EMC
2-Gigabit Disk-Array Enclosure (DAE2)
FC and ATA Models

HARDWARE REFERENCE

P/N 014003048
REV A02

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Trademark Information

Regulatory Notices

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Testing was done with shielded cables. Therefore, in order to comply with the FCC regulations, you must use shielded cables with your installation. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 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.

This Class A digital apparatus complies with Canadian ICES-003

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

Manufacturer's Declaration of Conformity - CE mark

This equipment has been tested and found to comply with the requirements of European Community Council Directives 89/336/EEC, 73/23/EEC, and 98/68/EEC relating to electromagnetic compatibility and product safety respectively.

This product complies with EN55022, CISPR22 and AS/NZS 3548 Class A.

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラス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。

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。

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.

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Preface

This manual is your primary source of information about EMC 2-Gigabit Disk-Array Enclosure (DAE2) hardware. It covers DAE2 models that use Fibre Channel disks, and DAE2-ATA models that include Advanced Technology Attachment drives.

The DAE2 is often called a *disk enclosure*.

Audience

This guide is part of the DAE2 documentation set, and is intended for use by system administrators and others responsible for the installation, setup, and maintenance of the product.

Readers of this guide are expected to be familiar with the following topics:

- Storage-system operation
- Basic computer hardware safety and maintenance procedures.

Organization

The information in this guide is organized as follows:

Chapter 1, *About DAE2 Disk Enclosures*, provides a descriptive overview of the disk enclosure.

Chapter 2, *Installing a DAE2*, describes how to set up and power up the enclosure(s) in your cabinet.

Chapter 3, *Servicing a DAE2*, provides instructions and procedures for recognizing and replacing failed components.

Appendix A, *Technical Specifications*, lists operating limits, shipping and storage requirements, and technical specifications.

Related Documentation

This guide refers to various documents that provide detailed descriptions of each step. The most current versions of DAE2 documentation are available on the EMC Powerlink website, http://powerlink.emc.com. Once logged in to Powerlink, select **Support** (or **Services**), then **Document Library, CLARiiON, CLARiiON Fibre Channel Storage (FC)** and then **CLARiiON FC Hardware, CLARiiON FC Core Software,** or **CLARiiON FC Software** for lists and .pdf copies of relevant manuals, notes, and articles, including:

Cabinet Setup Guide for the 40U Cabinet (P/N 014003099)

Site Preparation and Unpacking Guide for the 40U Cabinet (P/N 014003100)

EMC Rails and Enclosures Installation Guide for 19-Inch NEMA Cabinets (P/N 014003082)

EMC 2-Gigabit Disk Enclosure (DAE2) Setup Guide (P/N 014003104)

EMC ControlCenter Navisphere Manager Revision 6.X Administrator's Guide (P/N 069001161)

EMC Storage System CX400-Series and CX600-Series Configuration Planning Guide (P/N 014003113)

EMC Fibre Channel Storage System CX-200 Configuration Planning Guide (P/N 014003115)

EMC ControlCenter Navisphere Version 6.X Security Administrator's Guide (P/N 069001124)

EMC Installation Roadmap for CX-Series and FC-Series Storage Systems (P/N 069001166)

Conventions Used in This Guide

EMC uses the following conventions for notes, cautions, warnings, and danger notices.

A note presents information that is important, but not hazard-related.

CAUTION

A caution contains information essential to avoid data loss or damage to the system or equipment. The caution may apply to hardware or software.

WARNING

A warning contains information essential to avoid a hazard that can cause severe personal injury, death, or substantial property damage if you ignore the warning.

DANGER

A danger notice contains information essential to avoid a hazard that will cause severe personal injury, death, or substantial property damage if you ignore the message.

Typographical Conventions

EMC uses the following type style conventions in this guide:

This typeface	Indicates text (including punctuation) that you type verbatim, all commands, pathnames, filenames, and directory names. It indicates the name of a dialog box, field in a dialog box, menu, menu option, or button.
This typeface	Represents variables for which you supply the values; for example, the name of a directory or file, your username or password, and explicit arguments to commands.
`This typeface`	Represents a system response (such as a message or prompt), a file or program listing.
`x -> y`	Represents a menu path. For example, Operations -> Poll All Storage Systems tells you to select **Poll All Storage Systems** on the **Operations** menu.
`[ ]`	Encloses optional entries.
`|`	Separates alternative parameter values; for example: *LUN-name* | *LUN-number* means you can use either the LUN-name or the LUN-number.

Where to Get Help

For questions about technical support and service, contact your service provider.

If you have an EMC service contract, contact EMC Customer Service at:

United States:	**(800) 782-4362 (SVC-4EMC)**
Canada:	**(800) 543-4782 (543-4SVC)**
Worldwide:	**(800) 497-7901**

Follow the voice menu prompts to open a service call, then select CLARiiON Product Support.

Sales and Customer Service Contacts

For the list of EMC sales locations, please access the EMC home page at:

`http://www.emc.com/contact/`

For additional information on the EMC products and services available to customers and partners, refer to the EMC Powerlink Web site at:

`http://powerlink.emc.com`

Your Comments

Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Please send a message to **techpub_comments@emc.com** with your opinions of this guide.

Warnings and Cautions

The following warnings and cautions pertain throughout this guide.

WARNING

Trained service personnel only.

This unit has two power supply cords. To reduce the risk of electric shock, disconnect both power supply cords before servicing.

Ground circuit continuity is vital for safe operation of the machine. Never operate the machine with grounding conductors disconnected. Remember to reconnect any grounding conductors removed for or during any installation procedure.

Resérvé au personnel autorisé.

Cet appareil comporte plus d'un cordon d'alimentation. Afin de prévenir les chocs électriques, débrancher les deux cordons d'alimentation avant de faire le dépannage.

Un circuit de terre continu est essentiel en vue du fonctionnement sécuritaire de l'apareil. Ne jamais mettre l'appareil en marche lorsque le conducteur de mise a la terre est débranché.

Nur für Fachpersonal.

Das Geraet hat mehr als eine Anschlussleitung. Zur Vermeidung der Gefahr eines elektrischen Schlages sind vor dem öffnen beide Anschlussleitungen vom Netz zu trennen.

STROMSTREUVERLUST: Gerät muss geerdet werden, bevor es am Stromnetz angeschlossen wird.

CAUTION

Trained personnel are advised to exercise great care at all times when working on the unit. Remember to:

- **Remove rings, watches, or other jewelry and neckties before you begin any procedures.**
- **Use caution near any moving part and any part that may start unexpectedly such as fans, motors, solenoids, and so on.**
- **Always use the correct tools for the job.**
- **Always use the correct replacement parts.**
- **Keep all paperwork, including incident reports, up to date, complete, and accurate.**

Static Precautions

EMC incorporates state-of-the-art technology in its designs, including the use of LSI and VLSI components. These chips are very susceptible to damage caused by static discharge and need to be handled accordingly.

CAUTION

Before handling printed-circuit boards or other parts containing LSI and/or VLSI components, observe the following precautions:

- **Store all printed-circuit boards in antistatic bags.**
- **Use a ground strap whenever you handle a printed-circuit board.**
- **Unless specifically designed for nondisruptive replacement, never plug or unplug printed-circuit boards with the power on. Severe component damage may result**

Replacing the Lithium Battery

The CX200LC LCC includes a lithium battery that only trained personnel should change or replace.

WARNING

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Discard used batteries according to manufacturer's instructions.

1

About DAE2 Disk Enclosures

Topics in this chapter include

Introduction

The DAE2 (2-gigabit disk-array enclosure) is a highly available, high-performance, high-capacity storage system that uses a Fibre Channel Arbitrated Loop (FC-AL) as its interconnect interface. An enclosure connects to another DAE2 or a processor such as a CX600, CX400 or CX200, and is managed by storage-system software in RAID (Redundant Array of Independent Disk) configurations. The enclosure is only 3U (5.25 inches) high, but can include 15 hard disk drive/carrier modules. Its modular, scalable design allows for additional disk storage as your needs increase. The examples and illustrations in this manual show the rackmounted DAE2 in a standard 40U EMC cabinet.

EMC produces two types of DAE2. The standard version includes Fibre Channel disk drives and FC-AL link control cards to manage them. The DAE2-***ATA*** (Advance Technology Attachment) version uses economical ATA disk drives and FC-to-ATA link control cards to manage the disks and provide an interface between the FC-AL and the drives.

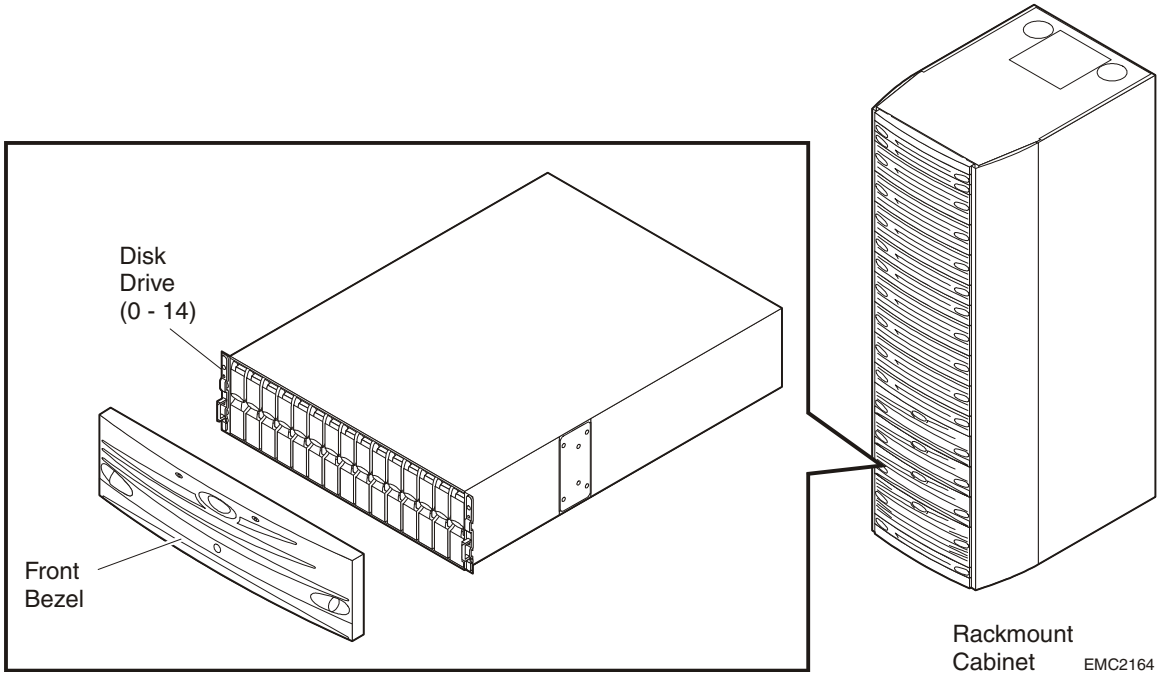

Figure 1-1 DAE2

Any DAE2 can support up to fifteen 3.5-inch disk modules. Simple serial cabling provides easy scalability. You can interconnect as many as eight DAE2s to Fibre Channel loops (sometimes called *busses*) to form a large disk storage system. The number of loops depends on the capabilities of your storage processor; highly available configurations require at least two loops, other configurations use a single loop. You can place the disk enclosures in the same cabinet, or in one or more separate cabinets. High-availability features are standard.

