COMPAQ
STORAGEWORKS

Enclosure 4200 Family
LVD Disk Enclosures

User Guide

First Edition (July 1999)
Part Number: EK–SW2ZS–UG. A01 / 148451–001
Compaq Computer Corporation

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Model 4200 Family LVD Disk Enclosure
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About This Guide

Intended Audience

This publication is designed for use by Compaq StorageWorks users who are responsible for installing and maintaining the Model 4214R (rack) and 4214T (tower) Ultra2 SCSI low voltage differential (LVD) disk enclosures.

How this Guide is Arranged

This manual discusses the product features and operations from the general to the specific. The major sections of this publication include:

Chapter 1, "Introducing the Enclosure"

This chapter is a description of the LVD disk enclosure features and elements.

Chapter 2, "Starting the Enclosure"

This chapter discusses operating an LVD disk enclosure.

Chapter 3, "I/O Module"

This chapter discusses the I/O modules functions, operation, and status displays.

Chapter 4, “Disk Drives”

This chapter describes the disk drives, operation, and status reporting.

Chapter 5, “Enclosure Power and Cooling”

The chapter describes the power supply and fan operation and status reporting.

Chapter 6, “Replacing CRUs”

This chapter describes the procedures for replacing customer replaceable units (CRUs).

Appendix A, “Regulatory Notices”

This appendix defines the country-specific regulatory standards for this product.

Appendix B, “Specifications”

This appendix describes the physical, environmental, and electrical specifications of the LVD disk enclosure and elements.

Glossary

The glossary defines terms common to this product.

Index

An alphabetical reference to major subjects.

Documentation Conventions

The documentation conventions used in this publication are shown in Table 1.

Table 1 Documentation Conventions

Symbol	Description
Boldface type	Boldface type indicates the first instance of terms being defined in the text, the glossary, or both.
italic type	Italic type indicates one of the following: ■ Emphasis ■ A publication title ■ A glossary cross-reference to another glossary entry.
	Caution *Text symbol* for information essential to avoid damaging software, hardware, or data.
Note	Notes contain information of *special interest*.
	WARNING *Text symbol* for actions required to prevent the possibility of personal injury.
	Enclosure and EMU LED label (Symbol definitions follow.)
	Enclosure Status LED symbol (green)
	Enclosure Power Status LED symbol (green)
	NOTE: This *LED symbol* is not the same as the *text symbol* for an action required to prevent the possibility of personal injury. Enclosure Fault LED symbol (amber)
	I/O module LED label Terminator Status LED (green)

Table 1 Documentation Conventions (Continued)

Symbol	Description
	I/O module LED label Power Status (ON) or EMU Locate (FLASHING) LED (green)
	I/O module label Ultra2 SCSI, Single Bus, LVD input connector
	Light emitting diode (LED) is OFF.
	LED is FLASHING.
	LED is ON.

Related Documents

Table 2 lists publications that contain additional information relevant to the LVD disk enclosure products.

Table 2 Related Publications

StorageWorks Publication Title	Part Number
Disk Enclosure RETMA Rack Mounting Kit Installation Card	127430-001
Disk Enclosure RETMA Rack Mounting Template	102943-001
Environmental Monitoring Unit for Enclosure Models 4214R and 4214T User Guide	122941-001
Hot-Pluggable Wide-Ultra2 SCSI Hard Drives Installation Card	386195-001
Replacing a Disk Enclosure Environmental Monitoring Unit Installation Guide	148455-001
Replacing a Disk Enclosure Power Supply Installation Guide	148454-001
Replacing a Disk Enclosure Ultra2 SCSI I/O Module Installation Guide	148453-001
Replacing a Disk Enclosure Variable Speed Fan Installation Guide	148452-001
Tower Model 4200T-Series User Guide	122942-001

Chapter 1

Introducing the Enclosure

This chapter describes of the StorageWorks Enclosure 4200 family of **low voltage differential** (**LVD**) disk enclosures (see Figure 1–1 and Figure 1–2). These enclosures support **Wide-Ultra** and **Wide-Ultra2 small computer system interface** (**SCSI**) protocols. The internal bus supports *only* LVD drives. The external bus (the enclosure to the host controller bus) supports either Wide-Ultra2 (LVD) and or Wide-Ultra **single-ended** (**SE**) SCSI protocols.

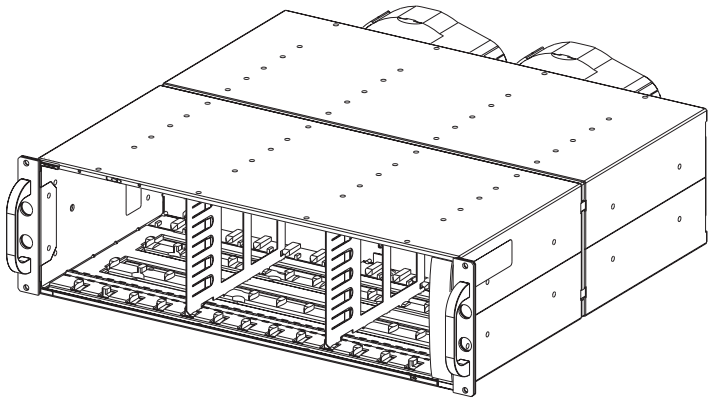

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Figure 1–1. Disk Enclosure (Front View)

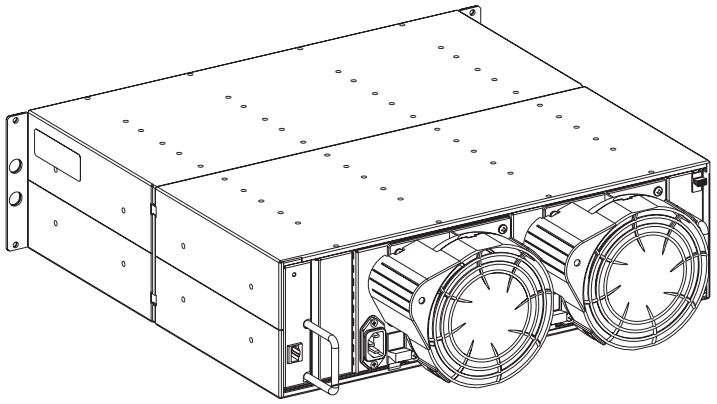

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Figure 1–2. Disk Enclosure (Rear View)

Disk Enclosure Features

The Model 4214 enclosure supports up to fourteen, 1-inch high, 3.5-inch **form factor hard disk drives**. This enclosure is available in either a rack mountable version (4214R) or in a tower (4214T). A rack (cabinet) mounted enclosure requires a RETMA 3U vertical opening (5.25-inches) where a “U” is 1.75-inches.

The enclosure provides several features, including:

- **Hot-pluggable** drives, **environmental monitoring unit** (**EMU**), **fans**, and **power supplies** are replaceable without halting SCSI bus data transfers.
- **Pluggable I/O module** and SCSI bus cables require **quiescing** the bus (that is, stopping all data transfers), but do not require removing power before replacing.
- Depending upon the host controller, the I/O module is capable of supporting Wide-Ultra SCSI (LVD) or Wide-Ultra SCSI (SE) bus operations.
- Depending upon the host-interface controller, an EMU may support the automatic monitoring of specific enclosure and drive functions.

