

Service Handbook

Model 748



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Safety and Regulatory Statements

Safety

See the owner's guide that came with your system for safety information.

Regulatory Statements

Emissions Regulations

Federal Communications Commission (FCC) The Federal Communications Commission of the U.S. government regulates the radio frequency energy emanated by computing devices through published regulations. These regulations specify the limits of radio frequency emission to protect radio and television reception. All HP nodes and peripherals have been tested and comply with these limits. The FCC regulations also require that computing devices used in the U.S. display the agency's label and that the related documentation include the following statement:

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications (CDC) This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the Radio Interference Requirements of the Canadian Department of Communications.

Emissions Regulations Compliance Any third-party I/O device installed in HP system(s) must be in accordance with the requirements set forth in the preceding Emissions Regulations statements.

Safety and Regulatory Statements

In the event that a third-party noncompliant I/O device is installed, the customer assumes all responsibility and liability arising therefrom.

Electrostatic Discharge (ESD) Precautions Electrostatic charges can damage the integrated circuits on printed circuit boards. To prevent such damage from occurring, observe the following precautions during board unpacking and installation:

- Stand on a static-free mat.
- Wear a static strap to ensure that any accumulated electrostatic charge is discharged from your body to ground.
- Connect all equipment together, including the static-free mat, static strap, routing nodes, and peripheral units.
- Keep uninstalled printed circuit boards in their protective antistatic bags.
- Handle printed circuit boards by their edges, once you have removed them from their protective antistatic bags.

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Product Information

Product Description

This chapter introduces the Model 748 workstation. The Model 748 uses the Model 744 board computer in one of the following configurations:

Model 748/132L ruggedized workstation

Model 748/165L ruggedized workstation

Figure 1-1 shows the Model 748 workstation, and Table 1-1 lists the Model 748 workstation features.

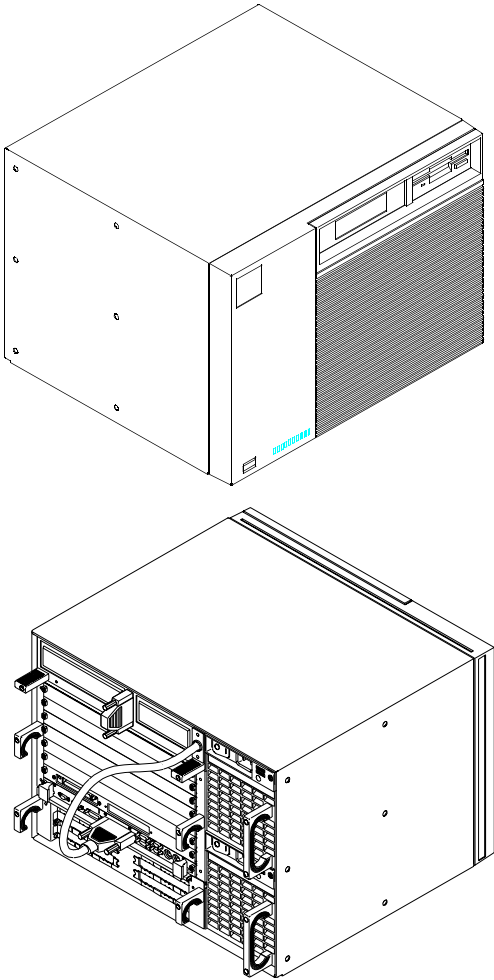


Figure 1-1

Model 748 Ruggedized Workstation

Product Information
Product Description

Table 1-1 Model 748 Ruggedized Workstation Features

Feature	Functionality
Operating system	HP-UX
CPU	132 MHz PA-RISC 7300LC in Model 748/132L 165 MHz PA-RISC 7300LC in Model 748/165L
Time sources	Battery-backed Real-Time Clock Bus error timer
Memory	1 RAM stack Maximum memory is 1GB
Built-in interfaces	HP Parallel, SCSI, AUI LAN, HP-HIL, RS-232C (2 ports)
Graphics	On-board
Mass storage module	Up to four devices, including: 4 or 9 GB hard disk drive 2, 4-8, or 12-24 GB DDS tape drive with data compression 3.5 in. flexible disk drive CD-ROM drive
VME module	8 VME slots (six slots for VME add-in cards, two for SPU)
EISA module	Up to four EISA accessory cards
PCI module	Up to four PCI accessory cards (Replaces EISA module)
Power supply	Two 300 watt power supplies

Rack Mounting Configurations

Rack mounting orientations, either front out or back out are supported. Power switching has both front and back accessibility. Status and test LEDs are located on the Model 744 VMEbus Board Computers. The mass storage module can be configured for front or rear access to removable media. A rack-mount kit is supplied with each workstation.

These features allow the workstation to be operated from either the front or back, depending on how they are mounted. EISA and VME card cages are fixed and cannot be reversed.

Memory

Standard memory is an Error Checking and Correcting (ECC) RAM board. 32 MB is the minimum required for the HP-UX operating system. Memory boards are designed to be stacked in the single stack available on a Model 744. Options may add more factory installed memory.

Memory for a 744 upgrade include:

- HP A4503A 64 MB RAM card
- HP A4449A 128 MB RAM card
- HP A6005A 256MB RAM card

Mass Storage

Up to four single-ended SCSI devices may be installed in the mass storage tray. One or two single-ended SCSI removable media devices may be installed. Mass storage devices are factory installed with the removable media drives accessed from the front. Users may reconfigure devices to reverse the access. Hard disk drives are single-ended devices in the standard tray. Hard drives are typically installed behind the removable media devices.

Mass storage devices are also available as these upgrades:

- 4 GB SE Hard Disk Drive Upgrade
- 9 GB SE Hard Disk Drive Upgrade
- DDS Tape Drive Upgrade
- CD-ROM Disk Drive Upgrade
- 3.5-in. Flexible Disk Drive Upgrade

System Graphics

The Model 748 supports system board (on-board) graphics.

System Board Graphics

These products have system board graphics configurations factory set. They can be changed by users. Table 1-2 lists the monitors supported. Note that grayscale monitors are not supported.

Table 1-2 Supported Monitors for Model 748

Type	Resolution
17-inch color	1280 x 1024
19-inch color	1280 x 1024

GSC Mezzanine (Expansion Kit) Slot

Model 748 ruggedized workstation computers support GSC upgrades.

PMC Expansion

The Model 748 accepts the PMC expansions available for the Model 744 board computer. Table 1-3 shows the supported PMC graphics upgrades.

Table 1-3 Supported PMC Graphics Upgrades

Product Number	Product Name	Products Included
HP A4979A	Visualize-EG Graphics	One PMC Graphics Card

Depending on which HP-UX operating system you are running, you can have up to three graphic heads connected. To support four graphics heads, you must have HP-UX 10.20 ACE or higher.

Built-In Interfaces

This section describes the built-in interfaces of the Model 748 workstation.

Model 744 System Board Interfaces

The Model 744 built-in interfaces have ports on the connector panel as shown in Figure 1-2. For full descriptions including pin-I/O information consult the appropriate model owner's guide and service handbook.

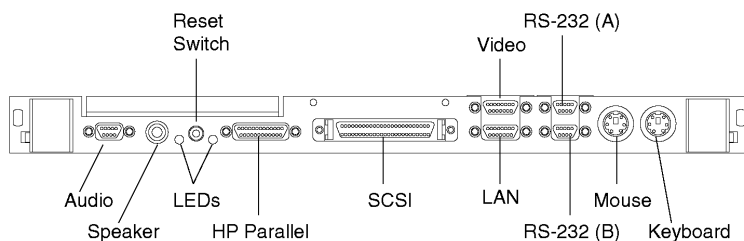


Figure 1-2 I/O Connector Panel

Small Computer Systems Interface (SCSI). A cable from the mass storage module connects to the system board's SCSI connector and must be connected for internally mounted SCSI drives to operate. SCSI interface circuits use high-density, shielded connectors. The mass storage module has a separate SCSI connector for connecting external SCSI device cables. When the external SCSI interface connector is not used, a SCSI terminator should be plugged into the SCSI connector. The internal cable length is 1.8 meters (5.9 feet).

RS-232 Serial Interface. Two 9-pin RS-232 serial interface ports are provided, labeled A and B. Terminals and other RS-232 devices are supported on the RS-232 interface connectors. The A connector is used for the console.

HP Parallel Interface. A 25-pin HP Parallel interface port is provided for use with devices using the Centronics™ interface protocols.

NOTE: You can only use one of the Human Interfaces (HP-HIL or PS-2) at a time for a keyboard or other device. Using one automatically excludes the other interface.

HP-HIL. The HP-HIL connector (located on the EISA module, if ordered with your system) accepts a variety of HP-HIL input devices. However, HP-HIL devices are no longer available from HP.

Product Information

Product Description

PS/2 Ports. Two PS/2 Ports are integral parts of the 743/744 VMEbus Board Computer which provide the primary interface for the PS/2 keyboard and mouse. The keyboard and mouse are part of localization kit HP A4030A.

Local Area Network Interface. The IEEE 802.3 Ethernet Local Area Network (LAN) circuit on the system board has one interface port for an AUI transceiver or media attachment unit (MAU). No ThinLAN circuits or BNC connector is installed. Table 1-4 lists the supported LAN adapters and other network devices. Table 1-5 lists supported X-terminals.

Table 1-4 Supported AUI LAN Adapters and Devices

LAN Adaptor	Network Devices
HP 28641A/B ThinLAN Transceiver	HP 28645A Multiport Repeater, 1 AUI/f, 3 30Base2/m HP 28648B LAN Bridge 2 AUI/f HP 28649A IEEE 802.3 LAN to 802.5 Token Ring Bridge HP 28683A Fiber Optic Transceiver
HP 28685A 10BaseT EtherTwist MAU	HP 28682A Fiber Optic Hub Plus
HP 30241A 10Base5 ThickLAN MAU	HP 28684A EtherTwist Hub

Table 1-5 Supported 700/RX Family X-Terminals

Product Number	Product Name
HP C2701A	700/RX Mi Base Unit
HP C2702A	700/RX 19Mi X-Station
HP C2704A	700/RX Ci Base Unit
HP C2705A	700/RX 14Ci X-Station
HP C2706A	700/RX 16Ci X-Station
HP C2709A	700/RX Ca Base Unit
HP C2711A	700/RX 19Ca X-Station

Audio Interface. Model 744 board computers provide compact disc-quality audio input and output in stereo with a 16-bit coder-decoder (CODEC) over a frequency range of 25-20,000 Hz. A conversion cable provides a stereo headphone mini-plug for output, and a stereo line-in and mono microphone mini-plugs for input.

EISA Module. The Model 748 has a 4-slot EISA module.

PCI Module. The Model 748 has an optional 4-slot PCI module that accommodates standard +5V bus signalling accessory cards. The PCI module requires a minimum HP-UX release of 10.20.

VME Module. The VME module has six slots available for add-on cards, numbered 3 through 8 (slots 1 and 2 are used by the board computer). The slots conform to the 6U form factor. Slot numbers from top to bottom are 8 through 1. The VME backplane provides an interconnect connector for the EISA/PCI module.

Hardware Architecture

Most of the functionality is on one assembly, the Model 743/744 VMEbus board computer. The Model 743/744 has the interface controllers, CPU circuits, memory controller and graphics/video circuits. RAM boards plug into sockets on the system board. The VMEbus board computer typically plugs into slots 1 and 2 of the VME backplane.

