Netfinity Fibre Channel RAID Controller Unit

User’s Handbook

Before using this information and product it supports, be sure to read the general information under "Appendix A. Product Warranties and Notices".

First Edition (September 1998)

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Caution and Danger Statements

Important:

All caution and danger statements in this book begin with a number. This number is used to cross-reference an English caution or danger statement with translated versions of the caution or danger statement that can be found in the Safety Information book.

For example, if a caution statement begins with a number 1, translations for that caution statements appear in the Safety Information book under statement 1.

Be sure to read all caution and danger statements before performing any instructions.

Instruções de Cuidado e Perigo (Português do Brasil)

Importante:

Todas as instruções de cuidado e perigo deste manual são iniciadas por um número. Este número é utilizado para fazer a referência cruzada de uma instrução de cuidado ou perigo no idioma inglês com as versões traduzidas das instruções de cuidado e perigo que podem ser encontradas na publicação *Safety Information* (Informações sobre Segurança).

Por exemplo, se uma instrução de cuidado é iniciada pelo número 1, as traduções para aquela instrução de cuidado aparecem na publicação *Safety Information* sob a instrução 1.

Leia todas as instruções de cuidado e perigo antes de executar qualquer operação.

Sikkerhedsforskrifter mærket Pas på! og Fare! (dansk)

Vigtigt:

Alle sikkerhedsforskrifter i dette hæfte begynder med et tal. Dette tal bruges som krydshenvisning fra en engelsk sikkerhedsforskrift mærket CAUTION (Pas på!) eller DANGER (Fare!) til de oversatte forskrifter, der findes i dette hæfte (*Safety Information*).

Hvis f.eks. en sikkerhedsforskrift mærket Pas på! hedder Forskrift 1, er denne en oversættelse af den engelske forskrift nummer 1 i hæftet.

Læs alle sikkerhedsforskrifter mærket Pas på! og Fare!, før du følger nogen af instruktionerne.

Turvaohjeet (suomi)

Tärkeää:

Kaikkien tämän *Safety Information* -kirjan turvaohjeiden alussa on numero, jonka avulla englanninkielistä VAARA-ilmoitusta (DANGER) tai varoitusta (CAUTION) vastaava suomenkielinen turvaohje löytyy kätevästi.

Jos varoitus alkaa esimerkiksi numerolla 1, vastaavalla suomenkielisellä käännöksellä on sama numero, ja se löytyy jäljempänä tästä kirjasta.

Lue kaikki turvaohjeet, ennen kuin aloitat ohjeissa kuvatut toimet.

Consignes Attention et Danger (Français)

Important:

Toutes les consignes Attention et Danger indiquées dans ce document sont précédées d'un numéro. Ce dernier permet de mettre en correspondance la consigne en anglais avec ses versions traduites situées dans le livret *Safety Information*.

Par exemple, si une consigne de type Attention est précédée du chiffre 1, ses traductions sont également précédées du chiffre 1 dans le livret *Safety Information*.

Prenez connaissance de toutes les consignes de type Attention et Danger avant de procéder aux opérations décrites par les instructions.

Sicherheitshinweise (Deutsch)

Wichtig:

Alle Sicherheitshinweise in dieser Broschüre beginnen mit einer Nummer. Diese Nummer verweist auf einen englischen Sicherheitshinweis mit den übersetzten Versionen dieses Hinweises, die in der Broschüre mit den Sicherheitshinweisen (*Safety Information*) enthalten sind.

Wenn z. B. ein Sicherheitshinweis mit der Nummer 1 beginnt, so erscheint die Übersetzung für diesen Sicherheitshinweis in der Broschüre *Safety Information* unter dem Hinweis 1.

Lesen Sie alle Sicherheitshinweise, bevor Sie eine Anweisung ausführen.

Avvisi di attenzione e di pericolo (Italiano)

Importante:

Tutti gli avvisi di attenzione e di pericolo riportati in questo manuale iniziano con un numero. Tale numero contrassegna gli avvisi in lingua inglese e le corrispondenti versioni tradotte che sono riportate nella nelle informazioni di sicurezza (*Safety Information*).

Ad esempio, se un avviso di attenzione inizia con il numero 1, la corrispondente versione tradotta è riportata nella pubblicazione *Safety Information* come l'avviso numero 1.

Accertarsi di leggere tutti gli avvisi di attenzione e di pericolo prima di effettuare qualsiasi operazione.

Veiligheidsinstructies (Nederlands)

Belangrijk:

Alle veiligheidsinstructies in dit boekje beginnen met een nummer. Met dit nummer wordt verwezen naar de Engelse instructie en alle vertalingen in dit boekje *Safety Information*.

Als een instructie bijvoorbeeld begint met nummer 1, kunt u de Engelse versie en alle vertalingen in dit boekje *Safety Information* eveneens vinden onder instructie 1.

Lees alle instructies in dit boekje voordat u installatie- of onderhoudsprocedures uitvoert.

Advarsels- og faremerknader (norsk)

Viktig:

Alle advarsels- og faremerknader i denne boken begynner med et nummer. Dette nummeret brukes som kryssreferanse mellom en engelsk advarsels- eller faremerknad og den oversatte versjonen av merknaden som du kan finne i boken om sikkerhetsinformasjon (*Safety Information*).

Hvis for eksempel en advarselsmerknad begynner med nummeret 1, finner du oversettelsen av advarselsmerknaden i boken *Safety Information* under merknad 1.

Pass på at du leser alle advarsels- og faremerknader før du utfører noen av instruksjonene.

Notas de Cuidado e de Perigo (Português)

Importante:

Todas as notas de cuidado e de perigo, incluídas neste manual, começam por um número. Este número é utilizado para, a partir de uma nota de cuidado ou perigo, em Inglês, identificar a respectiva tradução, a qual pode ser encontrada no manual *Safety Information* (Informações sobre Segurança).

Por exemplo, se uma nota de cuidado começa pelo número 1, a respectiva tradução é apresentada no manual *Safety Information*, identificada como nota número 1.

Não deixe de ler todas as notas de cuidado e perigo, antes de executar qualquer das instruções.

Declaraciones sobre precauciones y peligros (español)

Importante:

Todas las declaraciones de precaución y peligro contenidas en este manual empiezan por un número. Dicho número se emplea para establecer una referencia cruzada entre de una declaración de precaución o peligro en inglés con las versiones traducidas que de dichas declaraciones pueden encontrarse en el manual Información de seguridad (*Safety Information*).

Por ejemplo, si una declaración de peligro empieza con el número 1, las traducciones de esta declaración de precaución aparecen en el manual Información de seguridad (*Safety Information*) bajo Declaración 1.

Lea atentamente todas las declaraciones de precaución y peligro antes de llevar a cabo cualquier operación.

Varningsmeddelanden (Svenska)

Viktigt:

Alla varningsmeddelanden i den här boken inleds med ett nummer. Med hjälp av numren kan du identifiera meddelandenas översättningar, som finns i boken Safety Information.

Om t ex ett varningsmeddelande har nummer 1 hittar du översättningen av det i Safety Information också som meddelande nummer 1.

Läs alla varningsmeddelanden innan du börjar utföra några åtgärder.

注意及危險聲明（中文）

重要資訊：

本書中所有「注意」及「危險」的聲明均以數字開始。此一數字是用來作為交互參考之用，英文「注意」或「危險」聲明可在「安全資訊」(Safety Information) 一書中找到相同內容的「注意」或「危險」聲明的譯文。

例如，有一「危險」聲明以數字 1 開始，則該「危險」聲明的譯文將出現在「安全資訊」(Safety Information) 一書的「聲明」1 中。

執行任何指示之前，請詳讀所有「注意」及「危險」的聲明。

Navedbe svaril in nevarnosti (slovensko)

Važno:

Vse navedbe svaril in nevarnosti v tej knjigi se začenjajo s številko. To številko uporabljamo za navzkrižno povezavo angleške navedbe svarila ali nevarnosti s prevedenimi verzijami navedbe svarila ali nevarnosti, ki jo lahko najdemo v knjigi *Informacije o varnosti (Safety Information)*.

Na primer, če se navedba svarila začenja s številko 1, se prevod za to navedbo svarila pojavi v knjigi *Informacije o varnosti (Safety Information)* pod navedbo 1.

Obvezno preberite vse navedbe svaril in nevarnosti, preden začnete izvajati katerokoli navodilo.

Inštrukcie Nebezpečenstvo a Pozor (Slovensky)

Pozor:

Všetky bezpečnostné inštrukcie v tejto knižke začínajú číslom. Tieto čísla sú používané pre hľadanie zodpovedajúceho prekladu anglickej bezpečnostnej inštrukcie v knižke *Safety Information*.

Napíklad ak bezpečnostné inštrukcie začínajú číslom 1, nájdete zodpovedajúci perklad v knižke*Safety Information* pod číslom 1.

Uistite sa, že ste si pre začiatkom vykonávania akejkoľvek inštrukcie najprv prečítali všetky bezpečnostné inštrukcie.

Замечания "Осторожно" и "Опасно" (Русский)

Важное замечание:

Все замечания, помеченные в этой книге словами "Осторожно" ("Caution") и "Опасно" ("Danger"), пронумерованы. По этим номерам вы сможете найти перевод замечаний "Осторожно" или "Опасно" в брошюре *Safety Information* (Информация по технике безопасности).

Так, если вам нужен перевод замечания "Caution" ("Осторожно") под номером 1, то вы найдете его в брошюре *Safety Information* (Информация по технике безопасности) тоже под номером 1.

Перед тем, как выполнять какие-либо инструкции, обязательно прочтите все замечания, помеченные в этой книге словами "Осторожно" ("Caution") и "Опасно" ("Danger").

Ostrzeżenia i uwagi o niebezpieczeństwie (polski)

Ważne:

Wszystkie uwagi o niebezpieczeństwie i ostrzeżenia przed niebezpieczeństwem w tej książce zaczynają się numerem. Numer ten jest używany do porównania angielskiej wersji uwag i ostrzeżeń z ich tłumaczeniem, które można znaleźć w książce *Uwagi dotyczące bezpieczeństwa (Safety Information)*.

Na przykład, jeśli uwaga zaczyna się numerem 1, to w książce *Uwagi dotyczące bezpieczeństwa (Safety Information)*, znajduje się jej tłumaczenie zaczynające się też numerem 1.

Należy przeczytać wszystkie uwagi i ostrzeżenia przed wykonaniem jakiejkolwiek instrukcji.

Изјави за предупредување и опасност (македонски)

Важно:

Сите изјави за предупредување и опасност во оваа книга почнуваат со број. Овој број е употребен за поврзување на англиските изјави за предупредување и опасност со преведените верзии на изјавите за предупредување и опасност кои може да се најдат во книгата *Безбедносни информации (Safety Information).*

На пример, ако изјавата за предупредување почнува со бројот 1, преводот на таа изјава за предупредување се појавува во книгата Safety Information под изјава 1.

Прочитајте ги сите изјави за предупредување и опасност пред да изведете било која инструкција

주의 및 위험 경고문(한글)

중요:

이 책에 나오는 모든 주의 및 위험 경고문은 번호로 시작됩니다. 이 번호는 *Safety Information* 책에 나오는 영문판 주의 및 위험 경고문과 한글판 주의 및 위험 경고문을 상호 참조하는데 사용됩니다.

예를 들어 주의 경고문이 번호 1로 시작되면 *Safety Information* 책에서 이 주의 경고문은 경고문 1번 아래에 나옵니다.

지시를 따라 수행하기 전에 먼저 모든 주의 및 위험 경고문을 읽도록 하십시오.

注意と危険に関する記述(日本語)

重要：

この本では、番号の後に注意と危険に関する記述が掲載されています。この番号は英語の注意と危険に関する記述と小冊子「Safety Information」に記載されている翻訳版の記述との相互参照のために使用します。

たとえば、もし注意の記述が番号 1 で始まる場合は、この注意の記述は小冊子「Safety Information」の記述 1 にあります。

作業を始める前に、すべての注意と危険に関する記述をお読みください。

Figyelmeztetések és veszély ismertetések (Magyar)

Fontos:

A könyvben szereplő mindegyik figyelmeztetés és veszély ismertető egy számmal kezdődik. Ez egy hivatkozási szám, mely összeköti a Biztonsági információk (Safety Information) című kötetben található ismertetők angol nyelvű verzióit a fordított verziókkal.

Például ha egy figyelmeztetés 1-essel kezdődik, a fordítása a Biztonsági információk (Safety Information) című kötetben az 1. ismertető alatt található.

Feltétlenül olvassa végig a figyelmeztetéseket és veszély ismertetőket, mielőtt nekikezd bármelyik útmutató végrehajtásához.

Instrukce Nebezpečí a Pozor (Česky)

Pozor:

Všechny bezpečnostní instrukce v této knize začínají číslem. Tato čísla jsou používána pro nalezení odpovídajícího překladu anglické bezpečnostní instrukce v knize *Safety Information*.

Například pokud bezpečnostní instrukce začíná číslem 1, naleznete odpovídající překlad v knize *Safety Information* pod číslem 1.

Ujistěte se, že jste si před začátkem provádění jakékoli instrukce nejdříve přečetli všechny bezpečnostní instrukce.

Instrukce Nebezpečí a Pozor (Česky)

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Všechny bezpečnostní instrukce v této knize začínají číslem. Tato čísla jsou používána pro nalezení odpovídajícího překladu anglické bezpečnostní instrukce v knize *Safety Information*.

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Ujistěte se, že jste si před začátkem provádění jakékoli instrukce nejdříve přečetli všechny bezpečnostní instrukce.

Instrukce Nebezpečí a Pozor (Česky)

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Například pokud bezpečnostní instrukce začíná číslem 1, naleznete odpovídající překlad v knize *Safety Information* pod číslem 1.

Ujistěte se, že jste si před začátkem provádění jakékoli instrukce nejdříve přečetli všechny bezpečnostní instrukce.

Napomene opasnosti i upozorenja (hrvatski)

Važno

Sva napomene upozorenja i opasnosti u ovoj knjizi zapocinju brojem. Taj se koristi za usporedbu izvornih napomena na engleskom jeziku s prijevodom koji se nalazi u *Sigurnosnim Uputama (Safety Information)*.

Na pr. ako napomena upozorenja počinje s brojem 1, prijevod tog teksta se nalazi u *Sigurnosnim Uputama (Safety Information)* kao napomena br. 1

Obavezno pročitajte sve napomene upozorenja i opasnosti prije nego započnete s radovima prema ovim uputama.

注意和危险声明(简体中文)

重要事项：

本书中的所有注意和危险声明之前都有编号。该编号用于英语的注意或危险声明与 *Safety Information* 一书中可以找到的翻译版本的注意或危险声明进行交叉引用。

例如，如果一个注意声明以编号 1 开始，那么对该注意声明的翻译出现在 *Safety Information* 一书中的声明 1 中。

在按说明执行任何操作前，请务必阅读所有注意和危险声明。

Electrical Safety

1

DANGER

To avoid a shock hazard, do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.

To avoid shock hazard:

- **The power cord must be connected to a properly wired and earthed receptacle.**
- **Any equipment to which this product will be attached must also be connected to properly wired receptacles.**

When possible, use one hand to connect or disconnect signal cables to prevent a possible shock from touching two surfaces with different electrical potentials.

Electrical current from power, telephone, and communications cables is hazardous. To avoid shock hazard, connect and disconnect cables as described following when installing, moving, or opening covers of this product or attached devices.

To Connect	To Disconnect
1. Turn everything OFF. 2. First, attach all cables to devices. 3. Attach signal cables to receptacles. 4. Attach power cord(s) to outlet. 5. Turn device ON.	1. Turn everything OFF. 2. First, remove power cord(s) from outlet. 3. Remove signal cables from receptacles. 4. Remove all cables from devices.

NOTE: In the UK, by law, the telephone cable must be connected after the power cord.	NOTE: In the UK, by law, the power cord must be disconnected after the telephone cable.

Chapter 1. Getting Started

This section provides brief descriptions of and reference pages for the primary components of the controller unit.

Controller Unit Cabinet

The Netfinity Fibre Channel RAID controller unit is available in a standard rackmount model (Figure 1).

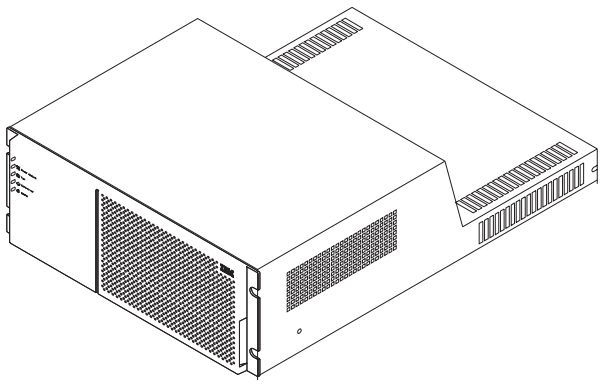


Figure 1. Rackmount Cabinet

Removable Components

Each model contains several removable, portable canisters, called *customer replaceable units (CRUs)*, that you can access from either the front or back of the unit. These CRUs include: a battery, controllers, power supplies, and cooling fans. The controller unit also has a removable front cover.

Front View

The front of the controller unit has the following primary components (Figure 2):

- **Front cover (bezel)** – a removable panel with holes for viewing the status lights and for boosting air circulation. See "Gaining Access to the Controls."
- **Controller CRUs** – two removable units that contain array controllers. See "4766 Controller CRU."
- **Battery CRU** – one removable unit that contains batteries and battery charger circuitry. See "Battery CRU."
- **Controller fan CRU** – one removable unit that contains two cooling fans and status LEDs. See Figure 16. "Controller Fan CRU and Status LEDs."

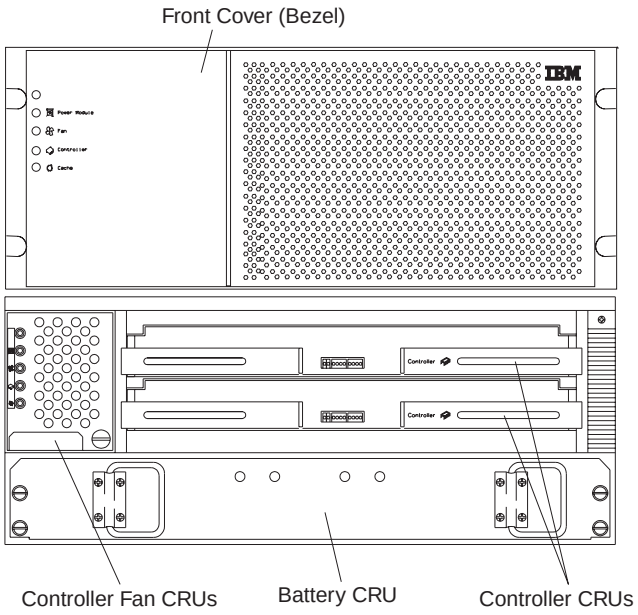


Figure 2. Front View of Controller Unit

Back View

The back of the controller unit has the following primary components (Figure 3):

- **Connector plate** – a protective panel that contains access holes for interface connectors and jumpers. See Figure 3.
- **Power supply CRUs** – two removable units for the power supplies. See "Power Supply CRU."
- **Power supply fan CRU** – one removable unit for the power supply cooling fans. See "Power Supply Fan CRU."

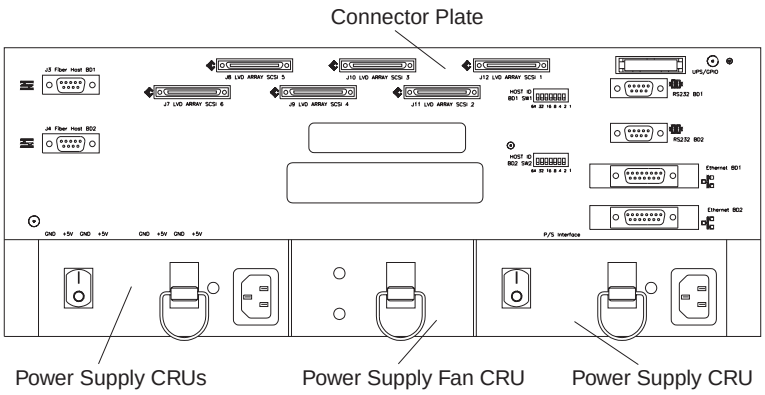


Figure 3. Back View of Controller Unit

Basic Operation

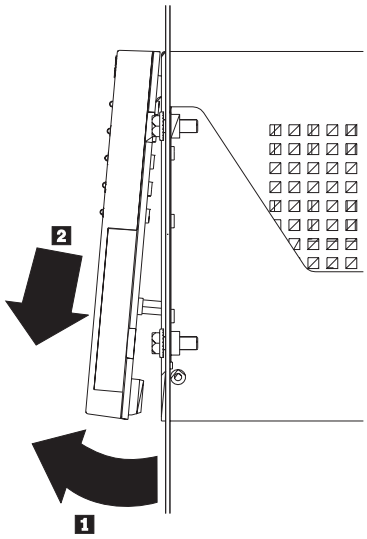
The controller unit has several features that aid in operating and servicing the hardware. These include:

- **LEDs** (light emitting diodes) – green or amber lights that glow or blink to indicate either a normal operating status or hardware error
- **Power switches** – two switches that turn the power on and off on the controller unit
- **Handles and levers** – allow you to remove and install individual CRUs more easily
- **Connectors** – sockets for attaching interface and power cables to the controller unit

This section explains how to use these controls to turn the controller unit on and off under normal and emergency circumstances. It also explains how to check the hardware status of the controller unit.

Gaining Access to the Controls

To gain access to the CRUs, cables, LEDs, and switches inside the controller unit, you must remove the front cover. Figure 4 shows how to remove the cover.



Front Cover

To remove the front cover, pull out on bottom to release pins, then slide down.

To replace the front cover, slide top edge under lip on chassis, then push bottom until pins snap into mounting holes.

Figure 4. Removing the Covers on the Controller Unit

Turning On the Power

Note: If you are turning on the controller unit after an emergency shutdown or power outage, use the procedure "Restoring Power."

You must turn on the drive modules first before turning on the controller unit. The controllers will not acknowledge any attached drives that are powered up after the controller unit. Use this procedure to power-up the controller unit. For instructions on powering-up the drive modules, refer to the drive module documentation.

1 Remove the access panel from the back of the rackmount cabinet.

2 If you are turning on the controller unit:

After a normal shutdown. Turn on both power switches on the back of the controller unit (Figure 5 on page 5). You must turn on both switches to take advantage of the redundant power supplies. Then, go to "Using the Status LEDs."

At initial start-up. Do the following:

a. Verify the following:

- All cables and CRUs are plugged securely into the controller unit.
- The host IDs are set correctly.
- The hosts and other devices are ready for power-up.

b. Check for other devices attached to the system and determine the proper start-up sequence for all applicable devices.

c. Based on this power-up sequence, turn on the power to each device, including applicable circuit breakers in rackmount cabinets. When the activity to the disk drives has quiesced, turn on both controller unit power switches (Figure 5 on page 5).

d. Go to "Using the Status LEDs."

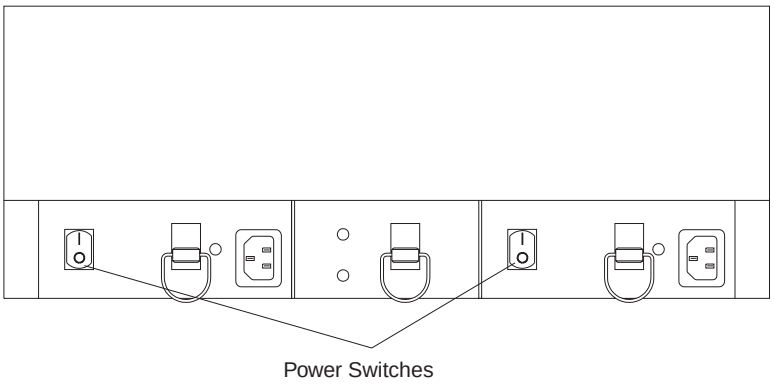


Figure 5. Controller Unit Power Switches

Turning Off the Power

Attention: Except in an emergency, never turn off the power if any Fault LEDs are lit on the controller unit. Always correct the fault before turning off the power, using the proper troubleshooting or servicing procedure. This will ensure that the controller unit will power up correctly later. For guidance, refer to "Controller and Interface Problems."

Use this procedure to turn off the power to the controller unit. The controller unit is designed to run continuously, 24 hours a day. Once you turn on the controller unit, it should remain on except during certain service procedures.

1. Remove the access panel (Figure 4 on page 4) from the back of the rackmount cabinet.

2. Prepare the controller unit for shutdown.

a. **Stop all I/O activity to the controller unit and attached drive modules.** If applicable, logically disconnect the controllers and drive modules from the hosts. Make sure that the Fast Write Cache LED on the front cover and all applicable drive activity LEDs are off (not blinking).

b. **Make sure that all amber Fault LEDs on the controller unit are off.** If any Fault LEDs are lit, correct the problem before you turn off the power (see "Using the Status LEDs.").

3. Turn off the power switches on the controller unit before removing power from drive modules (Figure 5 on page 5).

   Turn off both power switches on the back of the controller unit. If you want to shut down the entire system, turn off the main circuit breakers (or power switches) in the cabinet.

Restoring Power

Caution: Never turn on any equipment when there is evidence of fire, water, or structural damage. Doing so may cause severe electrical shock.

Use this procedure to restart the controller unit after a power failure or emergency shutdown.

1. After the emergency situation is over or power is restored to the building, check all components and cables for damage. If there is no visible damage, go to Step 2.

