User Guide

hp rp7405/7410 Servers

Third Edition

Legal Notices

The information in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

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Revision History

Table 1   Revisions

Revision	Part Number	Release Date	Description
Third	A6752-96008	November 2002	Corrected power cord and power reqirements section. Corrected DIMM oading order. Other general corrections.
Second	A6752-96002	August 2002	Changed title, revised entire book
First	A6752-91001	February 2002	Initial release

Notational Conventions

WARNING	**Warnings highlight procedures or information necessary to avoid injury to personnel. The warning should tell the reader exactly what will result from what actions and how to avoid them.**

CAUTION	A caution highlights procedures or information necessary to avoid damage to equipment, damage to software, loss of data, or invalid test results.

NOTE	A note highlights supplemental information.

Safety and Regulatory

Regulatory Model: RSVLA-0102

For your protection, this product has been tested to various national and international regulations and standards. The scope of this regulatory testing includes electrical/mechanical safety, radio frequency interference, acoustics, and know hazardous materials.Where applicable, approvals obtained from third-party test agencies are shown on the product label.

Safety in Material Handling
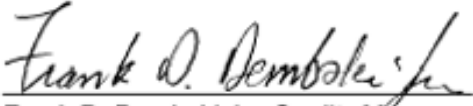
WARNING	**Do not lift the cabinet manually. To avoid physical injury you must use a mechanical lifting device.**

WARNING	**Use care when working with hazardous voltages. This equipment may be configured with dual input line sources. Hazardous voltages and energy maybe present even after the removal of a single input source. Trained service personnel must follow the service guidelines.**

WARNING	**Do not stand in front of the equipment as it is rolled off the pallet onto the ramps. When removing the equipment from the shipping pallet, follow the guidelines specified in the Installation Procedures section of the appropriate equipment guides.**

Figure 1   Declaration of Conformity

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Company
                               Internet & Applications Systems Division

Manufacturer's Address: 8000 Foothills Blvd.
                               Roseville, CA 95747
                               USA

declares, that the product

Product Name: HP Server rp7410

Regulatory Model: RSVLA-0102-xx (where -xx is an optional suffix and x is
                         any letter or blank)

Product Options: All

conforms to the following Product Specifications:

Safety: IEC 60950:1991+A1+A2 +A3 +A4 /

          EN 60950: 1992+A1+A2 +A3 +A4 +A11
          IEC 60825-1:1993 +A1 / EN 60825-1:1994+A11, Class 1
          GB 4943-1995

EMC: CISPR 22:1997 / EN 55022:1998 Class A [1]

        CISPR 24:1997 / EN 55024:1998

        IEC 61000-3-2:1995 / EN 61000-3-2:1995 +A14
        IEC 61000-3-3:1994 / EN 61000-3-3:1995
        GB 9254-1988

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive
73/23/EEC and the EMC Directive 89/336/EEC and carries the CE marking
accordingly.

1) The product was tested in a typical configuration with Hewlett-Packard computer
   peripherals.

2) DC versions of the product were tested in a typical configuration with a Hewlett-
   Packard 6813A AC/DC power source.

Roseville, 12/1/01   Frank D. Dembski Jr., Quality Manager

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH,
Department HQ-TRE, Herrenberger Straße 130, D-71034 Böblingen (FAX: + 49-7031-14-3143)

USA Radio Frequency Interference
FCC Notice

The Federal Communications Commission (in 47 CFR Part 15 subpart B) has specified that the following notice be brought to the attention of the users of this product.

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.

The user is cautioned that changes or modifications not expressly approved by Hewlett-Packard could result in the equipment being noncompliant with FCC Class A requirements and void the user's authority to operated the equipment.

Japanese Radio Frequency Interference
VCCI

This equipment is in the Class A category information technology equipment based on the rules of Voluntary Control Council For Interference by Information Technology Equipment (VCCI). When used in a residential area, radio interference may be caused. In this case, user may be required to take appropriate corrective actions.

Figure 2   **Japanese RFI**

この装置は、クラスA情報技術装置です。この装置を
家庭環境で使用すると電波妨害を引き起こすことがあり
ます。この場合には使用者が適切な対策を講ずるよう要
求されることがあります。   VCCI-A

Korean RFI Statement

Certification Number: E - AAAAA - BB - CCCC

- E: EMC registration
- AAAAA: equipment codes (RRL notice, 2000.10.26)
- BB: certification year
- CCCC: registration number

Figure 3   **Korean RFI**

사용자 안내문 (A 급기기)

이 기기는 업무용으로 전자파 장해검정을 받은 기기이오니, 만약 잘못 구입
하셨을 때에는 구입한 곳에서 비업무용으로 교환 하시기 바랍니다.

사용자 안내문 (B 급기기)

이 기기는 비업무용으로 전자파 장해검정을 받은 기기로서, 주거지역에서는
물론 모든 지역에서 사용할 수 있습니다.

Translation

Class A Equipment:

Please note that this equipment has been approved for business purpose with regards to electromagnetic interference, if purchased un error for use in residential area, you may wish to exchange the equipment where you purchase it.

Class B Equipment:

Please note that this equipment has been approved for non-business with regards to electromagnetic interference. So, this equipment can be allowed to use all area as well as residential area.

European Union RFI Statement

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Canada RFI Statement

This Class A digital apparatus complies with Canadian ICES-003.

Notice relative aux interférences radioélectriques (Canada)

Cet appareil numéric de la classe A est conforme à la norme NMB-003 du Canada.

BSMI (Taiwan Area)

This product is fully compliant to CNS 13438 (CISPR 22: 1993) Class A. The EMC label is in the form shown in Figure 4.

Figure 4   **Taiwan Area EMC**

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。
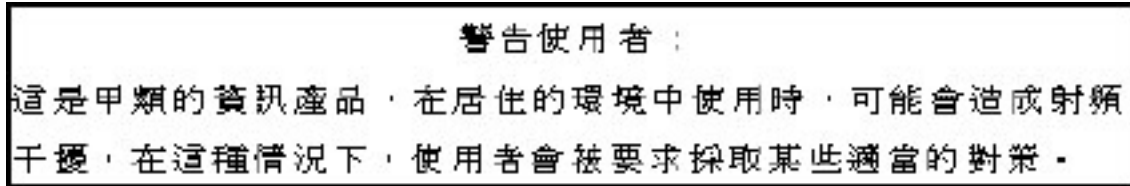
NOTE   Electrical practices and suggestions in this guide are based on North American practices. For countries outside North America, local electrical codes will take precedence over North American electrical codes.

An example would be the recommendation that the PE (protective earthing) conductor be green with yellow stripes. This requirement is a North American directive and does not override the local code requirements for a country outside North America.

Throughout this manual, the [LAHJ] acronym will be used to indicate Local Authority Has Jurisdiction.

Acoustics (Germany)

Acoustic Noise (A-weighted Sound Pressure Level LpA) measured at the bystander position, normal operation, to ISO 7779: LpA = 59 dB.

Geräuschemission (Deutschland)

Lärmangabe (Schalldruckpegel LpA) gemessen am fiktiven Arbeitsplatz bei normalem Betrieb nach DIN 45635, Teil 19: LpA = 59 dB.

IT Power System

This product has not been evaluated for connection to an IT power system (an AC distribution system having no direct connection to earth according to IEC 60950).

TT, TN-C, and TN-C-S Power Systems

These products should not be connected to power systems that switch open the return lead when the return lead also functions as the protective earth (PE). A separate PE ground wire must be connected to the equipment at the designated PE terminal tie point.

Installation Conditions

See installation instructions before connecting this equipment to the input supply.

Voir la notice d'installation avant de raccorder au réseau.

WARNING NORDIC Class 1 Equipment

Denmark: Før tilslutning af de øvrige ledere, se medfølgende installationsvejledning.

WARNING NORDIC Class 1 Equipment

Sweden: Apparaten skall anslutas till jordat uttag, när den ansluts till ett nätverk.

Network Connected Equipment

The installation must provide a ground connection for the network equipment.

CAUTION Sweden: Apparaten skall anslutas till jordat uttang när deb abskuts till ett nätverk.

CAUTION Norway: Apparaten skall anslutas till jordat uttang nar deb abskuts till ett natverk.

Lithium Battery Caution

WARNING	**Observe the correct polarity when changing the lithium battery. There is a danger of explosion if battery is installed incorrectly.**
	Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions and local disposal requirements.

IMPORTANT	Switzerland: Annex 4.10 of SR 814.013 applies to batteries.

Australian C-Tick Label

Figure 5   **C-Tick Label**

Laser Safety

| NOTE | If a Fibre Channel I/O card is present, the following laser safety statement applies. |

This product contains a laser internal to the Optical Link Module (OLM) for connection to the Fibre communications port.

In the USA, the OLM is certified as a Class 1 laser product conforming to the requirements contained in the Department of Health and Human Services (DHHS) regulation 21 CFR, Subchapter J. The certification is indicated by a label on the plastic OLM housing.

Outside the USA, the OLM is certified as a Class 1 laser product conforming to the requirements contained in IEC 60825-1:1993 and EN 60825-1:1994, including Amendment 11:1996.

| NOTE | If a DVD is present, the following laser safety statement applies. |

This product contains a laser internal to the Digital Versatile Disc (DVD) housing.

In the USA, the DVD is certified as a Class 1 laser product conforming to the requirements contained in the Department of Health and Human Services (DHHS) regulation 21 CFR, Subchapter J. The certification is indicated by a label on the DVD housing.

Outside the USA, the DVD is certified as a Class 1 laser product conforming to the requirements contained in IEC 60825-1:1993+A1 and EN 60825-1:1994+A11.

1   Introduction

The hp rp7410 is a member of Hewlett-Packard's business-critical computing platform family: a mid-range, mid-volume server, positioned as an upgrade to the current N-Class product in the PL-1X product line. It provides increased performance over its predecessor but in a smaller volume. Its shallower depth allows it to fit in a standard rack. In addition to the hp rp7410, Hewlett-Packard offers a series of cost-effective servers based on the hp rp7410 with somewhat less performance. See "hp rp7405 Servers" on page 5.

hp rp7405/rp7410 Overview

The hp rp7405/rp7410 is a 10U, 8-way SMP, rack-mount server that accommodates up to 32 GB of memory (64 GB available at a later date); PCI-4X I/O; and internal peripherals including disks and DVD/tape. Its high availability features include N+1 hot-pluggable fans and power, redundant power cords, and hot-pluggable PCI cards and internal disks. It uses the PA8700 PA-RISC processors.

Figure 1-1   hp rp7405/rp7410 Server (front view)
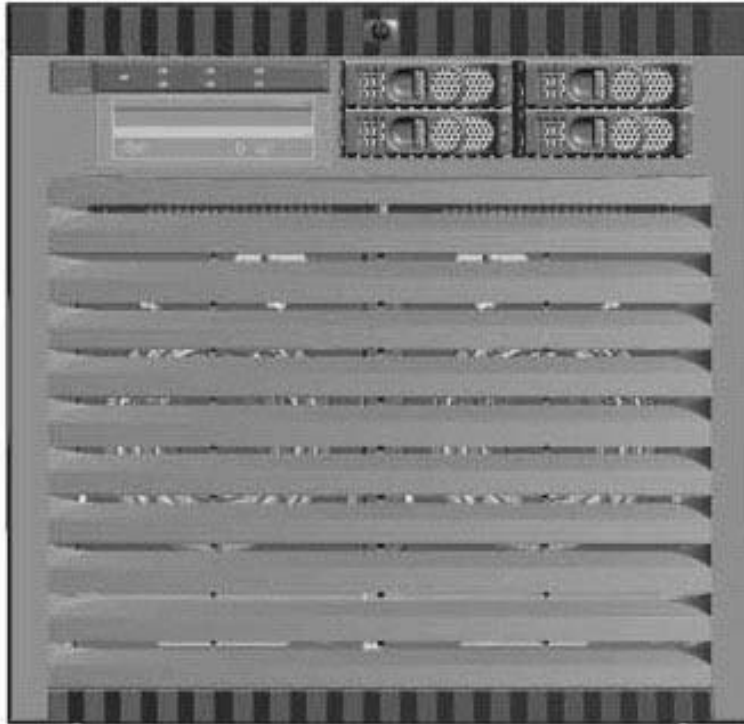
Figure 1-2   hp rp7405/rp7410 Server (without front bezel)

Improvements over its predecessor, N4000, include:

- Better availability and up time

- Depth optimized (shallower, fewer racking issues)

- Performance density increase

- Performance increase

- Internal removable media

- More internal disks

- Optimal power cord quantity (2 min., 4 max)

- Enabled for cell hot-plug, dual-partition, dual and/or redundant MP Core I/O

- More PCI slots (up to 16)

- Upgradeable to PCI-X

- Superset of MP Core I/O functionality

Cell Board

The cell board contains the processors, main memory, and the CC ASIC that interfaces the processors and memory to the off-board I/O. The CC provides a crossbar connection, which allows communication with other cell boards in the system. It connects to the PDH and SINC hardware. Each cell board holds up to 16 DIMMS. There can be one or two cell boards installed in a server. The cell boards have hot-plug capability.

System Backplane

The system backplane comprises the system clock generation logic, the system reset generation logic, DC-to-DC converters, power monitor logic, and two Local Bus adaptor (LBA) link-to-PCI converter ASICs. It also includes connectors for attaching the cell boards, PCI backplane, MP Core I/O MP/SCSI boards, SCSI cables, bulk power, chassis fans, front panel display, intrusion switches, and the system scan card. Unlike Superdome or the rp8400, there are no XBC chips on the system backplane. The "crossbar-less" back-to-back CC connection increases performance and reduces costs.

There are only two sets of cell board connectors, because the server has only two cells

Also, only half of the MP Core I/O board set connects to the system backplane. The MP/SCSI boards plug into the backplane, while the LAN/SCSI boards plug into the PCI Backplane.

I/O Subsystem

All of the I/O is integrated into the system by way of the PCI busses. The CC on each cell board communicates with one SBA over the SBA link. The SBA link consists of both an inbound and an outbound link with an effective bandwidth of approximately 1 GB/sec. The SBA converts the SBA link protocol into "ropes". SBA can support up to 16 of these high-speed bi-directional links for a total aggregate bandwidth of approximately 4 GB/sec. The LBA acts as a bus bridge, supporting either one or two ropes, and capable of driving either PCI-2x Turbo (33 MHz x 64 bits) or PCI-4 Twin Turbo (66 MHz x 64 bits) respectively.

hp rp7405 Servers

Hewlett-Packard offers a cost-effective server based on the hp rp7410 by employing a reduced number of processors, memory, core I/O, or power supplies as indicated in Table 1-1.These servers provide a somewhat reduced performance than the fully functional hp rp7410 servers.

Table 1-1   hp rp7405 Servers

Server	Product Number	Description
rp7405 2-way system	A7111A	Includes rp7405 SMP base system, two 650-MHz PA-RISC processors, 4-GB memory (2 x 2GB memory modules), two 73-GB 10k internal disks, one DVD drive, one cell board, one core I/O, and two power supplies
rp7405 4-way system	A7112A	Includes rp7405 SMP base system, four 650-MHz PA-RISC processors, 8-GB memory (4 x 2 GB memory modules), four 73-GB 10k internal disks, one DVD drive, two cell boards, two core I/O, and two powers supplies
rp7405 8-way system	A7113A	Includes rp7405 SMP base system, eight 650-MHz PA-RISC processors, 16-GB memory (8 x 2 GB memory modules), four 73-GB 10k internal disks, one DVD drive, two cell boards, two core I/O, and two power supplies

These servers may be upgraded with additional processors/cell boards, memory, core I/O, etc. according to the corporate price list.

In addition, these servers may be upgraded to fully functional hp rp7410 servers with the kits given in Table 1-2.

Table 1-2   hp rp7405-to-rp7410 Upgrades

Kit Description	Upgrade	Part Number
Upgrade kit from 2-way rp7405 to rp7410	750 MHz upgrade	A7144A
	875 MHz upgrade	A7145A
Upgrade kit from 4-way rp7405 to rp7410	750 MHz upgrade	A7146A
	875 MHz upgrade	A7147A
Upgrade kit from 8-way rp7405 to rp7410	750 MHz upgrade	A7148A
	875 MHz upgrade	A7149A

Detailed hp rp7405/rp7410 Description

Figure 1-3 **hp rp7410 8-Way Block Diagram**
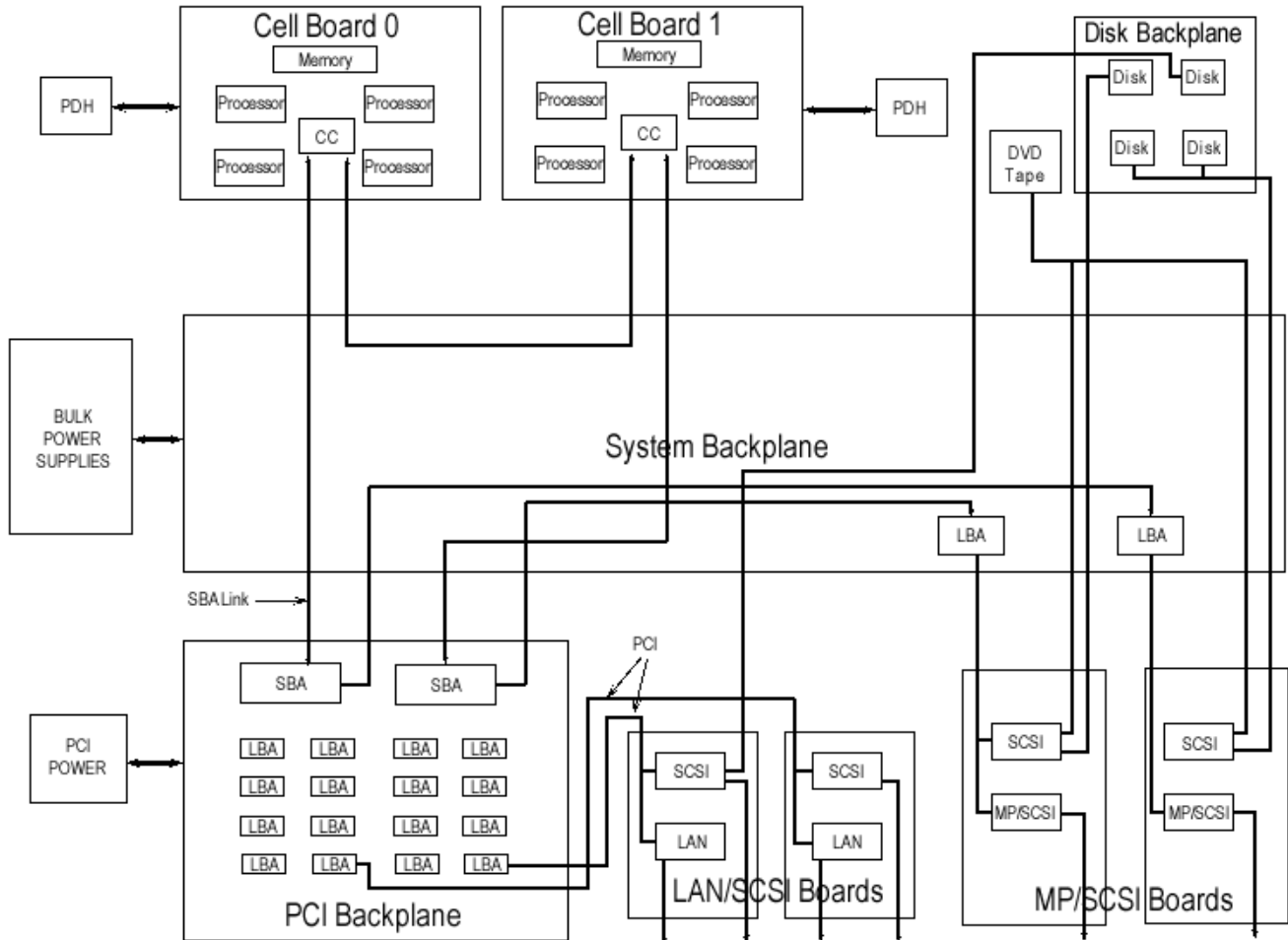
Cell Board

The cell board contains the processors, main memory, and the cell controller (CC) ASIC that interfaces the processors and memory to the off-board I/O. Shown in Figure 1-4 is the CC. This is the heart of the cell board. The CC provides a crossbar connection, which allows communication with other cell boards in the system. It connects to the PDH and SINC hardware. Each cell board holds up to 16 DIMMs. There can be one or two cell boards installed in an system. The cell boards have hot-plug capability.

Figure 1-4   Cell Controller
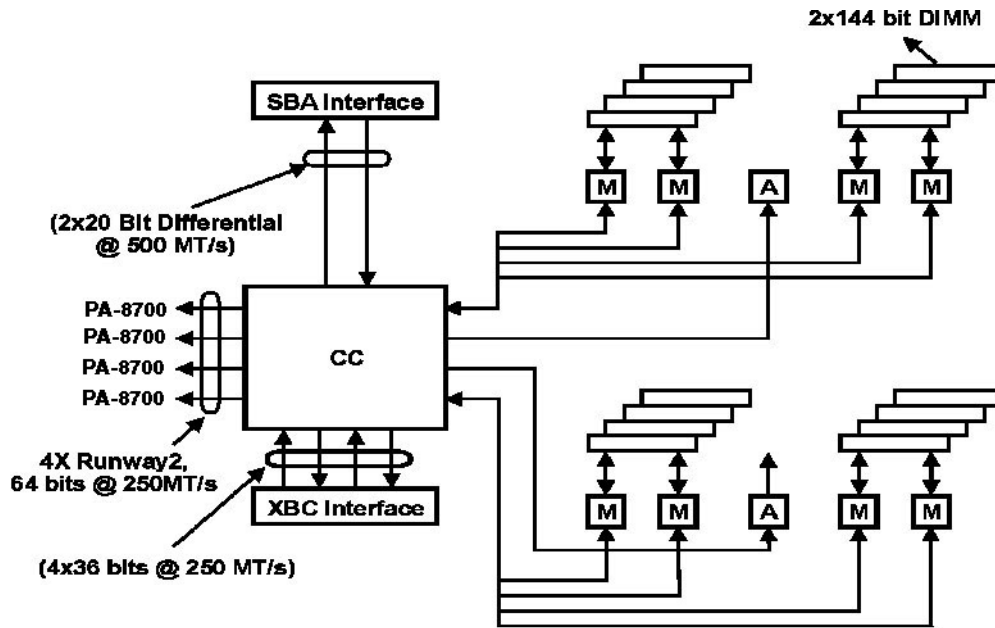
Figure 1-5   Cell Board
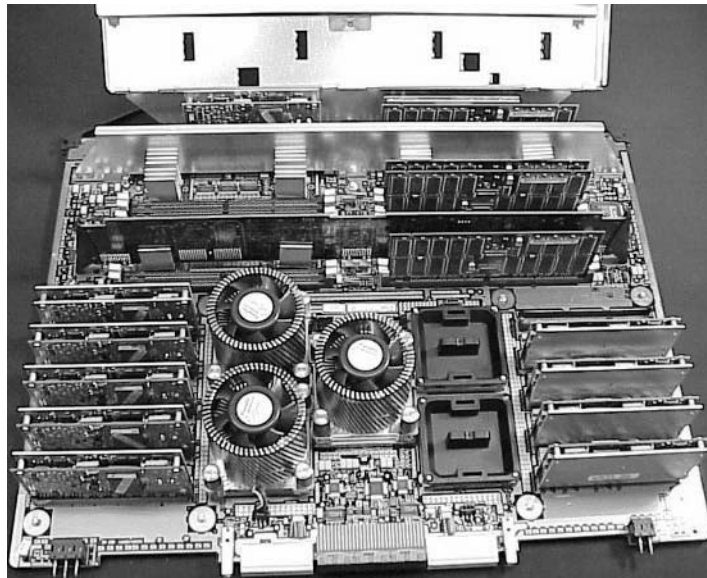
The hp rp7405/rp7410 has a 48V distributed power system and receives the 48V power from the system backplane board. The cell board contains DC-to-DC converters to generate the required voltage rails. The DC-to-DC converters on the cell board do not provide N+1 redundancy.

The cell board contains several major buses including:

- Runway buses for each of the four processors

- Two memory buses (one going to each half of the main memory array)

- Incoming and outgoing I/O bus that goes off board to a SBA chip

- Incoming and outgoing crossbar bus that goes off board to the other cell boards

- PDH bus that goes to the PDH/SINC circuitry

All of these buses come together at the CC chip.

Due to space limitations on the cell board the PDH/SINC circuitry resides on a riser board that plugs at a right angle into the cell board. The cell board also includes clock circuits, test circuits and de-coupling capacitors.

Figure 1-6 shows a simplified view of the memory subsystem. It consists of two independent access paths, each path having its own address bus, control bus, data bus, and DIMMs. In practice, the CC runs the two paths 180 degrees out of phase with respect to each other to facilitate pipelining in the CC. Address and control signals are fanned out through register ports to the SDRAMs on the DIMMs.

Data transferred between the CC and SDRAM passes through custom VLSI circuits (M2) that are bit-sliced; four form one 72-bit CC memory data bus. These circuits perform speed and width conversion between the SDRAM and MID busses. They also perform the write (tag update) portion of a read-modify-write (RMW) access. The CC memory data busses are bi-directional and run at 250 MT/s (million transfers per second). These links are self-clocked in that a pair of clock strobes is passed along with the data so that phase realignment can be done by the receiver.

Figure 1-6   Memory Subsystem
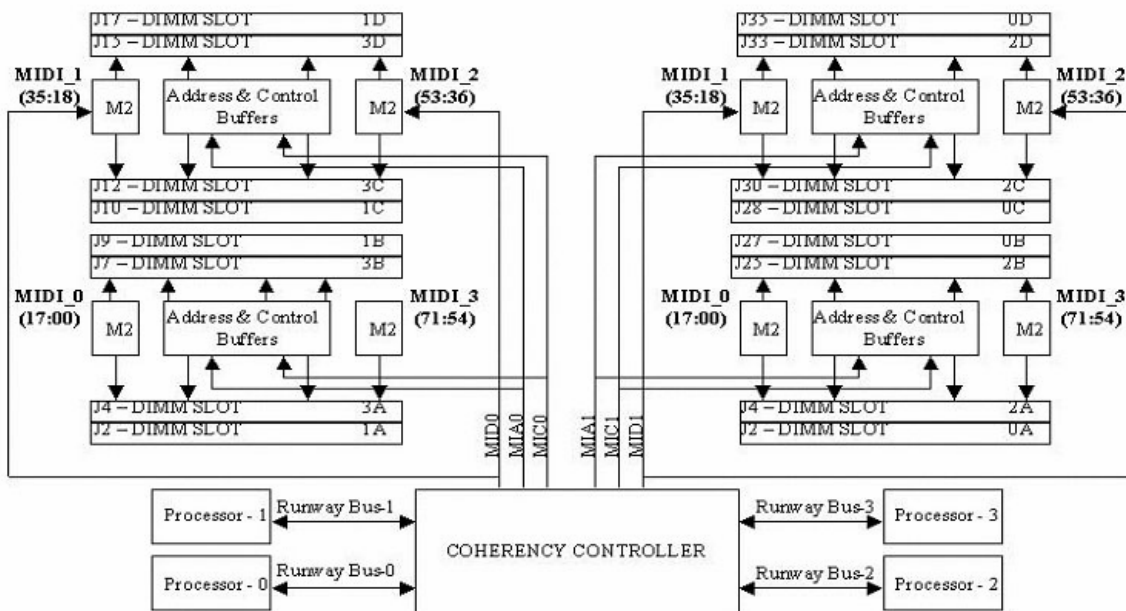
PDH Riser Board

The PDH riser board is a daughter card for the cell board. It contains a micro-processor memory interface microcircuit, processor-dependent hardware (PDH) including the processor dependant code (PDC) Flash memory, and a manageability micro-controller, called SINC, with associated circuitry. The PDH obtains cell board configuration information from cell board signals and from the cell's LPM. See the PDH Riser Board ERS for operational details.