The enclosure has guides that ensure the drives, EMU, I/O module, and power supplies (the enclosure **elements**) align and properly mate with the backplane connectors. A guide post on the fan ensures that the fan properly mates with the power supply. The elements and the metal enclosure provide **electromagnetic interference** (**EMI**) suppression and control airflow within the enclosure.

SCSI Buses

The enclosure supports only Wide-Ultra2 SCSI, wide (16-bit), *internal* LVD buses. Depending on the host interface, the external SCSI bus, the bus from the I/O module to the host can be either Wide-Ultra or Wide-Ultra2, LVD or SE. The SCSI bus type determines the length of this bus, and therefore, the maximum cable length. The *standard* Compaq cable length of 12 ft (3.7 m) ensures satisfactory operation. As for all SCSI buses, the shorter the cable, the more efficient the bus operation.

High Availability

The high availability features of the enclosure are a function of the fans and the power supplies.

Variable Speed Fans

All enclosures have two variable speed fans. In all configurations, the failure of one fan automatically causes the other fan to operate at a high speed. This ensures that the failure of a *single* fan does not disable the enclosure.

Power Supplies

In a single power supply configuration, the failure of a power supply disables the enclosure. Use the *optional* redundant power supply configuration to prevent this. In this configuration, the failure of a single power supply or fan does not disable the enclosure.

Data Integrity

Data integrity could be compromised if data transfers occur when there is no DC power to the I/O module or the drives, To avoid inducing errors, the power pins on these elements are longer than the data pins. This ensures that power is always present when a data transfer occurs.

Status Monitoring and Display

The major status monitoring capabilities of these enclosures include:

- Displaying the enclosure status on the enclosure LEDs
- Displaying the element status on the power supply, EMU, drive, and I/O module LEDs
- Detecting the installation of a fan, power supply, drive, or I/O module
- Detecting the removal of a fan, power supply, drive, or I/O module
- Sensing enclosure temperatures
- Sensing power supply voltage, current, and total power

The EMU user guide describes the functions and features of the EMU.

Enclosure Layout

The physical layout of the enclosure is the same whether in a rack or a tower. The drives mount in the **bays** in the front of the enclosure. These bays are numbered from the left (bay ❶) to the right (bay ⓮, see Figure 1–3). The common method of referring to a drive is by the bay number. The drive in bay ❶ is drive 1, the drive in bay ❽ is drive 8, and so forth.

At location ⓯ are the three enclosure status LEDs.

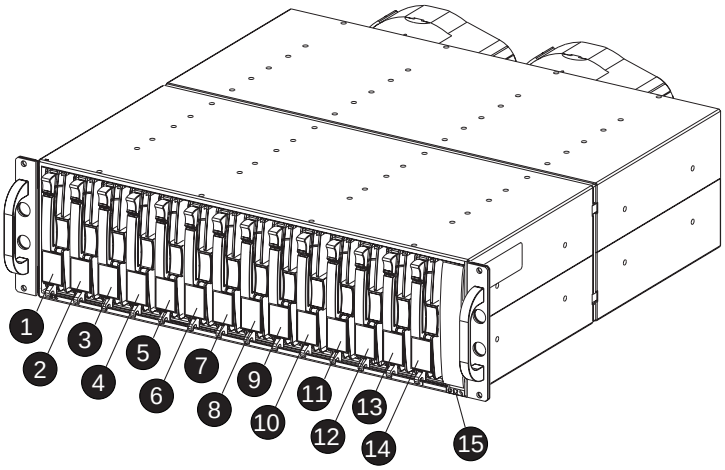
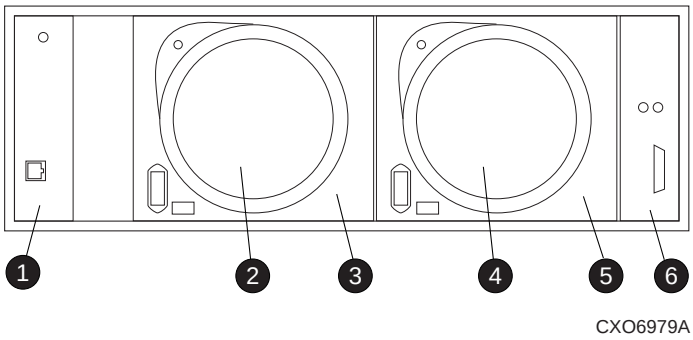


Figure 1–3. Front Mounted Elements

The I/O module, power supplies, fans, EMU, and cables mount in the rear of the enclosure (see Figure 1–4).



❶ EMU
❷ Fan 1
❸ Power Supply Bay 1, or Fan Mounting Assembly[1]
❹ Fan 2
❺ Power Supply Bay 2
❻ I/O Module

1. In a single power supply configuration, the fan mounts on the fan mounting assembly.

Figure 1–4. Rear Mounted Elements

Major Elements

The elements each enclosure requires for proper operation include:

- An EMU
- Two power supplies, or
  1 power supply and 1 fan mounting assembly
- Two Fans
- An I/O module
- A disk drive or disk drive blank in each bay

Element Functions

A full description of the individual elements and their functions can be found in the individual chapters.

Element Replacement

The methods used to replace an element depend upon several factors. The primary factors are:

- **Could element replacement affect SCSI bus operation?**
  When the element being replaced does not interrupt data transfer nor affect the operation of another element, the element is "**hot-pluggable**."

  If replacement of the element could affect data transfers or the operation of another element, the element replacement method is "**pluggable**."
- **Are there any personal safety issues involved?**
  Whenever there is an issue involving personal safety, such as an electrical hazard, then the element replacement requires quiescing the SCSI bus and *removing power* from the enclosure.

  Table 1–1 identifies the replacement method and type of replacement for each element.

Table 1–1 CRU Replacement Methods

Element	Method
Drive	Hot-pluggable
EMU	Hot-pluggable

Table 1–1 CRU Replacement Methods (Continued)

Element	Method
Fan	Hot-pluggable
I/O Module	Hot-pluggable
Power Supply–Dual	Hot-pluggable
Power Supply–Single	No Power Applied[1]
SCSI Bus Cables	Pluggable

1. In a single power supply configuration, the enclosure is disabled when the power supply fails.

Chapter 2

Starting the Enclosure

With the enclosure installed in a rack or tower it is necessary to:

1. Connect the SCSI bus cables.
2. Apply power.
3. Verify proper operation.

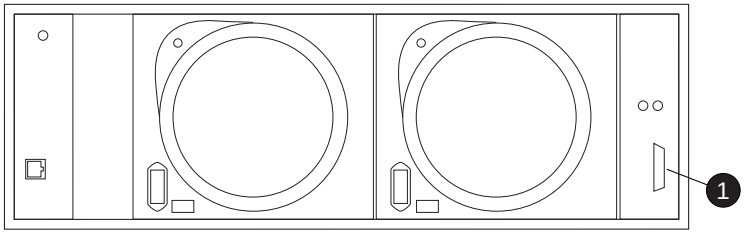
Connecting the SCSI Bus Cables

Connecting the enclosure to a host adapter or SCSI bus controller is simply a matter of connecting cables to the I/O module. All I/O modules has 68-pin, **very high density computer interface** (**VHDCI**) connectors.