A split power VME backplane (slots 3 through 8 have a dedicated power supply) provides 8 slots of which 6 may be used for VME add-on cards.

The EISA and PCI card cages have their own interface converter boards and accessory card backplanes. Test and function LED indicators are located on the Model 743/744 back panel. The mass storage module gets interface data through a cable connected to the system board.

Operating Systems

HP-UX

HP-UX 10.20 (or later) is supported on the Model 748 Ruggedized Workstations with the Model 744 as the board computer. HP-UX 9.05 (or later) is supported on the Model 748 Ruggedized Workstations with the Model 743 as the board computer. The Model 748 is booted from an internal hard disk drive factory installed with Instant Ignition. HP-UX may also be installed from external DDS or CD-ROM drives. If the workstation is a client on LAN, HP-UX can be booted over the LAN.

Table 1-6 lists the HP-UX operating systems and languages for the ruggedized workstations.

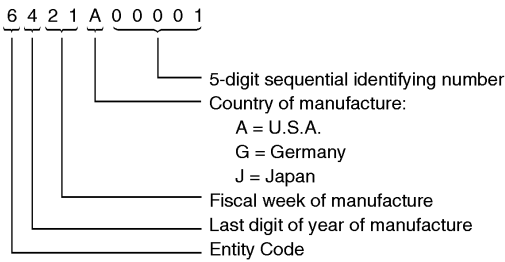
Table 1-6 HP-UX Operating Systems and Languages

Operating system	HP-UX complies with the UNIX System V Interface Definition X/Open and POSIX Specifications and will be fully compliant with Operating Systems Foundation (OSF).
ISU Test and Measurement Software	Standard Instrument Control Library (SICL)Rocky Mountain Basic/UX VEE
ISU Languages	C/ ANSI C FORTRAN 9000 Pascal HP C ++ C ++ Developer
ISU User Interface and Graphics Libraries	HP GKS X11R5 Motif 1.2 VUE 3.0 Architect 2.0

Product Identification

On the bottom, a label lists the product serial number. Its information can be interpreted as shown in Figure 1-3 below for an example serial number 6247A00001:

Figure 1-3 **Serial Number Information**



Product Information
Technical Information

Table 1-8 **EISA, PCI, and VME Slot Power Availability**

Accessory Slot	+12 V dc Amps	+5 V dc Amps	-5.2 V dc Amps	-12 V dc Amps
EISA/PCI, each slot	1.12	4.5	0.05	0.07
EISA/PCI, 4-slot module, total	4.5	18.0	0.2	0.3
VME, each slot	1.3	5.6		0.25
VME, 6-slot module, total	8.0	34.0		1.5

NOTE: Model 748 Ruggedized Workstations are to be operated only in an environment that is free from conductive pollution, including dry non-conductive pollution which could become conductive due to expected condensation.

Table 1-9 lists the Model 748 physical information.

Table 1-9 **Physical Information**

Rack mount units	7 high
Height:	312.0 mm (12.22-in.)
Width:	425 mm (16.75-in.)
Depth:	412.6 mm (16.24-in.)
Weight:	29.0 kg (60.0 pounds)

Support

Support services and policies mentioned in this section are subject to change. Please consult your local Hewlett-Packard Sales and Service Office for the current support policies.

Hardware Support

Field Repair Philosophy

Field Repair Philosophy for these products is assembly, or board level. When a failure occurs, the problem is diagnosed to the assembly having the failed part, that assembly is then replaced.

Some assemblies may be exchanged for rebuilt ones. Other assemblies are only available as new ones. Refer to appropriate service handbook for information on replacement parts.

Additional Technical Information

Additional technical information on these products can be found in the *Models 743, 744, and 748 Technical Reference*. Detailed information about architecture is provided.

Schematics

In support of the repair philosophy, this manual contains information to the assembly level. Schematics are not available for these products.

Supported Configurations

Only products with Hewlett-Packard approved parts, accessories, peripherals, operating systems and application programs are supported by Hewlett-Packard. Any product with other than HP approved hardware or software connected or installed must have the non-HP approved hardware and software removed by the customer before On-Site repair is accomplished.

Repair Services

Hewlett-Packard supports three repair services:

- Return to Hewlett-Packard Repair

- On-Site Repair

- Customer Repair

For Return to Hewlett-Packard Repair, customers return the product to their local HP Sales and Service Office, where an HP Bench Repair Engineer troubleshoots, and repairs the hardware to the assembly level. The defective assembly is replaced with a new or rebuilt assembly and the product is returned to the customer. This service is available through a service contract or a time-and-materials basis.

On-Site Repair is performed at the customer's site. This service is available through a service contract or a time-and-materials basis.

Customers have the option of repairing their own HP products. Contact your nearest Hewlett-Packard Sales and Service Office for information concerning service training, special tools and test equipment, and spare parts.

**Environmental/
Installation/PM**

Overview

This chapter lists the environmental specifications and regulatory requirements for the system. Installation and preventive maintenance information, if applicable, is also provided.

Environmental Specifications

Table 2-1 lists the environmental specifications for this workstation.

Table 2-1 Environmental Information

Operating temperature	0° - 55° C (without mass storage) 5° - 40° C (with mass storage)
Non-operating temperature	-40° - 71° C
Heat dissipation	Model 748i; 1,836 BTU, 464 Kcal/hr Model 748i; 3,672 BTU, 928 Kcal/hr
Humidity (non-condensing); operating	95% maximum at 40° C (without mass storage) 80% maximum at 40° C (with mass storage)
Humidity (non-condensing); non-operating	5 - 95%
Maximum altitude, operating (to 47° C):	4.6 K meters (15 K ft.)
Maximum altitude, non-operating:	4.6 K meters (15 K ft.)

Regulatory Requirements

Table 2-2 lists the regulatory requirements for this workstation.

Table 2-2	Regulatory Information
Safety Specification:	UL 1950, CSA 22.2 950-M, TUV EN60950, Finland TSH, EMKO TUE(74) DK203, Sweden's SS4361450
Laser Safety:	European Harmonized document 194 IEC 825 VBG 93 (Germany) BS4803 Part II (UK)
Ergonomics:	TUV ZH1/618, ISO 9241, 90/270 EEC
Acoustics	NS ISO 7779/ISO 9296 Methods for SP
Electromagnetic Certification	FCC 47 cfr, part 15, subpart J, Class A Korean RRL, Class A VCCI, Class A EN55022/CISPR22, Class A

Installation

Refer to *Model 748 Owner's Guide* for system installation information.

Preventive Maintenance

The system unit requires no preventive maintenance. Some removable media storage devices require operator preventive maintenance. Refer to *Model 748 Owner's Guide* for more information.



Configuration

Power Budgeting

If the workstation application requires several accessory cards and mass storage devices, power budgeting may be required. This ensures the power needed for these internal devices does not exceed the power available:

Devices

- Model 744 VMEbus Board Computer,
- Mass storage devices,
- VME, EISA, or PCI accessory cards
- Standard internal printed circuit boards

The Model 748 ruggedized workstation uses two power supplies. Each power supply provides voltages to the workstation modules and accessory card slots as listed in Table 3-3 through Table 3-7.

These tables are also worksheets to use in determining your power budget. You can copy these tables to have as many copies as you need.

Determining the Workstation's Power Needs

To determine the workstation's power needs, follow these instructions:

- 1 Determine the board computer's current requirements from the Computer Current Requirements Worksheet (Table 3-3 or Table 3-4).
- 2 To determine the maximum current usage of the Model 744 memory cards, you will need to use Figure 3-1 and Table 3-1 (for Model 744/132L) or Table 3-2 (for Model 744/165L). You must work with the worst case power draw to correctly determine power usage. Determine worst case power draw by examining active memory bank configurations, using the following steps:
 - a Examine your memory card configuration, noting which size card is in each memory slot.
 - b The worst case active memory bank configuration depends on the slot position of the memory cards, and the size of the cards. The 32 MB memory card has two banks per card, and the 16, 64, 128, and 256 MB cards each have only one memory bank per card.
 - When 32 MB cards are used as a pair in memory slots 2 and 3 they can use three memory banks concurrently.
 - When used as a pair in slots 0, 1, or 2, the 32 MB cards can have two active memory banks.
 - The 16, 64, 128, and 256 MB cards each have only one memory bank that is active at any one time.

The worst case power draw is when your system has two 32MB cards in slots 2 and 3 (these banks would be considered active, all other memory cards/banks would be considered inactive). The next worst case is a 256 MB card in any slot (all other memory cards in the system would be inactive), followed by a 64 MB card in any slot (all other memory cards in the system would be inactive), followed by two 32 MB cards in slots 0, 1, or 2 (all other memory cards in the system would be inactive), followed by a 128 MB card in any slot, and finally a 16 MB card in any slot (all other memory cards in the system would be inactive).

- c Inactive memory banks are those banks on cards in your configuration in addition to the worst case active memory banks. They must also be added to the calculation.
- d Fill in the information in Table 3-1 or Table 3-2.

Configuration
Power Budgeting

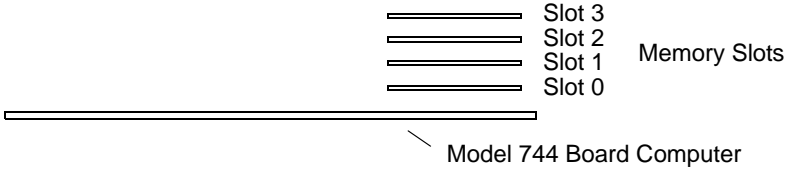


Figure 3-1 Model 744 Memory Slots

Table 3-1 Model 744/132L Memory Card Current Usage Worksheet

Memory Card Size	First Active Bank ¹	Second Active Bank	Third Active Bank	Inactive Banks	Totals (+5V)
32 MB ²	1.15 A	1.15 A	1.15 A	0.05A x ____	_____
64 MB	2.6 A	N/A	N/A	0.1 A x ____	_____
128 MB	1.45A	N/A	N/A	0.07 A x ____	_____
16 MB	1.15 A	N/A	N/A	0.05A x ____	_____
256 MB	2.90 A	N/A	N/A	0.14 A x ____	_____
Total					_____
¹ Choose the worst case active bank(s) for your calculation. ² Slot positions and amount of 32 MB cards determine the number of active banks.					

Table 3-2 Model 744/165L Memory Card Current Usage Worksheet

Memory Card Size	First Active Bank ¹	Second Active Bank	Third Active Bank	Inactive Banks	Totals (+12V)	Totals (+5V)
32 MB ²	0.53 A (+12V)	0.53 A	0.53 A	0.023A x ____	_____	
64 MB	1.2 A (+12V)	N/A	N/A	0.05 A x ____	_____	
128 MB	1.45 A (+5V)	N/A	N/A	0.07 A x ____		_____
16 MB	0.53 A (+12V)	N/A	N/A	0.023A x ____	_____	
256 MB	2.90 A (+5V)	N/A	N/A	0.14 A x ____		_____
Totals					_____	_____
¹ Choose the worst case active bank(s) for your calculation. ² Slot positions and amount of 32 MB cards determine the number of active banks.						

Configuration

Power Budgeting

- 3 Write in the board computer's concurrent requirements in the line provided for VME slots 1 and 2 in the Lower Power Supply Worksheet (Table 3-7).
- 4 Determine each device's current requirements from the Internal Device Requirements table and the VME accessory card's specifications sheet (Table 3-5).
- 5 Write in each device's current requirements in the spaces provided in the Upper or Lower Power Supply current budgeting worksheets (Table 3-6 and Table 3-7).
- 6 Total each column in both worksheets, then write the total in the Total Current Required line.
- 7 If *either* worksheet has a column whose current totals exceed the maximum available for that column's voltage, you must reduce the number of devices to lower the total current being drawn at that voltage. You may be able to relocate VME accessory cards between the upper eight and lower two slots to reduce the power required from either power supply.

