

IBM TotalStorage DS4300
Fibre Channel Storage Server



Installation and User's Guide

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Fibre Channel Storage Server



Installation and User's Guide

Note: Before using this information and the product it supports, be sure to read the safety information in “Safety” on page iii and general information in “Notices” on page 109.

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Safety

Before installing this product, read the Safety information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 **Safety Information** (安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

The following Caution notices are printed in English throughout this document. For translations of these notices, refer to *IBM Safety Information*.

Statement 3



CAUTION:

When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.



Danger

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

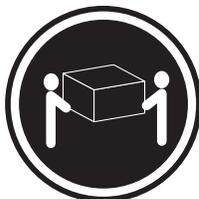
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Class 1 laser statement

Class 1 Laser Product
Laser Klasse 1
Laser Klass 1
Luokan 1 Laserlaite
Appareil À Laser de Classe 1

IEC 825-1:1993 CENELEC EN 60 825

Statement 4



≥18 kg (37 lbs)



≥32 kg (70.5 lbs)



≥55 kg (121.2 lbs)

CAUTION:

Use safe practices when lifting.

Statement 5



CAUTION:

The power control button on the device and the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 8:



CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

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About this document

This guide provides instructions on how to install and configure the IBM® TotalStorage® DS4300 Fibre Channel Storage Server.

FAST product renaming

IBM is in the process of renaming some FAST family products. Table 1 identifies each new DS4000 product name with its corresponding FAST product name. Note that this change of **product name only** indicates no change in functionality or warranty. All products listed below with new names are functionally-equivalent and fully-interoperable. Each DS4000 product retains full IBM service as outlined in service contracts issued for analogous FAST products.

Table 1. Mapping of FAST names to DS4000 Series names

Current FAST Product Name	New DS4000 Product Name
IBM TotalStorage FAST Storage Server	IBM TotalStorage DS4000
FAST	DS4000
FAST Family	DS4000 Mid-range Disk System
FAST Storage Manager vX.Y (for example v9.10)	DS4000 Storage Manager vX.Y (for example v9.10)
FAST100	DS4100
FAST600	DS4300
FAST600 with Turbo Feature	DS4300 Turbo
FAST700	DS4400
FAST900	DS4500
EXP700	DS4000 EXP700
EXP710	DS4000 EXP710
EXP100	DS4000 EXP100
FAST FlashCopy	FlashCopy for DS4000
FAST VolumeCopy	VolumeCopy for DS4000
FAST Remote Mirror (RM)	Enhanced Remote Mirroring for DS4000
FAST Synchronous Mirroring	Metro Mirroring for DS4000
	Global Copy for DS4000 (New Feature = Asynchronous Mirroring without Consistency Group)
	Global Mirroring for DS4000 (New Feature = Asynchronous Mirroring with Consistency Group)

Who should read this document

This document is intended for system operators and service technicians who have extensive knowledge of Fibre Channel and network technology.

How this document is organized

Chapter 1, “Introduction,” on page 1 describes the storage server. This chapter includes an overview of the storage server features and components.

Chapter 2, “Installing and configuring the storage server,” on page 15 contains information about installing the storage subsystem configuration and gives Fibre Channel loop configuration examples.

Chapter 3, “Cabling the storage server,” on page 33 contains information about cabling the storage server to other devices.

Chapter 4, “Operating the storage server,” on page 45 describes the tasks that are required to operate the storage server, including the proper sequences for powering the storage subsystem on and off.

Chapter 5, “Installing and replacing components,” on page 59 contains step-by-step instructions for installing and removing the storage server components.

Chapter 6, “Solving problems,” on page 99 contains storage server problem symptoms and possible solutions.

Appendix A, “Records,” on page 105 provides a form on which you can record and update important information about the storage server, including serial number and device records. When you add components to the storage server, be sure to update the information in this appendix.

Appendix B, “Accessibility,” on page 107 provides information about DS4000 Storage Manager accessibility features, which help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

DS4000 installation process overview

The following flow chart gives an overview of the DS4000 hardware and the DS4000 Storage Manager software installation process. Lined arrows in the flow chart indicate consecutive steps in the hardware and software installation process. Labeled arrows indicate which current documents provide detailed information about those steps.