Figure 2–1 shows the cable connectors for a single bus configuration.

CAUTION: Connecting or disconnecting a SCSI bus cable while data is being transferred causes the loss of data.

To prevent inducing an error, *always* quiesce the SCSI bus before connecting or disconnecting a cable.



❶ Primary host controller connector

Figure 2–1. Single Bus Cable Connection

Table 2–1 lists the host array controller cables available. As for any SCSI bus, using the shortest length cable possible enhances performance.

Table 2–1 SCSI Bus Cables

Description	Length		Part Number
	Meters	Feet	
68-conductor SCSI cable with	1.8	6	332616-001
2 Vertical Offset VHDCI straight plug connectors	3.7	12	332616-002[1]
with jack screws	11.9	39	150214-B21[2]

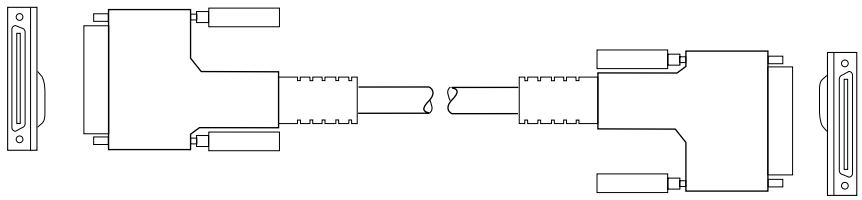
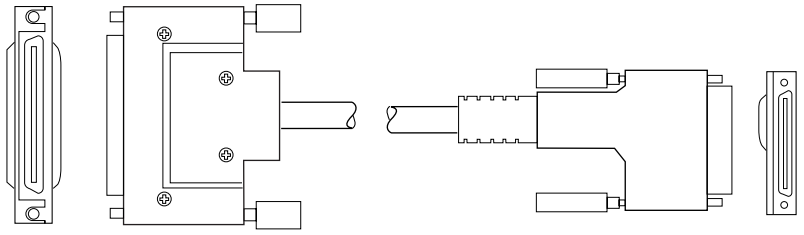


Table 2–1 SCSI Bus Cables (Continued)

Description	Length		Part Number
	Meters	Feet	
68-conductor SCSI cable with	1.8	6	110941-001
1 High-Density straight plug connector with jack screws 1 Vertical Offset VHDCI straight plug connector with jack screws	3.7	12	110941-002[1]



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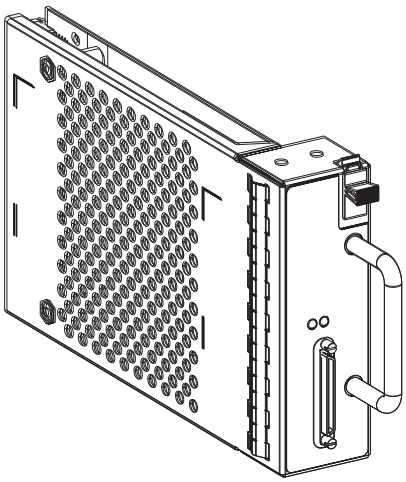
1. One cable provided with each enclosure.
2. Use only with Ultra2 SCSI LVD bus operating at speeds of 80 Mb/sec or less.

Table 2–2 Installing SCSI Bus Cables

1. Stop all SCSI bus data transfers.
2. Align the D-shaped cable connector with D-shaped I/O module connector.



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3. Firmly seat the cable connector on the module connector.
4. Finger tighten the thumbscrews to fully seat the connector.
5. Restart data transfers over the SCSI bus.

Applying Power

There are no disk enclosure power control switches. Connecting an AC power cord from a power source to the power supply is all that is required. When a power supply has an AC input, it develops and distributes DC voltages within the enclosure.

Verifying Operation

Applying power causes the elements to begin operating. Check the enclosure status LEDs in the front, lower right corner (see Figure 2–2). If the display is not exactly as shown, there is an element error condition. Check the drive and enclosure status LEDs on the front and the EMU, power supplies, fans, and I/O module status LEDs on the rear (see Figure 2–3) to determine the defective element.

NOTE: There are two different drive displays for a properly functioning disk.

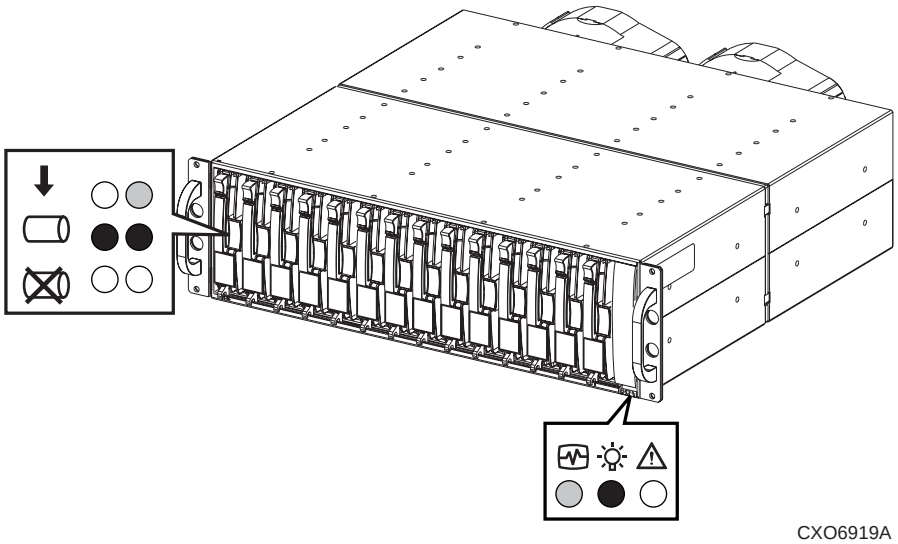

Figure 2–2. Front Status LEDs

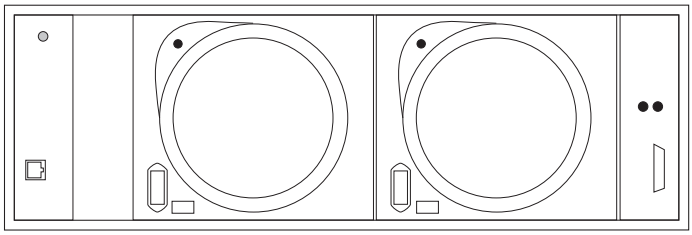

Figure 2–3. Rear Status LEDs

Chapter 3

I/O Module

This chapter discusses the operation and function of the LVD disk enclosure I/O module (the “module”).

Each enclosure requires an I/O module for operation with a wide (16-bit) controller SCSI bus. The module is the CRU that connects the enclosure to the host controller through a 68-pin, VHDCI connector and a SCSI bus cable. This module can support a maximum of 14 drives in a single enclosure or on a single-bus.