   DO NOT continue with this procedure if you find any evidence of fire, water, or structural damage. If there is no visible damage, go to Step 2.

   If there is evidence of damage, contact IBM for technical support:

   - Within the U.S. call the Options by IBM HelpCenter at 800-772-2227
   - Within Canada
     - For support, call HelpPC at 800-565-3344
     - For more information or to place an order call 800-465-7999
   - Outside the U.S. and Canada contact your IBM HelpWare number, your place of purchase, or your local IBM office.

2. Plug in the power cords and turn on the power (Figure 5 on page 5).

   a. After checking for physical damage, plug in the power cords.

   b. Turn on the power switches on all drive modules attached to the controller unit. Then, turn on the circuit breakers.

   c. Next, turn on both power switches on the back of the controller unit.

Note: If the controller unit is attached to disk storage devices, you must turn on these devices before you turn on the controller unit.

3. Check the status of the controller unit and other devices.

   Make sure all Fault LEDs are off on the front and back of the controller unit (see "Using the Status LEDs."). Once all the devices on the system are powered-up, check the overall system status using the storage management software.

4. Replace the rear access panel.

Using the Status LEDs

The LEDs on the controller unit indicate the status of the controller unit and its individual components. The green LEDs indicate a normal operating status; amber LEDs indicate a hardware fault. It is important that you check all of the LEDs on the front and back of the controller unit when you turn on the power.

In addition to checking for faults, you can use LEDs on the front cover, controller CRUs, and drive units (if applicable) to determine if the controllers and drives are responding to I/O transmissions from the host. Refer to your storage management software User's Guide for additional information about checking system status.

Consider the following LED activities when you check LED status:

- If a Fast Write Cache operation or other I/O activity is in progress to the controller unit (or attached drive units), you may see several green LEDs blinking, including: the Fast Write Cache LED (on the front cover), controller CRU status LEDs, or applicable drive activity LEDs.
- The green Heartbeat LEDs on the controller CRUs blink continuously. The number and pattern of green status LEDs lit on the controllers depend on how your system is configured. An active controller will not have the same status LEDs lit as a passive controller.
- If you just turned on the power, the green and amber LEDs may turn on and off intermittently. Wait until the controller unit finishes powering up before you begin checking for faults.

Use the following procedure to check the LEDs and operating status of the controller unit and its components. For additional information on status LEDs, refer to "Controller Fan CRU." For troubleshooting instructions, go to "Controller and Interface Problems."

1. Remove the front cover and panel.

   To view the controller CRU LEDs, you must remove the front cover from the controller unit.

2. Check the LEDs on the front.

Use Figure 6 and Table 1 to check the status LEDs on the front of the controller unit. Under normal conditions, the green Power LED (top or left light) is on and the amber LEDs are off. If any amber LEDs are on, go to the service page indicated in the last column of Table 1.

Note: Two controllers are shown in Figure 6. "LEDs on the Front."

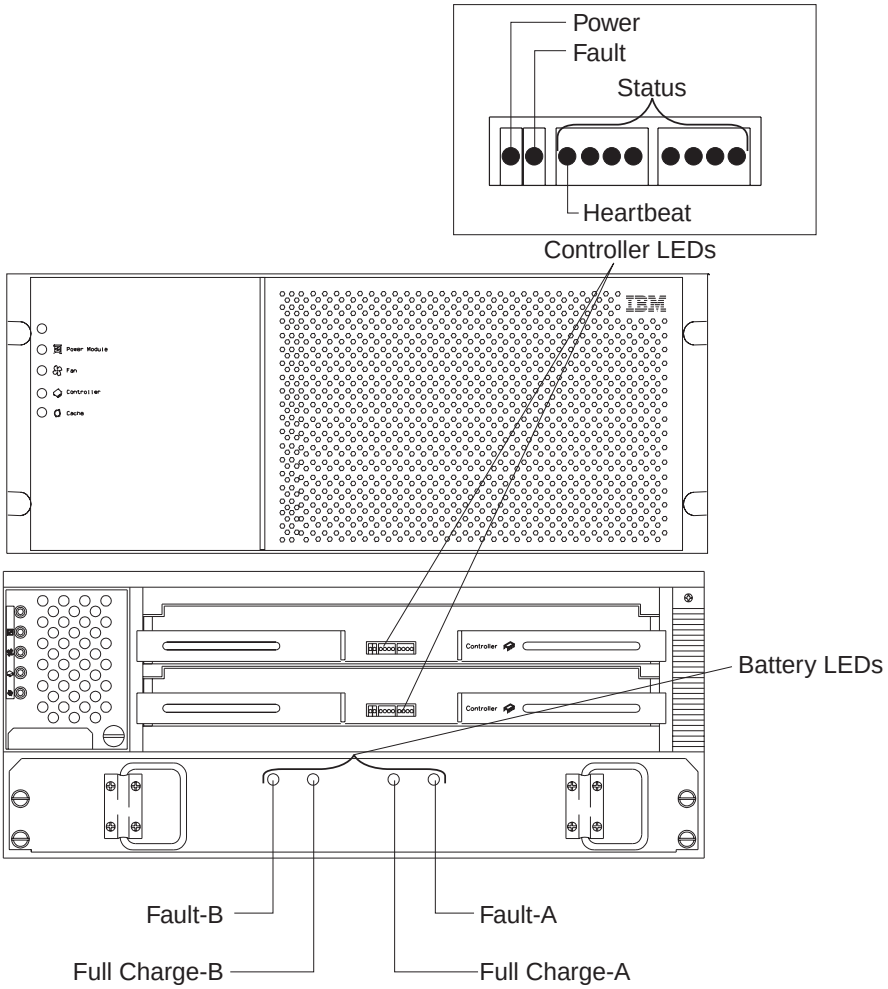


Figure 6. LEDs on the Front

Table 1: Status LEDs on Front of Controller Unit

Location	LED/Switch	LED Color	Normal Status	Problem Status	See Page
Front Cover (Controller Fan CRU)	Power	Green	On	Off	page 4
	Power Supply	Amber	Off	On	page 50
	Fan	Amber	Off	On	page 26
	Controller	Amber	Off	On	page 20
	Fast Write Cache	Green	Blinking[1]	Off[1]	page 87
Controller CRU	Fault	Amber	Off	On	page 20
	Power	Green	On	Off	page 19
	Heartbeat	Green	Blinking[2]	Off	page 19
	Status	Green	On[2]	Off[2]	page 20
Battery CRU	Fault-B	Amber	Off	On	page 43
	Full Charge-B	Green	On	Off	page 48
	Fault-A	Amber	Off	On	page 43
	Full Charge-A	Green	On	Off	page 87

[1] Fast Write Cache LED blinks only during a fast write operation. Refer to Figure 16. "Controller Fan CRU and Status LEDs" on page 28 for details.
[2] The controller CRU has eight status LEDs, including one Heartbeat LED, that glow in various patterns. See Figure 10. "Controller CRU, Slots, and LEDs" on page 16 for details.

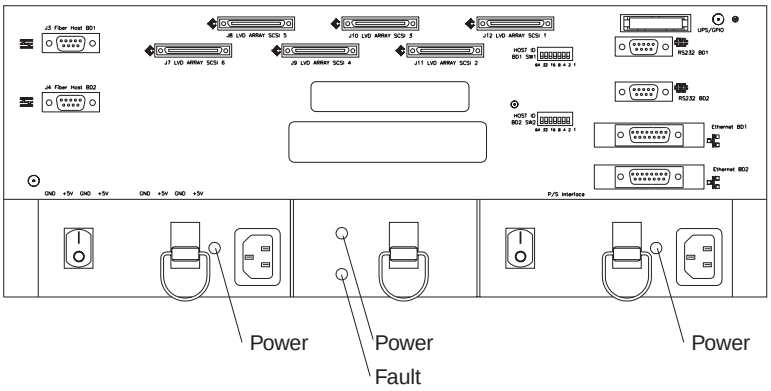


Figure 7. LEDs on the Back

Table 2: Status LEDs on Back of Controller Unit

Location	LED	LED Color	Normal Status	Problem Status	See Page
Power Supply CRU	Power	Green	On	Off	page 50
Power Supply Fan CRU	Fault	Amber	Off	On	page 34
	Power	Green	On	Off	page 29

3. Check the LEDs on the back.

   Use Figure 7 and Table 2 to check the status LEDs on the back of the controller unit. All green LEDs should be on and the amber Fault LED should be off. If the Fault LED is on or one of the green LEDs is off, go to the page indicated in the last column of Table 2.

4. With all status LEDs indicating a “normal status,” replace all front and back covers.

Instructions for Modifying the Controller Unit

You may need to make changes to the controller unit under the following circumstances:

- Moving the controller unit to a new location (refer to "Preparing to Move the Controller Unit" below)
- Removing one or more CRUs during a service procedure or to make the controller unit easier to lift.

You can use the instructions in this section to prepare the controller unit for relocation or servicing.

Preparing to Move the Controller Unit

Perform the following preparatory tasks before moving the controller unit to a new location. These will help safeguard the equipment and ensure a smoother transition to the new environment. These tasks include:

- Always make sure that all I/O activity to and from the controller unit has stopped.
- Shut down all devices in the rackmount cabinet before moving it to the new location.
- If you are moving the controller unit a significant distance (for example, to another building or city), pack it in its original shipping container for safe transit.

Removing and Installing CRUs

You will need antistatic protection and a cart or level surface (on which to place the CRUs).

Use this procedure to remove one or more CRUs from a controller unit.

1. Remove the front cover and back access panel.
2. Stop all activity to the controller unit (non redundant model only).

   Stop all system processes and I/O activity to the controller unit and clear all data from cache memory (refer to the software documentation for instructions). Make sure:

   - No activity LEDs on the drives are blinking.
   - All fault LEDs and the Fast Write Cache LED on the controller unit are off.
3. Which CRUs are you removing?

   - **All CRUs, the battery CRU, or a power supply CRU**. Put on a grounding strap, turn off both power switches, and unplug the power cords from the controller unit. Then, go to Step 4.
   - **Controller or fan CRUs**. Put on a grounding strap, then go to Step 4.

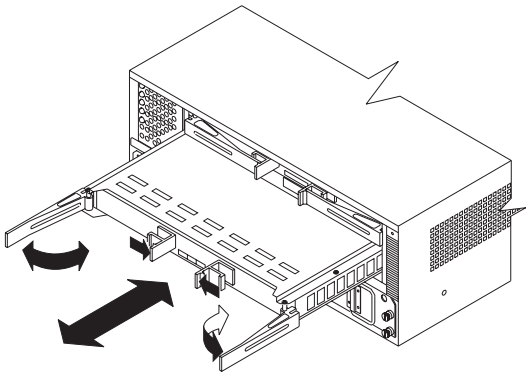
Attention: **Electrostatic charges can damage sensitive components.** Use proper antistatic precautions before removing or handling the CRUs.

4. Using Figure 8 on page 12 as a guide, remove one or more CRUs.

   Return to the appropriate procedure and continue with the service instructions. To re-install the CRU or CRUs, reverse steps 1 through 4 in this procedure.

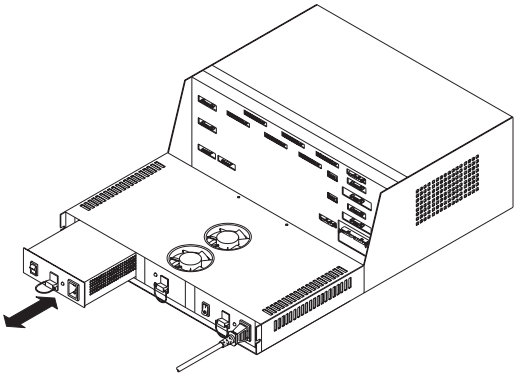
Remove Controllers

Unlock and open levers, then pull out one or both controllers.



Remove Power Supplies

Pull levers up to unlatch, then remove both power supplies.

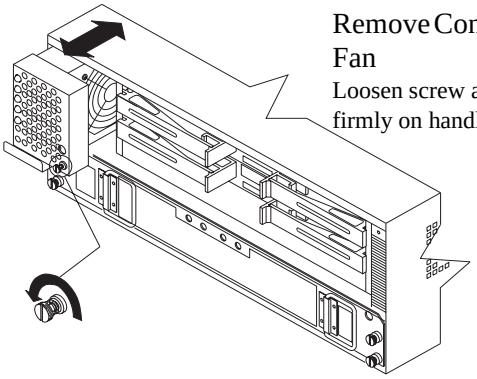


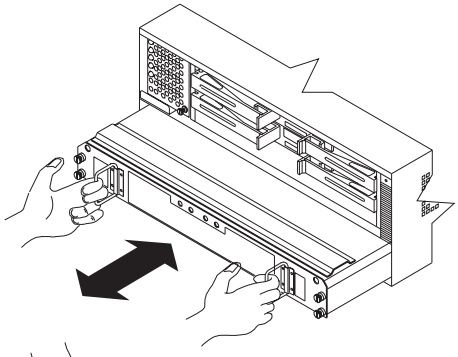
Important

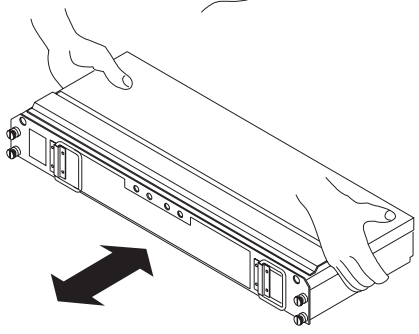
Keep track of which controller (A or B) belongs in each slot. To prevent data loss, you must replace both controllers in their original slots.

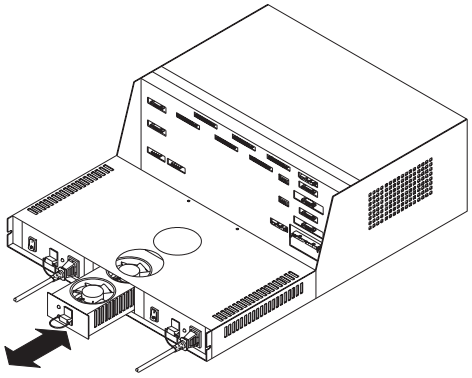
Remove Controller Fan

Loosen screw and pull firmly on handle.









Remove Battery

Loosen screws and pull battery out a few inches. Grasp both sides of CRU and remove it. The battery CRU weighs approximately 24 lb. Make sure you are prepared to support its weight when you remove it

Remove Power Supply Fan

Pull lever up to unlatch, then remove power supply fan.

Figure 8. Removing and Installing CRUs

Chapter 2. Controller

The controller unit supports *redundant array of independent disks* (*RAID*) technology through its interface boards. The controller unit has two types of interface boards:

- Array controllers (Figure 9)
- Controller backpanel (not shown)

This chapter discusses how to identify interface problems and how to replace the controller CRUs.

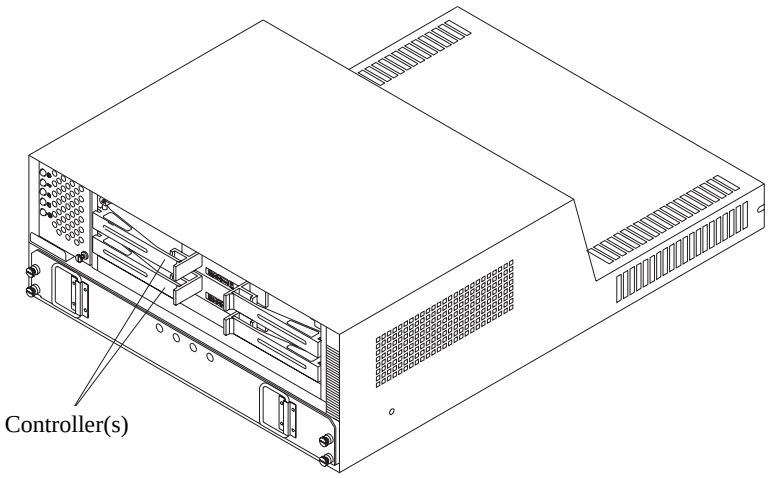


Figure 9. Controller CRUs in Controller Unit

Identifying Interface Problems

Interface problems include any malfunctions that delay, interrupt, or prevent successful input/output (I/O) activity between the hosts and other devices on the Fibre Channel loop. This includes transmissions between the controller unit and drive modules attached to it. For the purpose of this discussion, the controller unit's *interface components* include:

- Internal components
  - One controller
  - Controller card cage (includes controller backpanel)
- External connections:
  - Fibre Channel host adapters, cables, terminators, and hub or switching devices
  - SCSI drive cables

Interface problems on any computer system can be divided into two main categories:

- *Software problems* that hamper communications typically involve one or more of the following elements:
  - Host operating system software error
  - Disk array or other application error
  - Incorrect configuration settings
- *Hardware problems* that might disrupt communications include the following elements:
  - Loose, disconnected, damaged interface cables or connectors
  - Improper interface ID settings (hardware switches)
  - Failed controllers, memory modules, or controller backpanel
  - Failed drive modules, host adapter boards, or other devices on the Fibre Channel loop(s)

Hints for Troubleshooting Interface Problems

The first step is to determine whether the interface problem is caused by hardware or software. Hardware problems indicate defective equipment. Software problems indicate operating system or disk array application errors. To do this, do the following:

- If the interface problem occurred during or immediately following a software activity, try to undo whatever the software did, then step through each software function (in smaller increments) until the problem occurs again. This will help identify the function that is working incorrectly.
- If the interface problem occurred without an apparent software-related activity, check the operating system and storage management software for error messages and associated procedures. This may help determine if it is a software or hardware problem.
- Check the controller unit for faults (see Figure 10 on page 16 or "Using the Status LEDs" on page 7). If any amber LEDs are on, go to the "Controller and Interface Problems" on page 87 for instructions.
- Check all interface cables, especially the host Fibre Channel cables, to make sure they are securely connected and undamaged.
- If you have moved the controller unit to another location or attached new devices to it, check the following:

  a. **Host ID settings for both controllers.** Although Fibre Channel will move conflicting addresses, make sure these settings are unique.

  b. **Interface cable connections.** Make sure all cables are routed correctly. Change the cable connections as necessary. See Chapter 5 for information on interface cable routing and connections to the controller unit.

Problems resulting from a defective host adapter board, controller, memory module, or controller backpanel may be difficult to detect. If checking all the items listed above does not identify the problem, try:

a. Replacing the host adapter and appropriate interface cable to each host

b. Replacing the controller CRU

4766 Controller CRU

Each controller comes in a removable, portable canister, called a *controller CRU* (Figure 10). The controller CRUs slide into one of two *controller slots* on the front of the controller unit and plug directly into the controller backpanel. Two handles lock the controller in place. Each controller slot has a *controller slot letter* that identifies the

physical location of the controllers in the chassis: controller slot A or controller slot B (Figure 10). There are ten LEDs (one power, one Fault, and eight Status) on each controller.

The controller unit supports one or two controllers that attach to hosts through Fibre Channel connections. The controllers also support a SCSI interface for attaching to drive modules. Each controller must have a unique host Fibre ID number assigned through ID switches on the back of the controller unit or host software. For more information on setting host IDs, refer to "Connectors and Host IDs" on page 60.

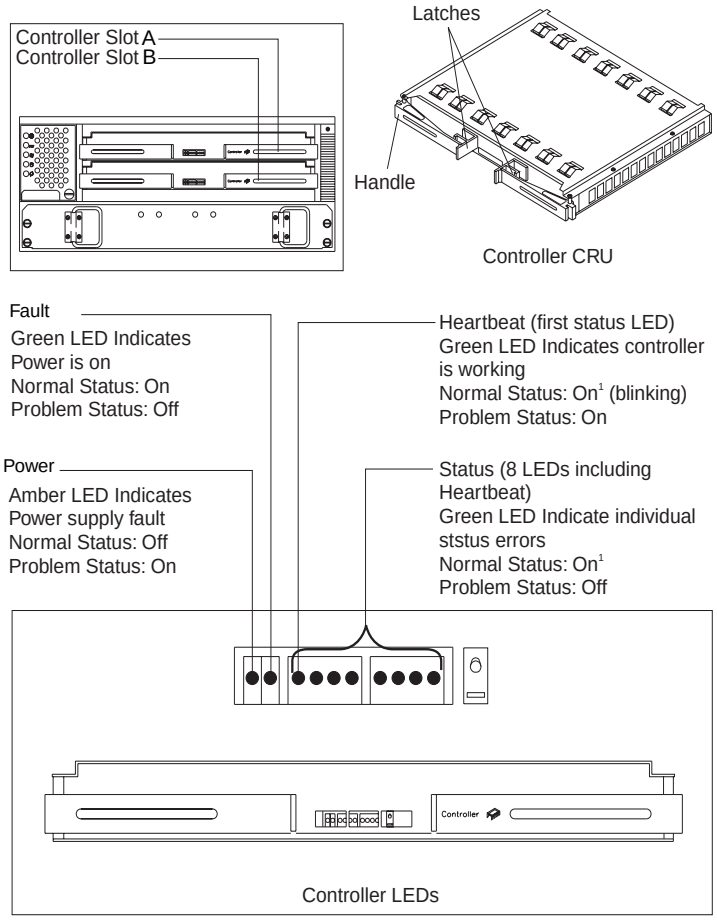


Figure 10. Controller CRU, Slots, and LEDs

Controller Specifications

Table 3: Controller CRU Specifications

Weight	Interface	Array Support
Component weight - 3.0 kg (6.6 lb) Shipping weight - 5.0 kg (11.0 lb) **Power Requirement** +5 VDC - 7.0 A +12 VDC - 0.1 A **Memory** Processor/Cache Size - 32/ 128 MB	Host – using MIA • Fibre Channel • Fiber optic • 1 host connection per controller Host – using Ethernet • 1 Ethernet connection per controller Drive • LVD SCSI • 16-bit, Ultra-2 synchronous • 6 drive channels total Service • 1 RS-232 connection per controller	Drives channels - 6 Drives per channel - 10 Maximum no. of drives - 60 RAID levels - 0, 1, 3, and 5 **Factory Settings** • Controller 1: Host ID 5 • Controller 2: Host ID 4 **Data Transfer Rates** Fibre Channel Host - 100 MB/sec maximum LVD SCSI Drive - 80 MB/sec (16-bit synchronous)

Controller Servicing Notes

Here are a few suggestions to consider when servicing the controllers in the controller unit:

- **Always use proper precautions against electrostatic discharge** before removing and handling the controller CRUs or other components inside the controller unit.
- **Always read pertinent documentation.** This includes online instructions on replacing failed controllers and documentation shipped with the replacement controller CRU, particularly the kit instructions. Kit instructions often contain the most current information on controller servicing.
- **Interface cables and controllers are user replaceable.** The memory modules and controller card cage assembly, which includes the controller backpanel, must be serviced by a qualified, trained service technician ONLY.
- **You can *hot swap* a failed controller** (replace it while the controller unit is turned on and operating) as long as the failed controller:

a. Is one of a *redundant pair* (two controllers attached to the same host) and

b. Has a “passive” or “active/failed” status in the storage management software.

- **If cache mirroring is enabled in a redundant pair of controllers and one controller fails**, the second controller will assume processing functions without data loss. However, some or all data may be lost if:

  a. A catastrophic controller failure occurs in a non-redundant controller, or

  b. Cache mirroring is disabled and a failure occurs before data can be written from cache memory to disk.

- **Remove the front cover** (Figure 4 on page 4) to service the controllers or view the LEDs on each CRU.

- **Make sure that the new controller is the same type** (memory size, firmware version, etc.) as the one you are replacing. If you have two controllers, make sure they are both the same firmware version and memory size.

- **A controller fault may be due to a failed memory module.** If this occurs, call for service.

Troubleshooting Controller Problems

You can use the following chart, along with Figure 7 on page 9 and Figure 11 on page 21 to identify possible causes for controller problems.

Table 4: Controller Unit Troubleshooting Chart

Symptom	Possible Cause	Possible Solution
Controller LED (front cover) is on.	A. Controller CRU is missing or unplugged.	1. Check the Power LEDs on both controller CRUs. If both Power LEDs are on, go to cause B. If one Power LED is off, make sure that the CRU is plugged in correctly and its handles are locked in place.
		2. If the Power LED remains off or the Fault LED turns on, go to cause B.
	B. Controller CRU failed.	1. Check the Fan LED on the front cover. If it is on, go to "Troubleshooting Controller Fan Problems" on page 29. If not, go to the next step.
		2. Replace the failed controller CRU using the instructions on page 20.
		3. If the Fault LED remains on after replacing the controller, go to cause C or D.
	C. One or more memory modules failed.	Call for service.
	D. Controller backpanel failed.	Call for service.

Table 4: Controller Unit Troubleshooting Chart (continued)

Symptom	Possible Cause	Possible Solution
Software issued a controller error message.	Controller CRU failed.	1. Check the Fan LED on the front cover. If it is on, go to "Troubleshooting Controller Fan Problems" on page 29. If not, go to the next step.
		2. Replace the failed controller CRU using the instructions on page 20.
Controller and Fan LED (front cover) are on.	Controller fan failure caused one or both conrollers to overheating.	1. Stop all activity to the controller unit and turn off the power.
		2. Replace the failed controller fan CRU using the instruction on page 26.
		3. Allow the controller unit to cool, then turn on the power.
		4. Check both controller CRUs for fault LEDs. If a controller Fault LED turns on, replace the failed controller CRU using the instructions on page 20.

Replacing a Failed Controller

You will need a replacement controller CRU and grounding strap (or other antistatic protection device).