Table 3-3 Model 744 Current Requirements Worksheet

Each Model 744 Board Computer	+5V dc Amps	+12V dc Amps	-12V dc Amps
If 132 MHz, current for +5V dc is 4.7A ¹ If 165 MHz, current for +5V dc is 6.3A	_____	0.1A	0.1A
RAM cards (see Table 3-1 or Table 3-2)	_____	_____	
Graphics subsystems ² x 0.9A each =	_____		
FWD SCSI GSC card x 0.7A each =	_____		
HCRX graphics board 2.0A	_____		
PMC bridge adapter 0.6A	_____		
PMC cards on bridge adapter ³	_____	_____	_____
Totals for Model 744 board computer	_____	_____	_____
<p>1. Does not include on-board graphics, if installed. 2. On-board graphics and graphics accessory cards are each separate graphics subsystems. 3. PMC cards may also draw +3.3 current that is provided through the +5 on the bridge adapter. The +3.3 current FOR ALL PMC CARDS ON THE BRIDGE ADAPTER AND EXPANSION ADAPTER (do not include other expansion adapter currents) must be entered into the +5 column after multiplying the +3.3 current by .75 to convert to the actual +5 current draw.</p>			

Configuration
Power Budgeting

Table 3-4 Model 743 Current Requirements Worksheet

Each Model 743 Board Computer	+5V dc Amps	+12V dc Amps	-12V dc Amps
If 64 MHz, current for +5V dc is 6.1A ¹ If 100 MHz, current for +5V dc is 7.5A	_____	0.1A	0.1A
_____ RAM cards x 0.2A each =	_____		
Graphics subsystems ² x 0.7A each =	_____		
FWD SCSI GSC card x 0.7A each =	_____		
HCRX graphics board 2.0A	_____		
PMC bridge adapter 0.6A	_____		
PMC cards on bridge adapter ³	_____	_____	_____
Totals for Model 743 board computer	_____	_____	_____
<p>1. Does not include on-board graphics, if installed.</p> <p>2. On-board graphics and graphics accessory cards are each separate graphics subsystems.</p> <p>3. PMC cards may also draw +3.3 current that is provided through the +5 on the bridge adapter. The +3.3 current FOR ALL PMC CARDS ON THE BRIDGE ADAPTER AND EXPANSION ADAPTER (do not include other expansion adapter currents) must be entered into the +5 column after multiplying the +3.3 current by .75 to convert to the actual +5 current draw.</p>			

Table 3-5 summarizes the current requirements for internal devices.

Table 3-5 Internal Device Current Requirements

Device	+5.1V dc Amps	+12V dc Amps	-12V dc Amps
Internal mass storage devices:			
CD-ROM drive	1.6 A	1.8 A	
DDS tape drive	1.0 A	0.8 A	
Flexible disk drive	0.8 A		
1 GB SE hard drive	1.2 A	1.8 A	
2 GB FWD hard drive	1.1A	0.9 A	
2 GB SE hard drive	1.0 A	0.9 A	
4 GB FWD hard drive	1.1 A	1.0 A	
4 GB SE hard drive	1.0 A	1.0 A	
9 GB FWD hard drive	1.2 A	0.9 A	
Hewlett-Packard EISA Cards:			
HP 25525A SCSI DIFF	3.1 A	0.05 A	
HP 25525B EISA SCSI	3.06 A	5 mA	5 mA
HP 25560A HPIB	3.1 A		
HP 25567A LAN	3.4 A	0.04 A	
HP J2156A FDDI	2.0 A	0.09 A	0.05 A
HP J2159A X.25 PSI	3.4 A	0.04 A	
HP J2165A LAN	2.1 A		
HP J2645AA VG Any LAN	0.3 A		
HP J2802B ATM			

Configuration
Power Budgeting

Table 3-6 Upper Power Supply Current Budgeting Worksheet

Location	Device	+5V dc Amps	+12V dc Amps	-12V dc Amps
VME Slot 8	_____	_____	_____	_____
VME Slot 7	_____	_____	_____	_____
VME Slot 6	_____	_____	_____	_____
VME Slot 5	_____	_____	_____	_____
VME Slot4	_____	_____	_____	_____
VME Slot 3 or PMC cards in Expansion Adapter ¹	_____	_____	_____	_____
Total Current Required:		_____	_____	_____
Maximum Available:		34.0A	8.0A	1.5A
1. +3.3 current must be entered into Table 3-3 or Table 3-4				

CAUTION: If you upgrade your Model 748 ruggedized workstation, adding more: RAM cards, mass storage devices, GSC, VME, EISA, PCI, or PMC accessory cards, you must recompute the power budget to ensure the new configuration will be within the available current each power supply can provide.

NOTE: The PCI tray provides power for option cards from both a +5 Vdc source and a +3.3 Vdc source. Cards may use either or both power sources, up to 25W per slot. However, the +3.3 V dc source is limited to 39.8 W combined for slots 1 and 2, and 39.8 W combined

for slots 3 and 4. For example, if the card in slot 1 draws 25 W at +3.3 V dc, only 14.8 W at +3.3 V dc is available to a card in slot 2. The limits of +5 Vdc is 25 W per slot.

Table 3-7 Lower Power Supply Current Budgeting Worksheet

Location	Device	+5V dc Amps	+12V dc Amps	-12V dc Amps	-5.2V dc Amps
Mass Storage Device 1					
Mass Storage Device 2					
Mass Storage Device 3					
Mass Storage Device 4					
VME Slot 2 and VME Slot 1	Model 743/ 744 Board Computer	_____	_____	_____	
EISA/PCI Slot 1					
EISA/PCI Slot 2					
EISA/PCI Slot 3					
EISA/PCI Slot 4					
Total Current Required:		_____	_____	_____	_____
Maximum Available:		33.0A	8.0A	1.5A	1.0A

Configuration
Power Budgeting



Troubleshooting

Introduction to Troubleshooting

Troubleshooting information and procedures for the Model 743/744i board computers are divided into these sections:

- Introduction to Troubleshooting
- Diagnostic Overview

Model 743 and Model 744 board computers use different firmware and diagnostic tools. Consult the appropriate Service Handbook for the model you are working with for specifics on the various tools and tests for that model.

Diagnostic Philosophy

The diagnostic philosophy is to support the repair strategy. As a result, the goal of the troubleshooting process is to isolate a problem to a specific board or assembly. Several diagnostic methods may be used. When a system problem is traced to the board computer, the diagnostic is run to isolate the problem to the defective part. The defective part is then replaced.

Analytic Troubleshooting

Troubleshooting is the process of getting answers to these six questions:

- What is different now from what the board computer was before?
- What exactly is wrong, or what are the bad symptoms?
- When do the bad symptoms occur?
- How bad is the problem or to what extent does it occur?
- What actually caused the problem in the first place?

Getting the answers to these questions usually makes the troubleshooting process much more effective and less costly. When a failure in a computer system occurs, use these questions and their answers to begin your diagnostic procedure.

The troubleshooting strategy for these board computers is in the form of a bottom-up approach. That is, you note any error or status messages, and then you run the power-up Boot ROM diagnostics known as Self-Test. If the Self-Test diagnostics fail, replace the assembly that is indicated.

After you have all answers possible, decide what's the most probable cause of the problem. Sometimes you'll arrive at several choices for a cause. For each choice, qualify it against the answers to the questions above. The most probable cause is the one that logically justifies the correct answers to these questions.

Note any error or status messages, and then run the diagnostics. If the self-tests fail, replace the assembly that is indicated.

Diagnostic Overview

Three types of diagnostics are available for the Model 743\744:

- **Selftests** are part of the Boot ROM code. They initialize and test the functional areas needed to boot the operating system.
- **Offline diagnostics** are on the Support Tape, a separate tape or CD-ROM media. They are ISL based and test the CPU, VME and I/O functions.
- **Online diagnostics** are supplied with the operating system, but require the operating system to be booted. These diagnostics are called SupportWave and test the CPU, I/O and several peripherals.

Diagnostic Documentation

Table 4-1 lists manuals that provide complete information.

Troubleshooting

Introduction to Troubleshooting

Table 4-1 Diagnostic Documentation

Manual Title	Part Number
HP 9000 Series 700i/rt Model 743 Board Computer Service Handbook	A2636-90604
Model 744/132L Board Computer Service Handbook	A4500-90608
Support Tools Manager User's Manual; HP 9000 Series 700 and 800	5961-1612
HP 9000 Series 700 Diagnostics Manual, Volume 1	09740-90041
HP 9000 Series 700 Diagnostics Manual, Volume 2	09740-90043
HP 9000 Series 700 Support Tape/CD-ROM User's Manual	B2380-90000
PA-RISC Support Tools Manual Licensed Users Volume 1, SPU	5960-3149
PA-RISC Support Tools Manual Licensed Users Volume 2, Device Adapters/MUXes	5960-3151
PA-RISC Support Tools Manual Licensed Users Volume 3, LAN	5960-3153
PA-RISC Support Tools Manual Licensed Users Volume 4, SCSI	5960-3155
PA-RISC Support Tools Manual Licensed Users Volume 5, Disks	5960-3157
PA-RISC Support Tools Manual Licensed Users Volume 6, Tapes/Printers	5960-3159
PA-RISC Support Tools Manual Licensed Users Volume 7, Utilities	5960-3161
PA-RISC Support Tools Manual Licensed Users Volume 8, ISL Support Tools	5960-3163
PA-RISC Support Tools Manual HP Employees	5960-3165
Offline Diagnostics Environment (ODE) User's Manual	5962-3648
System Exerciser Install and Operating Guide	5961-1624

Board Computer Troubleshooting

Please refer to the service documentation for the Model 743 or Model 744 board computer for details about troubleshooting the board computer.



Field Replaceable Units

Introduction

This chapter contains the procedures to replace assemblies in the VMEbus Board Computer and the Model 748i chassis components (such as the VME module, EISA/PCI module, Mass Storage module, Power supplies and chassis mounted hardware).

CAUTION: Removal of the VMEbus cage requires the removal of the EISA/PCI module first! The EISA/PCI converter to VME backplane connector extends below VME cage, removal of the VME cage prior to removal of the EISA/PCI module will result in damage to the connector.

Tools Required

All field replaceable parts can be accessed with these tools:

- Grounding wrist strap.
- No. 1 Pozidriv screwdriver.
- Small flat-tipped screwdriver.
- 3mm (0.125-in.) thin-wall nutdriver, maximum outer diameter of 5.7mm (0.225-in.).

Safety Precautions

As with any electrical/electronic product, certain safety precautions must be practiced. These safety precautions, *when followed*, can protect you from injury, and the equipment from possible permanent damage.

CAUTION: Integrated circuit components in these products can be damaged by electro-static discharge. It doesn't make any difference whether the ICs are installed on a printed circuit board or laying on a table. Static charges can build up in people to a potential of several thousand volts by simply walking across a room.

Integrated circuits can be protected by using a static free work place and wearing clothes that do not hold static charges before handling any of the workstation's PC boards.

When you need to remove or install a part or assembly, remove power from the product first. At the static free work place, touch sheet metal with your fingers before touching a printed circuit

assembly. If the assembly is not going to be re-installed, place the assembly in an anti-static bag and set it aside.