The DAE2 includes the following components:

- A sheet-metal enclosure with a midplane and front bezel
- Two link control cards (LCCs)
- As many as 15 disk modules
- Two power supply/system cooling modules

The power supply and system cooling components of the power/cooling modules function independently of each other, but the assemblies are packaged together into a single field-replaceable unit (FRU).

Any unoccupied disk module slot has a filler module to maintain air flow.

The LCCs, disk modules, power supply/system cooling modules, and filler modules are field-replaceable units (FRUs), which you can add or replace without tools while the array is powered up.

Standard DAE2 disk modules are FC-AL compliant and support dual-port FC-AL interconnects through the two LCCs and their cabling. ATA disk modules include dual-port ATA interconnects; the FC-to-ATA link control cards provide the bridge between Fibre Channel and ATA signals.

You can integrate and connect FC and ATA enclosures within a storage system, but you cannot mix ATA and fibre components within a DAE2. Standard link control cards will not recognize ATA disk drives, and ATA link control cards will not recognize fibre channel disks.

The system can continue running with one operating power supply and a single functional LCC. At least three of the four system cooling blowers must be running correctly for continuous operation.

Figures 1-2 through 1-4 show the disk enclosure components. Details on each component accompany the figures. Where the enclosure provides slots for two identical components, the components are

called *component-name* A or *component-name* B, as shown in the illustrations.

For increased clarity, the following figures depict the disk enclosure outside of the rack cabinet. Your disk enclosure may be installed in a rackmount cabinet as shown in Figure 1-1.

As shown in Figure 1-2, the front LED display contains two status lights for each disk module, and two disk enclosure status lights. The enclosure status lights are visible with the front bezel installed.

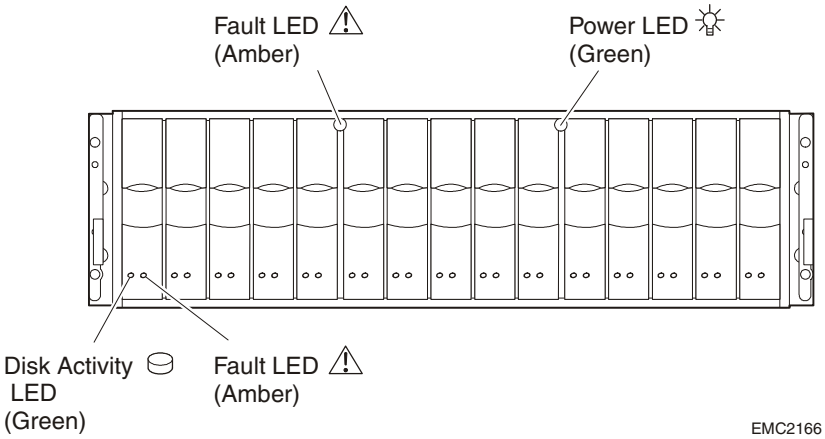

Figure 1-2 DAE2 Front LED Display

Figure 1-3 shows the DAE2 components visible from the rear of the enclosure. Each highly-available DAE2 includes two link control cards and two power supply/system cooling (power/cooling) modules.

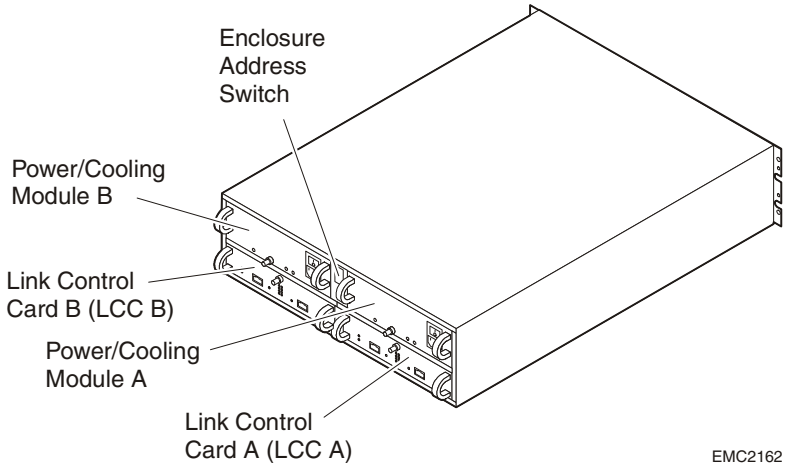

Figure 1-3 Disk Enclosure Rear View

As shown in Figure 1-3 and Figure 1-4, an enclosure address (EA) switch/indicator is located between the power supplies at the rear of the disk enclosure. (The EA is sometimes referred to as an enclosure ID.) Each link control card (LCC) includes a loop (bus) identification indicator. The storage processor initializes loop ID when the operating system loads.

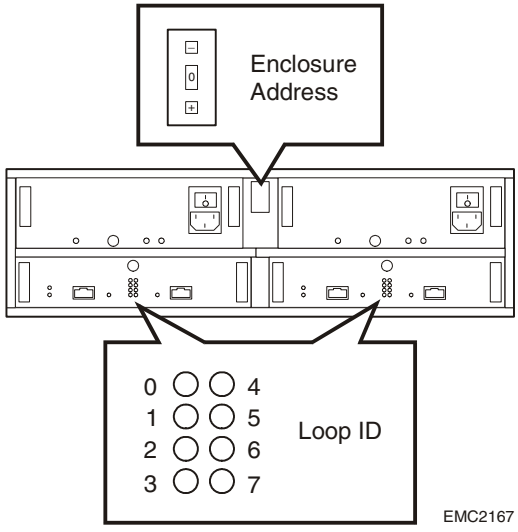

Figure 1-4 Disk Enclosure Rear Displays

The enclosure address is set on the switch at installation. Disk module IDs are numbered left to right (looking at the front of the unit) and are contiguous throughout an array: enclosure 0 contains modules 0-14; enclosure 1 contains modules 15-29; enclosure 2 includes 30-44, and so on through eight enclosures.

The enclosure EA switch and loop indicator are described in the installation procedure in Chapter 2. The status lights are described in the *Monitoring Disk Enclosure Status* section of Chapter 3.

Midplane

A midplane between the disk modules and the LCC and power/cooling modules distributes power and signals to all components in the enclosure. LCCs, power/cooling modules, and disk drives — the enclosure's field-replaceable units (FRUs) — plug directly into the midplane.

Front Bezel

The front bezel, shown in Figure 1-5, has a locking latch and an electromagnetic interference (EMI) shield. You must remove the bezel to remove and install drive modules. EMI compliance requires a properly installed front bezel.

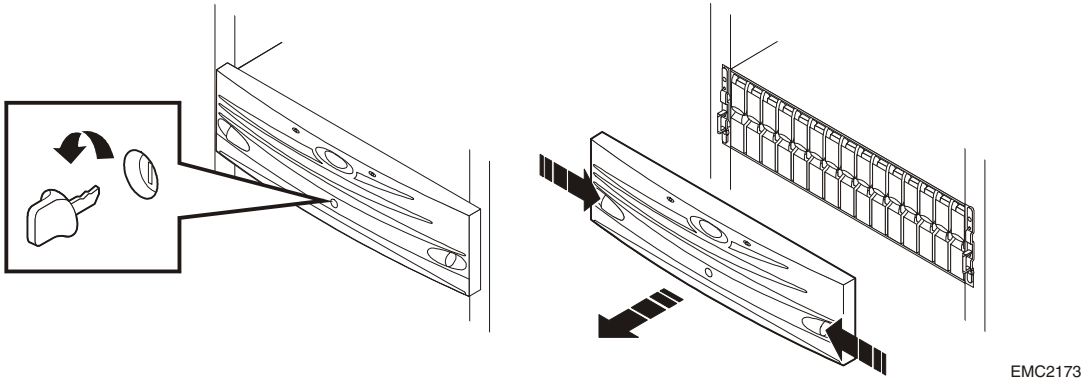

Figure 1-5 Disk Enclosure Front Bezel

Link Control Cards (LCCs)

An LCC supports and controls one Fibre Channel loop and monitors the DAE2.

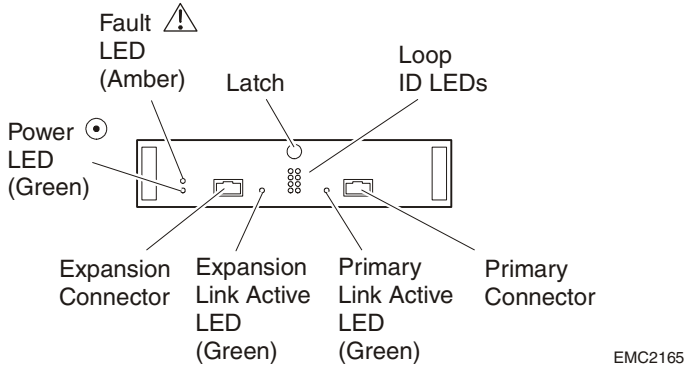

Figure 1-6 LCC Connectors and LEDs

The LCCs in a DAE2 are connected to other Fibre Channel devices (hosts, DAE2s, and so on) using twin-axial copper cables. The cabling is not explicitly configured as a loop (with a long return from the last disk enclosure to the server), but instead, as a set of full-duplex, point-to-point connections with the last disk enclosure in the chain closing the loop on its LCC.

The LCC independently receives and electrically terminates the incoming FC-AL signal. The LCC passes the input signal to the disk drives in the enclosure; it then sends the output signal, via cables, to the next DAE2 in the loop. ATA link control cards provide the same Fibre Channel input and output, but convert those signals to and from the ATA protocol used by their disk drives.

Each LCC independently monitors the environmental status of the entire enclosure, using a microcomputer-controlled FRU (field-replaceable unit) monitor program. The monitor communicates status to the server, which polls DAE2 status. LCC firmware also controls the LCC port bypass circuits and the disk-module status lights.

LCCs do *not* communicate with or control each other.

Each LCC has four status lights. These status lights are described in *Monitoring Disk Enclosure Status* in Chapter 3.

A latch on the LCC locks it into place to ensure proper connection to the midplane. You can add or replace an LCC while the disk enclosure is powered up.

Disk Modules

Each disk module consists of one disk drive in a carrier. You can add or remove a disk module while the DAE2 is powered up, but should exercise special care when removing modules while they are in use.