Use this procedure to replace a failed controller CRU.

1. Look at the LEDs on the front cover and answer the following questions (Figure 11 on page 21).
   - Is the amber Controller LED glowing on the front cover?

     Yes: Go to Step 2 on page 21.

No: If the power supply or fan LED is lit on the front cover, go to "Possible Cause: Defective power interface board." on page 93 for instructions. Otherwise, go to the next question.

- Has the operating system or storage management software issued an error relating to transmissions between the controller and hosts or drive modules?

  Yes. Go to Step 2 on page 21.

  No. Answer the next question.

- Can you perform I/O operations to the drives successfully?

  Yes. Return to normal operation.

  No. To help you determine the source of the problem, read "Identifying Interface Problems" on page 14. If you still cannot identify the problem, go to Step 2 on page 21 and replace the controller CRU.

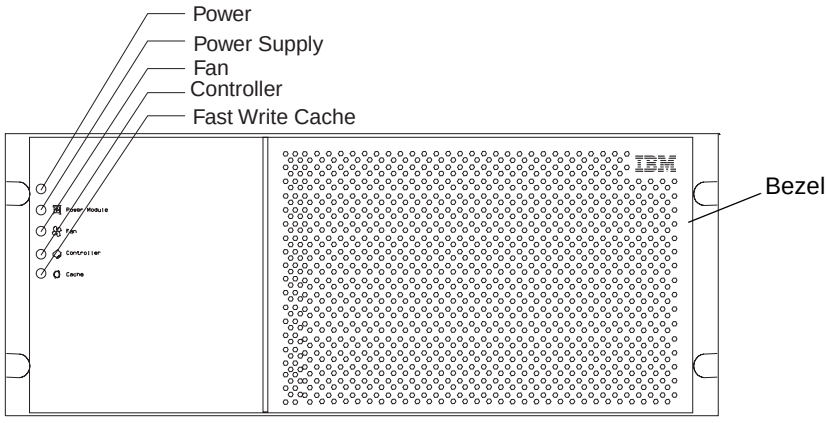


Figure 11. LEDs on Front Covers

2. Determine if you must modify the steps in this procedure.

   a. Open the box containing the replacement controller CRU and remove the instructions.

   b. Read the following:

      - The instructions
      - "Controller Servicing Notes" on page 17
      - All controller repair and recovery instructions provided with the operating system and storage management software.

c. If necessary, modify the remaining steps to accommodate requirements unique to your system. Shipped instructions often contain the most current information regarding controllers and servicing procedures. **If the shipped instructions conflict with those provided in this procedure, use the shipped instructions.** Go to Step 3.

3. Remove the front cover (Figure 1 on page 1), check the controller CRU LEDs (Figure 10 on page 16), and answer the following questions.

- Is an amber Fault LED glowing on one of the controllers?

  Yes: This indicates a failed controller or memory module. Note which controller has a fault (A or B) and go to the next question.

  No: This may indicate an overheating problem or a controller backpanel failure. Go to "Controller and Interface Problems" on page 87 for instructions.

- Do the status lights on the controller indicate a problem with the memory?

  Yes: Call for service.

  No: If no memory failure is indicated, or if you are unable to determine that the fault is caused by a failed memory module, continue at Step 4 and replace the controller CRU.

Attention: **Electrostatic charges can damage sensitive components.** Use a grounding wrist strap or other antistatic precaution before removing or handling the controllers.

Removing a controller that is operating normally (not failed) could result in data loss. Only remove a controller (a) that has a Fault LED glowing or (b) that you marked as “Failed” (offline) through the storage management software.

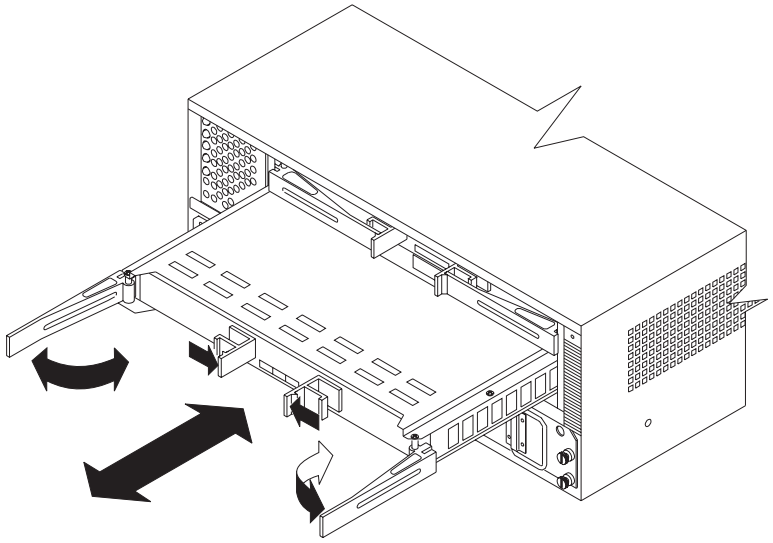


Figure 12. Removing and Installing a Controller CRU

4. Remove the failed controller (Figure 12).

5. Unpack and check the new controller CRU.

   Using the proper handling precautions, remove the controller from the packing material.

6. Install the new controller CRU (Figure 12).

7. Using the Storage Manager software, verify that the firmware version is the same level or newer than what was on the replaced controller.

8. Restore the controller's operating status.

   Use the storage management software to bring the controller back online and to perform any necessary recovery procedures. Check the LEDs on the controller CRU to make sure the Fault LED remains off. If the Fault LED remains on, it may indicate that the new controller has failed or a controller backpanel problem. Try replacing the controller with another one. If this does not resolve the problem, call a service technician for assistance.

9. Replace the front cover on the controller unit.

Chapter 3. Cooling System

The controller unit's *cooling system* (Figure 13) includes the following components:

- Controller Fan CRU
- Power Supply Fan CRU
- Chassis ventilation holes

These components cool the controllers and power supplies by circulating air through the chassis. This chapter describes proper ventilation, the controller fan CRU and power supply fan CRUs, and tells how to service the cooling system.

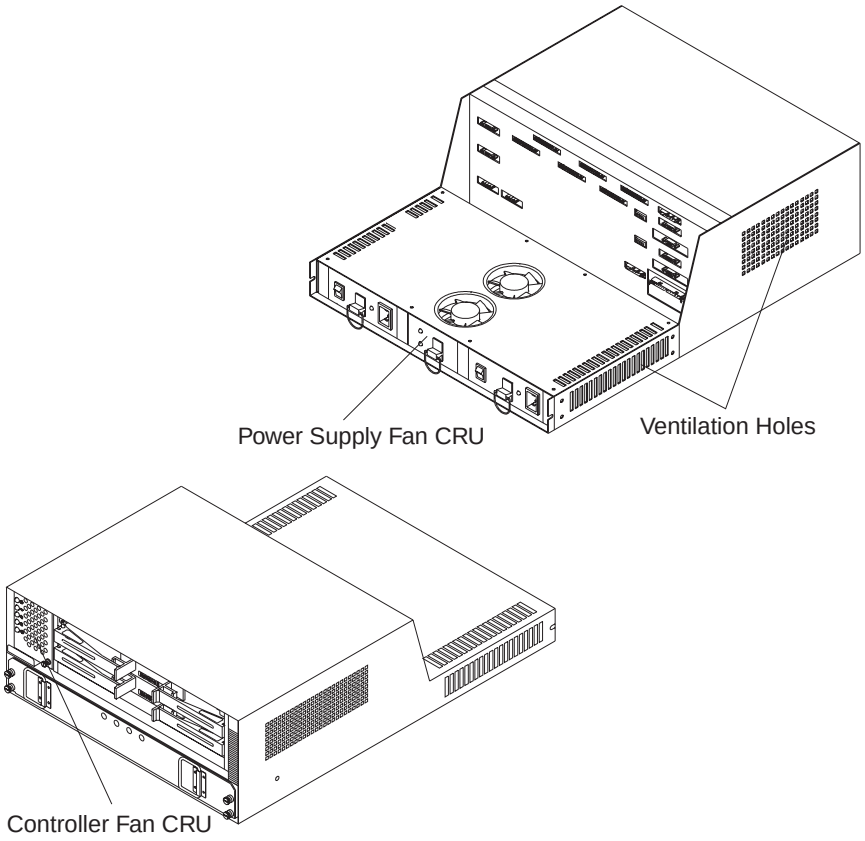


Figure 13. Controller Unit Cooling System

Servicing the Cooling System

Cooling problems include any malfunctions or obstructions that impede air flow and cause one or more components in the controller unit to overheat. To avoid cooling problems, always keep the air vents free of obstructions. Also, make sure that the air temperature around the controller unit is within the environmental requirements. (Refer to "Heating and Air Conditioning" on page 57.)

Preserving Proper Air Flow

The controller unit must have proper air circulation throughout the chassis. To boost air circulation, the chassis has air vents along its top and sides (Figure 14). These vents serve as air intake and exhaust passages. Always keep vents clean and free of obstruction.

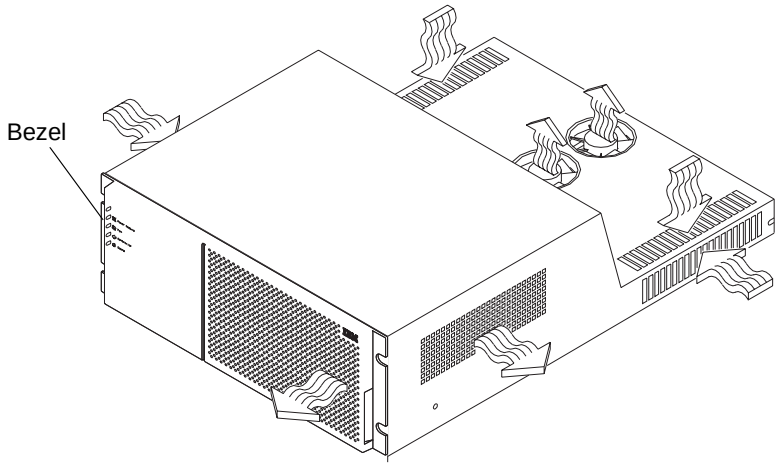


Figure 14. Air Flow through Chassis

Determining Which Fan Failed

Instructions

If the Fan LED on the front cover is glowing, it means that one of the fan CRUs in the controller unit has failed. Check the LEDs on the front cover (Figure 15) to determine whether the controller fan or power supply fan has failed.

If the Fan LED is on, look at the LEDs on the power supply fan CRU and choose one of the following. If a different LED is glowing on the front cover, go to "Controller and Interface Problems" on page 87.

- **Power supply Fan CRU Fault LED is off**. Go to "Replacing a Failed Controller Fan" on page 31.
- **Power supply Fan CRU Fault LED is on. Go to** "Replacing a Failed Power Supply Fan" on page 34.

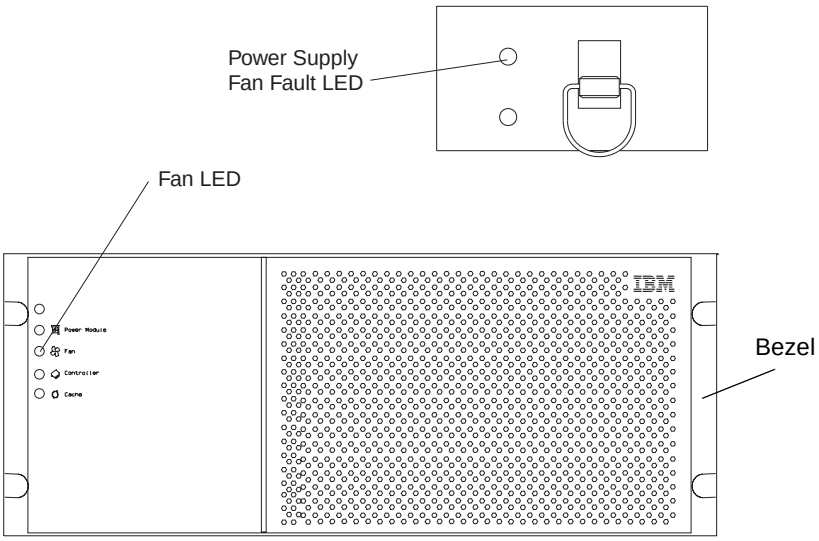


Figure 15. Controller Unit Fan Fault LEDs

Controller Fan CRU

The *controller fan CRU* (Figure 16) is a single, removable unit containing two cooling fans, temperature monitoring logic, and five LEDs that provide overall system status information. The dual fans provide a redundant cooling system to both controller CRUs. If one fan fails, the other will continue to operate, providing sufficient air circulation to prevent the controllers from overheating until you can replace the entire controller fan CRU. The controller fan CRU plugs directly into a slot on the front of the controller unit, to the left of the controllers. It has a handle and captive screw for easy service.

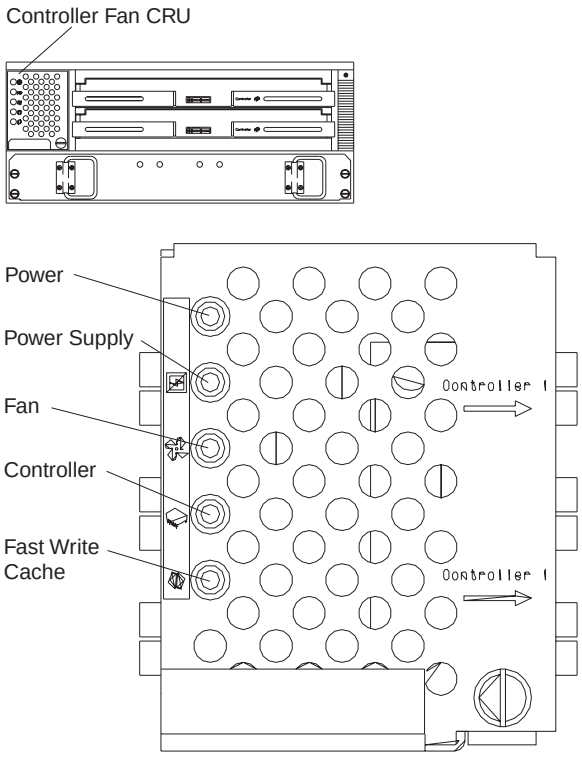


Figure 16. Controller Fan CRU and Status LEDs

Controller Fan Specifications

Table 5: Controller Fan CRU Specifications

Category	Criteria	Specification
Weight	Component Weight	0.9 kg (1.9 lb)
	Shipping Weight	2.3 kg (5.0 lb)
Power Requirement	+5 VDC	0.07 A
	+12 VDC	0.7 A

Controller Fan Servicing Notes

You can *hot swap* the controller fan CRU (replace it while the controller unit is turned on and running), as long as you complete the exchange within 15 minutes. The time limit only applies to the total time that the fan CRU is out of the chassis. The time begins when you remove the failed CRU and ends when you re-seat the new one. This does not include the time it takes you to perform this entire procedure (for example, checking the LEDs).

Both fans failing simultaneously in the controller fan CRU fail is unlikely. Such a failure would cause either one or both controllers to overheat. Under these circumstances, the amber controller LED on the front cover may turn on. Shut down the controller unit immediately and let the unit cool to room temperature. Replace the controller fan (see page 31) and turn on the power. Check the controller fault LED. It should remain off. If not, replace the controller (see "Replacing a Failed Controller" on page 20.)

Troubleshooting Controller Fan Problems

Symptom: Fan LED (front cover) is on.

A Possible Cause: Power supply fan CRU missing or unplugged.

1 Make sure the power supply fan CRU is plugged in correctly.

2 Check the LEDs on the power supply fan CRU. The power LED should be on and the Fault LED should be off. If so, go to cause C. If the power LED is off or the Fault LED is on, go to cause B.

B Possible Cause: Power supply fan CRU failure.

1 Replace the power supply fan CRU using the instructions on page 34.

C Possible Cause: Controller fan CRU missing or unplugged.

1 Make sure controller fan CRU is plugged in correctly.

2 If Power LED remains off, it indicates a failed controller fan CRU. Go to cause D.

D Possible Cause: Controller fan CRU failure.

1 Check the Fault LED on power supply fan CRU. If the Fault LED is off, replace the controller fan CRU using the instructions on page 31. If the Fault LED is on, replace the power supply fan CRU using the instructions on page 34.

E Possible Cause: Circuitry failed or Power LED burned out on controller fan CRU.

1 Replace the controller fan CRU using the instructions on page 31.

Symptom: Controller and Fan Fault LEDs (front cover) are on.

A Possible Cause: Both a controller and the controller fan failed.

1. Check both controller CRUs for fault LEDs, then replace the failed controller CRU using the instructions on page 20.
2. After replacing the failed controller, check the LEDs on the front cover. If the Fan LED is still on, replace the controller fan CRU using the instructions on page 31.

B Possible Cause: Controller fan failure caused one or both controllers to overheat.

1. Stop all activity to the controller unit and turn off the power.
2. Replace the controller fan CRU using the instructions on page 31.
3. Allow the controller unit to cool, then turn on the power.
4. Check both controller CRUs for fault LEDs. If either Fault LED is on, replace the failed controller CRU using the instructions on page 20.

Replacing a Failed Controller Fan

Tools and Equipment

Replacement controller fan CRU and screwdriver

Instructions

Use this procedure to replace a failed controller fan. The instructions assume that you used the procedure "Determining Which Fan Failed" on page 26 to identify which controller fan has failed.

1. Read "Controller Fan Servicing Notes" on page 29.
2. Unpack the new controller fan.

Attention: Do not operate the controller unit without adequate ventilation and cooling to the controllers. Operating the controller unit without proper cooling to the controllers may damage their circuitry. You must shut down the controller unit to prevent overheating if you take more than 15 minutes to remove the controller fan CRU and insert a new one.

3. Remove the failed controller fan CRU (Figure 17).

   Remove the front cover from the controller unit. Loosen the captive screw on the controller fan CRU by turning it counterclockwise. If the thumbscrew is too tight, use a flat blade screwdriver to loosen it.

4. Install the new controller fan CRU (Figure 17).

   Slide the new CRU into the slot and tighten the screw. The captive screw is spring-loaded and will not tighten unless the fan CRU is inserted all the way into the chassis. If the screw keeps spinning without tightening, push on the front of the fan CRU until it snaps into place – then tighten the captive screw.

To Remove:
Loosen captive screw, pull firmly on handle, and remove CRU.
To Install:
Push controller fan CRU firmly into slot and tighten captive screw.

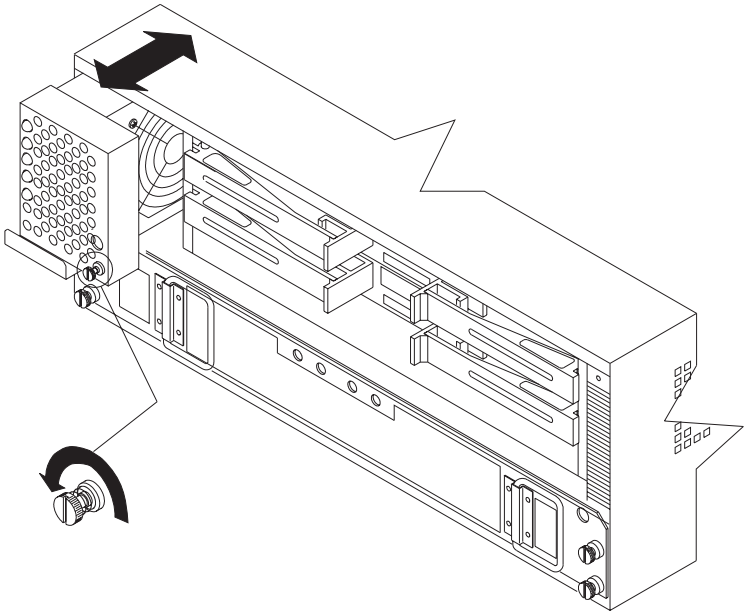


Figure 17. Removing and Installing a Controller Fan

5. Check the LEDs on the controller fan CRU (Figure 16 on page 28).

   The green Power LED should be on and the amber LEDs should be off.

   - **If the amber fan LED is on, or the green power LED remains off —** make sure that the CRU is inserted all the way into the chassis and the thumbscrew is tight.
   - **If the fan LED remains on** — it may indicate a problem with the new controller fan CRU. Replace the controller fan CRU with a spare, if available. If not, turn off the controller unit to prevent it from overheating while you get a replacement fan.

6. Replace the front and back covers.

Power Supply Fan CRU

Like the controller fan, the *power supply fan CRU* (Figure 18) is a single, removable unit that contains two cooling fans. The dual fans provide a redundant cooling system to both power supply CRUs. If one fan fails, the other will continue to operate. A single fan will provide sufficient air circulation to prevent the power supplies from overheating until you can replace the entire power supply fan CRU. The power supply fan CRU plugs directly into a slot on the back of the controller unit between the power supplies. It has a locking lever by which you unlatch and remove the power supply fan CRU.

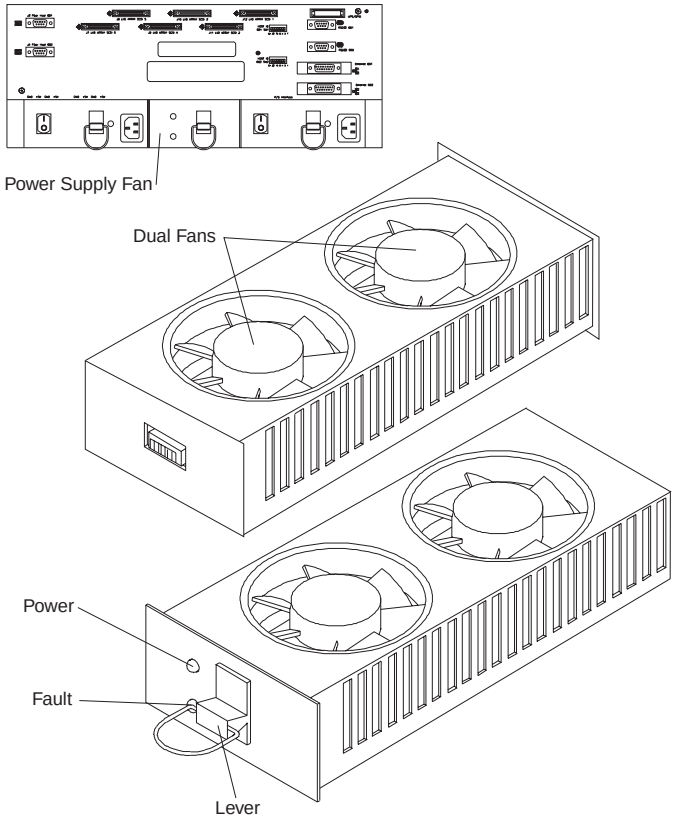


Figure 18. Power Supply Fan CRU

Power Supply Fan Specifications

Table 6: Power Supply Fan CRU Specifications

Category	Criteria	Specification
Weight	Component Weight	0.7 kg (1.5 lb)
	Shipping Weight	2.1 kg (4.5 lb)
Power Requirement	+5 VDC	0.02 A
	+12 VDC	0.65 A

Power Supply Fan Servicing Notes

You can *hot swap* the power supply fan CRU (replace it while the controller unit is turned on and running), as long as you complete the exchange within 15 minutes. This time limit applies only to the total time that the fan CRU is out of the chassis, beginning when you remove the failed unit and ending when you re-seat the new one. This does not include the time it takes you to perform this entire procedure, such as checking LEDs.

Both fans in the power supply fan CRU failing simultaneously is unlikely. Such a failure would cause one or both power supplies to overheat. Under these circumstances, the amber power supply LED on the front cover turns on and the overheated power supply automatically shuts down (its green power LED turns off). Once the ambient air temperature cools to below 70º C (158° F), the power supply automatically turns on. Replace the failed power supply fan using the procedure on page 34, then check the power supply LEDs (fault LED on the front and power LED on the back). If the power supply fault LED remains on, replace the power supply using the instructions on page 50.

Troubleshooting Power Supply Fan Problems

Symptom: Fan LED (front cover) is on.

A Possible Cause: Power supply fan CRU missing or unplugged.

1 Make sure power supply fan CRU is plugged in correctly.

2 Check LEDs on the power supply fan CRU. The Power LED should be on and the Fault LED should be off. If so, replace the controller fan CRU using the instructions on page 31. If the power LED is off or the Fault LED is on, replace the power supply fan CRU using the instructions on page 34.

Replacing a Failed Power Supply Fan

Tools and Equipment

Replacement power supply fan CRU

Instructions

Use this procedure to replace a failed power supply fan CRU. These instructions assume that you used the procedure "Determining Which Fan Failed" on page 26 to identify that the power supply fan has failed.