Following these precautions will extend the life of the computer products you maintain.

New Parts

New parts are available direct from:

Support Materials Organization Hewlett-Packard Company 8050 Foothills Boulevard Roseville, California 95678 USA Telephone: (916) 786-8000	Parts Center Europe Hewlett-Packard GmbH Wolf-Hirth Strasse 33 D-7030 Boblingen, Germany Telephone: +41 7031 14-2253
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Exchange Parts

Exchange parts are available for some items at a reduced cost. When an exchange part is ordered, your account will be charged for a new part.

Place failed exchange parts in anti-static bags and package them securely in a sturdy container. It's a good idea to save the containers and static-free bags you receive parts in and use them to ship parts in. Please return failed exchange parts to your exchange parts source as soon as possible. Customers have 15 days to return the failed part to receive credit for the difference between a new and exchange part.

Exchange parts only are available direct from:

Support Materials Organization Hewlett-Packard Company 8050 Foothills Boulevard Roseville, California 95678 USA Telephone: (916) 786-8000	Support Material & Services Europe Hewlett-Packard Ltd. Filton Road - Stoke Gifford Bristol BS12 6QZ United Kingdom Telephone: +44 272 799910
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Local Hewlett-Packard Sales & Service Office

Name: _____

Address: _____

City, State, Zip: _____

Tel. Number: _____

Replaceable Parts

Figure 5-1 shows an exploded view of the Model 748 workstation.

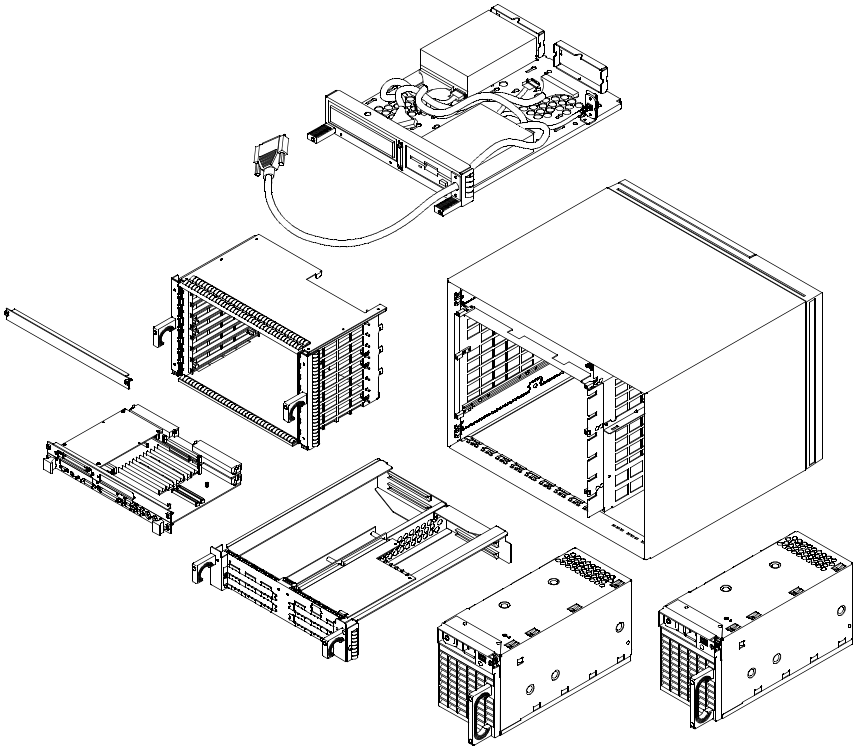


Figure 5-1

Model 748 Exploded View

Mass Storage Module Parts

Figure 5-1 and Figure 5-2 show exploded views of the Single-Ended (SE) and Fast-Wide-Differential (FWD) mass storage modules.

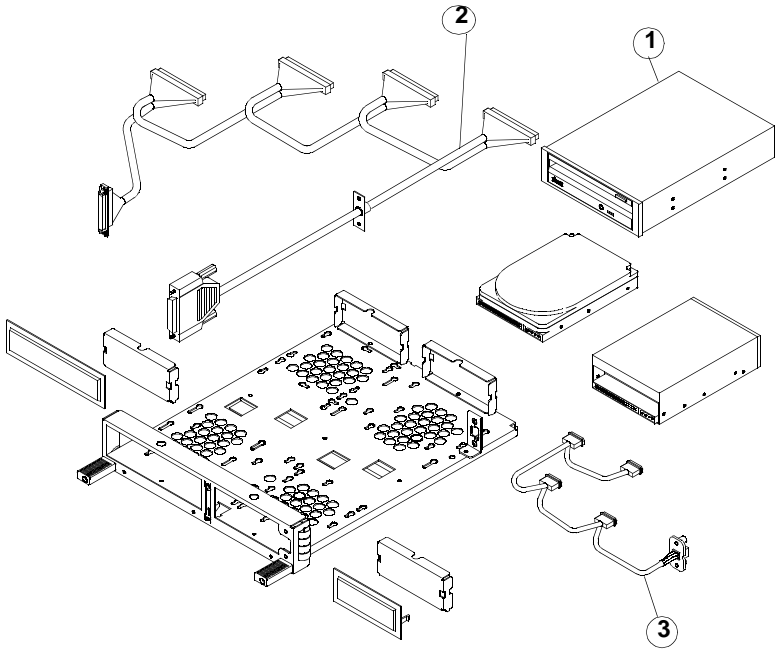


Figure 5-1 SE Mass Storage Module Parts

Table 5-2 is a SE mass storage module parts list.

Table 5-1 Model 748 SE Mass Storage Module Parts List

Ref No.	Exchange Part Number	New Part Number	Description	Notes
1	A1094-69007 A2084-69001 A2084-69002 A1658-69108 A1658-69009 A1658-69012 C1503-69201 C1504-69201 C1536-69201 C1533-69203 C1539-69201 C1537-69201 C2293-69004 A3416-60001 A1658-60015		3.5 in. Flexible Disk Drive 525MB Hard Disk Drive, SE 1GB Hard Disk Drive, SE 2GB Hard Disk Drive, SE 2GB Hard Disk Drive, SE 4GB Hard Disk Drive, SE DDS-1 Tape Drive DDS-1 Tape Drive w/compression DDS-DC Tape Drive DDS-2 Tape Drive DDS-2 Tape Drive DDS-3 Tape Drive CD-ROM Drive, 2x CD-ROM Drive, 4x CD-ROM Drive, 4x	7200 RPM Dove Gray Flint Gray
2		A4309-61601	SE SCSI Cable - SE Tray	
3		A4309-61602	Power Cable	
		A1658-62016	SE SCSI Terminator	

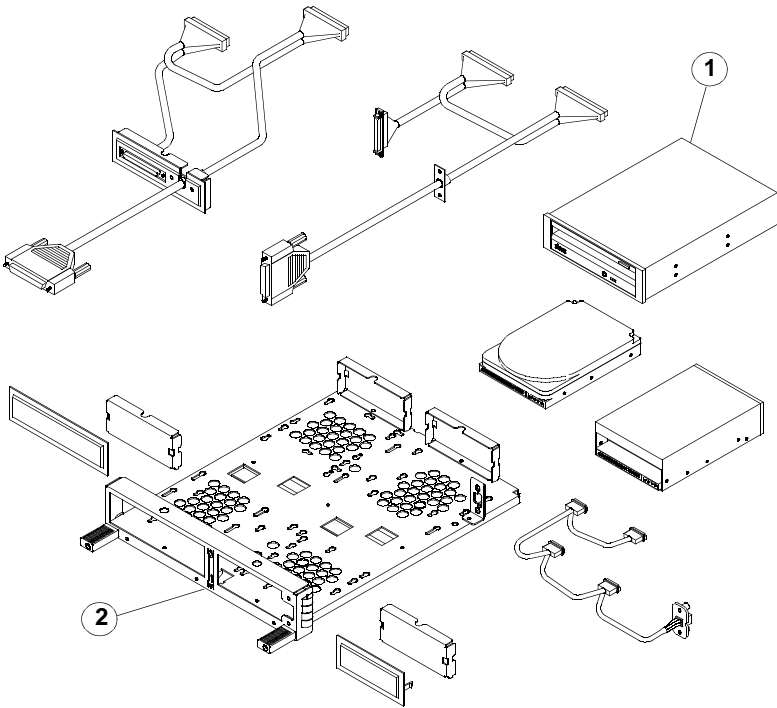


Figure 5-2 FWD Mass Storage Module Parts

Table 5-2 is a FWD mass storage module parts list.

Table 5-2 Model 748 FWD Mass Storage Module Parts List

Ref No.	Exchange Part Number	New Part Number	Description	Notes
1	A1094-69007		3.5 in. Flexible Disk Drive	7200 RPM 7200 RPM Dove Gray Flint Gray
	A1658-69016		2GB Hard Disk Drive, FWD	
	A2084-69016		2GB Hard Disk Drive, FWD	
	A1658-69010		2GB Hard Disk Drive, FWD	
	A1658-69011		4GB Hard Disk Drive, FWD	
	A4218-69016		9GB Hard Disk Drive, FWD	
	C1503-69201		DDS-1 Tape Drive	
	C1504-69201		DDS-1 Tape Drive w/compression	
	C1536-69201		DDS-DC Tape Drive	
	C1533-69203		DDS-2 Tape Drive	
	C1539-69201		DDS-2 Tape Drive	
	C1537-69201		DDS-3 Tape Drive	
	C2293-69004		CD-ROM Drive, 2x	
	A3416-60001		CD-ROM Drive, 4x	
A1658-60015		CD-ROM Drive, 4x		
2		A4309-60003	Assy, FWD Tray with .9m cable	
		A4350-60007	Assy, FWD Tray with 1.2m cable	
		A1658-63013	FWD SCSI Terminator	

EISA and PCI Module Parts

The EISA and PCI trays are similar modules, with the exception of the interface modules. Figure 5-3 shows an exploded view of the EISA or PCI module parts.

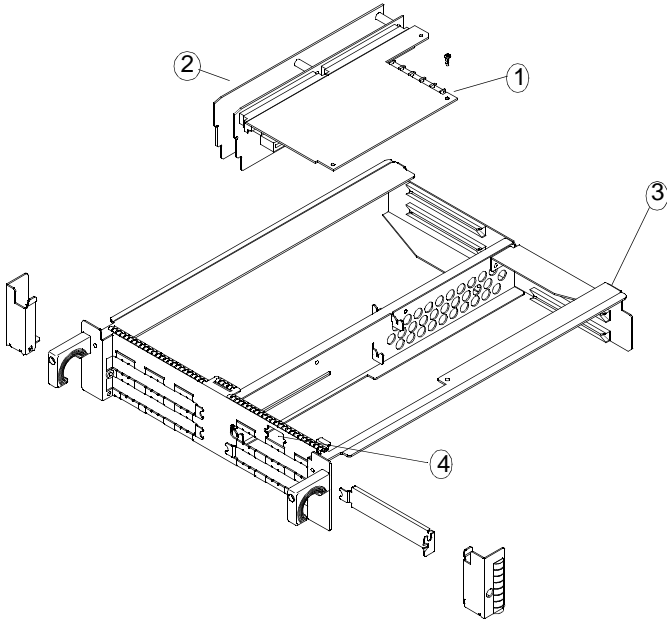


Figure 5-3

EISA and PCI Module Parts

Table 5-3 is an EISA and PCI module parts list.