Drive modules are extremely sensitive electronic components. Refer to the instructions on *Handling FRUs* and *Replacing or Adding a Disk Module* in Chapter 3 whenever you handle a disk module.

Fibre Channel disk modules will not work in an ATA enclosure, and vice versa. You can visually distinguish between module types by their different latch and handle mechanisms. ATA drive modules also include a small printed-circuit adapter board in the back (connector side) of the carrier. Figure 1-7 shows the DAE2 disk modules.

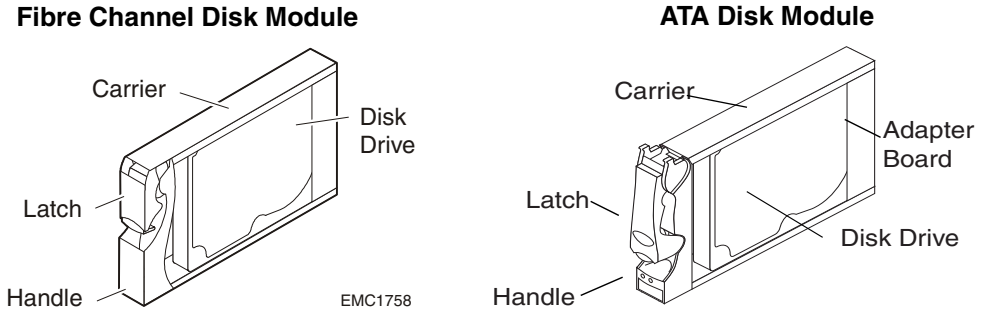

Figure 1-7 Disk Modules

Disk Drives

DAE2 disk drives conform to either FC-AL or ATA 6 specifications, and either 1-Gbit and 2-Gbit Fibre Channel or 1.5-Gbit serial ATA interface standards. The disk module slots in the enclosure accommodate 1-inch (2.54 cm) by 3.5-inch (8.75 cm) disk drives.

Drive Carrier

The disk drive carriers are metal and plastic assemblies that provide smooth, reliable contact with the enclosure slot guides and midplane connectors. Each carrier has a handle with a latch and spring clips.

The latch holds the disk module in place to ensure proper connection with the midplane. Disk drive Activity/Fault LEDs are integrated into the carrier.

Power Supply/System Cooling Modules

The power supply/system cooling (power/cooling) modules are located above the LCCs. The units integrate independent power supply and dual-blower cooling assemblies into a single module.

Each power supply is an auto-ranging, power-factor-corrected, multi-output, off-line converter with its own line cord and on/off switch. Each supply supports a fully configured DAE2 and shares load currents with the other supply. The drives and LCC have individual soft-start switches that protect the disk drives and LCCs if you install them while the disk enclosure is powered up. A FRU (disk, LCC, or power/cooling module) with power-related faults will not adversely affect the operation of any other FRU.

The enclosure cooling system includes two dual-blower modules. If one blower fails, the others will speed up to compensate. If two blowers in a system (both in one power/cooling module, or one in each module) fail, the DAE2 will go off line within two minutes.

Each power/cooling module has three visible status lights. The rightmost LED indicates power to the supply; the LED adjacent to it indicates a power supply fault. The leftmost LED indicates a failure in one of the integrated blowers within that module that cool the disk enclosure. The status lights are shown in Figure 1-8 and described in *Monitoring Disk Enclosure Status* in Chapter 3.

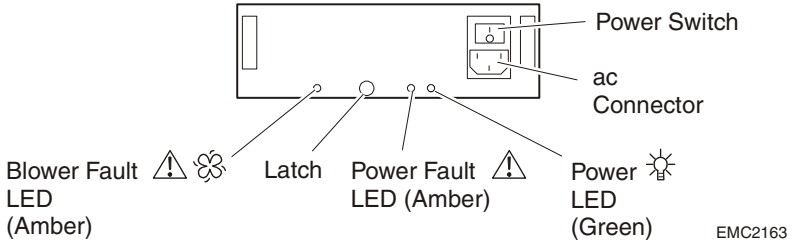

Figure 1-8 Power Supply/System Cooling Module

A latch on the power/cooling module locks it into place to ensure proper connection to the midplane. You can add or remove one

power supply/system cooling module in a DAE2 while the system is powered up.

2

Installing a DAE2

This chapter describes the DAE2 installation requirements and procedures. Major topics are

Requirements

This section explains site and cabling requirements.

Site Requirements

For proper operation, the installation site must conform to certain environmental specifications. These are detailed below and in Appendix A.

Power

To determine a DAE2's worst case power requirements, use the power rating on the enclosure label. This rating is the maximum power required for a fully loaded enclosure. The amount of internally regulated power that a maximum configuration requires from the power supplies and cooling system determines the values for input current, power (VA), and dissipation per disk enclosure. Typical values will be less depending on the number, manufacturer, and type (FC or ATA) of disk drives. These values represent the sum of the values shared by the line cords of two power supplies in the same enclosure. Power cords and supplies share the power load evenly. If one of the two power supplies fails, the remaining supply and cord support the full load. You must use a rackmount cabinet with ac power distribution, and have main branch ac distribution that can handle these values for the number of disk enclosures that you will interconnect.

Cooling

The temperature at the front bezel inlet must meet the ambient temperature specification described in Appendix A. The site must have air conditioning that can maintain the specified ambient temperature range. The air conditioning must be able to handle the BTU requirements of the DAE2 disk enclosures.

Cabling Requirements

The DAE2 supports copper cable for a Fibre Channel connection to another Fibre Channel device (for example, a storage processor or another DAE2).

Any copper cables you use must meet the appropriate standards for 2-Gbit FC-AL. Such cables are fully shielded, twin-axial, full-duplex cables with High Speed Serial Data Connector (HSSDC) connectors. Distances greater than 1 meter require equalized cables; unequalized one-meter cables are adequate. The DAE2 does not support cables shorter than 1 meter or longer than 10 meters.

EMC supports and can provide 1-, 5-, and 10-meter cables. The 5- and 10-meter cables are equalized.

Interconnections between disk enclosures should maintain LCC consistency; that is, one Fibre Channel (FC) loop should interconnect all and only the LCC As, and the other Fibre Channel loop should interconnect all and only LCC Bs.

Do not leave an unused (that is dangling) cable connected to a host or LCC port because it may cause excess noise on the loop.

Installing a Disk Enclosure in a Cabinet

You will install each disk enclosure on two L-shaped mounting rails connected to the cabinet's vertical channels.

- The *Cabinet Setup Guide for the 40U Cabinet* ships with standard EMC cabinets, and explains how to unpack and install the 40U cabinet itself.
- The *EMC Rails and Enclosures Installation Guide for 19-Inch NEMA Cabinets* ships with the mounting rails. It explains how to install universal mounting rails in the cabinet, and how to install the enclosure on those rails.

Warnings and Recommendations

The cabinet in which you will install the disk enclosure(s) must have a full earth ground to provide reliable grounding. Also, the cabinet should have its own switchable power distribution. We suggest that you use a cabinet that has dual power distribution units, one on each side.

WARNING

The enclosure is heavy and should be installed into a rack by two people. To avoid personal injury and/or damage to the equipment, do not attempt to lift and install the enclosure into a rack without a mechanical lift and/or help from another person.

L'armoire étant lourde, sa mise en place sur une rampe nécessite deux personnes. Afin de ne pas vous blesser et/ou endommager le matériel, n'essayez pas de soulever et d'installer l'armoire sur une rampe sans avoir recours à un relevage mécanique et/ou à l'aide d'une autre personne.

Das Gehäuse ist schwer und sollte nur von zwei Personen in einem Rack installiert werden. Zur Vermeidung von körperlichen Verletzungen und/oder der Beschädigung des Gerätes, bitte das Gehäuse nicht ohne die Hilfe einer zweiten Person anheben und einbauen.

Il contenitore è pesante e dev'essere installato nel rack da due persone. Per evitare danni personali e/o all'apparecchiatura, non tentare di sollevare ed installare in un rack il contenitore senza un sollevatore meccanico e/o l'aiuto di un'altra persona.

Debido a su considerable peso, la instalación del compartimento en el bastidor deben realizarla siempre dos personas. Para evitar daños personales o en el equipo, el compartimento no debe levantarse ni instalarse en el bastidor sin la ayuda de un elevador mecánico o de otra persona.

We recommend that you use cabinet anti-tip devices, especially if you are installing or removing a disk enclosure in the upper half of the cabinet when the lower half is empty.

Setting Up an Installed Disk Enclosure

Each disk enclosure in a Fibre Channel loop must have a unique enclosure address (also called an EA, or enclosure ID) that identifies the enclosure and determines disk module IDs. In many cases, the factory sets the enclosure address before shipment to coincide with the rest of the system; you will need to reset the switch if you installed the enclosure into your rack independently. The enclosure address ranges from 0 through 7. You set the EA with the enclosure address switch, which has one push button for incrementing the address and another for decrementing it. To set the EA, use a tool such as a pen, paper clip, or small screwdriver.

The enclosure address is set on the EA switch at installation. Disk module IDs are numbered left to right (facing the unit) and are contiguous throughout an array: enclosure 0 contains modules 0-14; enclosure 1 contains modules 15-29; enclosure 2 includes 30-44, and so on through eight enclosures.

CAUTION

The drives read their FC-AL physical address only at powerup or when the drive is reset. To avoid losing data, *you must set the enclosure address when power is off*; you cannot change the EA while power is on.

1. Set the enclosure address to the desired value, as shown in Figure 2-1.

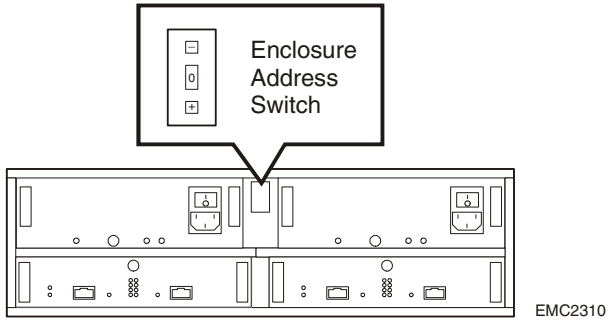

Figure 2-1 Setting the Enclosure Address (EA)

2. Plug an ac line cord from the cabinet's power distribution unit into each power/cooling module, as shown in Figure 2-2.

Make certain you secure the power cord with the strain reliefs at each connector. The strain reliefs prevent the power cord from pulling out of the connections.