1. Read "Power Supply Fan Servicing Notes" on page 34.

2. Unpack the new power supply fan CRU.

3. Remove the power supply fan CRU (Figure 19) by lifting up on the latching lever and pulling out.

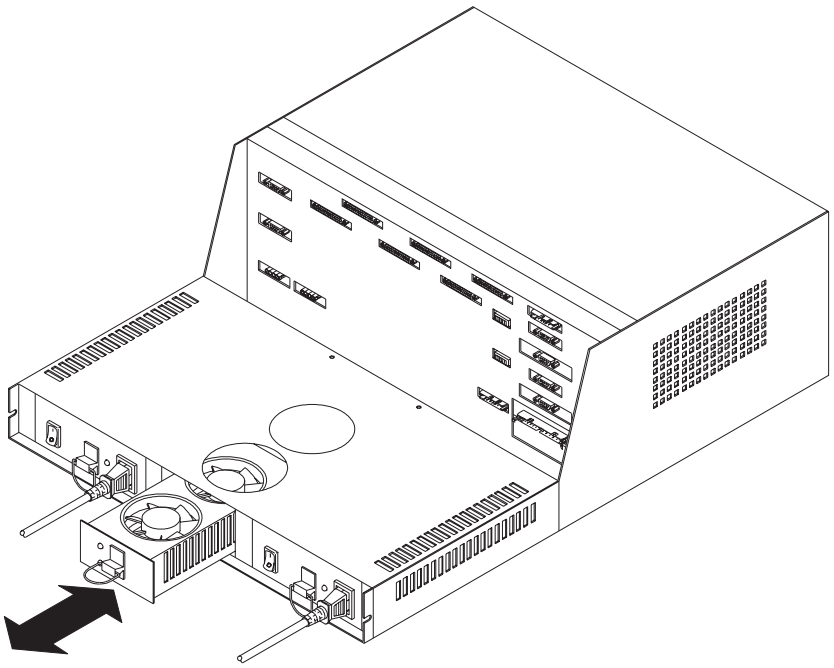


Figure 19. Removing and Installing a Power Supply Fan CRU

4. Install the new power supply fan CRU (Figure 19).

   The lever will snap down when the CRU is seated properly in the chassis. If the lever remains up, push on the power supply fan CRU until it snaps into place.

5. Check the LEDs.

   The green power LED should be on and the amber fault LEDs should be off. If the power LED remains off or the fault LED turns on, make sure that the power supply fan CRU is inserted all the way into the chassis and locked in place.

   If this does not correct the problem (the fault LED remains on), it may indicate that the new fan CRU is malfunctioning. Replace the power supply fan CRU with another CRU. If a spare power supply fan CRU is not available, turn off the controller unit. This will prevent the power supplies from overheating while you get a replacement fan.

Chapter 4. Power System

The controller unit's *power system* includes the following hardware components:

- One battery CRU
- Two power supply CRUs
- Two power cords (one for each power supply)

These components provide power to the controllers and fans inside the chassis. This section describes the basic features of the battery and power supplies, and explains how to troubleshoot these components.

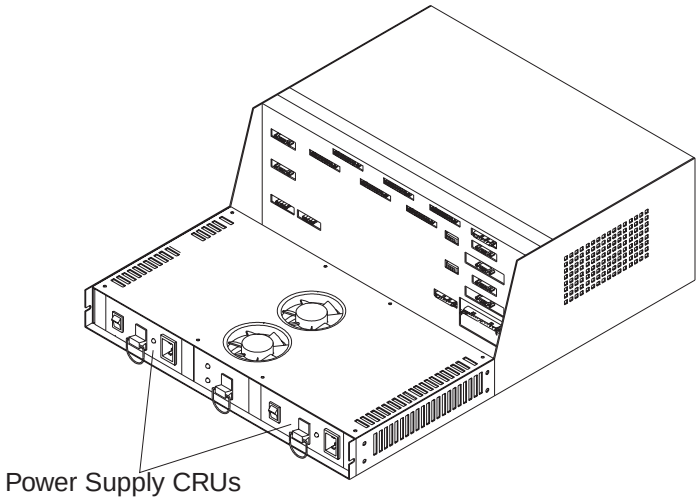


Figure 20. Controller Unit Power System CRUs

Troubleshooting the Power System

Power system problems include any malfunctions that delay or interrupt power distribution to the controller unit and its components. This includes external and internal power problems such as power outages, weak batteries, or a failure of the power interface

board. All power system failures are caused by some type of hardware problem, either in the incoming power lines, the building's wiring, the cabinet's electrical system, or in the controller unit's circuitry.

Thr battery CRU is a sealed unit. You must replace the entire CRU when it fails. Review your status log in SYMplicity Storage Manager regularly and check battery indicator LEDs.

Types of Power System Problems

Some electrical problems are difficult to trace, especially if they involve complex site wiring in a large facility. Use the controller unit's LEDs and the troubleshooting procedures in this chapter to determine if the power problem is in the unit, the cabinet, or the building. For more information on troubleshooting the controller unit, refer to page 87.

Hardware-Related Problems

Problems involving the hardware components in the controller unit’s power system might include:

- Loose or damaged power connectors
- Disconnected or damaged power cables
- Weak or failed batteries
- Failed power supplies
- Failure of other power-related components of the controller unit
- Power failure of the power unit (internal AC distribution unit or UPS)
- Power failure of the external AC source (facility circuit breakers/wiring, UPS, etc.)

Battery CRU

The controller unit contains a portable, removable unit, called a *battery CRU*, which houses rechargeable batteries and a battery charger board. The battery CRU plugs into the front of the controller unit (Figure 21 on page 39) where it provides backup power to the controllers’ cache memory. During a power outage, a properly charged battery CRU maintains electrical current to the controllers for up to three days. All data stored in memory will be preserved as long as the batteries can sustain power to the cache memory.

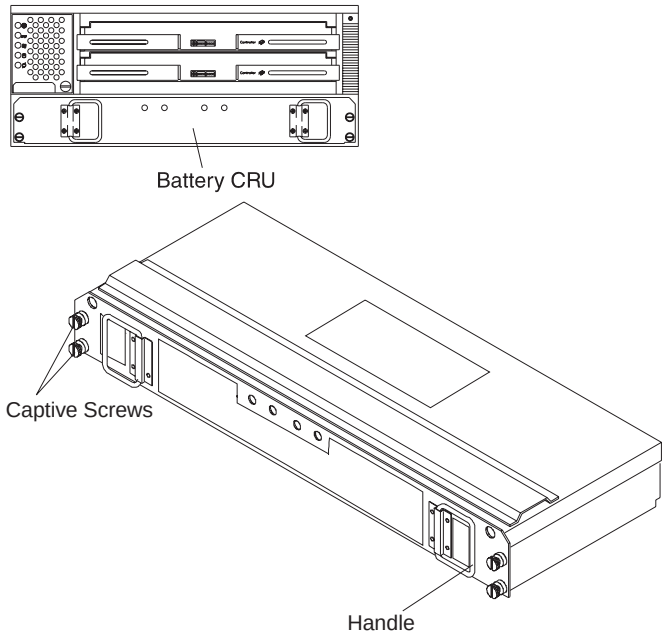


Figure 21. Battery CRU

Battery Specifications

Table 7: Battery CRU Specifications

Category	Criteria	Specification
Weight	Component Weight	9.7 kg (21.4 lb)
	Shipping Weight	11.8 kg (26.0 lb)
Power Requirement (input)	+5 VDC	0.07 A
	+12 VDC	2.5 A

Battery Servicing Notes

Replace the battery whenever it fails to hold a charge. The service label on the battery CRU provides a blank line for recording the last date on which the battery was serviced. If you replace the battery CRU and still experience battery-related problems – such as loss of

battery power to the controllers or batteries not charging properly – then the controller unit may have defective battery components, such as the battery harness or the battery connection to the controller backpanel, power harnesses, or power interface board.

Use proper facilities to recycle the used battery CRUs. The battery CRU contains non-spillable lead acid batteries that may be considered a hazardous material. You must handle this unit in accordance with all applicable local and federal regulations.

Caution: The battery CRU is a sealed canister with no user-serviceable parts inside. When servicing the battery CRU, replace the entire CRU, not individual batteries or parts. Opening the battery CRU will void your warranty.

Troubleshooting Battery Problems

Symptom: Fault-A or Fault-B LED (battery CRU) is on.

A Possible Cause: Left or right battery bank has failed.

1 Replace the battery CRU using the instructions on page 43.

Symptom: Full Charge-A or Full-Charge-B LED (battery CRU) is off.

A Possible Cause: Left or right battery bank is not yet fully charged.

1 Turn on the power and allow controller unit to run 24 hours in order recharge the battery.

2 If after 24 hours, the Full Charge LED remains off or one of the Fault LEDs turns on, replace the battery CRU using the instructions on page 43.

Symptom: “Battery Low” error issued by software.

A Possible Cause: Power turned off for extended period and battery power drained.

1 Turn on the power and allow controller unit to run 24 hours to recharge the battery.

2 If after 24 hours, the battery low error persists, replace the battery CRU using the instructions on page 43.

B Possible Cause: Batteries are weak and CRU needs replacement.

1 Check the last service date for the battery CRU. If it has been three years since the battery was replaced, replace the battery CRU using the instructions on page 43.

Symptom: Battery CRU is new, but will not hold a charge.

A Possible Cause: Battery charger board failure.

1 Replace the battery CRU using the instructions on page 43.

2 Allow the system to run for at least 24 hours in order to properly charge the batteries. If this does not solve the problem, go to cause B.

B Possible Cause: Faulty battery harness

1 Replace the battery harness. This procedure should be performed by a qualified service technician only. Call for service.

Symptom: Loss of battery backup during a power outage.

A Possible Cause: Battery failure or battery CRU is missing.

1 Replace the battery CRU using the instructions on page 43.

Checking the Battery Service Date

NOTE Under normal circumstances, the battery CRU should be replaced after three years. Using the controller unit in a hot environment (above 35º C or 95º F), lowers the battery CRU's life expectancy. Under these conditions you may need to replace the battery more often.

Instructions

Use this procedure to check the service date on the battery CRU. For more information about the battery, refer to "Battery CRU" on page 38.

1. Remove the front cover from the controller unit (Figure 22 on page 42).
2. Check the "Installation Date" on the label (Figure 23 on page 43).

   The label on the front of the battery CRU has two dates:

- **Date of Manufacture** — the date the battery CRU was built at the factory
- **Date of Installation** — the date the battery CRU was installed in the controller unit

  Look at the installation date. If it has been more than three years, install a new battery CRU using the instructions "Replacing the Battery CRU" on page 43. Otherwise, go to Step 3.

3. Replace the front cover on the controller unit (Figure 22 on page 42).

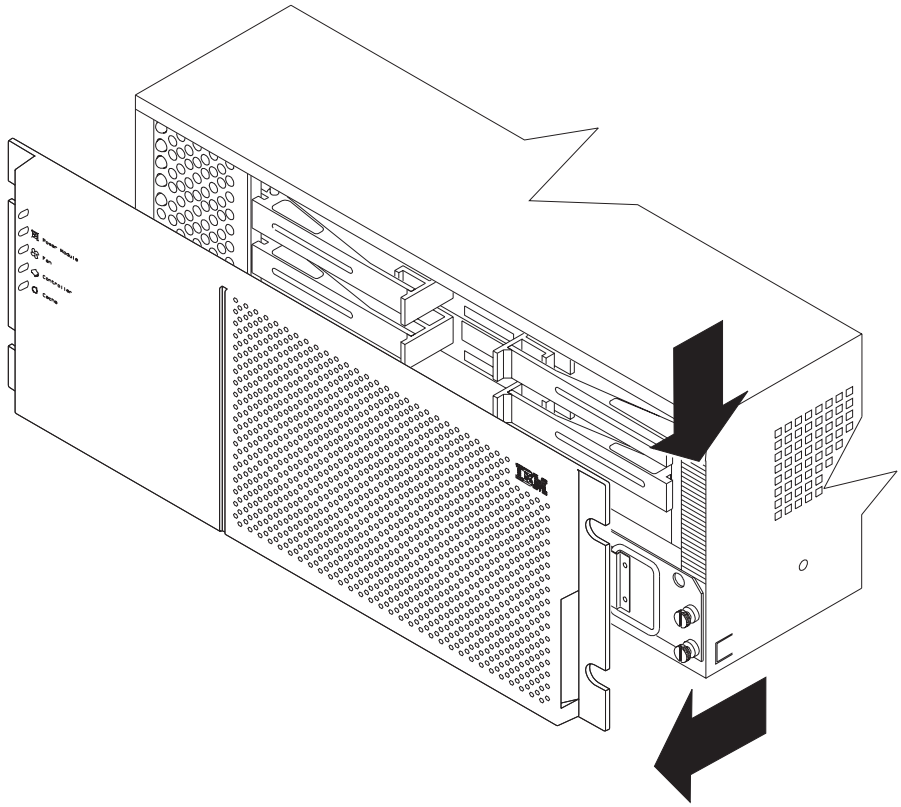


Figure 22. Removing and Replacing a Front Cover

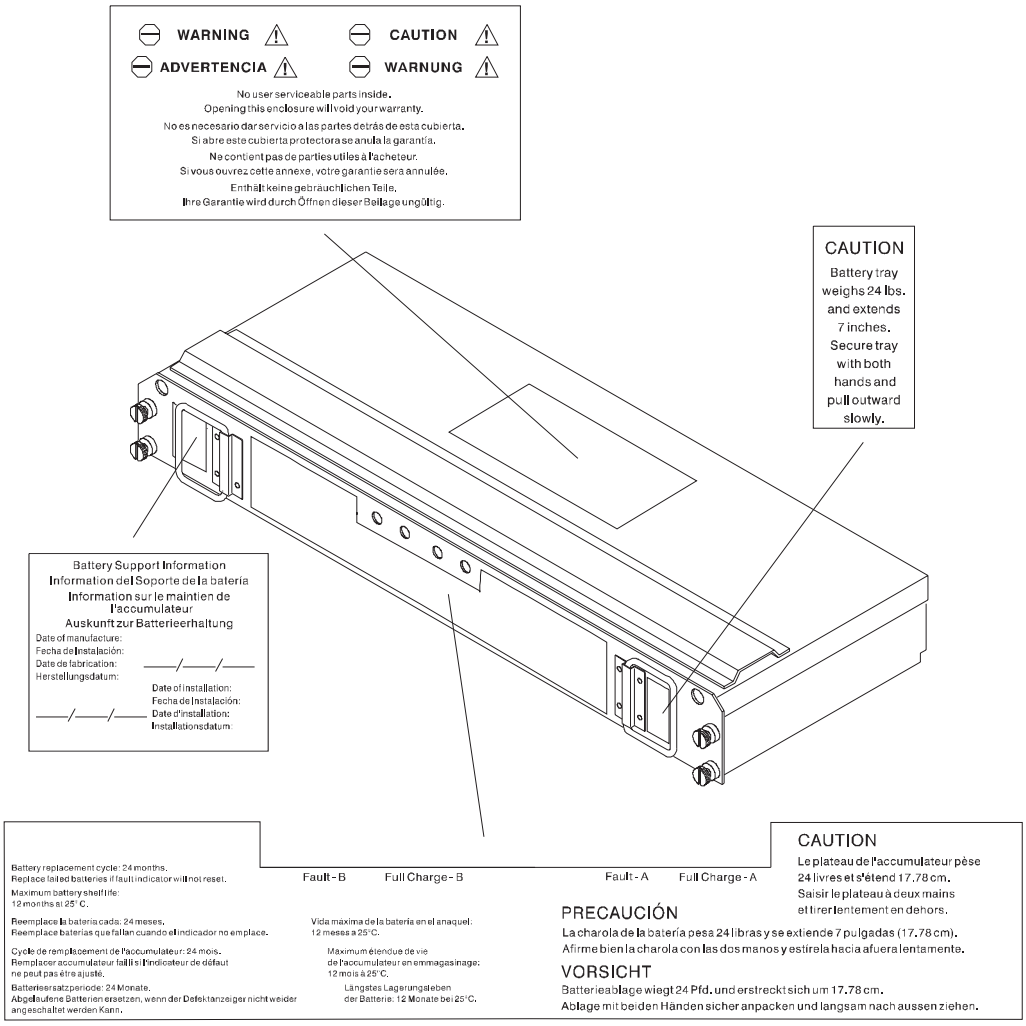


Figure 23. Battery CRU Service Label

Replacing the Battery CRU

Tools and Equipment

Replacement battery CRU and flat blade screwdriver (optional)

Instructions

Use this procedure to replace the battery CRU as part of routine maintenance or to replace a failed battery.

1. Prepare the new battery *(*Figure 21 on page 39*)*.

Unpack the battery CRU. Save the shipping material for transporting the used battery CRU to a disposal facility. Find the “Battery Support Information” label on the front of the new battery CRU. Fill in the following information:

- Record today’s date on the blank line next to “Date of Installation.”

2. Remove the front cover (Figure 22 on page 42).

Attention: The battery CRU weighs approximately 24 lb. Make sure you are prepared to support its weight when you remove it from the chassis.

3. Remove the battery CRU (Figure 24 on page 44).

   Turn the captive screws on the battery CRU counterclockwise. If they are too tight, use a flat blade screwdriver to loosen the screws.

4. Install the new battery (Figure 24 on page 44).

   Slide the battery CRU into the slot and tighten all captive screws.

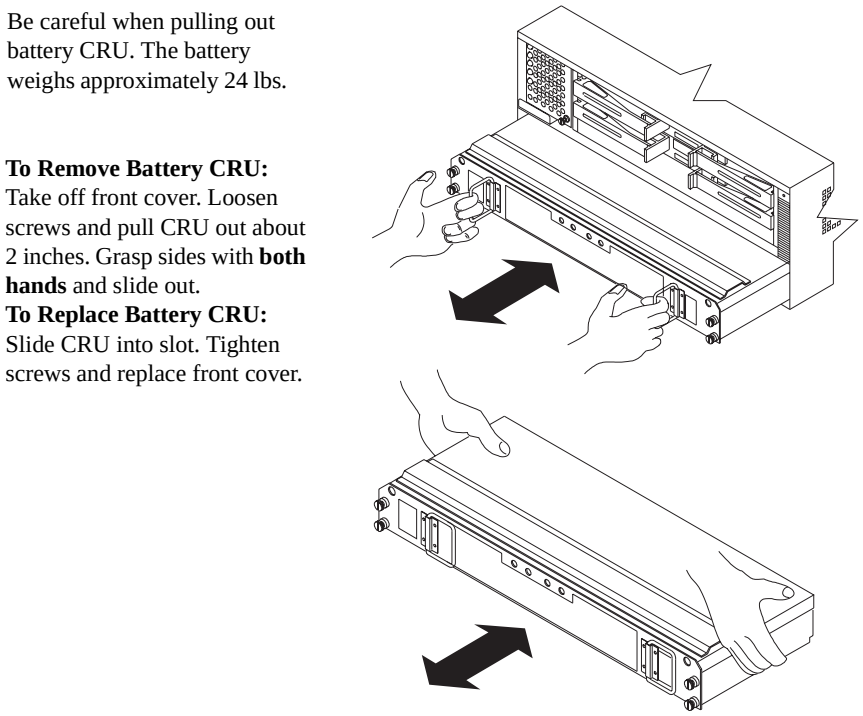


Figure 24. Removing and Installing the Battery CRU

5. Replace the front cover.

6. Allow the system to run for at least 24 hours in order to properly charge the batteries.

When properly charged, both Full Charge LEDs will be glowing on the front of the battery CRU.

7. Dispose of the old battery CRU.

   Dispose of the used battery CRU according to local and federal regulations, which may include hazardous material handling procedures.

Caution: **If the used battery CRU is leaking electrolyte gel, DO NOT ship it to a recycling center.** Handle damaged batteries according to your local regulations, which may include procedures for handling batteries as hazardous waste.

Power Supply CRU

Two *power supplies* in the controller unit provide electrical power to the internal components by converting incoming AC voltage to DC voltage. Both power supplies are housed in removable *power supply CRUs*. The CRUs slide into the two slots on the back of the controller unit (Figure 25 on page 46) and plug directly into the *power interface board.*

Each power supply uses one power cord. You can plug both power cords to a common power source or plug each cord into a separate circuit for power source redundancy. The power supplies are interchangeable and redundant. This means that one power supply will maintain electrical power to the controller unit if the second power supply shuts down or malfunctions. In addition, you can Hot Swap the redundant power supplies, which means you can replace a failed power supply while the controller unit is operating.

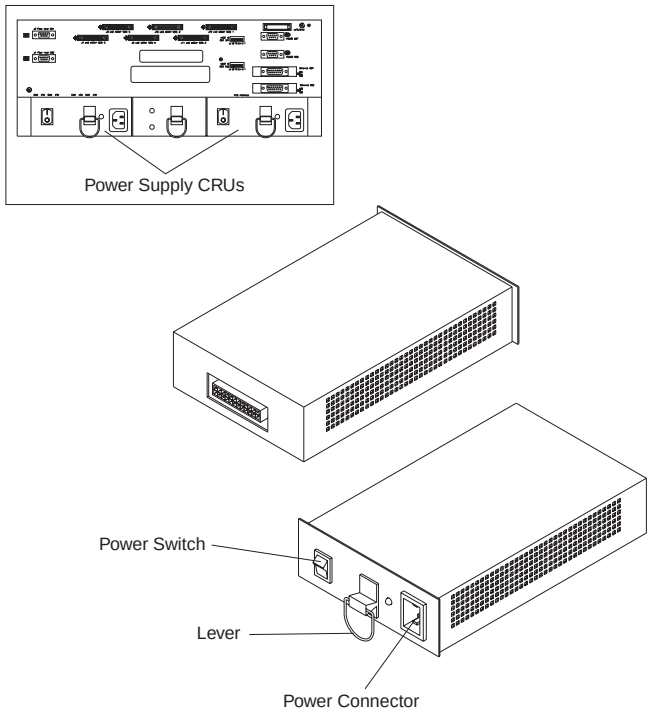


Figure 25. Power Supply CRU

Power Supply Specifications

Table 8: Power Supply CRU Specifications

Category	Criteria	Specification
Weight	Component Weight	1.5 kg (3.3 lb)
	Shipping Weight	2.9 kg (6.5 lb)
Power Requirement	+12 VDC	1.0 A (max. per CRU @ 220 VAC)
		2.0 A (max. per CRU @ 110 VAC)

Power Supply Recovery Notes

Both power supplies have a built-in temperature sensor designed to prevent the power supplies from overheating. If a temperature sensor detects an over-temperature condition, ambient air temperature of 70° C (158° F) or above, the “overheated” power supply will automatically shut down. The other power supply remains on as long as its temperature remains below 70° C (158° F). If not, the second power supply will shut down, which turns off all power to the controller unit.

Note: There is a serious problem in the cabinet if the air temperature inside the cabinet is hot enough to cause the power supplies to shut down!

Once the air temperature cools to below 70° C (158° F), the power supplies automatically restart. An automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the controller unit to a normal operating state. Typically, you will not need to perform recovery procedures after an automatic power supply shutdown and restart.

Troubleshooting Power Supply Problems

Symptom: No power to the controller unit (all Power LEDs off).

A Possible Cause: Power switches are turned off.

1 Turn on both power switches on the controller unit.

2 Turn on the main circuit breakers in the rackmount cabinet, if applicable.

B Possible Cause: Power cords are unplugged.

Make sure all power cords are plugged in securely.

C Possible Cause: Power supplies overheated or failed.

1 Wait 10 minutes. If the power supplies turn on automatically, use the recovery procedure on page 49. If not, go to step 2.

2 Go to page 50 and replace the power supplies.

Symptom: One power supply LED is on and the other is off.

A Possible Cause: Power supply is turned off or unplugged.

1 Plug in the power cord and turn on the power switch. If the LED remains off, go to cause B.

B Possible Cause: Power supply is overheated or failed.

1 Wait 10 minutes. If the power supply turns on automatically, use the recovery procedure on page 49. If not, go to step 2.

2 Replace the power supply CRU using the instructions on page 50.

Symptom: Power Supply LED (front cover) is on.

A Possible Cause: Power supply is missing or not plugged in properly.

1 Insert and lock the power supply into place. If the fault LED is still on, go to cause B.

B Possible Cause: Power supply is overheated or failed.

1 Wait 10 minutes. If the power supply turns on automatically, use the recovery procedure on page 49. If not, go to step 2.

2 Replace the power supply CRU using the instructions on page 50.

Recovering from a Power Supply Shutdown

Instructions

Use this procedure to regain normal system operation after a power supply shutdown. For more information, refer to "Power Supply CRU" on page 45.

1. Read the information in "Power Supply Recovery Notes" on page 47.
2. Remove the access panel from the back of the rackmount cabinet.
3. Answer the following questions:

   Does the current problem match one of the conditions listed below?

   - **One power supply has shut down.** The Power LED on the CRU and the Power Supply LED on the front cover are off.
   - **Both power supplies have shut down.** All power to the controller unit is off, but the drives are operating without fault.
   - **Power supplies are shutting down and restarting.** One or both power supplies shut down, then turn on again automatically.
   - **Temperature.** The air temperature at the back of the controller unit is 70º C [158º F] or higher.

   - **Yes:** Go to Step 4.
   - **No**: Go to the next question.

   Are both power cords plugged in securely on the controller unit and AC units in the cabinet or external AC outlet?

   - **Yes**: Go to the next question.
   - **No**: Correct the problem and continue normal operation.

   Is the Power Supply LED glowing on the front cover?

   - **Yes:** This indicates a failed power supply. Go to "Replacing a Failed Power Supply" on page 50.
   - **No:** Go to "Power Problems" on page 91.

Caution: **If the air temperature inside the cabinet is hot enough to cause the power supplies to shutdown, 70° C (158° F) or above, there is a serious problem in the cabinet.** Remove all panels from the cabinet immediately to help cool the controller unit and drives. Do whatever is necessary to alleviate the over-temperature problem (such as shutting down the power, using external fans to cool the area, etc.).

4. Cool the area to a normal operating temperature, then check the power supplies.

   If the power LED on one or both power supplies turns on again, go to Step 5. If the power supply (or both power supplies) remain off, it may indicate a faulty power cord, a failed power supply (see page 50), or a failed power interface board.

Note: Call for service.

5. Check the system for faults or damage.

   When the power supplies restart, check all the LEDs on the controller unit and the attached drive modules.