The memory interface microcircuit is the heart of the PDH. It provides the CC access to the PDH space by a 4-bit, 50-75 MHz bus. This microcircuit also supports an interrupt mechanism to the CC that can interrupt a processor for the PDH. It provides access to the FLASH ROM and scratch RAM memory chips together with the external registers and an interface to an I^2C micro controller (SINC) that monitors sensors throughout the system. It also controls system reset and initialization signals, as well as the low-level debugger (LDB) port, UART, semaphore register, and GPIO pins. It is the primary master for a Serial Presence Detect bus.

The PDH supports up to 4 MB of address space for ROM (FLASH) to hold the PDC firmware.

The non-volatile memory and scratch RAM have been combined and placed in a 512KB battery-backed SRAM

DIMMs

Custom designed by Hewlett-Packard, each DIMM contains 36x4 SDRAM memory components similar to PC-133 memory but qualified to run at 125MHz. They have an low-voltage TTL interface. The CEC does *not* support traditional DRAMs.

The hp rp7405/rp7410 supports DIMMs with 128, 256, 512, and 1024 Mbit devices. Table 1-3 shows each DIMM supported with its associated capacity, the resulting total system capacity, and the memory component density.

DIMMs must be loaded in sets of four at specific locations. For best performance, loading sets of eight DIMMs is recommended.

Table 1-3   **hp rp7405/rp7410 DIMMs**

DIMM Capacity	Total Capacity	Memory Component Density
512 Mbyte	16 Gbytes	128 Mbit
1G Byte	32 Gbytes	256 Mbit

Main Memory Performance Latency to main memory is an important parameter in determining overall system performance. With memory busses running at 125 MHz, the latency for a page hit is 8.5 cycles (68ns), the latency for a page closed is 11.5 cycles (92ns), and the latency for a page miss is 14.5 cycles (116ns).

Cells and nPartitions

NOTE   In the following discussion, the term "cell" refers to a cell board.

A cell board that has an I/O link to a bootable device and a console (usually supplied by an MP Core I/O card) is a potential boot cell. The cell that contains the boot console I/O path is the called the root cell. Both cells are potential root cells. The primary or default root cell in a single nPartition system is the bottom cell (cell 1).

An nPartition (also called a Protection Domain) is a cell(s) running the same OS and sharing processes and memory space among the components. Each nPartition must have one root cell and may have both. The hp rp7405/rp7410 has only two possible nPartition configurations: single or dual. The additional cell that may be part of the nPartition does not require I/O links nor MP Core I/O cards.

In the single nPartition case, if two cells are present, either cell may be the root cell, assuming the both cells have MP Core I/O functionality present. If only one cell is present, that cell is the root cell (and should be cell 1).

In the dual nPartition case (two cells required), each nPartition consists of one cell, and each cell must be a root cell. The ability to interconnect two cells in one nPartition or isolate the cells in a dual nPartition system provides system configuration flexibility. System partitioning is configured by the system management processor.

Internal Disk Devices for hp rp7405/rp7410

As Figure 1-4 shows, in an hp rp7405/rp7410 cabinet the top internal disk drives connect to cell 1 through the MP Core I/O for cell 1 (for 1/0/0/3/0.6) and the LAN/SCSI card in slot 1_8 (I/O chassis 1 slot 8, for 1/0/1/0/0/1/1.6). Both of the bottom disk drives (0/0/0/3/0.6 and 0/0/0/3/0.5) connect to cell 0 through the MP core I/O for cell 0. A CD/DVD-ROM drive or DAT drive connects to cell 1 through the core I/O card for cell 1, thus it can be accessed through the cell 1 nPartition only.

Figure 1-7   Internal Disks
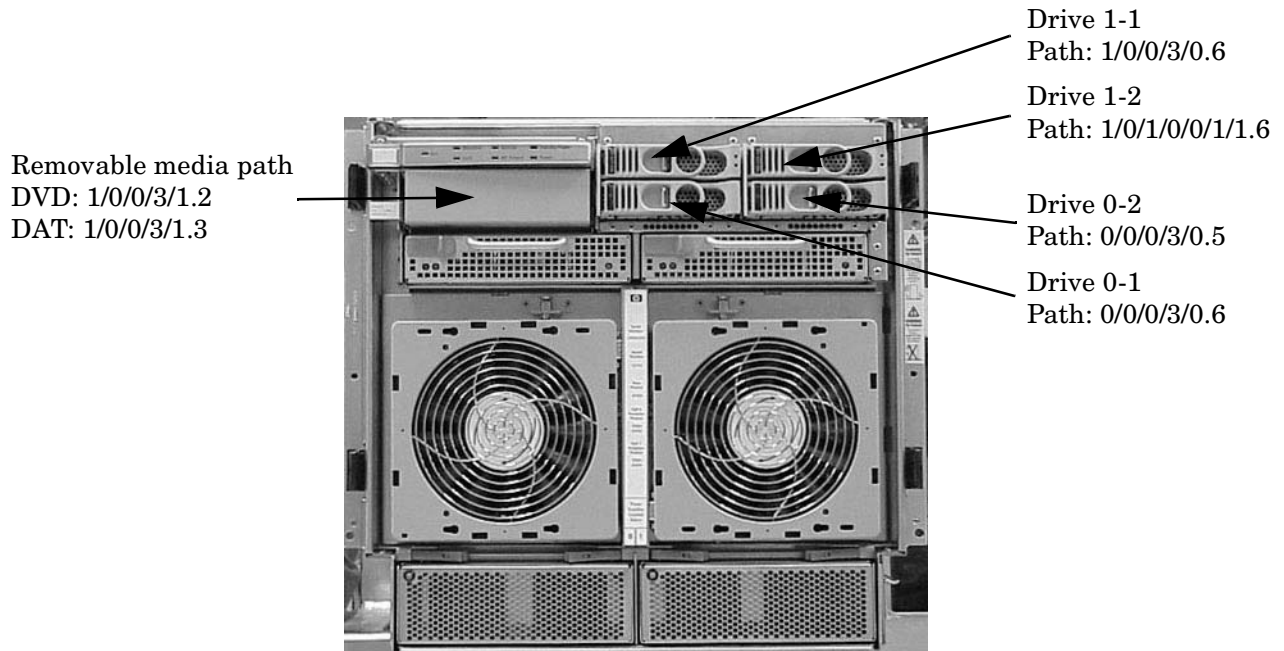
Drive 1-1
Path: 1/0/0/3/0.6

Drive 1-2
Path: 1/0/1/0/0/1/1.6

Removable media path
DVD: 1/0/0/3/1.2
DAT: 1/0/0/3/1.3

Drive 0-2
Path: 0/0/0/3/0.5

Drive 0-1
Path: 0/0/0/3/0.6

System Backplane

The system backplane comprises the system clock generation logic, the system reset generation logic, DC-to-DC converters, power monitor logic, and two LBA link-to-PCI converter ASICs. It also includes connectors for attaching the cell boards, PCI backplane, MP Core I/O MP/SCSI boards, SCSI cables, bulk power, chassis fans, front panel display, intrusion switches, and the system scan card.

Figure 1-8   System Backplane Block Diagram
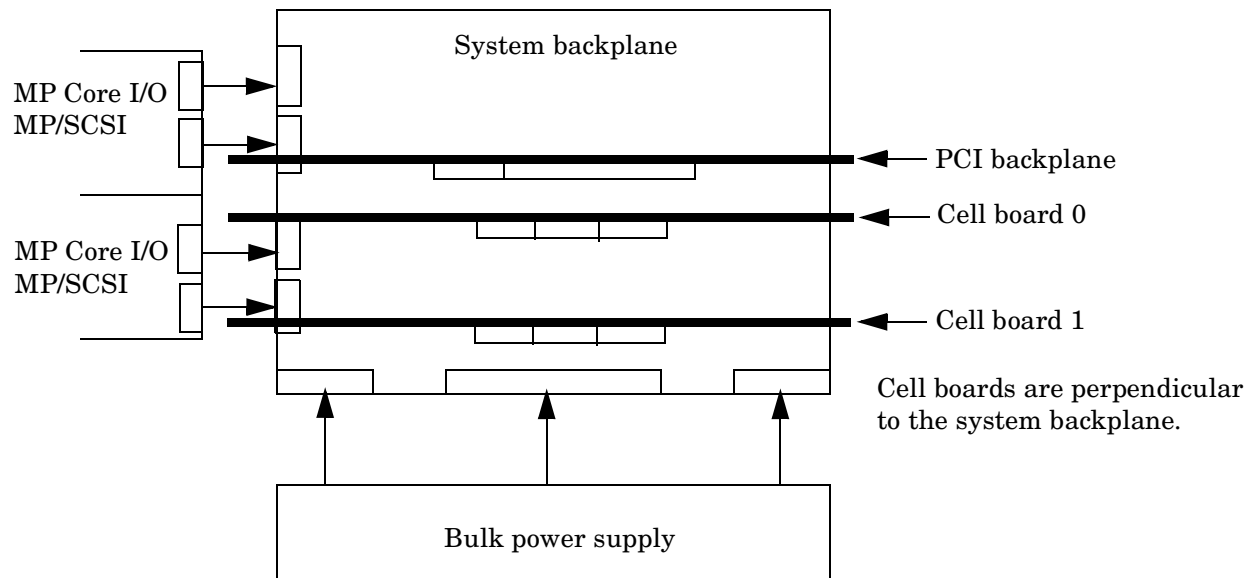
Only half of the MP Core I/O board set connects to the system backplane. The MP/SCSI boards plug into the backplane, while the LAN/SCSI boards plug into the PCI backplane.

Clocks and Reset

The system backplane contains reset and clock circuitry that propagates through the whole system. The central clocks drive all major chip set clocks. Therefore, these circuits represent a system wide single point of failure.

I/O Subsystem

The cell board-to-I/O path runs from the CC to the SBA, from the SBA to the ropes, from the ropes to the LBA, and from the LBA to the PCI buses. The CC on each cell board communicates with one SBA over the SBA link. The SBA link consists of both an inbound and an outbound link with an effective bandwidth of approximately 1 GB/sec. The SBA converts the SBA link protocol into "ropes." The SBA can support up to 16 of these high-speed bi-directional rope links for a total aggregate bandwidth of approximately 4 GB/sec. The LBA acts as a bus bridge, supporting either one or two ropes and capable of driving either PCI-2x Turbo (33 MHz x 64 bits) or PCI-4 Twin Turbo (66 MHz x 64 bits) respectively

.

Figure 1-9   I/O Subsystem Architecture
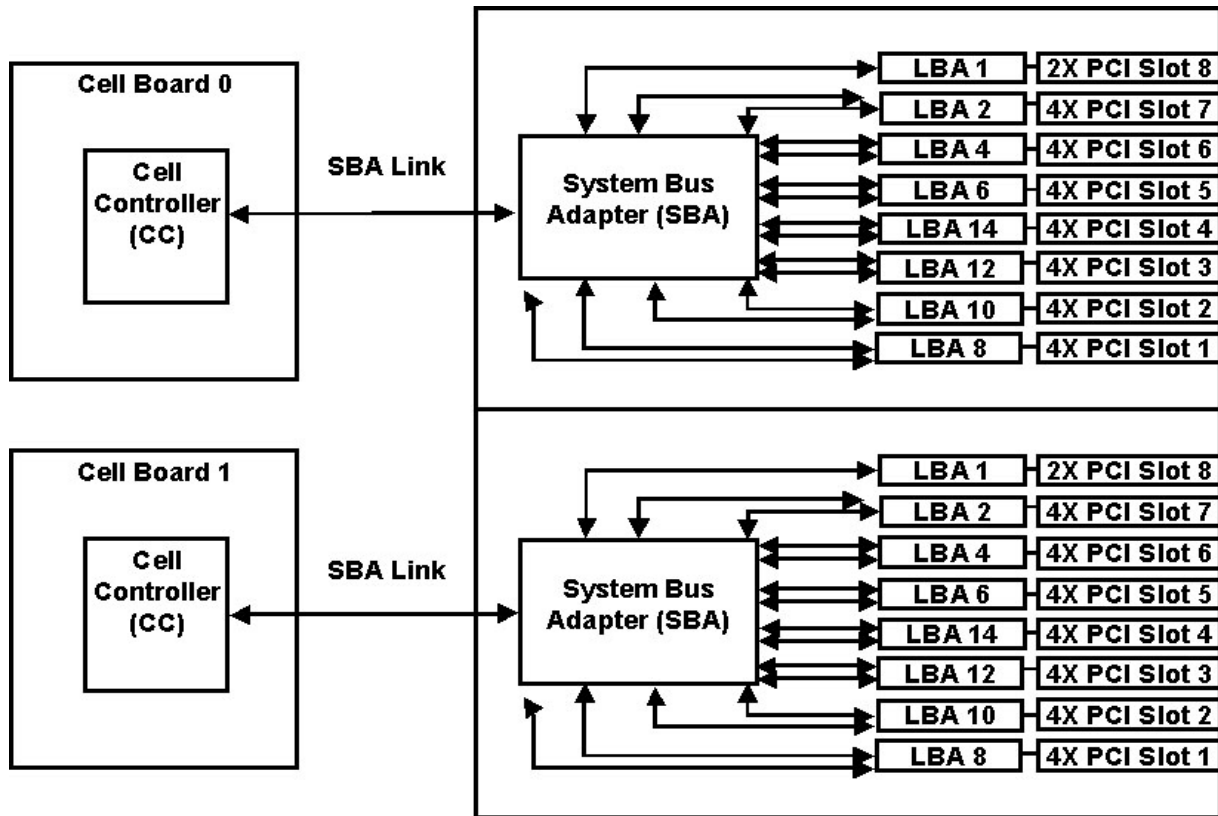
The server supports two internal SBAs. The SBAs generate 32 rope busses (16 per SBA). The 32 available internal rope busses are divided in the following manner:

- Two ropes are routed as single rope bundles to support PCI-2x Turbo (264 MB/sec. bandwidth, 64-bit transfers at 33 MHz) for the MP Core I/O boards for SCSI/LAN.

- Two ropes are routed as single rope bundles to two LBAs to support two slots operating at PCI-2x for MP/SCSI.

- The remaining 28 ropes are bundled in two rope pairs to 14 LBAs to support 14 slots operating at PCI-4x (528 MB/sec., 64-bit transfers at 66 MHz).

The hp rp7405/rp7410 uses Hewlett-Packard's proprietary adaptive signaling concept, also known as the Universal PCI slot concept (not to be confused with the Universal PCI card). Circuitry on the backplane senses a standard connector, keyed for 5V, to determine the type of the cards inserted. The circuitry controls the voltage rail supplied to the connector for powering the card's I/O pads, VIO. The card can either be of the 5V only, or universal type. 5V only cards require VIO to be 5V, whereas universal cards operate 5V as well as 3.3V. To take advantage of the 66-MHz potential of universal cards, one must operate those cards at 3.3V. The control circuitry on the backplane, therefore, provides 5V to the slot when a 5V-only card is present, or 3.3V when a universal card is present. Firmware controls the setting of the slot's clock rate.

This concept allows maximum connectivity for mainstream 5V-only, 33 MHz, 32 bit (PCI-1x) and 64-bit (PCI-2x) cards, as well as full I/O bandwidth utilization through the use of 64-bit, 66 MHz (PCI-4x) universal cards.

Table 1-4   PCI Slot Types

Slot#	Device:
0_1	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
0_2	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
0_3	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
0_4	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
0_5	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
0_6	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
0_7	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
0_8	PCI-2x, Turbo 64-bit, 33 MHz, Adaptive Signaling, 5V connector, Hot Swap Slot.
1_1	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
1_2	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
1_3	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
1_4	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
1_5	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
1_6	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
1_7	PCI-4x, Twin Turbo 64-bit, 66 MHz, 3.3V-only, 3.3V connector, Hot Swap Slot.
1_8	PCI-2x, Turbo 64-bit, 33 MHz, Adaptive Signaling, 5V connector, Hot Swap Slot.

MP/SCSI MP Core I/O Board

The hp rp7405/rp7410 accommodates two sets of MP Core I/O functionality. Each MP Core I/O board set consists of a MP/SCSI board and a Procurium LAN/SCSI board. At least one MP/SCSI board is required (independent of partitions) An additional MP/SCSI board can be added as well (and is required in a dual partition system). Both MP/SCSI boards are oriented vertically and plug into the system backplane. The MP/SCSI board incorporates a dual Ultra160 SCSI controller and is hot pluggable.

Procurium LAN/SCSI Board

At least one Procurium LAN/SCSI board is required for the minimum system configuration; two are required in a dual partition system. The Procurium board is a standard PCI form factor card with PCI card edge connectors. The PCI backplane has one slot location reserved for the required Procurium board and another that can accommodate either a Procurium board or any other supported add-in PCI card. The Procurium board is hot pluggable.

Mass Storage (Disk) Backplane

Internal mass storage connections (to disks) are routed on the mass storage backplane, having connectors and termination logic. All disks are hot pluggable. The hp rp7405/rp7410 accommodates one internal removable media device. Therefore, only one power connector for a removable media device is required on the mass storage backplane. The mass storage backplane incorporates a circuit that allows power to the internal removable media device to be programmatically cycled.

Package Description

Dimensions

The dimensions of the hp rp7405/rp7410 are as follows:

- Width: 44.45 cm (17.5 inches), constrained by EIA standard 19 inch racks.

- Depth: Defined by cable management constraints to fit into standard 36 inch deep racks (Rittal/Compaq, Rosebowl I):

  25.5 inches from front rack column to PCI connector surface:

  26.7 inches from front rack column to MP Core I/O connector surface

  30 inches overall package dimension, including 2.7 inches protruding in front of the front rack columns.

- Height: 10U – 5.4 cm = 43.91 cm (17.287 inches). This is the appropriate height for a product that consumes 10U of rack height while allowing adequate clearance between products directly above and below this product. Fitting four server units per 2 m rack and upgrade of current 10U height products in the future are the main height constraints.

System Chassis

The mass storage section located in the front allows access to removable mass storage devices without removal of the bezel (not shown.) This is especially helpful when the system is mounted in the lowest position in a rack. The mass storage bay accommodates one 5.25-inch removable media device and up to four 3.5-inch hard drives. The front panel display board, containing LEDs and the system power switch, is located directly above the 5.25-inch removable media bay.

Below the mass storage section and behind a removable bezel are two PCI DC-to-DC power converters.

The bulk power supply section is partitioned by a sealed metallic enclosure located in the bottom of the package. This enclosure houses the 2N fully redundant BPSs.

Figure 1-10   Right-Front View of hp rp7405/rp7410
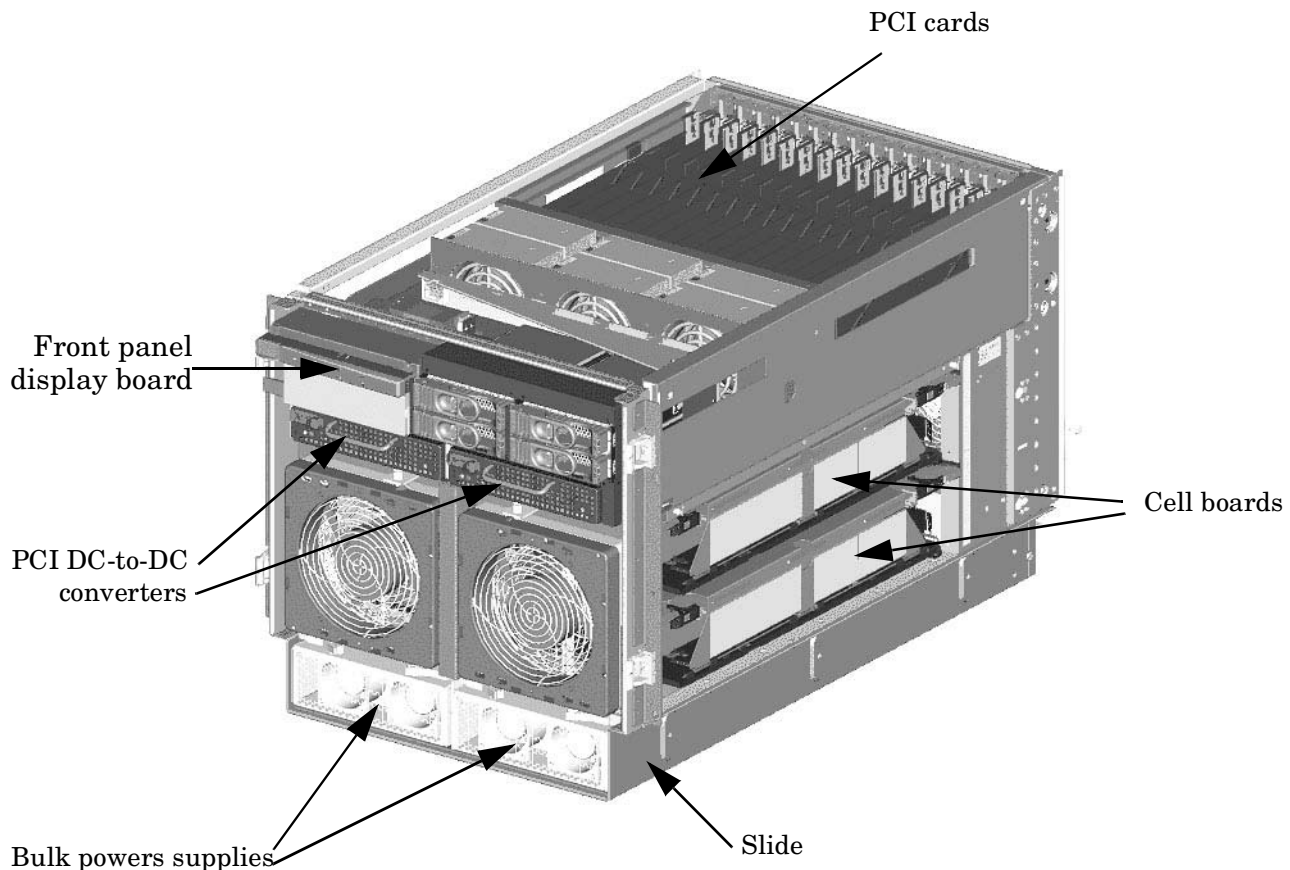
The PCI I/O card section, located towards the rear, is accessed by removing the top cover.

The PCI OLR fan modules are located in front of the PCI cards. These six 9.2 cm fans are housed in plastic carriers. They are configured in two rows of three fans.

The MP/SCSI MP Core I/O boards are positioned vertically at the rear of the chassis.

The PCI card bulkhead connectors are located in the top rear portion of the product volume.

Four OLR system fan modules, externally attached to the chassis, are 15 cm (6.5-inch) fans. Two fans are mounted on the front surface of the chassis and two are mounted on the rear surface.

Redundant line cords attach to the floating AC connector module at the bottom rear. Two 20-amp cords are required to power the server. Two additional line cords provide redundancy.

A cable harness that connects from the rear of the BPSs to the system backplane provides DC power distribution.

Access the system backplane is accomplished by removing the left side cover. The system backplane inserts by a guide/insertion mechanism using a single large jack screw assembly.

SCSI ribbon-cable assemblies route from the mass storage area to the backside of the system backplane and to the Procurium PCI MP Core I/O card.

Chapter 1   **15**

Cell boards are accessed from the right side of the chassis behind a removable side cover.

Figure 1-11   Left-Rear View of hp rp7405/rp7410

System backplane

MP Core I/O MP/SCSIs
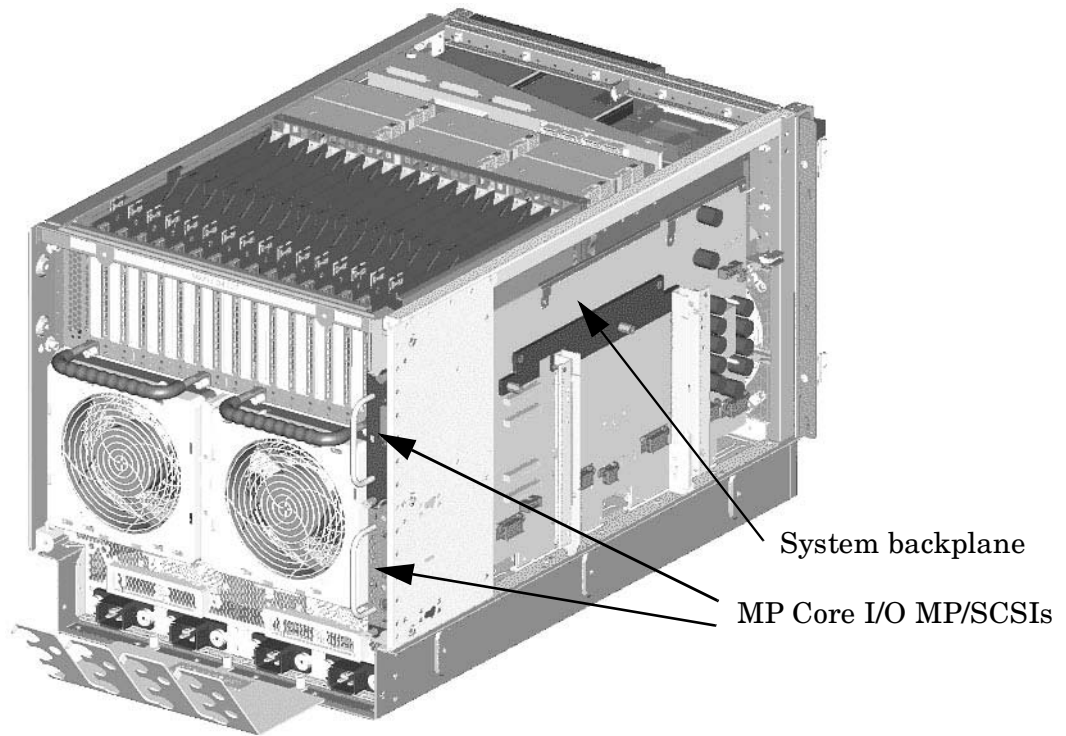
2   Installation

Unpacking the Server

Hewlett-Packard shipping containers are designed to protect their contents under normal shipping conditions. After the equipment arrives, carefully inspect each carton for signs of shipping damage. A tilt indicator is installed on each carton shipped. The beads in the indicator will roll to the upper position if the container has been tilted to an angle that could cause equipment damage. The tilt indicator itself will have two windows and each window under normal conditions will show four beads present. If a carton has been mishandled, accidentally dropped, or knocked against something, the tilt indicator will indicate missing beads. If damage is found, document the damage with photographs and contact the transport carrier immediately.