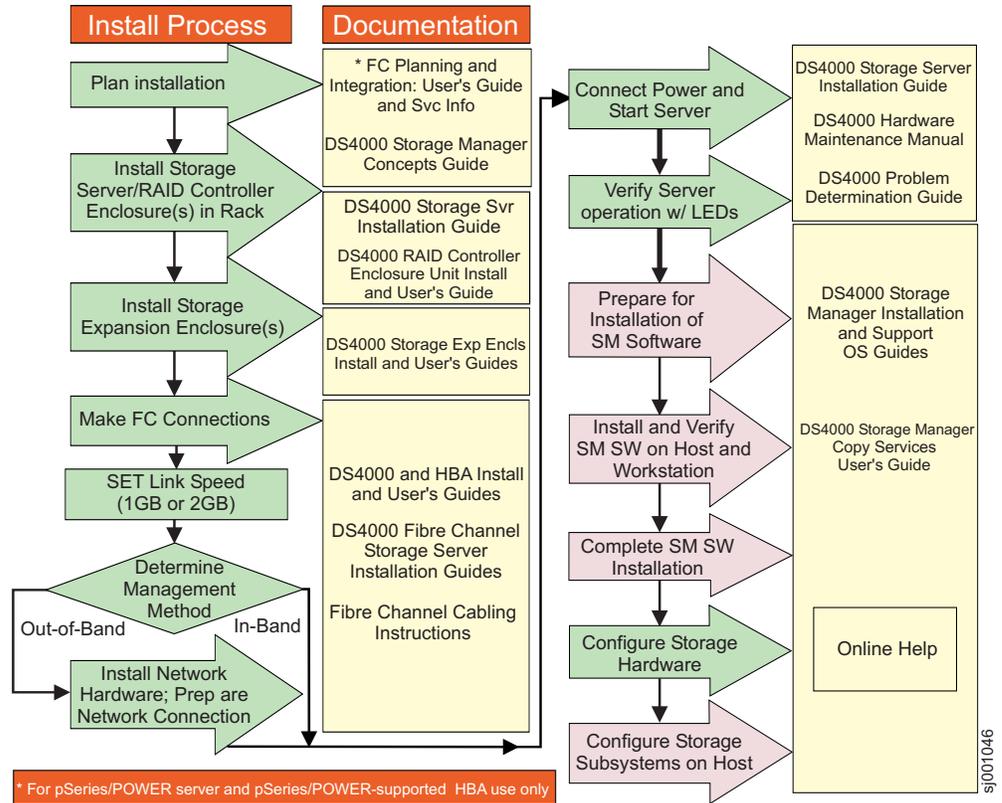


Figure 1. Installation process flow by current publications

DS4000 Storage Server publications

The following tables present an overview of the DS4500, DS4400, DS4300 Fibre Channel, and DS4100 SATA Storage Server product libraries, as well as other related documents. Each table lists documents that are included in the libraries and what common tasks they address.

You can access the documents listed in these tables at one of the following Web sites:

www.ibm.com/servers/storage/support/disk/

www.ibm.com/shop/publications/order/

DS4500 storage server library

Table 2 on page xviii associates each document in the DS4500 (previously FAST900) storage server library with its related common user tasks.

Table 2. TotalStorage DS4500 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
<i>IBM TotalStorage DS4500 Installation and Support Guide, GC26-7727</i>	✓	✓		✓		
<i>IBM TotalStorage DS4500 Fibre Channel Cabling Instructions, GC26-7729</i>	✓	✓				
<i>IBM TotalStorage DS4500 Storage Server User's Guide, GC26-7726</i>				✓	✓	✓
<i>IBM TotalStorage DS4500 Rack Mounting Instructions, GC26-7728</i>	✓	✓				

DS4400 storage server library

Table 3 associates each document in the DS4400 (previously FAStT700) storage server library with its related common user tasks.

Table 3. TotalStorage DS4400 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
<i>IBM DS4400 Fibre Channel Storage Server User's Guide, GC26-7730</i>	✓	✓		✓	✓	✓
<i>IBM DS4400 Fibre Channel Storage Server Installation and Support Guide, GC26-7731</i>	✓	✓		✓	✓	
<i>IBM DS4400 Fibre Channel Cabling Instructions, GC26-7732</i>	✓	✓				

DS4300 storage server library

Table 4 associates each document in the DS4300 (previously FAStT600) storage server library with its related common user tasks.