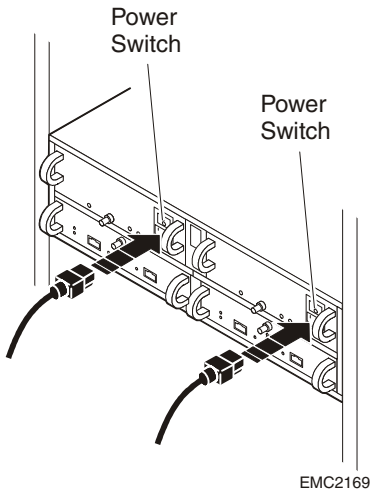

Figure 2-2 Plugging in the ac Line Cord

Highly available, write-caching configurations require that you connect the *first* disk enclosure (EA 0, loop 0) to a Standby Power Supply (SPS) for enclosure power. If you do connect a DAE2 to an SPS (if, for example, the DAE2 is the first disk enclosure in a CX600 configuration), be sure that you maintain power/loop integrity; always connect power/cooling module A to SPS A, and module B to SPS B.

Figure 2-3 shows the power cord connections for a typical CX600-Series configuration.

Do not configure an ATA model DAE2 as EA 0, loop 0. ATA enclosures do not support the boot and SPS requirements of the first disk array in a storage system.

An integrated disk-and-processor enclosure, such as a CX400- or CX200-Series DPE2, is always the first disk enclosure on the first loop (0,0). You should *not* connect the first DAE2 in a DPE2 configuration to an SPS.

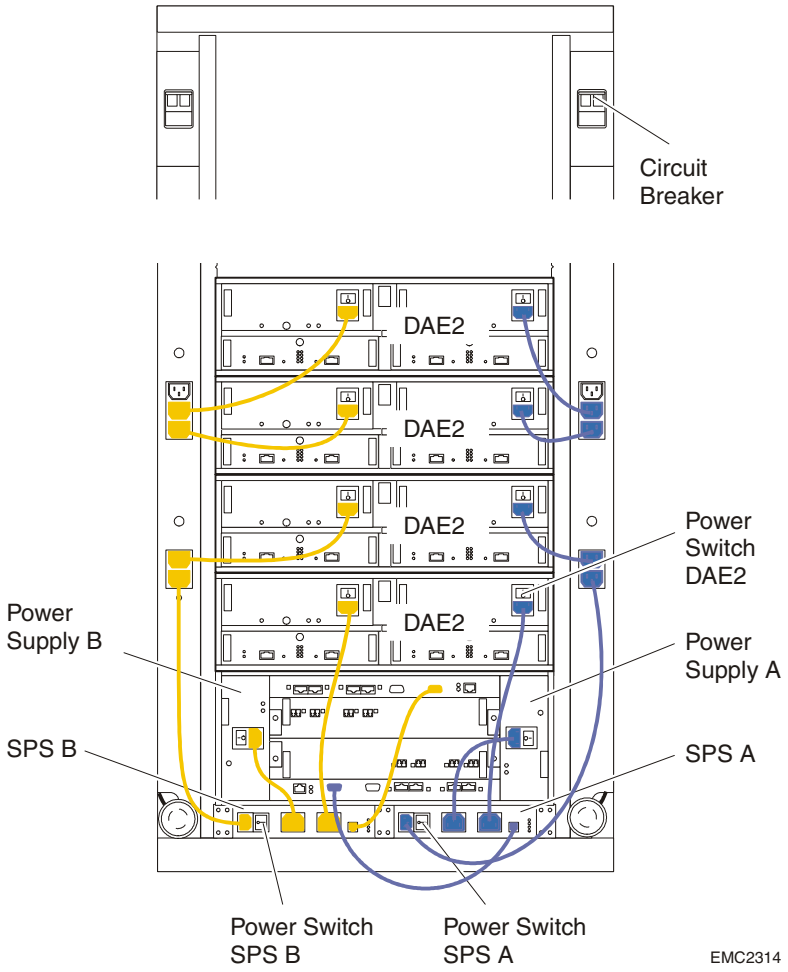

Figure 2-3 Connecting DAE2 Power Cords

3. Repeat steps 1 and 2 for each disk enclosure in the cabinet, as necessary.

4. Attach the copper cable from the external device (storage processor or another DAE2) to the PRI connector as shown in Figure 2-4. If you are continuing the loop to another DAE2, attach a cable from the EXP connector to the PRI connector in the next DAE2.

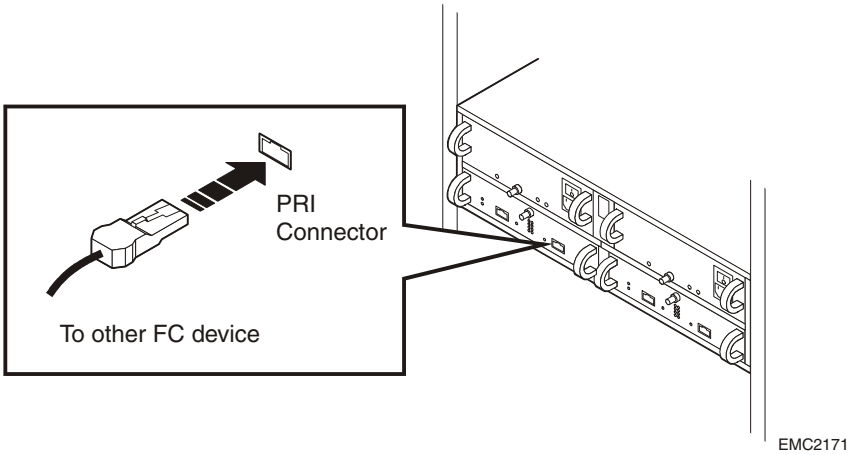

Figure 2-4 Connecting a Disk Enclosure to Another FC Device

5. If you are installing multiple disk enclosures, cable them as shown in Figure 2-5 or Figure 2-6.

   The example configuration in Figure 2-5 shows a CLARiiON® CX600 storage processor enclosure (SPE) below four DAE2 disk-array enclosures. The five devices support two completely redundant loops. Note that the external device connects to the *Primary* disk enclosure connectors, and subsequent enclosures connect in an Expansion-to-Primary chain.

EA 0, loop 0 must be a *Fibre Channel* DPE2 or DAE2. ATA enclosures do not support the boot and SPS requirements of the first disk array in a storage system.

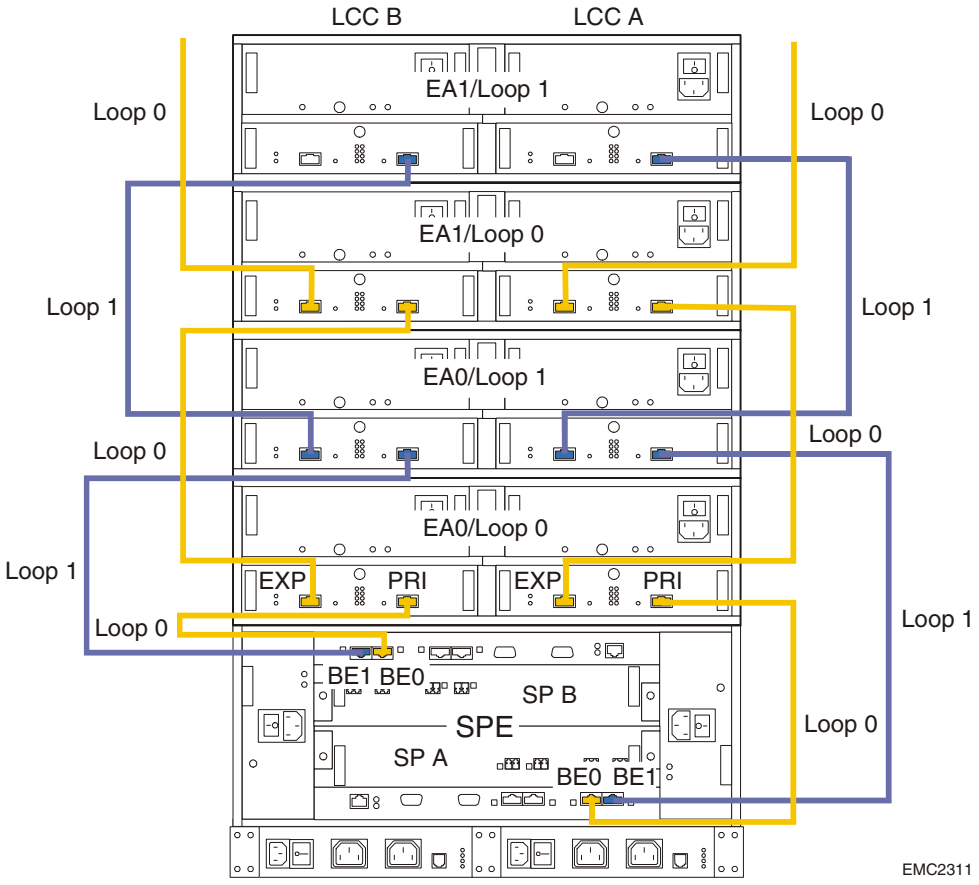

Figure 2-5 Cabling Disk Enclosures Together — Standard Configuration

All DAE2 configurations follow the same primary-to-expansion connection principles. For example, Figure 2-6 shows two segregated loops connecting contiguous disk enclosures.

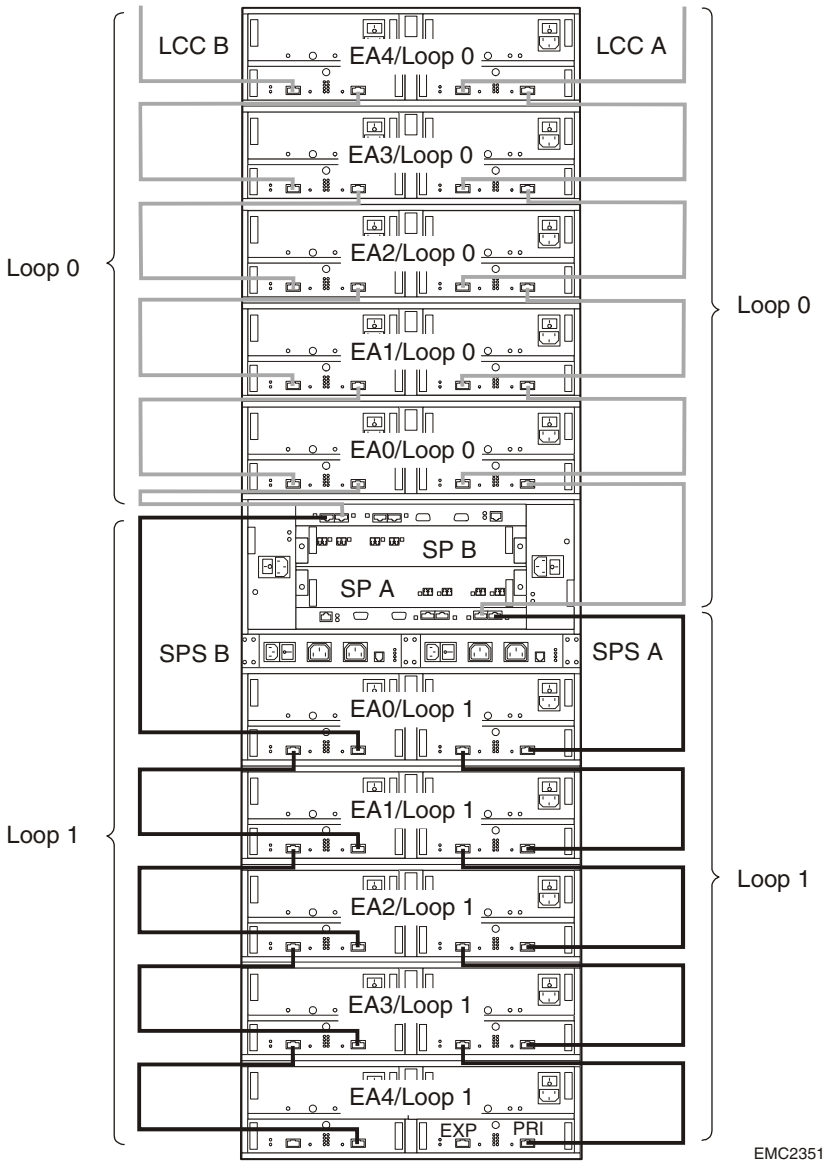

Figure 2-6 Cabling Disk Enclosures Together — Segregated Loop Configuration

6. For proper cooling and normal operation, make sure all the disk module slots in each disk enclosure contain either disk or filler modules.

