formation of characters which have slanted or curved lines (e.g. A, G, C, 7). Dot stretch is the mechanism by which the width of the dots are enlarged by approximately 1/3 in order to make characters with horizontal and vertical lines appear more proportional.

The alpha video hardware (consisting of an alpha video controller, memory and display circuitry) generates the following signals:

Alpha Dot Stream - A serial dot stream representation of the character to be displayed which will in turn be combined with the graphics dot stream in order to produce the signals controlling the on/off state of the electron beam.

Horizontal Sync - Signal which causes the electron beam to return to the left side of the CRT in prepartion for another horizontal scan (horizontal retrace).

Vertical Sync - Signal which causes the electron beam to return to the top of the CRT in preparation for another complete tube scan (vertical retrace).

The video controller used is an 9007 CRT Video Processor and Controller chip made by Standard Microsystems. The 9007 is responsible for retrieving alpha display information from memory and for generating the horizontal and vertical sync signals as well as the other display signals needed to generate the alpha display.

Alpha memory consists of two 6K X 8 banks of static RAM, each bank having its own distinct data bus. Each character to be displayed is written into alpha RAM (by the 8088) as a 16 bit character/enhancement pair. The most significant 8 bits contain enhancement and character set information, while the least significant 8 bits contain the character code.

The display circuitry is responsible for converting the character/enhancement pair stored in alpha RAM to the alpha dot stream. The main components of the alpha display circuitry are the character ROM, video attribute decoder, half-shifting and dot-stretch circuitry and attribute latch.

The interaction which takes place between the various components of the alpha video hardware in order to display a screen of alpha information is described in the following steps (refer to figure 10-5).

1. During the vertical retrace of the CRT, the 8088 updates the register in the 9007 which contains the address of the row pointer. The row pointer "points" to the location in RAM where the first character row to be displayed is stored. Also during the vertical retrace the 8088 updates the video attribute latch (VATT) which contains information on the current state of the display and cursor.

2. When RAM access by the 9007 is enabled, the 9007 fetches the row pointer and uses it to load the 16 bit character/enhancement pair (representing the first character to be displayed) into two 8-bit latches (the character latch and the enhancement latch).

3. The contents of the character latch along with the scan line count generated by the 9007 are then decoded by the character ROM. At the same time the contents of the VATT and enhancement latch are also being decoded.

4. The dot pattern produced by the character ROM is then converted from parallel to serial and sent through the half-shifting and dot strech circuitry to produce the alpha dot stream. While this is taking place the decoded enhancements are loaded into the attribute latch in order to synchronize them with the alpha dot stream.

5. The alpha dot stream is then sent through the enhancement processing and alpha/graphics mixing. At this point, the appropriate enhancements are engaged and alpha and graphics dot streams are ORed to produce the two signals (half bright and full bright) sent to the sweep which control the on/off state of the CRT's electron beam.

6. The result of all this is that the first scan line of the first character in the first character row is displayed on the screen. The 9007 will then increment the character address and repeat the process for the second character in the current row. This will continue until the first scan line of the entire character row is displayed, at which time the 9007 will increment its scan line counter by one and the process will be repeated for the second scan line of the current character row.

7. When the 14th scan line has been displayed, the 9007 will update its row pointer and the entire process will be repeated for the second character row. In this way the entire alpha screen is written. When the last row is displayed a vertical sync is generated by the 9007 and the entire process is repeated (see step #1).

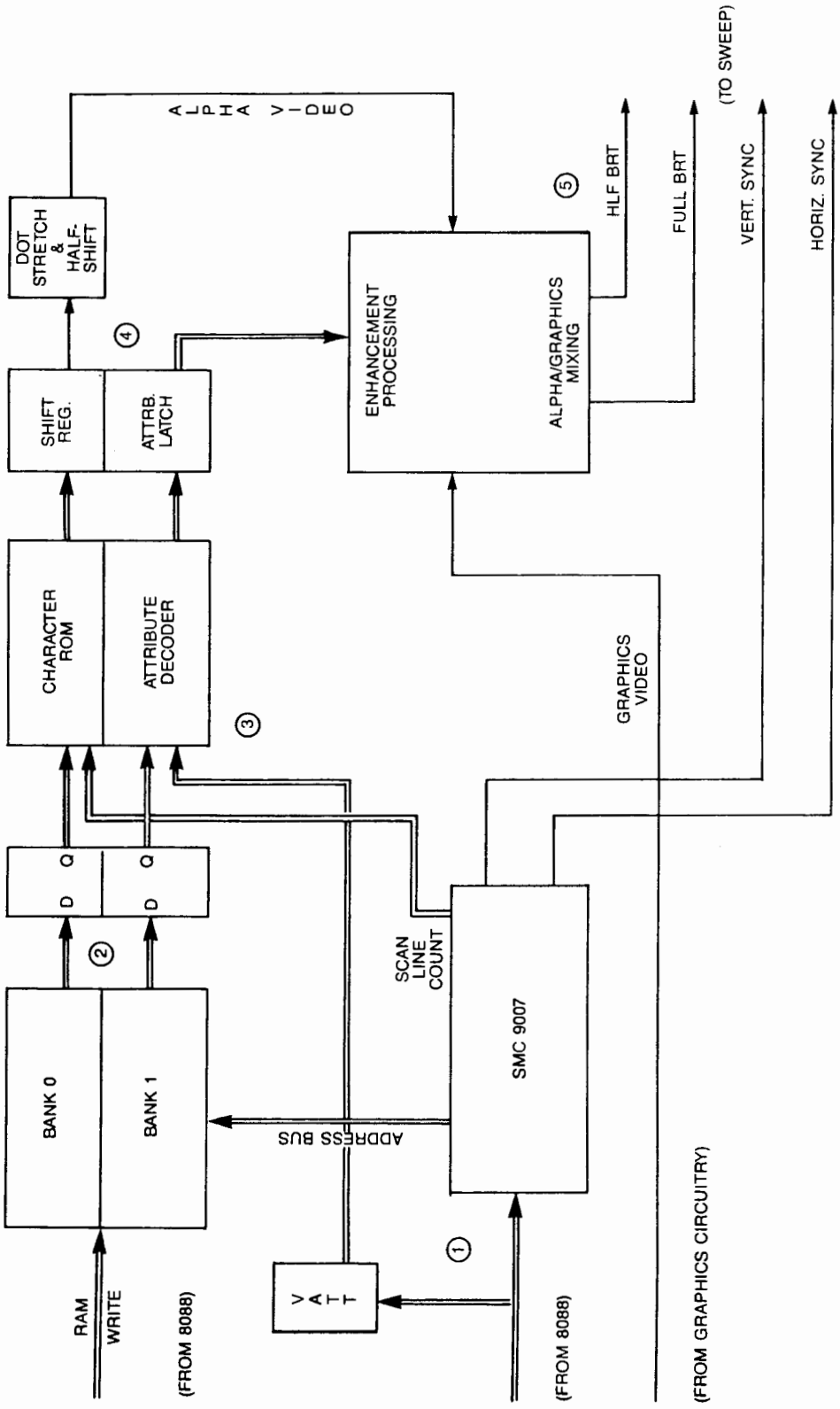


Figure 10-5. Alpha Video Block Diagram

Graphics Video

The graphics video display, consisting of 390 scan lines by 512 graphic dots (where a graphics dot equals 1.5 alpha dots), is a bit mapped display. This means the graphics display information is stored in memory exactly as it would appear on the screen (i.e. each dot is stored as one bit in memory).

The graphics video hardware (consisting of a graphics video controller, memory and clock/start-of-frame logic) generates the graphics dot stream (the serial dot stream representation of the graphics display which is ORed with the alpha dot stream to produce the half bright and full bright signals sent to the Sweep/CRT module). The graphics video controller used is a GDC-3091 customized gate array. The GDC-3091 is responsible for retreiving graphics display information from memory and converting it to the serial graphics dot stream. Graphics memory consists of a 32K X 8 block of dynamic RAM which stores the graphics display information. As was previously mentioned, graphics information, because the display is bit mapped, is stored in RAM exactly as it would appear on the screen. The clock/SOF logic synchronizes the graphics display with the alpha based on the vertical sync signal generated by the 9007. This portion of the circuitry also generates the 17MHz graphics clock.

The interaction between the various components of the graphics circuitry is described in the following steps (refer to figure 10-6).

1. Just prior to a screen refresh, a vertical sync signal is received from the alpha circuitry which causes a SOF signal to be generated and sent to the GDC-3091 chip. This SOF signal causes the internal address counters and registers in the GDC-3091 to be reset.

2. The GDC-3091 chip (once its access cycle is enabled) will then count through memory addresses loading the contents of RAM into an internal parallel to serial shift register. The graphics dot stream output of the shift register is then mixed with the alpha dot stream and output to the sweep board.

3. This continues until the entire screen has been written and another SOF signal is received by the GDC-3091 chip, which starts the process over.