6. Plug in the power cord and turn on the power.

7. Check the new power supply and other controller unit LEDs for faults.

8. Replace the back cover on the cabinet.

Replacing a Failed Power Supply

Tools and Equipment

Replacement power supply CRU

Instructions

Use this procedure to replace a failed power supply.

1. Remove the access panel from the back of the rackmount cabinet.

2. Check the LEDs on the front and back of the controller unit (Figure 26 on page 51).

   If a power supply has failed, the amber Power Supply LED on the front cover will be turned on. Look on the back of the controller unit. The green Power LED on the failed power supply will be turned off.

3. Turn off the power switch and unplug the power cord from the failed power supply (Figure 27 on page 51).

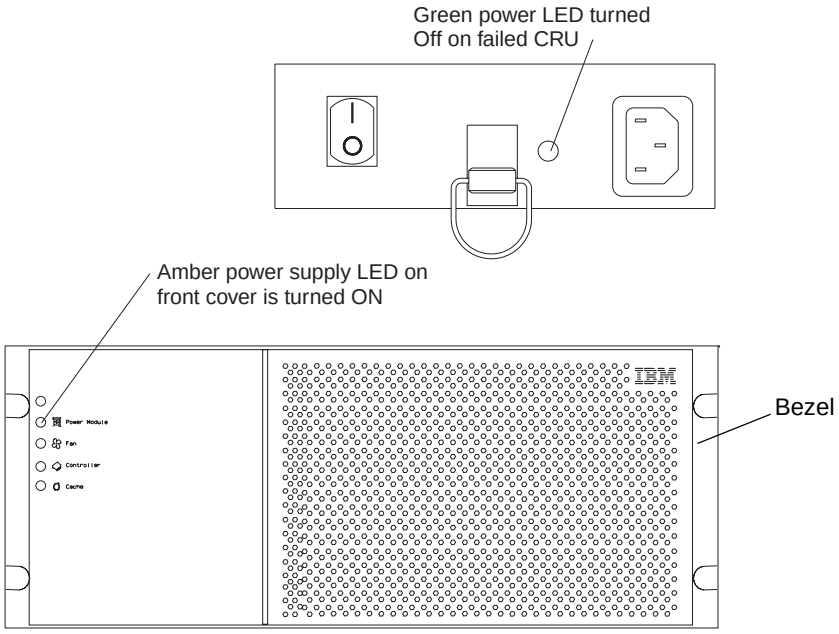


Figure 26. Fault Indicators for a Failed Power Supply

Caution: Always turn off the power switch and unplug the power cord before you remove or install a power supply CRU.

4. Remove the failed power supply (Figure 28 on page 52).

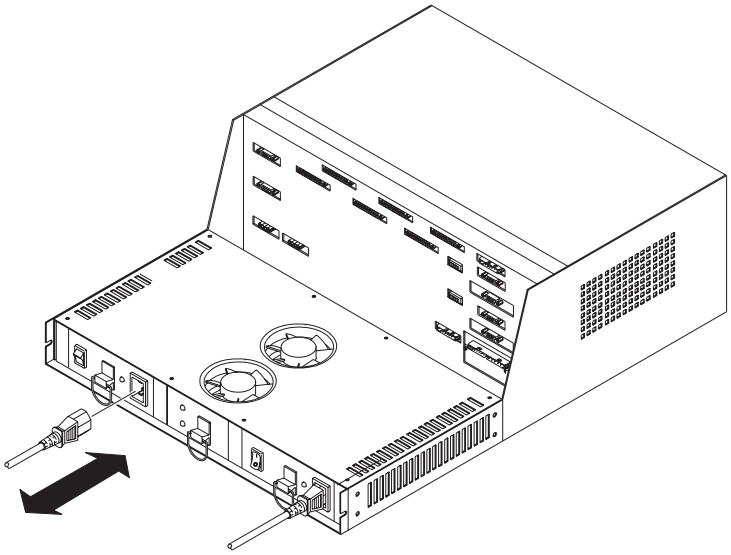


Figure 27. Turning Off the Power and Unplugging the Power Cord

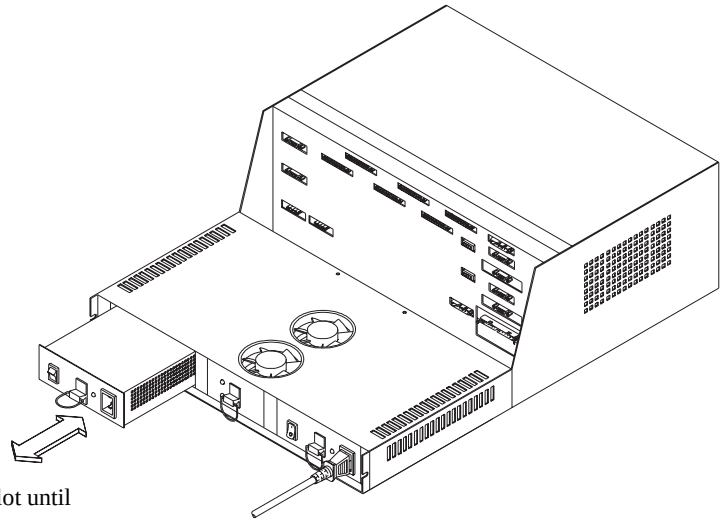


Figure 28. Removing and Installing a Power Supply CRU

5. Unpack and install the new power supply (Figure 28 on page 52).
6. Plug in the power cord and turn on the power (Figure 27 on page 51).
7. Check the new power supply and other controller unit LEDs for faults.
8. Replace the back cover on the cabinet, as necessary.

Chapter 5. Installation Guide

This section explains how to prepare the controller unit for installation by setting the interface options.

5

CAUTION:

Use safe lifting practices when lifting your machine.

Before you begin

- Read “Handling Static-Sensitive Devices.”

Handling Static-Sensitive Devices

Static electricity, though harmless to you, can seriously damage controller unit components or options.

Note: When you are adding an internal option, do not open the static-protective package containing the option until you are instructed to do so.

When you handle options and other controller unit components, take these precautions to avoid damage from static electricity:

- Limit your movement. Movement can cause static electricity to build up around you.
- Always handle components carefully. Never touch any exposed circuitry.
- Prevent others from touching components.
- When you are installing a new option, touch the static-protective package containing the option to a metal controller-slot screw or other unpainted metal surface on the controller unit for at least two seconds. (This reduces static electricity from the package and from your body.)

- When possible, remove the option and install it directly into the controller unit without setting the option down. When this is not possible, place the static-protective package that the option comes in on a smooth, level surface and place the option on it.
- Do not place the option on the controller unit's covers or any metal surface.

Preparatory Tasks

This section specifies the preparations you should complete before beginning the installation and explains the installation process. **Read everything in this section before you start** the installation procedure. The instructions in this book assume:

- You have already installed the applicable hosts and host adapters.
- Fibre Channel interface cables are attached to the appropriate hosts and are ready for final connection to the controller unit. (See "Fibre Channel Host Cable Requirements" on page 61).
- The installation site meets all area, environmental, power, and site requirements for the controller unit. (Refer to"Preparing the Site" on page 55.)
- If you are installing a rackmount controller unit in a rackmount cabinet, you have moved the cabinet to its permanent operation location and prepared it for final installation. (See "Preparing the Rackmount Cabinet" on page 62.)
- The rackmount drive modules are near their final location and prepared for installation.

Tools and Equipment You May Need

To complete the installation procedure, you will need some or all of the following:

- Power cords (shipped with unit)
- Screwdrivers
- Antistatic protection (such as a grounding wrist strap)
- Interface cables
- Mounting hardware (for rackmount installations)
- Table or cart (optional)
- Software (to configure the disk array)

About the Installation Procedure

The step-by-step procedures in this chapter guide you through the entire installation process for the rackmount controller units. These procedures include:

- Preparing the site
- Preparing drive modules that you intend to attach to the controller unit
- Preparing the cabinet
- Preparing the controller unit
- Installing the controller unit
- Completing the installation

You should perform these tasks in the order given, beginning with "Preparing the Site" on page 55.

Preparing the Site

This section lists the space, environmental, and power requirements for the controller unit. For information on interface cables and connections, refer to "Fibre Channel Host Cable Requirements" on page 61 and "LVD-SCSI Drive Cable Requirements" on page 62.

Floor Space

The floor area at the installation site must provide:

- Enough stability to support the weight of the controller unit and associated equipment (Table 9).
- Sufficient space to install the controller unit (see Table 10 on page 56 and Figure 29).

Weight

The controller unit's total weight depends on the number of components installed in the chassis. Table 9 lists the overall weight of the controller unit (unit and shipping), plus the weight for individual components. The maximum weight equals a controller unit containing two controllers, one battery, two power supplies, and two fans. Empty weight equals a controller unit with all CRUs removed.

Table 9: Controller Unit Weight

Weight Criteria	Controller Unit Weight		Individual Component Weight				
	Maximum	Empty	Control-ler	Battery	Control-ler Fan	Power Supply Fan	Power Supply
Unit	34.5 kg (76.0 lb)	14.3 kg (31.6 lb)	3.0 kg (6.6 lb)	9.7 kg (21.4 lb)	0.9 kg (1.9 lb)	0.7 kg (1.5 lb)	1.5 kg (3.3 lb)
Shipping	48.5 kg (107.0 lb)	28.4 kg (62.6 lb)	11.0 kg (5.0 lb)	11.8 kg (26.0 lb)	2.3 kg (5.0 lb)	2.1 kg (4.5 lb)	2.9 kg (6.5 lb)

Dimensions

Table 10 lists the controller unit dimensions, with and without the front cover, in and out of a shipping carton. Figure 29 shows dimensions for the models.

Table 10: Controller Unit Dimensions

With Front Cover			Without Front Cover		
Height	Width	Depth	Height	Width	Depth
173 mm (6.8 in.)	440 mm (17.32 in.)	630 mm (24.8 in.)	173 mm (6.8 in.)	440 mm (17.32 in.)	610 mm (24.0 in.)

Shipping Carton		
Height	Width	Depth
480 mm (18.9 in.)	610 mm (24.0 in.)	845 mm (33.3 in.)

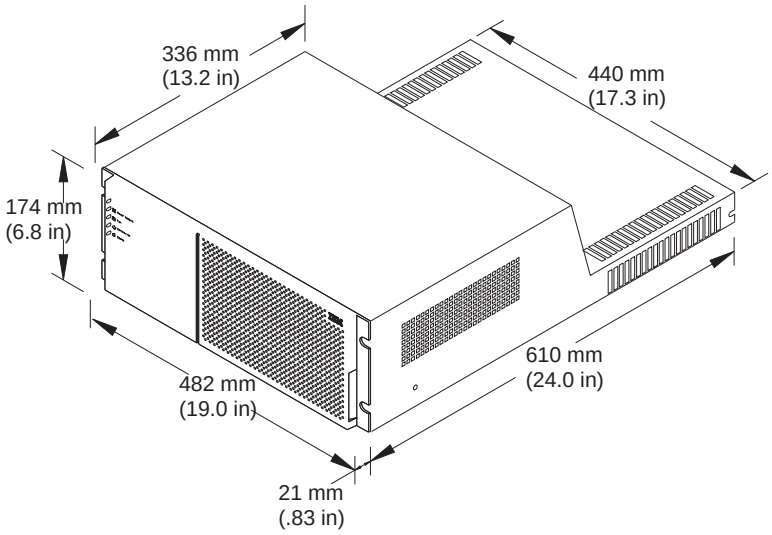


Figure 29. Controller Unit Dimensions

Heating and Air Conditioning

Table 11 lists the temperature, humidity, and air flow requirements for the controller unit.

Table 11: Environmental Requirements

Element	Unit of Measure	Requirement
Air temperature	System on	10° C to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft.)
	System on	10° C to 32° C (50° F to 95° F) Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.)
	System off	10° C to 43° C (50° F to 110° F) Maximum altitude: 2133 m (7000 ft.)

Table 11: Environmental Requirements

Humidity	System on	8% to 80%; maximum wetbulb 23° C (73.4° F)
	System off	8% to 80%; maximum wetbulb 27° C (80.6° F) Altitude: 0 to 2133 m (0 to 7000 ft.)
Heat Output	Approximate heat output in British thermal units (BTU) per hour: 731.0 (0.329 kVA or 214.0 W)	
Sound	Sound Power, idling and operating[1]	6.4 bel
	Sound Pressure, idling and operating[1]	50 dBA

[1] These levels are measured in controlled acoustical environments according to ISO 7779 and are reported in accordance with ISO 9296. The declared sound power levels indicate an upper limit below which a large portion of machines operate. Sound pressure levels in your location might exceed the average 1-meter values stated because of room reflections and other nearby noise.

Electrical

Table 12 lists the electrical power requirements for the controller unit.

Table 12: Power Requirements

Item	Unit of Measure	Requirement
Circuit Breaker	3.0 A (slow-blow fuse per power supply)	
Controller Unit AC Power	Nominal Voltage	100 to 240 VAC
	Frequency	50/60 Hz
	Idle Current	1.0 A[1]
	Maximum Operating Current	1.0 A[1]
	Maximum Surge Current	2.0 A[1]

Table 12: Power Requirements

Component DC Power		**+5 VDC**	**+12 VDC**
	Controller	7.0 A	0.1 A (per controller)
	Battery	0.07 A	2.5 A
	Controller Fan	0.07 A	0.7 A
	Power Supply Fan	0.02 A	0.65 A (per fan CRU)
	Power Supply	Low voltage: 2.0 A (max. per power supply at 220 VAC)	
		High voltage: 1.0 A (max. per power supply at 120 VAC)	

[1] Typical current at 240 VAC, 60 Hz (assumes 0.70 power efficiency, 0.99 power factor).

Site Wiring and Power Considerations

The controller unit is a nominal 10 VAC to 240 VAC, 50/60 Hz unit that meets standard voltage requirements for both domestic (USA) and international (outside USA) operation. It uses standard industrial wiring with a line-to-neutral or line-to-line power connection (Table 13 on page 60).

Consider the following when preparing the site and cabinet for installation:

- **AC power source.** The AC power source must provide the correct voltage, current, and frequency specified on the manufacturer's nameplate. Internal AC distribution boxes (such as the cabinet's power units) must be able to handle the power requirements for this unit (Table 11 on page 69). You must have an independent AC power source for each power supply in the controller unit in order to maintain full redundancy.
- **Earth ground.** There must be an earth ground conductor on the AC power source.
- **Circuit overloading**. Make sure the power circuits and associated circuit breakers in both the cabinet and building provide sufficient power and overload protection. To prevent possible damage to the unit, isolate its power source from large switching loads (such as air conditioning motors).
- **Power interruptions**. The controller unit will withstand the following applied voltage interruptions:
  - Input transient: 50% of nominal voltage
  - Duration: one half cycle
  - Minimum frequency: once every 10 seconds

- **Power failures** — Once power is restored after a complete power failure, the unit will automatically perform a power-up recovery sequence without operator intervention.

Table 13: Site Wiring Voltages

Input Power	50 Hz			60 HZ		
	Nominal	Minimum	Maxi-mum	Nominal	Minimum	Maxi-mum
Single-Phase Line to Neutral	100	90	107	100	90	107
	127	114	136	120	104	127
	220	198	235			
	230	207	246			
	240	216	257			
Single-Phase Line to Line	200	180	214	200	180	214
				208	180	220
				240	208	254

Interface Connectors and Cables

The controller unit supports the following interface protocols:

- **Host interface** – Fibre Channel (fiber optic), one per controller
- **Drive interface** – LVD Ultra 2 SCSI (low-voltage differential, small computer system interface), six drive channels
- **Network interface** – Ethernet, one each per controller through an attachment unit interface (AUI) connection (not provided)

Connectors and Host IDs

The host ID switches and connectors for interface cables are on the *connector plate* (Figure 30), located on the back of the controller unit.

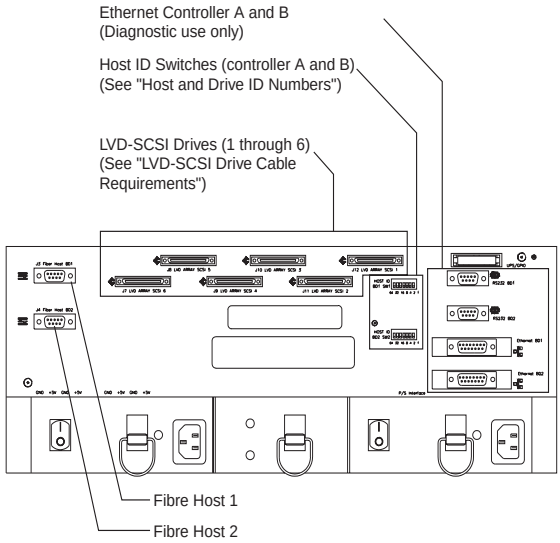


Figure 30. Interface Connections on Controller Unit

Host and Drive ID Numbers

Each controller must have a unique *Fibre Host ID number.* The host ID numbers assigned to each controller are based on two elements:

- Host ID numbers set through hardware switches on the controller unit (Figure 30). There are five Host ID switches that allow you to set ID numbers 0 through 127 for each controller. The factory default settings are ID #5 for Controller A and ID #4 for controller B.
- Software algorithms that calculate the actual Fibre Channel address, based on the controller unit's hardware settings and position on the loop or hub.

Fibre Channel Host Cable Requirements

Table 14 lists the cable requirements for all Fibre Channel connections. For fiber optic connections, you must use multi-mode, 50 micrometer fiber optic cable and a Media Interface Adapter (MIA) (provided with your controller) as shown in Figure 31.

Table 14: Fibre Channel Interface Cable Requirements

Cable Descriptions				
Item	**Media Type**	**Data Size**	**Transfer Speed**	**Range**
Fiber optic (multi-mode, 50 micrometer)	Shortwave laser	100 MB/sec	1062.5 Mbaud	up to 500 m

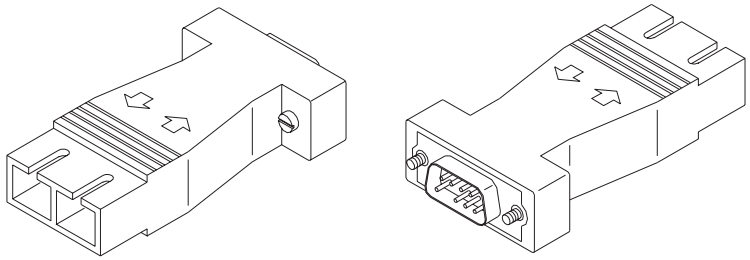


Figure 31. Media Interface Adapter

LVD-SCSI Drive Cable Requirements

To connect the controller unit to a drive module, you must use 68-pin, VHDCI (very high density cable interface) LVD, Ultra 2 SCSI cables. The controller unit has six drive connectors that support 16-bit interface protocols. Each connector represents a single drive channel that supports up to 10 drives per channel for a total of 60 drives. Refer to "LVD-SCSI Drive Cable Routing Examples" on page 72 for examples of connecting the controller unit to one or more LVD-SCSI drive modules.

Preparing the Rackmount Cabinet

To prepare the rackmount cabinet for installation, review the following checklist and complete all applicable preparatory procedures.

Cabinet Preparation Checklist

Preparation may include:

- Moving, unpacking, and leveling the cabinet at the installation site
- Removing external cabinet panels

- Stopping all I/O activity to the devices in the cabinet
- Turning off all module and cabinet power, and disconnecting existing power, network, and other external cables
- Installing additional interface cables, power cables, or independent power sources, such as an *uninterruptible power supply (UPS)*
- Installing support rails for mounting the controller unit and drive modules (refer to "Installing the Support Rails" on page 63)
- Removing, adding, or reconfiguring drive modules or devices in the cabinet

Once the rackmount cabinet is ready, go to "Preparing the Drive Modules" on page 66.

Installing the Support Rails

To install the controller unit in a rackmount cabinet, use the rails and mounting hardware supplied with your controller unit.

Where you place the support rails in or on the cabinet depends on where you intend to position the controller unit.

Use this procedure to install mounting hardware in a cabinet before installing a **rackmount controller unit**. These instructions assume that you have completed the cabinet preparation tasks listed on page 62.

1. Turn off the power, if applicable.

   Stop all I/O activity to the devices in the cabinet in which you are installing the controller unit. Turn off the power switches on both AC distribution boxes in the cabinet.

2. Carefully remove the battery CRU and controller CRU.

3. Install the support rails.

   a. Loosen the screws in the rail.

   b. From the front of the rack, locate the desired position on the rack based on the even EIA (U level) space and line up the rail with the holes in the rack.

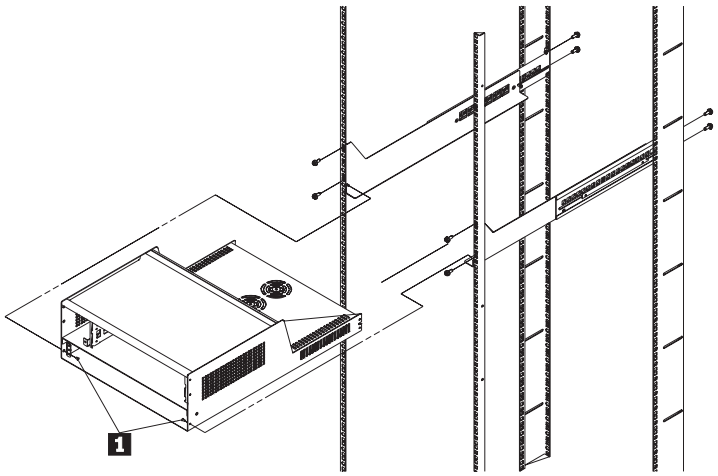


Figure 32. Aligning the Rail

c. Install two of the eight (black) hex head screws (provided with your hardware kit) in the top and bottom positions, starting with the top front on each side.

d. Move to the rear of the rack.

e. Slide the rear rail assembly toward you until it makes contact with the rack rail. Install the rear screws, then tighten the two side screws.

Note: Make sure the front rail position matches the rear rail position.

f. Repeat the rail assembly procedure on the opposite side of the rack.

g. Slide the controller unit into the rack.

h. Install the two screws **1** on the front sides.

i. Tighten the rear side screws.

j. Install the CRUs.

Note: Refer to Figure 35 on page 68 and reverse the instructions to install the CRUs into the controller unit.

k. Install the front bezel.

l. Install a MIA for each controller purchased (see Figure 33)

m. Attach the host Fibre Channel cables to the MIA(s).

Attach the other end of your Fibre Channels according to your configuration requirements.

n. Connect the LVD-SCSI drive cables (Figure 33).

Attach LVD-SCSI drive cables to the drive LVD connectors on the controller unit and to the drive modules. Refer to the cabling examples on page 72 through page 85, for drive module cabling examples.

You may need to set the Bridge Enable switch on attached drive modules. Refer to installation instructions shipped with the drive modules.

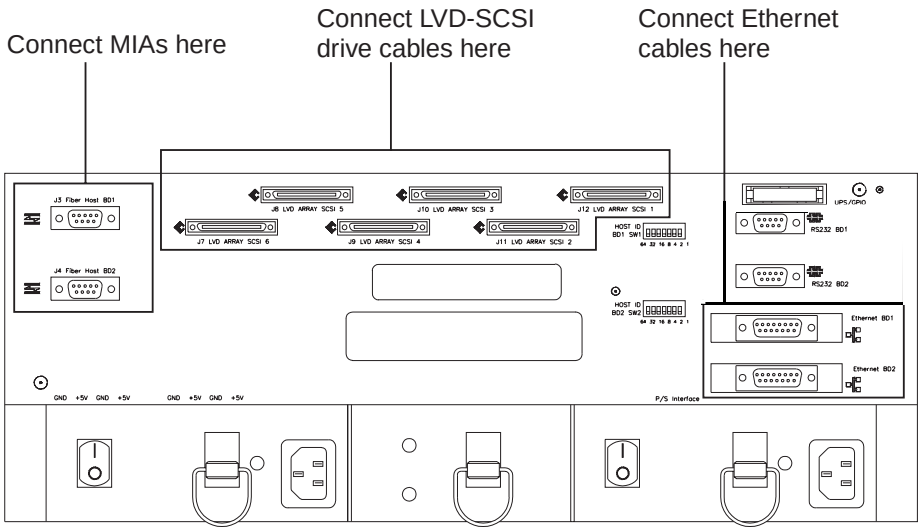


Figure 33. Interface Connections on a Rackmount controller unit

o. If applicable, attach secondary interface cables (Figure 33 on page 65).

There is one Ethernet connector for each controller. Attach cables to these connections if you are using Networked RAID Manager.

p. Route and secure the interface cables.

Arrange the interface cables so they clear the vents on the back of the controller unit.

q. Go to "Completing the Installation" on page 70. Then continue with "Preparing the Drive Modules" on page 66.

For information about cable management, visit the following IBM World Wide Web site:

http://www.pc.ibm.com/support/

Preparing the Drive Modules

Prepare the drive modules that you are attaching to the controller unit. This may involve any or all of the following tasks:

- Moving the drive modules to the installation site
- Unpacking the drive modules from their shipping cartons
- Checking the shipping contents
- Removing all *customer replaceable units (CRUs)*
- Setting the Bridge Enable switch, as necessary
- Installing support rails in the cabinet

For detailed instructions on preparing the drive modules, refer to the hardware documentation shipped with each unit. When you are finished preparing the drive modules, continue with "Preparing the Controller Unit" on page 66. Refer to "LVD-SCSI Drive Cable Routing Examples" on page 72 for examples of connecting the controller unit to one or more LVD-SCSI drive modules.