Examine the server cabinet for visible shipping damage. After unpacking the cabinet, check for damage that may have been obscured by the shipping container. If damage is found after visual inspection, document the damage with photographs and contact the transport carrier immediately.

If the equipment has any damage, a damage claim form must be obtained by the customer from the shipping representative. The customer should complete the form and return it to the shipping representative.

NOTE	The server may come already racked, or ready for rack installation.

Unpacking a Racked Server

This section contains information pertaining to unpacking the cabinet.

WARNING	**Wear protective glasses while cutting the plastic bands around the shipping container. These bands are under tension. When cut, they can spring back and cause serious eye injury.**

NOTE	Position the pallet allowing for enough space to roll the cabinet off the pallet before starting.

Remove the cabinet using the following procedure:

Step 1. Cut the polystrap bands around the shipping container.

Step 2. Lift the cardboard top cap from the shipping box. See Figure 2-1.

Step 3. Remove the corrugated wrap from the pallet.

Step 4. Remove the packing materials.

CAUTION	The plastic wrapping material should be cut off rather than pulled off. Pulling the plastic covering off represents an ESD hazard.

Figure 2-1 Removing the Polystraps and Cardboard
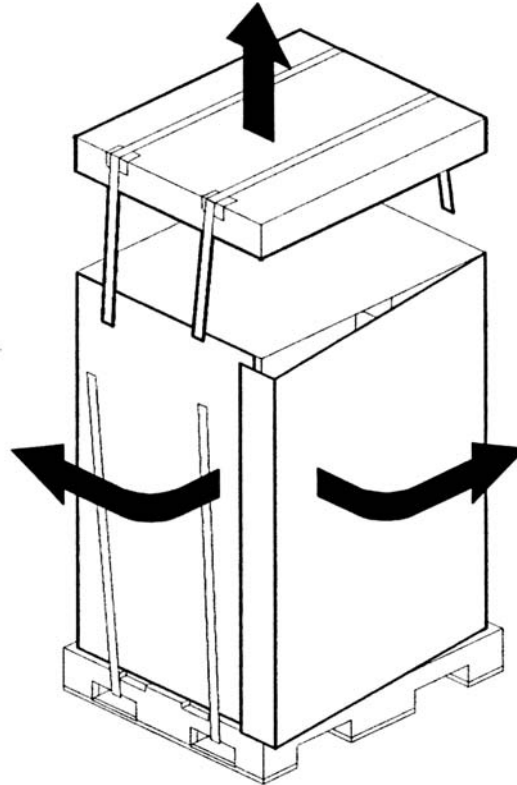
Step 5. Remove four bolts holding down the ramps and remove the ramps. See Figure 2-2.

Figure 2-2 Removing the Shipping Bolts and Plastic Cover
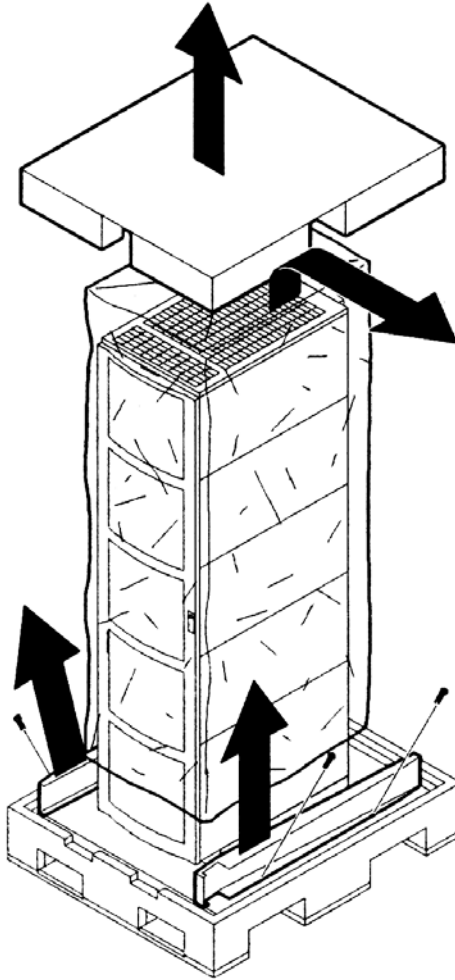
Step 6. Remove the six bolts from the base attaching the rack to the pallet. See Figure 2-3.

Figure 2-3 Preparing to Roll Off the Pallet
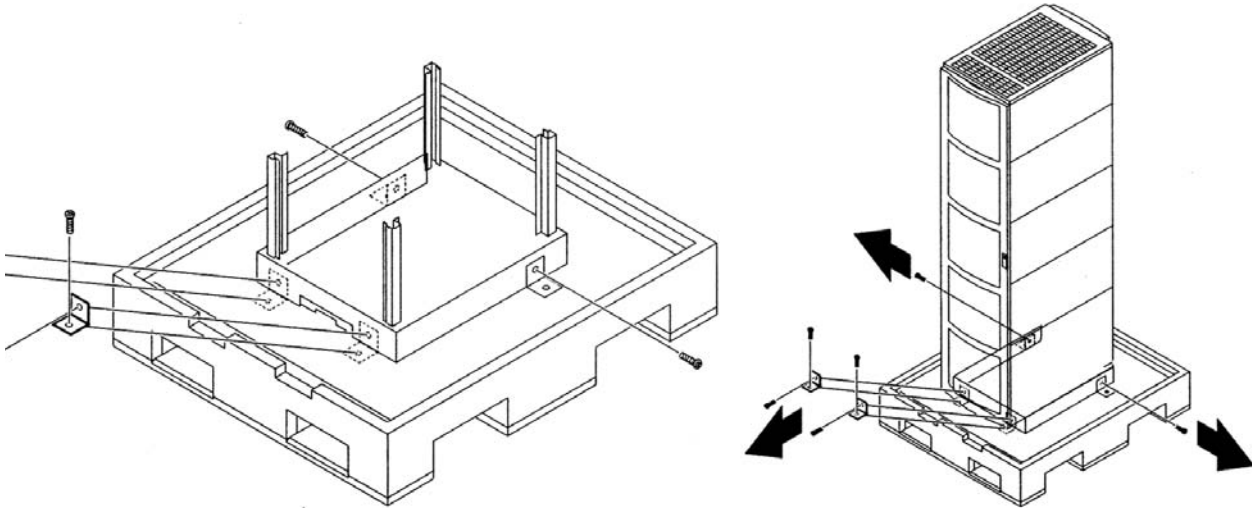
WARNING	Make sure that the leveling feet on the rack are raised before you roll the rack down the ramp and any time you roll the rack on the casters. Use caution when rolling the cabinet off the ramp. A single server in the cabinet weighs approximately 400 pounds. It is strongly recommended that two people roll the cabinet off the pallet.

Securing the Cabinet

Once in position, secure and stabilize the cabinet using the leveling feet at the corners of the base and install the anti-tip mechanisms on the bottom front and rear of the rack.

Figure 2-4   Securing the Cabinet
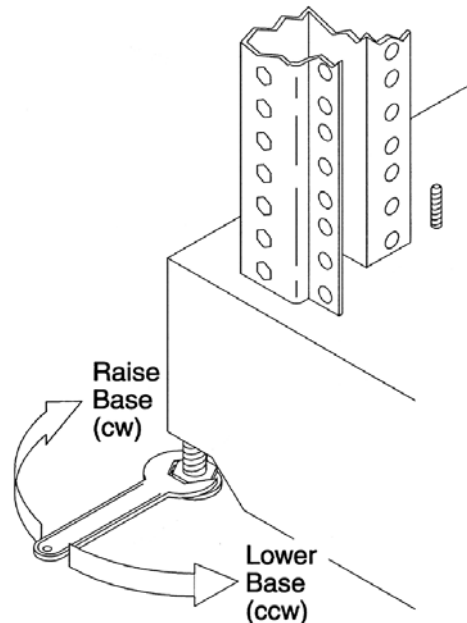
Unpacking a Non-Racked Server

NOTE	Hewlett-Packard recommends the use of a lifter, such as a RONI Company model 17000 SP 400 lifting device, when moving a non-racked system, shown in Figure 2-5. If no lifter is available, install the lift handle panels provided with the system.

Unloading with a Lifter

Use the following procedure to unload the server from the pallet using a lifter.

WARNING	**Use caution when using a lifter. Because of the weight of the server, it must be centered on the lifter forks before raising it off the pallet to avoid injury.**
	Never extend more than one server from the same cabinet while installing or servicing either an hp rp7405/rp7410 or another server product. Failure to follow these instructions could result in the cabinet tipping over.

Figure 2-5   RONI Lifter

Step   1. Follow the instructions on the outside of the server packaging to remove the banding and carton top from the server pallet.

Figure 2-6 Server with Shipping Box Removed
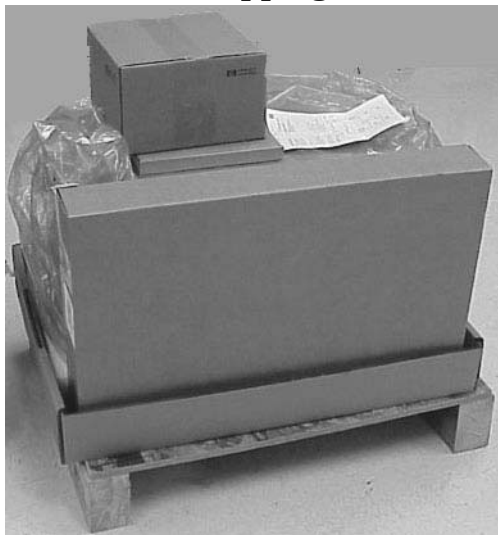
Step   2. Remove all cartons from the pallet leaving only the server.

Step **3.** Observe Figure 2-7. Remove the two foam cushion for lift access.

Figure 2-7 Remove Cushions for Lift Access

Remove cushion

Remove cushion

Clearance for RonI lift is 28"x5"
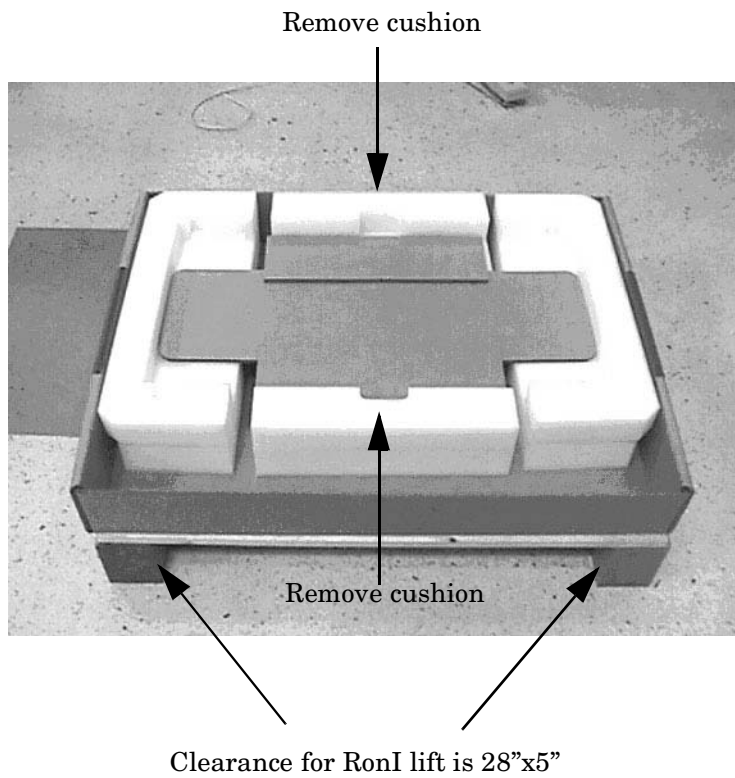
Step **4.** Insert the lifter forks under the server.

Step **5.** Carefully roll the lift forward until it is fully positioned against the side of the server.

Step 6. Slowly raise the server off the pallet until it clears the pallet cushions.

Figure 2-8 Raising a Server Off the Pallet
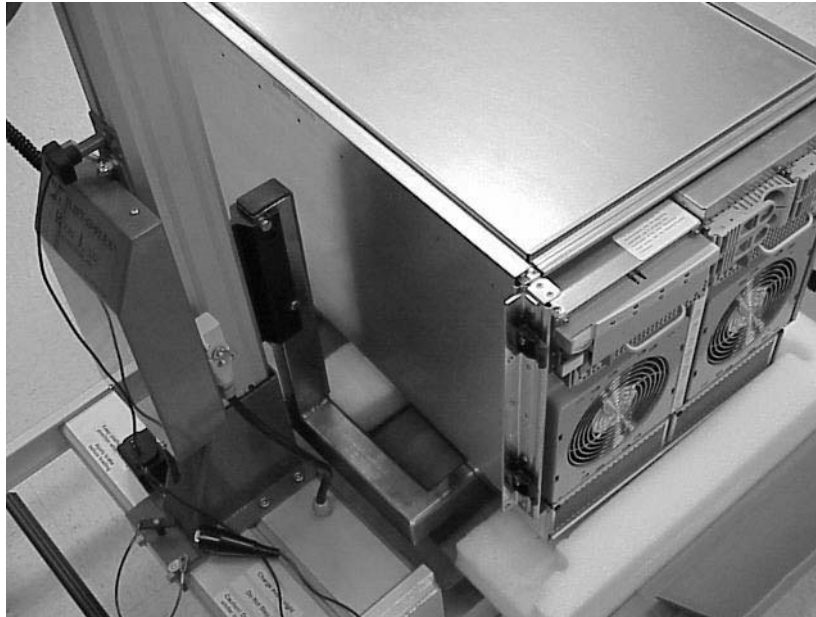
Step 7. Roll the lifter and server away from the pallet. Do not raise the server any higher than necessary when moving it over to the rack.

Figure 2-9 Lifting the Server to the Rack
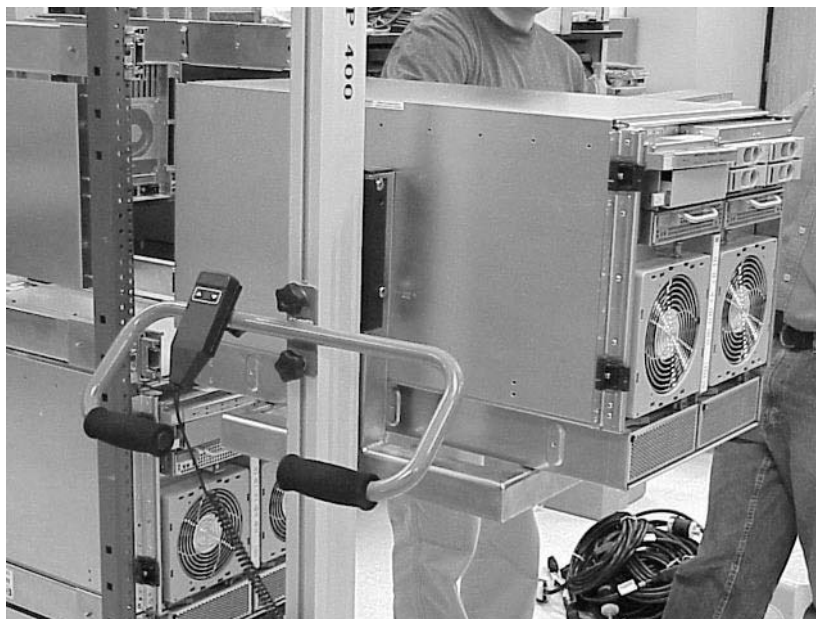
NOTE	If you are installing the system in a rack, refer to the hp J1530A Rack Integration Kit Installation Guide.

Unloading with Lift Handle Panels

WARNING	**Use this procedure only if no Hewlett-Packard approved lift is available. This procedure should only be attempted by two (2) authorized Hewlett-Packard service people.**
	Before attempting this procedure, it is recommended that you first remove all Cell Boards and AC power supplies. Instructions for removing these components can be found in the Removal and Replacement chapter of the service manual. Check with local safety regulations before attempting to move the system using the lift handle panels.
	Failure to observe these precautions can cause serious injury to personnel or damage to equipment.

CAUTION	Unpack the server in an ESD safe environment. Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Step 1. Remove both side covers. If present, remove the front panel.

Step 2. Locate lift handles and remove from storage plate.

Step 3. Orient lift handle panels such that when installed, the handles hang downward at 90 degrees and lock in a horizontal position during lifting.

Figure 2-10 Positioning the Lift handles

Step 4. With one handle in each hand, install the pin end of the panel into the backside of the front rack mount ears on the chassis.

Figure 2-11 Inserting the Pins Into the Rack
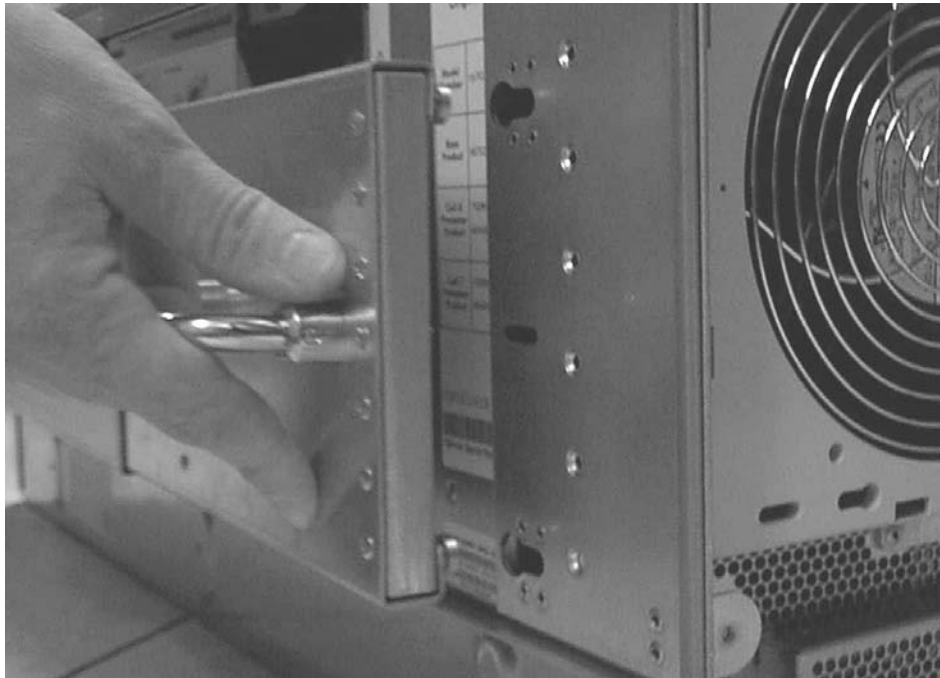
Step 5. Pull the spring plunger out, move the handles apart and install the shoulder washer end of the panel into the keyway feature.

Figure 2-12 Lift Handles Mounted

Step 6. Continue to pull the handles apart until the spring plunger snaps into final position. The spring plunger will drop down into the recess position.

Step 7. Check that the handles are secure by pressing the handles together and moving back and forth. Check to see if lift handle panel breaks free of chassis.

Step 8. Repeat the steps above for the other handle

Step 9. To lift the server, rotate the handles 90 degrees to horizontal position.

NOTE   If you are installing the system in a rack, refer to the *installation guide, hp J1530A, rack installation kit* (lower case intended).

Step 10. After moving the server, remove the lift handle panels from the chassis and reinstall the server covers and front bezel. Refer to *installation guide, hp J1530A, rack installation kit* (lower case intended).

Figure 2-13 Lifting the Server
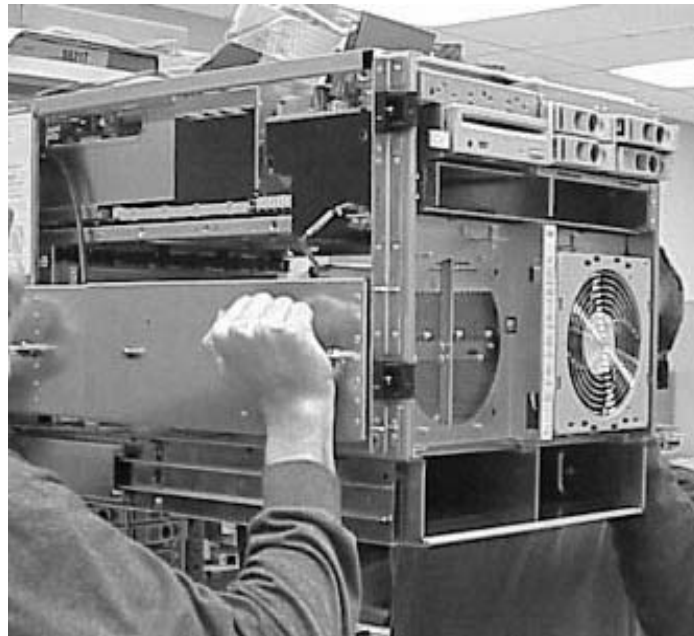
Installing Server Into the Rack

Any hp rp7405/rp7410 server that is to be installed into a rack is shipped with equipment slides. With every set of slides comes an installation guide: *installation guide, hp J1530A, rack installation kit* (lower case intended). Follow the steps in this installation guide to determine where and how to place the server into the rack.

Installing the Cable Management Arm (CMA)

Once the server is installed in the rack, the CMA must be installed on the rear of the server. Follow the instructions for installing the CMA can be found in the *installation guide, hp J1530A, rack installation kit* (lower case intended).

Figure 2-14   Cable Management Arm

Cable Management Arm
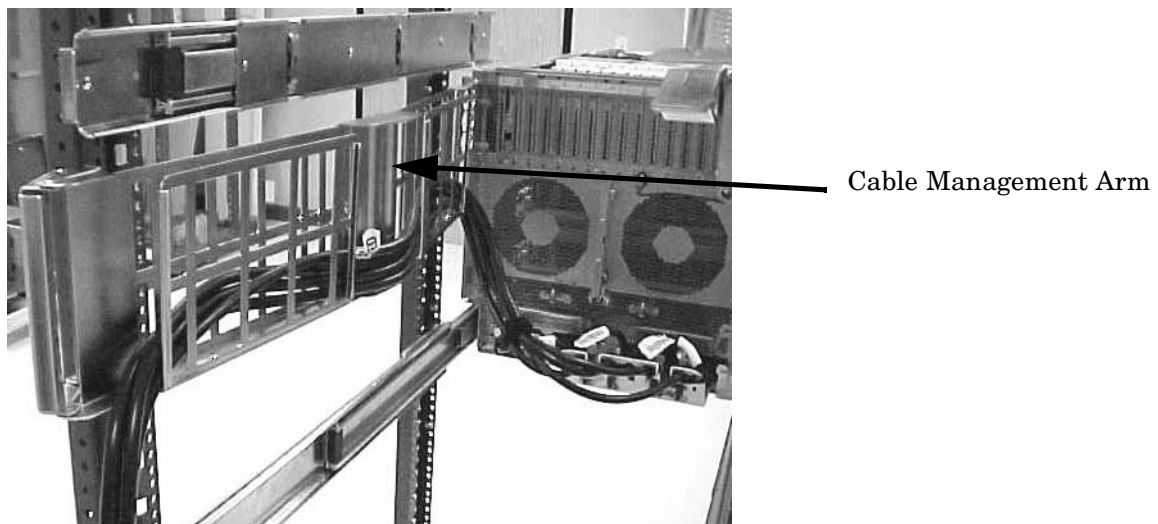
Step   1. Attach CMA to the rack using T-25 Torx screws.

Figure 2-15 Attaching CMA to Rack
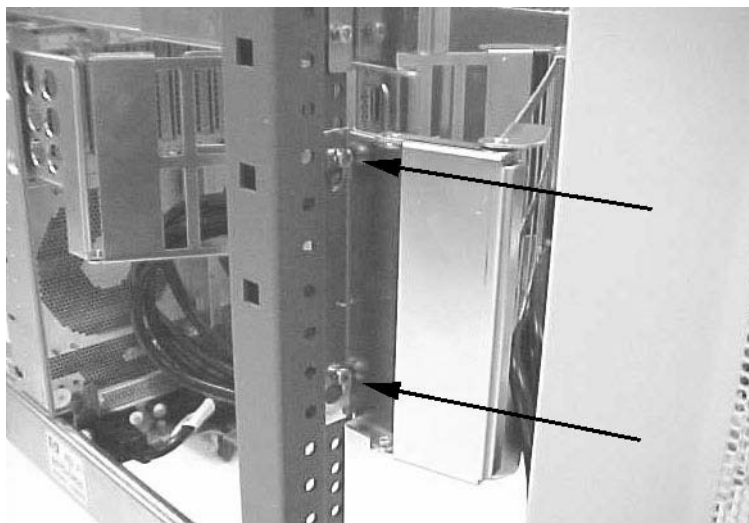
Step 2. Attach the other end of the CMA to the server using the thumb screws that came with the CMA.

Figure 2-16 Attaching CMA to the Server
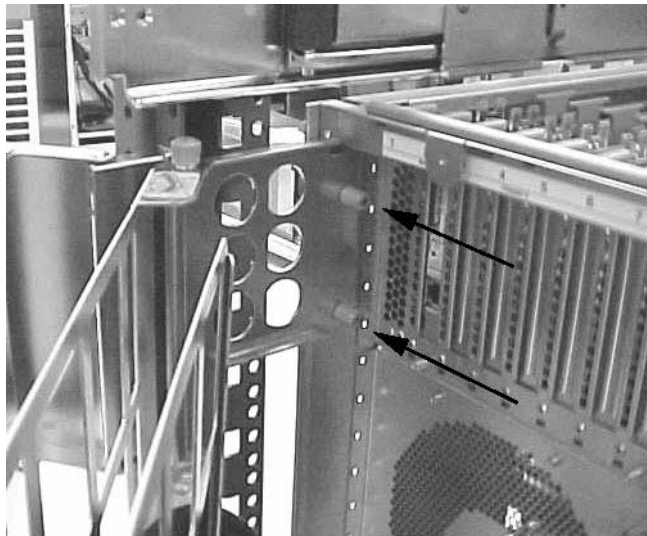
Installing Add-On Products

This section explains load orders and dependencies for add-on products. For physical installation procedures, refer to that components replacement procedure in Chapter 4, "Removal and Replacement."

If installing add-on products to an existing server, follow operating system backup and shutdown procedures before powering off the server.

Cell Boards

The server requires at least one cell board to operate. Install the first cell board slot 1 (lower slot) and the second cell board in slot 0 (upper). Cell Board 0 enables the PCI cards in Chassis 0 and Cell Board 1 enables the PCI cards in Chassis 1.

MP Core I/O Cards

MP Core I/O consists of two cards that must be installed in pairs: the MP/SCSI and the LAN/SCSI.

The first (primary) set of MP Core I/O cards is installed as follows: MP/SCSI in MP/SCSI slot 1 (lower slot) and LAN/SCSI in PCI slot 8 of Chassis 1 (from the rear, the extreme right-hand PCI slot).

The second set of MP Core I/O cards is installed as follows: MP/SCSI in MP/SCSI slot 0 and LAN/SCSI in PCI slot 1 of Chassis 0. Cell Board 0 is required to enable the MP/SCSI slot 0 (upper slot) and LAN/SCSI slot 1 in Chassis 0 (from the rear, the extreme left-hand PCI slot).