Table 5-3 Model 748 EISA and PCI Module Parts List

Ref No.	Exchange Part Number	New Part Number	Description	Notes
1		A4309-62005 A4505-66001	EISA Assembly PCI Assembly	
2		A4309-66001 A4505-60002	EISA Backplane Assembly PCI Backplane Assembly	
3		A4309-00010 A4505-00011	EISA Tray Assembly PCI Tray Assembly	
4		A4505-00007	HIL Port Cover Plate	PCI only

VME Module

Figure 5-5 shows an exploded view of the VME module.

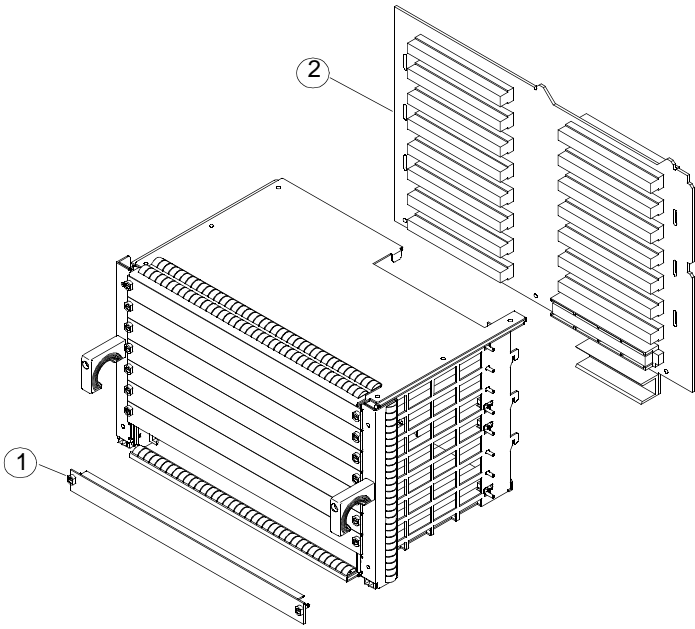


Figure 5-5

VME Module Parts

Table 5-5 is a VME module parts list.

Table 5-5 Model 748 VME Module Parts List

Ref No.	Exchange Part Number	New Part Number	Description	Notes
1		A2636-00004	VME Cover Plate	
2		A4309-66003	VME Backplane	

Model 743/744 VMEbus Board Computer Parts

Consult the appropriate model Service Handbook for parts and part numbers.

Removing and Replacing Mass Storage Devices

Section Contents

- Removing the Mass Storage Module
- Removal and replacement instructions for mass storage devices
- Device addressing and location

Introduction

Instructions for removing and replacing Mass Storage Devices (internal) are in this section. The procedures for all devices are the same. Devices include the following:

- 3.5-inch Flexible Disk Drive
- Hard Disk Drives
- CD-ROM Drive
- DDS Tape Drive

Preliminary Requirements

Before you remove the Mass Storage Module perform the following:

- 1 Before system shut down is performed you should execute **ioscan**, and record the SCSI addresses in-use.
- 2 Shut down any applications.
- 3 Shut down the Operating System.
- 4 Refer to the owner's guide, for information on properly shutting down HP-UX.
- 5 Turn off power to the Model 748.
- 6 Set up a static-free work place to handle the mass storage tray.

Removing and Replacing Mass Storage Devices

Removing Mass Storage Module

CAUTION:

The mass storage module can weigh about 10 lbs, and may be awkwardly balanced. Use care when handling the module, as dropping it could damage the mass storage devices!

NOTE:

All Installation procedures are the reverse of removal in this section.

Procedure

- 1 Disconnect any SCSI cables connected to module.
- 2 Unscrew both Mass Storage Module screws.
- 3 Slide out tray. See Figure 5-6.
- 4 If replacing a device go to Selecting Device Address.
- 5 If the only action is to remove a device go to Mass Storage Device Removal.

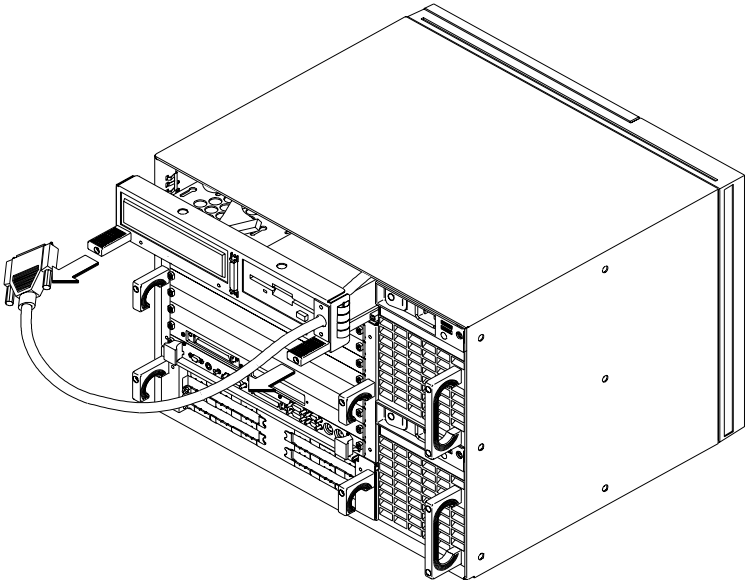


Figure 5-6

Mass Storage Tray Removal

Selecting Device Address

Procedure

- 1 Unpack the device.
- 2 Set only jumpers or switches that are required to change the device SCSI address, any others should remain as shipped.

The default SCSI addresses for devices is shown in Table 5-6. You should check the address as set on the failing drive and set the address on the new drive to the same value.

Table 5-6

Default SCSI Addressing

1st Hard Disk Drive	ID 6
2nd Hard Disk Drive	ID 5
3rd Hard Disk Drive	ID 4
DDS Drive	ID 3
CD-ROM Drive	ID 2
Floppy Drive	ID 0

Removing and Replacing Mass Storage Devices

CD-ROM

Figure 5-7 and Figure 5-8 show the CD-ROM disk drive address settings.

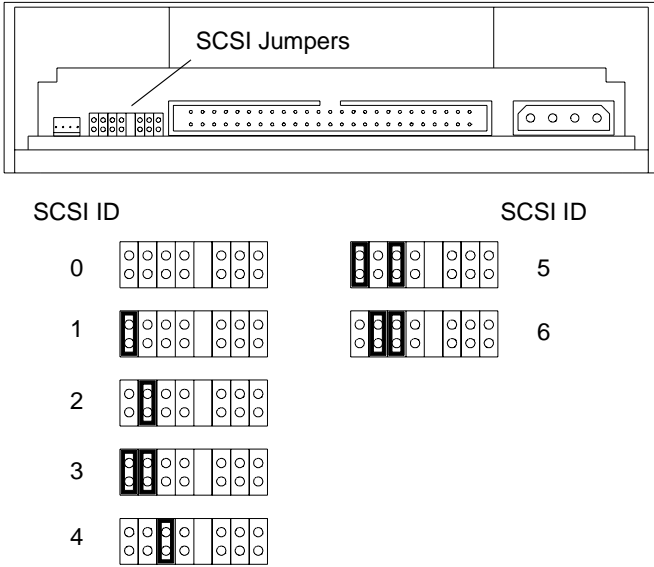
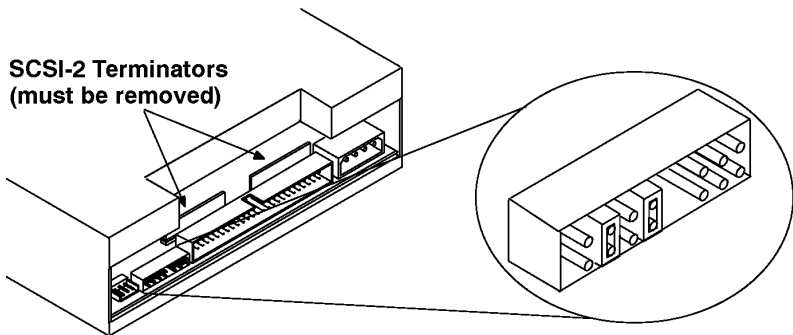


Figure 5-7

Early Model CD-ROM Disk Drive

Removing and Replacing Mass Storage Devices



Jumpers							Jumpers								
Target ID	ID1	ID2	ID4	PRTY	PRV/ALW	TEST	TERM	Target ID	ID1	ID2	ID4	PRTY	PRV/ALW	TEST	TERM
0	○	○	○	○	○	○	○	4	○	○	○	○	○	○	○
1	○	○	○	○	○	○	○	5	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	6	○	○	○	○	○	○	○
Default	○	○	○	○	○	○	○	Default for root (NOT recommended for CD-ROM drive)	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○								

Figure 5-8

Later Model CD-ROM Disk Drive

Floppy Disk Drive

Figure 5-9 shows the floppy disk drive address settings.

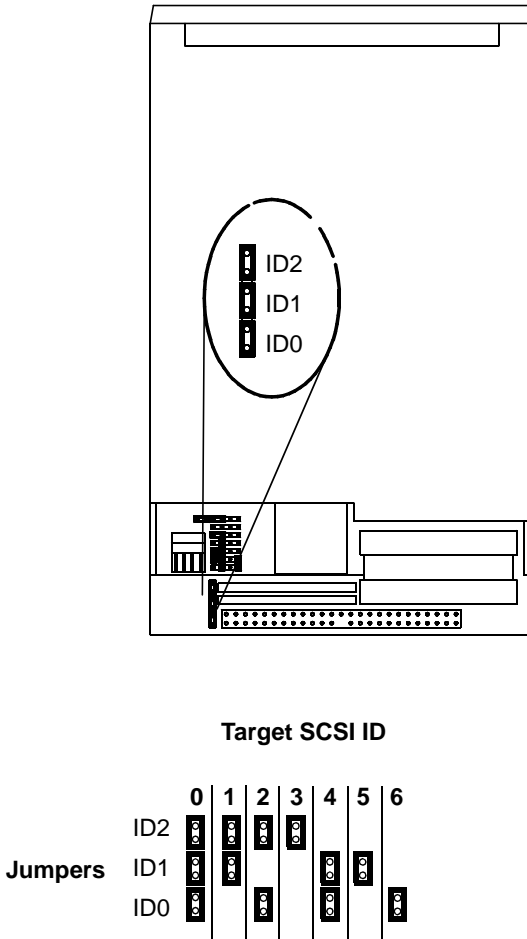


Figure 5-9

Floppy Disk Drive

DDS Tape Drive

Figure 5-10 shows the DDS tape drive address settings.