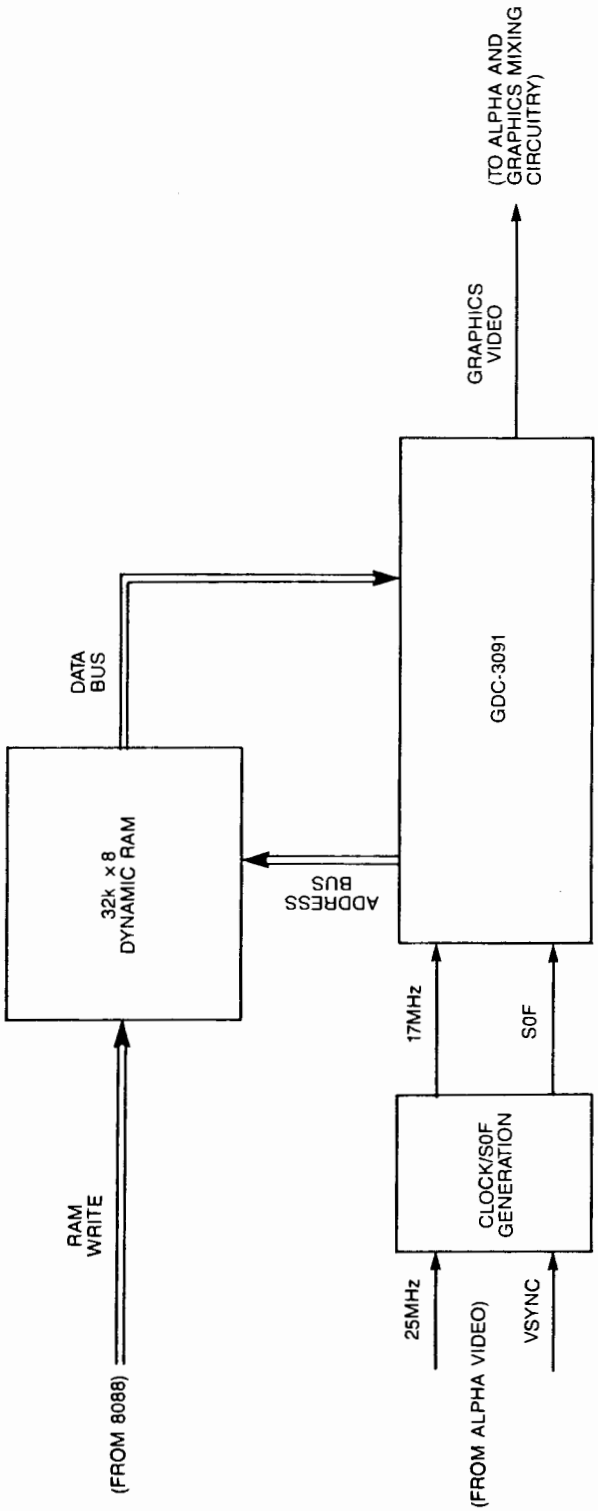


Figure 10-6. Graphics Video Block Diagram

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The HP 150 display is a raster scanned CRT which utilizes magnetic deflection and is refreshed at a rate of 60Hz. The video board supplies the TTL level horizontal sync, vertical sync and video drive signals to the sweep board which in turn uses these signals to provide the appropriate bias to the CRT.

The four basic functions of the sweep board are,

1. To generate the current required for the vertical deflection of the electron beam.

2. To generate the current required for the horizontal deflection of the electron beam.

3. To supply the grid voltages and the accelerating potential for the electron beam.

4. To amplify the video signals to the voltage level required to drive the cathode of the tube.

The sweep board, in order to accomplish the above, contains three main circuits. They are the video amplifier circuit, the vertical drive circuit and the horizontal drive circuit (see figure 10-7).

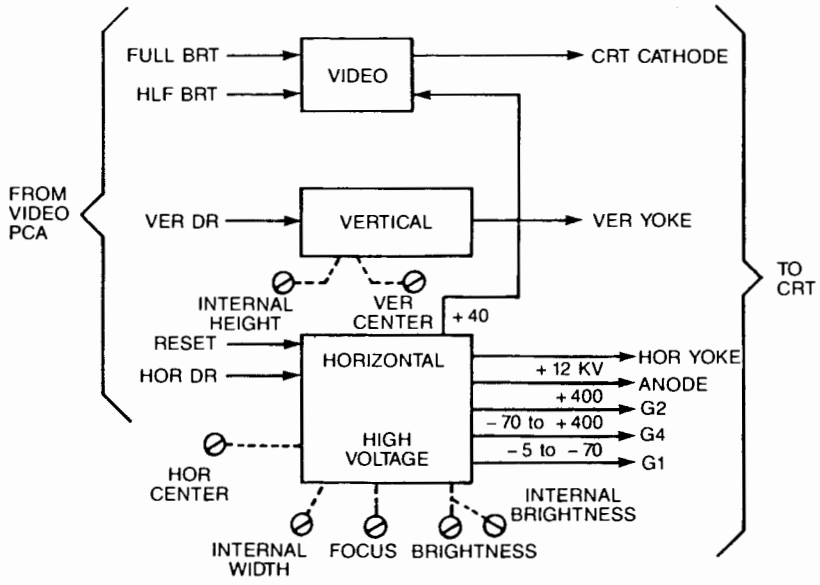

Figure 10-7. Sweep Block Diagram

Video Amplifier Circuit

The video drive circuit is responsible for amplifying the signals from the video board to the voltage level required by the CRT. The video amplifier converts the FULL BRT and HALF BRT TTL level inputs to one of three outputs: 30 volts (beam off), 0 volts (full-bright) and 6 volts (half-bright).

Vertical Drive Circuit

The vertical drive circuit generates the current required for the vertical deflection of the CRT. This circuit converts the input (VER SYNC) from the Video board to the current output to the vertical yoke winding which controls the vertical deflection of the electron beam. Two potentiometers in this circuit control the vertical adjustment of the CRT. One of these pots (located at the back of the HP 150 and accessible by the user) is a vertical center adjustment, while the other (located on the component side of the sweep board and not accesible by the user) is a height adjustment.

Horizontal Drive Circuit

The horizontal drive circuit generates the current required by the CRT for horizontal deflection of the electron beam. This deflection is produced by a resonant circuit which oscillates at the same frequency as the horizontal sync signal. Each oscillation corresponds to a horizontal scan across the CRT.

Also generated in the horizontal drive circuit are voltages required by the CRT and video amplifier circuit. A flyback transformer is used to generate the following voltages:

1. A positive voltage of 12KV for electron acceleration (anode voltage).
2. A -5 to -70 volts for grid G1 (brightness).
3. A positive 400V for grid G2.
4. A -70 to +400 volts for grid G4 (focus).
5. A positive 40V for the video amplifier circuit.

There are also five potentiometers located within the horizontal drive circuitry (three of which are user accessible) which control the adjustment of the horizontal center, width, focus and brightness (see figure 10-7).

TOUCHSCREEN

The Touchscreen is a user interface which digitizes the coordinates of an object touching the screen. The Touchscreen consists of a counter, LED pair decoders/drivers, infrared emitter/detector LED pairs and signal processing circuity (see figure 10-8), all of which are located on the Touchscreen PCA mounted inside the unit's bezel. The basic operation of the Touchscreen is described in the following paragraphs.

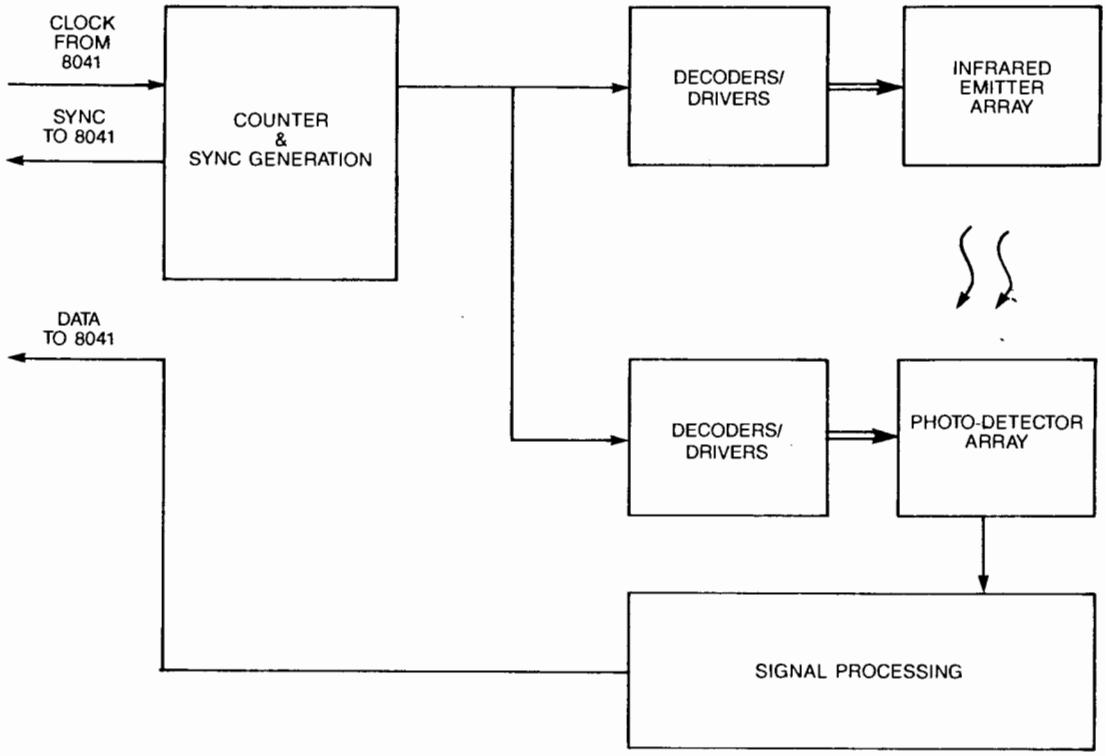

Figure 10-8. Touchscreen Block Diagram

When the HP 150 is powered-on or reset, a sync pulse (TSSYNC) is generated by the counter circuitry on the Touchscreen PCA and sent to the 8041 Keyboard/Touchscreen controller in order to synchronize the 8041's software counter with the Touchscreen's hardware counter (i.e. both counters are set to zero). The 8041's software counter then begins to increment at the rate of the 8041 clock which is at the same time supplying the clock to the Touchscreen's hardware counter (the result of which is that both counters begin to increment at the same frequency and will therefore always be at the same count). The outputs of the Touchscreen's hardware counter are then decoded by the LED pair decoders/drivers which causes the scanning of the LED emitter/detector pair array (21 pairs horizontally by 14 pairs vertically).

While scanning of the LEDs takes place, the state of the Touchscreen is monitored by the 8041 via the TSDATA line output from the signal processing circuitry. When a touch is detected the 8041 stores the contents of its software counter identifying which LED pair was blocked. At the end of a screen scan, the 8041 checks for the following:

VALID HITS	At least one interrupted pair in the column range and at least one interrupted pair in the row range. More than one pair, in a row or column, is okay as long as the interrupted pairs are adjacent (e.g. pair 3 interrupted, pair 4 not interrupted and pair 5 interrupted would be an error condition).
NO HITS	A scan cycle which finds no pair interrupted.
ERROR CONDITIONS	- an interrupted row pair, but no interrupted column pair. - An interrupted column pair, but no interrupted row pair. - multiple hit condition where any two interrupted row or column pairs are seperated by one or more uninterrupted pairs (i.e. two distinct objects are touching the screen at the same time).