   Do not power up a disk enclosure without at least one LCC installed.

   You can configure a driveless disk enclosure within a Fibre Channel loop. High availability with write-caching requires disks in slots 0-4 in the *first* DPE2 or DAE2 connected to a storage processor (Enclosure Address 0, loop 0).

7. Turn the DAE2 power switch(es) to the on position. If necessary, set the SPS switches, and then the main circuit breaker switches, to the on position. The disk enclosures in the cabinet power up.

Powerup and Initialization

The only power switches on a DAE2 are those on the power supply/system cooling module, which are normally *on*. As a result, a DAE2 is *always active*.

When you initially apply ac power to a disk enclosure, the disk drive modules power up according to their specifications, and spin up in a specified sequence dictated by enclosure and loop IDs. The slot spin-up delays range from 0 to 84 seconds. The same delays are used when you insert a drive module while the system is powered up.

The LCC hardware monitor (FRU monitor) resets and begins its control loop. The port bypass circuits enter the states indicated by their associated drives. The monitor continues to run in this local mode until it receives commands that dictate otherwise. In local mode, the monitor maintains the port bypass circuits in the same states as the drive command signals. When a drive fault occurs, the corresponding drive fault light turns on. Firmware commands can take control of the port bypass circuits and the drive status lights.

CAUTION

The drives read their FC-AL physical address only at powerup or when the drive is reset. To avoid potential data loss, you must set the enclosure address when you install the disk enclosure and power is off; you cannot change the EA while power is on.

Binding Disk Modules into RAID Groups

After cabling the disk enclosure, use EMC ControlCenter™ Navisphere® Manager software to bind the disks into RAID groups. Refer to the *EMC ControlCenter Navisphere Manager Revision 6.X Administrator's Guide* and your storage processor configuration and planning guide for detailed information.

3

Servicing a DAE2

This chapter describes how to monitor disk enclosure status, handle FRUs, and replace or add a Field Replaceable Unit (FRU). Topics are

For more information about upgrading your DAE2, contact your service provider.

Monitoring Disk Enclosure Status

Status lights on the DAE2 and its FRUs indicate error conditions. These lights are visible outside the disk enclosure. Some lights are visible from the front, and the others from the back. Figures 3-1 through 3-4 and Tables 3-1 through 3-3 describe the status lights.

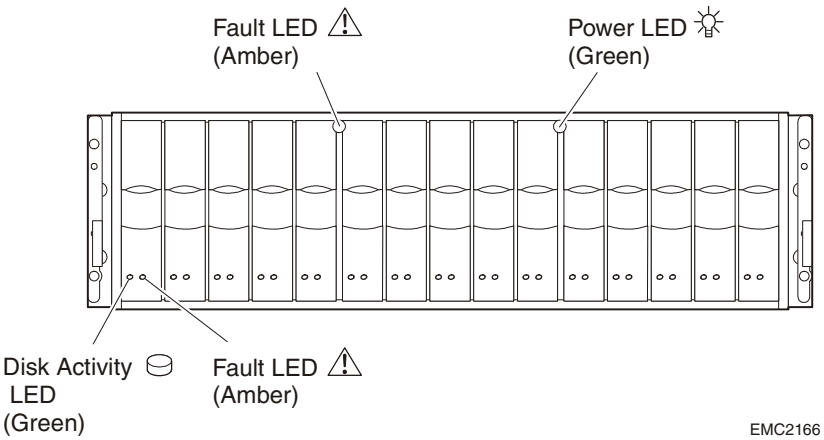

Figure 3-1 Front Disk Enclosure and Disk Module Status Lights (Bezel Removed)

Table 3-1 describes the LEDs visible from the front of the DAE2.

Table 3-1 Status Lights Visible from the Front of the Disk Enclosure

Light	Quantity	Color	Meaning
Disk Enclosure Power	1	Green	Power to enclosure is on.
Disk Enclosure Fault	1	Amber	On when any fault condition exists; if the fault is not obvious from a disk module light, look at the back of the disk enclosure.
Disk Active	1 per disk module	Green	Off when the slot is empty or contains a filler module. Also off when the disk is powered down by command; for example, the result of a temperature fault. Flashing *(mostly off)* when the FC drive is powered up but not spinning; this is a normal part of the spin-up sequence, occurring during the spin-up delay of a slot. Flashing *(at a constant rate)* FC drive: when the drive is spinning up or spinning down normally. ATA drive: when the module has received power but the disk has not started spinning On when the drive has power but is not handling any I/O activity (the ready state). ATA modules also show the Disk Active LED on while the disk spins up or down normally. Flashing *(mostly on*) when the drive is spinning and handling I/O activity. Flashing (constant fast rate) when an ATA LCC has forced ownership of the drive.
Disk Fault	1 per disk module	Amber	On when the disk module is faulty, or as an indication to remove the drive.

Figure 3-2 shows the enclosure address and loop ID indicators, visible from the back of the enclosure.

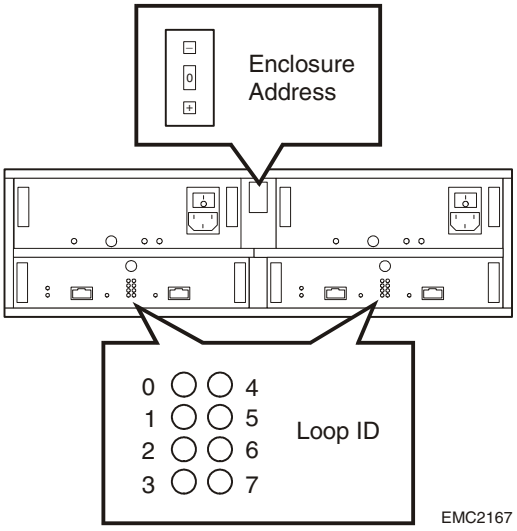

Figure 3-2 Enclosure Address and Loop ID Indicators

Table 3-2 describes the ID indicators.

Table 3-2 Enclosure and Loop ID Indicators

Light	Quantity	Color	Meaning
Enclosure Address	1	Green	Displayed number indicates Enclosure Address
Loop ID	8	Green	Displayed number indicates Loop ID

Figure 3-3 shows the status LEDs for the power/cooling modules.

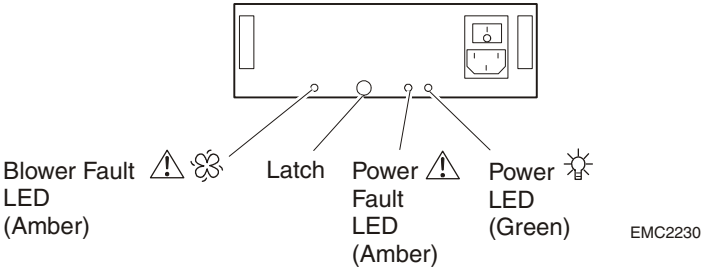

Figure 3-3 Power Supply/System Cooling Module Status Indicators

Figure 3-4 shows the status LEDs for the link control cards.

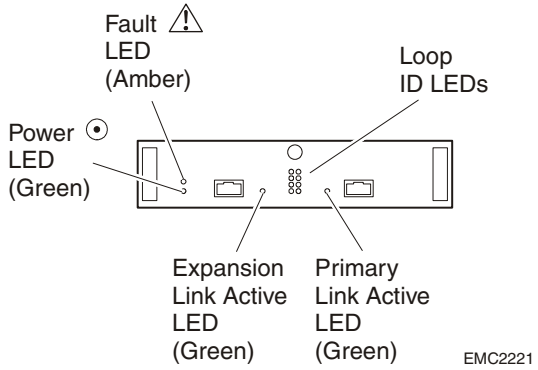

Figure 3-4 LCC Status LEDs

Table 3-3 describes the status LEDs visible from the rear of the disk enclosure.

Table 3-3 Status Lights Visible from the Rear of the Disk Enclosure

Light	Quantity	Color	Meaning
LCC Power	1 per LCC	Green	On when the LCC is powered up.
LCC Fault	1 per LCC	Amber	On when either the LCC or a Fibre Channel connection is faulty. Also on during Power On Self Test (POST).
Primary Link Active	1 per LCC	Green	On when Primary connection is active.
Expansion Link Active	1 per LCC	Green	On when Expansion connection is active.
Power Supply Active	1 per supply	Green	On when the power supply is operating.
Power Supply Fault	1 per supply	Amber	On when the power supply is faulty or is not receiving ac line voltage. Flashing when either a multiple blower or ambient overtemperature condition have shut off dc power to the system.
Blower Fault	1 per power supply	Amber	On when a blower in the power supply is faulty.

If the disk enclosure Fault light is on, examine the other status lights to determine which FRU(s) is faulty. If a fault light on a FRU remains on, you should replace that FRU as soon as possible.

When a redundant FRU fails, high availability will be compromised until you replace the faulty FRU.

Handling FRUs

This section describes the precautions that you must take and the general procedures you must follow when removing, installing, and storing FRUs.

Power Issues and FRUs

The DAE2 is designed to always be powered up and hot repairable. Its front bezel should be attached and each of its compartments should contain a FRU or filler panel to ensure EMI compliance and proper air flow over the FRUs.

While the disk enclosure is powered up, you can service or replace any FRU, although removing an active LCC will affect operating system access to the disks it controls. You should not remove a faulty FRU until you have a replacement available.

Since you can replace or add any FRU without sliding the disk enclosure out of the cabinet, you do *not* have to use cabinet anti-tip devices when you upgrade or service a DAE2.

If you need to power down a DAE2, simply turn both the power switches to Off, or unplug the unit. You do not need to shut down main ac lines to the disk enclosure unless you need to power down all the cabinet contents connected to that line.