Preparing the Controller Unit

You will need an antistatic wrist strap, and cart or level surface (to hold the CRUs)

Use this procedure to prepare a controller unit for installation. These instructions assume that you have completed all applicable site, rackmount cabinet, and drive module preparations discussed on pages 55 through 66.

1. Check the contents of the shipping container.

   The controller unit shipment should include:

   - **Two power cords.** These attach the controller unit to the AC power sources inside the cabinet or to an external receptacle.

Attention: Electrostatic discharge can damage sensitive components. Use a grounding wrist strap or other antistatic precautions before removing or handling any components in the cabinet.

2. Set the Fibre Host IDs (Figure 34).

Each controller must have a unique *Fibre Host ID number* (refer to "Host and Drive ID Numbers" on page 61). The Fibre Host ID switches are located on the upper right corner of the controller unit. If you need to change the controller's host ID setting, move the switches up or down.

Note: This is the preferred ID that will be assigned on the Fibre Channel loop unless it is already being used. If the ID is already in use, a soft ID will be assigned.

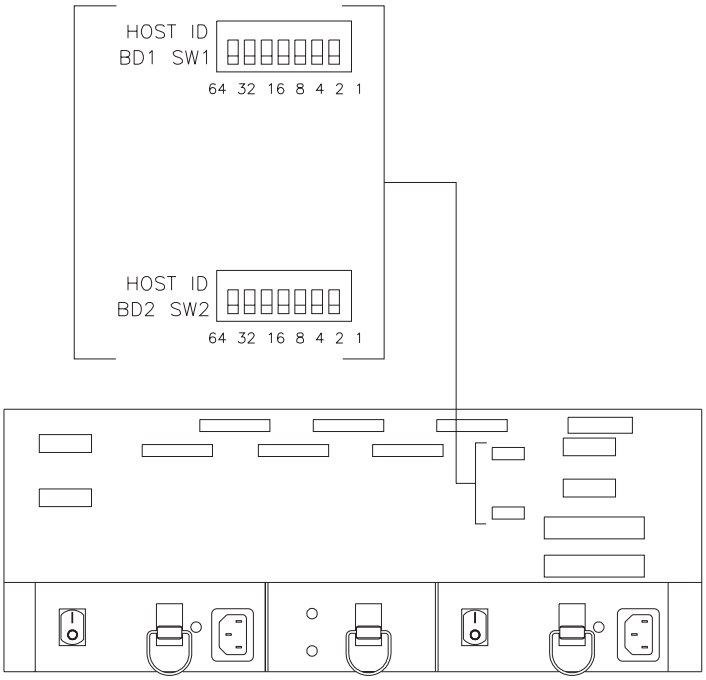


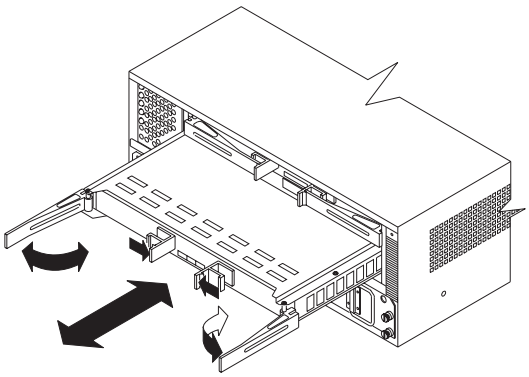
Figure 34. Setting the Fibre Host IDs

3. Remove all the CRUs, using Figure 35 as a guide.

4. Go to "Removing the Controller Unit from a Rack" on page 69.

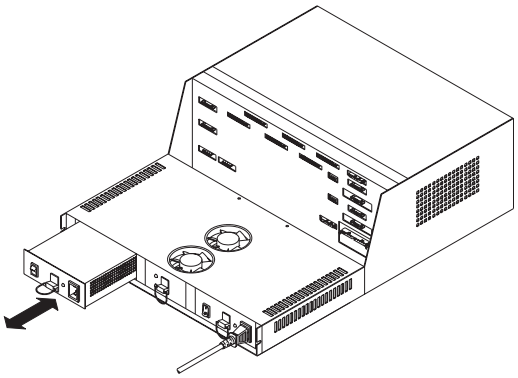
Remove Controllers

Unlock and open levers, then pull out both controllers.



Remove Power Supplies

Pull levers up to unlatch, then remove both power supplies.

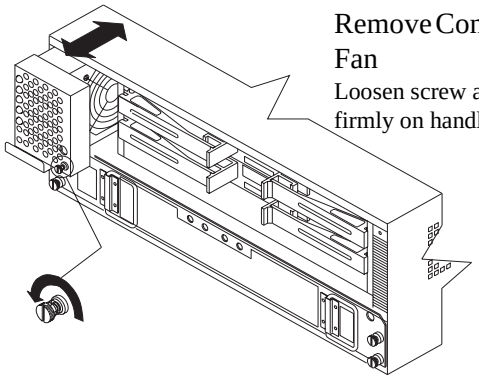


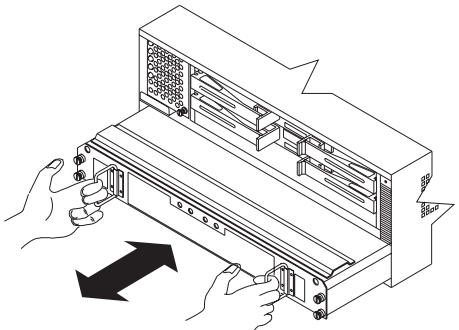
Important

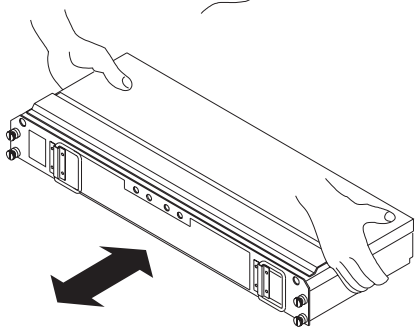
Keep track of which controller (A or B) belongs in each slot. To prevent data loss, you must replace both controllers in their original slots.

Remove Controller Fan

Loosen screw and pull firmly on handle.

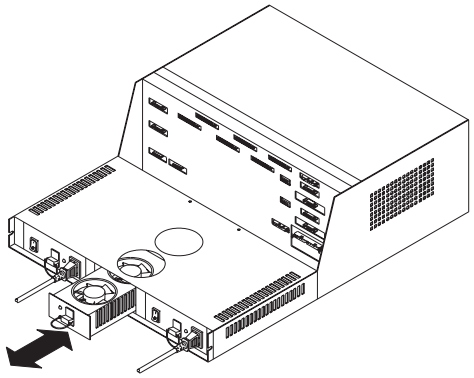






Remove Battery

Loosen screws and pull battery out a few inches. Grasp both sides of CRU and remove it.



Remove Power Supply Fan

Pull lever up to unlatch, then remove power supply fan.

Figure 35. Removing The CRUs

Removing the Controller Unit from a Rack

Before you begin

- Turn off both power supply switches on the rear of your controller unit.
- Follow any additional installation and safety instructions that come with the rack.

5

CAUTION:
Use safe lifting practices when lifting your machine.

To remove the controller unit from the rack:

1. Remove the front bezel
2. Remove the CRUs from the controller unit.
3. Loosen the two 6-32 screws from the rear of the controller unit.
4. Remove the two screws from the front sides.

Attention: Do not remove the bottom (black) hex head screws. These secure the rails that support your controller unit.

5. Slide the controller unit out of the rack.

Completing the Installation

Start-up Notes

- **You must power up the drive modules before powering up the controller unit.** If the controller unit is attached to one or more IBM 3520 Drive Modules, turn on the drive modules first, followed by the controller unit.
- The controller unit has *light emitting diodes* (LEDs) that indicate the status of both the overall controller unit and the individual components within the unit. Check all LEDs on the controller unit (front and back) when you power up the unit to make sure there are no problems.

Configuration Notes

Once the controller unit hardware is installed and turned on, you may need to perform certain tasks to complete the installation. These tasks may include:

- Installing RAID management software
- Checking and setting software parameters
- Preparing attached drive modules for data storage

Starting Up the Controller Unit

You will need the power cords (2) shipped with the controller unit.

Use these instructions to connect the power cords, turn on the power, and check the controller unit.

1. Make sure that both power switches on the controller unit are turned off (Figure 36).
2. Plug both power cords into the controller unit (Figure 36).
3. Plug both power cords into the AC outlets.

   To maintain power redundancy, plug each power cord into an independent power source such as external receptacles, UPS outlets, or AC distribution boxes inside a rackmount cabinet.

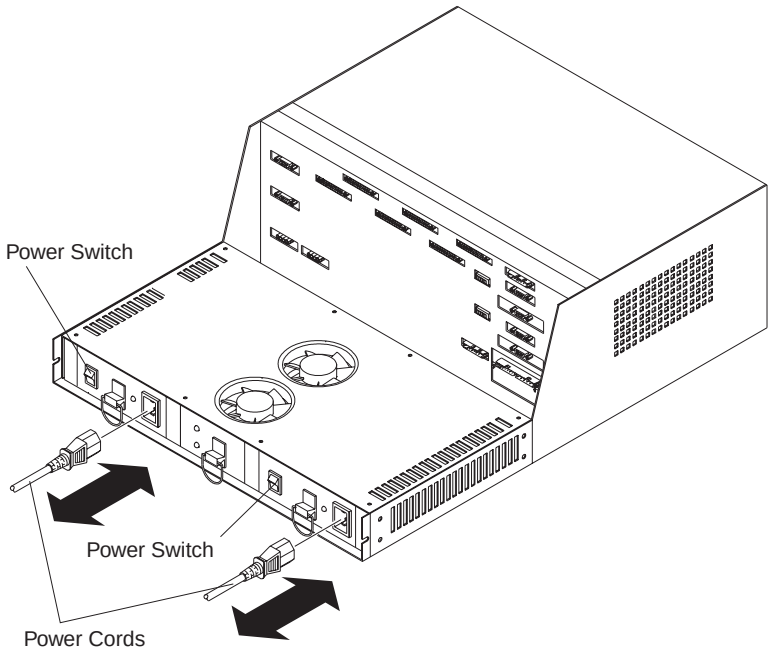


Figure 36. Power Cords and Power Switches

4. Turn on the power as follows:

   a. Main circuit breakers in the rackmount cabinet, if applicable

   b. All drive modules attached to the controller unit

   c. Both power switches on the back of the controller unit (Figure 36)

NOTE The controller unit may take from three to 10 seconds to power-up. During this time, you will see the amber and green LEDs on the controller unit turn on and off intermittently.

5. Check the controller unit for faults.

   Go to "Using the Status LEDs" on page 7 and follow the instructions to check the controller unit's status. If any Fault LEDs turn on and remain on, refer to the appropriate page listed in Table 1 and Table 2.

6. Replace front cover.

7. Go to "Configuring the System" on page 72.

Configuring the System

Tools and Equipment

You will need the following items:

- Software materials shipped with the controller unit
- Configuration worksheet showing how you want to set up the disk array (optional)

Instructions

Use this procedure as a guideline for installing the disk array management software and configuring the controllers and drives.

1. Read "Configuration Notes" on page 70.
2. Check the controller unit shipping cartons for software materials, which include software installation media and documentation.
3. Install the software using the appropriate instructions shipped with the CD.
4. Configure the system using the appropriate RAID management software.

   Some default software parameters (such as RAID level, drive groups, and caching) are set at the factory before shipment. If SYMplicity Storage Manager or other RAID management software is already installed on the host, use it to check the current software configuration for both the controllers and drives. Change the system configuration, as necessary. Refer to the appropriate software documentation for instructions on using the software.

NOTE Depending on the RAID management software you are using, the controller unit, drive units, or other components in your system may be identified by names that differ from those used in this book. Keep this in mind when using the software.

5. Begin normal system operation and maintenance using Chapters 1 through 4 as a guide.

LVD-SCSI Drive Cable Routing Examples

Use the following examples for connecting a controller unit to one or more LVD-SCSI drive modules.

Rackmount LVD-SCSI Drive Cabling Examples

Configuration:
1 controller unit
1 drive module
2 drive channels
5 drives per channel
Bridge Disable = ON

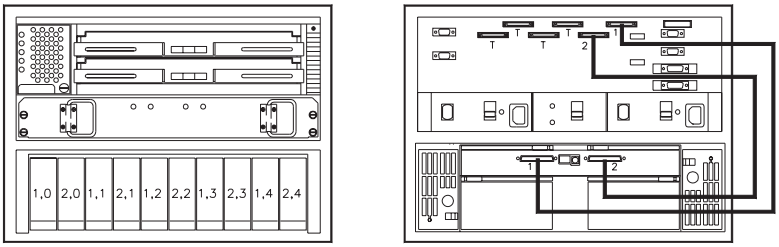


Figure 37. Rackmount Cabling to One Drive Module

Configuration:
1 controller unit
2 drive modules
4 drive channels
5 drives per channel
Bridge Disable = ON

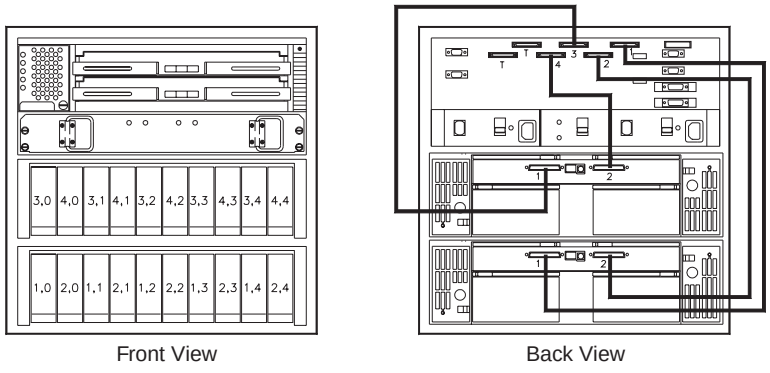


Figure 38. Rackmount Cabling to Two Drive Modules

Configuration:
1 controller unit
3 drive modules
6 drive channels
5 drives per channel (channels 1 through 6)
All Bridge Disables = ON

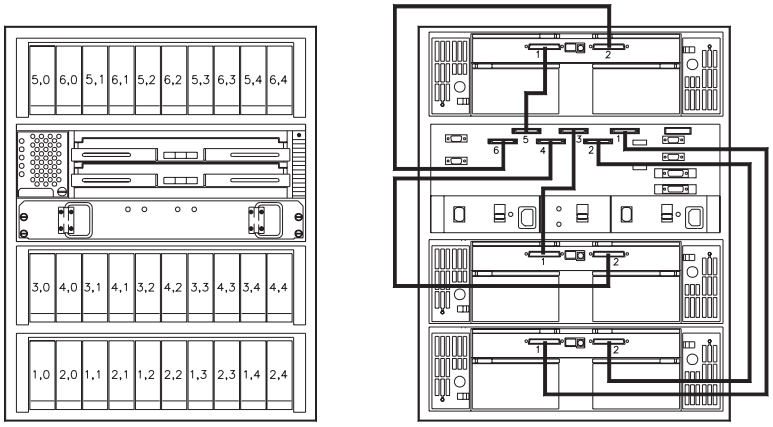


Figure 39. Rackmount Cabling to Three Drive Modules

Configuration:
1 controller unit
4 drive modules
4 drive channels
10 drives per channel (10 drives for each drive module)
All 4 Bridge Disables = OFF

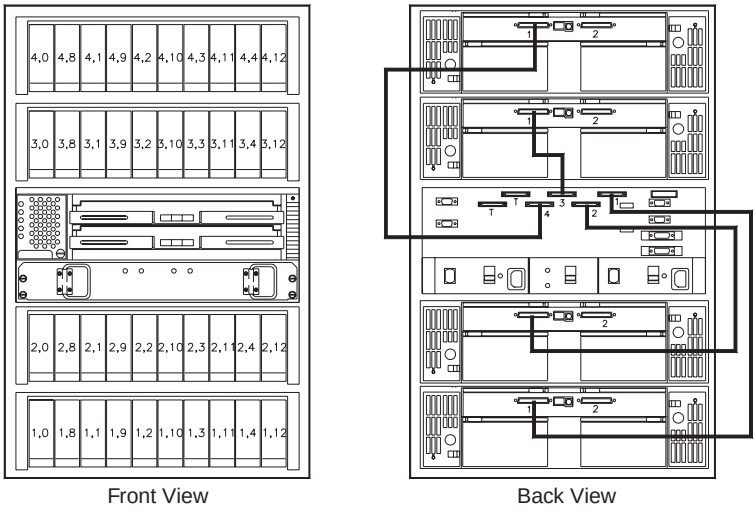


Figure 40. Rackmount Cabling to Four Drive Modules

Configuration:
1 controller unit
5 drive modules
5 drive channels
10 drives per channel
All 5 Bridge Disables = OFF

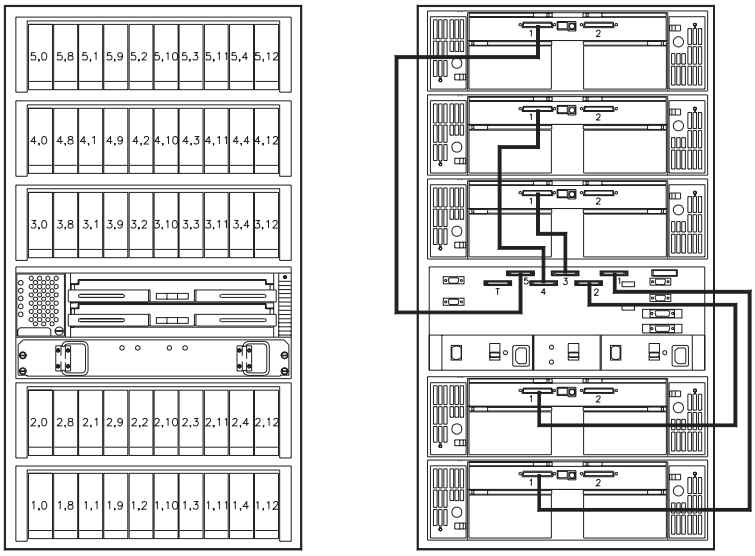


Figure 41. Rackmount Cabling to Five Drive Modules

Configuration:
1 controller unit
6 drive modules
6 drive channels
10 drives per channel
All 6 Bridge Disables = OFF

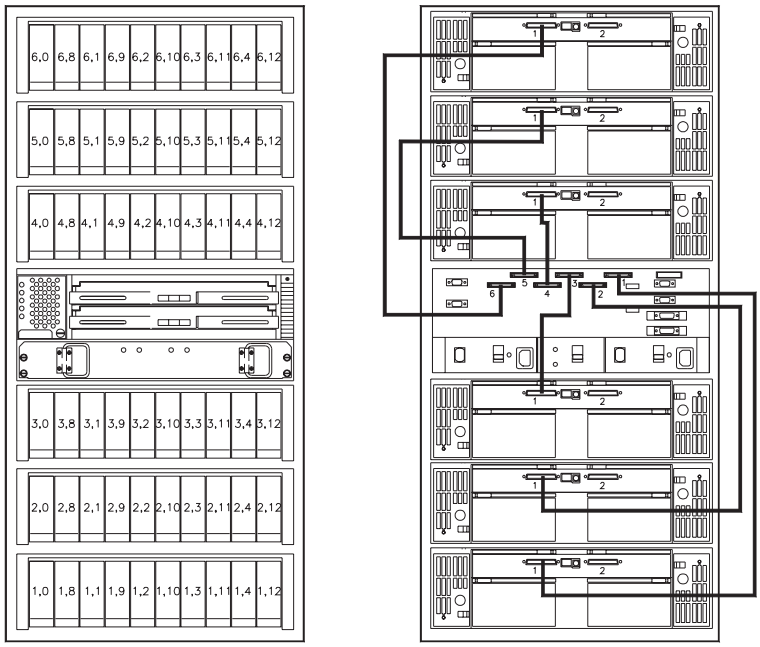


Figure 42. Rackmount Cabling to Six Drive Modules

Configuration:

2 controller units (A and E)

5 drive modules (B, C, D, F, and G)

5 drives per channel on channels 1 through 5 (controller unit A; drive modules B, C, and D)

5 drives per channel on channels 1 through 5 (controller unit E; drive modules D, F, and G)

All 5 Bridge Disables = ON

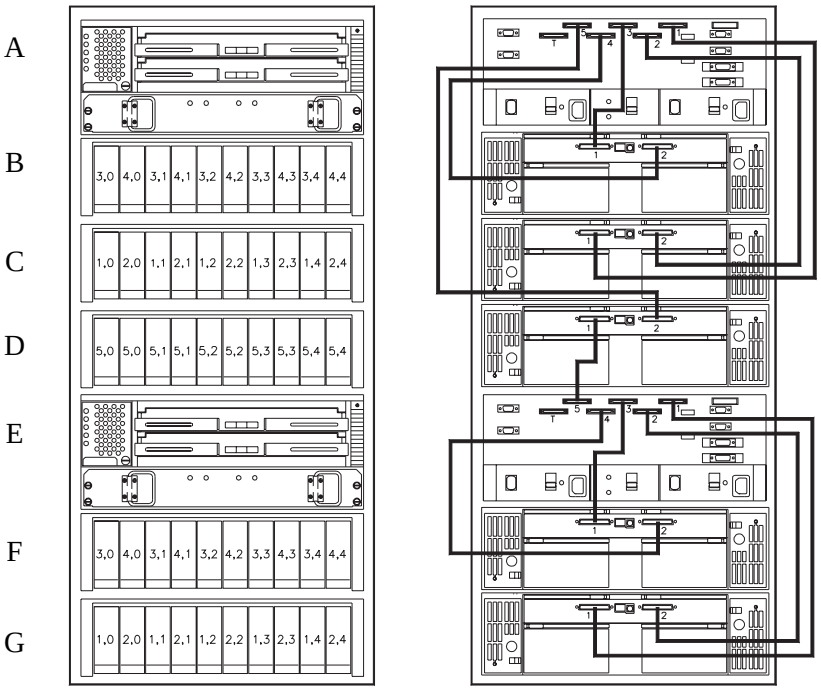


Figure 43. Dual Controller Unit Rackmount Cabling to Five Drive Modules

Configuration:

2 controller units (A and F)

6 drive modules (B, C, D, E, G, and H)

5 drives on channel 1 (controller units A and F; drive modules D and H)

5 drives on channel 2 (controller units A and F; drive modules D and H)

5 drives on channel 3 (controller units A and F; drive modules C and G)

5 drives on channel 4 (controller units A and F; drive modules C and G)

5 drives on channel 5 (controller units A and F; drive modules B and E)

5 drives on channel 6 (controller units A and F; drive modules B and E)

All 6 Bridge Disables = ON

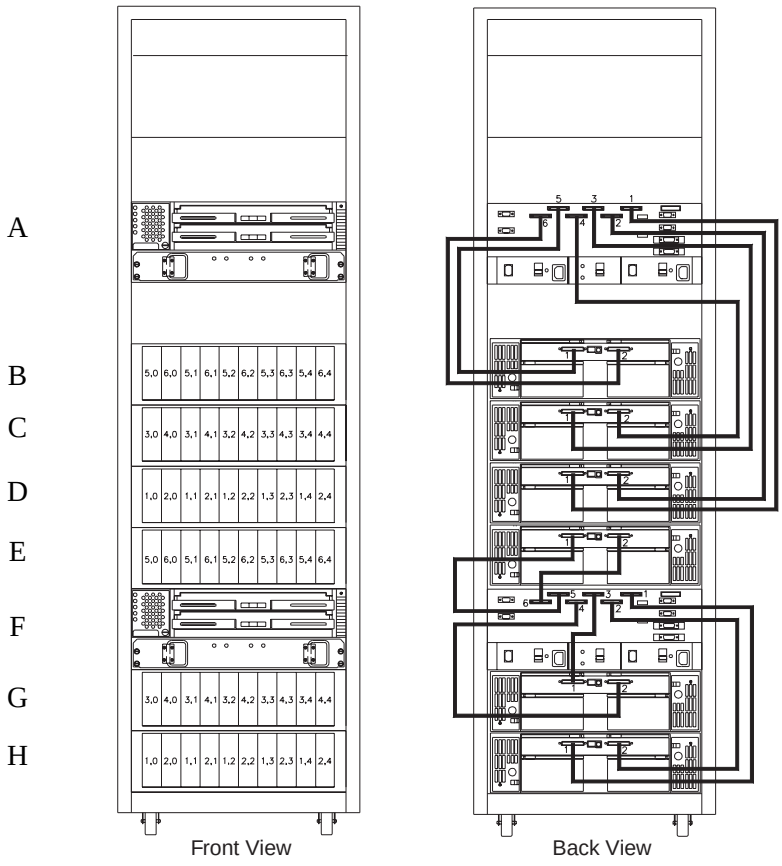


Figure 44. Dual Controller Unit Rackmount Cabling to Six Drive Modules

Configuration:
2 controller units (A and G)
7 drive modules (B, C, D, E, F, H, and I)
5 drives on channels 1 and 2 (controller unit A and drive module D)
5 drives on channels 3 and 4 (controller unit A and drive module C)
5 drives on channels 5 and 6 (controller unit A and drive module B)
5 drives on channels 3, 4, 5, and 6 (controller unit G; drive modules E and F)
10 drives each on channels 1 and 2 (controller unit G; drive modules H and I)
Modules B through F, Bridge Disables = ON
Modules H and I, Bridge Disables = OFF