Table 4. TotalStorage DS4300 Fibre Channel Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
<i>IBM TotalStorage DS4300 Fibre Channel Storage Server Installation and User's Guide, GC26-7722</i>	✓	✓		✓		
<i>IBM TotalStorage DS4300 Rack Mounting Instructions, GC26-7724</i>	✓	✓				
<i>IBM TotalStorage DS4300 Fibre Channel Cabling Instructions, GC26-7725</i>	✓	✓				
<i>IBM TotalStorage DS4300 SCU Base Upgrade Kit, GC26-7740</i>		✓	✓			
<i>IBM TotalStorage DS4300 SCU Turbo Upgrade Kit, GC26-7741</i>		✓	✓			
<i>IBM TotalStorage DS4300 Turbo Models 6LU/6LX Upgrade Kit, GC26-7723</i>		✓	✓			

DS4100 storage server library

Table 5 associates each document in the DS4100 (previously FAStT100) storage server library with its related common user tasks.

Table 5. TotalStorage DS4100 SATA Storage Server document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
<i>IBM TotalStorage DS4100 Installation, User's and Maintenance Guide, GC26-7733</i>	✓	✓		✓	✓	✓
<i>IBM TotalStorage DS4100 Cabling Guide, 24P8973</i>		✓				

DS4000 Storage Manager Version 9 publications

Table 6 associates each document in the DS4000 Storage Manager (previously FAST Storage Manager) library with its related common user tasks.

Table 6. TotalStorage DS4000 Storage Manager Version 9 titles by user tasks

Title	User tasks					
	Planning	Hardware installation	Software installation	Configuration	Operation and administration	Diagnosis and maintenance
<i>IBM TotalStorage DS4000 Storage Manager Version 9 Installation and Support Guide for Windows 2000/Server 2003, NetWare, ESX Server, and Linux, GC26-7706</i>	✓		✓	✓		
<i>IBM TotalStorage DS4000 Storage Manager Version 9 Installation and Support Guide for AIX, UNIX, Solaris and Linux on POWER, GC26-7705</i>	✓		✓	✓		
<i>IBM TotalStorage DS4000 Storage Manager Version 9 Copy Services User's Guide, GC26-7707</i>	✓		✓	✓	✓	
<i>IBM TotalStorage DS4000 Storage Manager Version 9 Concepts Guide, GC26-7734</i>	✓	✓	✓	✓	✓	✓

Other DS4000 and DS4000-related documents

Table 7 associates each of the following documents with its related common user tasks.

Table 7. TotalStorage DS4000 and DS4000–related document titles by user tasks

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
<i>IBM Safety Information, P48P9741</i>					✓	
<i>IBM TotalStorage DS4000 Quick Start Guide, GC26-7738</i>	✓	✓				
<i>IBM TotalStorage DS4000 Hardware Maintenance Manual,GC26-7702</i>						✓
<i>IBM TotalStorage DS4000 Problem Determination Guide, GC26-7703</i>						✓
<i>IBM Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329</i>	✓	✓			✓	✓
<i>IBM TotalStorage DS4000 FC2-133 Host Bus Adapter Installation and User's Guide, GC26-7736</i>		✓			✓	
<i>IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7737</i>		✓			✓	
<i>IBM TotalStorage DS4000 Fibre Channel and Serial ATA Intermix Premium Feature Installation Overview GC26-7713</i>	✓	✓	✓	✓		
<i>Fibre Channel Solutions - IBM DS4000 EXP500 Installation and User's Guide, 59p5637</i>	✓	✓		✓	✓	✓

Table 7. TotalStorage DS4000 and DS4000–related document titles by user tasks (continued)

Title	User Tasks					
	Planning	Hardware Installation	Software Installation	Configuration	Operation and Administration	Diagnosis and Maintenance
<i>IBM TotalStorage DS4000 EXP700 and EXP710 Storage Expansion Enclosures Installation, User's, and Maintenance Guide, GC26-7735</i>	✓	✓		✓	✓	✓
<i>IBM TotalStorage DS4000 Hard Drive and Storage Expansion Enclosures Installation and Migration Guide, GC26-7704</i>	✓	✓				
<i>IBM DS4000 Management Suite Java User's Guide, 32P0081</i>					✓	✓
<i>IBM Netfinity® Fibre Channel Cabling Instructions, 19K0906</i>		✓				
<i>IBM Fibre Channel SAN Configuration Setup Guide, 25P2509</i>	✓		✓	✓	✓	

Notices used in this document

This document contains the following notices designed to highlight key information:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Figures used in this document

The figures used in this document are for illustrative purposes only. In some cases, the actual device might look different from the figure.