Avoiding Electrostatic Discharge (ESD) Damage

When you replace or install FRUs, you can inadvertently damage the sensitive electronic circuits in the equipment by simply touching them. Electrostatic charge that has accumulated on your body discharges through the circuits. If the air in the work area is very dry, running a humidifier in the work area will help decrease the risk of ESD damage. You must follow the procedures below to prevent damage to the equipment.

Read and understand the following instructions:

- Provide enough room to work on the equipment. Clear the work site of any unnecessary materials or materials that naturally build up electrostatic charge, such as foam packaging, foam cups, cellophane wrappers, and similar items.

- Do not remove replacement or upgrade FRUs from their antistatic packaging until you are ready to install them.
- Gather together the ESD kit and all other materials you will need before you service a disk enclosure. Once servicing begins, you should avoid moving away from the work site; otherwise, you may build up an electrostatic charge.
- An ESD wristband is supplied with your disk enclosure. To use it, attach the clip of the ESD wristband (strap) to any bare (unpainted) metal on the disk enclosure; then put the wristband around your wrist with the metal button against your skin.
- Use the ESD kit when handling any FRU. If an emergency arises and the ESD kit is not available, follow the procedures in the *Emergency Procedures (Without an ESD Kit)* section.

Emergency Procedures (Without an ESD Kit)

In an *emergency* when an ESD kit is not available, use the following procedures to reduce the possibility of an electrostatic discharge by ensuring that your body and the subassembly are at the same electrostatic potential.

These procedures are not a substitute for the use of an ESD kit. Follow them only in the event of an emergency.

- Before touching any FRU, touch a bare (unpainted) metal surface of the cabinet or enclosure.
- Before removing any FRU from its antistatic bag, place one hand firmly on a bare metal surface of the enclosure, and at the same time, pick up the FRU while it is still sealed in the antistatic bag. Once you have done this, *do not* move around the room or touch other furnishings, personnel, or surfaces until you have installed the FRU.
- When you remove a FRU from the antistatic bag, avoid touching any electronic components and circuits on it.
- If you must move around the room or touch other surfaces before installing a FRU, first place the FRU back in the antistatic bag. When you are ready again to install the FRU, repeat these procedures.

Precautions When Removing, Installing, or Storing FRUs

Use the precautions listed below when you remove, handle, or store FRUs:

- Do not remove a faulty FRU until you have a replacement available.
- Handle a FRU only when using an ESD wristband. Attach the clip of the ESD wristband to the ESD bracket or bare metal on the enclosure, and put the wristband around your wrist with the metal button against your skin.
- Handle FRUs gently. A sudden jar, drop, or vibration can permanently damage a FRU and may not be immediately evident. Never place a FRU on a hard surface such as an unpadded cart, floor, or desktop, or stacked on top of another FRU.
- Never use excessive force to remove or install a FRU.
- Store a FRU in the antistatic bag and specially designed shipping container in which you received it. Use that container if you need to return the FRU for repair.
- Maintain the location where you store FRUs within the limits specified in Appendix A.
- Place the cables where no one can step on them or roll equipment over them.

Replacing or Adding a Disk Module

CAUTION

Disk modules are extremely sensitive electronic components. Always handle a disk module gently, and observe the following guidelines:

- **Always replace a disk drive with another of the same model; do not mix Fibre Channel and ATA components in the same enclosure. Refer to Figure 1-7 on page 1-8 for a visual comparison of FC and ATA disk carriers.**
- **Follow the instructions in the preceding section *Avoiding Electrostatic Discharge (ESD) Damage* on page 3-6.**
- **Always wear a properly-attached ESD wristband when removing or replacing a disk module.**
- **When removing a disk module, pull the module part way out of the slot, then wait 30 seconds for the drive to spin down before removing it.**
- **Place modules on a soft, antistatic surface, such as an industry-standard antistatic foam pad or the container used to ship the module. Never place a disk module directly on a hard surface.**
- **Never hit modules, stack modules, or allow them to tip over or fall.**
- **Avoid touching any exposed electronic components and circuits on the disk module.**
- **Do not remove a faulty disk module until you have a replacement module (with the same part number) or a filler module available. The part number (PN005xxxxxx) appears on the top or bottom of the module. A replacement or add-on disk module should have the same format (bytes per sector) and the same capacity (size and speed) as the other modules in the enclosure**.

You must remove the disk enclosure's front bezel to gain access to the disk modules. The bezel is required for EMI compliance when the enclosure is powered up. Remove it only to replace or add a disk module.

Unlocking and Removing the Front Bezel

Follow these steps to remove the front bezel and gain access to the disk modules. Refer to Figure 3-5.

1. Insert the key that shipped with your enclosure into the bezel lock, and turn it to release the lock.
2. Press the two latch buttons on the bezel surface toward each other to release the bezel from the cabinet.
3. Pull the bezel off the cabinet and put it on a clean, static-free surface.

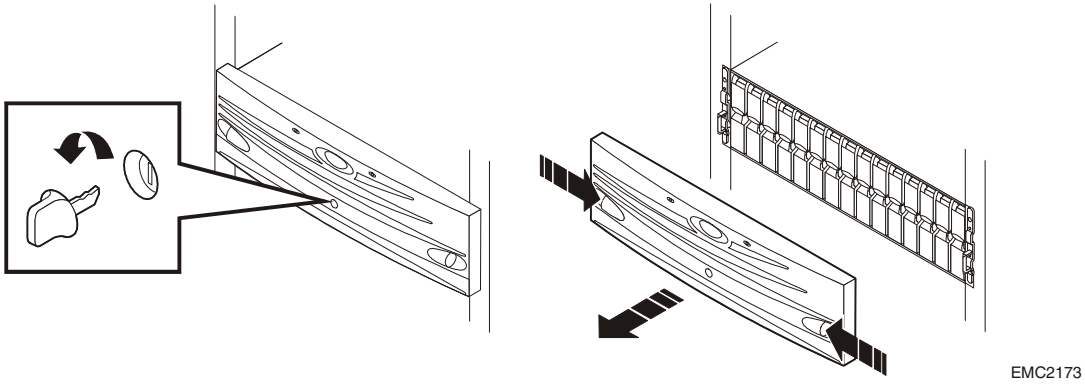

Figure 3-5 Unlocking and Removing the Front Bezel

If you are adding a new disk module, continue to the disk filler module removal procedure that follows. If you are replacing a faulty disk module, proceed to the disk module removal procedure.

Removing a Disk Filler Module

Locate the slot where you want to install the disk module, and remove the filler module, as shown in Figure 3-6.

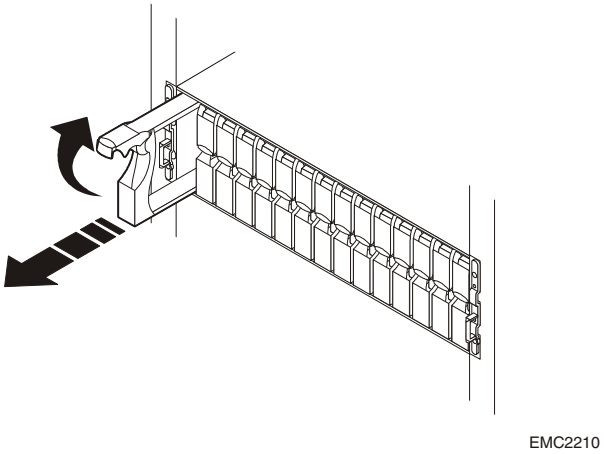

Figure 3-6 Removing a Disk Filler Module (FC Disk Carrier Shown)

Skip to the disk installation procedure (Page 3-12) to install the add-on disk in the slot you just emptied.

Removing a Disk Module

CAUTION

If a disk module has been bound into a LUN, do not move it to another slot unless you do not care about the data on the LUN. Each module contains LUN-identifying information written when it was bound. Moving it to another slot can make information on the original LUN inaccessible.

Generally, you should not remove a disk module unless its amber fault light is on. See Table 3-1.

1. Attach an ESD wristband to your wrist and the enclosure (see the precautions on Page 3-7).

2. If the active light is on steadily, pull the latch, and slowly pull the module about 1 in (3 cm) from its slot. Wait 30 seconds for the disk to stop spinning. Then remove the module and place it on a padded, static-free surface.

   If the active light is off or mostly off you do not need to wait for the disk to stop spinning. Pull the latch and slowly pull the module from its slot, as shown in Figure 3-7. Place it on a padded, static-free surface.

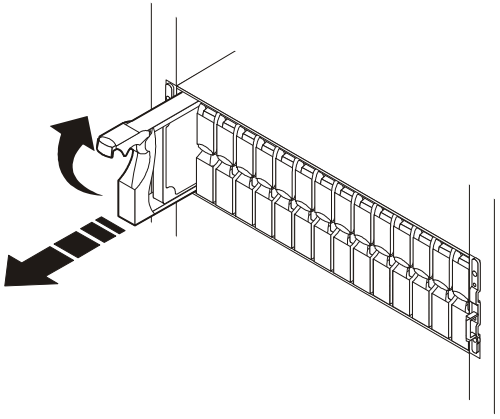

Figure 3-7 Removing a Disk Module (FC Disk Carrier Shown)

Continue to the next section to install the replacement disk module.

Installing a Disk or Filler Module

Always replace a disk drive with another of the same model; do not mix Fibre Channel and ATA components in the same enclosure. Refer to Figure 1-7 on page 1-8 for a visual comparison of FC and ATA disk carriers.

1. Make sure an ESD wristband is attached to your wrist and the enclosure (see the precautions on Page 3-7).
2. Align the module with the guides in the slot.
3. *Gently* push the module completely into the slot, and then engage the latch. See Figure 3-8.

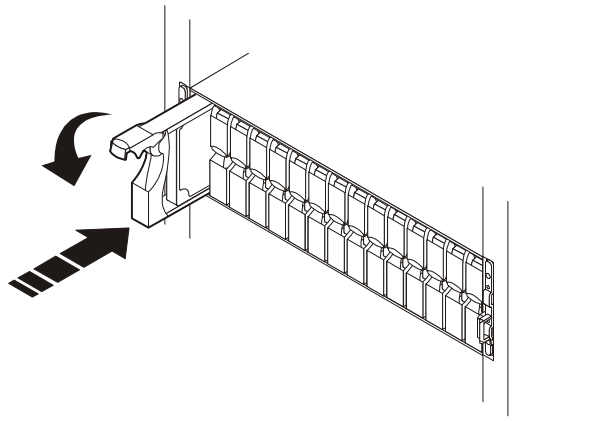

Figure 3-8 Installing a Disk or Filler Module (FC Disk Carrier Shown)

The disk module's Active light flashes to reflect the disk's spin-up sequence.