If a valid hit is detected, the 8041 sends two bytes identifying the location (i.e. the row and column) of the hit to the 8088 for processing.

KEYBOARD

The operation of the Keyboard is similiar to that of the Touchscreen, discussed in the previous section. The main components of the Keyboard are the binary counter, decoders and keyswitch array (see figure 10-9). The Keyboard operation is described in the follow paragraph.

When the HP 150 is powered-on or a hard reset is performed the 8041 synchronizes its internal counter with the keyboard counter via the SYNC line to the keyboard counter's reset line. Because the 8041 is supplying the clock to the keyboard counter, both counters will begin incrementing at the same rate and will therefore always be at the same count. The output of the keyboard counter is then decoded into row and column select lines which scan the keyswitch array. When a key is pressed the row decoder sends a signal (KEY) to the 8041 which causes the contents of the 8041's internal counter (identifying the location of the key which was pressed) to be sent to the 8088 for processing.

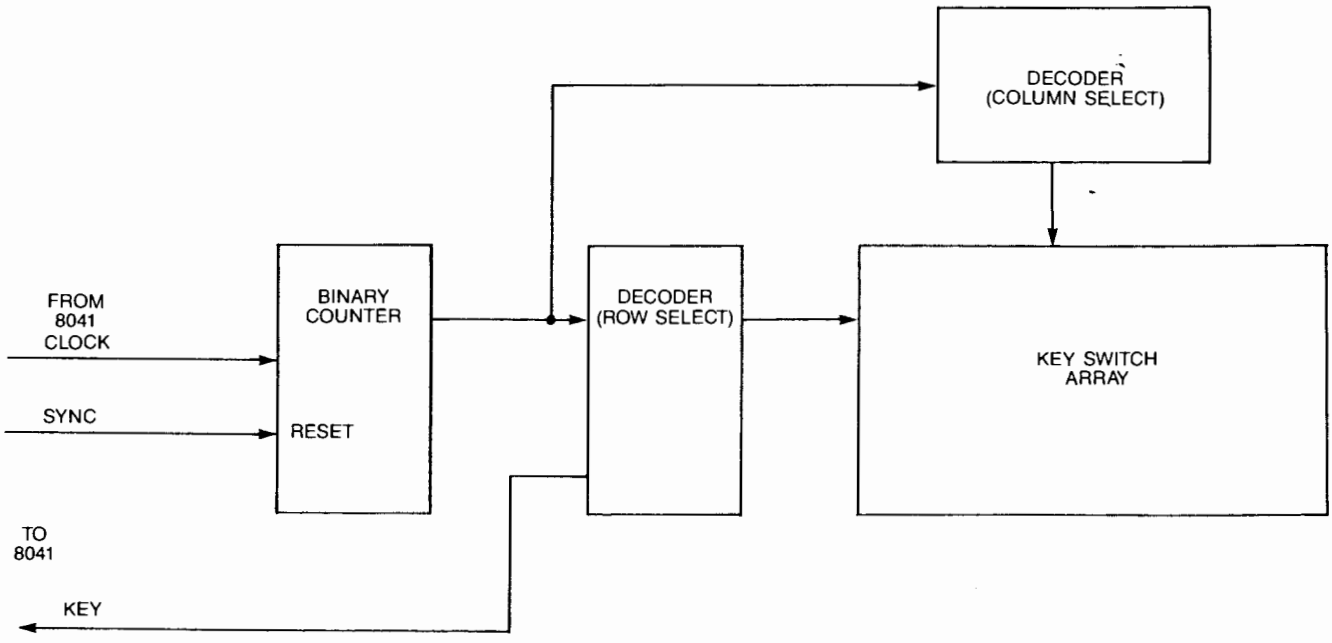

Figure 10-9. Keyboard Block Diagram

POWER SUPPLY

The HP 150 Power Supply, which uses a feed forward design, supplies three different voltages: +5, +12 and -12. A block diagram of the HP 150 Power Supply is shown below in figure 10-10. Basic operation of the power supply is discussed in the following paragraphs.

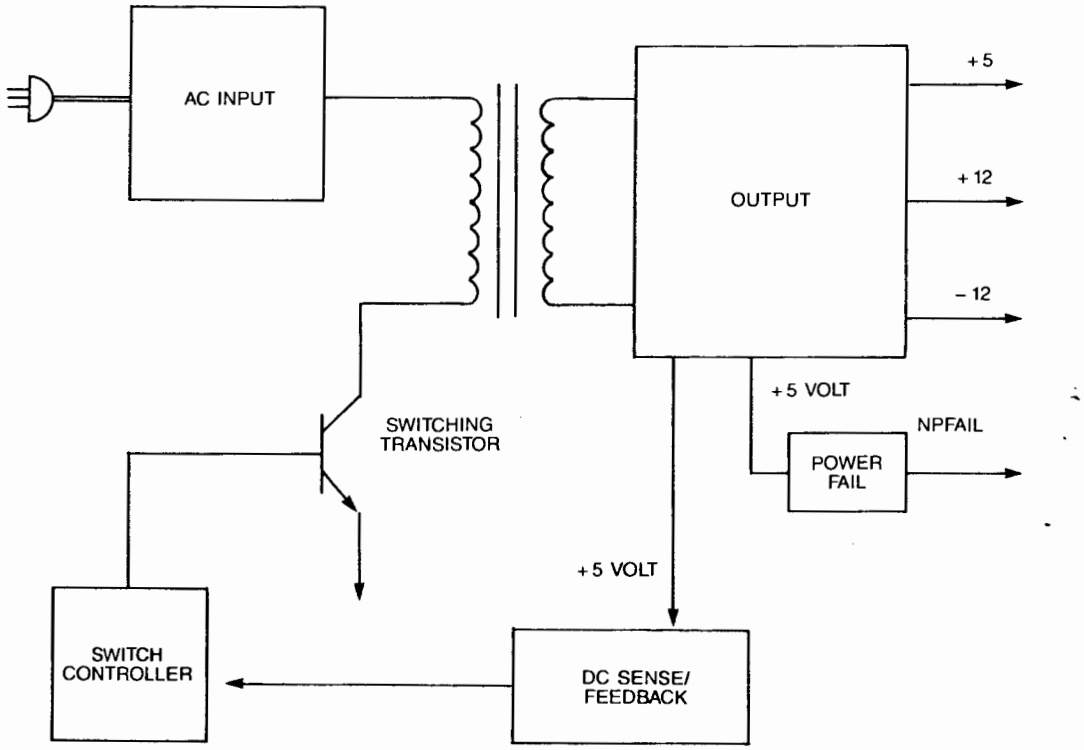

Figure 10-10. Power Supply Block Diagram

During normal operation the input to the AC input circuitry is a 115 or 230 VAC AC line voltage. This voltage is converted by the AC input circuitry (which consists of a RFI filter, rectifier and smoothing filter) to a DC voltage. During the "on" state of the switching transistor the energy generated by the DC voltage is transferred from the primary side of the transformer to the secondary side. This energy is then converted by the output circuitry to voltages required by the rest of the HP 150 (+5, +12 and -12 volts).

The "on" and "off" state of the switching transistor is controlled by the switch controller and DC sense/feed-back circuitry. The DC sense/feed-back circuitry uses an opto-coupler on the +5 volt line to sense the energy needs of the output circuitry. When more energy is required by the output circuitry the switch controller keeps the switching transistor "on" for a longer period of time. When the energy requirements of the output are met the switch controller turns the switching transistor off. This switching frequency is typically around 43KHz.

If a short circuit or over-voltage condition is sensed on the +5 or +12 volt lines the switch controller will turn the supply off. To reset the power supply the power switch must be turned off for approximately 5 minutes before turn-on can be attempted. An alternate method is to short the two reset points on the non-component side of the Power Supply PCA. This will reset the supply and turn-on may be attempted immediately. In the case of the -12 volt output, if a short circuit or over-voltage condititon exists the 3-terminal regulator within the -12 volt circuitry will shut down the -12 volt output without affecting either the +5 or +12 volt outputs. The -12 volt output will return to normal operation as soon as the cause of the fault condition is removed.

The power-fail circuit senses when the AC input voltage has been removed or has dropped to an insufficient level. When either of the above conditions are detected, a signal is sent to the system by the power-fail circuitry to warn of impending power loss.

FRONT PLANE

The Front Plane provides the communication path between all of the HP 150 modules (with the exception of the Keyboard since it connects directly to the Processor PCA). The Front Plane module consists of one board (the Front Plane PCA) which all the boards inside the HP 150 (excluding the Mezzanine Memory and Datacomm boards since they connect directly to the Processor PCA) connect to via either a cable or edge connector. The Front Plane PCA also contains interface circuitry for the user installable internal printer.

APPENDIX A: Error Messages

The following is a list of the system, operating system and utilities generated error messages. The messages are listed in alphabetical order and include the message, a cause and a remedy. This list does not include application generated error messages. Refer to the appropriate application reference manual for information on specific application generated error messages.

Message: **A directory file must be empty before it can be deleted.**

Cause: You tried to delete a directory that still contains files; you must "empty" the directory first.

Remedy: From P.A.M., press Delete File/ Dir, press the name(s) of the file(s) on the screen, then press Start Delete.

Message: **A disc was not selected. Select the correct disc(s) below. Press Show Applics.**

Cause: You are using the Remove part of the INSTALL program, and did not select a disc.

Remedy: Select a disc, then press Show Applics.

Message: **A disc was not selected from both columns. Select the correct disc(s) below. Press Show Applics.**

Cause: You are using the INSTALL Application program, and forgot to pick two discs, one from each column.

Remedy: Press one disc name in the left column, and one in the right column, then press Show Applics.

Message: **A directory file must be chosen.**

Cause: You are in File Manager, and neglected to select a directory file for an operation.

Remedy: If the directory name is on the screen, touch it. If not, type the name of the directory and press Return.

Message: **A file cannot be renamed to another disc.**

Cause: You are using the rename feature of File Manager, and tried to rename a file (e.g., B:SAMPLE) to another name on another disc (e.g., A:EXAMPLE).

Remedy: Use the same disc letter; just change the name of the file (e.g., B:SAMPLE to B:EXAMPLE).