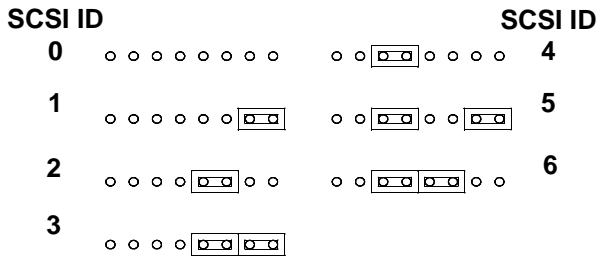
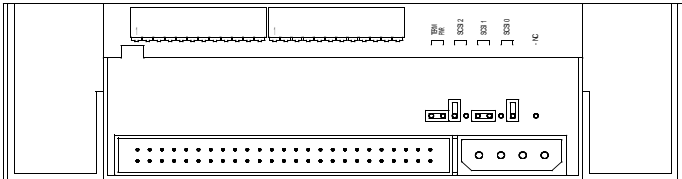


Figure 5-10

DDS Tape Drive Address Selection

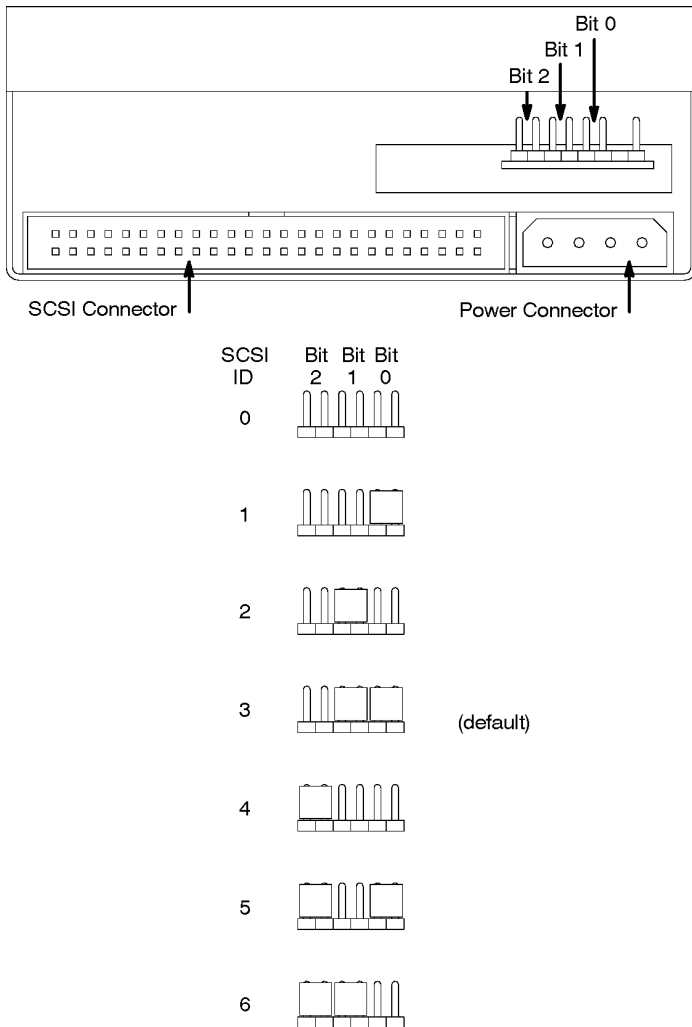


Figure 5-11

Later Model DDS Tape Drive Address Selection

Hard Disk Drive Address Selection

All replacement hard disk drives are shipped with jumper/configuration documentation. Please refer to the documentation shipped with the replacement disk drive for jumper settings and any applicable software patch dependencies.

Device Locations in Tray

Figure 5-12 through Figure 5-16 show the possible device locations for the Model 748 workstation.

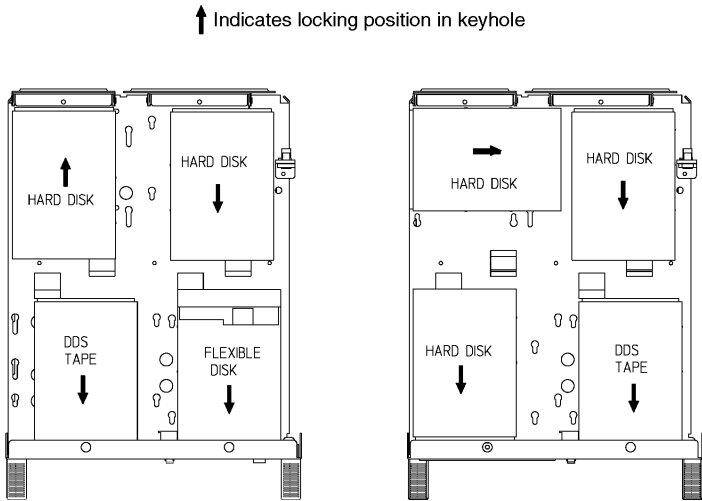


Figure 5-12

Device Locations 1 of 4

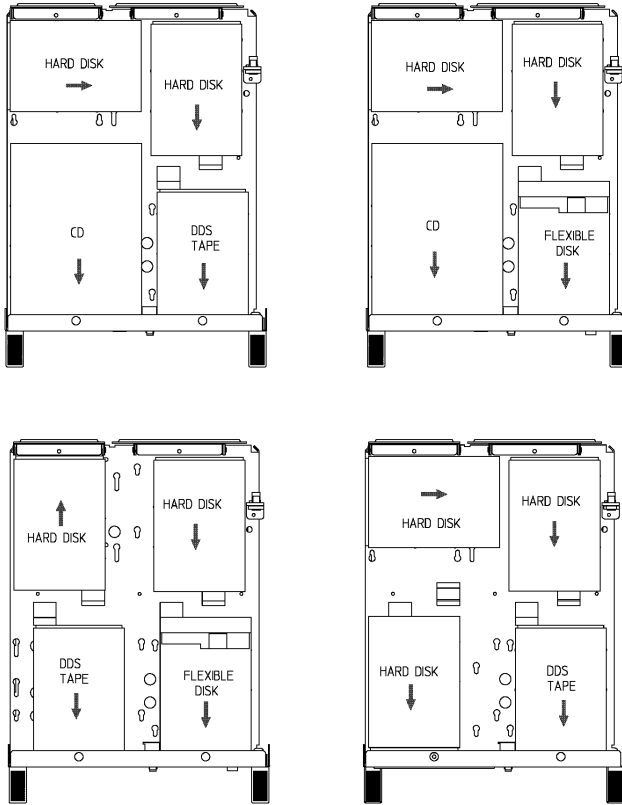


Figure 5-13

Device Locations 2 of 4

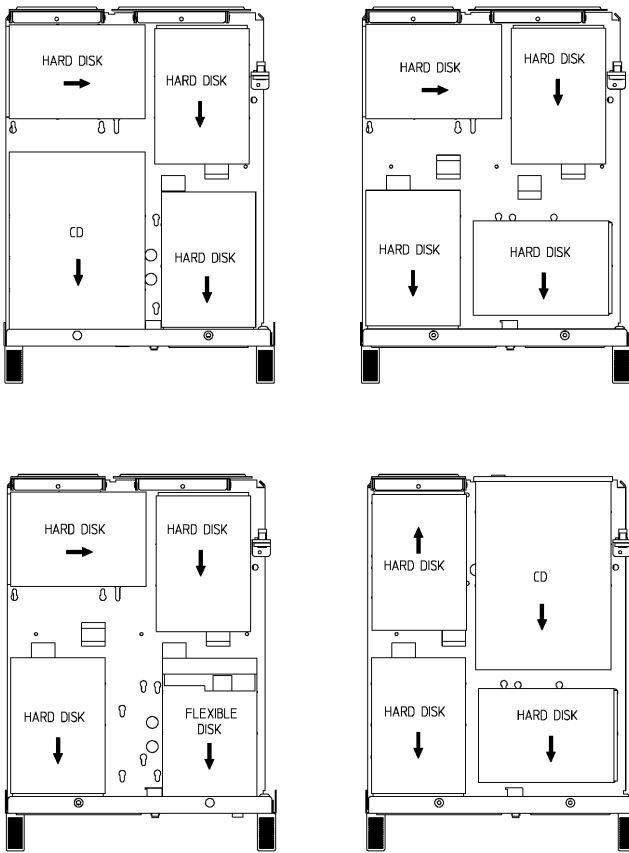


Figure 5-14

Device Locations 3 of 4

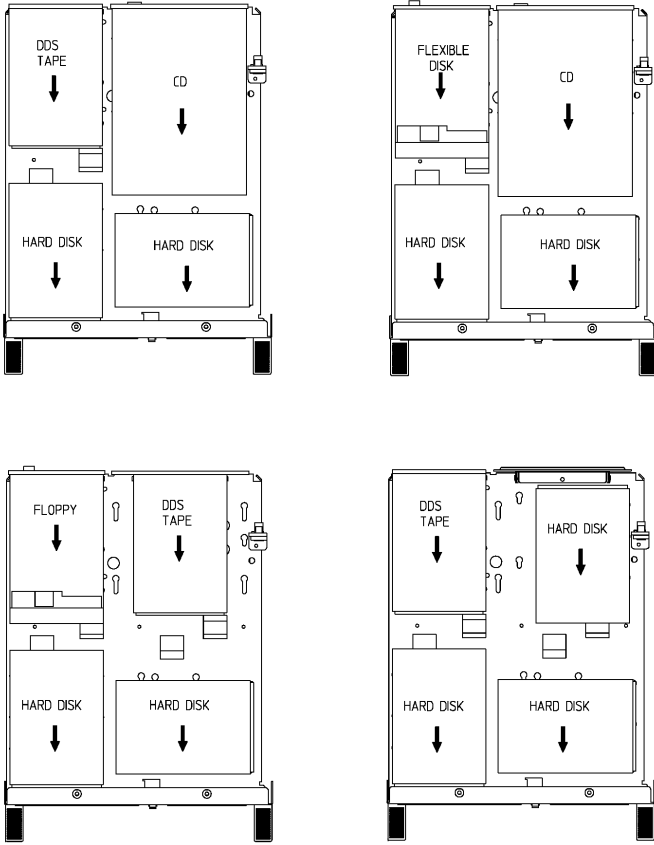


Figure 5-15

Device Locations 4 of 4

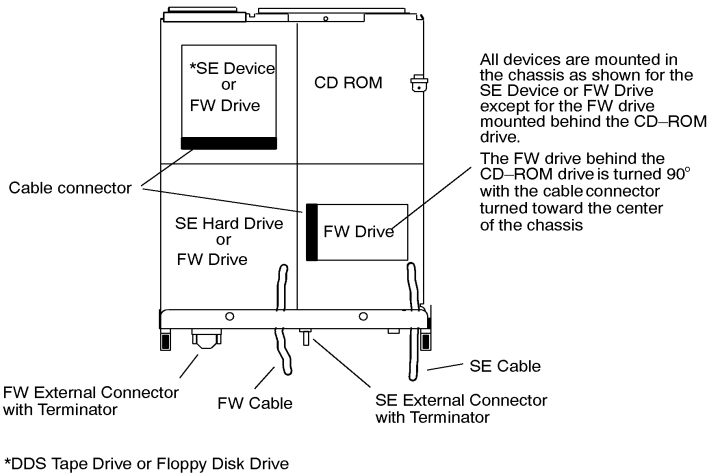
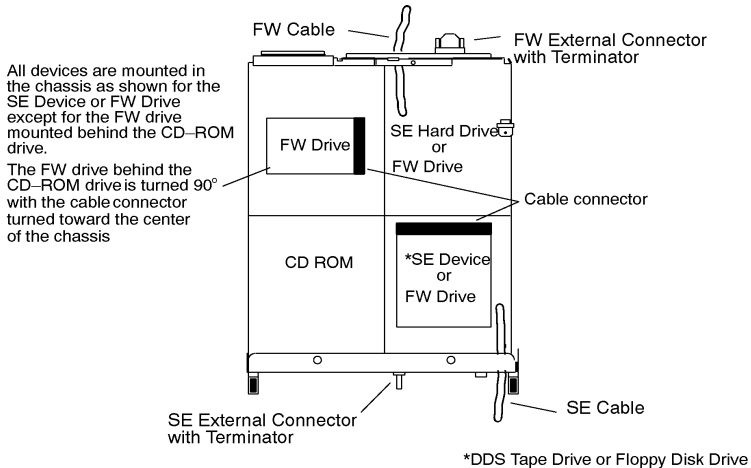


Figure 5-16

FWD Device Locations

Mass Storage Device Removal

NOTE: When replacing a floppy disk drive, you may need to add or replace a bezel.