4. Remove and store the ESD wristband and continue to the next section to install the front bezel.

Installing and Locking the Front Bezel

Refer to Figure 3-9 as you do the following:

1. Align the bezel with the disk enclosure.
2. Gently push the bezel into place on the cabinet until it latches.
3. Secure the bezel by turning the key in the lock.

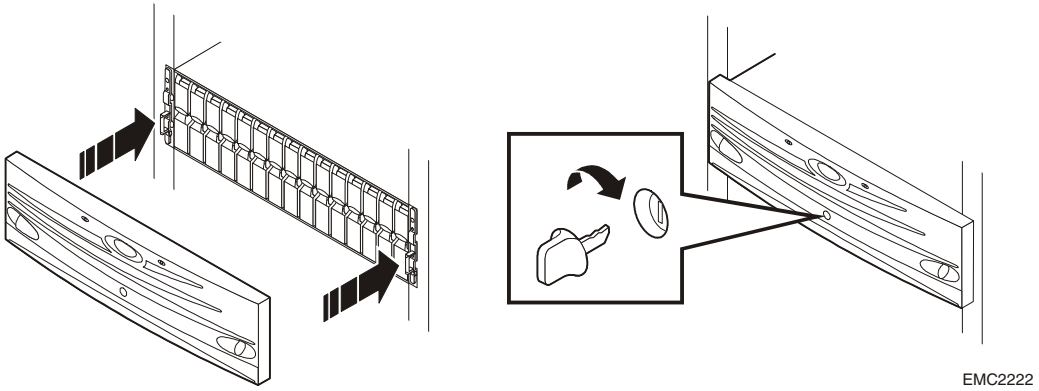

Figure 3-9 Installing and Locking the Front Bezel

Replacing an LCC Module

CAUTION

Handle an LCC gently and use an ESD wristband. Do not remove a faulty LCC until you have a replacement module available.

A DAE2 must have at least one LCC installed while it is powered up. Do not remove both LCCs while the disk enclosure is powered up.

Always replace an LCC with another of the same model; do not mix fibre channel and ATA components in the same enclosure. (An "ATA Ctlr" label on the module bulkhead identifies the ATA LCC.)

Removing an LCC

1. Gently press the connector latches to release them as you remove the copper cables connected to the LCC, as shown in Figure 3-10.

   Note where the cable(s) connect to the LCC; you will need to reconnect them to the replacement LCC.

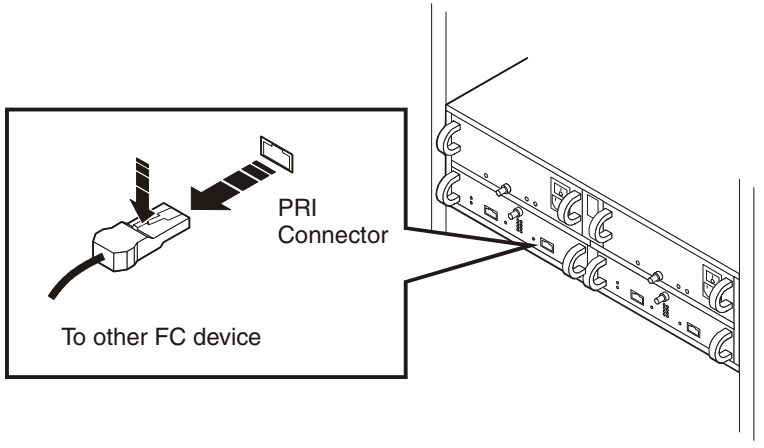

Figure 3-10 Removing a Copper Cable from an LCC

2. Turn the latch counterclockwise to release the module, and then remove the LCC from its slot, as shown in Figure 3-11.

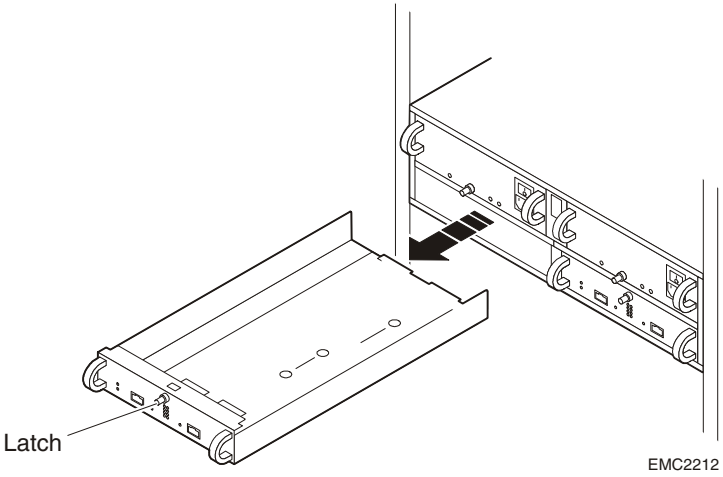

Figure 3-11 Removing an LCC

Continue to the next section to install the replacement LCC.

Installing an LCC

1. *Gently* insert the LCC as shown in Figure 3-12. Be sure the module is completely seated in the DAE2 midplane.

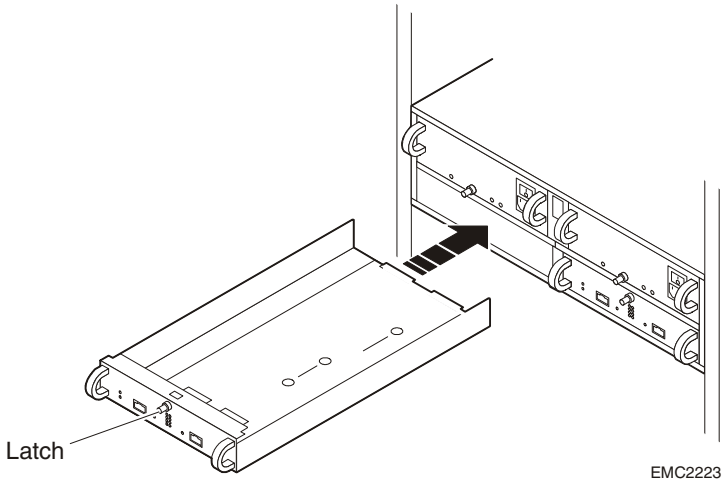

Figure 3-12 Installing an LCC

The LCC Power light turns on.

2. Turn the latch clockwise to secure the module.

The DAE2 LCC latch holds the module in an established position. It does not pull or otherwise help to seat the LCC.

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3. Reattach the copper cables to the same connector from which you removed them, as shown in Figure 3-13.

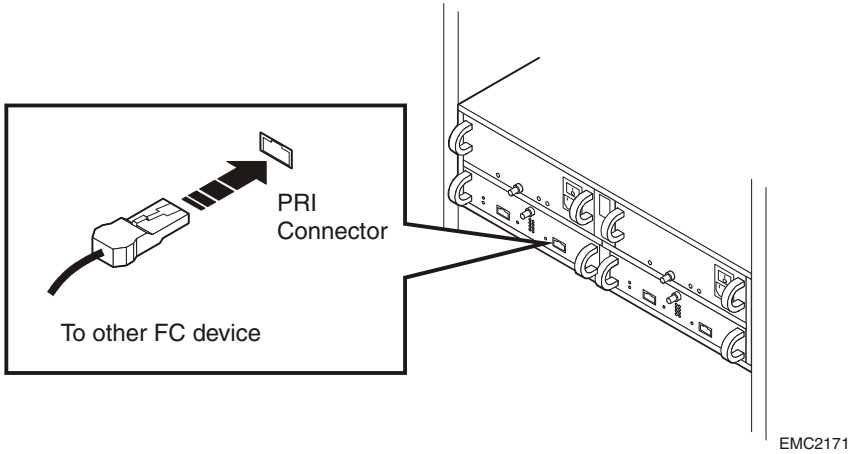

Figure 3-13 Reconnecting a Copper Cable to an LCC

4. Remove and store the ESD wristband.

The example configuration in Figure 3-14 shows a generic CLARiiON® storage processor enclosure (SPE) below four DAE2 disk-array enclosures. Note that the external device connects to the *Primary* disk enclosure connectors, and subsequent enclosures connect in an Expansion-to-Primary chain.

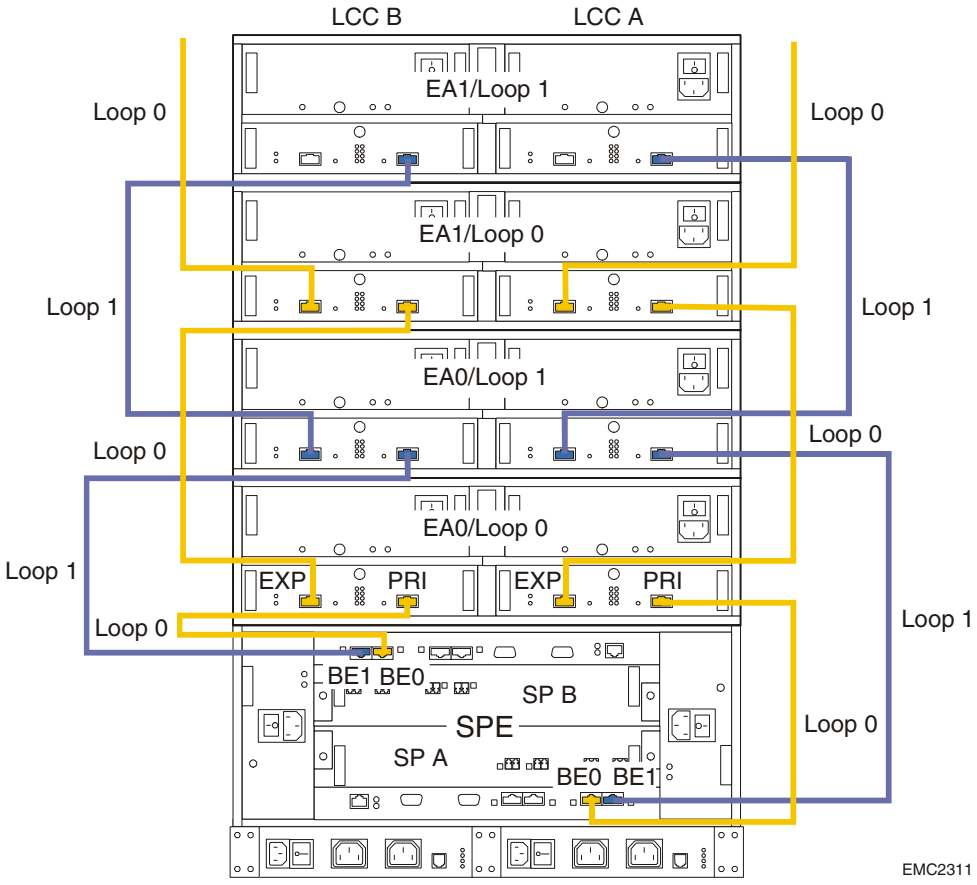

Figure 3-14 Connecting Disk Enclosures Together with Copper Cable

Replacing a Power Supply/System Cooling Module

CAUTION

Handle a power supply/system cooling module gently and use an ESD wristband. Do not remove a power/cooling module until you have a replacement module available.