Message: **A read only file cannot be deleted.**

Cause: You are using File Manager's Delete, and tried to delete a read only file.

Remedy: The file must be modified by the programmer, so that it is no longer read only.

Message: **Access to browse file interrupted.**

Cause: File Manager is having a problem finding information in a browse file.

Remedy: Make sure the disc(s) containing File Manager and your file are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Access to directory interrupted.**

Cause: File Manager is having a problem finding information in a directory.

Remedy: Make sure the disc(s) containing File Manager and the directory are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Access to file interrupted.**

Cause: File Manager was using a file, but can't now.

Remedy: Make sure the disc(s) containing File Manager and your files are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Access to input file interrupted.**

Cause: File Manager is having a problem finding information in an input file.

Remedy: Make sure the disc(s) containing File Manager and your files are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Access to output file interrupted.**

Cause: File Manager is having a problem finding information in an output file.

Remedy: Make sure the disc(s) containing File Manager and your files are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Access to printer interrupted.**

Cause: File Manager was using the printer, and something happened to interrupt that use.

Remedy: Check the cable from the printer to the Hp 150. Be sure that the printer is turned on. Check any error lights (such as out of ribbon) on the printer. Try printing again.

Message: **Access to temporary file interrupted.**

Cause: File Manager is having a problem finding information in a temporary file.

Remedy: Make sure the disc(s) containing File Manager and your files are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Application is too large to install onto disc X. Select the applics to be installed. Press Start Install.**

Cause: There is not enough room on the disc for the application you chose.

Remedy: Put the application on another disc.

Message: **"Application" was not found on disc drive X.**

Cause: P.A.M. tried to run an application that is no longer in the drive.

Remedy: Be sure the drive is turned on. Be sure the disc is inserted correctly. Press Reread Discs to see the applications that are on the discs.

Message: **Backup aborting: out of memory.**

Cause: There is not enough computer RAM memory to run the COPY/BACKUP program.

Remedy: Call your hardware support person.

Message: **Bad command or filename**

Cause: You are using MS-DOS from the command prompt, and either mistyped a command, or tried to use a command not present on the disc.

Remedy: Type DIR to see if the command is on the disc. If so, retype your command.

Message: **BAD tracks found - disc unusable.**

Cause: You are using FORMAT to format a disc that is damaged.

Remedy: Do not use this disc; use another disc.

Message: **Cannot close file.**

Cause: File Manager tried to close a file and could not; the disc was probably removed in the middle of an operation.

Remedy: Reinsert the original disc, and try again.

Message: **Cannot create to-file. Copied to $$$$$$$.$$$.**

Cause: You are using File Manager's Copy command, and named an illegal name for the new copy. File Manager named the file $$$$$$$$.$$$ instead.

Remedy: You can do two things. Repeat the operation with a legal name, then delete $$$$$$$$.$$$, or go to the MS-DOS command prompt, and use the copy command to copy $$$$$$$$.$$$ to another name. DO NOT leave the file with the name $$$$$$$$.$$$. File Manager needs this file.

Message: **Cannot find the correct files on drive X to install/ remove application. Insert the correct disc into drive X and press New Disc Ready.**

Cause: You are installing a multi-disc application, and have placed the wrong disc into the drive.

Remedy: Place the next sequential disc into the drive, and press New Disc Ready.

Message: **Cannot open browse file.**

Cause: File Manager tried to open a browse file and could not.

Remedy: Make sure the disc(s) containing File Manager and your file are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Cannot open input file.**

Cause: File Manager tried to open an input file and could not.

Remedy: Make sure the disc(s) containing File Manager and your file are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Message: **Cannot open output file.**

Cause: File Manager tried to open an ouput file and could not.

Remedy: Make sure the disc(s) containing File Manager and your file are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

Check your pathname to be sure you used a legal disc letter, directory name(s), and file name, seperated by back slashes.

Message: **Cannot open temporary file.**

Cause: File Manager wants to open a temporary file, but can't because you have used the name it wants to use.

Remedy: Delete any file or directory named $$$$$$$$.$$$. Try again.

Message: **Cannot use printer**

Cause: File Manager tried to use your printer and could not.

Remedy: Be sure your printer is turned on, and that cables are secure. If the above are true, try pressing the reset button on the printer; try printing again.

Message: **Could not find files on disc drive X.**

Cause: You named a disc in COPY/BACKUP that either contains no files at all, or contains files in a format that COPY/ BACKUP cannot read.

Remedy: Press Continue. Choose a source directory or disc that contains the files you want to copy.

Message: **Could not identify disc. Check drive.**

Cause: FORMAT could not identify this disc drive as one that is supported (3 1/2", 5 1/4", 8", fixed 5Mb.,10 Mb., 15 Mb., or IBM 3740 format.)

Remedy: Be sure the drive is turned on. Check your cables to be sure they are secure. Only format supported discs.

Message: **Create error on disc X. (May exist as hidden file.)**

Cause: The file system returned an error when COPY/BACKUP attempted to create a destination file. This can occur if the file name already exists on the destination but has an attribute such as "hidden file."

Remedy: Press Continue to remove the message from the screen. Try changing the name of the file (on the source disc) you are copying.

Message: **Datacomm test failed**

Cause: The HP 150 firmware has detected an error during the datacommunications test.

Remedy: Press Return to clear the message from the screen. Be sure that the cable or test hood is connected correctly. Contact your hardware support person.

Message: **Default configurations used**

Cause: The battery in the HP 150 was too weak to hold any changes you may have made to the Configuration Menus. The entries used to start the system were the default entries.

Remedy: Press Return to clear the message from the screen. Change the two batteries in the battery pack (see the appendix on Maintenance). If the error persists with new batteries, you may be running a program that resets your configuration entries as it runs, or you may be experiencing a CMOS chip failure. Contact your support person.

Message: **Destination disc in drive X is write protected.**

Cause: You have write protected the destination disc by sliding the small tab in the slot to the down position with a 3 1/2" disc, or placing a write-protect sticker on a 5 1/4" disc.

Remedy: Move the small tab to the up position if you are using a 3 1/2" disc. Remove the write-protect tab from a 5 1/4" disc. Press Continue, then Start Copy or Start Backup.

Message: **Destination disc is a backup disc.**

Cause: You are using COPY/BACKUP, and want to copy files to a disc that has been formatted and used as a backup disc. Copied files and backed up files cannot exist on the same disc.

Remedy: Press Continue to remove the message from the screen. Use different discs for backup and copy files. If you want to use this particular disc for copied files, use the FORMAT program to clear the backup files from it.

Message: **Directory does not exist.**

Cause: In File Manager, you asked for a directory that is not on the system or on the disc.

Remedy: Be sure you are looking on the correct disc for the directory. Be sure you are spelling the directory name correctly.

Message: **Disc access error on disc drive**

Cause: COPY/BACKUP can not read or write to the disc named.

Remedy: Press Continue to remove the message from the screen. Be sure that the drive indicated is turned on. Be sure that a disc is present in the drive. Be sure that you are indicating the correct disc letter (see the chapter on installation) for the drive. If these two criteria are met and the error still occurs, you may have a bad disc.

Message: **Disc drive address is already in use for device X.**

Cause: In MS-DOS Config, you pressed Save Config after choosing the same interface/ address/ unit number as the one already assigned to device X.

Remedy: Change the values of one of the devices, so that each is unique.

Message: **Disc drive is empty, off, or undefined.**

Cause: COPY/BACKUP has tried to find a disc drive and failed.

Remedy: Press Continue to remove the message from the screen. Be sure that the drive indicated is turned on. Be sure that a disc is present in the drive. Be sure that you are indicating the correct disc letter (see the chapter on installation) for the drive. If these two criteria are met, and the error still occurs, you may have a bad disc.

Message: **Disc error on output file**

Cause: File Manager has encountered a disc problem while using an output file.

Remedy: Make sure the disc(s) containing File Manager and your file(s) are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

If none of these measures work, you may have a bad disc; in this case, use the MS-DOS Recover command to recover as much information as possible, and put it on another disc.

Message: **Disc error on print file**

Cause: File Manager has encountered a disc problem while using print with one of your files.

Remedy: Make sure the disc(s) containing File Manager and your file are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

If none of these measures work, you may have a bad disc; in this case, use the MS-DOS Recover command to recover as much information as possible, and put it on another disc.

Message: **Disc error on temporary file**

Cause: File Manager has encountered a disc problem while using a temporary file.

Remedy: Make sure the disc(s) containing File Manager and your file(s) are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

If none of these measures work, you may have a bad disc; in this case, use the MS-DOS Recover command to recover as much information as possible, and put it on another disc.

Message: **Disc error reading drive X**

Cause: Your disc may be worn or damaged.

Remedy: Press Continue to remove the message from the screen. Try again. If the next read works, duplicate this disc right away (use COPY/BACKUP's COPY). If it doesn't work, try using the MS-DOS RECOVER command.

Message: **Disc drive X is empty, off, or write protected. Check disc drive and press New Disc Ready to continue or Stop Install to exit.**

Cause: You are using the INSTALL Application program. You indicated a drive with no disc in it or a drive that is turned off.

Remedy: Put a disc into drive X if it is a flexible drive, or turn the drive on if it is off.

Message: **Disc error on browse file**

Cause: File Manager has encountered a disc problem while using browse with a file.

Remedy: Make sure the disc(s) containing File Manager and your file are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

If none of these measures work, you may have a bad disc; in this case, use the MS-DOS Recover command to recover as much information as possible, and put it on another disc.

Message: **Disc error on directory file**

Cause: File Manager has encountered a disc problem while using a directory.

Remedy: Make sure the disc(s) containing File Manager and the directory are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

If none of these measures work, you may have a bad disc; in this case, use the MS-DOS Recover command to recover as much information as possible, and put it on another disc.

Message: **Disc error on input file**

Cause: File Manager has encountered a disc problem while using an input file.

Remedy: Make sure the disc(s) containing File Manager and your file(s) are in a drive(s). Make sure the door(s) are closed on the drive(s), and the cables from the drive to the HP 150 are secure. Try again.

If none of these measures work, you may have a bad disc; in this case, use the MS-DOS Recover command to recover as much information as possible, and put it on another disc.

Message: **Disc error writing drive X**

Cause: Your disc may be worn or damaged.