Embedded Disks

The hp rp7405/rp7410 server can operate in the diskless (LAN boot) mode. If disks are to be installed, the top two disks are driven by the primary MP Core I/O set. Install the first embedded disk in the top left location. Install the second embedded disk in the top right location.

Figure 2-17   Embedded Disks

Drive 1-1
Path: 1/0/0/3/0.6

Drive 1-2
Path: 1/0/1/0/0/1/1.6

Drive 0-2
Path: 0/0/0/3/0.5

Drive 0-1
Path: 0/0/0/3/0.6
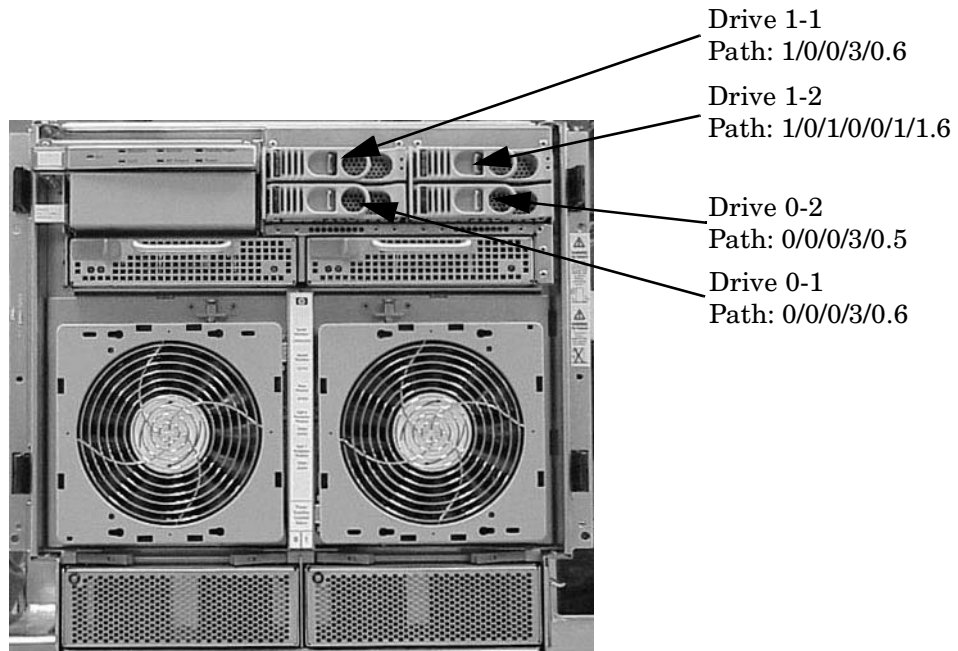
Processors

Each cell board can hold up to four processors. Processor slots are numbered 0-3. Install processors in ascending order: slot 0, 1, 2, and 3. It is not necessary to balance the number of processors across both cell boards.

Figure 2-18   Cell Board (Two processors and CC Shown)
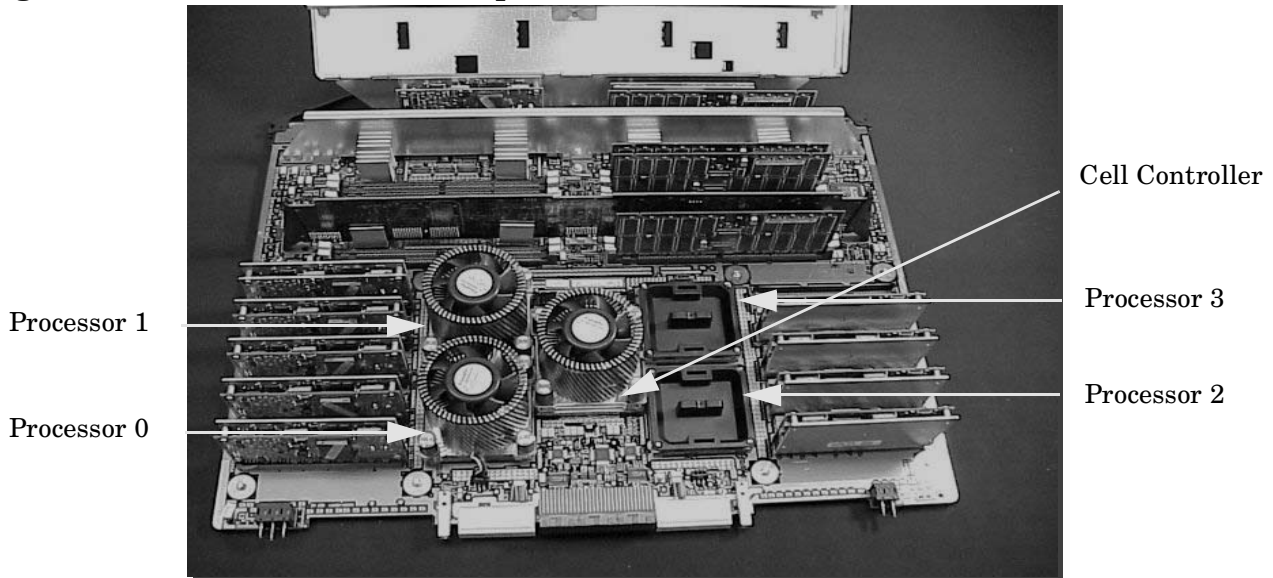
DIMMs

Each cell board can hold up to four quads (or ranks) of DIMMs. A rank is a group of four DIMMs. Each DIMM within a rank must be the same capacity. The slots within each rank are numbered a,b,c,d. Install DIMMs in ascending order: rack 0, 1, 2 and 3. It is not necessary to balance the number of DIMMs across both cell boards. For Example: one rank = slots 0a, 0b, 0c and 0d.

Valid Memory Configurations DIMMs must be loaded in sets of four at specific locations. For best performance, loading sets of 8 DIMMs is recommended.

Table 2-1   hp rp7405/rp7410 DIMMs

DIMM Capacity	Total Capacity	Memory Component Density
512 Mbyte	16 GBytes	128 Mbit
1G Byte	32 Gbytes	256 Mbit

The hp rp7405/rp7410 is capable of supporting as little as 2 Gbytes of main memory using four 512 MByte DIMMs and one cell board and as much as 32 Gbytes using all 16 DIMM slots on both cell boards with 1GB DIMMs.

Different densities of main DIMMs can be mixed within a system, but each set of four DIMMs must be identical. A set of DIMMs is defined as the group of four DIMMs that must be loaded together on a cell board. Each cell board has four sets of DIMM slots, and they must be populated in order. Figure 2-19 shows the order in which the DIMM slots must be populated.

Figure 2-19   DIMM Loading Sequence
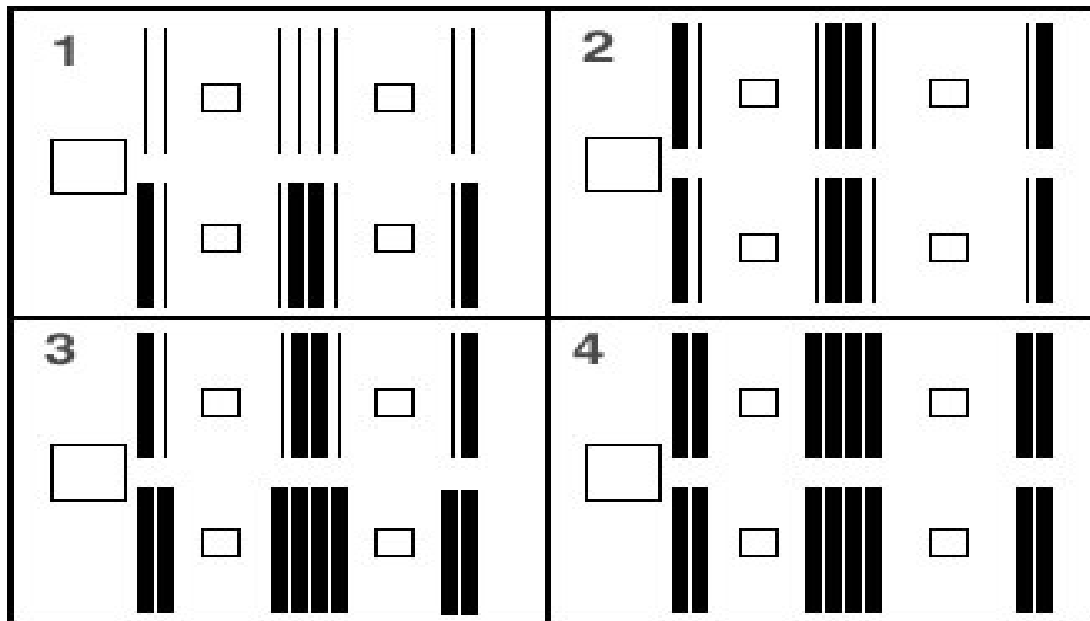
Block 1 shows the minimum memory configuration per cell board. Each cell board, therefore, could have up to four different density DIMMs (if there were that many), as long as each set of four are identical. Box 2 and Box 4 show the more optimal memory configurations, because loading DIMMs in sets of eight takes advantage of the pipelined structure of the memory interface of the CC.

Connecting AC Input Power

The hp rp7405/rp7410 has five line cord configurations:

- All four line cords

- Cords A0 and A1 only

- Cords B0 and B1 only

- Cords A0 and B0 only

- Cords A1 and B1 only

A single-line-cord configuration is not allowed.

Figure 2-20   Power Cord Configuration
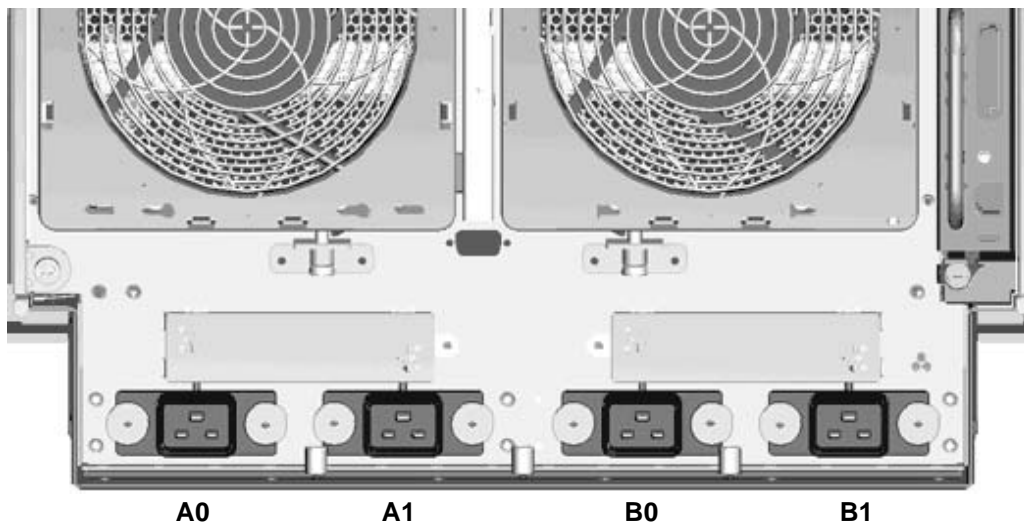
The power cord configuration is passed to the operating system using the `pwrgrd` (Power Grid) command. Each of the five selections in the `pwrgrd` command matches one of the configurations. The appropriate option should be selected for the actual line cord configuration. With the correct configuration selected, the LEDs should be green. when the pwrgrd command is invoked, the following menu is displayed.

IMPORTANT   Options 1 and 2 are for Hewlett-Packard internal use only. Do not select these options.

```
prompt> pwrgrd
Power grid configuration preference.
1. Grid A only (Cords A0,A1 required)
2. Grid B only (Cords B0,B1 required)
3. Grids A & B (Cords A0,A1,B0,B1 required)
4. Cords A0 & B0 only
5. Cords A1 & B1 only
Select Option:
```

If two separate power sources are available, the two power supplies can be plugged into the separate power sources, increasing system reliability should one power source fail.

Figure 2-21   Power Source vs. Power Distribution

Rear of Cabinet
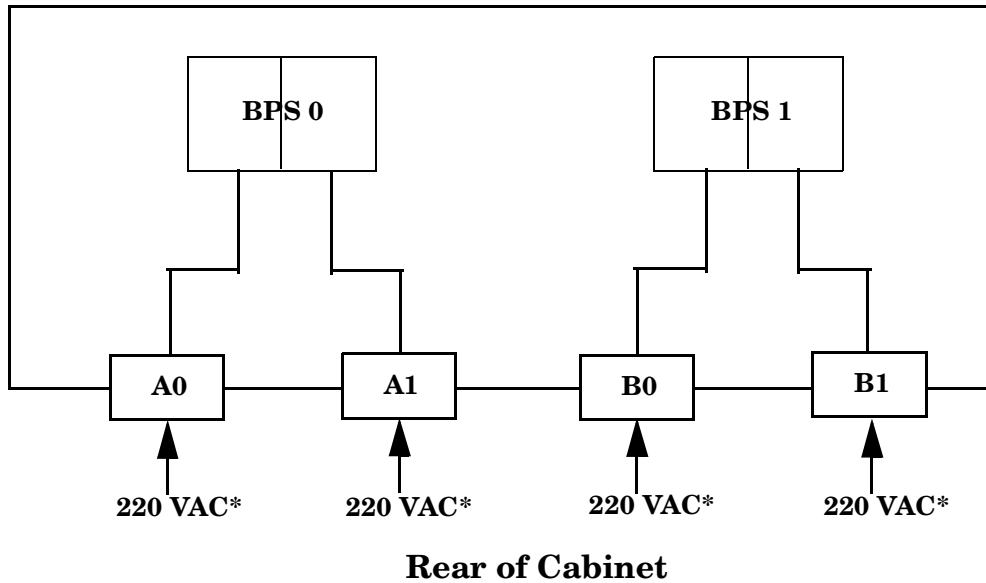
*180-269 VAC

WARNING	**Voltage is present at various locations within the server whenever a power source is connected. This voltage is present even when the main power switch is in the off position. Failure to observe this warning could result in personal injury or damage to equipment.**

NOTE	System firmware will prevent boot when a single power cord configuration is detected.

MP Core I/O Connections

Each hp rp7405/rp7410 can have up to two MP Core I/O board sets installed. This allows for two partitions to be operating, or allows for MP Core I/O redundancy in a single partition configuration. Each MP Core I/O board set consists of two boards: the MP/SCSI board and the LAN/SCSI board. The MP/SCSI board is oriented vertically and accessed from the back of the server. The LAN/SCSI is accessed from the PCI expansion card bay. Only the primary MP core I/O board set (MP/SCSI slot 1 & LAN/SCSI slot 8, Chassis 1) is required for a single partition implementation. The secondary MP/SCSI board is not necessary for full operation, however, without the secondary MP/SCSI board only two internal disks can be accessed.

MP/SCSI Connections

The MP/SCSI board is required to update firmware, access the console, turn partition power on/off, access all but one of the internal peripherals, and utilize other features of the system.

Connections to the MP/SCSI board include the following:

- DB25 Connector; via the M cable.

  This RS232 connector provides connections for a local console, external modem, and a UPS. The server end of the M cable terminates in a DB25 connector. The opposite side of the cable terminates in 3 DB9 connectors labeled CONSOLE, UPS, and REMOTE.

- 10/100 Base-T LAN RJ45 connector (for LAN and Web Console access).

  This LAN uses standby power and is active when AC is present and the front panel power switch is off.

- Internal LVD Ultra 160 SCSI channel for connections to internal mass storage.

- Internal SE Ultra SCSI channel for connection to internal removable media device.

LAN/SCSI Connections

The LAN/SCSI board is a PCI form factor card that provides the basic external I/O connectivity for the system.

Connections to the LAN/SCSI board include the following:

- PCI-X to PCI-X Bridge for multi-device compatibility

- Internal LVD Ultra 160 SCSI channel for connections to internal mass storage.

- External LVD Ultra 160 SCSI channel connected to a 68-pin VHDCI connector

- 10/100/1000 Base-T LAN RJ45 connector.

The primary LAN interface is located on the LAN/SCSI board installed in the rightmost slot when viewing the system from the back.

Management Processor Access

NOTE   In order to access the Management Processor for the initial installation, the M cable must first be connected to the DB25 connector located on the Primary MP/SCSI board. The Primary MP/SCSI board is located in the lower MP/SCSI board slot.

Setting Up the CE Tool (PC)

The CE Tool is usually a laptop. It allows communication with the Management Processor (MP) in the hp rp7405/rp7410. The MP monitors the activity of either a one partition or a multiple partition configuration.

During installation, communicating with the MP enables such tasks as:

* Verifying that the components are present and installed correctly

* Setting LAN IP addresses

* Shutting down cell board power

Communication with the MP is established by connecting the CE Tool to the Local RS-232 port on the MP Core I/O card.

Setting CE Tool Parameters

After powering on the CE Tool, ensure the communications settings are as follows:

* 8/none (parity)

* 9600 baud

* na (Receive)

* na (Transmit)

If the CE Tool is a laptop using Reflection 1, check or change these communications settings using the following procedure:

1. From the Reflection 1 Main screen, pull down the **Connection** menu and select **Connection Setup**.

2. Select **Serial Port**.

3. Select **Com1**.

4. Check the settings and change, if required.

   Go to **More Settings** to set Xon/Xoff. Click **OK** to close the More Settings window.

5. Click **OK** to close the Connection Setup window.

6. Pull down the **Setup** menu and select **Terminal** (under the **Emulation** tab).

7. Select any HP terminal type.

   Preferred types are **HP70092, HP70096** or **HP70094, HP70098, VT100**.

8. Click **Apply**.

   This option is not highlighted if the terminal type you want is already selected.

9. Click **OK**.

Connecting the CE Tool to the Local RS-232 Port on the MP

This connection allows direct communications with the MP. **Only one window can be created** on the CE Tool to monitor the MP. When enabled, it provides direct access to the MP and any partition.

Use the following procedure to connect the CE Tool to the Local RS-232 Port on the MP:

1. Connect one end of a null modem cable (9-pin to 9-pin) (Part Number 5182-4794) to the M cable connector labeled CONSOLE.

2. Connect the other end of the RS-232 cable to the CE Tool.

Standby Power and Logging in to the MP

After connecting the serial device, it is possible to login to the Management Processor (MP). Housekeeping power (also known as standby power) is generated as soon as AC power is applied to the server. Because the MP uses standby power, it is possible to login to the MP even when the power switch is in the OFF position. The power switch is a DC power switch that controls +48v DC.

Before powering up the hp rp7405/rp7410 server for the first time:

1. Verify that the AC voltage at the input source is within specifications for each hp rp7405/rp7410 being installed.

2. If not already done so, power on the serial display device.

   The preferred tool is the CE tool running Reflection 1.

To power up the MP, set up a communications link, and login to the MP:

1. Connect the server to AC power.

On the front of the hp rp7405/rp7410, a solid green **Standby Power**, a solid green **MP Present**, and a flashing amber **Attention** light will illuminate after about 30 seconds.

Figure 2-22   Front Panel Display
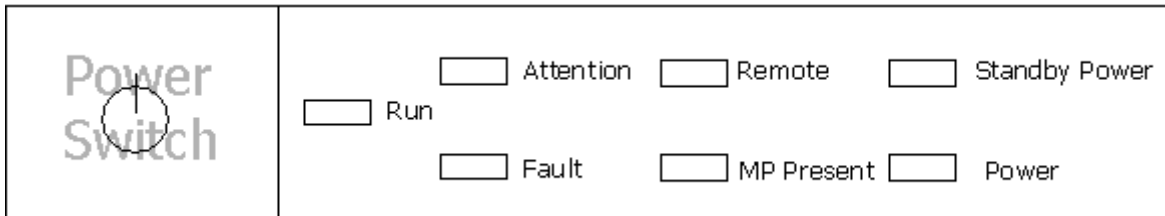
2. Check the bulk power supply LED for each BPS.

When on, the breakers distribute power to the BPSs. AC power is present at the BPSs:

- When power is first applied. Note the BPS LEDs will be flashing amber.

- After 30 seconds has elapsed. Note the flashing amber BPS LED for each BPS becomes a flashing green LED

Refer to power cord policies to interpret LED indicators.

3. Login to the MP:

a. Enter **Admin** at the login prompt. This term is case sensitive.

It takes a few moments for the MP prompt to appear. If it does not, make sure the laptop serial device settings are correct: 8 bits, no parity, 9600 baud, and na for both Receive and Transmit. Then, try again.

b. Enter **Admin** at the password prompt. This term is case sensitive.

The MP Main Menu appears:

Figure 2-23 MP Main Menu

```
MP login: Admin
MP password:


                          Welcome to the

                             rp7410

                       Management Processor

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    MP MAIN MENU:

         CO: Consoles
        VFP: Virtual Front Panel
         CM: Command Menu
         CL: Console Logs
         SL: Show chassis Logs
         HE: Help
          X: Exit Connection

MP>
```

Configuring LAN Information for the MP

To set the MP LAN IP address:

1. At the MP Main Menu prompt (*MP>*), enter `cm.` From the MP Command Menu prompt (*MP:CM>*), enter `lc` (for LAN configuration).

   The screen displays the default values and asks if you want to modify them. It is a good idea to write down the information, as it may be required for future troubleshooting.

NOTE   If the Command Menu is not shown, enter `q` to return to the MP Main Menu, then enter `cm`

Enter `lc` and press the *Return* key. The following screen appears:

Figure 2-24   The lc Command Screen

```
MP:CM> LC

This command modifies the LAN parameters.

Current configuration of MP LAN interface
  MAC address  : 00:30:6e:05:09:24
  IP address   : 15.99.83.215   (0x0f6353d7)
  Hostname     : quartz-s
  Subnet mask  : 255.255.255.0          (0xffffff00)
  Gateway      : 15.99.83.254   (0x0f6353fe)
  Status       : UP and RUNNING
  AutoNegotiate : Enabled
  Data Rate    : 100 Mb/s
  Duplex       : Half
  Error Count  : 0
  Last Error   : none


    Do you want to modify the configuration for the customer LAN? (Y/[N]) q
MP:CM>
```

NOTE	The value in the "IP address" field has been set at the factory. The customer must provide the actual LAN IP address.

2. At the prompt, *Do you want to modify the configuration for the customer LAN?*, enter **y**.

   The current IP address is shown; then the following prompt appears: *Do you want to modify it? (Y/[N])*

3. Enter **y**.

4. Enter the new IP address.

   The customer shall provide this address for network interface 0.

5. Confirm the new address.

6. Enter the MP Network name.

   This is the host name for the customer LAN. The name can be as many as 64 characters, and include alpha numerics, - (dash), _ (under bar),. (period), or a space. It is recommended that the name be a derivative of the complex name. For example, Acme.com_MP.

7. Enter the LAN parameters for *Subnet mask* and *Gateway address*.

   This information shall come from the customer.

8. Once step 7 is completed, the system will indicate the parameters have been updated and return to the MP Command Menu prompt (*MP:CM>*)

9. To check the LAN parameters and status, enter the `ls` command at the MP Command Menu prompt (*MP:CM>*).

---

10. A screen similar to the following will appear allowing verification of the settings:

Figure 2-25   The ls Command Screen

```
MP:CM> LS

Current configuration of MP LAN interface
  MAC address   : 00:30:6e:05:09:24
  IP address    : 15.99.83.215    (0x0f6353d7)
  Hostname      : quartz-s
  Subnet mask   : 255.255.255.0           (0xffffff00)
  Gateway       : 15.99.83.254    (0x0f6353fe)
  Status        : UP and RUNNING
  AutoNegotiate : Enabled
  Data Rate     : 100 Mb/s
  Duplex        : Half
  Error Count   : 0
  Last Error    : none

MP:CM>
```

To return to the MP main menu, enter **ma**.

To exit the MP, enter **x** at the MP main menu.

Verifying Presence of the Cell Boards

To perform this activity, either connect to the management processor (MP) using a console or connect the CE Tool (laptop) to the RS-232 Local port on the MP.

After login to the MP, verify that the MP detects the presence of all the cells installed in the cabinet. It is important for the MP to detect the cell boards. If it does not, the partitions will not boot.

To determine if the MP detects the cell boards:

1. At the MP prompt, enter **cm**.

   This displays the Command Menu. Among other things, the Command Menu allows one to view or modify the configuration and/or look at utilities controlled by the MP.

   To look at a list of the commands available, enter **he**. You may have to press **Enter** to see more than one screen of commands. Use the Page Up and Page Down keys to view the previous or next screen of commands. To exit the Help Menu, enter **q**.

2. From the command prompt (MP:CM>), enter **du**.

The du command displays the MP Bus topology. A screen similar to the following appears:

Figure 2-26   The du Command Screen

```
MP:CM> DU

The following MP bus devices were found:
+---+----+-----+-------+------+-----------+
|   |    |     |       |      |           |
|   |    | Sys |       | PCI  |    BPS    |
|Cab| MP |Bkpln| Cells |Domain|           |
| # |    |     |  0 1  | 0  1 |    0 1    |
+---+----+-----+-------+------+-----------|
| 0 | *  |  *  |  * *  | *  * |    * *    |
+---+----+-----+-------+------+-----------+

MP:CM>
```

3. There will be an asterisk *(*)* in the column marked *MP*.

4. Verify that there is an asterisk (*) for each of the cells installed in the cabinet, by comparing what is in the *Cells* column with the cells physically located inside the cabinet.

   Figure 5-9 shows that cells are installed in slots 0 and 1. In the cabinet, there should be cells physically located in slots 0 and 1.

Powering On the hp rp7405/rp7410 Server

After powering on the Management Processor (MP) (+3.3 V HKP), and checking that the MP detects the presence of the cell boards, power up the server.

If using a LAN crossover cable with the laptop, review server activity for each partition configured, as it powers up and boots. Windows can be opened for the complex and for each partition. It is recommended that at least two windows be opened.

*   A window showing all activity in the complex. Following the installation procedure in this manual, will have a window open already on the laptop.

    To display activity for the complex:

    1. If not already done, open a separate Reflection 1 window and connect to the MP.

    2. From the MP Main Menu, select the VFP command with the s option.

*   A window showing activity for a single partition.

    To display activity for each partition as it powers up:

    1. Open a separate Reflection 1 window and connect to the MP.

    2. Select the VFP command and choose the partition desired to view.

       There should be no activity on the screen at this point in the installation process.

NOTE	More than one window cannot be opened using a serial display device.

To power on the server:

1. Switch the power switch at the front of the server to **On**. The following events occur:

    *   Power is applied to the server.

    *   Processor Dependent Code (PDC) starts to run on each cell.

    *   Cell self test executes.

    *   Hardware initializes for the server.

    *   Console communication is established.

2. When activity on the Reflection 1 screen stops, return to the MP Main Menu by typing `Ctrl-B`.

3. Enter `co` to enter console mode.

4. Enter the partition number of the partition to boot.

5. Press `Enter`.

Selecting a Boot Partition using the Management Processor

At this point in the installation process, the hardware is set up, the Management Processor (MP) is connected to the LAN, the AC and DC power have been turned on, and the selftest is completed. Now the configuration can be verified.

After DC is powered on and the selftest is complete, use the MP to select a boot partition.