The host adapter or controller determines whether the external bus is LVD or SE. Regardless of the host controller type, the internal SCSI bus to the devices is always a Wide-Ultra2 SCSI LVD bus.

The module is the interface between the host controller (the initiator) the drives and the EMU. Each enclosure has two SCSI buses. Half of the disks drive bays are on each bus. The module shown in Figure 3–1 links the two SCSI buses into a single bus.

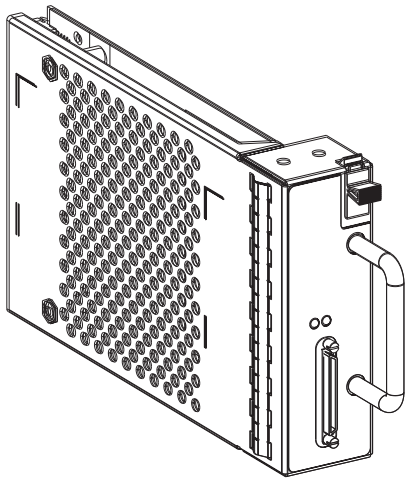

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Figure 3–1. Single-Bus I/O Module

Module Power Protection

A sensor on the +5 VDC line in the module detects overcurrent conditions. Should this error occur, the sensor disconnects the voltage from the module and the power LED is OFF (see Figure 3–2). This disables the module until one of the following conditions occurs:

- The overcurrent condition no longer exists.
- The defective module is replaced.

A disabled module prevents data transfers between the host controller and the drives, and the host controller and the EMU. An LED on the module displays the module power status.

Single-Bus Module

This section describes the unique features of the single-bus module. This module (see Figure 3–1) has *one* VHDCI connector and *two* LEDs.

SCSI Bus Connectors

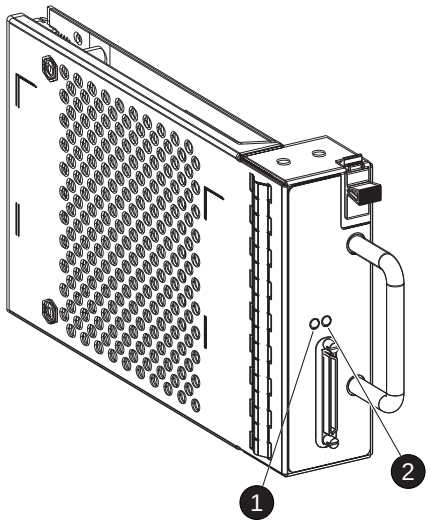
The 68-pin VHDCI connector enables you to configure the enclosure as single-bus, single initiator subsystem.

SCSI Bus Termination

A SCSI bus is defined by two bus terminators. The *external bus* has terminators on the controller and on the module. Each *internal bus* has a terminator on the module and on the backplane. The module connects the external bus and the internal bus together. On each module, there is a green LED (see Figure 3–2) that defines the status of internal bus, backplane terminator.

Status Displays

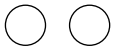
See Figure 3–2 for the location of the two green status LEDs, and Table 3–1 for a description of the LED displays.



❶ Terminator Status LED ❷ Power or Locate LED

Figure 3–2. Single Bus Status LEDs

Table 3–1 Single-Bus Module LED Displays

LEDs	Definition
Operational Status LED Displays	
	Terminator enabled (LED ON) Module power present (LED ON)
	Terminator enabled (LED ON) EMU locating module (LED FLASHING)
Nonoperational Status LED Display	
	No module power Module nonoperational

SCSI Address Map

The module assigns a SCSI address to each drive bay in the enclosure using a SCSI address map. The active map (see Table 3–2) is determined by a combination of:

- Backplane
- EMU
- I/O module

Each disk drive bay and each controller has a SCSI bus ID. The factory-assigned disk enclosure addresses are shown in Table 3–2.

Table 3–2 Disk Enclosure Bay Addresses

Bay	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SCSI ID	00	01	02	03	04	05	08	09	10	11	12	13	14	15

Replacing an I/O Module

Replacing an I/O module requires you to order a replacement using the spare part number (see Chapter 6, “Replacing CRUs”).

Each I/O module replacement kit contains detailed replacement instructions.

Chapter 4

Disk Drives

The enclosure supports Compaq hot-pluggable, Wide-Ultra2 SCSI, LVD disk drives. This chapter describes the disk drive features, functions, and characteristics.

The 14-disk enclosure supports 1.0-inch, 3.5-inch form factor drives mounted in a carrier (see Figure 4–2).

CAUTION: Controlling airflow within the enclosure requires installing a disk drive or a drive blank in each drive bay.

To avoid overheating, never remove more than 1 drive or drive blank from an operating enclosure at the same time.

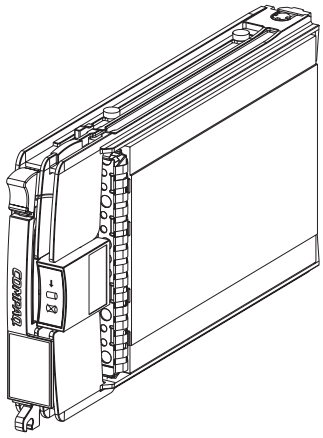


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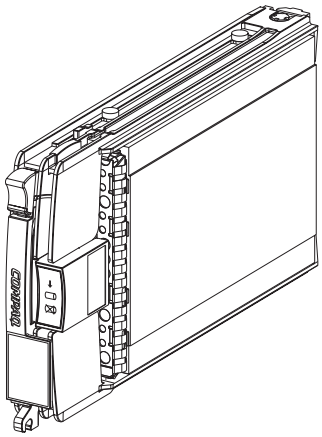
Figure 4–1. Typical 1-Inch Disk Drive

Status Reporting

The three disk drive status LEDs (see Figure 4–2) define the operational status of each drive. To determine the drive status you must observe all three LEDs (see Table 4–1).



Drive Activity LED
This green LED indicates the drive activity, that is drive being accessed, spinning-up, and so forth.

On-line LED
This green LED indicates if the drive is operational, non-operational, part of RAID set, a replacement drive, a spare drive, or a rebuilding RAID drive.

Drive Failure LED
This amber LED indicates the drive status as either operational (OFF) or failed (ON).

Figure 4–2. Disk Drive LEDs Display

Disk Status

The drives have two green and one amber LEDs that are either ON, OFF, or FLASHING. Since the status LED displays are easily interpreted, they are the most commonly used indicators of drive status. The symbols for these conditions are shown in Table 4–1.