Remedy: Press Return to clear the message from the screen. Try again. If the next read works, duplicate this disc right away (use COPY/BACKUP's COPY). If it doesn't work, try using the MS-DOS RECOVER command.

Message: **Disc is not formatted.**

Cause: Using File Manager, you tried to use a disc that was not formatted.

Remedy: Format the disc, according to the directions in the chapter on discs.

Message: **Disc is write protected.**

Cause: Using File Manager, you are trying to write information on a disc that is write protected.

Remedy: You can store the information elsewhere, or reverse the write protection, as described in the Disc chapter.

Message: **Disc read error on disc drive X.**

Cause: COPY/BACKUP has tried to read your disc and failed.

Remedy: Press Continue to remove the message from the screen. Be sure the drive door is shut (if flexible drive). Be sure that the disc is placed in the drive with the label side up, silver plate in first. If these two criteria are met and the error still occurs, you may have a bad disc.

Message: **Disc unsuitable for system disc.**

Cause: You are using FORMAT with the Copy System option on. FORMAT is unable to copy the operating system to the disc being formatted because this disc has bad sectors in the location where the operating system should be placed.

Remedy: You could possibly use this disc to store information other than the operating system. If you need a copy of the operating system present, use another disc.

Message: **Disc write error on disc drive X.**

Cause: COPY/BACKUP has tried to write on your disc and failed.

Remedy: Press Continue to clear the message from the screen. Be sure the drive door is shut (if flexible drive). Be sure that the disc is placed in the drive with the label side up, silver plate in first. If these two criteria are met and the error still occurs, you may have a bad disc.

Message: **Duplicate files (displayed below) on backup disc.**

Cause: You are using COPY/BACKUP to back up files, and indicated a destination disc that already contains a copy of the files.

Remedy: BACKUP will not overwrite files with duplicate names. Press Continue to clear the message from the screen. Use another destination disc, or clear these files with the FORMAT program.

Message: **Entered date is invalid.**

Cause: You are using COPY/BACKUP, and are selecting files by last date altered. You entered an illegal date.

Remedy: Press Continue and type a date in the format MM-DD-YY or the format MM/DD/YY (e.g., 7/15/83). Do not type dates before 1/1/80 or after 12/31/43.

Message: **ERROR 1 - NO XXXX.MSG**

Cause: A vital part of your software cannot be found.

Remedy: Call your support person.

Message: **ERROR ACCESSING DRIVE X. Check that the correct disc is in and is not write protected. Press Continue to resume or Setup Main.**

Cause: You are using SET UP P.A.M. and chose a disc to alter that cannot be found.

Remedy: Make sure that the write protect tab is in the up position or has never been removed. Make sure the disc is placed in the drive with the silver plate in first.

Message: **ERROR ACCESSING DRIVE X. Check that the correct disc is in and is not write protected. Press Continue to resume or Exit.**

Cause: You are using SET UP P.A.M. and chose a disc to alter that cannot be found.

Remedy: Make sure that the write protect tab is in the up position or has never been removed. Make sure the disc is placed in the drive with the silver plate in first.

Message: **Error occurred while reading saved configuration. Default assignments assumed.**

Cause: The MS-DOS Configuration program could not read the configuration information saved by the last Save Config, or the information that was read was invalid.

Remedy: Change the values to those you want to use. Press Save Config.

Message: **FILE ALLOCATION TABLE BAD FOR DRIVE X**

Cause: One of the allocation tables in memory points to non- existant blocks of memory on the disc. The disc may have been incorrectly formatted, or not formatted at all.

Remedy: Type R (Retry) and press Return. If this does not work, format disc X before trying to use it again.

Message: **File was too large to copy.**

Cause: You are using COPY/BACKUP, and chose a file to copy that is bigger than the entire destination disc.

Remedy: Press Continue to remove the message. Use BACKUP instead of COPY.

Message: **Format failure. No disc in drive.**

Cause: The FORMAT program tried to format a disc that was not in the drive.

Remedy: Be sure a disc is in the drive, the drive is turned on, and the door is closed.

Message: **Format failure. One or more discs could not be formatted.**

Cause: The FORMAT program tried to format a disc that was damaged, taken out of the drive in mid format, or had the door opened.

Remedy: A damaged disc should not be formatted; use another disc. Be sure the disc is present in the drive, the door is closed, and the drive is turned on.

Message: **Format failure. Write-protected disc.**

Cause: The FORMAT program tried to format a disc that was write-protected.

Remedy: Remove the write-protect from the disc and try again.

Message: **Found maximum number of installed applications. Only first 80 displayed.**

Cause: P.A.M. can only deal with 80 applications at a time. The rest don't appear on the screen.

Remedy: Remove or turn off discs that are not needed. If this is not possible, regroup applications (using INSTALL) on discs in a more convenient fashion.

Message: **Function locked**

Cause: Functions, such as terminal test, may be locked out by setting in the terminal configuration menu, or by escape sequences generated by a program. Any attempt to use a locked function results in this message.

Remedy: Press [Return] to clear the message from the screen. Either avoid using the locked function, or unlock it in the terminal configuration menu.

Message: **HP-IB Device Error**

Cause: A non-recoverable error has occurred as the HP 150 firmware tried to access the HP-IB device.

Remedy: Press [Return] to clear the message. Check the HP-IB cables for firm connections. Check HP-IB addresses as described in Chapter 2.

Message: **HP-IB ERROR**

Cause: An error occurred while the HP 150 firmware was sending information on the HP-IB port.

Remedy: Press [Return] to clear the message. Check the HP-IB cables for firm connections. Check printers, drives, etc. to be sure they are turned on and operating properly. Check HP-IB addresses as described in Chapter 2.

Message: **HP-IB printer error**

Cause: The HP 150 tried to send information to a printer connected via the HP-IB port, and got no response.

Remedy: Press [Return] to clear the message from the screen. Be sure the printer is turned on. Be sure the printer is correctly configured according to the directions in Chapter 2 of this manual.

Message: **Illegal for edit type: ALPHABETIC**

Cause: The HP 150 firmware has detected that the data in this field doesn't match the field's data type.

Remedy: Press [Return] to clear the message from the screen. Use only alphabetic data in this field (no numbers).

Message: **Illegal for edit type: NUMERIC**

Cause: The HP 150 firmware has detected that the data in this field doesn't match the field's data type.

Remedy: Press [Return] to clear the message from the screen. Use only numeric data in this field (no letters).

Message: **Illegal or no Destination Device**

Cause: The HP 150 firmware has look for your "to device" entry and either can't find or can't understand it.

Remedy: Press [Return] to clear the message from the screen. Be sure a printer is named as a "to device", as described in Chapter 2.

Message: **Illegal or no Source Device**

Cause: The HP 150 firmware has looked for your "to device" entry and either can't find or can't understand it.

Remedy: Press [Return] to clear the message from the screen. Be sure a printer is named as a "to device", as described in Chapter 2.

Message: **Illegal Unit Device**

Cause: The HP 150 firmware

Remedy: Press [Return] to clear the message from the screen.

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Message: **Incorrect DOS version**

Cause: You are using FORMAT with an old version of MS-DOS.

Remedy: Press [Return]. Use MS-DOS version 2.0 or later with FORMAT.

Message: **Insufficient memory for system transfer.**

Cause: You are using the FORMAT program with the Copy System option on. There is not enough memory available inside the HP 150 to copy the operating system to the new disc.

Remedy: Press [Return] to remove the message from the screen. Contact your hardware support engineer.

Message: **Integral Printer Error**

Cause: The HP 150 firmware has detected a problem with the printer built into your HP 150.

Remedy: Press [Return] to clear the message from the screen. If the problem persists, check the printer with the internal printer test. If the internal printer test fails, contact your hardware support person.

Message: **Internal P.A.M. error. Bad MSDOS command issued.**

Cause: P.A.M. had problems loading a program.

Remedy: Restart your system; try again. If this does not work, call your support person.

Message: **Invalid characters in volume label.**

Cause: In FORMAT, you supplied a name for a disc to be formatted; this name contained illegal characters.

Remedy: Press [Return] to clear the message. Type a new name that does not contain the characters .] [? \ = * ; : - < >.

Message: **Invalid Configuration**

Cause: The HP 150 firmware has detected that the configuration you selected isn't supported by the datacommunications hardware that you have installed.

Remedy: Press [Return] to clear the message from the screen. Use a different configuration, or add the optional hardware (printer, plotter, accessory boards, internal hardware, etc.).

Message: **Invalid date format. Be sure to enter Month/Day/Year.**

Cause: You are trying to set the HP 150 date from P.A.M.'s Set Date and Time, and typed an unacceptable date.

Remedy: Backspace to the beginning of the line. Type a date that is in the Month/Day/Year format, with the year greater than 1980 or 80.

Message: **Invalid destination disc or directory.**

Cause: You are using COPY/BACKUP, and typed a disc or directory name. You probably forgot a necessary part of the name.

Remedy: Press Continue to clear the message from the screen. For a disc, type the letter and a colon (A: B: C:). For a directory, type the disc letter, colon, backslash, and directory names (A:\DIRNAME1\ DIRNAME2).

Message: **Invalid drive.**

Cause: You are using FORMAT, and named a disc drive letter that you either don't have or have turned off.

Remedy: If the drive is off, turn it on, press [Return] and try again. If the drive doesn't exist on your system, press [Return] and choose another drive letter.

Message: **Invalid source disc disc or directory.**

Cause: You are using COPY/BACKUP, and typed a disc or directory name. You probably forgot a necessary part of the name.

Remedy: Press Continue to clear the message from the screen. For a disc, type the letter and a colon (A: B: C:). For a directory, type the disc letter, colon, backslash, and directory names (A:\DIRNAME1\ DIRNAME2).

Message: **Invalid time format. Be sure to enter Hours:Minutes.**

Cause: You are trying to set the HP 150 time from P.A.M.'s Set Date and Time, and typed an unacceptable time.

Remedy: Backspace to the beginning of the line. Type a time that is in the Hours:Seconds format on a 24 hour clock.

Message: **Load Op Sys failed, device not found.**

Cause: The HP 150 can't find your disc drive or accessory board.