1. From the MP Main Menu, enter `cm`.

2. From the MP Command Menu, enter `bo`.

3. Select the partition to boot. Partitions may be booted in any order.

4. Return to the MP Main menu by typing `ma` from the MP Command menu

5. Exit the MP by typing `co` at the MP Main Menu.

Exiting the MP should automatically bring you to the Boot Console Handler Main menu.

Verifying the System Configuration using Boot Console Handler (BCH)

From the BCH main menu, type **in** to go the Information Menu. Use the corresponding command from the menu to verify the type and quantity of processors, memory and I/O cards:

- PR (Processors)

- ME (Memory)

- IO (Check the PCI Device Information to determine if the values match the devices installed in the server)

Once the parameters have been verified, use the ma command to return to the BCH Main Menu.

Booting HP-UX using Boot Console Handler (BCH)

If Instant Ignition was ordered, HP-UX will have been installed in the factory at the Primary Path address. If HP-UX is at a path other than the Primary Path, use the **pa** (path) command (from the Configuration Menu) to set boot path.

1. Main Menu: Enter command or Menu> **co**

2. Configuration Menu> **pa pri** xx/xx/xx

3. Configuration Menu> **ma**

Once the Primary Path has been set, use the bo (boot) command (from the Main Menu) to boot HP-UX.

1. Main Menu: Enter command or Menu> **bo pri**

2. The following prompt appears:

   Do you wish to stop at the ISL prompt prior to booting (y/n)?

   Enter **n**.

NOTE   If the partition fails to boot, or if the server was shipped without *instant ignition*, you may have to boot from a DVD that contains the operating system and other necessary software.

---

3 Troubleshooting

Common Installation Problems

The following sections contain general procedures to help you locate installation problems.

CAUTION   Replace the top cover before operating the server, even for a short time. Otherwise, overheating can damage chips, boards, and mass storage devices. However, you can safely remove the PCI access panel while the server is running to remove and replace PCI hot-plug boards. For any other service activity requiring access to the processor baseboard or I/O backplane, power down the server and observe all safety precautions.

Most problems are the result of incorrect system and SCSI subsystem configurations.

To troubleshoot an installation problem, perform the following checks in the order given:

1. Check all cable and power connections, including those in the rack, etc.

2. Ensure the server is configured properly.

   Check the Setup Utility. If the error is a network-related problem, determine if the server has enough memory and hard disk drive capacity.

3. Verify all cables and boards are securely plugged into the appropriate connectors or slots.

4. Remove all extra options such as disk drives one at a time, checking its affect on the server.

5. Unplug the power cord, wait 20 seconds, plug the power cord in again, and restart the server.

6. If you suspect a hardware error, follow these steps:

   a. Log users off the LAN and power down the server.

   b. Extend the server out of the rack and remove the top cover.

   c. Simplify the hp rp7405/rp7410 to the minimum configuration.

      The minimum configuration consists of the following:

      • One cell

      • Two processors

      • One quad of memory DIMMS (size 256MB or larger)

      • One MP/SCSI card

      • One LAN/SCSI card

      • System Backplane

      • PCI Backplane

      • One BPS

      • Two PCI power modules

      • Two power cords.

7. Remove all third-party options, and reinstall each one, one at a time, checking the server after each installation.

8. Replace the top cover and reconnect the power cord and other cables.

---

9. Boot the server and if it does not function properly, refer to the following procedures.

The Server Does Not Power On

Use these steps to check for power related problems:

1. Check each bulk power supply's (BPS) LED.

   The LED is located in the lower left hand corner of the power supply face. Table 3-2 shows the states of the LEDs.

2. Check that the power supply and both power cords are plugged in to the chassis.

The Server Powers On But Then Shuts Down with a Fault Light

Use this checklist to check for the following problems when the server powers on and then off:

1. Check that a conductive item has not been dropped or left inside the server chassis.

2. Check the connections on all boards.

3. Check the system backplane for bent pins.

hp rp7405/rp7410 LED Indicators

The server has LEDs that indicate the health of the server. This section defines those LEDs.

Front Panel LEDs

There are seven LEDs located on the front panel.

Table 3-1   Front Panel LEDs

LED	Driven By	State	Description
Bulk Power Good	GPM	On Green	48V Good (LED works even if SP is not installed, or installed and not active)
		Off	48V Off
Standby Power Good	GPM	On Green	3.3V SB Good (LED works even if SP is not installed, or installed and is not active)
		Off	3.3V Off
SP Active	GPM	On Green	At least one SP is installed and Active
		Off	No SPs are installed or at least one is installed but not active
Remote	SP via GPM	On Green	Dial-in (remote) console enabled
		Off	Dial-in (remote) console is disabled, or SP not installed, or SP installed and not active
Attention	SP via GPM	Flash Yellow	Chassis log alert unread
		Off	No alert, or SP not installed, or SP installed and not active

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Table 3-1   Front Panel LEDs (Continued)

LED	Driven By	State	Description
Run	PDC/SP via GPM	On Green	One or more partition running
		Off	No partition running, or SP not installed, or SP installed and not active
Fault	PDC/SP via GPM	Flash Red	One or more Partitions have reported a fault
		Off	No Partitions running, or SP not installed, or SP installed and not active

Bulk Power Supply LEDs

There is a single three-color LED on each bulk power supply.

Table 3-2   BPS LEDs

LED Indication	Description
Blink Green	BPS in standby state and no faults or warnings
Green	BPS in run state (48 volt output enabled) and no faults or warnings
Blink Yellow	BPS in standby or run state and warning(s) present but no faults
Yellow	BPS in standby state and recoverable fault(s) present but no non-recoverable faults
Blink RED	BPS state may be unknown, non-recoverable fault(s) present
Red	Not Used (therefore BPS Failure)
Off	BPS state unknown, (therefore BPS Fault or Failure)

PCI Power Supply LEDs

There are three LEDs on the PCI power supply. Green and yellow LEDs follow OL* operation. A multi-color LED reports warnings and faults.

Table 3-3   PCI Power Supply LEDs

LED	Driven By	State	Description
Power	Each Supply	On Green	All output voltages generated by the power supply are within limits.
		Off	Output voltages are turned off
Attention	SP via PCI LPM	Yellow	See Table 3-7.

Table 3-3   **PCI Power Supply LEDs (Continued)**

LED	Driven By	State	Description
Fault	Each Supply	Flash Yellow	The temperature within the power supply is above the lower threshold.
		On Yellow	The temperature of the power supply is approaching the thermal limit
		Flash Red	Power supply has shut down due to an over temperature condition, a failure to regulate the power within expected limits, or a current-limit condition.
		On Red	Not Used
		Off	No Faults

System, Standby, and I/O Fan LEDs

There is a single three-color LED on each System, Standby, and I/O Fan.

Table 3-4   **System, Standby, and I/O Fan LEDs**

LED	Driven By	State	Description
Fan Status	Fan	On Green	Normal
		Flash Yellow	Predictive Failure
		Flash Red	Failed
		Off	No Power

SINC POST LEDs

The four SINC POST LEDs (Green) display the current state of the SINC firmware.

Table 3-5   **SINC POST LEDs**

LED	Driven By	State	Description
SINC POST	SINC	Off	3.3V SB Off
		All On	SINC is reset or dead
		0x1-0xE	SINC POST State

OL* LEDs

Table 3-6   OL* LEDs

Location	LED	Driven By	State	Description
Chassis Beside Cell and On Cell	Cell Board Power	Cell LPM	On Green	3.3V SB and Cell_Pwr_Good
				3.3V SB off, or 3.3V SB on and no Cell_Pwr_Good
	Cell Attention	SP via GPM	Yellow	See Table 3-7.
PCI OL* Board	PCI Slot Power	LBA	On Green	Slot is powered
			Off	Slot is not powered
	PCI Slot Attention	LBA	Off	Normal
			Yellow	See Table 3-7.
MP Core I/O Panel	PCI Slot Power	LBA	On Green	Core is powered
			Off	Core is not powered
	PCI Slot Attention	LBA	Off	Normal
			Yellow	See Table 3-7.

PCI/Cell LED OL*

Table 3-7   OL* LEDs States

State	Power (Green)	Attention (Yellow)
Normal Operation (powered)	On	Off
Fault Detected, power on	On	Flashing
Slot Selected, power on, NOT Ready for OL*	On	On
Power off or Slot Available	Off	Off
Fault Detected, power off	Off	Flashing
Ready for OL*	Off	On

MP Core I/O LEDs

The MP Core I/O LEDs are located on the MP Core I/O Panel.

Table 3-8   MP Core I/O LEDs

LED	Driven By	State	Description
Management Processor Power Good	3.3SB	On Green	3.3V SB is on
		Off	3.3V SB off

Table 3-8   MP Core I/O LEDs (Continued)

LED	Driven By	State	Description
Management Processor Active	SP	On Green	Service Processor on this MP Core I/O Board is managing box.
		Off	SP is not managing box.
Management Processor POST	SP	Off	SP is reset or off
		0x1-0xF Green	SP POST Code
MP LAN 100BT	SP LAN Controller	On Green	SP LAN in 100BT Mode
MP LAN 10BT	SP LAN Controller	On Green	SP LAN in 10BT Mode
MP LAN Link OK	SP LAN Controller	On Green	SP LAN Link OK
MP LAN Activity	SP LAN Controller	On Green	SP LAN Data Activity
System SCSI Diffsense	System SCSI Controller	On Green	On=LVD, Off=Single Ended
System SCSI TermPower	System SCSI Controller	On Green	Terminators are powered
SelfTest		On Yellow	Yellow during POST of failure

LAN/SCSI (PCI Slot) LEDs

The LAN/SCSI LEDs are located on the PCI Panel.

Table 3-9   LAN/SCSI LEDs

LED	Driven By	State	Description
System LAN 1000BT	System LAN Controller	On Green	System LAN in 1000BT Mode
System LAN 100BT	System LAN Controller	On Green	System LAN in 100BT Mode
System LAN 10BT	System LAN Controller	On Green	System LAN in 10BT Mode
System LAN Link OK	System LAN Controller	On Green	System LAN link OK
System LAN Activity	System LAN Controller	On Green	System LAN Data Activity
System LAN Full Duplex	System LAN Controller	On Green	System LAN in full duplex mode
System SCSI Diffsense	System SCSI Controller	On Green	On=LVD, Off=Single ended
System SCSI TermPower	System SCSI Controller	On Green	Terminators are powered

4   Removal and Replacement

Shutting Down nPartitions and Powering Off Hardware Components

When you remove and replace hardware you may need to shut down one or more nPartitions on the server. In some cases you also will need to power off hardware components as part of the remove and replace procedure.

This section gives details on how to ensure that an nPartition is properly shut down, and it also describes how to power off (and power on) hardware components.

Shutting Down an nPartition

This procedure is for checking an nPartition's boot status and, if needed, shutting down HP-UX on the nPartition.

Step 1. Advise the customer that the system (one or more nPartitions) must be shut down for repairs.

Ensure that the customer has a current backup, and inform the customer of the anticipated downtime.

Step 2. Login to the server's service processor (MP).

Step 3. Use the Virtual Front Panel (VFP) to view the current state of the nPartition that you will shut down.

From the MP Main menu, enter **VFP** to access the Virtual Front Panel menu, and select the nPartition whose boot state you want to view.

Type **Control-b** (**^B**) to exit the VFP display.

- If an nPartition has booted HP-UX, or if it is in the process of launching HP-UX, you must shut down HP-UX on the nPartition.

  When HP-UX is running on an nPar, its VFP displays "HP-UX heartbeat" with a blinking asterisk (*) to indicate its interactivity.

  In this case, proceed with the next step.

- If the nPartition is at its Boot Console Handler (BCH) interface, then HP-UX has already been shut down.

- If the nPartition currently is booting, then you should wait for it to reach the BCH interface and—if necessary—interrupt auto-boot when you see the "Attempting to boot" and "To discontinue, press any key within 10 seconds" messages.

If the nPartition is at the BCH menu interface then HP-UX is shut down. Otherwise, proceed with the next step to shut down HP-UX.

Step 4. From the MP Main menu, enter **CO** and select the console for the nPartition you plan to shut down.

You should have access to the HP-UX login prompt (or command line) when using the nPartition's console. If you have no interactivity at the console, HP-UX may be halted or hung.

Step 5. At the nPartition's console, login to HP-UX and shut down the operating system.

After making arrangements with the customer, issue the `shutdown` command to shut down and halt HP-UX on the nPartition.

For example, the `shutdown -h 240` command will shut down and halt HP-UX on the nPartition after waiting for a grace period of four minutes (240 seconds).

To reboot the nPartition after it is halted, use the MP Command menu's `RS` command to restart the nPartition. (This allows the nPartition to reset and boot to its BCH interface; if auto-boot is configured it also boots HP-UX.)

Powering Off Hardware Components

This procedure is for powering off and powering on components that are to be removed and replaced.

Step 1. Login to the server's service processor (MP).

Step 2. If the component you will power off is assigned to an nPartition, then use the Virtual Front Panel (VFP) to view the current boot state of the nPartition.

HP-UX on the nPartition must be shut down before you power off any of the hardware assigned to the nPartition.

Once you are certain the nPartition is not running HP-UX, you can power off components that belong to the nPartition.

Refer to the procedure Shutting Down an nPartition for details on determining the nPartition boot state and shutting down HP-UX.

Step 3. Access the MP Command menu.

From the MP Main menu enter `CM` to access the Command menu.

Step 4. Use the MP Command menu's `PS` command to check details about the hardware component you plan to power off.

The `PS` command enables you to check the status of the cabinet, system backplane, MP Core I/O, PCI power domains — or bricks — in the I/O card cage, and cells.

Step 5. Use the MP Command menu's `PE` command to power off the hardware component.

Using the `PE` command you can power on or off the cabinet (including all cells and I/O in the cabinet), individual cells, or PCI power domains (bricks).

Using the Command menu's `PE` command to manage cabinet power is equivalent to using the front panel power switch.

Step 6. If you need to disable *all power* in the entire cabinet, you also must disconnect all power cords in order to disable all housekeeping power.

NOTE Ensure that all power cords are labeled to indicate which receptacle each cord plugs into. Because of power redundancy capabilities it is important that each power cord plugs into its proper receptacle.

Also, ensure that the cabinet power has been turned off before disconnecting any power cords.

Step 7. Perform the hardware removal and replacement procedure for the powered off component.

Step 8. If needed, reconnect all power cords to the receptacles where they belong.

Step 9. Use the MP Command menu's `PE` command to power on the hardware component that you powered off.

Step 10. Use the MP Command menu's `PS` command to confirm the status of the newly replaced component.

NOTE   You may need to allow time for some components to complete power on self tests (POST) before a complete status is available.

Removing and Replacing the Top Cover

It is necessary to remove and replace one or more of the covers to access the components within the server chassis.

CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-1   **Top Cover**
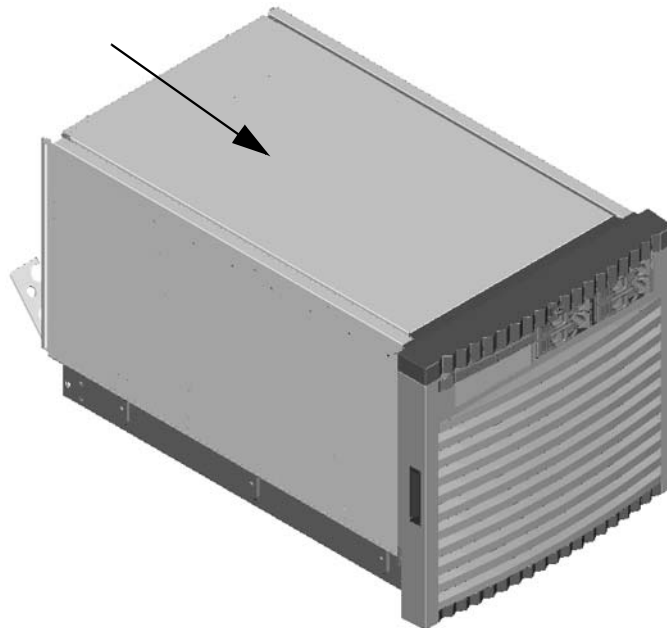
Removing the Top Cover

Figure 4-2   Top Cover Retaining Screws
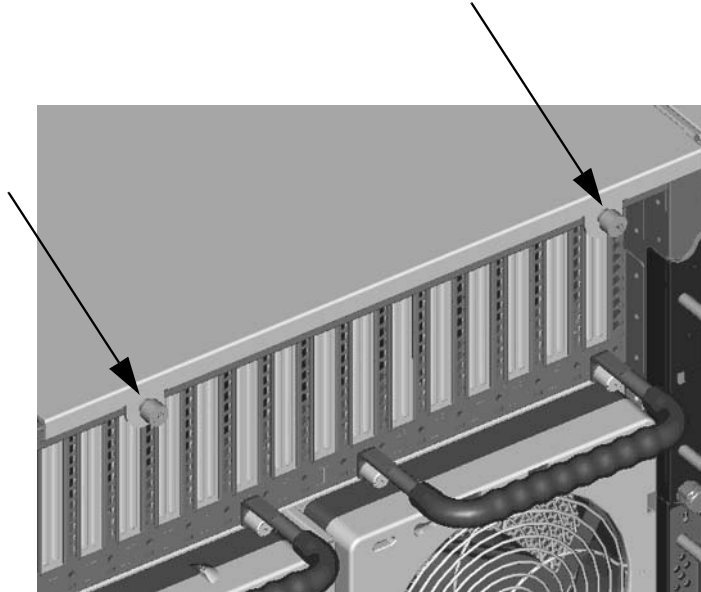
Step   1. Loosen the retaining screws securing the cover to the rear of the chassis.

Step   2. Slide the cover toward the rear of the chassis.

Step   3. Lift the cover up and away from the chassis.

Replacing the Top Cover

Step   1. Slide the cover into position. It should easily slide into position; however, a slow firm pressure will be needed to properly seat the cover.

Step   2. Tighten the retaining screws securing the cover to the chassis.

Removing and Replacing a Disk Drive

The disk drives are located in the front of the chassis. The nPartition must be shutdown to remove or replace the drive that serves as the boot disk. Refer to "Shutting Down nPartitions and Powering Off Hardware Components" for more information. The remainder of the internal disk drives are hot pluggable.

CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-3   **Disk Drive Location**
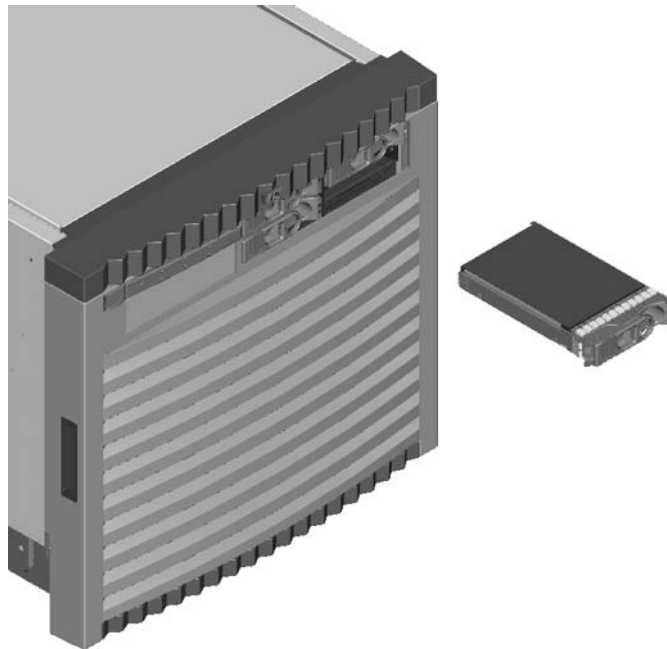
Removing a Disk Drive

Figure 4-4   Disk Drive Detail
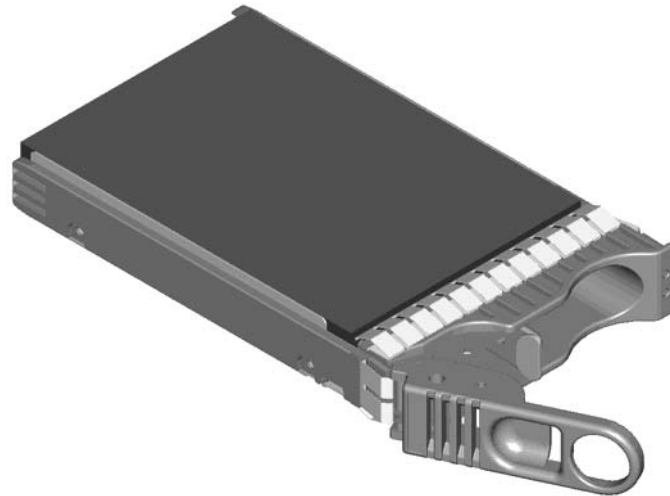
Step 1. Disengage the front locking latch on the disk drive by pushing the release tab to the right and the latch lever to the left.

Step 2. Pull forward on the front locking latch and carefully slide the disk drive from the chassis.

Replacing a Disk Drive

NOTE	Sometimes using the `diskinfo` and `ioscan` commands will produce encached data. To resolve this, these commands should be run when the disk drive is removed.

Step 1. Before installing the disk drive, enter the following command:

```
#diskinfo -v /dev/rdsk/cxtxdx
```

Step 2. Enter the following command:

```
#ioscan -f
```

The response message after running this command is:

```
NO_HW
```

**Step 3.** Make sure the front locking latch is open, then position the disk drive in the chassis.

Step 4. Slide the disk drive into the chassis; a slow firm pressure will be needed to properly seat the connection.

Step 5. Depress the front locking latch to secure the disk drive in the chassis.

Step 6. Spin up the disk by entering one of the following commands:

```
#diskinfo -v /dev/rdsk/cxtxdx
```

```
#ioscan -f
```

```
#pvcreate
```

```
#vgcfgrestore
```

Removing and Replacing a CD/DVD Drive

The CD/DVD is located in the front of the chassis. The system power to this component must be removed before attempting to remove or replace it. Refer to "Shutting Down nPartitions and Powering Off Hardware Components" for more information.

CAUTION   Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-5   **CD/DVD Location**
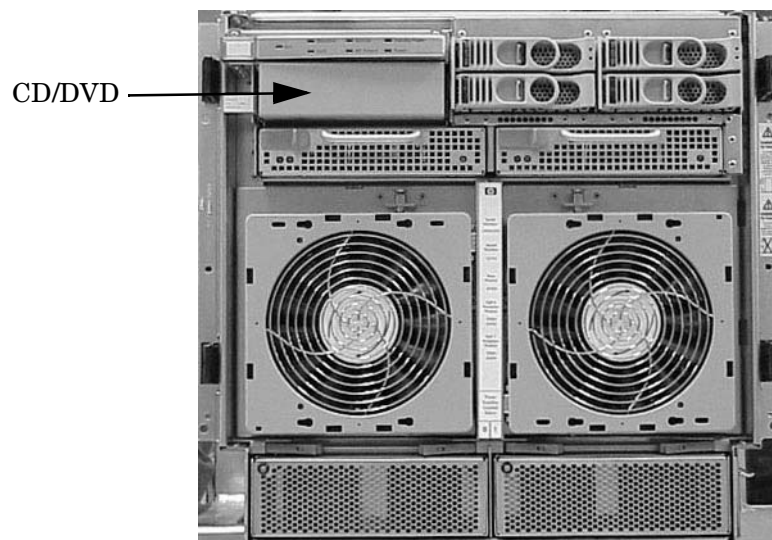
Removing a CD/DVD Drive

Figure 4-6   CD/DVD Detail
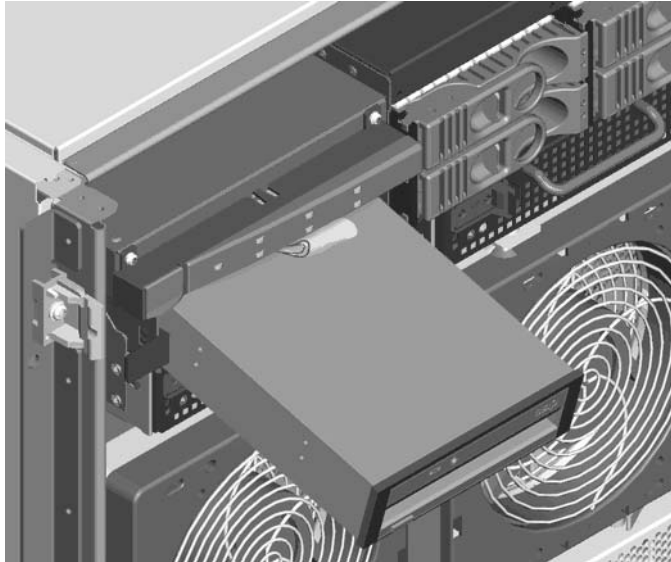
Step 1. To remove the CD/DVD, depress the front locking latch to loosen the drive from the chassis.

Step 2. Disengage the cables from the rear of the CD/DVD.

Step 3. Slide the drive from the chassis.

Replacing a CD/DVD

Figure 4-7   CD/DVD Detail
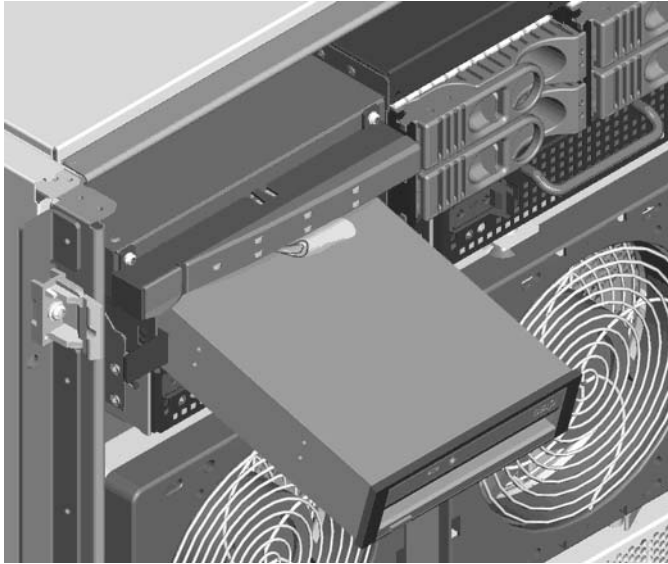
Step 1. Connect the cables to the rear of the CD/DVD.

Step 2. Slide the drive in the chassis.

CAUTION   Before attempting to install the drive into the chassis, position the data cable over the top of the drive in order to avoid pinching the cable during installation.

Step 3. The drive easily slides into the chassis; however, a slow firm pressure is needed to properly seat the drive.

Step 4. Depress the front locking latch to secure the disk drive in the chassis.

Removing and Replacing a Front Smart Fan Assembly

The Front Smart Fan Assembly is located in the front of the chassis. The fan assembly is a hot swappable component.

CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-8   **Front Smart Fan Assembly Locations**

FAN 0 → ← FAN 1

Front View

LED   LED
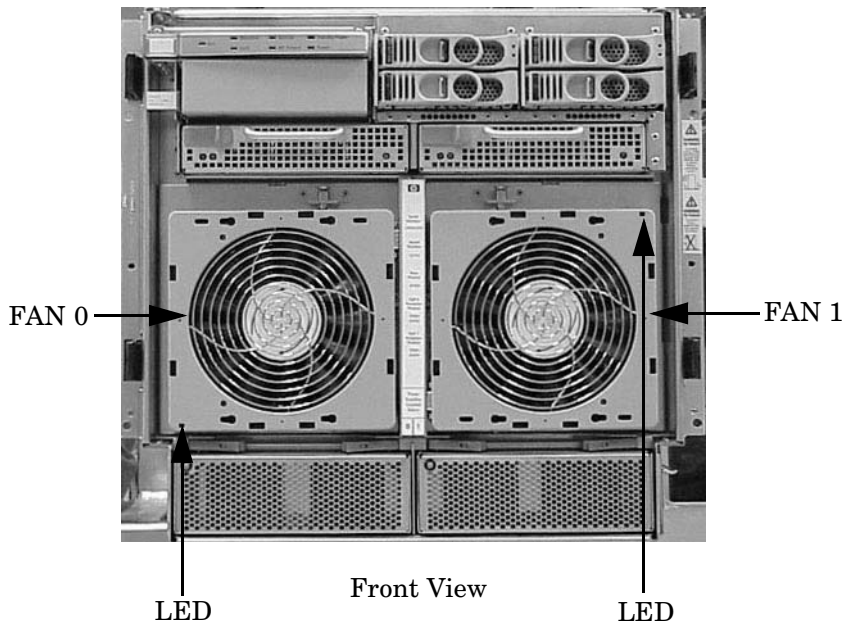
Table 4-1   **Front Smart Fan Assembly LED Indications**

LED State	Meaning
On Green	Fan is at speed and in sync or not at speed less than 6 seconds
Flash Yellow	Fan is not keeping up with speed/sync pulse for greater than 6 seconds
Flash Red	Fan failed/stalled or has run slow or fast for greater than 6 seconds
Off	Fan is not installed or no power is applied to fan

Removing a Front Smart Fan Assembly

Figure 4-9   **Front Fan Detail**

Step 1. Push the Fan Release Pin away from the fan.

Step 2. Slide the fan away from the connector.

Step 3. Pull the fan away from the chassis.

Replacing a Front Smart Fan Assembly

Step 1. Position the fan assembly on the chassis fan guide pins.

Step 2. Slide the fan into the connector.

Step 3. Verify that the Fan Release Pin is in the locked position.

NOTE   The fan LED should show fan is operational (green).

Removing and Replacing a Rear Smart Fan Assembly

The Rear Smart Fan Assembly is located in the rear of the chassis. The Fan assembly is a hot swappable component.

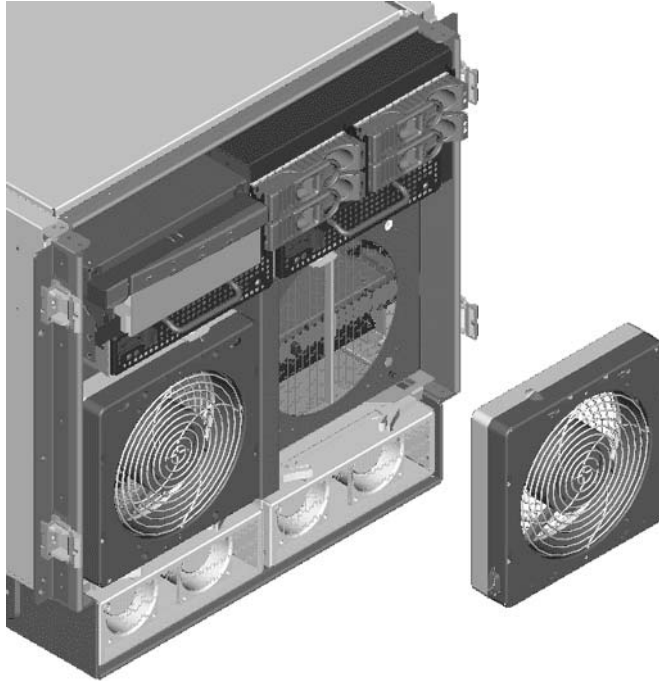| CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-10   Rear Smart Fan Assembly Locations

FAN 2   FAN 3

LED   Rear View   LED
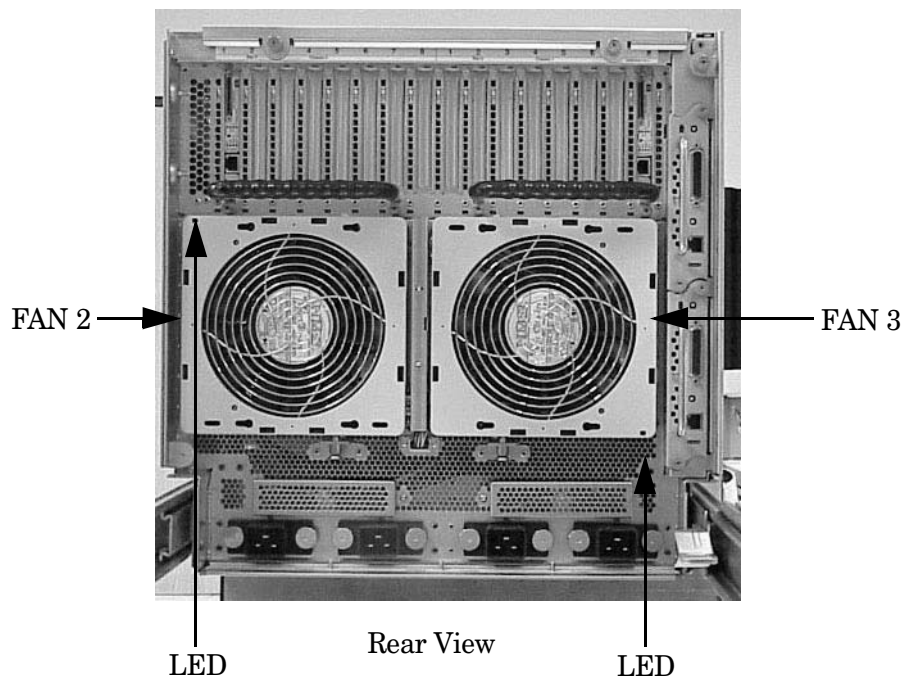
Table 4-2   Rear Smart Fan Assembly LED Indications

LED State	Meaning
On Green	Fan is at speed and in sync or not at speed less than 6 seconds
Flash Yellow	Fan is not keeping up with speed/sync pulse for greater than 6 seconds
Flash Red	Fan failed/stalled or has run slow or fast for greater than 6 seconds
Off	Fan is not installed or no power is applied to fan

Removing a Rear Smart Fan Assembly

Figure 4-11   **Rear Fan Detail**
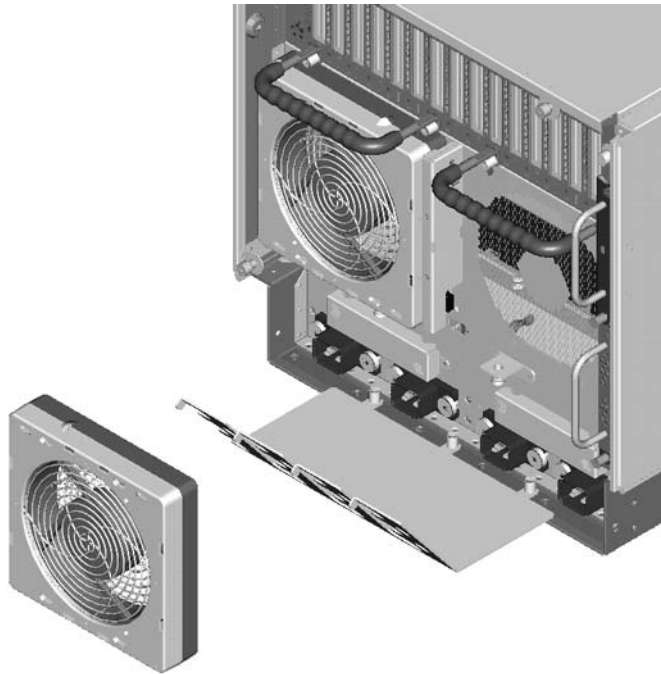
Step 1. Push the Fan Release Pin away from the fan.

Step 2. Slide the fan away from the connector.

Step 3. Pull the fan away from the chassis.

Replacing a Rear Smart Fan Assembly

Step 1. Carefully position the fan assembly on the chassis fan guide pins.

Step 2. Slide the fan into the connector.

Step 3. Verify that the Fan Release Pin is in the locked position.

       NOTE   A green fan LED indicates the fan is operational.

Removing and Replacing a PCI Smart Fan Assembly

The PCI Smart Fan Assembly is located in the rear of the PCI cardcage. The Fan assembly is a hot swappable component.

|	
CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-12   **PCI Smart Fan Assembly Location**
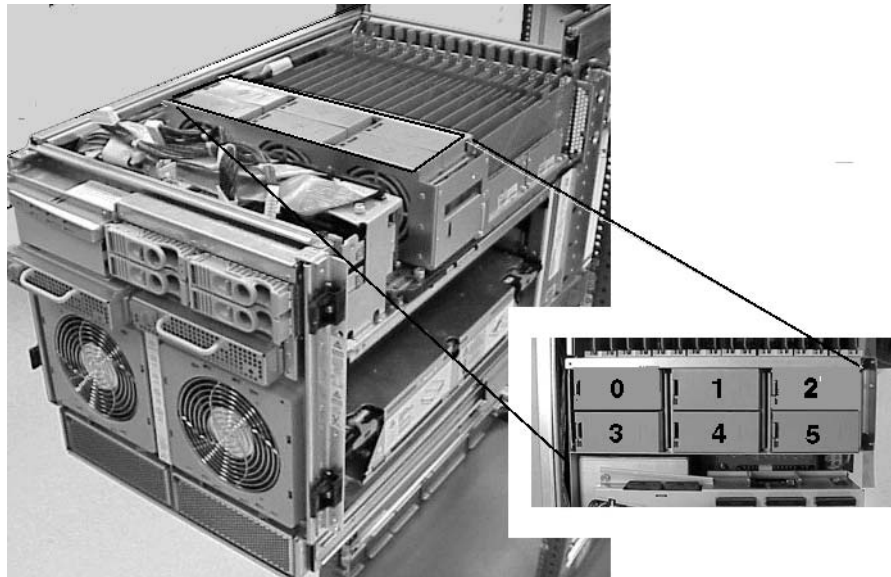
Table 4-3   **Smart Fan Assembly LED Indications**

LED State	Meaning
On Green	Fan is at speed and in sync or not at speed less than 6 seconds
Flash Yellow	Fan is not keeping up with speed/sync pulse for greater than 6 seconds
Flash Red	Fan failed/stalled or has run slow or fast for greater than 6 seconds
Off	Fan is not installed or no power is applied to fan

Removing a PCI Smart Fan Assembly

Figure 4-13   **PCI Smart Fan Assembly Detail**
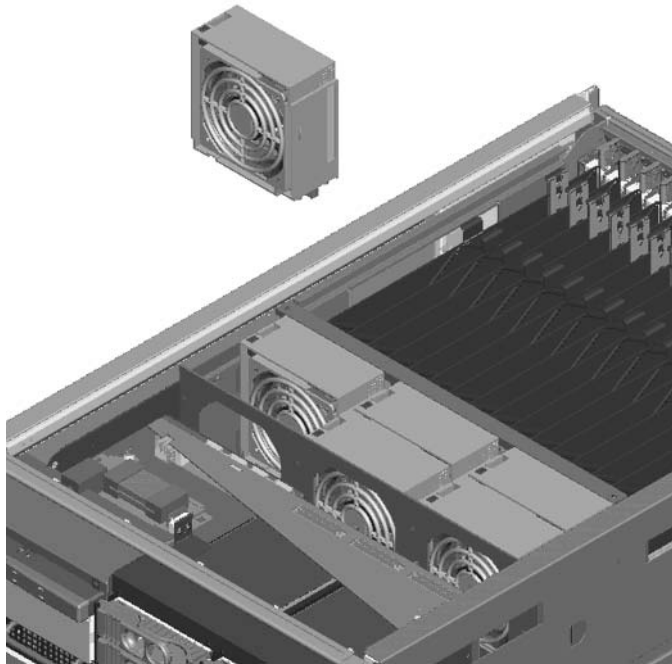
Step 1. Securely grasp the two thumb holds on the fan assembly.

| **NOTE** | The two right side fans, as viewed from the front, are located very close to the chassis. It may be necessary to use a tool such as a flatblade screwdriver to assist in removing them. |

Step 2. Slide the fan upward from the chassis.

Replacing a PCI Smart Fan Assembly

Step 1. Carefully position the fan assembly in the chassis.

Step 2. The fan easily slides into the chassis; however, a slow firm pressure will be needed to properly seat the connection.

| NOTE | A green fan LED indicates the fan is operational. |

Removing and Replacing a Bulk Power Supply

The bulk power supply is located in the front of the chassis. The BPS is a hot swappable component.

|	
CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-14   BPS Location

BPS Locations
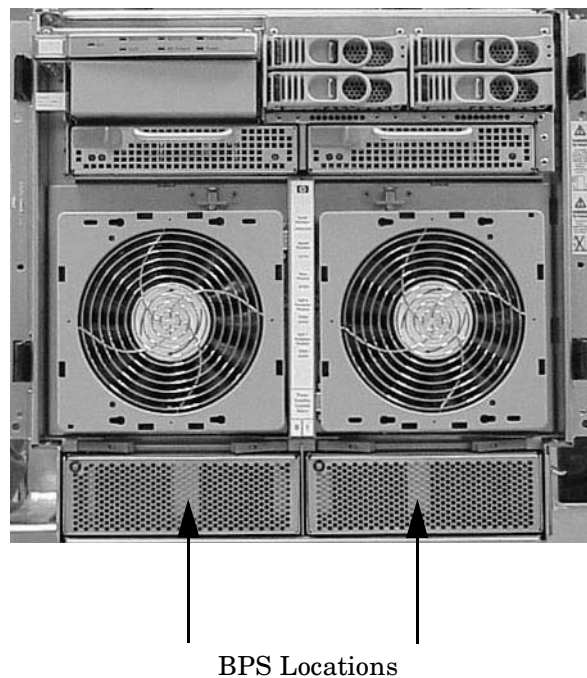
IMPORTANT	When a BPS is pulled from the server and then immediately re-inserted, the server can report an overcurrent condition and shut down.

Removing a BPS

Figure 4-15   **BPS Detail**
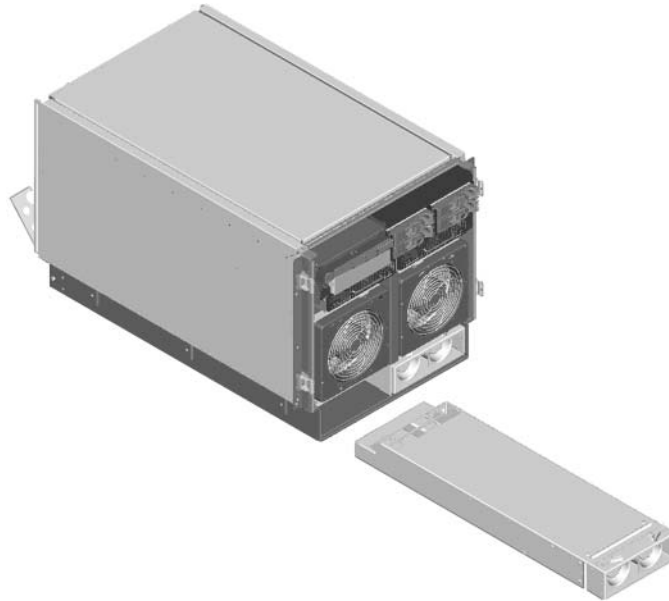
Step   1. Pull the extraction levers located on the upper front outer portion of the BPS.

Step   2. Slide the BPS forward using the extractions levers to remove it from the chassis.

Replacing a BPS

Step   1. Verify that the extraction levers are in the open position, then insert the BPS into the empty slot.

NOTE   The BPS easily slides into the chassis; however, a slow firm pressure will be needed to properly seat the connection.

**Step   2.** Ensure the BPS has seated by closing the extraction levers.

NOTE   BPS LED should show BPS operational and no fault. BPS LED should be GREEN.

Removing and Replacing a PCI Power Module (Brick)

The PCI power module is located in the front of the chassis. The PCI power module is a hot pluggable component.

|	
CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-16   PCI Power Module Location
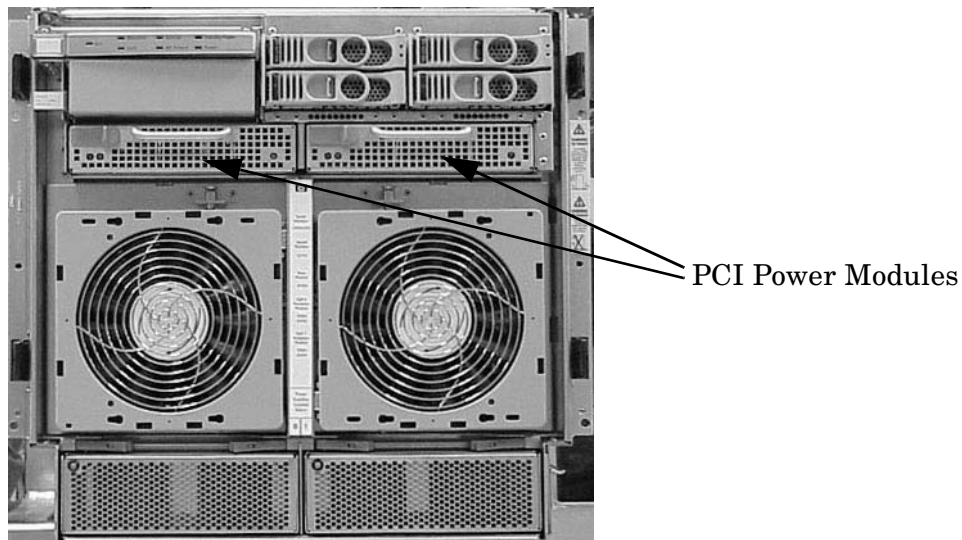
PCI Power Modules

Table 4-4   PCI Power Module LED Indications

LED	LED State	Meaning
Power LED (Green)		
	Off	Power module failure
	On	Normal operation
Fault LED (Multi-color)	Off	Normal operation
	Blink amber	Module internal failure
	Amber	Module internal failure
	Bink red	Module internal failure

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Removing a PCI Power Module (Brick)

Figure 4-17 **PCI Power Module Detail**
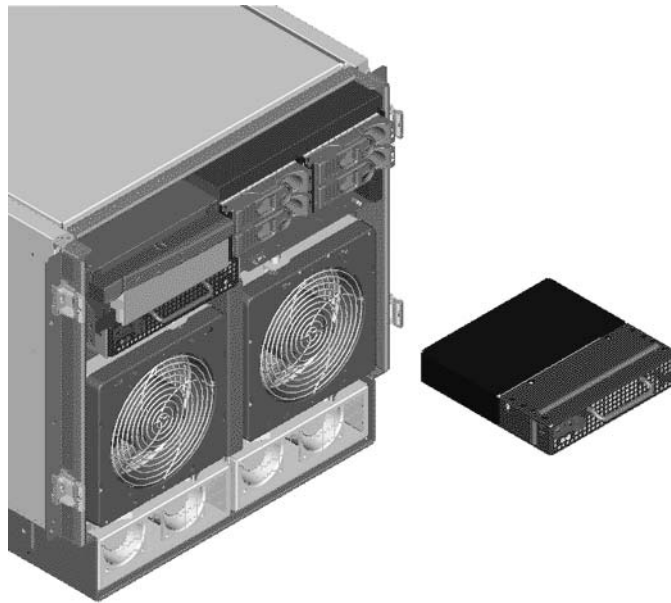
Step 1. Securely grasp the handle on the front of the power module.

Step 2. Firmly depress the securing thumb latch.

Step 3. Slide the module from the chassis.

Replacing a PCI Power Module (Brick)

Step 1. Carefully position the power module in the chassis and depress the thumb latch.

Step 2. The module easily slides into the chassis; however, a slow firm pressure will be needed to properly seat the connection.

Step 3. Release the thumb latch.

NOTE	PCI power module LED should show power module is operational and the green LED should be on.

Removing and Replacing the PCI Voltage Regulator Modules

Removing PCI VRM

Step 1. Power down server.

IMPORTANT   Power must be removed from both PCI Chassis 0 and PCI Chassis 1 to continue.

Step 2. Remove right side cover.

Step 3. Remove PCI side panel.

Step 4. Identify VRM to be replaced (O or 1).

Step 5. Unscrew VRM from bracket (2 screws on non-component side).

Step 6. Lift up and gently pull from the socket.

Figure 4-18   **Locating the VRMs on PCI Backplane**
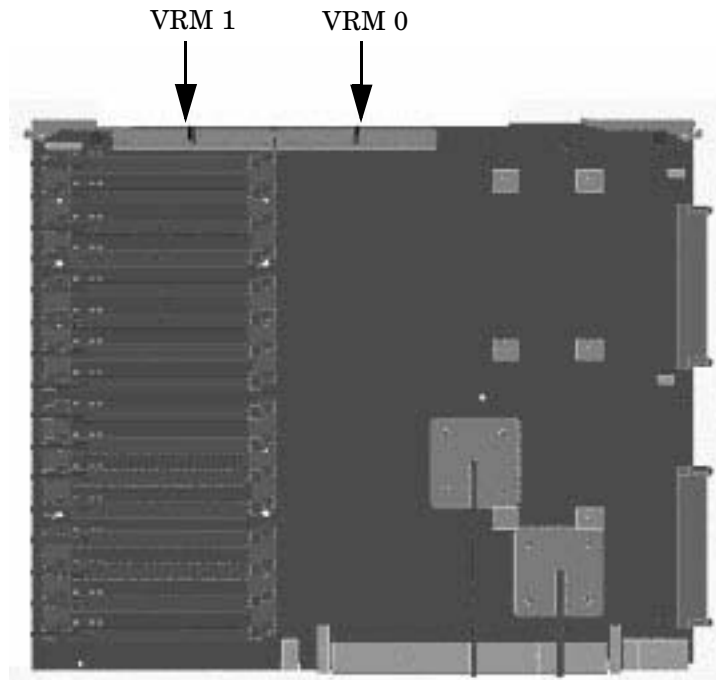
Replacing the PCI VRM

Step 1. Firmly seat the VRM into the socket being careful not to bend pins.

Step 2. Attach bracket to VRM using 2 screws removed earlier.

Step 3. Put PCI side panel back onto chassis.

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Step 4. Put right side cover back onto chassis.

Step 5. Power server back up.

Removing and Replacing a PCI Card

The PCI cards are located in the rear of the chassis in the PCI card cage. PCI cards are hot swappable components.

| CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-19   **PCI Cards**
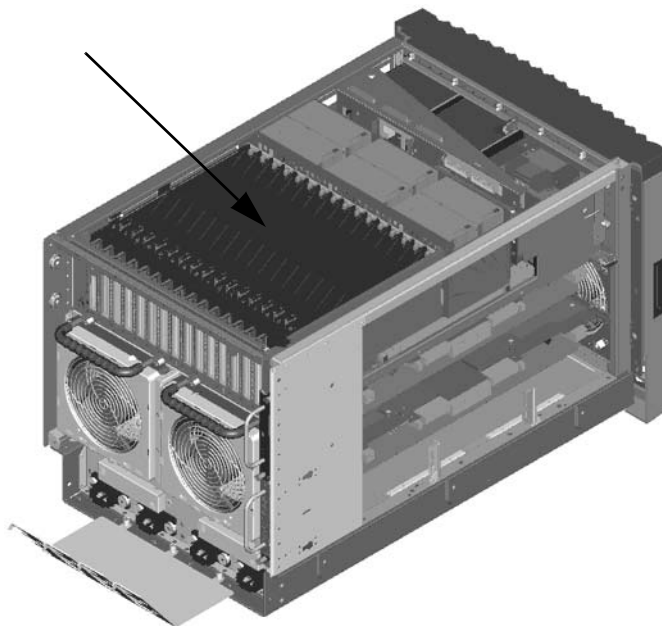
Removing and Replacing a PCI Card

You can remove and replace a PCI I/O card by using the SAM (`/usr/sbin/sam`) application or by using Partition Manager (`/opt/parmgr/bin/parmgr`).

This procedure describes how to perform an *online replacement* of a PCI card using SAM, for cards whose drivers support online add or replacement (OLAR).

IMPORTANT	Some PCI I/O cards cannot be added or replaced online (while HP-UX remains running). For these cards, you must shut down HP-UX on the nPartition before performing the card replacement or addition. See "Shutting Down nPartitions and Powering Off Hardware Components" on page 58.

Step 1. Run SAM (`/usr/sbin/sam`) and from the main SAM Areas screen select the **Peripheral Devices** area, then select the **Cards** area.

Step 2. From the I/O Cards screen, select the card you will replace and then select the **Actions—>Replace** menu item.

Step 3. Wait for SAM to complete its critical resource analysis for the selected card and then review the analysis results.

If no critical resources will be disabled by taking the selected card offline then click the **OK** button to suspend the card's driver and power off the card's PCI slot, and then proceed with the next step.

If SAM detected that the selected PCI card cannot be taken offline, you will not be able to click the **OK** button and cannot replace the card while HP-UX remains running. In this case, you must shut down HP-UX on the nPartition before replacing the defective card.

Step 4. Locate the PCI slot where the selected card resides.

On the server, you can view the PCI slots and slot LEDs from the rear of the cabinet.

The selected slot will be powered off (its green power LED will be off), and the slot's amber attention indicator (a dark orange yellow LED) will be blinking.

Step 5. Label and remove the cable(s) connected to the PCI card to be removed.

Step 6. Remove the top cover.

Step 7. Flip the card slot's PCI gate to the open position.

Figure 4-20PCI Gate Detail
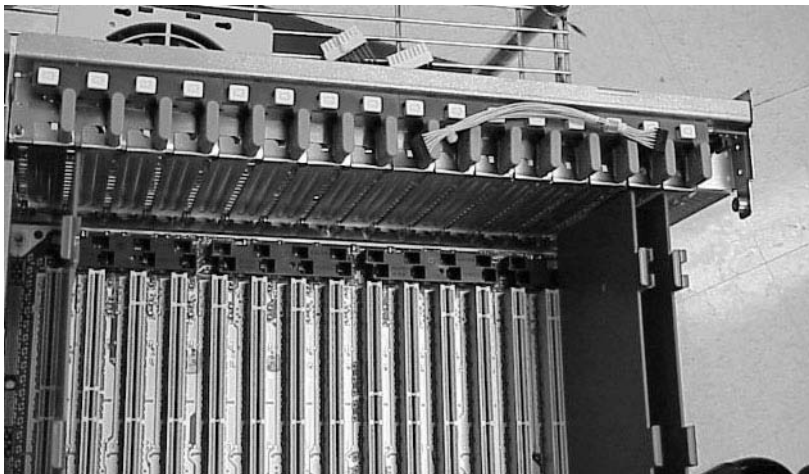
Step 8. Firmly pull up on the tabs on the PCI card separator.

Step 9. Remove the card from the PCI slot.

Note that the card is defective, for future reference.

Step 10. Position the new, replacement PCI card in the slot.