Table 4–1 Disk LED Status Displays

LEDs	Status
Operational Status	
↓ ○	Drive not being accessed
▭ ○	The drive is a replacement drive to be rebuilt or the drive is an inactive spare disk or the
⊠ ○	SCSI controller cannot control LED. The drive is Operational
	DO NOT REPLACE DRIVE

Table 4–1 Disk LED Status Displays (Continued)

LEDs	Status
	Operational Status (Continued)
↓ ○ ▭ ◉ ⊠ ○	Drive not being accessed Drive is being rebuilt or Array Capacity expansion in progress Drive Operational DO NOT REPLACE DRIVE
↓ ○ ▭ ● ⊠ ○	Drive not being accessed Drive configured as part of an array Drive Operational DO NOT REPLACE DRIVE
↓ ◉ ▭ ◉ ⊠ ◉	Drive selected using the Array Configuration Utility. DO NOT REPLACE DRIVE
↓ ● ▭ ○ ⊠ ○	Drive is being accessed or spinning-up. Replacement drive to be rebuilt, or the drive is an inactive spare disk, or drive is spinning up during POST, or the SCSI controller cannot control LED. The drive is Operational DO NOT REPLACE DRIVE
↓ ● ▭ ◉ ⊠ ○	Drive is being accessed Drive is being rebuilt or Array Capacity expansion in progress Drive Operational DO NOT REPLACE DRIVE
↓ ● ▭ ● ⊠ ○	Drive is being accessed Drive configured as part of an array Drive Operational DO NOT REPLACE DRIVE
	Fault Status
↓ ○ ▭ ○ ⊠ ●	Drive not being accessed Drive failure Drive failure OK TO REPLACE DRIVE

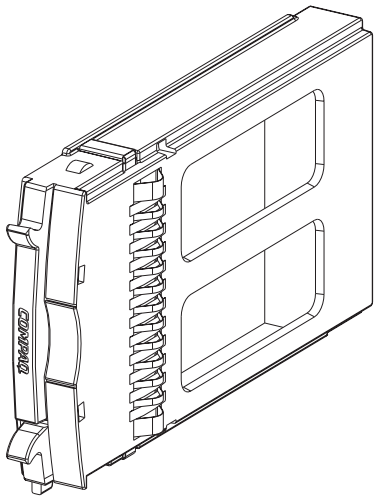
Drive Power

Backplane overcurrent sensors monitor the +5 VDC and +12VDC drive voltages. When there is a drive overcurrent condition the sensor disconnects the voltage from the drive. This disables the drive, ensuring that no data is written to it. The drive is disabled until one of the following conditions occurs:

- The defective drive is replaced.
- The overcurrent condition no longer exists.

Drive Blank

To maintain the proper enclosure airflow there must be a drive or a drive blank in each drive bay. The function of the drive blank (see Figure 4–3) is to control airflow within a bay.



CXO6824A

Figure 4–3. Drive Blank

Replacing a Disk

Replacing a disk requires you to order a replacement using the spare part number (see Chapter 6, “Replacing CRUs”).

The disk replacement kit contains detailed replacement instructions.

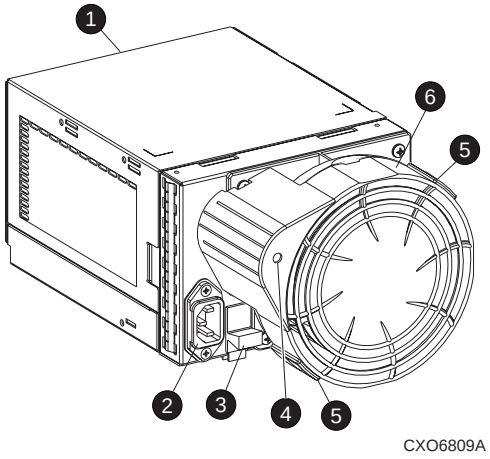
CAUTION: Removing more than one disk drive at a time can cause the enclosure to overheat. Never remove more than one disk drive at a time.

NOTE: Removing a drive from the enclosure affects the airflow in the enclosure. This can result in an overheating condition that could affect disk reliability. Compaq recommends installing a disk drive of equal or greater capacity, or a disk drive blank as soon as possible.

Chapter 5

Enclosure Power and Cooling

This chapter describes the function and general operation of the enclosure power supply and fans. See Figure 5–1 for major component locations.



❶ Power Supply Element

❷ AC Input Connector

❸ Module Latch

❹ Status LED

❺ Fan Tabs

❻ Fan Element

Figure 5–1. Power Supply and Fan Assembly Components

Enclosure Power

The power supply and fan assembly mount in the rear of the enclosure. The supply is auto-ranging and operates on an AC input voltage of 100 to 240 VAC ±10%, 50 to 60 Hz ± 5% (90 to 264 VAC, 47 to 63 Hz).

There are three DC outputs:

- +5 VDC for the EMU, I/O module, backplane, and drives
- +12.3 VDC for the drives.
- +12.5 VDC for the fans.

The nominal output of each supply is 377W, with a peak output of 425W. Either power configuration, single or dual, can support an enclosure with a full complement of disks, fans, EMU, and I/O module.

- A single power supply, the standard configuration, supports *sequential drive spin-up.*
- The Compaq recommended dual power supply configuration can support *simultaneous drive spin-up*.

The power supply circuitry provides protection against:

- Overloads
- Short circuits
- Thermal protection against cooling system faults.

Power supply status and diagnostic information is reported to the EMU using the voltage, current, and temperature signals.

See Appendix B, “Specifications,” for the enclosure power specifications.

Power Options

The enclosure can accommodate one or two power supplies. One power supply is sufficient to power the enclosure with a full complement of drives.

NOTE: Installing two power supplies, a redundant power configuration, eliminates the power supply as a single point of enclosure failure. This is the preferred, high-availability configuration.

The fan mounting assembly is the element for mounting the second fan. This element has no power circuitry. It does contain a circuit board for processing signals to and from the fan.

Temperature Sensing

The power supply temperature sensor provides a temperature range signal to the EMU. The EMU can use this signal to set the fan speed.

Fan Interface

The fan mounts on the rear of the power supply. A power supply connector is the interface between the fan and the enclosure. The interface signals include:

1. Fan speed control from the EMU
2. Fan speed to the EMU through the power supply
3. Power supply high-speed enable
4. Fan operating voltage

Fans

The power supply-mounted fans cool the enclosure by circulating air through the enclosure and elements. The rate at which air moves, the airflow, determines the amount of cooling. This airflow is a function of fan speed (rpm). These fans, under the control of the EMU or the associated power supply, can operate at multiple speeds. This ensures that when the enclosure temperature changes, the fans can automatically adjust the airflow.

Should a fan fail, EMU and power supply circuitry automatically increase the speed of the operational fan to high speed. Simultaneously, the error condition is reported to the user in several ways.

NOTE: The failure of the power supply 12.5 VDC circuit disables the associated fan.

Status Reporting

The green status LED on the fan displays the status of either the power supply or the fan. See Table 5–1 for definitions of the LED displays.

Table 5–1 Power Supply and Fan Status Displays

LED	Status
	Operational Status
	Both the power supply and the fan are operational.
	The EMU is locating either the power supply or the fan.
	Nonoperational Status
	Either the power supply or the fan is nonoperational. For a fan problem, the other fan runs at high-speed.

Replacing a Power Supply or Fan

Replacing a power supply or fan requires that you to order a replacement using the spare part number (see Chapter 6, “Replacing CRUs”).

Each power supply or fan replacement kit contains detailed replacement instructions.