Remedy: Press Return to remove the message from the screen. Be sure the disc drive is turned on, and a copy of the operating system is in the A: drive (or in the drive you load the operating system from if you changed from A:).

Message: **Load Op Sys failed, no Op Sys on disc.**

Cause: The operating system is not on your A: disc.

Remedy: Press Return to remove the message from the screen. Replace the disc in drive A: with one that contains the operating system. (If you changed the boot disc from A:, then be sure the operating system is in that disc.)

Message: **Load Op Sys failed, not enough memory.**

Cause: The amount of memory (inside the HP 150) is not enough to load the operating system.

Remedy: Call your hardware support person.

Message: **Load Op Sys failed, Op Sys disc not found.**

Cause: The HP 150 can't find the operating system disc.

Remedy: Press [Return] to remove the message from the screen. Be sure the disc drive is turned on, and a copy of the operating system is in the A: drive (or in the drive you load the operating system from if you changed from A:).

Message: **MEMORY FULL**

Cause: The HP 150 alpha memory (memory that contains characters that are read to the screen) is full, and can't contain all of the enhancements plus the data sent.

Remedy: Some data was probably lost. Press [Return] to clear the message from the screen. Press [Shift] [Clear Display] when possible. Retype the data.

Message: **Memory test failed**

Cause: The HP 150 firmware has detected an error during the memory test (run from the [User System] keys).

Remedy: Write down any numbers that appeared on the screen. Contact your hardware support person.

Message: **MUST SELECT A DISC TO CLEAR.**

Cause: You are using the FORMAT program and pressed Clear Disc before you chose a disc.

Remedy: Press [Return], then select a disc. Touch Clear Disc again.

Message: **MUST SELECT A DISC TO FORMAT.**

Cause: You are using FORMAT, and touched Start Format before you selected a disc to format.

Remedy: Press [Return], then touch a disc letter on the screen. Touch Start Format.

Message: **No device driver.**

Cause: The HP 150 firmware can't find a program called a device driver for this printer, plotter, or other device.

Remedy: Press [CTRL] [Shift] [Reset]. If the error persists, contact your hardware support person.

Message: **Load Op Sys failed, Op Sys disc not found.**

Cause: The HP 150 can't find the operating system disc.

Remedy: Press [Return] to remove the message from the screen. Be sure the disc drive is turned on, and a copy of the operating system is in the A: drive (or in the drive you load the operating system from if you changed from A:).

Message: **MEMORY FULL**

Cause: The HP 150 alpha memory (memory that contains characters that are read to the screen) is full, and can't contain all of the enhancements plus the data sent.

Remedy: Some data was probably lost. Press [Return] to clear the message from the screen. Press [Shift] [Clear Display] when possible. Retype the data.

Message: **Memory test failed**

Cause: The HP 150 firmware has detected an error during the memory test (run from the [User System] keys).

Remedy: Write down any numbers that appeared on the screen. Contact your hardware support person.

Message: **MUST SELECT A DISC TO CLEAR.**

Cause: You are using the FORMAT program and pressed Clear Disc before you chose a disc.

Remedy: Press [Return], then select a disc. Touch Clear Disc again.

Message: **MUST SELECT A DISC TO FORMAT.**

Cause: You are using FORMAT, and touched Start Format before you selected a disc to format.

Remedy: Press [Return], then touch a disc letter on the screen. Touch Start Format.

Message: **No device driver.**

Cause: The HP 150 firmware can't find a program called a device driver for this printer, plotter, or other device.

Remedy: Press [CTRL] [Shift] [Reset]. If the error persists, contact your hardware support person.

Message: **No discs were found. Insert a disc and press Reread Discs or press Exit.**

Cause: SET UP P.A.M. looked for discs and found none.

Remedy: Be sure drives are turned on and discs are properly inserted in drives. Press Reread Discs.

Message: **No file or directory was selected.**

Cause: In File Manager, you tried to use PRINT without naming a file or directory.

Remedy: Press Return to remove the message. Select a file or directory. Try again.

Message: **No files were selected for copy.**

Cause: In COPY/BACKUP, you pressed Start Copy before you selected any files to be copied.

Remedy: Touch Continue then a file name(s) on the screen. Touch Start Copy again.

Message: **Non-DOS disc error reading/writing drive X.**

Cause: The disc in drive X has not been properly formatted to run on an HP 150.

Remedy: Type A to abort the read or write, and reformat the disc (if you don't mind losing all of the data on it).

Message: **Not enough memory to run.**

Cause: There is not enough memory to run File Manager.

Remedy: Call your support person.

Message: **NOT READY ERROR READING DRIVE X**

Cause: You tried to read from a disc that isn't ready.

Remedy: Make sure drive X is turned on. Make sure a disc is in the drive. Make sure the door is shut. Type R (Retry) and press Return or press A (terminate program) and press Return.

Message: **No discs were found. Insert a disc and press Reread Discs or press Exit.**

Cause: SET UP P.A.M. looked for discs and found none.

Remedy: Be sure drives are turned on and discs are properly inserted in drives. Press Reread Discs.

Message: **No file or directory was selected.**

Cause: In File Manager, you tried to use PRINT without naming a file or directory.

Remedy: Press [Return] to remove the message. Select a file or directory. Try again.

Message: **No files were selected for copy.**

Cause: In COPY/BACKUP, you pressed Start Copy before you selected any files to be copied.

Remedy: Touch Continue then a file name(s) on the screen. Touch Start Copy again.

Message: **Non-DOS disc error reading/writing drive X.**

Cause: The disc in drive X has not been properly formatted to run on an HP 150.

Remedy: Type A to abort the read or write, and reformat the disc (if you don't mind losing all of the data on it).

Message: **Not enough memory to run.**

Cause: There is not enough memory to run File Manager.

Remedy: Call your support person.

Message: **NOT READY ERROR READING DRIVE X**

Cause: You tried to read from a disc that isn't ready.

Remedy: Make sure drive X is turned on. Make sure a disc is in the drive. Make sure the door is shut. Type R (Retry) and press Return or press A (terminate program) and press Return.

Message: NOT READY ERROR WRITING DRIVE X

Cause: You tried to write to a disc that isn't ready.

Remedy: Make sure drive X is turned on. Make sure a disc is in the drive. Make sure the door is shut. Type R (Retry) and press Return or press A (terminate program) and press Return.

Message: **Not enough memory to run Application.**

Cause: P.A.M. tried to run the application you indicated, but could not because there is not enough memory available to do so.

Remedy: If the program lacks 40K or less memory, try running it from the MS-DOS prompt. If you called P.A.M. from the MS-DOS prompt (not recommended), touch Exit P.A.M.. Another remedy is to buy more memory.

Message: **Not enough space on disc. No action taken.**

Cause: File Manager tried to create a new file or perform a task that required disc space. Not enough disc space was available.

Remedy: Use another disc, or delete some of the files on this disc.

Message: **Pod/Driver Types Not Matched**

Cause: The HP 150 firmware has detected either a bad datacommunications port, or the wrong type of datacommunications port for the configuration you set.

Remedy: Press Return to clear the message. Check your datacommunications port configuration as described in the appendix on configuration. If the problem persists, contact your hardware support person.

Message: **Power-on test failed**

Cause: The HP 150 firmware tests the system every time you turn it on, and this test failed.

Remedy: Try starting the system again. If the message appears again, contact your hardware support person.

Message: **Root directory of "To file" full. Unable to open temporary.**

Cause: Your root directory is full; it has 512 files in it. This is the maximum number of files.

Remedy: Create subdirectories, and split the files up.

Message: **SEEK ERROR READING DRIVE X**

Cause: Disc X is improperly formatted.

Remedy: Reformat this disc (if you don't mind losing the data on it), or use the MS-DOS RECOVER command.

Message: **SEEK ERROR WRITING DRIVE X**

Cause: Disc X is improperly formatted.

Remedy: Reformat this disc (if you don't mind losing the data on it), or use the MS-DOS RECOVER command.

Message: **Selected file(s) not on disc X.**

Cause: You are using COPY/BACKUP, and indicated that you wanted to copy files from disc X. The files on disc X however, do not match the list of files on the screen; you probably took the disc in drive X out since COPY/ BACKUP read the files from it.

Remedy: Reinsert the disc containing the files into drive X. Touch Continue, then Start Copy or Start Backup. (To copy files from a new disc, press Continue, Reread Disc, then select files from the new list.)

Message: **Source = Destination**

Cause: An attempt was made to send data from a device to itself.

Remedy: If the error occurred while using the printer from a programming language, the MSDOS prompt, or Local Mode, go to the "to devices" level of function labels and turn off the incorrect device (usually display). If the error occurred while an application program was running, call your support person for that program.

Message: **Source and destination disc/directory are the same.**

Cause: You are using COPY/BACKUP, and chose the same disc to copy from and to copy to.

Remedy: Press Continue, and indicate different discs for Copy From: and Copy to:

Message: **System error.**

Cause: File Manager has detected a system error.

Remedy: Call your support person.

Message: **System test failed**

Cause: The HP 150 firmware has detected an error during the System test.

Remedy: Write down any numbers that appeared with this test. Contact your hardware support person.

Message: **The browse failed. Check pathname.**

Cause: You are using File Manager's Browse, and your command is not working.

Remedy: Make sure you are using a legal path name (X:\dir \subdir\ file).

Message: **The copy failed. Check pathname.**

Cause: You are using File Manager's Copy, and your command is not working.

Remedy: Make sure you are using a legal path name (X:\dir \subdir\ file).

Message: **The delete failed. Check pathname.**

Cause: You are using File Manager's Delete, and your command is not working.

Remedy: Make sure you are using a legal path name (X:\dir \subdir\ file).

Message: **The directory already exists.**

Cause: You are using File Manager to create a directory that already exists.

Remedy: Choose another name for the new directory, or delete each file from the old directory and use it.

Message: **The directory already exists or matches a device name.**

Cause: You are using File Manager to create a directory that already exists or is the name used for a device.

Remedy: Choose another name for the new directory.

Message: **The directory cannot be read. Check disc.**

Cause: File Manager cannot read the directory you have indicated. You may have changed discs since this list was generated.

Remedy: Touch Reread Discs to be sure the directory is in a drive. Replace discs if necessary.

Message: **The directory contains no files.**

Cause: You tried to list the contents of an empty directory.