NOTE   A slow firm pressure is needed to properly set the card into its connection. PCI cards tend to be difficult to install.

Step 11. Flip the card slot's PCI gate to the closed position.

Step 12. Replace the top cover.

Step 13. Connect all cables to the replacement PCI card.

Step 14. In SAM's Replace Card window, click the **OK** button.

SAM powers the PCI slot back on, and turns off (stops blinking) the slot's attention indicator. SAM also resumes the card's drivers.

Step 15. Confirm that the replacement card is online and powered in, using SAM's I/O Cards screen.

Step 16. Synchronize the PDH and I/O card SCSI parameters.

1. When powering up system, go into CO (console window). When POST finishes running, the system displays the Main Menu (the system is at BCH at this point in time).

2. From the Main Menu enter **ser**. This takes you to the Service Menu.

3. At the Service Menu prompt enter **scsi default**. The system then informs you that it will clear (reset) all scsi paths and prompts you to enter either Yes or No.

4. Enter **y**. The system takes a few seconds to reset the scsi ports, list all the ports with the reset values, then displays the Service Menu prompt.

5. Reboot the system.

Removing and Replacing the Mass Storage Backplane

Removing the Backplane

Step 1. Remove all internal disks.

Figure 4-21 Locating Internal Disks
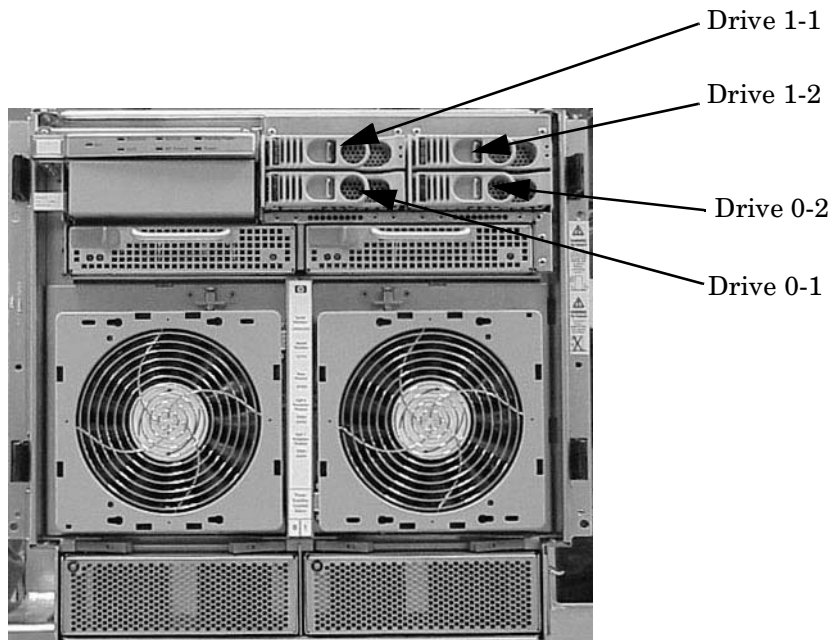
Step 2. Remove the top and right side covers.

Step 3. Remove the PCI side panel.

Step 4. Disconnect all cables to the backplane.

Ensure that you notice where each is removed, so that they may be correctly reinstalled.

Figure 4-22Locating the Mass Storage Backplane

Mass Storage Backplane
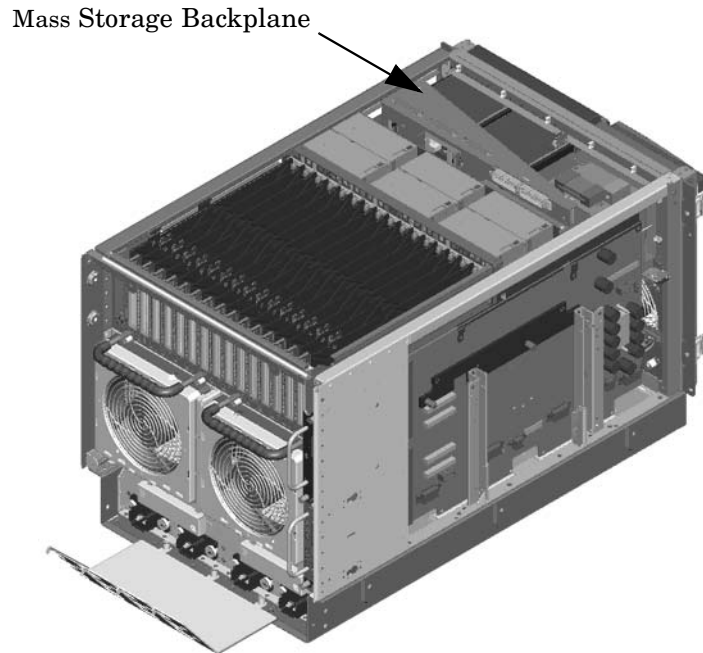
Step 5. Unscrew the two captive screws and remove backplane/bracket assembly.

Figure 4-23Mass Storage Backplane
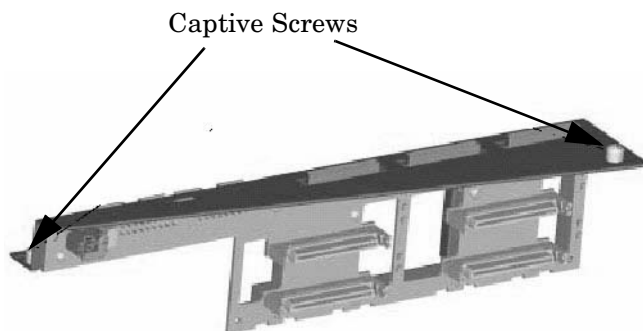
Captive Screws

Replacing the Backplane

Step 1. Align and press the backplane/bracket assembly into its mount.

Step 2. Fasten the two captive screws.

Step 3. Connect all cables to the backplane.

Step 4. Install the PCI side panel.

Step 5. Install the top and right side covers.

Step 6. Install all internal disks.

Removing and Replacing a MP/SCSI Board

The MP/SCSI board is located in the rear of the chassis. The MP/SCSI board is a hot pluggable component. There may be up to two MP/SCSI boards installed in a system.

CAUTION	Observe all ESD safety precautions before attempting this procedure. Failure to follow ESD safety precautions could result in damage to the server.

Figure 4-24   **MP/SCSI Location**
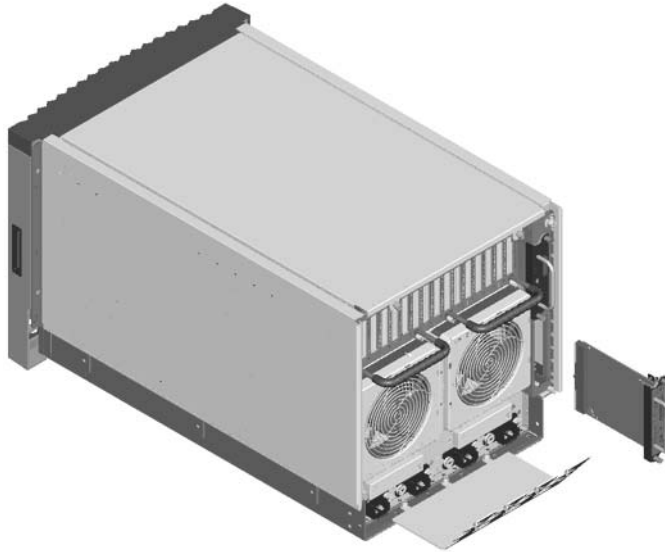
Removing a MP/SCSI board

Figure 4-25   MP/SCSI Detail
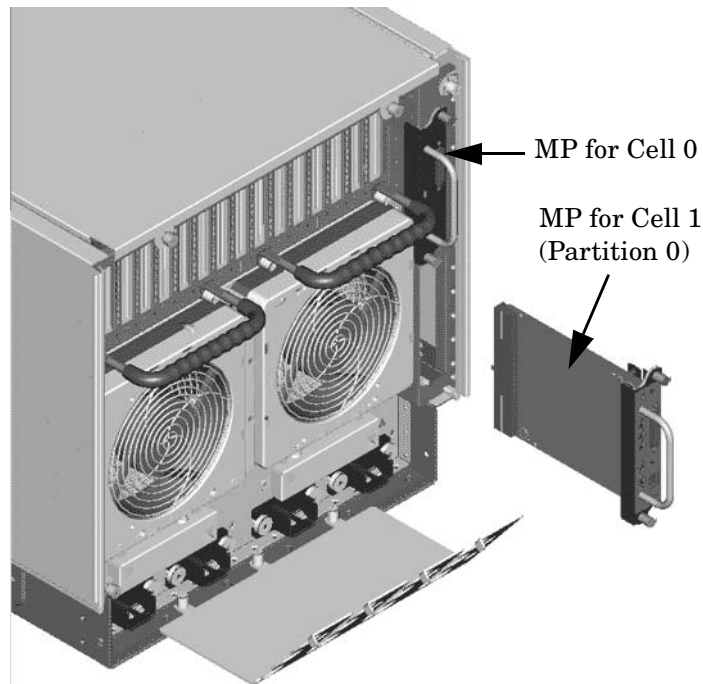
Step 1. Label and remove all cables connected to the MP/SCSI board to be removed.

Step 2. Loosen the two retaining screws securing the MP/SCSI board to the chassis.

Step 3. Securely grasp the handle on the MP/SCSI board.

Step 4. Slide the MP/SCSI board from the chassis.

Replacing a MP/SCSI Board

Step 1. Position the MP/SCSI board in the chassis.

Step 2. The board slides easily into the chassis; however, a slow firm pressure will be needed to properly seat the connection.

Step 3. Tighten the two retaining screws securing the MP/SCSI board to the chassis.

A Replaceable Parts

Table A-1　　　hp rp7405/rp7410 Field Replaceable Unit (FRU) List

FRU Description	Replacement Part Number	Exchange Part Number
18GB 10K RPM SCSI Disk	A6537-67001	A6537-69001
1GB DIMM (single)	A6098AX	A6098-69001
240V N. American UPS 4.5m C19/L6-30P	8120-8494	None
256MB DIMM (single)	A6802AX	A6802-69001
36GB 15K RPM SCSI Disk	A6541-60001	A6541-69001
512MB DIMM (single)	A6097AX	A6097-69001
73GB 10K RPM SCSI Disk	A6539-60001	A6539-69001
AC cord retention bracket	A6752-00123	None
AC Power Supply (qty 2 per system)	0950-4173	A6752-69013
Adaptor, SCSI	A6093-00239	None
Anti-tip Foot	A6752-67042	None
Assembly, Cell/PDH Riser	A6094AX	A6094-69003
Assembly, Cover, Left Side	A6752-67034	None
Assembly, Cover, Right Side	A6752-67033	None
Assembly, Cover, Top	A6752-67035	None
Assembly, Front Bezel	A6752-04003	None
Assembly, Front Panel Plastic	A6752-67037	None
Assembly, Interlock Device	5065-5959	None
Assembly, Lift handle, left panel	A6752-04045	None
Assembly, Lift handle, right panel	A6752-04048	None
Assembly, PCI Card Cage	A6752-67014	A6752-69014
Assembly, PCI OLR	A6093-67014	None
Assembly, PCI OLR Paddle	A6093-40041	None
Assembly, PCI Separator (W/Light Pipe)	5065-7443	None
Assembly, Slide rail, left	A6752-04058	None
Assembly, Slide rail, right	A6752-04059	None
Assembly, Smart Fan (Front/Rear) (qty 4)	A6752-67029	None
Assembly, Smart Fan (PCI C/C) (qty 6)	A6752-67030	None

Table A-1 **hp rp7405/rp7410 Field Replaceable Unit (FRU) List (Continued)**

FRU Description	Replacement Part Number	Exchange Part Number
Assembly, Front Bezel, No NamePlate	A6752-04066	
Ballast, J1479 (1 per system)	J1479-60001	None
Box, DVD Filler	A6752-67041	None
Cable Management Arm	5065-5951	None
Cable, DVD Power	A6752-67021	None
Cable, Intrusion Switch	A6093-63025	None
Cable, Mass Storage Power #1	A6752-67019	None
Cable, Mass Storage Power #2	A6752-67020	None
Cable, PCI OLR Switch	A6752-63027	None
Cable, SCSI Bundle	A6752-63019	None
Cable, System Fan, External	A6752-67022	None
Cable, System Fan, Internal	A6752-67023	None
DC-to-DC Converter, 48V (PCI VRM)	0950-4352	None
Filler, Bulkhead Core I/O	A6752-04017	None
Filler, Internal Disk	A6198-60002	None
Harness, Main Power	A6752-67025	None
Intrusion Switch	5040-6317	None
Jumper, PDU-PDU 2.5m C19/C20	8120-6884	None
Jumper, UPS-PDU 4.5m C19/C20	8120-6961	None
Kit, Removable Media Rail	A6752-67011	None
M-Cable	A6144-63001	None
Nameplate, rp7405	A7111-40001	
Nameplate, rp7410	A6752-40002	
Panel, PCI, Upper Right Side	A6752-67036	None
PCA, Front Panel (Display)[a]	A6752-67005	None
PCA, LAN/SCSI (Procurium)	A6794AX	A6794-69001
PCA, Mass Storage Backplane	A6752-67003	None
PCA, MP/SCSI (Core IO)	A6793AX	A6793-69001
PCA, System Backplane	A6752-60001	A6752-69001

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Table A-1   **hp rp7405/rp7410 Field Replaceable Unit (FRU) List (Continued)**

FRU Description	Replacement Part Number	Exchange Part Number
PCI Filler Plate	5001-6892	None
PCI Power Module (Brick)	0950-3819	A6093-69023
Power Cord, C19/CEE 7-7 4.5m Black CA Assembly	8120-6899	None
Power Cord, C19/GB 1002 4.5m Black CA Assembly	8121-0070	None
Power Cord, C19/IEC-309 L6-20 4.5m Black CA Assembly	8120-6897	None
Power Cord, C19/ISI-32 2.5m Black CA Assembly	8121-0161	None
Power Cord, C19/L6-20 4.5m Black CA Assembly	8120-6903	None
Power Cord, C19/unterminated International-Europe	8120-6895	None
Processor Module (650 MHz)	A6443AX	A6443-69001
Processor Module (750 MHz)	A644AX	A6444-69001
Processor Module (875 MHz)	A6435-67001	A6435-69001
Removable DAT Tape Drive (DDS4)	C5686-67203	C5686-69203
Removable DVD Drive	A5220-67003	None
Socket, PCX-W	1253-0703	None
VAC Value Added Chassis	A6752-04002	None

a. Cable assembly is part of the FRU.

B   System Specifications

This chapter describes the basic server configuration and its physical specifications and requirements:

Dimensions and Weights

This section provides dimensions and weights of the system components.

Table B-1   hp rp7405/rp7410 Server Dimensions and Weights

	Standalone	**Packaged**
Height - Inches (centimeters)	17.3 (43.9)	35.75 (90.8)
Width - Inches (centimeters)	17.5 (44.4)	28.0 (71.1)
Depth - Inches (centimeters)	30.0 (76.2)	28.38 (72.0)
Weight - Pounds (kilograms)	220 (100)	N./A

Shipping box, pallet, ramp, and container adds approximately 50 lbs to the total system weight. The size and number of miscellaneous pallets will be determined by the equipment ordered by the customer.

Table B-2   hp rp7405/rp7410 Component Weights

Quantity	**Description**	**Weight (lb/kg.)**
1 or 2	Cell board	19.81(9.0)
1	System backplane	12 (estimate) 5.44 (estimate)
1	PCI backplane	20.4 (9.25)
2	Bulk power supply	18 (8.2)
1	Mass storage backplane	1 (0.45)
2	PCI DC-to-DC converters	5 (2.27)

Electrical Specifications

This section provides electrical specifications for hp rp7405/rp7410 servers.

Grounding

The site building shall provide a safety ground/protective earth for each AC service entrance to all cabinets.

Install a PE (protective earthing) conductor that is identical in size, insulation material, and thickness to the branch-circuit supply conductors. The PE conductor must be green with yellow stripes. The earthing conductor described is to be connected from the unit to the building installation earth or, if supplied by a separately derived system, at the supply transformer or motor-generator set grounding point.

Circuit Breaker

The Marked Electrical for the hp rp7405/rp7410 server is 12 amps. The recommended circuit breaker size is 20 amps for North America. For countries outside North America, consult your local electrical authority having jurisdiction for the recommended circuit breaker size.

System AC Power Specifications

Power Cords

The supplied power cord length is 15 feet (457.4 cm). Table B-3 lists the various power cables available for use with a hp rp7405/rp7410 system. Each power cord is 15 feet (4.5 meters) in length with a IEC 60320-1 C19 female connector attached to one end.

Table B-3   Power Cords

Part Number	Description	Where Used
8120-6895	Stripped end, 240 volt	International-Europe
8120-6897	Male IEC309, 240 volt	International
8121-0070	Male GB-1002, 240 volts	China
8120-6899	Male CEEE 7/7, 240 volt	Continental Europe
8121-0558	Male ISI-32, 240 volts	Israel
8120-6903	Male NEMA L6-20, 240 volt	North America/Japan

System Power Specifications

Table B-4 and Table B-5 list the AC power requirements for an hp rp7405/rp7410 server. These tables provide information to help determine the amount of AC power needed for your computer room.

Table B-4   AC Power Specifications

Requirements	Value	Comments
Nominal input voltage	200, 208, 220, 240 VAC	
Minimum Operating Voltage	180 VAC	
Maximum Operating Voltage	269 VAC	
Frequency range (minimum - maximum)	50 - 60 (Hz)	
Number of phases	1	
Rated line current	12 A rms	
Maximum inrush current	30 A peak for 15 ms	Per line cord
Dropout carry-through time at minimum line voltage	20 ms	
Circuit breaker rating	20 A	Per line cord
Branch Circuit Breaker (Size, Type)	20A, slow trip delay type	
Power factor correction	>0.97 @269VAC >0.93 @262VAC	At all loads of 50% - 100% of supply rating At all loads 0f 30% - 50% of supply rating
Ground leakage current (mA)	<3.0 (ma)	Per line cord
kVA rating	2.7 KVA	

Table B-5   System Power Requirements

Power Required (50 - 60 Hz)	VA	Comments
Maximum configuration hp rp7405/rp7410 server PA8700	3000	Theoretical
Typical configuration hp rp7405/rp7410 server PA8700	1700	Typical

Future upgrades may increase the Maximum Theoretical System Power to 3400 VA.

Maximum power is the sum of the worst case power consumption of every subsystem in the box, and should be used to size worst case power consumption for facility installation. Typical power consumption numbers are what HP engineers have measured running power intensive applications. These are generally lower than maximum power numbers due to the fact that getting all of the subsystems in the box to simultaneously draw maximum power for long durations being uncommon.

Environmental Specifications

This section provides the environmental, power dissipation, noise emission, and air flow specifications for the hp rp7405/rp7410 server.

Temperature and Humidity

The cabinet is actively cooled using forced convection in a Class C1-modified environment.

Operating Environment

The system is designed to run continuously and meet reliability goals in an ambient temperature of 5° C - 35° C at sea level. The maximum allowable temperature is derated 1° C per 1000 feet of elevation above 5000 feet above sea level up to 30° C at 10,000 feet. For optimum reliability and performance, the recommended operating range is 20° C to 25° C

Environmental Temperature Sensor

To ensure that the system is operating within the published limits, the ambient operating temperature is measured using a sensor placed near the chassis inlet, between the cell boards. Data from the sensor is used to control the fan speed and also to initiate system overtemp shutdown. (For more details see the platform management section.)

Non-Operating Environment

The system is designed to withstand ambient temperatures between -40° C to 70° C under non-operating conditions.

Cooling

Cell Section Cooling

The cabinet incorporates front to back airflow across the cell boards and system backplane. Two (2) 150mm fans, mounted externally on the front chassis wall behind the cosmetic front bezel, push air into the Cell section; and two (2) 150mm fans housed in cosmetic plastic fan carriers and mounted externally to the rear chassis wall, pull air through the Cell section.

Each cell area fan cooling is controlled by a smart fan control board, embedded in the fan module plastic housing. The smart fan control board receives fan control input from the system fan controller on the system backplane and returns fan status information to the system fan controller. The smart fan control board also controls the power and the pulse width modulated control signal to the fan and monitors the speed indicator back from the fan. The fan status LED is driven by the smart fan control board.

Bulk Power Supply Cooling

Cooling for the bulk power supplies is provided by two (2) 60mm fans contained within each BPS. Air flows into the front of the BPS and is exhausted out of the top of the power supply though upward facing vents near the rear of the supply. The air is then ducted out of the rear of the chassis with minimal leakage into the cell airflow plenum.

PCI/Mass Storage Section Cooling

Six (6) 92mm fans located between the Mass Storage Devices and the PCI Card Cage provide airflow through these devices. The PCI fans are powered off of housekeeping power and + run at full speed at all times. The air is pulled through the mass storage devices and pushed through the PCI Card Cage. Perforation is provided between the PCI bulkheads to allow adequate exhaust ventilation and to help reduce the localized airflow dead spots that typically occur at the faceplate tail of each PCI card.

Standby Cooling

Several components within the chassis consume significant amounts of power while the system is in standby mode. The system fans will be run at 1541 rpm, or 38% of full speed, during standby to remove the resulting heat from the cabinet. The fans within the power supply will operate at full speed during standby.

Typical Power Dissipation and Cooling

Table B-6   Typical hp rp7405/rp7410 Configurations

Cell Boards	Memory Per Cell Board	PCI Cards (assumes 10 watts each)	DVDs	Hard Disk Drives	Core I/O	Bulk Power Supplies	Typical Power	Typical Cooling
Qty	GBytes	Qty	Qty	Qty	Qty	Qty	Watts	Watts
2	16	16	2	4	2	2	2000	6826
2	8	8	0	2	2	2	1810	6179
2	4	8	0	2	2	2	1757	5998
1	4	8	0	1	1	2	1148	3919

Acoustic Noise Specification

The acoustic noise specification for the hp rp7410 server is 57.3 db (sound pressure level at bystander position) It is appropriate for dedicated computer room environments, not office environments. The LwA is 7.5 Bels. Care should be taken to understand the acoustic noise specifications relative to operator positions within the computer room or when adding servers to computer rooms with existing noise sources.

Air Flow

The hp rp7405/rp7410 servers require that the cabinet air intake temperature be between 68° F and 77° F (20° C and 25° C) at 960 CFM.

Figure B-1 illustrates the location of the inlet and outlet airducts on a single cabinet.

Figure B-1   Airflow Diagram

C Site Preparation

Electrical Considerations

Proper design and installation of a power distribution system for an hp rp7405/rp7410 server requires specialized skills. Those responsible for this task must have a thorough knowledge and understanding of appropriate electrical codes and the limitations of the power systems for computer and data processing equipment.

In general, a well-designed power distribution system exceeds the requirements of most electrical codes. A good design, when coupled with proper installation practices, produces the most trouble-free operation.

The electrical factors discussed in this section are:

A detailed discussion of power distribution system design and installation is beyond the scope of this document. However, electrical factors relating to power distribution system design and installation must be considered during the site preparation process.

- Computer room safety

- Electrical load requirements (circuit breaker sizing)

- Power quality

- Distribution hardware

- System installation guidelines

Electrical Load Requirements (Circuit Breaker Sizing)

It is always a good idea to derate power distribution systems for one or more of the following reasons:

- To avoid nuisance tripping from load shifts or power transients, circuit protection devices should never be run above 80% of their root-mean-square (RMS) current ratings.

- Safety agencies derate most power connectors to 80% of their RMS current ratings.

Power Quality

This equipment is designed to operate over a wide range of voltages and frequencies. It has been tested and shown to comply with EMC Specification EN50082. However, damage can occur if these ranges are exceeded. Severe electrical disturbances can exceed the design specifications of the equipment.

Sources of Electrical Disturbances

Electrical disturbances, sometimes called glitches, affect the quality of electrical power. Common sources of these disturbances are:

- Fluctuations occurring within the facility's distribution system

- Utility service low-voltage conditions (such as sags or brownouts)

- Wide and rapid variations in input voltage levels

- Wide and rapid variations in input power frequency

- Electrical storms

- Large inductive sources (such as motors and welders)

- Faults in the distribution system wiring (such as loose connections)

- Microwave, radar, radio, or cell phone transmissions

Power System Protection

Computer systems can be protected from the sources of many of these electrical disturbances by using:

- A dedicated power distribution system

- Power conditioning equipment

- Over- and under-voltage detection and protection circuits

- Screening to cancel out the effects of undesirable transmissions

- Lightning arresters on power cables to protect equipment against electrical storms

Every precaution has been taken during power distribution system design to provide immunity to power outages of less than one cycle. However, testing cannot conclusively rule out loss of service. Therefore, adherence to the following guidelines provides the best possible performance of power distribution systems for server equipment:

- Dedicated power source—Isolates server power distribution system from other circuits in the facility.

- Missing-phase and low-voltage detectors—Shuts equipment down automatically when a severe power disruption occurs. For peripheral equipment, these devices are recommended but optional.

- Online uninterruptible power supply (UPS)—Keeps input voltage to devices constant and should be considered if outages of one-half cycle or more are common. Refer to qualified contractors or consultants for each situation.

Distribution Hardware

This section describes wire selection and the types of raceways (electrical conduits) used in the distribution system.

Wire Selection

Use copper conductors instead of aluminum, as aluminum's coefficient of expansion differs significantly from that of other metals used in power hardware. Because of this difference, aluminum conductors can cause connector hardware to work loose, overheat, and fail.

Raceway Systems (electrical conduits)

Raceways (electrical conduits) form part of the protective ground path for personnel and equipment. Raceways protect the wiring from accidental damage and also provide a heatsink for the wires.

Any of the following types may be used:

- Electrical metallic tubing (EMT) thin-wall tubing

- Rigid (metal) conduit

- Liquidtight with RFI strain relief (most commonly used with raised floors)

Building Distribution

All building feeders and branch circuitry should be in rigid metallic conduit with proper connectors (to provide ground continuity) Conduit that is exposed and subject to damage should be constructed of rigid galvanized steel.

Power Routing

Power drops and interface cables from the equipment are routed down from the power panel, through a grommet protected opening (beneath the floor level), and under the floor panels.

Grounding Systems

hp rp7405/rp7410 servers require two methods of grounding:

- Power distribution safety grounding

- High frequency intercabinet grounding

Power Distribution Safety Grounding

The power distribution safety grounding system consists of connecting various points in the power distribution system to earth ground using green (green/yellow) wire ground conductors. Having these ground connections tied to metal chassis parts that may be touched by computer room personnel protects them against shock hazard from current leakage and fault conditions.

Power distribution systems consist of several parts. Hewlett-Packard recommends that these parts be solidly interconnected to provide an equipotential ground to all points.

Main Building Electrical Ground

The main electrical service entrance equipment should have an earth ground connection, as required by applicable codes. Connections such as a grounding rod, building steel, or a conductive type cold water service pipe provide an earth ground.

Electrical Conduit Ground

All electrical conduits should be made of rigid metallic conduit that is securely connected together or bonded to panels and electrical boxes, so as to provide a continuous grounding system.