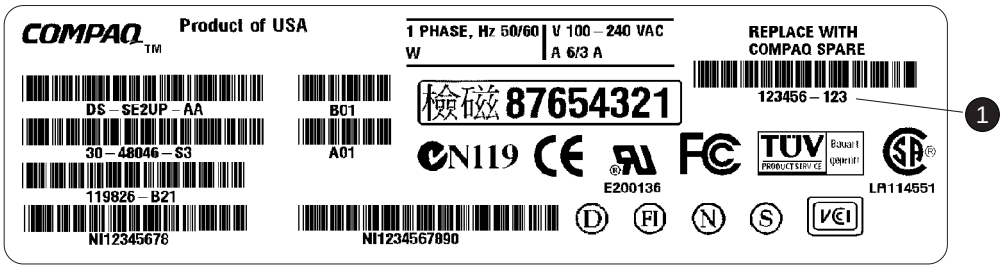
Chapter 6

Replacing CRUs

Each replacement CRU kit contains detailed replacement instructions. This chapter describes the general replacement procedures.

Ordering a Spare CRU

Ordering a replacement CRU requires the Compaq spare part number. This number is located in the upper-right corner of the product label (see ❶, Figure 6–1).



CXO6879A

Figure 6–1. Typical Product Label

The first six characters of the part number identify the CRU. The last three define the revision level.

ESD Protection

When you replace a CRU, you must take precautions to prevent the possibility of **electrostatic discharge** (**ESD**) damaging sensitive electronic items.

1. *Always* transport and store CRUs in a static-safe container.
2. Do not remove the CRU from the static-free container until you are ready to install it.
3. Avoid touching the CRU connector pins, leads, or circuitry.

Basic Replacement Procedures

The procedures in Table 6–1 apply to all the CRU replacement procedures.

CAUTION: The hot-pluggable power supplies, fans, EMU, and drives *do not* require quiescing the SCSI bus, that is halting all data transfers**,** the SCSI bus.

Replacing an I/O module or a SCSI bus cable a*lways requires* quiescing the SCSI bus.

Table 6–1 Common Replacement Procedures

1.	*Always* transport and store CRUs in a static-safe container.
Before starting the replacement procedure	
	CAUTION: To prevent ESD damage, *never* touch the CRU connector pins, leads, or circuitry.
2.	Remove the defective CRU from the enclosure.
3.	Remove the replacement CRU from the static safe container and verify that it is a compatible replacement (refer to Figure 6–1).
4.	Align the CRU with the enclosure guide slots.
5.	Slide the CRU into the enclosure until it is against the backplane connector.
6.	Fully seat the CRU in the enclosure and verify that if operating properly.
After replacing the CRU	
7.	Place the defective CRU in the static safe container for shipment.

CAUTION: An assembled enclosure (all elements installed) weighs more than 65 lb (29.5 kg). Moving the assembled enclosure requires a minimum of two individuals.

To safely and easily install the enclosure requires removing the drives, power supply and fans, EMU, and I/O module. This reduces the enclosure weight to approximately 24 lb (11.3 kg). Even though a single person can lift this weight, the physical size makes it very difficult to install.

Compaq requires a minimum of two individual to install an empty enclosure in a rack or tower.

Replacing a Drive with a Drive Blank

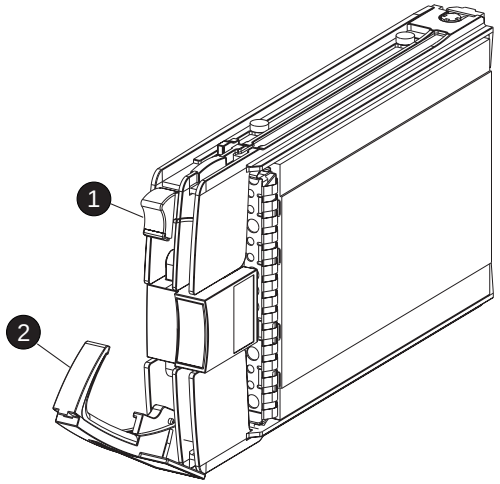
Should a disk drive fail you may wish to replace it with a drive blank using the procedure in Table 6–2.

CAUTION: Removing more than one disk drive at a time can cause the enclosure to overheat. Never remove more than one disk drive at a time.

NOTE: Removing a drive from the enclosure affects the airflow in the enclosure. This can result in an overheating condition that could affect disk reliability. Compaq recommends installing a disk drive of equal or greater capacity, or a disk drive blank as soon as possible

Table 6–2 Installing a Drive Blank

1. Press in on the Ejector Button ❶ and pivot the Release Lever ❷ to the full, open positions.



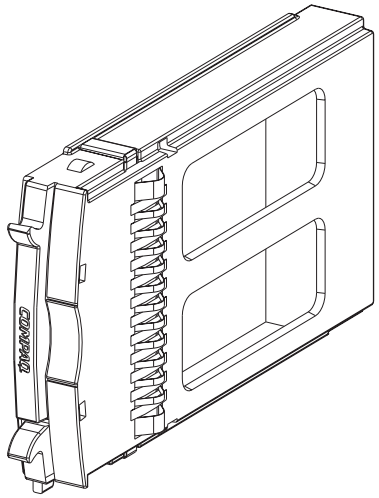
CXO6826A

2. Pull out on the drive until it is disconnected from the backplane connector.
DO NOT REMOVE THE DRIVE FROM THE ENCLOSURE WHILE THE MEDIA IS ROTATING.

3. When you are sure that the disk is no longer spinning, remove the drive from the enclosure.

Table 6–2 Installing a Drive Blank (Continued)

4. Insert the drive blank part-way into the enclosure.



CXO6824A

5. Firmly press in on the drive bank to seat it in the connector.

Appendix A

Regulatory Notices

FCC Class B Certification

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Any changes or modifications made to this equipment may void the users authority to operate this equipment.

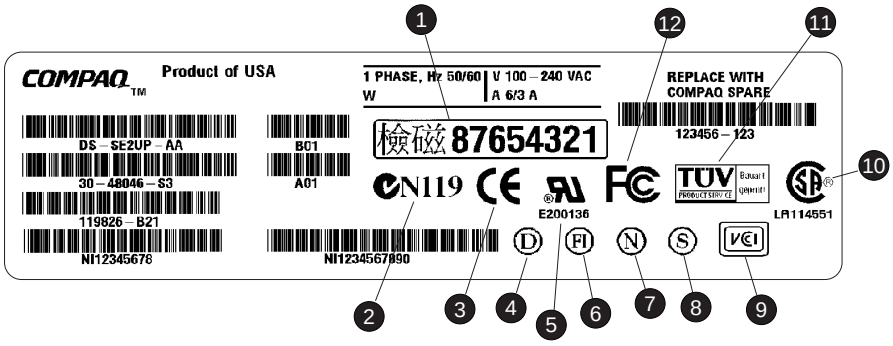
This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Country-Specific Certifications

Compaq tests all the electronic products for compliance with country-specific regulatory requirements either as an individual item or as part of an assembly. The product label (see Figure A–1) specifies the regulations with which the product complies.