If one power supply is off and the other is on, do *not* turn one on and immediately turn off the other. Instead, turn one on and wait five seconds after the green LED lights before turning the other off.

Turn off the power supply before unplugging the power cord from the supply.

Access to the disks in your enclosure will time out and the disks will power down two minutes after a power supply/system cooling module is removed from the system. While the system can continue operating on a single power supply, the loss of a module's two blowers will cause a time-out unless you replace the module within two minutes.

Follow these steps to replace a power supply/system cooling module.

1. Turn off the power supply and unplug its ac line cord as shown Figure 3-15.

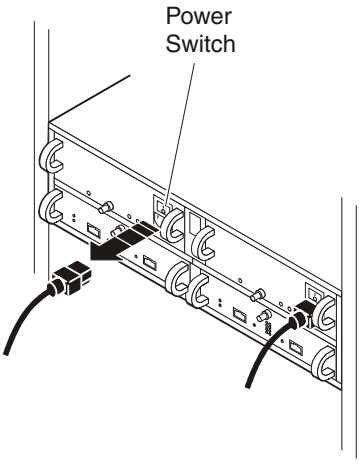

Figure 3-15 Turning Off a Supply's Power and Unplugging Its ac Power Cord

2. Turn the latch counterclockwise to release the module, and then remove the power/cooling module as shown in Figure 3-16.

To protect a running system from overheating, the enclosure will time out unless you replace the power/cooling module within two minutes.

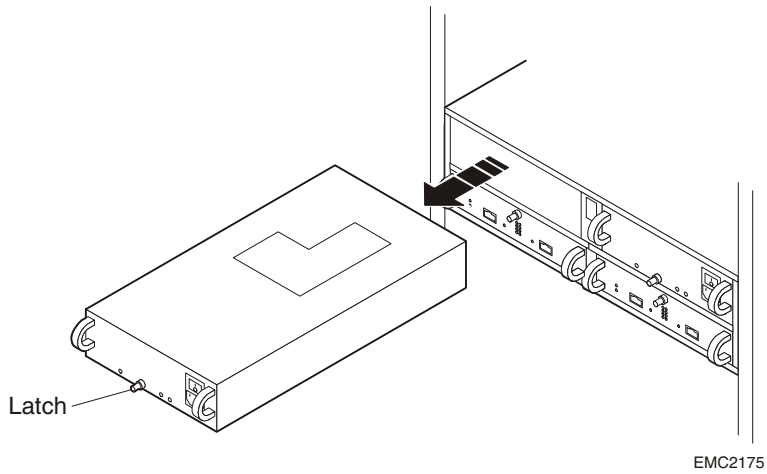

Figure 3-16 Removing a Power Supply/System Cooling Module

3. *Gently* insert the new power/cooling module into the enclosure, as shown in Figure 3-17. Be sure the module is completely seated.

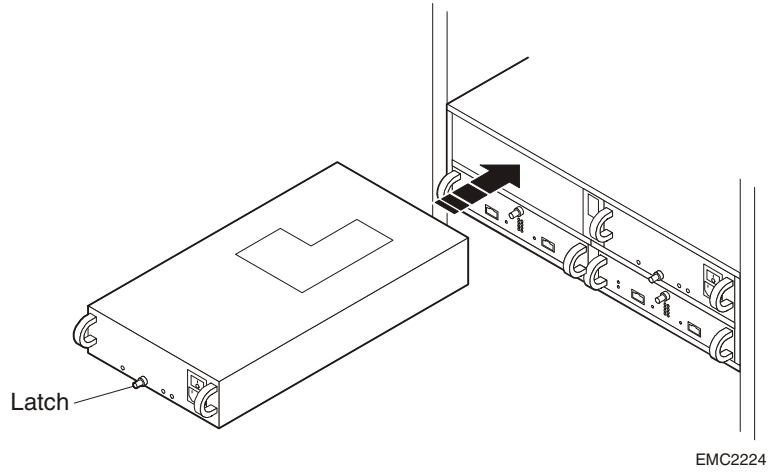

Figure 3-17 Installing a Power Supply/System Cooling Module

4. Turn the latch clockwise to secure the module.

The latch holds the power/cooling module in an established position. It does not pull or otherwise help to seat the module.

5. Plug the ac power cord into the new supply, and turn on the power supply as shown in Figure 3-18.

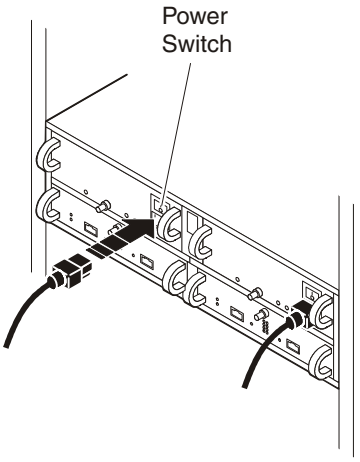

Figure 3-18 Plugging in the Power Cord and Turning on Power

Make certain you secure the power cord with the strain reliefs at each connector. The strain reliefs prevent the power cord from pulling out of the connections.

A

Technical Specifications

This appendix describes the disk enclosure technical specifications, operating limits, and shipping and storage requirements. Major topics are

Enclosure Specifications

Technical enclosure specifications include power requirements, size, drive, interface, and standards information.

Ac Power Requirements

The input current, power (VA), and dissipation per DAE2 are based on the requirements that a maximum DAE2 configuration places on the power supplies and cooling system to provide internal regulated power. Typical values will be less, depending on the number and manufacturer of disk modules. These values represent either

- the values for a single power supply line cord, or
- the sum of values shared by the line cords of two power supplies in the same DAE2, with the division between the line cords and supplies at the current sharing ratio (approximately 50% each).

A failure of one of the two power supplies in the DAE2 results in the remaining supply and cord supporting the full load. You must use a rackmount cabinet with ac power distribution, and have main branch ac distribution that can handle these values for each disk enclosure in the cabinet.

	Description	
Requirement	**DAE2 (Fibre Channel)**	**DAE2-ATA**
ac line voltage	100 to 240 Vac ± 10%, single phase, 47 to 63 Hz	
ac line current	4.0 A at 100 Vac, 1.6 A at 200 Vac	3.0 A at 100 Vac, 1.4 A at 200 Vac
Power consumption	400 VA(392 W) max (fully configured)*	300 VA (294) W) max (fully configured)*
Power factor	0.98 min at full load, low voltage	
Heat dissipation	1.41 106 J/hr (1,330 BTU/hr) max *	1.06 106 J/hr (1,017 BTU/hr) max *
In-rush current	25 A max for 1/2 line cycle, per power supply at 240 Vac 15 A max for 1/2 line cycle, per power supply at 120 Vac	
Startup surge current	15 Apk (10.6 Arms) max for 100 ms, at any line voltage	
ac protection	10 A fuse in each power supply, both phases	
ac receptacle type	IEC320-C14 appliance coupler, per power supply	
Ride-through time	30 ms min	
Current sharing	60% max, 40% min, between power supplies	

* A *fully configured* DAE2 includes two power supplies, two LCCs, and 15 disk drives.

Size and Weight

Requirement	Measurement
Height	133.35 mm (5.25 in) 3 NEMA units including mounting hardware
Width	450 mm (17.72 in)
Depth	603.25 mm (23.75 in)
Weight	43.2 kg (95.3 lbs) maximum configuration 1.1 kg (2.4 lbs) per FC disk module; 1.125 kg (2.5 lbs) per ATA module 1.4 kg (3 lbs) per link control card 4.1 kg (9 lbs) per power supply 12.7 kg (28 lbs) chassis and midplane

Drive Type

The DAE2 uses 3.5-inch (8.75 cm) by 1.0-inch (2.54 cm) disk drives. Standard, Fibre Channel versions are 12-volt, and support the Fibre Channel interface. ATA versions are 12- and 5-volt and support the ATA-6 interface.

Each drive slot provides an average maximum of 16 W drive module power.

Refer to the *EMC Storage Systems CX-Series Disk and Software Support Matrix* for a list of supported drives.

LCC FC-AL Interface

Connectors are shielded HSSDC (High Speed Serial Data Connector).

Copper Cabling

Type:	Shielded, 150 Ω differential, shield bonded to HSSDC plug connector shell (360°) FC-PI Standard, Revision 13 or higher
Length:	1 meter (3.3 feet) unequalized; 5 meter (16.5 feet) and 10 meter (33 feet) equalized

Standards Certification and Compliance

Rackmount disk enclosures are tested and certified for compliance with the international environmental and safety specifications listed below and marked to indicate such compliance and certification as required.

Standard	Description
CSA 22.2 No. 950	Safety of Information Technology Equipment including Electrical Business Equipment
EN 60950	
UL 1950	
CE Mark	European EMC Directive & Low Voltage Directive Requirements

EMI Standards

Standard	Description
FCC Part 15	Class A, Radio Frequency Device Requirements
ICES-003	Class A, Interference-Causing Equipments Standard - Digital Apparatus
CE Mark	European EMC Directive & Low Voltage Directive Requirements.
VCCI	Class A, Voluntary Control Council for Interference
AS/NZS 3548	Class A, Electromagnetic Interference - Limits & Methods of Measurement of ITE
CNS13438	BSMI EMC Requirements

Fibre Channel Related Standards

Standard	Description
Fibre Channel	Physical and signaling interface, FC-PI, draft Rev. 13
Fibre Channel	Arbitrated Loop (FC-AL), Revision 4.5
Fibre Channel	Private Loop Direct Attach (PLDA), Revision 2.1

In some cases, the DAE2 uses functions from later revisions of specifications.

Operating Limits

The ambient temperature specification is measured at the front bezel inlet. The site must have air conditioning of the correct size and placement to maintain the specified ambient temperature range. The air conditioning must be able to handle the BTU requirements of the disk enclosures.

Requirement	Description
Ambient temperature	10ºC to 40ºC (50ºF to 104ºF)
Temperature gradient	10ºC/hr (18ºF/hr)
Relative humidity	20% to 80% noncondensing
Elevation	2438 m (8,000 ft) at 40ºC, 3077 m (10,000 ft) at 37ºC

The operating limits for temperature and humidity must not be exceeded inside the closed cabinet in which the DAE2s are mounted. Mounting equipment in a cabinet directly above or below a DAE2 does not restrict air flow to the disk enclosure, because air flows through the enclosure from front to back. Cabinet doors must not impede the front-to-back air flow.

Shipping and Storage Requirements

Requirement	Description
Ambient temperature	-40ºC to 65ºC (-40ºF to 149ºF)
Temperature gradient	25ºC/hr (45ºF/hr)
Relative humidity	10% to 90% noncondensing
Elevation	7625 m (25,000 ft)

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