Power Panel Ground

Each power panel should be grounded to the electrical service entrance with green (green/yellow) wire ground conductors. The green (green/yellow) wire ground conductors should be sized per applicable codes (based on circuit over current device ratings).

NOTE	The green wire ground conductor mentioned above may be a black wire marked with green tape.

Computer Safety Ground

Ground all computer equipment with the green (green/yellow) wire included in the branch circuitry. The green (green/yellow) wire ground conductors should be connected to the appropriate power panel and should be sized per applicable codes (based on circuit over current device ratings).

Cabinet Performance Grounding (High frequency Ground)

Signal interconnects between system cabinets require high frequency ground return paths. Connect all cabinets to site ground.

NOTE	In some cases power distribution system green (green/yellow) wire ground conductors are too long and inductive to provide adequate high frequency ground return paths. Therefore, the server is shipped with a ground strap for connecting the system cabinet to the site grounding grid (customer-supplied). When connecting this ground, ensure that the raised floor is properly grounded.

Power panels located in close proximity to the computer equipment should also be connected to the site grounding grid. Methods of providing a sufficiently high frequency ground grid are described in the next sections.

Raised Floor Grounding

If a raised floor system is used, install a complete signal grounding grid for maintaining equal potential over a broad band of frequencies. The grounding grid should be connected to the equipment cabinet and electrical service entrance ground at multiple connection points using a minimum #6 AWG (16mm2) wire ground conductor.

Hewlett-Packard recommends the following approaches:

• Excellent—Add a grounding grid to the subfloor. The grounding grid should be made of aluminum strips mounted to the subfloor. The strips should be 0.032 in. (0.08 cm) thick and a minimum of 3.0 in. (8.0 cm) wide.

   Connect each pedestal to four strips using 1/4 in. (6.0 mm) bolts tightened to the manufacturer's torque recommendation.

- Good—Use the raised floor structure as a ground grid. In this case, the floor must be designed as a ground grid with bolted down stringers and corrosion resistive plating (to provide low resistance and attachment points for connection to service entrance ground and server equipment). The use of conductive floor tiles with this style of grid further enhances ground performance.

Figure C-1   Raised Floor Ground System
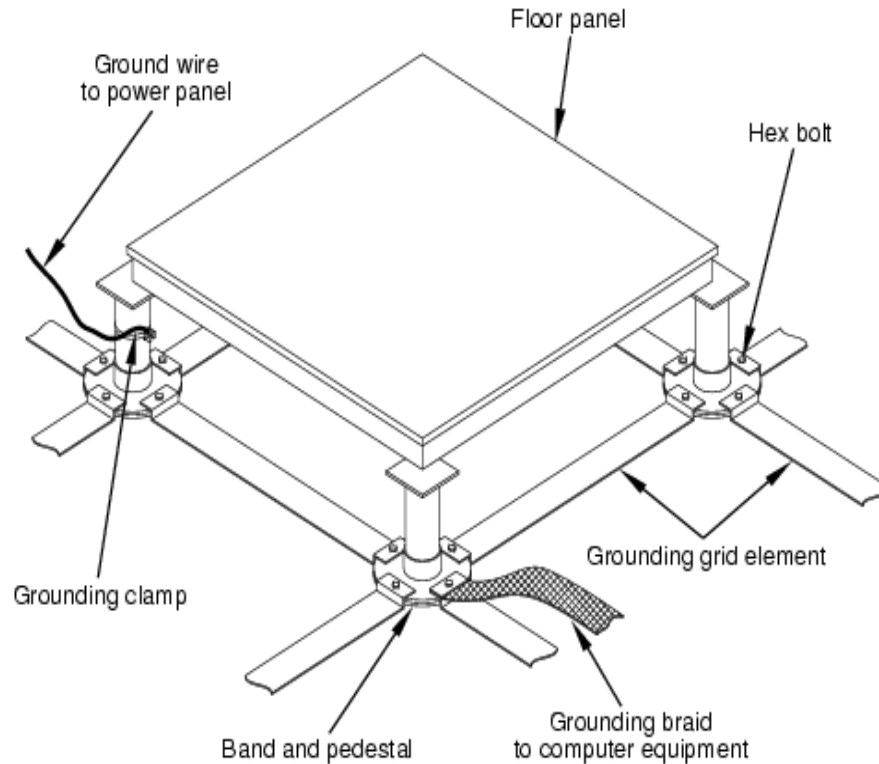
Equipment Grounding Implementation Details

If it has been determined to be necessary, connect all Hewlett-Packard equipment cabinets to the site ground grid as follows:

Step 1. Attach one end of each ground strap to the applicable cabinet ground lug.

Step 2. Attach the other end to the nearest pedestal base (raised floor) or cable trough ground point (nonraised floor).

Step 3. Check that the braid contact on each end of the ground strap consists of a terminal and connection hardware (a 1/4-in. (6.0-mm) bolt, nuts, and washers).

Step 4. Check that the braid contact connection points are free of paint or other insulating material and treated with a contact enhancement compound (similar to Burndy Penetrox).

System Installation Guidelines

This section contains information about installation practices. Some common pitfalls are highlighted. Both power cable and data communications cable installations are discussed.

NOTE   In domestic installations, the proper receptacles should be installed prior to the arrival of Hewlett-Packard equipment. Refer to the appropriate installation guide for installation procedures.

Wiring Connections

Expansion and contraction rates vary among different metals. Therefore, the integrity of an electrical connection depends on the restraining force applied. Connections that are too tight compress or deform the hardware and causes it to weaken. This usually leads to high impedance causing circuit breakers to trip.

CAUTION   Connections that are too loose have a high resistance that cause serious problems, such as erratic equipment operation. A high resistance connection overheats and sometimes causes fire or high temperatures that can destroy hard-to-replace components such as distribution panels or system bus bars.

Wiring connections must be properly torqued. Many equipment manufacturers specify the proper connection torque values for their hardware.

Ground connections must only be made on a conductive, nonpainted surface. When equipment vibration is present, lockwashers must be used on all connections to prevent connection hardware from working loose.

Data Communications Cables

Power transformers and heavy foot traffic create high energy fields. Route data communications cables away from these areas. Use shielded data communications cables that meet approved industry standards to reduce the effects of external fields.

Environmental Elements

The following environmental elements can affect an hp rp7405/rp7410 server installation:

- Computer room preparation

- Cooling requirements

- Humidity level

- Air conditioning ducts

- Dust and pollution control

- Electrostatic discharge (ESD) prevention

- Acoustics (noise reduction)

Computer Room Preparation

The following guidelines are recommended when preparing a computer room for an hp rp7405/rp7410 server system:

- Locate the computer room away from the exterior walls of the building to avoid the heat gain from windows and exterior wall surfaces.

- When exterior windows are unavoidable, use windows that are double or triple glazed and shaded to prevent direct sunlight from entering the computer room.

- Maintain the computer room at a positive pressure relative to surrounding spaces.

- Use a vapor barrier installed around the entire computer room envelope to restrain moisture migration.

- Caulk and vapor seal all pipes and cables that penetrate the envelope.

- Use at least a 12-inch raised floor system for the most favorable room air distribution system (underfloor distribution).

- Ensure a minimum ceiling height of 12 inches between the top of the server and the ceiling and that all ceiling clips are in place.

Basic Air Conditioning Equipment Requirements

The cooling capacity of the installed air conditioning equipment for the computer room should be sufficient to offset the computer equipment dissipation loads, as well as any space envelope heat gain. This equipment should include:

- Air filtration

- Cooling or dehumidification

- Humidification

- Reheating

- Air distribution

- System controls adequate to maintain the computer room within the operating range.

Lighting and personnel must also be included. For example, a person dissipates about 450 BTUs per hour while performing a typical computer room task.

At altitudes above 10,000 feet (3048 m), the lower air density reduces the cooling capability of air conditioning systems. If your facility is located above this altitude, the recommended temperature ranges may need to be modified. For each 1000 feet (305 m) increase in altitude above 10,000 feet (up to a maximum of 15,000 feet), subtract 1.5° F (0.83° C) from the upper limit of the temperature range.

Air Conditioning System Guidelines

The following guidelines are recommended when designing an air conditioning system and selecting the necessary equipment:

- The air conditioning system that serves the computer room should be capable of operating 24 hours a day, 365 days a year. It should also be independent of other systems in the building.

- Consider the long-term value of computer system availability, redundant air conditioning equipment or capacity.

- The system should be capable of handling any future computer system expansion.

- Air conditioning equipment air filters should have a minimum rating of 45% (based on "AShRA Standard 52-76, Dust Spot Efficiency Test").

- Introduce only enough outside air into the system to meet building code requirements (for human occupancy) and to maintain a positive air pressure in the computer room.

Air Conditioning System Types

The following three air conditioning system types are listed in order of preference:

- Complete self-contained package unit(s) with remote condenser(s)—These systems are available with up or down discharge and are usually located in the computer room.

- Chilled water package unit with remote chilled water plant—These systems are available with up or down discharge and are usually located in the computer room.

- Central station air handling units with remote refrigeration equipment—These systems are usually located outside the computer room

- Scalable overhead distribution system—This system distributes water overhead to air heat exchangers, which cool the air locally over the servers. This system called DataCool^{TM} is primarily used in high density environments of 100 to 500 watts per square foot.

Basic Air Distribution Systems

A basic air distribution system includes supply air and return air.

An air distribution system should be zoned to deliver an adequate amount of supply air to the cooling air intake vents of the computer system equipment cabinets. Supply air temperature should be maintained within the following parameters:

- Ceiling supply system—From 55° F (12.8° C) to 60° F (15.6° C)

- Floor supply system—At least 60° F (15.6° C)

If a ceiling plenum return air system or a ducted ceiling return air system is used, the return air grille(s) in the ceiling should be located directly above the computer equipment cabinets.

The following three types of air distribution system are listed in order of recommendation:

- Underfloor air distribution system—Downflow air conditioning equipment located on the raised floor of the computer room uses the cavity beneath the raised floor as plenum for the supply air.

  Perforated floor panels (available from the raised floor manufacturer) should be located around the perimeter of the system cabinets. Supply air emitted though the perforated floor panels is then available near the cooling air intake vents of the computer system cabinets.

- Ceiling plenum air distribution system—Supply air is ducted into the ceiling plenum from upflow air conditioning equipment located in the computer room or from an air handling unit (remote).

  The ceiling construction should resist air leakage. Place perforated ceiling panels (with down discharge air flow characteristics) around the perimeter of the system cabinets. The supply air emitted downward from the perforated ceiling panels is then available near the cooling air intake vents of the computer system cabinets.

  Return air should be ducted back to the air conditioning equipment though the return air duct above the ceiling.

- Above ceiling ducted air distribution system—Supply air is ducted into a ceiling diffuser system from upflow air conditioning equipment located in the computer room or from an air handling unit (remote).

  Adjust the supply air diffuser system grilles to direct the cooling air downward around the perimeter of the computer system cabinets. The supply air is then available near the cooling air intake vents of the computer system cabinets.

Table C-1   Computer Room Environment

Parameter	Operating Limits	Recommended Operating Range	Maximum Rate of Change (per hour)	Non-Operating Ranges
Temperature[a]	41° - 95° F (5° - 35° C)	68° - 77° F (20° - 25° C)	20° C/hour	-40° C - +70° C
Humidity	15% - 80% with no condensation (40% - 55% recommended)	40% - 55% RH non-condensing	30% RH/hour non-condensing	90% RH non-condensing @ 65° C (149° F)

a. The temperature ranges stated are at 0 to 5,000 feet. The maximum operating temperature must be de-rated by 1° C/1,000 feet from 5,000 to 10,000 feet.

Air Conditioning System Installation

All air conditioning equipment, materials, and installation must comply with any applicable construction codes. Installation of the various components of the air conditioning system must also conform to the air conditioning equipment manufacturer's recommendations.

Humidity Level

Maintain proper humidity levels. High humidity causes galvanic actions to occur between some dissimilar metals. This eventually causes a high resistance between connections, leading to equipment failures. High humidity can also have an adverse affect on some magnetic tapes and paper media.

CAUTION	Low humidity contributes to undesirably high levels of electrostatic charges. This increases the electrostatic discharge (ESD) voltage potential. ESD can cause component damage during servicing operations. Paper feed problems on high-speed printers are usually encountered in low-humidity environments.

Low humidity levels are often the result of the facility heating system and occur during the cold season. Most heating systems cause air to have a low humidity level, unless the system has a built-in humidifier.

Air Conditioning Ducts

Use separate computer room air conditioning duct work. If it is not separate from the rest of the building, it might be difficult to control cooling and air pressure levels. Duct work seals are important for maintaining a balanced air conditioning system and high static air pressure. Adequate cooling capacity means little if the direction and rate of air flow cannot be controlled because of poor duct sealing. Also, the ducts should not be exposed to warm air, or humidity levels may increase.

Dust and Pollution Control

Computer equipment can be adversely affected by dust and microscopic particles in the site environment.

Specifically, disk drives, tape drives, and some other mechanical devices can have bearing failures resulting from airborne abrasive particles. Dust may also blanket electronic components like printed circuit boards causing premature failure due to excess heat and/or humidity build up on the boards. Other failures to power supplies and other electronic components can be caused by metallically conductive particles. These metallic particles are conductive and can short circuit electronic components. Use every effort to ensure that the environment is as dust and particulant free as possible.

Smaller particles can pass though some filters and, over a period of time, resulting in possible cause problems in mechanical parts. Small dust particles can be prevented from entering the computer room by maintaining its air conditioning system at a high static air pressure level.

Other sources of dust, metallic, conductive, abrasive, and/or microscopic particles can be present. Some sources of these particulants are:

- Subfloor shedding

- Raised floor shedding

- Ceiling tile shedding

These pollutants are not always visible to the naked eye. A good check to determine their possible presence is to check the underside of the tiles. The tile should be shiny, galvanized, and free from rust.

The computer room should be kept clean. The following guidelines are recommended:

- Smoking—Establish a no-smoking policy. Cigarette smoke particles are eight times larger than the clearance between disk drive read/write heads and the disk surface.

- Printer—Locate printers and paper products in a separate room to eliminate paper particulate problems.

- Eating or drinking—Establish a no-eating or drinking policy. Spilled liquids can cause short circuits in equipment such as keyboards.

- Tile floors—Use a dust-absorbent cloth mop rather than a dry mop to clean tile floors.

Special precautions are necessary if the computer room is near a source of air pollution. Some air pollutants, especially hydrogen sulfide (H2S), are not only unpleasant but corrosive as well. Hydrogen sulfide damages wiring and delicate sound equipment. The use of activated charcoal filters reduces this form of air pollution.

Electrostatic Discharge (ESD) Prevention

Static charges (voltage levels) occur when objects are separated or rubbed together. The voltage level of a static charge is determined by the following factors:

- Types of materials

- Relative humidity

- Rate of change or separation

Table C-2 lists charge levels based on personnel activities and humidity levels.

Table C-2   Effect of Humidity on ESD Charge Levels

Personnel Activity[a]	Humidity[b] and Charge Levels (voltages)[c]			
	26%	32%	40%	50%
Person walking across a linoleum floor	**6,150 V**	**5,750 V**	**4,625 V**	**3,700 V**
Person walking across a carpeted floor	18,450 V	17,250 V	13,875 V	11,100 V
Person getting up from a plastic chair	24,600 V	23,000 V	18,500 V	14,800 V

a. Source: B.A. Unger, Electrostatic Discharge Failures of Semiconductor Devices (Bell Laboratories, 1981)
b. For the same relative humidity level, a high rate of airflow produces higher static charges than a low airflow rate.
c. Some data in this table has been extrapolated.

Static Protection Measures

Follow these precautions to minimize possible ESD-induced failures in the computer room:

- Install conductive flooring (conductive adhesive must be used when laying tiles).

- Use conductive wax if waxed floors are necessary.

- Ensure that all equipment and flooring are properly grounded and are at the same ground potential.

- Use conductive tables and chairs.

- Use a grounded wrist strap (or other grounding method) when handling circuit boards.

- Store spare electronic modules in antistatic containers.

- Maintain recommended humidity level and airflow rates in the computer room.

Acoustics

Computer equipment and air conditioning blowers cause computer rooms to be noisy. Ambient noise level in a computer room can be reduced as follows:

- Dropped ceiling—Cover with a commercial grade of fire-resistant, acoustic rated, fiberglass ceiling tile.

- Sound deadening—Cover the walls with curtains or other sound deadening material.

- Removable partitions—Use foam rubber models for most effectiveness.

Computer Room Safety

Inside the computer room, fire protection and adequate lighting (for equipment servicing) are important safety considerations. Federal and local safety codes govern computer installations.

Fire Protection

The national Fire Protection Association's Standard for the Protection of Electronic Computer Data Processing Equipment, NFPA 75, contains information on safety monitoring equipment for computer rooms.

Most computer room installations are equipped with the following fire protection devices:

- Smoke detectors
- Fire and temperature alarms
- Fire extinguishing system

Additional safety devices are:

- Circuit breakers
- An emergency power cutoff switch
- Devices specific to the geographic location i.e., earthquake protection

Lighting Requirements for Equipment Servicing

Adequate lighting and utility outlets in a computer room reduce the possibility of accidents during equipment servicing. Safer servicing is also more efficient and, therefore, less costly.

For example, it is difficult to see cable connection points on the hardware if there is not enough light. Adequate lighting reduces the chances of connector damage when cables are installed or removed.

The minimum recommended illumination level is 70 foot-candles (756 lumens per square meter) when the light level is measured at 30 inches (76.2 cm) above the floor.

Facility Characteristics

This section contains information about facility characteristics that must be considered for the installation or operation of an hp rp7405/rp7410 server. Facility characteristics are:

- Floor loading

- Windows

- Altitude effects

Floor Loading

The computer room floor must be able to support the total weight of the installed computer system as well as the weight of the individual cabinets as they are moved into position.

Floor loading is usually not an issue in nonraised floor installations. The information presented in this section is directed toward raised floor installations.

| NOTE | Any floor system under consideration for an hp rp7405/rp7410 server installation should be verified by an appropriate floor system consultant. |

Raised Floor Loading

Raised floor loading is a function of the manufacturer's load specification and the positioning of the equipment relative to the raised floor grid. While Hewlett-Packard cannot assume responsibility for determining the suitability of a particular raised floor system, it does provide information and illustrations for the customer or local agencies to determine installation requirements.

The following guidelines are recommended:

- Because many raised floor systems do not have grid stringers between floor stands, the lateral support for the floor stands depends on adjacent panels being in place. To avoid compromising this type of floor system while gaining under floor access, remove only one floor panel at a time.

- Larger floor grids (bigger panels) are generally rated for lighter loads.

| CAUTION | Do not install any raised floor system until you have carefully examined it to verify that it is adequate to support the appropriate installation. |

Floor Loading Terms

Table C-3 defines floor loading terms.

Table C-3   Floor Loading Term Definitions

Term	Definition
Dead load	The weight of the raised panel floor system, including the understructure. Expressed in lb/ft2 (kg/m2).
Live load	The load that the floor system can safely support. Expressed in lb/ft2 (kg/m2).

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Table C-3   Floor Loading Term Definitions (Continued)

Term	Definition
Concentrated load	The load that a floor panel can support on a 1-in2 (6.45 cm2) area at the panel's weakest point (typically the center of the panel), without the surface of the panel deflecting more than a predetermined amount.
Ultimate load	The maximum load (per floor panel) that the floor system can support without failure. Failure expressed by floor panel(s) breaking or bending. Ultimate load is usually stated as load per floor panel.
Rolling load	The load a floor panel can support (without failure) when a wheel of specified diameter and width is rolled across the panel.
Average floor load	Computed by dividing total equipment weight by the area of its footprint. This value is expressed in lb/ft2 (kg/m2).

Average Floor Loading

The average floor load value, defined in Table C-4, is not appropriate for addressing raised floor ratings at the floor grid spacing level. However, it is useful for determining floor loading at the building level, such as the area of solid floor or span of raised floor tiles covered by the hp rp7405/rp7410 server footprint.

Typical Raised Floor Site

This section contains an example of a computer room raised floor system that is satisfactory for the installation of an hp rp7405/rp7410 server.

Based on specific information provided by Hewlett-Packard, Tate Access Floors has approved its Series 800 all-steel access floor with bolt-together stringers and 24 in. (61.0 cm) by 24 in. (61.0 cm) floor panels.

In the event that the flooring is being replaced or a new floor is being installed, Tate Access Floors recommends its Series 1250 all-steel access floor with bolt-together stringers and 24 in. (61.0 cm) by 24 in. (61.0 cm) floor panels be used to support the server installation.

NOTE   If the specific floor being evaluated or considered is other than a Tate Series 800 floor, the specific floor manufacturer must be contacted to evaluate the floor being used.

Table C-4 lists specifications for the Tate Access Floors Series 800 raised floor system.

Table C-4   Typical Raised Floor Specifications

Item[a]	Rating
Dead load	7 lb/ft 2 (34.2 kg/m2)
Live load	313 lb/ft 2 (1528.3 kg/m2)
Concentrated load[b]	1250 lb (567 kg)

Table C-4   Typical Raised Floor Specifications (Continued)

Item[a]	Rating
Ultimate load	4000 lb (1814 kg) per panel
Rolling load	400 lb (181 kg)
Average floor load	500 lb (227 kg)

a. From Table C-3 on page 117
b. With 0.08 in (0.2 cm) of span maximum deflection

Windows

Avoid housing computers in a room with windows. Sunlight entering a computer room may cause problems. Magnetic tape storage media is damaged if exposed to direct sunlight. Also, the heat generated by sunlight places an additional load on the cooling system.

Space Requirements

This section contains information about space requirements for an hp rp7405/rp7410 server. This data should be used as the basic guideline for space plan developments. Other factors, such as airflow, lighting, and equipment space requirements must also be considered.

Delivery Space Requirements

There should be enough clearance to move equipment safely from the receiving area to the computer room. Permanent obstructions, such as pillars or narrow doorways, can cause equipment damage.

Delivery plans should include the possible removal of walls or doors.

Figure C-2   Cabinet Dimensions
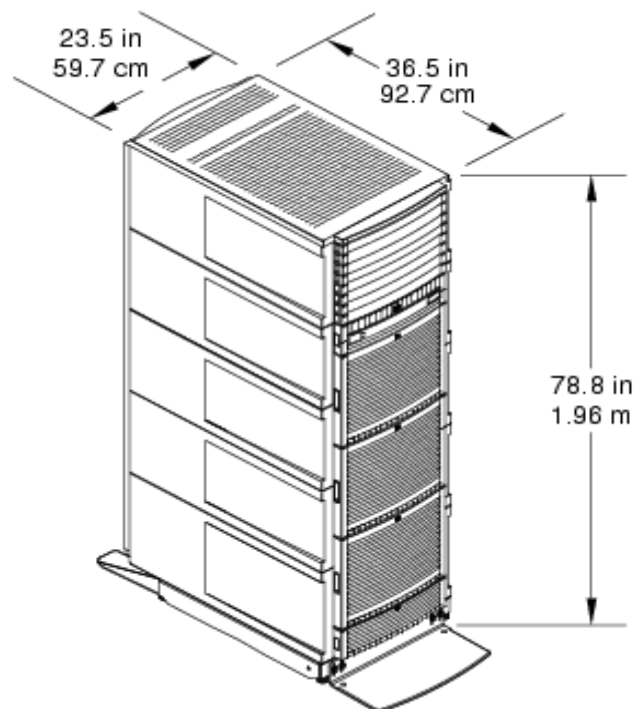
Operational Space Requirements

Other factors must be considered along with the basic equipment dimensions. Reduced airflow around equipment causes overheating, which can lead to equipment failure. Therefore, the location and orientation of air conditioning ducts, as well as airflow direction, are important. Obstructions to equipment intake or exhaust airflow must be eliminated.

The locations of lighting fixtures and utility outlets affect servicing operations. Plan equipment layout to take advantage of lighting and utility outlets. Do not forget to include clearance for opening and closing equipment doors.

Clearance around the cabinets must be provided for proper cooling airflow through the equipment.

The service area space requirements, shown in Figure C-3, are minimum dimensions. If other equipment is located so that it exhausts heated air near the cooling air intakes of the computer system cabinets, larger space requirements are needed to keep ambient air intake to the computer system cabinets within the specified temperature and humidity ranges.

Figure C-3   Footprint
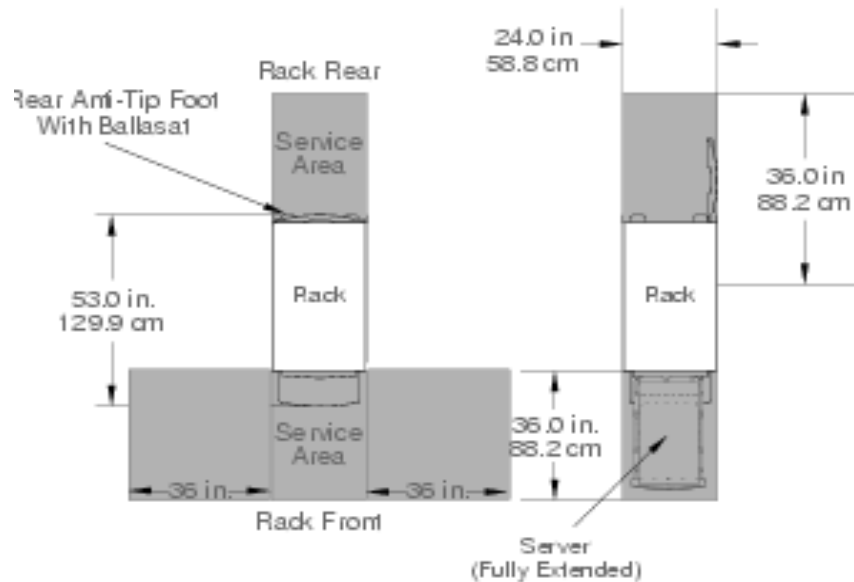
Space planning should also include the possible addition of equipment or other changes in space requirements. Equipment layout plans should also include provisions for the following:

- Channels or fixtures used for routing data cables and power cables

- Access to air conditioning ducts, filters, lighting, and electrical power hardware

- Power conditioning equipment

- Cabinets for cleaning materials

- Maintenance area and spare parts

Appendix C   **121**

Zinc Particle Contamination

Metallic particulates can be especially harmful around electronic equipment. This type of contamination may enter the data center environment from a variety of sources, including but not limited to raised floor tiles, worn air conditioning parts, heating ducts, rotor brushes in vacuum cleaners or printer component wear. Because metallic particulates conduct electricity, they have an increased potential for creating short circuits in electronic equipment. This problem is exaggerated by the increasingly dense circuitry of electronic equipment.

Over time, very fine whiskers of pure metal can form on electroplated zinc, cadmium, or tin surfaces. If these whiskers are disturbed, they may break off and become airborne, possibly causing failures or operational interruptions. For over 50 years, the electronics industry has been aware of the relatively rare but possible threat posed by metallic particulate contamination. During recent years, a growing concern has developed in computer rooms where these conductive contaminants are formed on the bottom of some raised floor tiles.

Although this problem is relatively rare, it may be an issue within your computer room. Since metallic contamination can cause permanent or intermittent failures on your electronic equipment, Hewlett-Packard strongly recommends that your site be evaluated for metallic particulate contamination before installation of electronic equipment.

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