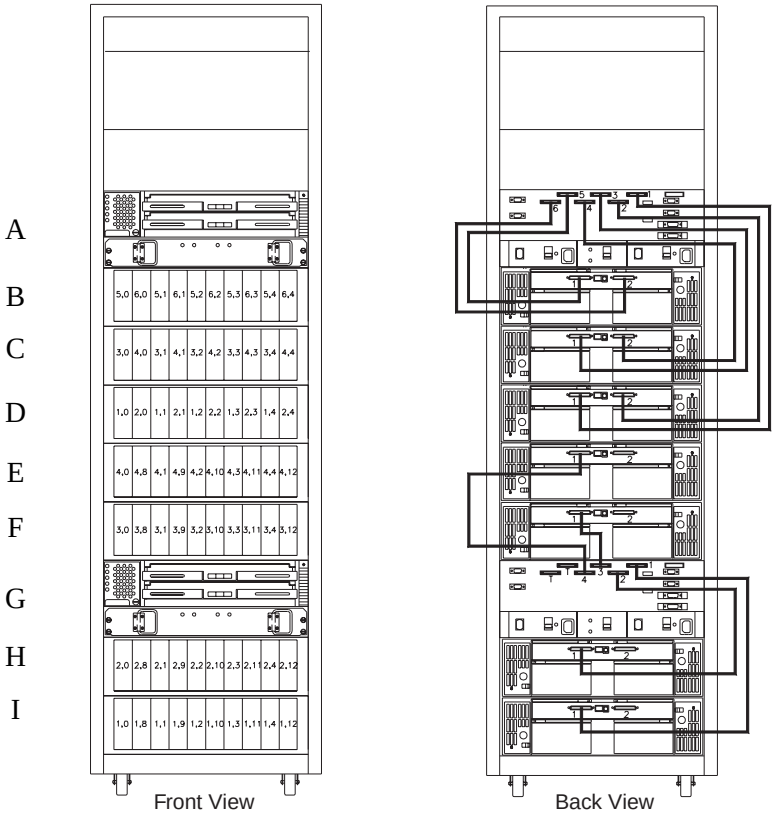


Figure 45. Dual Controller Unit Rackmount Cabling to Seven Drive Modules

Configuration:

2 controller units (B and H)

8 drive modules (A, C, D, E, F, G, I, and J)

5 drives on channels 1 and 2 (controller unit B and drive module D)

5 drives on channels 3 and 4 (controller unit B and drive module C)

5 drives on channels 5 and 6 (controller unit B and drive module A)

10 drives each on channels 1 through 5 (controller unit H; drive modules E, F, G, I, and J)

Modules A, C, and D, Bridge Disables = ON

Modules E, F, G, I, and J, Bridge Disables = OFF

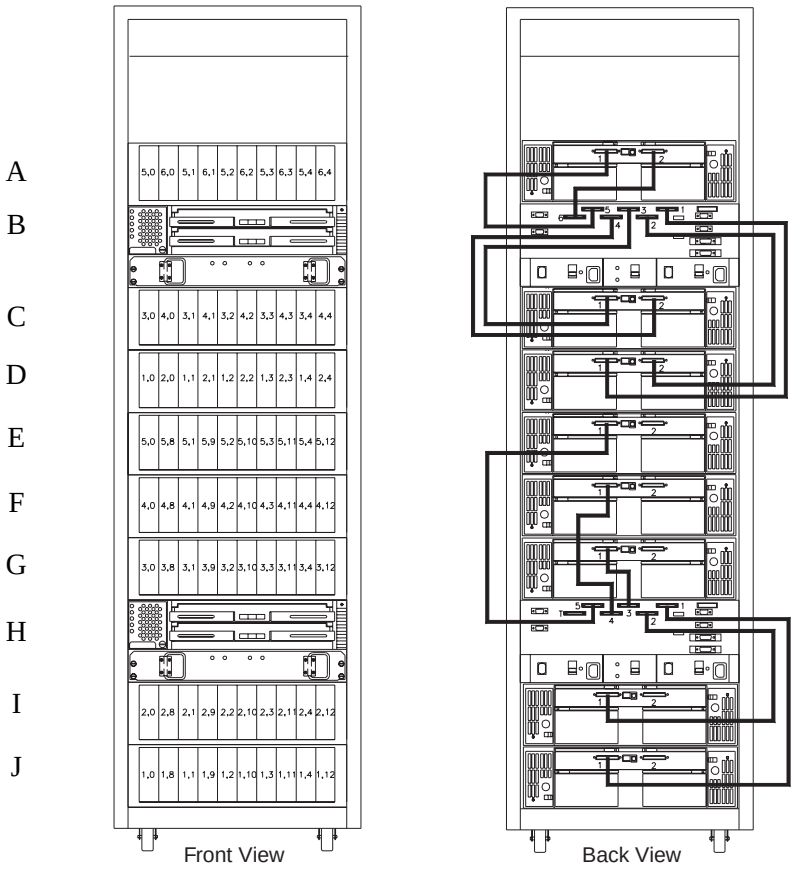


Figure 46. Dual Controller Unit Rackmount Cabling to Eight Drive Modules

Configuration:
2 controller units (C and I)
9 drive modules (A, B, D, E, F, G, H, J, and K)
5 drives each on channels 1 through 6 (controller unit C)
10 drives each (drive modules A, B, D, and E)
10 drives each on channels 1 through 6 (controller unit I)
10 drives each (drive modules F, G, H, J, and K)
Modules A, B, and D, Bridge Disables = ON
Modules E, F, G, H, J, and K, Bridge Disables = OFF

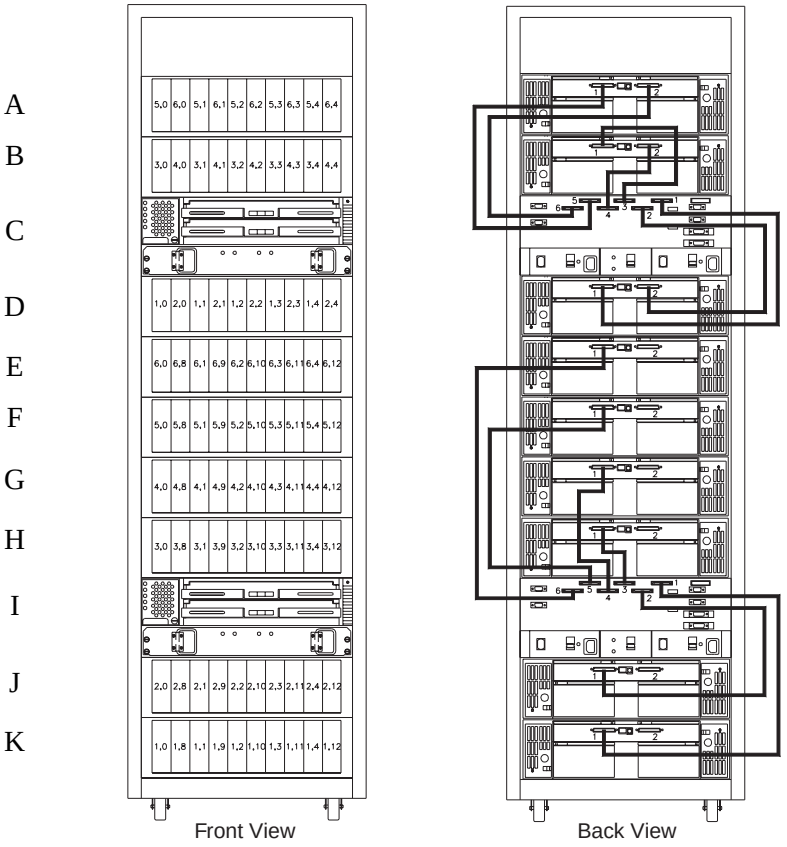


Figure 47. Dual Controller Unit Rackmount Cabling to Nine Drive Modules

Configuration:
2 controller units (D and J)
10 drive modules (A, B, C, E, F, G, H, I, K, and L)
10 drives each on channels 1 through 5 (controller unit D)
10 drives each (drive modules A, B, C, E, and F)
10 drives each on channels 1 through 5 (controller unit J)
10 drives each (drive modules G, H, I, K, and L)
All Bridge Disables = OFF

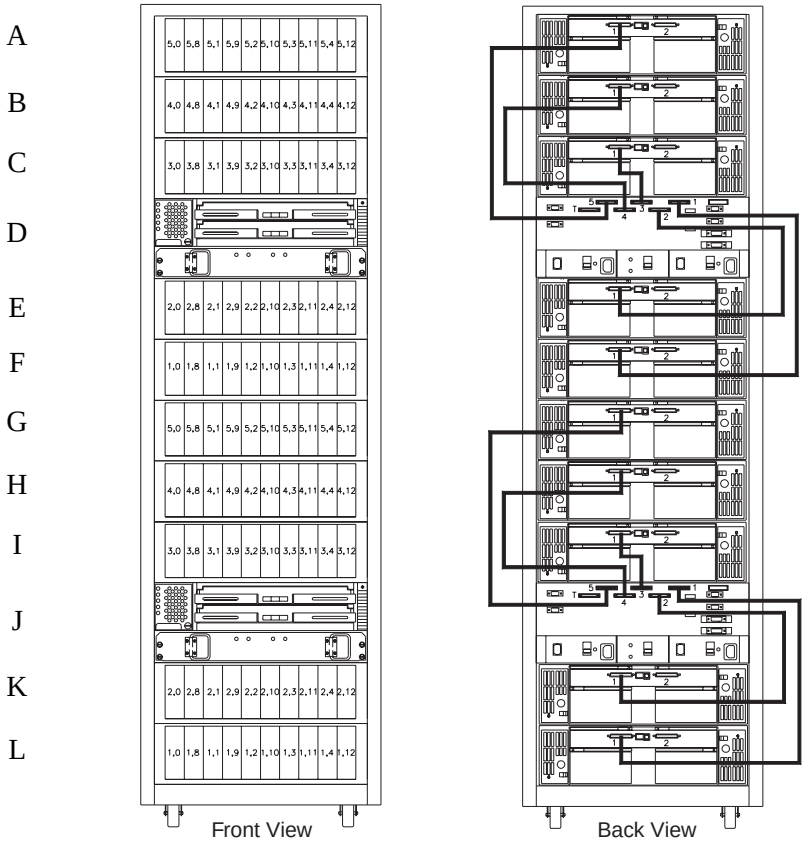


Figure 48. Dual Controller Unit Rackmount Cabling to Ten Drive Modules

Configuration:
3 controller units (C, D, and G)
6 drive modules (A, B, E, F, H, and I)
5 drives each on channels 1 through 4 (controller unit C)
10 drives each (drive modules A and B)
5 drives each on channels 1 through 4 (controller unit D)
10 drives each (drive modules E and F)
5 drives each on channels 1 through 4 (controller unit G)
10 drives each (drive modules H and I)
All Bridge Disables = ON

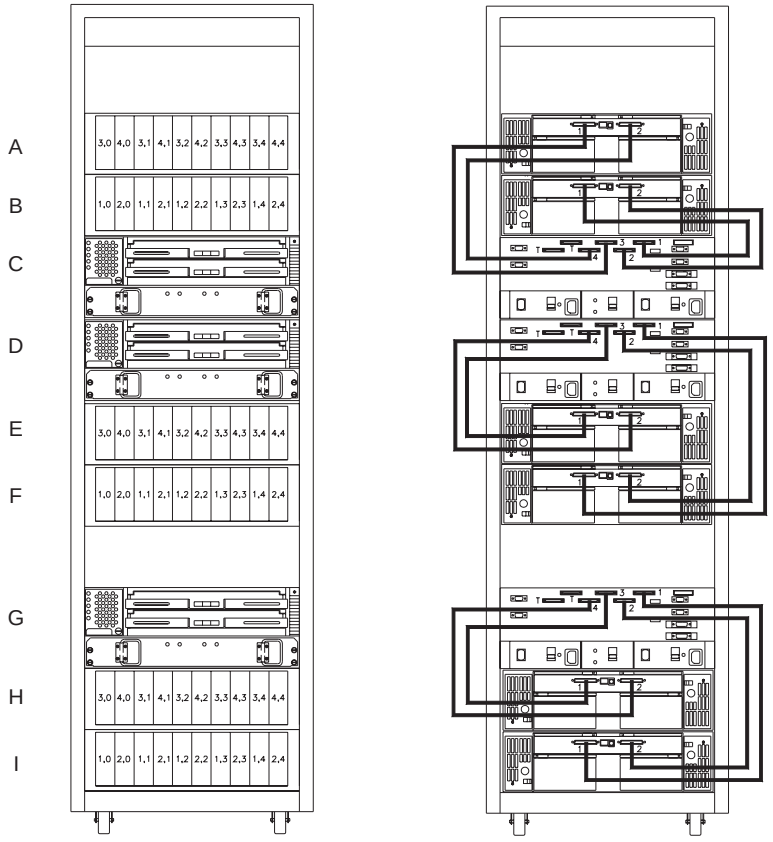


Figure 49. Triple Controller Unit Rackmount Cabling to Six Drive Modules

Configuration:
3 controller units (C, D, and H)
7 drive modules (A, B, E, F, G, I, and J)
5 drives each on channels 1 through 4 (controller unit C)
10 drives each (drive modules A and B)
5 drives each on channels 1 through 5 (controller unit D)
10 drives each (drive modules E and F); 5 drives on drive module G
5 drives each on channels 1 through 5 (controller unit H)
10 drives each (drive modules I and J); 5 drives on drive module G
All Bridge Disables = ON

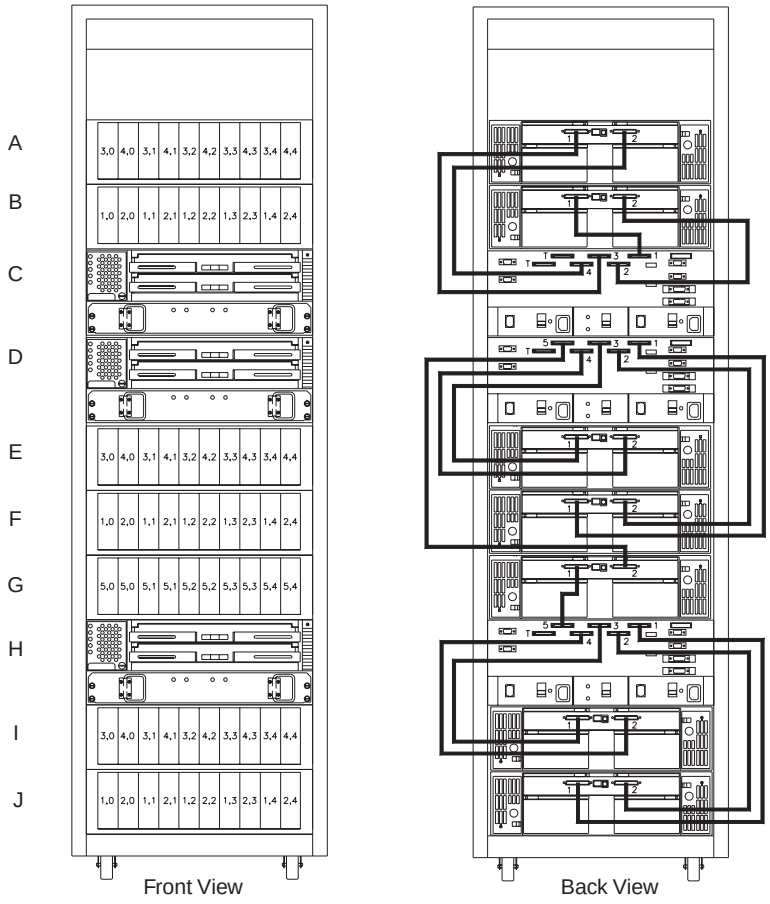


Figure 50. Triple Controller Unit Rackmount Cabling to Seven Drive Modules

Configuration:
3 controller units (D, E, and I)
8 drive modules (A, B, C, F, G, H, J, and K)
10 drives on channel 1 of controller unit D; 5 drives each on drive modules A and C
5 drives each on channels 2 through 5 (controller unit D, drive modules A, B, and C)
5 drives each on channels 1 through 5 (controller unit E, drive modules F, G, and H)
5 drives each on channels 1 through 5 (controller unit I, drive modules H, J, and K)
All Bridge Disables = ON

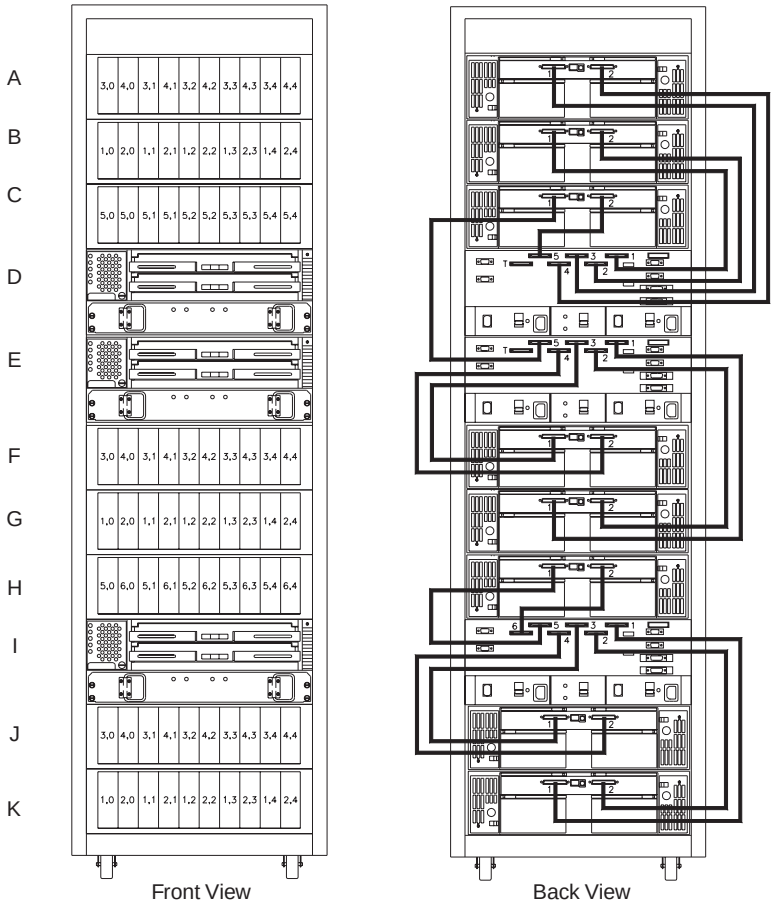


Figure 51. Triple Controller Unit Rackmount Cabling to Eight Drive Modules

Chapter 6. Troubleshooting Quick Reference

Controller and Interface Problems

Symptom: Controller LED (front) is on.

A Possible Cause: Controller CRU missing or unplugged.

1. Check the Power LEDs on both controller CRUs. If both Power LEDs are on, go to cause B. If one Power LED is off, make sure that the CRU is plugged in correctly and its handles are locked in place.
2. If the Power LED remains off or the Fault LED turns on, go to cause B.

B Possible Cause: Controller CRU failed.

1. Check the Fan LED on the front cover. If it is on, go to "Troubleshooting Controller Fan Problems" on page 29. If not, continue at the next step.
2. Replace the failed controller CRU using the instructions on page 20.
3. If the Fault LED remains on after replacing the controller, go to cause C.

C Possible Cause: One or more memory modules failed.

1. Call the IBM Support Center.

D Possible Cause: Controller backpanel failed.

1. Call the IBM Support Center.

Symptom: Software issued a controller error message.

A Possible Cause: Controller CRU failed.

1. Check the Fan LED on the front cover. If it is on, go to "Troubleshooting Controller Fan Problems" on page 29. If not, continue at the next step.
2. Replace the failed controller CRU using the instructions on page 20.

Symptom: Controller and Fan LEDs (front) are on.

A Possible Cause: Controller fan failure caused one or both controllers to overheat.

1 Stop all activity to the controller unit and turn off the power.

2 Replace the failed controller fan CRU using the instructions on page 31.

3 Allow the controller unit to cool down, then turn on the power.

4 Check both controller CRUs for fault LEDs. If a controller Fault LED turns on, then replace the failed controller CRU using the instructions on page 20.

Symptom: Power LEDs (front and power supply CRUs) are on, but all other Power LEDs are off.

A Possible Cause: Other CRUs are missing or not installed correctly.

1 Check all CRUs in the controller unit and make sure they are installed securely. If this does not fix the problem, go to cause B.

B Possible Cause: Defective DC power harness or power interface board.

1 Call a service technician for assistance.

C Possible Cause: Failed controller backpanel.

1 Call a service technician for assistance.

Symptom: Controller Fault LEDs (front and controller CRU) are on.

A Possible Cause: Controller is missing or not installed correctly.

1 Check the Power LEDs on both controller CRUs. If one is off, make sure that the CRU is locked securely in place.

2 If the controller CRUs Power LED remains off, a CRU Fault LED turns on, or both controllers look normal yet the Controller LED on the front cover remains on, go to cause B.

B Possible Cause: Controller failure.

1 Replace the failed controller using the instructions on page 20. If this does not fix the problem, go to cause C.

C Possible Cause: Memory module failure.

1 Call a service technician for assistance.

D Possible Cause: Failed controller backpanel.

1 Call a service technician for assistance.

Symptom: Software errors occur when attempting to access controllers or drives.

A Possible Cause: Software function or configuration problems.

1 Check the appropriate software and documentation to make sure the system is set up correctly or that the proper command was executed.

B Possible Cause: controller unit power switches or main circuit breakers in rackmount cabinet turned off.

1 Make sure that all power switches are turned on.

C Possible Cause: Loose, disconnected, or defective interface cables.

1 Check all the cables between the host, controller unit, drive modules, and other devices on the network. Make sure they are undamaged (particularly fiber optic cables) and securely attached.

D Possible Cause: Improper ID settings.

1 Make sure that the Fibre host IDs and SCSI drive IDs are set properly for all devices, particularly if you just removed or added a new device to the loop.

E Possible Cause: Failed controller or drive.

1 Check the controller unit for a controller fault. If the Controller LED on the front cover is turned on, replace the controller CRU using the instructions on page 20.

2 Check the drive module for a drive fault. If a failed drive is indicated, replace the drive using the instructions in the drive module documentation.

F Possible Cause: Failed controller backpanel.

1 Call a service technician for assistance.

Cooling Problems

Symptom: Fan LED (front) is on.

A Possible Cause: Power supply fan CRU is missing or unplugged.

1 Make sure the power supply fan CRU is plugged in correctly.

2 Check the LEDs on the power supply fan CRU. Power LED should be on, Fault LED should be off. If so, go to cause C. If the power LED is off or the Fault LED is on, go to cause B.

B Possible Cause: Power supply fan CRU failed.

1 Replace the power supply fan CRU using the instructions on page 31.

C Possible Cause: Controller fan CRU is missing or unplugged.

1 Make sure controller fan CRU is plugged in correctly.

2 If Power LED remains off, it indicates a failed controller fan CRU. Go to cause D.

D Possible Cause: Controller fan CRU failed.

1 Check the Fault LED on power supply fan CRU. If the Fault LED is off, replace the controller fan CRU using the instructions on page 31. If the Fault LED is on, replace the power supply fan CRU using the instructions on page 34.

E Possible Cause: Circuitry failed or Power LED burned out on controller fan CRU.

1 Replace the controller fan CRU using the instructions on page 31.

Symptom: Controller and Fan LEDs (front) are on.

A Possible Cause: Both a controller and the controller fan failed.

1 Check both controller CRUs for fault LEDs, then replace the failed controller CRU using the instructions on page 20.

2 After replacing the failed controller, check the LEDs on the front cover. If the Fan LED is still on, replace the controller fan CRU using the instructions on page 31.

B Possible Cause: Controller fan failure caused one or both controllers to overheat.

1 Stop all activity to the controller unit and turn off the power.

2 Replace the controller fan CRU using the instructions on page 31.

3 Allow the controller unit to cool down, then turn on the power.

4 Check both controller CRUs for fault LEDs. If either Fault LED is on, replace the controller fan CRU using the instructions on page 20.

Power Problems

Symptom: Fault-A or Fault-B LED (battery CRU) is on.

A Possible Cause: Left or right battery bank has failed.

1 Replace the battery CRU using the instructions on page 43.

Symptom: Full Charge-A or Full-Charge-B LED (battery CRU) is off.

A Possible Cause: Left or right battery bank is not yet fully charged.

1 Turn on the power and allow controller unit to run 24 hours in order to recharge the battery.

2 If after 24 hours, the Full Charge LED remains off or one of the Fault LEDs turns on, replace the battery CRU using the instructions on page 43.

Symptom: “Battery Low” error was issued by software.

A Possible Cause: Power turned off for extended period and drained battery power.

1 Turn on the power and allow controller unit to run 24 hours to recharge the batteries.

2 If after 24 hours, the battery low error persists, replace the battery CRU using the instructions on page 43.

B Possible Cause: Batteries are weak and CRU is due for replacement.

1 Check the last service date for the battery CRU. If it has been three years since the battery was replaced, replace the battery CRU using the instructions on page 43**.**

Symptom: Battery CRU is new, but will not hold a charge.

A Possible Cause: Battery charger board failure.

1 Replace the battery CRU using the instructions on page 43.

2 If this does not solve the problem, go to cause B.

B Possible Cause: Faulty battery harness.

1 Replace both power supplies using the instructions on page 43.

2 Allow the system to run for at least 24 hours in order to properly charge the batteries. If this does not solve the problem, call a service technician for assistance.

Symptom: Loss of battery backup during a power outage.

A Possible Cause: Battery failure or battery CRU is missing.