Procedure

Power & SCSI cables

- Disconnect both the power and SCSI cables connected to the device.

Retaining screws

- Loosen the four screws holding the device in the tray.

Device removal

- 1 Slide screw heads towards large end of keyholes, remove device (see Figure 5-17).
- 2 Transfer screws and shoulder bushings to new device.

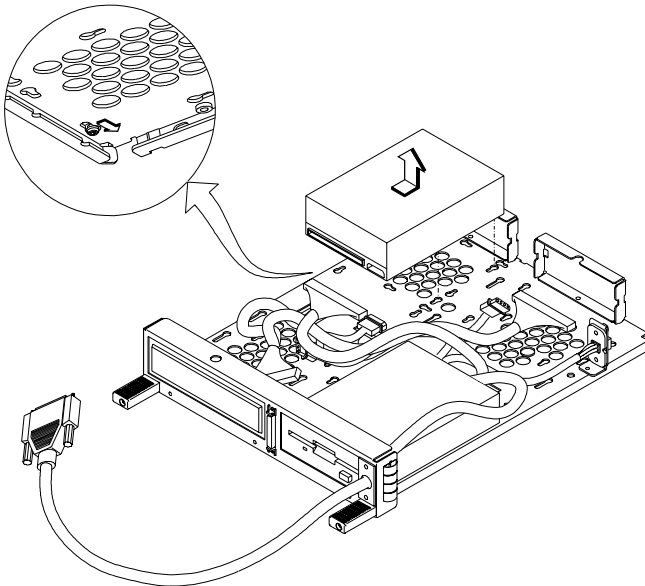


Figure 5-17 Mass Storage Device Removal

EISA or PCI Module Removal

Preliminary Requirements

- 1 Shut down any applications.
- 2 Shut down the OS. Refer to the owner's guide for information on properly shutting down HP-UX.
- 3 Turn power off to the Model 748.
- 4 Set up a static-free work place to handle the EISA or PCI card cage.
- 5 Disconnect power cords.

Procedure

- 1 Remove all cables attached to card cage.
- 2 Loosen the two screws in handles of the EISA or PCI card cage.
- 3 Slide out tray (see Figure 5-18).

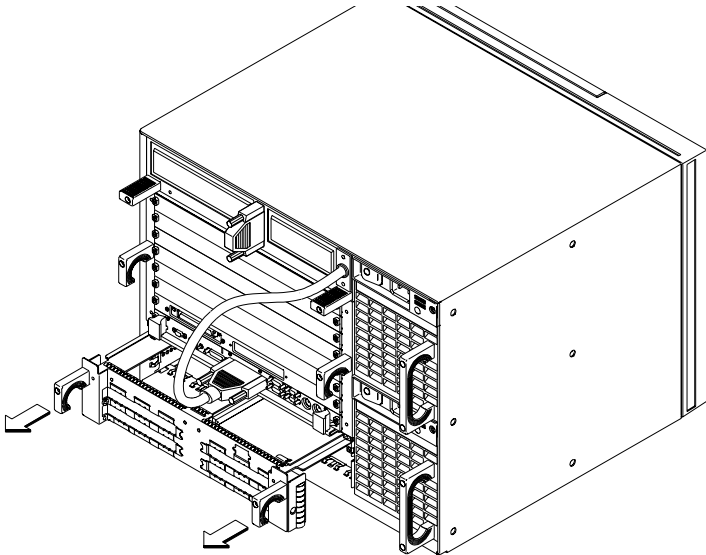


Figure 5-18

Tray Removal

EISA or PCI Module Removal

EISA or PCI Converter Board and Backplane Removal

- 1 Remove any cards installed in cage.
- 2 In an EISA card cage, remove the two HP HIL connector screws (1 in Figure 5-19) located on the front of the cage to free the connector.
- 3 Remove the screw (2 in Figure 5-19) on the converter board.
- 4 Dislodge the plastic tab from the sheet metal hook holding the backplane in place.
- 5 Remove the Converter board and Backplane assembly.

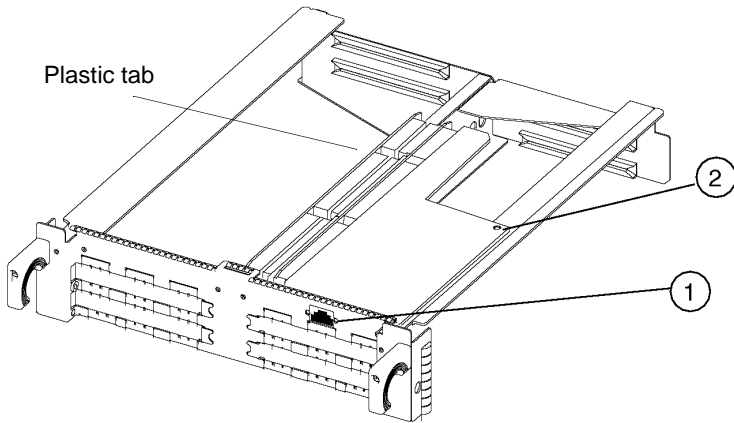


Figure 5-19

EISA or PCI Converter Board and Backplane Removal

VME Module Removal

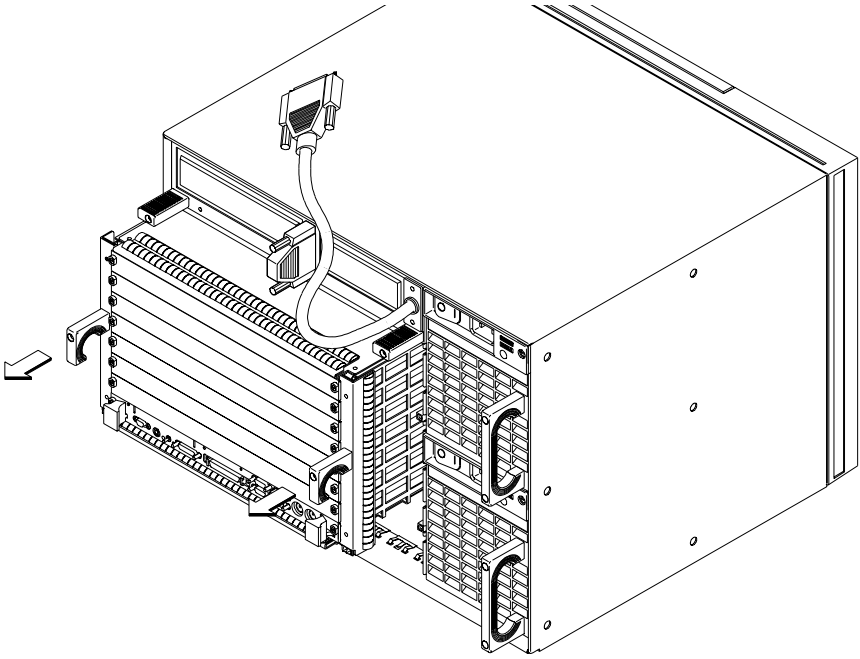
CAUTION:

The EISA or PCI card cage **MUST** be removed before the VME cage can be removed!

Preliminary Requirements

- 1 Shut down any applications.
- 2 Shut down the OS. Refer to the owner's guide for information on properly shutting down HP-UX.
- 3 Turn off power to the Model 748.
- 4 Set up a static-free work place to handle the VME card cage.
- 5 Disconnect power cords.
- 6 Remove EISA card cage.

VME Module Removal



Procedure to remove VME Module

- 1 Remove all external cables connected to the 743/744 VMEbus computer(s) and any other VME card.
- 2 Loosen captive screws (located in handles of cage)
- 3 Slide VME card cage out of unit.
- 4 Place cage on static mat.

NOTE: If VME backplane is to be removed, all VME Cards must be removed prior to cage removal.

VME Backplane Removal

- 1 Remove VME card cage as directed in previous steps.
- 2 Place the VME card cage on static mat with the EISA connector facing up.
- 3 Remove the three screws on the backplane.
- 4 Slide backplane up and away from unit.

Power Supply and Chassis Parts Replacement

The following parts are covered by this section:

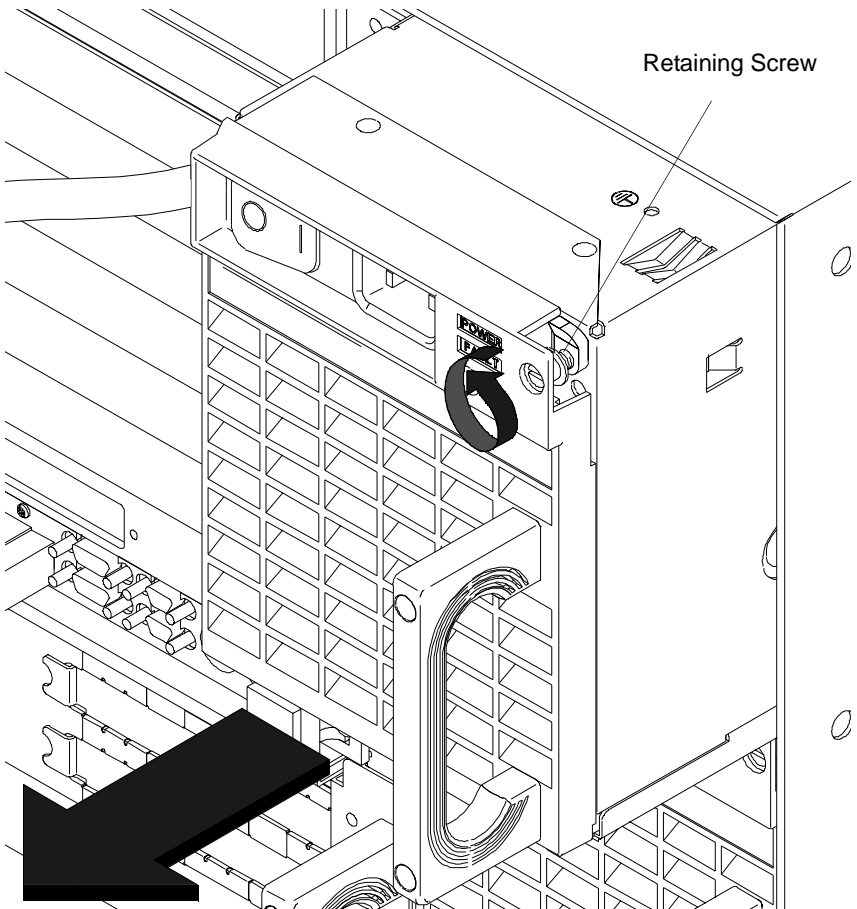
- Power Supply(s)
- Power Distribution PCA
- Power Switch Assembly

Preliminary Requirements

All procedures in this section require the following:

- OS shutdown
- Power removed from the Model 748
- Power cords removed from power supplies
- Ground wires removed from power supplies (M4 grounding points)

Power Supply Removal



- 1 Remove power cord(s) and ground wire(s) connected to power supply.
- 2 Loosen retaining screw.
- 3 Slide out power supply.
- 4 Repeat process to remove other supply.

Power Switch Assembly

- 1 Remove both power supplies as previously directed.
- 2 Disconnect the power switch assembly connector from the power distribution PCA.