Remedy: You can delete an empty directory, or add files to it.

Message: **The directory name corresponds with a device name.**

Cause: You tried to create a new directory in File Manager with a name that is used by MS-DOS.

Remedy: Use another name for the directory.

Message: **The directory contains no files.**

Cause: In File Manager, you tired to list the contents of an empty directory.

Remedy: Either delete the directory or add files to it.

Message: **The drive select failed. Check pathname and drive.**

Cause: You are using File Manager, and selected a drive that cannot be used.

Remedy: Be sure the drive you want to use is turned on. Be sure to use the correct letter name for the drive. If you used a pathname, be sure that all directory names are spelled correctly and exist.

Message: **The file exists.**

Cause: Using File Manager, you tried to name a file with a name used by another file.

Message: **The full path name must be less than 64 characters.**

Cause: In File Manager, you named a drive/directory/file that was too long.

Remedy: If the path is longer than 64 characters, name half of it first. When you get to that directory, name the other half.

Message: **The parent directory does not exist.**

Cause: You are using File Manager, and gave a path name that contains a non-existant directory name (e.g., X:\OLDIE\file) .

Remedy: Find out what the real parent file name is. Touch Choose Dir and supply the directory name \ to get to the root directory. Look at the list of subdirectories. Is the one you want there? Did you misspell its name in your path name?

Message: **The path name is not valid.**

Cause: You have named a pathname in File Manager that is not legal.

Remedy: Be sure you are using back slashes (not forward). Be sure you are typing the names of the directories correctly (8 characters that are legal file name characters, as shown in Chapter 4).

Message: **The print failed. Check pathname.**

Cause: You are using File Manager's Print, and your command is not working.

Remedy: Make sure you are using a legal path name (X:\dir \subdir\ file).

Message: **The rename failed. Check pathname.**

Cause: You are using File Manager's Rename, and your command is not working.

Remedy: Make sure you are using a legal path name (X:\dir \subdir\ file).

Message: **The root directory cannot be deleted.**

Cause: You are using File Manager, and tried to delete the root directory on a disc.

Remedy: Do not try to delete the root; it contains all of your applications programs and disc "housekeeping" information.

Message: **The root directory is full.**

Cause: You are only allowed 512 files in a directory; you are trying to add # 513 with File Manager.

Remedy: Regroup your files into subdirectories.

Message: **The selected disc is not presently on the system. Please select again.**

Cause: You are using SET UP P.A.M., and chose to alter a disc that is not available.

Remedy: Be sure the disc you want to use is in the drive, and the drive is turned on. Try again.

Message: **The "To file" already exists as a directory file.**

Cause: In File Manager's Copy, you tried to name the new copy a name that has already been used for a directory.

Remedy: Use another name, or delete the directory before naming the file.

Message: **There are no installed applications to run. Press Help for more information.**

Cause: No applications have been installed on the checked discs.

Remedy: Install applications according to the directions in the Applications chapter.

Message: **There are no removable/ installable applications on disc X. Select the correct disc(s) below. Press Show Applics.**

Cause: You are using INSTALL and selected a disc with no applications on it.

Remedy: Choose another disc (or replace the flexible disc in the drive) and press Show Applics again.

Message: **There are no selected applications. Select the applications to be installed. Press Start Install.**

Cause: You are using the INSTALL Application program, and pressed START INSTALL before you pressed an application name on the screen.

Remedy: Press the name of the application you want installed or removed, and press START INSTALL.

Message: **Too many files open.**

Cause: File Manager has determined that the MS-DOS open file tables are full, probably because File Manager was run from an application.

Remedy: Exit the application, and run File Manager from P.A.M.

Message: **Unable to save new configuration.**

Cause: You pressed Save Config in the MS-DOS Configuration program, and the information could not be written and successfully read back from memory.

Remedy: Change the batteries in the HP 150, and try again.

Message: **Use NEXT or PREVIOUS key**

Cause: You tried to type characters into a next/prev type of configuration field in a configuration menu.

Remedy: Press Return to clear the message. Position the cursor at the field you want to change and touch NEXT CHOICE or PREV CHOICE.

Message: **Value out of range**

Cause: You are using the HP 150 configuration menus, and entered a value for a field that is either too great or too small for the field.

Remedy: Press Return to clear the message. Retype the entry, using a valid entry as described in the appendix on configuration.

Message: **Warning: Configuration has been changed and not saved.**

Cause: In the MS-DOS Configuration program, you pressed Exit Config after you changed some of the values.

Remedy: This is only a warning. If you want to permanently change the menu to reflect the changes, press Save Config then Exit Config. Otherwise, press Exit Config.

Message: **Warning: Disc drive A: is not assigned to Op Sys Dev in GLOBAL CONFIGURATION.**

Cause: In MS-DOS Config, you pressed Save Config when Op Sys Dev was not set to A: (usual state). There are three entries that must be set: Op Sys Dev, Op Sys Dev address, and Drive A. The address should match the number following HP-IB in the Op Sys Dev field, and the drive A: value would be zero.

Remedy: This is only a warning. Press Save Config again to override the warning, or change the Drive A or Op Sys Dev entry in the Global Configuration menu.

Message: **WARNING: Unable to display all files on disc.**

Cause: The disc named has more than 512 files; COPY/BACKUP can only display/select the first 512 files in any directory.

Remedy: Press Continue to remove the message from the screen. Create some subdirectories to regroup the files.

Message: **WRITE PROTECT ERROR WRITING DRIVE X**

Cause: You tried to store a file on a flexible disc that is write-protected.

Remedy: If it is a 3 1/2" disc, move the small plastic tab in the lower corner down. If it is a 5 1/4" disc, remove the tab on the square hole. If it is an 8" disc, put a tab on the round hole. Replace the disc in the drive, type R (for Retry), and press Return.

Message: **Wrong source disc, expected disc X.**

Cause: You are using COPY/BACKUP, and restoring a backup of more than one disc. The discs are date stamped, and numbered in the order that you backed them up. The disc you are using is either in the wrong order, or the date on it doesn't match the first disc.

Remedy: Press Continue, and insert the correct disc into the drive. Try again.

Message: **You cannot install from and to the same disc.**

Cause: You are using the INSTALL Disc Application program, and pressed the same disc to install from as the disc to install to.

Remedy: Press one disc name in the left column and a different disc name in the right column, then press DISPLAY APPLICS.

APPENDIX B: Self-test Codes

The following table contains the codes which identify failures detected after running either the Power-on Test, Datacomm Test, Memory Test or Manufacturing Test (for information on these tests refer to Chapter VI in this manual). The table lists in sequential order the failure codes (in hex) along with a description of the test that failed and the appropriate method of repair.

Note that, as a rule, the last two digits are don't care states denoted by a "x". This portion of the code tells in more detail the nature of the fault but is not useful for board level repair.

Failure Codes (in hex)	Method of Repair
00xx	User RAM bank 0 failed the extensive memory test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
01xx	User RAM bank 1 failed the extensive memory test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
02xx	User RAM bank 2 failed the extensive memory test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
03xx	User RAM bank 3 failed the extensive memory test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
04xx	User RAM bank 4 failed the extensive memory test. Non-socketed component failure. Replace the Expansion Memory PCA.
05xx	User RAM bank 5 failed the extensive memory test. Non-socketed component failure. Replace the Expansion Memory PCA.
06xx	User RAM bank 6 failed the extensive memory test. Non-socketed component failure. Replace the Expansion Memory PCA.
07xx	User RAM bank 7 failed the extensive memory test. Non-socketed component failure. Replace the Expansion Memory PCA.
08xx	User RAM bank 8 failed the extensive memory test. Non-socketed component failure. Replace the Expansion Memory PCA.
09xx	User RAM bank 9 failed the extensive memory test. Non-socketed component failure. Replace the Expansion Memory PCA.
10xx	User RAM bank 0 failed traveling 1s test. No-socketed component failure. Replace the Mezzanine Memory PCA.
11xx	User RAM bank 1 failed traveling 1s test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
12xx	User RAM bank 2 failed traveling 1s test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
13xx	User RAM bank 3 failed traveling 1s test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
14xx	User RAM bank 4 failed traveling 1s test. Non-socketed component failure. Replace the Expansion Memory PCA.
15xx	User RAM bank 5 failed traveling 1s test. Non-socketed component failure. Replace the Expansion Memory PCA.
16xx	User RAM bank 6 failed traveling 1s test. Non-socketed component failure. Replace the Expansion Memory PCA.
17xx	User RAM bank 7 failed traveling 1s test. Non-socketed component failure. Replace the Expansion Memory PCA.
18xx	User RAM bank 8 failed traveling 1s test. Non-socketed component failure. Replace the Expansion Memory PCA.
19xx	User RAM bank 9 failed traveling 1s test. Non-socketed component failure. Replace the Expansion Memory PCA.
20xx	User RAM bank 0 failed RAM refresh test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
21xx	User RAM bank 1 failed RAM refresh test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
22xx	User RAM bank 2 failed RAM refresh test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
23xx	User RAM bank 3 failed RAM refresh test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
24xx	User RAM bank 4 failed RAM refresh test. Non-socketed component failure. Replace the Expansion Memory PCA.
25xx	User RAM bank 5 failed RAM refresh test. Non-socketed component failure. Replace the Expansion Memory PCA.
26xx	User RAM bank 6 failed RAM refresh test. Non-socketed component failure. Replace the Expansion Memory PCA.
27xx	User RAM bank 7 failed RAM refresh test. Non-socketed component failure. Replace the Expansion Memory PCA.
28xx	User RAM bank 8 failed RAM refresh test. Non-socketed component failure. Replace the Expansion Memory PCA.
29xx	User RAM bank 9 failed RAM refresh test. Non-socketed component failure. Replace the Expansion Memory PCA.
30xx	User RAM bank 0 failed marching 1s test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
31xx	User RAM bank 1 failed marching 1s test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
32xx	User RAM bank 2 failed marching 1s test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
33xx	User RAM bank 3 failed marching 1s test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
34xx	User RAM bank 4 failed marching 1s test. Non-socketed component failure. Replace Expansion Memory PCA.
35xx	User RAM bank 5 failed marching 1s test. Non-socketed component failure. Replace Expansion Memory PCA.
36xx	Use RAM bank 6 failed marching 1s test. Non-socketed component failure. Replace Expansion Memory PCA.
37xx	User RAM bank 7 failed marching 1s test. Non-socketed component failure. Replace Expansion Memory PCA.