1 Replace the battery CRU using the instructions on page 43.

Symptom: No power to the controller unit (all Power LEDs off).

A Possible Cause: Power switches turned off.

1 Turn on both power switches on the controller unit.

2 Turn on the main circuit breakers in the rackmount cabinet, if applicable.

B Possible Cause: Power cords unplugged.

1 Check to make sure all power cords are plugged in securely.

C Possible Cause: Power supplies overheated or failed.

1 Wait 10 minutes. If the power supplies turn on automatically, use the recovery procedure on page 49. If not, go to step 2.

2 Go to page 50 and replace the power supplies.

Symptom: One power supply LED (CRU) is on and the other is off.

A Possible Cause: Power supply is turned off or unplugged.

1 Plug in the power cord and turn on the power switch. If the LED remains off, go to cause B.

B Possible Cause: Power supply is overheated or failed.

1 Wait 10 minutes. If the power supply turns on automatically, use the recovery procedure on page 49. If not, go to step 2.

2 Replace the power supply CRU using the instructions on page 50.

Symptom: Power Supply LED (front) is on.

A Possible Cause: Power supply is missing or not plugged in properly.

1 Insert and lock the power supply into place. If the fault LED is still on, go to cause B.

B Possible Cause: Power supply is overheated or failed.

1 Wait 10 minutes. If the power supply turns on automatically, use the recovery procedure on page 49. If not, go to step 2.

2 Replace the power supply CRU using the instructions on page 50.

Symptom: Power is on and working in the rackmount cabinet, but the controller unit has no power.

A Possible Cause: controller unit is unplugged or turned off.

1 Plug in both power cords and turn on both power switches (see page 4). If this does not resolve the problem, go to cause B.

B Possible Cause: Power supply failure.

1 Check the power supply LED on the front cover. If it is on, go to the next step. If not go to cause C.

2 Look at the LEDs on both power supply CRUs. If a Fault LED is on, replace the failed power supply using the instructions on page 50. If both are off, go to the next symptom.

Symptom: The power supply CRUs LEDs are on, but all the other CRU LEDs are off.

A Possible Cause: Defective DC power harness.

1 Call a service technician for assistance.

B Possible Cause: Defective power interface board.

1 Call a service technician for assistance.

Chapter 7. Getting Help, Service, and Information

If you need help, service, technical assistance, or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you.

For example, IBM maintains pages on the World Wide Web where you can get information about IBM products and services, find the latest technical information, and download device drivers and updates. Some of these pages are:

http://www.ibm.com	Main IBM home page
http://www.pc.ibm.com	IBM Personal Computing
http://www.pc.ibm.com/support	IBM Personal Computing Support
http://www.pc.ibm.com/us/desktop/	IBM Commercial Desktop (U.S.)
http://www.pc.ibm.com/us/intellistation/	IBM IntelliStation (U.S.)
http://www.pc.ibm.com/us/netfinity/	IBM Netfinity and PC Servers (U.S.)
http://www.pc.ibm.com/us/options/	IBM Options (U.S.)

You can select a country-specific Web site from these pages.

Help is also available from bulletin boards and online services, as well as by fax and telephone. This section provides information about these sources.

Services available and telephone numbers listed are subject to change without notice.

Service Support

With the original purchase of an IBM hardware product, you have access to extensive support coverage. During the IBM hardware product warranty period, you may call the IBM Personal Computer HelpCenter (1-800-772-2227 in the U.S.) for hardware product assistance covered under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:

- Problem Determination - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.

- IBM Hardware Repair - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service.
- Engineering Change Management - Occasionally, there might be changes that are required after a product has been sold. IBM or your reseller, if authorized by IBM, will make Engineering Changes (ECs) available that apply to your hardware.

Be sure to retain your proof of purchase to obtain warranty service.

Please have the following information ready when you call:

- Machine Type and Model
- Serial numbers of your IBM hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

If possible, be at your computer when you call.

The following items are not covered:

- Replacement or use of non-IBM parts or nonwarranted IBM parts
- All warranted parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources
- Configuration of BIOS as part of an installation or upgrade
- Changes, modifications, or upgrades to device drivers
- Installation and maintenance of network operating systems (NOS)
- Installation and maintenance of application programs

Refer to the IBM Statement of Limited Warranty for a full explanation of IBM's warranty terms.

Before You Call for Service

Many computer problems can be solved without outside assistance, by using the online help or by looking in the online or printed documentation that comes with your computer or software. Also, be sure to read the information in any README files that come with your software.

Most computers, operating systems, and application programs come with documentation that contains troubleshooting procedures and explanations of error messages. The documentation that comes with your computer also contains information about the diagnostic tests you can perform.

If you receive a POST error code when you turn on your computer, refer to the POST error-message charts in your hardware documentation. If you do not receive a POST error code, but suspect a hardware problem, refer to the troubleshooting information in your hardware documentation or run the diagnostic tests.

If you suspect a software problem, consult the documentation (including README files) for the operating system or application program.

Getting Customer Support and Service

Purchasing an IBM PC hardware product entitles you to standard help and support during the warranty period. If you need additional support and services, a wide variety of extended services are available for purchase that address almost any need.

Using Electronic Support Services

If you have a modem, you can get help from several popular services. Bulletin boards and online information services provide assistance through question-and-answer message areas, live chat rooms, searchable databases, and more.

Technical information is available on a wide range of topics, such as:

- Hardware setup and configuration
- Preinstalled software
- OS/2, DOS, and Windows
- Networking
- Communications
- Multimedia

In addition, the latest device driver updates are available.

The IBM Bulletin Board System (BBS) can be reached 24 hours a day, 7 days a week. Modem speeds of up to 14,400 baud are supported. Long distance telephone charges might apply. To access the IBM BBS:

- In the U.S., call 1-919-517-0001.
- In Canada:

–In Montreal, call 514-938-3022.
–In Toronto, call 905-316-4255 or 416-956-7877.
–In Vancouver, call 604-664-6464.

- In the U.K., call 01256 336655.

Commercial online services that contain information about IBM products include:

- CompuServe

  Use the following GO words: APTIVA, IBMPS2, ThinkPad, PowerPC, ValuePoint, IBMSVR, or IBMOBI.

- PRODIGY

  Use the Jump command; type **IBM** and select **PC Product Support**.

- America Online

  Use the “Go to” keyword **IBM Connect**.

Using the World Wide Web

On the World Wide Web, the IBM Personal Computing Web site has up-to-date information about IBM Personal Computer products and support. The address for the IBM Personal Computing home page is:

http://www.pc.ibm.com

You can find support information for your IBM products, including supported options, on the IBM Personal Computing Support page at:

http://www.pc.ibm.com/support

If you select Profile from the support page, you can create a customized support page that is specific to your hardware, complete with Frequently Asked Questions, Parts Information, Technical Hints and Tips, and Downloadable Files. You will have the information you need, all in one place.

In addition, you can choose to receive e-mail notifications whenever new information becomes available about your registered products. You also can access online support forums, which are community sites monitored by IBM support staff.

For information about specific Personal Computer products, visit the following pages:

http://www.pc.ibm.com/us/intellistation/

http://www.pc.ibm.com/us/desktop/

http://www.pc.ibm.com/us/netfinity/

http://www.pc.ibm.com/us/thinkpad/

http://www.pc.ibm.com/us/options/

http://www.pc.ibm.com/us/aptiva/

You can select a country-specific Web site from these pages.

Getting Information by Fax

If you have a touch-tone telephone and access to a fax machine, in the U.S. and Canada you can receive by fax marketing and technical information on many topics, including hardware, operating systems, and local area networks (LANs). You can call the IBM Automated Fax System 24 hours a day, 7 days a week. Follow the recorded instructions, and the requested information will be sent to your fax machine.

To access the IBM Automated Fax System, do the following:

- In the U.S., call 1-800-426-3395.
- In Canada, call 1-800-465-3299.

Getting Help Online

Online Housecall is a remote communication tool that allows an IBM technical-support representative to access your PC by modem. Many problems can be remotely diagnosed and corrected quickly and easily. In addition to a modem, a remote-access application program is required. This service is not available for servers. There might be a charge for this service, depending on the request.

For more information about configuring your PC for Online Housecall:

- In the U.S., call 1-800-772-2227.
- In Canada, call 1-800-565-3344.
- In all other countries, contact your IBM reseller or IBM marketing representative.

Getting Help by Telephone

During the warranty period, you can get help and information by telephone through the IBM PC HelpCenter. Expert technical-support representatives are available to assist you with questions you might have on the following:

- Setting up your computer and IBM monitor

- Installing and setting up IBM options purchased from IBM or an IBM reseller
- 30-day, preinstalled-operating-system support
- Arranging for service (on-site or carry-in)
- Arranging for overnight shipment of customer-replaceable parts

In addition, if you purchased an IBM PC Server or IBM Netfinity Server, you are eligible for IBM Start Up Support for 90 days after installation. This service provides assistance for:

- Setting up your network operating system
- Installing and configuring interface cards
- Installing and configuring network adapters

Please have the following information ready when you call:

- Machine Type and Model
- Serial numbers of your computer, monitor, and other components, or your proof of purchase
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information for your system

If possible, be at your computer when you call.

In the U.S. and Canada, these services are available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9:00 a.m. to 6:00 p.m.[1]

Country	Telephone number
Austria	1-546 585 075
Belgium - Dutch	02-717-2504
Belgium - French	02-717-2503
Canada	1-800-565-3344
Denmark	3-525-6905

1. Response time will vary depending on the number and complexity of incoming calls

Finland	9-22-931805
France	01-69-32-40-03
Germany	069-6654-9003
Ireland	01-815-9207
Italy	02-4827-5003
Luxembourg	298-977-5060
Netherlands	020-504-0531
Norway	2-305-3203
Portugal	01-791-5147
Spain	091-662-4270
Sweden	08-632-0063
Switzerland - German	01-212-1810
Switzerland - French	022-310-0418
Switzerland - Italian	091-971-0523
United Kingdom	01475-555555
U.S.A. and Puerto Rico	1-800-772-2227

In all other countries, contact your IBM reseller or IBM marketing representative.

Getting Help Around the World

If you travel with your computer or need to move it to another country, you can register for International Warranty Service. When you register with the International Warranty Service Office, you will receive an International Warranty Service Certificate that is honored virtually worldwide, wherever IBM or IBM resellers sell and service IBM PC products.

For more information or to register for International Warranty Service:

- In the U.S. or Canada, call 1-800-497-7426.
- In Europe, call 44-1475-893638 (Greenock, U.K.).
- In Australia and New Zealand, call 61-2-9354-4171.

In all other countries, contact your IBM reseller or IBM marketing representative.

Purchasing Additional Services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and name might vary by country.

Enhanced PC Support Line

Enhanced PC Support is available for desktop and mobile IBM computers that are not connected to a network. Technical support is provided for IBM computers and IBM or non-IBM options, operating systems, and application programs on the Supported Products list.

This service includes technical support for:

- Installing and configuring your out-of-warranty IBM computer
- Installing and configuring non-IBM options in IBM computers
- Using IBM operating systems in IBM and non-IBM computers
- Using application programs and games
- Tuning performance
- Installing device drivers remotely
- Setting up and using multimedia devices
- Identifying system problems
- Interpreting documentation

You can purchase this service on a per-call basis, as a multiple-incident package, or as an annual contract with a 10-incident limit. For more information about purchasing Enhanced PC Support, see "900-Number Operating System and Hardware Support."

900-Number Operating System and Hardware Support

In the U.S., if you prefer to obtain technical support on a pay-as-you go basis, you can use the 900-number support line. The 900-number support line provides support for IBM PC products that are out of the warranty period.

To access this support, call 1-900-555-CLUB (2582). You will be notified of the charge per minute.

Network and Server Support Line

Network and Server Support is available for simple or complex networks made up of IBM servers and workstations using major network operating systems. In addition, many popular non-IBM adapters and network interface cards are supported.

This service includes all of the features of the Enhanced PC Support Line, plus:

- Installing and configuring client workstations and servers
- Identifying system problems and correcting problems on the client or the server
- Using IBM and non-IBM network operating systems
- Interpreting documentation

You can purchase this service on a per-call basis, as a multiple-incident package, or as an annual contract with a 10-incident limit.

Ordering Support Line Services

Enhanced PC Support Line and Network and Server Support Line services are available for products on the Supported Products list. To receive a Supported Products list:

In the U.S.:

1. Call 1-800-426-3395.
2. Select document number 11683 for Network and Server support.
3. Select document number 11682 for Enhanced PC support.

In Canada, contact IBM Direct at 1-800-465-7999, or:

1. Call 1-800-465-3299.
2. Select the HelpWare catalog.
3. In all other countries, contact your IBM reseller or IBM marketing representative.

For more information or to purchase these services:

- In the U.S., call 1-800-772-2227.
- In Canada, call 1-800-465-7999.
- In all other countries, contact your HelpCenter.

Warranty and Repair Services

You can upgrade your standard hardware warranty service or extend the service beyond the warranty period.

Warranty upgrades in the U.S. include:

- Carry-in service to on-site service

  If your warranty provides carry-in repair service, you can upgrade to on-site repair service, either standard or premium. The standard upgrade provides a trained servicer within the next business day (9 a.m. to 5 p.m., local time, Monday though Friday). The premium upgrade provides 4-hour average response, 24 hours a day, 7 days a week.

- On-site service to premium on-site service

  If your warranty provides for on-site service, you can upgrade to premium on-site service (4-hour average on-site response, 24 hours a day, 7 days a week).

You also can extend your warranty. Warranty and Repair Services offers a variety of post-warranty maintenance options, including ThinkPad EasyServ Maintenance Agreements. Availability of the services varies by product.

For more information about warranty upgrades and extensions:

- In the U.S., call 1-800-426-4968.
- In Canada, call 1-800-465-7999.
- In all other countries, contact your IBM reseller or IBM marketing representative.

Ordering Publications

Additional publications are available for purchase from IBM. For a list of publications available in your country:

- In the U.S., Canada, and Puerto Rico, call 1-800-879-2755.
- In other countries, contact your IBM reseller or IBM marketing representative.

Appendix A. Product Warranties and Notices

Warranty Statements

The warranty statements consist of two parts: Part 1 and Part 2. Part 1 varies by country. Part 2 is the same for both statements. Be sure to read both the Part 1 that applies to your country and Part 2.

- **United States, Puerto Rico, and Canada (Z125-4753-05 11/97)**
  (Part 1 - General Terms on page 105)
- **Worldwide except Canada, Puerto Rico, Turkey, and United States (Z125-5697-01 11/97)**
  (Part 1 - General Terms on page 105)
- **Worldwide Country-Unique Terms**
  (Part 2 - Country-Unique Terms on page 105)

IBM Statement of Limited Warranty for United States, Puerto Rico, and Canada (Part 1 - General Terms)

*This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms.**The terms of Part 2 may replace or modify those of Part 1.**The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller.The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether preloaded with the Machine, installed subsequently or otherwise.Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Warranty affects any statutory rights of consumers that cannot be waived or limited by contract.If you have any questions, contact IBM or your reseller.*

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Machine: Netfinity Fibre Channel Controller

Warranty Period*: Limited Three-Year On-Site Service

**Contact your place of purchase for warranty service information. Some IBM Machines are eligible for On-site warranty service depending on the country where service is performed.*

The IBM Warranty for Machines
IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications. The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period IBM or your reseller, if approved by IBM to provide warranty service, will provide repair and exchange service for the Machine, without charge, under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded. The replacement may not be new, but will be in good working order.

Extent of Warranty

The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

Unless specified otherwise, IBM provides non-IBM machines **WITHOUT WARRANTIES OF ANY KIND.**

Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service

To obtain warranty service for the Machine, contact your reseller or IBM. In the United States, call IBM at 1-800-772-2227. In Canada, call IBM at 1-800-565-3344. You may be required to present proof of purchase.

IBM or your reseller provides certain types of repair and exchange service, either at your location or at a service center, to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. IBM may repair the failing Machine or exchange it at its discretion.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item.

Any feature, conversion, or upgrade IBM or your reseller services must be installed on a Machine which is 1) for certain Machines, the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;

2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and

3. where applicable, before service is provided

   a follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides,

   b secure all programs, data, and funds contained in a Machine,

   c provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations, and

   d inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary, or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Production Status

Each IBM Machine is manufactured from new parts, or new and used parts. In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's appropriate warranty terms apply.

Limitation of Liability

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and

2. the amount of any other actual direct damages, up to the greater of U.S. $100,000 (or equivalent in local currency) or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

   This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS OR SAVINGS), EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

IBM Statement of Warranty Worldwide except Canada, Puerto Rico, Turkey, United States (Part 1 - General Terms)

*This Statement of Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms.**The terms of Part 2 may replace or modify those of Part 1.** The warranties provided by IBM in this Statement of Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller.The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or*

otherwise.Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine.Nothing in this Statement of Warranty affects any statutory rights of consumers that cannot be waived or limited by contract.If you have any questions, contact IBM or your reseller.

Machine: Netfinity Fibre Channel Controller

Warranty Period*: Limited Three-Year On-Site Service

**Contact your place of purchase for warranty service information. Some IBM Machines are eligible for On-site warranty service depending on the country where service is performed.*

The IBM Warranty for Machines
IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications. The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period IBM or your reseller, if approved by IBM to provide warranty service, will provide repair and exchange service for the Machine, without charge, under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded. The replacement may not be new, but will be in good working order.

Extent of Warranty

The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

Unless specified otherwise, IBM provides non-IBM machines **WITHOUT WARRANTIES OF ANY KIND.**

Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service

To obtain warranty service for the Machine, contact your reseller or IBM. You may be required to present proof of purchase.

IBM or your reseller provides certain types of repair and exchange service, either at your location or at a service centre, to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. IBM may repair the failing Machine or exchange it at its discretion.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item.

Any feature, conversion, or upgrade IBM or your reseller services must be installed on a Machine which is 1) for certain Machines, the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;

2. obtain authorisation from the owner to have IBM or your reseller service a Machine that you do not own; and

3. where applicable, before service is provided

   a follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides,

   b secure all programs, data, and funds contained in a Machine,

   c provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfil their obligations, and

   d inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary, or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Production Status

Each IBM Machine is manufactured from new parts, or new and used parts. In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's appropriate warranty terms apply.

Limitation of Liability

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and

2. the amount of any other actual direct damages, up to the greater of U.S. $100,000 (or equivalent in local currency) or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS OR SAVINGS), EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR

POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Part 2 - Worldwide Country-Unique Terms

ASIA PACIFIC

AUSTRALIA: The IBM Warranty for Machines: The following paragraph is added to this Section:

The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other legislation and are only limited to the extent permitted by the applicable legislation.

Extent of Warranty: The following replaces the first and second sentences of this Section:

The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, operation in other than the Specified Operating Environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible.

Limitation of Liability: The following is added to this Section:

Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

PEOPLE'S REPUBLIC OF CHINA: Governing Law: The following is added to this Statement:

The laws of the State of New York govern this Statement.

INDIA: Limitation of Liability: The following replaces items 1 and 2 of this Section:

1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;

2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

NEW ZEALAND: The IBM Warranty for Machines: The following paragraph is added to this Section:

The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: The following is added to this Section:

Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

The following terms apply to all EMEA countries.

The terms of this Statement of Warranty apply to Machines purchased from an IBM reseller. If you purchased this Machine from IBM, the terms and conditions of the applicable IBM agreement prevail over this warranty statement.

Warranty Service

If you purchased an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchased an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirgihzia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

The applicable laws, Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided. However, the laws of Austria govern this Statement if the warranty service is provided in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria Croatia, Czech Republic, Federal Republic of Yugoslavia, Georgia, Hungary, Kazakhstan, Kirghizia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, and Ukraine.

The following terms apply to the country specified.

EGYPT: Limitation of Liability: The following replaces item 2 in this Section:

2. as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim.

Applicability of suppliers and resellers (unchanged).

FRANCE: Limitation of Liability: The following replaces the second sentence of the first paragraph of this Section:

In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: (items 1 and 2 unchanged).

GERMANY: The IBM Warranty for Machines: The following replaces the first sentence of the first paragraph of this Section:

The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this Section:

The minimum warranty period for Machines is six months.

In case IBM or your reseller are unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: The second paragraph does not apply.

Warranty Service: The following is added to this Section:

During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Production Status: The following paragraph replaces this Section:

Each Machine is newly manufactured. It may incorporate in addition to new parts, re-used parts as well.

Limitation of Liability: The following is added to this Section:

The limitations and exclusions specified in the Statement of Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

In item 2, replace "U.S. $100,000" with "1.000.000 DEM."

The following sentence is added to the end of the first paragraph of item 2:

IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

IRELAND: Extent of Warranty: The following is added to this Section:

Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: The following replaces items one and two of the first paragraph of this Section:

1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and 2. the amount of any other actual direct damages, up to the greater of Irish Pounds 75,000 or 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section:

IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY: Limitation of Liability: The following replaces the second sentence in the first paragraph:

In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than: (item 1 unchanged) 2) as to any other actual damage arising in all situations involving non-performance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim.

Applicability of suppliers and resellers (unchanged).

The following replaces the second paragraph of this Section:

Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: (items 1 and 2 unchanged) 3) indirect damages, even if IBM or your reseller is informed of their possibility.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND: Limitation of Liability: The following is added to this Section:

IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.

TURKIYE: Production Status: The following replaces this Section:

IBM fulfils customer orders for IBM Machines as newly manufactured in accordance with IBM's production standards.

UNITED KINGDOM: Limitation of Liability: The following replaces items 1 and 2 of the first paragraph of this Section:

1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;

2. the amount of any other actual direct damages or loss, up to the greater of Pounds Sterling 150,000 or 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

The following item is added to this paragraph:

3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

Applicability of suppliers and resellers (unchanged).

The following is added to the end of this Section:

IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default will be limited to damages.

NORTH AMERICA

CANADA: Warranty Service: The following is added to this Section:

To obtain warranty service from IBM, call 1-800-465-6666.

UNITED STATES OF AMERICA: Warranty Service: The following is added to this Section:

To obtain warranty service from IBM, call 1-800-IBM-SERV.

Notices

References in this publication to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Subject to IBM's valid intellectual property or other legally protectable rights, any functionally equivalent product, program, or service may be used instead of the IBM product, program, or service. The evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM, are the responsibility of the user.

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Trademarks

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IntelliStation
HelpCenter
OS/2
ThinkPad
HelpWare

Microsoft is a trademark of Microsoft Corporation.

Intel is a registered trademark of Intel.

Other company, product, and service names may be trademarks or service marks of others.

Electronic Emissions Notices

Note: The IBM Netfinity Fibre Channel RAID Controller Unit has been tested and found to comply with the Industry Canada and FCC *Class B* requirements. The IBM Netfinity servers in which you can install the Fibre Channel RAID Controller Unit comply with Industry Canada and FCC *Class A* requirements. When you install the Fibre Channel RAID Controller Unit in an IBM Netfinity server, the adapter complies with the Industry Canada and FCC *Class A* requirements.

Federal Communications Commission (FCC) Statement

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

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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.

Industry Canada Class A Emission Compliance Statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

United Kingdom Telecommunications Safety Requirements

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

European Community Directive Conformance Statement

This product is in conformity with the protection requirements of EC Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electro-magnetic compatibility.

A declaration of Conformity with the requirements of the Directive has been signed by IBM Corporation, 3039 Cornwallis Road, Research Triangle Park, North Carolina, 27709.

Attention: 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.

Australia and New Zealand Class A Statement

Attention: 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.

Taiwanese Electromagnetic Interference (EMI) Statement

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。

Glossary

battery CRU – a removable unit that contains batteries and battery charger circuitry.

connector plate – a protective panel that contains access holes for interface connectors and jumpers.

controller backpanel - a circuit board that provides interface and power connections between the components inside the chassis (controllers, power interface board, and fans), as well as to LVD-SCSI drives and to devices on the Fibre Channel loop.

controller CRU – a removable unit that contains an array controller.

controller fan CRU – a removable unit that contains two cooling fans.

controller slot - an opening on the front of the controller unit that holds a controller CRU.

controller slot letter - identifies the physical location of the controllers in the controller unit chassis.

cooling system - components, including controller fans, power supply fans, and air vents, that aid in air circulation and cooling within the controller unit's chassis.

CRU – (pronounced "crews") Customer Replaceable Unit. Removable, portable canisters that house controllers, batteries, power supplies and fans.

DIMM - (dual-inline memory module)

Fibre Host ID - numbers that identify each controller to the host or other devices on the Fibre Channel loop.

front cover – a removable panel with holes for viewing the status lights and for boosting air circulation.

hot swapping - a feature that allows you to replace a component while the controller unit is powered-up and running.

LEDs – (light emitting diodes), green or amber lights that glow or blink to indicate either a normal operating status or hardware error.

LVD-SCSI - (low voltage differential, small computer system interface)

MIA - (media interface adapter) a device that allows you to connect fiber optic cable to a copper wire connector.

power supply assembly – a modular structure inside the chassis consisting of the power interface board and slots for holding the power supply and power supply fan CRUs.

power supply CRU – a removable unit containing a power supplies.

power supply fan CRU – a removable unit containing fans for cooling the power supplies.

power system - components, including batteries, power supplies, power harnesses and cords, and a power interface board, that supply electricity to the controller unit and its components.

RAID - redundant array of independent disks.

redundant pair - two controllers attached to the same host.

SIMM - (single-inline memory module)

support rails - hardware used to mount a controller unit chassis into a rackmount cabinet.

UPS - (uninterruptible power supply)

VHDCI (very high density cable interface)

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