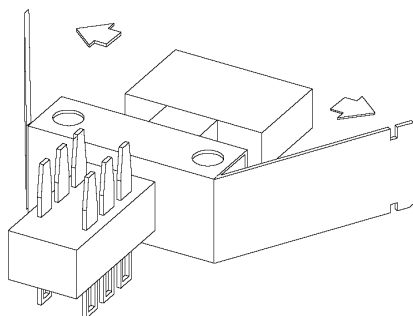


Figure 5-20 Magnified View of Power Switch Tabs

- 3 Spread the Power Switch support bracket tabs outward, as shown in Figure 5-20.
- 4 Remove Switch.

Power Distribution PCA

- 1 Remove the EISA and VME card cages following the procedures given in this chapter.
- 2 Remove both power supplies following the procedures given in this chapter.
- 3 As shown in Figure 5-21, loosen the thumb screw, then slide the power distribution PCA connector (located on wall assembly) down to disconnect from wall.

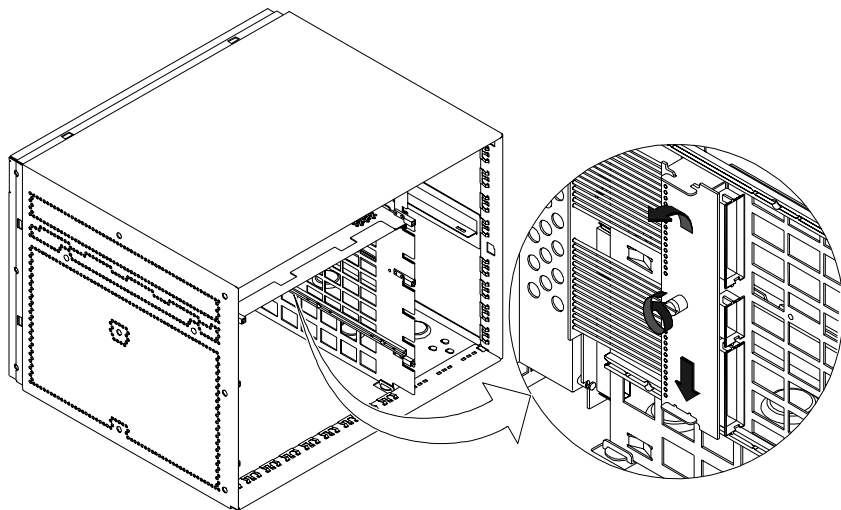


Figure 5-21

Removing the Power Distribution PCA from the Wall

Power Supply and Chassis Parts Replacement

- 4 Rotate lower edge of the center wall to the right about 2 inches, then slide tabs at the top of the wall out of slots in the mass storage module support. Refer to Figure 5-22. Set aside wall.

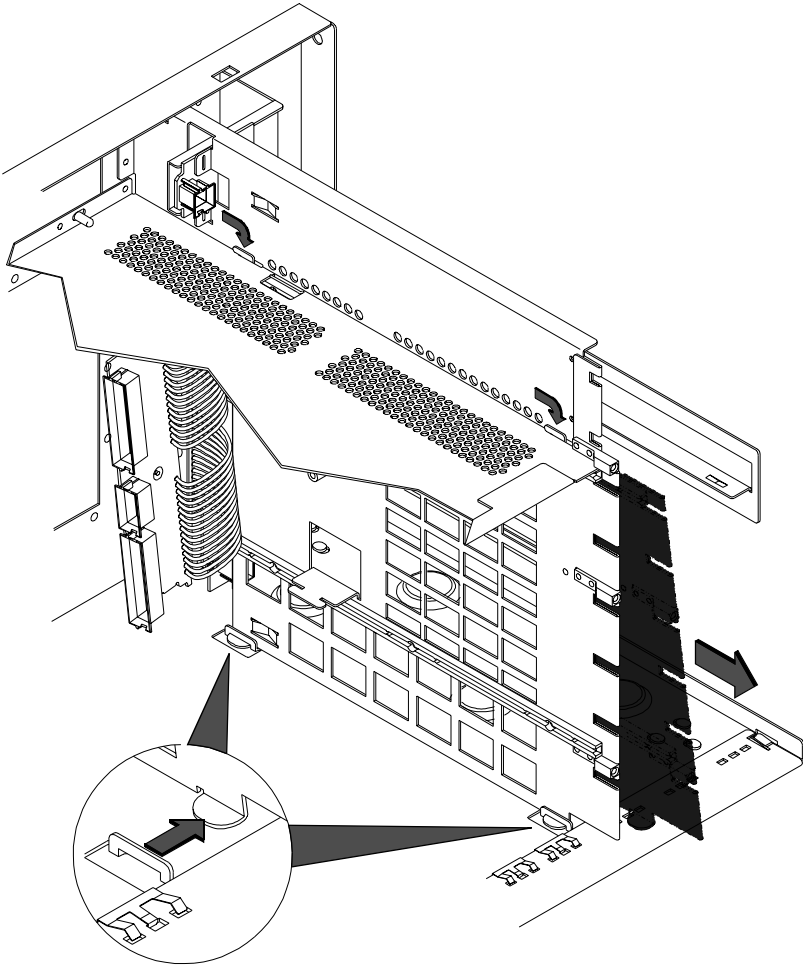


Figure 5-22

Center Wall Removal

Power Supply and Chassis Parts Replacement

- 5 Loosen captive screw holding the power distribution PCA circuit board to the front of the chassis. Slide board to right to remove. Refer to Figure 5-23.

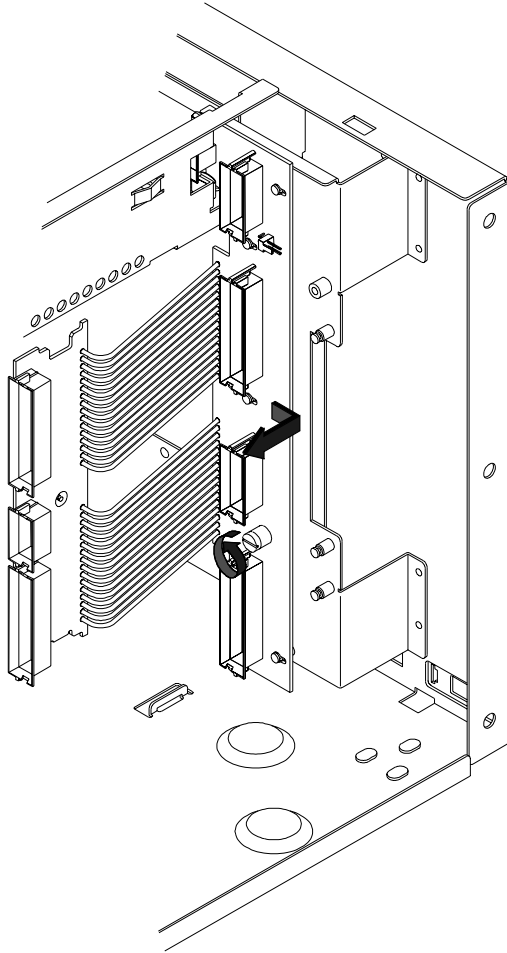


Figure 5-23

Power Distribution PCA Removal from Chassis

Power Supply and Chassis Parts Replacement



Diagrams

Functional Description of Model 748 Chassis

The Model 748 chassis provides the following:

- Two 300-Watt power supplies (one for VME slots 3 to 8, and one for VME slots 1 and 2, Mass Storage, and EISA).
- Four slot EISA Card Cage or four slot PCI Card Cage
- HP-HIL Interface (alternate human i/f via EISA ASIC in EISA card cage)
- Four Internal Mass Storage Device mounting and electrical capability

Figure 6-1 shows the Model 748 functional block diagram.

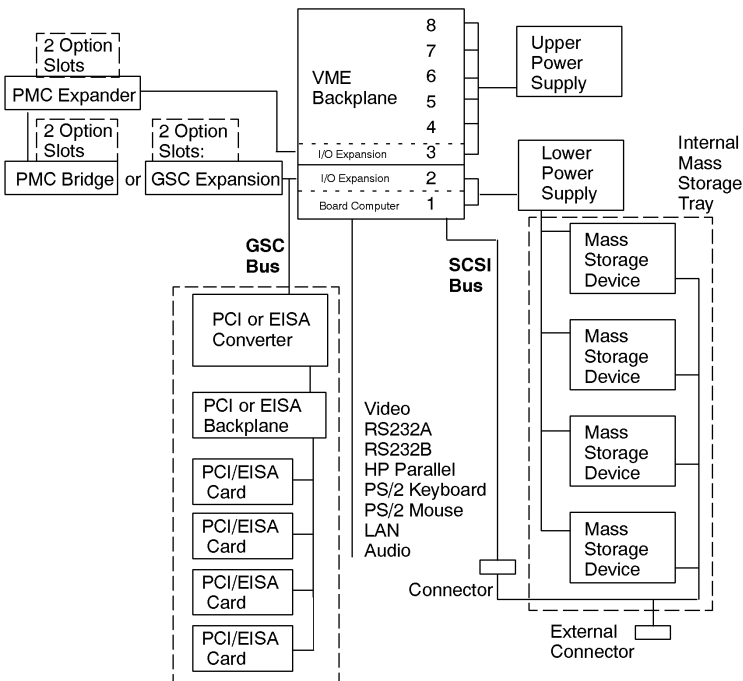


Figure 6-1 Functional Block Diagram



Reference Documentation

Introduction

Information in this chapter should help you in various situations. The references include part numbers of many hardware documents relating to these workstations.

Service Documentation

Table 7-1 **Related Service Documentation**

Manual Title	Part Number
HP Model 743 Board Computer Service Handbook	A2636-90604
HP Model 744 Board Computer Service Handbook	A4511-90603

Table 7-2 Diagnostic Documentation

Manual Title	Part Number
Support Tools Manager User's Manual; HP 9000 Series 700 and 800	5961-1612
HP Apollo 9000 Series 700 Diagnostics Manual, Volume 1	09740-90041
HP Apollo 9000 Series 700 Diagnostics Manual, Volume 2	09740-90043
HP Apollo 9000 Series 700 Support Tape/CD-ROM User's Manual	B2380-90000
PA-RISC Support Tools Manual Licensed Users Volume 1, SPU	5960-3149
PA-RISC Support Tools Manual Licensed Users Volume 2, Device Adapters/MUXes	5960-3151
PA-RISC Support Tools Manual Licensed Users Volume 3, LAN	5960-3153
PA-RISC Support Tools Manual Licensed Users Volume 4, SCSI	5960-3155
PA-RISC Support Tools Manual Licensed Users Volume 5, Disks	5960-3157
PA-RISC Support Tools Manual Licensed Users Volume 6, Tapes/Printers	5960-3159
PA-RISC Support Tools Manual Licensed Users Volume 7, Utilities	5960-3161
PA-RISC Support Tools Manual Licensed Users Volume 8, ISL Support Tools	5960-3163
PA-RISC Support Tools Manual HP Employees	5960-3165
Offline Diagnostics Environment (ODE) User's Manual	5962-3648
System Exerciser Install and Operating Guide	5961-1624

System Installation and Getting Started Documentation

Table 7-3 System Installation and Getting Started Documentation

Manual Title	Part Number
Model 743 Board Computer Owner's Guide	A2636-90603
Model 744 Board Computer Owner's Guide	A4511-90606
HP-UX 9.05 VME Configuration and Driver Development Guide	A2636-90020
VME Services for HP-UX 10	A4412-90022



Service Notes

Service Notes

Place service notes here.

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