NOTE: Elements without an individual product certification label are qualified as part of the *next higher* assembly (for example, enclosure, rack, or tower).



❶ Taiwan EMC and Safety BCIQ
❷ Australia C-Tick EMC
❸ Europe: CE-Mark EMC and Safety Declaration
❹ Denmark Safety (DEMCO)
❺ USA Underwriter's Laboratory component recognition
❻ Finland Safety (FIMKO)
❼ Norway Safety (NEMKO)
❽ Sweden Safety (SEMK)
❾ Japan VCCI Class B
❿ Canada CSA
⓫ Germany TÜVProduct services recognition
⓬ USA FCC Class B

Figure A–1. Typical Product Label Country-Specific Certifications

NOTE: The certification symbols on the label depend upon the certification level. For example, the FCC Class A certification symbol is not the same as the FCC Class B certification symbol (⓬). Other symbols that change based on the product or certification level are ❶, and ❾.

Appendix B

Specifications

This appendix defines the physical, environmental, and power specifications and the environmental specifications of the disk enclosure and the elements.

Physical Specifications

> **CAUTION:** The weight of the disk enclosure with the elements installed always requires at least two individuals to move it. Compaq recommends using fork lifts or hand trucks to move an enclosure in its shipping container.

Figure B–1 and Figure B–2 show the dimensions for vertical and horizontal orientations. Table B–1 defines the dimensions and weights of the enclosure. Table B–2 defines the dimensions of the EMU, fans, I/O module, and power supply.

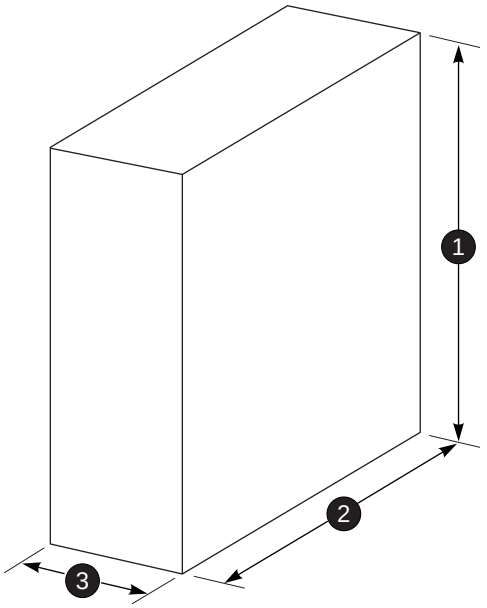


Figure B–1. Dimensions–Vertical Orientation

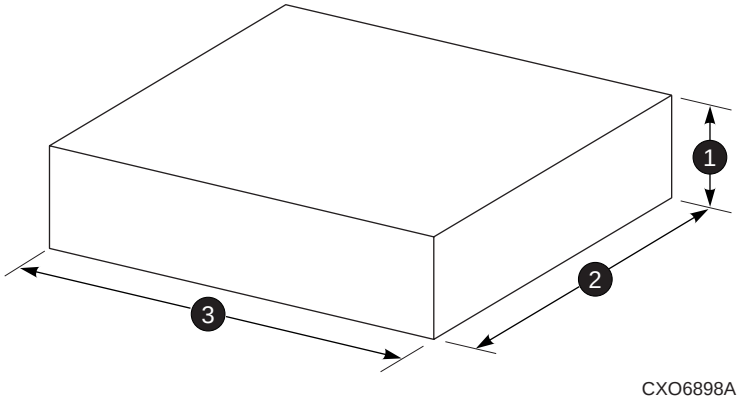


Figure B–2. Dimensions–Horizontal Orientation

Table B–1 14-Disk Enclosure Physical Specification

	Horizontal Orientation (see Figure B–1)		Vertical Orientation (see Figure B–2)	
	Empty	**Installed**	**Shipping Carton**	**Shipping Carton and Pallet**
❶	5.16 in (13.1 cm)	5.16 in (13.1 cm)	25.25 in (64.1 cm)	30.25 in (76.8 cm)
❷	17.625 in (44.8 cm)	17.625 in (44.8 cm)	23.5 in (59.7cm)	40.0 in (101.6 cm)
❸	19.875 in (50.5cm)	19.875 in (50.5cm	12.5 in (31.8 cm)	24 in (61 cm)
Weight	24 lb (11 kg)	68 lb (31 kg)	96 lb (44 kg)	108 lb (49 kg)

Table B–2 Element Physical Specifications

	Vertical Orientation (see Figure B–2)	Horizontal Orientation (see Figure B–1)
	Installed	**Shipping Carton**
	Environmental Monitoring Unit (EMU)	
❶	4.5 in (11.4 cm)	8.5 in (21.6 cm)
❷	9.5 in (24.1 cm)	13.0 in (33.0 cm)
❸	1.375 in (3.5 cm)	4.5 in (11.4 cm)
Weight	1.3 lb (0.6 kg)	2.3 lb (1.0 kg)
	Variable Speed Fan (without power supply)	
❶	5.5 in (14.0 cm)	7.5 in (19.0 cm)
❷	3.25 in (6.4 cm)	8.75 in (22.2 cm)
❸	6.25 in (15.9 cm)	8.0 in (20.3 cm)
Weight	1.0 lb (0.5 kg)	2.0 lb (0.9 kg)
	I/O Module	
❶	4.5 in (12.7 cm)	8.5 in (21.6 cm)
❷	9.5 in (24.1 cm)	13.0 in (33.0 cm)
❸	1.625 in (4.1 cm)	4.5 in (11.4 cm)
Weight	1.3 lb (0.6 kg)	2.3 lb (1.0 kg)

Table B–2 Element Physical Specifications (Continued)

	Vertical Orientation (see Figure B–2)	Horizontal Orientation (see Figure B–1)
	Installed	Shipping Carton
	Power Supply (without fan)	
❶	4.5 in (12.7 cm)	11.5 in (29.2 cm)
❷	9.5 in (24.1 cm)	16.75 in (42.6 cm)
❸	6.25 in (15.9 cm)	13.0 in (33.0 cm)
Weight	4.0 lb (1.8 kg)	6.0 lb (2.7 kg)

Environmental Specifications

To ensure optimum product operation you must maintain the operational environmental specifications listed in Table B–3. Especially critical is the ambient temperature.

Table B–3 Operating Specifications

Ambient Temperature: 10℃ to +35℃ (+50℉ to +95℉) with an average rate of change of 1℃/hour maximum and a step change of 3℃ or less Maintaining the *optimum ambient temperature* within the specified range ensures that the internal operating temperatures supports disk drive manufacturer's MTBF specifications.
Relative Humidity: 40% to 60% (noncondensing) with a step change of 10% or less (noncondensing)
Air Quality: Not to exceed a maximum of 500,000 particles, 0.5 micron or larger, per cubic foot of air.
Heat Dissipation: 1600 BTUs per hour

When shipping this product, or placing it in short term storage, Compaq recommends maintaining the environmental conditions listed in Table B–4.