Failure Codes (in hex)	Method of Repair
38xx	User RAM bank 8 failed marching 1s test. Non-socketed component failure. Replace Expansion Memory PCA.
39xx	User RAM bank 9 failed marching 1s test. Non-socketed component failure. Replace Expansion Memory PCA.
3Fxx	RAM integrity test failed. Non-socketed component failure. Replace the Expansion Memory PCA. If the problem persists, return the Expansion Memory PCA and replace the Mezzanine Memory PCA.
4xxx	User RAM bank position check. Banks of RAM that should be there are either missing or have multiple bit failures. Refer to figure B-1 for further diagnostic information.
53xx	CMOS RAM failed the CRC test. Non-socketed component failure. Check the battery. If the problem persists, replace the Memory Mezzanine PCA.
57xx	CMOS RAM failed the non-destructive test. Non-socketed component failure. Replace the Mezzanine Memory PCA.
6xxx	ROM CRC and position test failed. Refer to figure B-2 for further diagnostic information.
8000 to 911F	Non-socketed component failure on the Processor PCA. Replace the Processor PCA.
9120	Keyboard test error. Keyboard did not identify as being present. Make sure the kyeboard is connected properly. If the problem continues, replace the Keyboard.
9121 to 913F	Keyboard test error. Make sure the keyboard is connected properly. If the problem persists, replace the Processor PCA. If the problem continues, replace the Keyboard.
9180 to 91FF	Touchscreen test failure of one or more LED photo-diode pairs. Make sure that nothing is blocking the LEDs which make up the touchscreen grid (see the Touchscreen problems section). If the problem persists, replace the Touchscreen PCA and/or Touchscreen cable.
9300 to A1FF	Non-socketed component on the Processor PCA failed. Replace the Processor PCA.
A2xx	Datacomm Port 1 test error. No loop back test hood found. Install loop back test hood and run test again.
A300 to B1FF	Non-socketed component on the Processor PCA failed. Replace the Processor PCA.
B2xx	Datacomm Port 2 test error. No loop back test hood found. Install loop back test hood and run test again.
B300 to BFFF	Non-socketed component on the Processor PCA failed. Replace the Processor PCA.
D0xx	Alpha video RAM chip 0 failed marching 1s test. Non-socketed component. Replace the Video PCA.
D1xx	Alpha video RAM chip 1 failed marching 1s test. Non-socketed component. Replace the Video PCA.
D2xx	Alphavideo RAM chip 2 failed marching 1s test. Non-socketed component. Replace the Video PCA.
D3xx	Alpha video RAM chip 3 failed marching 1s test. Non-socketed component. Replace the Video PCA.
D4xx	Alpha video RAM chip 4 failed marching 1s test. Non-socketed component. Replace the Video PCA.
D5xx	Alpha video RAM chip 5 failed marching 1s test. Non-socketed component. Replace the Video PCA.
D8xx	Alpha video RAM chip 0 failed traveling 1s test. Non-socketed component. Replace the Video PCA.
D9xx	Alpha video RAM chip 1 failed traveling 1s test. Non-socketed component. Replace the Video PCA.
DAxx	Alpha video RAM chip 2 failed traveling 1s test. Non-socketed component. Replace the Video PCA.
DBxx	Alpha video RAM chip 3 failed traveling 1s test. Non-socketed component. Replace the Video PCA.
DCxx	Alpha video RAM chip 4 failed traveling 1s test. Non-socketed component. Replace the Video PCA.
DDxx	Alpha video RAM chip 5 failed traveling 1s test. Non-socketed component. Replace the Video PCA.
E000 to E1FF	GRAM refresh memory test failed. Replace the Video PCA.
E800 to E9FF	GRAM marching ls test failed. Replace the Video PCA.
EC00 to EDFF	GRAM traveling ls test failed. Replace the Video PCA.
FFxx	Non-socketed component on the Video PCA failed. Replace the Video PCA.

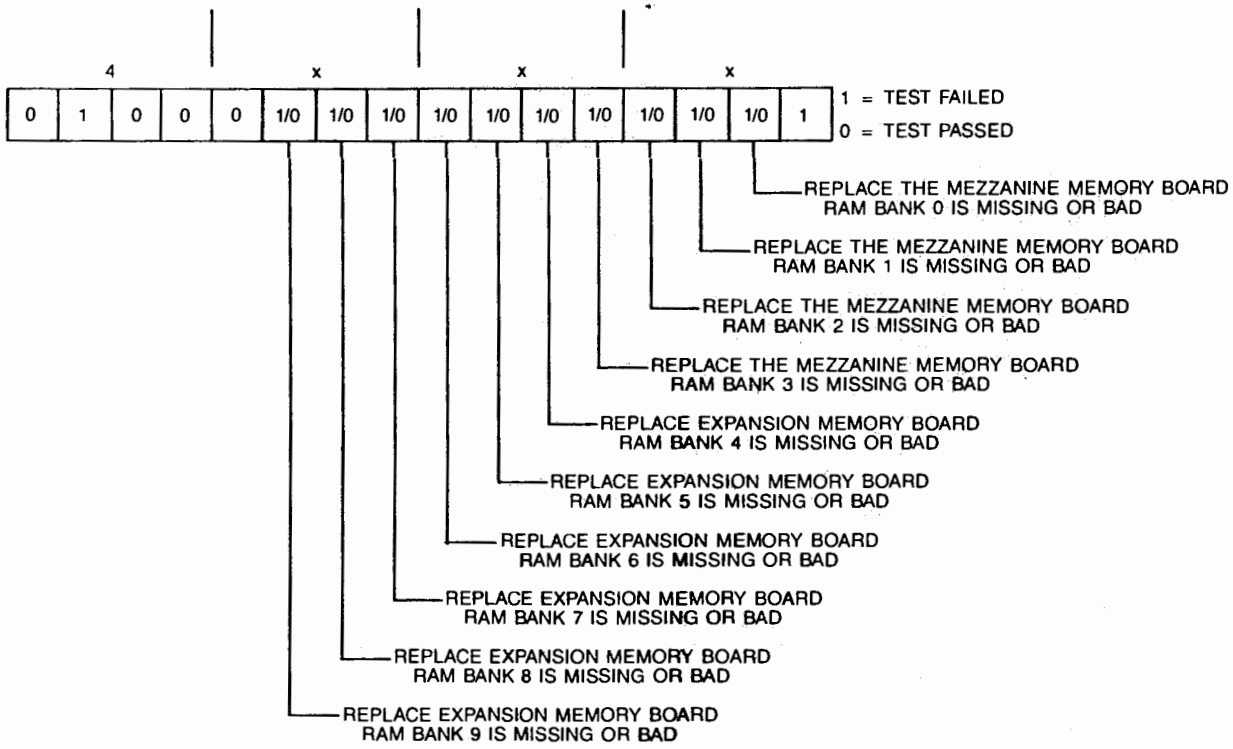

Figure B-1

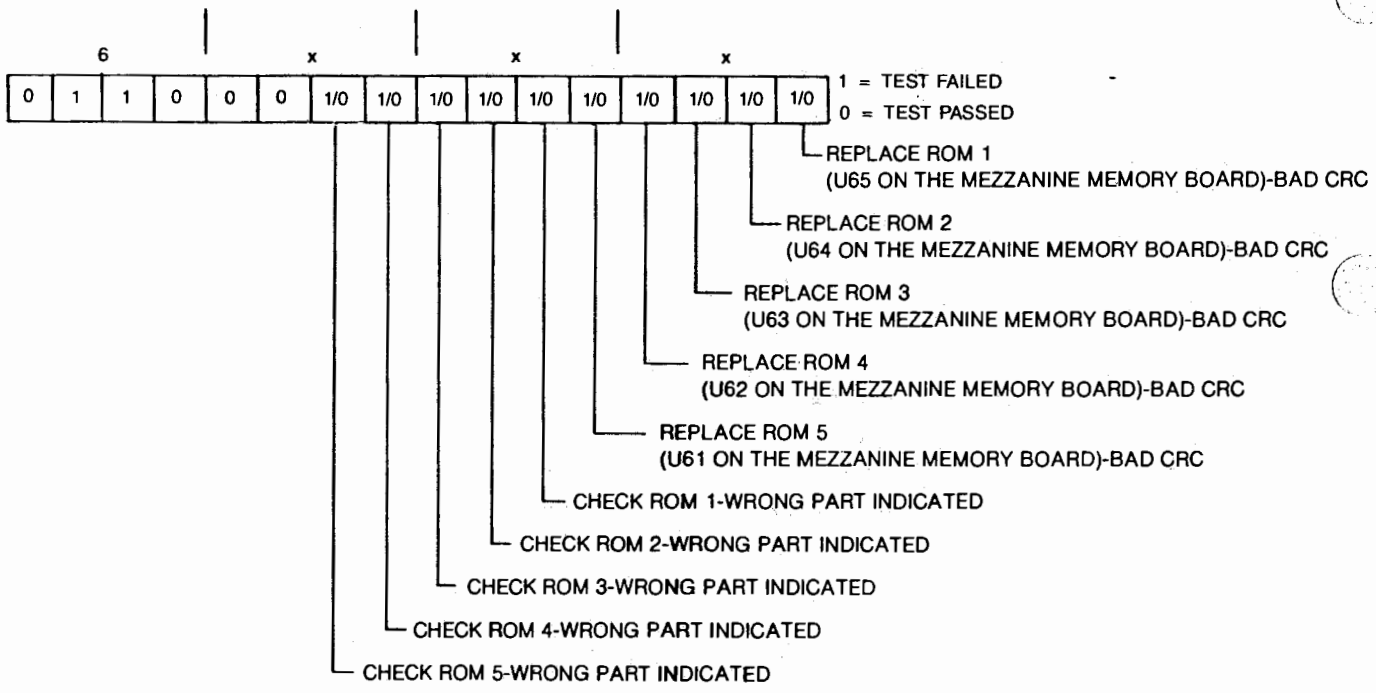

Figure B-2

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