Table B–4 Shipping or Short Term Storage Specifications

Ambient Temperature: –40℃ to +66℃ (–40℉ to +150℉)
Relative humidity: 10% to 80% noncondensing
Altitude: 15,240 m (50,000 ft)

Power Specifications

Table B–5 defines the AC and DC power specifications for the disk enclosure power supplies.

Table B–5 AC and DC Power Specifications

AC Power Specifications			
	Range		
	Minimum	**Nominal**	**Maximum**
Frequency (±5%)	47 Hz	50 to 60 Hz	63 Hz
Voltage (±10%)	90 VAC	100 to 240 VAC	264 VAC
DC Power Specifications			
Power		377 W	475 W
+5 VDC			
Initial Voltage	5.10 VDC	+5.15 VDC	5.20 VDC
Steady State Current		20.0 A	28.0 A
+12 VDC (Disks)			
Initial Voltage	12.13 VDC	12.25 VDC	12.37 VDC
Steady State Current		20.0 A	31.5 A
+12.5 VDC (Fans)			
Initial Voltage	12.25 VDC	12.50 VDC	12.75 VDC
Steady State Current			2.5 A

Glossary

The terms in this glossary are either unique to the disk enclosure, or are common StorageWorks terms.

ambient temperature The air temperature in an area where a system is installed. Also referred to as rack or enclosure intake air temperature.

bay The physical location of a drive in an enclosure. Each bay is numbered to define its location. The bay number may or may not be the same as the SCSI bus ID.

carrier The container in which storage devices are mounted to form CRUs. Carriers are available in 3.5-inch form-factors for both low-profile (1.0-in) and half-height (1.6-in) disks.

CRU Customer replaceable unit. An enclosure element that the customer can replace without using special tools or techniques.

device The targets, initiators, hubs, converters, and bus expanders, and similar devices interconnected to form a SCSI bus. Connectors, expanders, and hubs do not use a SCSI bus ID.
See also **nodes**.

disk enclosure A Compaq enclosure dedicated to supporting disk drives. Such an enclosure includes the power supplies, fans, I/O modules, and an EMU.

drive blank A carrier that is required to control airflow within the enclosure whenever there is less than a full complement of disk drives in an enclosure. The only function of a passive drive blank is to control airflow within the disk enclosure.

dual power *See* **redundant power configuration**.

element An object in an enclosure such as an EMU, power supply, disk, fan, I/O module, and so forth. The object can be controlled, interrogated, or described by the enclosure services process.

EMU Environmental monitoring unit. An element which monitors the status of an enclosure including the power, air temperature, fan status, and so forth. It detects problems and displays and reports these conditions to the user and the controller. In some cases, corrective actions are implemented.

enclosure A chassis containing a set of disk drives, power supplies, fans, an EMU, I/O modules, and so forth.

fan An airflow element mounted in a StorageWorks enclosure.

host The primary or controlling computer (in a multiple computer network) to which storage is attached.

hot-pluggable An element that can be replaced without removing power from the enclosure.

CAUTION: If removing the element interrupts the SCSI bus you cannot use this method. You must quiesce the bus and use the pluggable replacement method.

NOTE: The array controller must support this replacement method.

I/O module An element that integrates the enclosure bus with either an 8-bit single-ended, 16-bit single-ended, or 16-bit differential SCSI bus.

LED Light emitting diode. A diode that illuminates to define the status. The standard states are ON, OFF, or FLASHING.

pluggable A method of element replacement whereby the complete system remains on-line during element removal or insertion. There is no data transfers over the enclosure buses during removal or insertion of an element (the bus is “quiesced”). No booting or loading of code is permitted except on the element being inserted. User applications that are not dependent upon the elements on the affected SCSI bus are not noticeably impacted. See *also* **hot-pluggable**.

power supply The enclosure element that develops that DC voltages for operating the enclosure elements from either an AC or DC source.

quiesce To make a bus inactive or dormant. For example, you must quiesce SCSI bus operations when replacing an element without removing power. *See also* **pluggable**.

rack A floor-standing structure primarily designed for, and capable of, supporting equipment. All racks provide for the mounting of panels. (per *EIA Standard RS-310-C*).

RAID Redundant array of independent disks. A set of storage techniques devised to increase the performance and availability of a storage subsystem.

redundant power configuration A capability of StorageWorks cabinet and enclosures to ensure there is no single point of power failure. (1) For a cabinet two AC power sources and two power conditioning units distributed primary and redundant AC power to enclosure power supplies. (2) For an enclosure, the primary and redundant enclosure power supplies ensure the DC power is available even when there is a failure of one supply, one AC source, or one power conditioning unit. Implementing the redundant power configuration provides protection against the loss or corruption of data.

RETMA mounting pattern The repeating mounting pattern in a *vertical mounting rail* established by Radio, Electronics, and Television Manufacturers Association, the predecessor of the Electronics Industry Association (EIA).This pattern repeats every 1.75 in and is referred to as a unit. Therefore, a 3U pattern is 5.25 inches; a 4U pattern is 7.00 inches, and so forth.

SCSI Small computer system interface (SCSI). An ANSI interface which defines the physical and electrical parameters of a parallel I/O bus used to connect computers and a maximum of 16 bus elements.

SCSI bus An unbroken path consisting of conductors (in cables or on backplanes) and connectors. Every bus must have two terminators, one at each end.

SCSI ID (1.) The bit-significant representation of the SCSI addressing referring to one of the signal lines numbered 0 through 7 for an 8-bit bus or 0 through 15 for a 16-bit bus. Also referred to as “target ID”. (2.) The unique device identification number assigned to each target or initiator on a single SCSI bus. The valid address range for a wide bus is 0 through 15.

spin-up The process that begins when power is applied to a storage drive, and ends when the drive is determined to be operational and ready for data transfer operations.

StorageWorks The Compaq set of enclosure products that allows customers to design and configure their own storage subsystem. Elements include power, packaging, and interconnections in a StorageWorks enclosure. Storage devices, power supplies, I/O modules, EMUs, and array controllers may be integrated therein to form storage subsystems. System-level enclosures to house the enclosures are also included.

terminator Interconnect elements that form the ends of the transmission lines in bus segments. A SCSI domain must have at least one segment and therefore at least two terminators, *except* for special cases where the electrical transmission lines are very short and only one termination or pull–up is required.

tower A freestanding, floor mounted unit containing a disk enclosure in the vertical orientation. This unit can function as a stand-alone storage subsystem.

units The modular unit “U” on which panel heights is based on the vertical RETMA mounting pattern of 1.750 inches (44.45 mm). (Per *EIA Standard RS-310-C*.)

VHDCI Very High Density Computer Interconnect. A 68-pin interface with connectors on 0.8 mm centers. Required for Wide-Ultra2 SCSI configurations.

Wide-Ultra SCSI A SCSI bus that can operate either as an LVD or SE bus. This bus transfers data at rates up to 40 MB/s when using the LVD protocol. When using SE the maximum transfer rate is 20 MB/s.

Wide-Ultra2 SCSI A wide SCSI bus that transfers data at rates up to 80 MB/s when operating using the LVD protocol. There is no provision for this bus to operate in the narrow mode.

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