Note: This applies particularly in cases where the DS4300 single-controller storage server (model 6LU/6LX) differs from the DS4300 dual-controller storage server (model 60U/60X).

Getting information, help, and service

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your IBM @server xSeries® or IntelliStation® system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation and use the diagnostic tools that come with your system.
- Check for technical information, hints, tips, and new device drivers at the following Web sites:

<http://www-1.ibm.com/servers/storage/support/disk/>
www.pc.ibm.com/support

- Use an IBM discussion forum on the IBM Web site to ask questions.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documents that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most xSeries and IntelliStation systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

Using the documentation

Information about the xSeries or IntelliStation system and preinstalled software, if any, is available in the documents that come with your system. This includes printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software.

Web sites

IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates.

- For DS4000 information, go to the following Web site:

www-1.ibm.com/servers/storage/support/index.html

The support page has many sources of information and ways for you to solve problems, including:

- Diagnosing problems, using the IBM Online Assistant
 - Downloading the latest device drivers and updates for your products
 - Viewing frequently asked questions (FAQ)
 - Viewing hints and tips to help you solve problems
 - Participating in IBM discussion forums
 - Setting up e-mail notification of technical updates about your products
- You can order publications through the IBM Publications Ordering System at:

www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi/

- For the latest information about IBM xSeries products, services, and support, go to the following Web site:

www.ibm.com/eserver/xseries/

- For the latest information about IBM @server pSeries® products, services, and support, go to the following Web site:

www.ibm.com/eserver/pseries/

- For the latest information about the IBM IntelliStation information, go to the following Web site:

www.ibm.com/pc/intellistation/

- For the latest information about operating system and host bus adapter (HBA) support, clustering support, SAN fabric support, and Storage Manager feature support, see the TotalStorage DS4000 Interoperability Matrix at the following Web site:

www-1.ibm.com/servers/storage/disk/ds4000/interop-matrix.html

Software service and support

Through IBM Support Line, for a fee you can get telephone assistance with usage, configuration, and software problems with xSeries servers, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, go to the following Web site:

www.ibm.com/services/sl/products/

For more information about the IBM Support Line and other IBM services, go to the following Web sites:

- www.ibm.com/services/
- www.ibm.com/planetwide/

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to the following Web site for support telephone numbers:

www.ibm.com/planetwide/

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

Fire suppression systems

A fire suppression system is the responsibility of the customer. The customer's own insurance underwriter, local fire marshal, or a local building inspector, or both, should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection. IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire suppression systems, IBM does not make compatibility claims of any kind nor does IBM provide recommendations on fire suppression systems.

Table 10 on page 13 lists the environmental specifications for the DS4300 storage server.

How to send your comments

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- Mail or fax

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Chapter 1. Introduction

IBM TotalStorage DS4000 storage solutions support the large and growing data storage requirements of business-critical applications. These scalable IBM DS4000 solutions offer you data access and protection to meet your existing enterprise storage requirements and prepare for the future.

Fibre channel is a new technology, similar to a high-speed network, that you can use to connect large amounts of disk storage to a server or cluster of servers. Fibre Channel technology supports increased performance, scalability, availability, and distance for attaching storage subsystems to network servers. The storage server provides for the attachment of Fibre Channel disk drives to give superior performance and redundancy.

Fibre channel technology supports applications that require large amounts of disk storage that is shared by two or more servers. With fibre channel, you can see a higher throughput rate over longer distances than is possible with Small Computer System Interface (SCSI) or with serial storage architecture (SSA) technology.

This document describes how to install and configure the following types of IBM TotalStorage DS4300 storage servers:

- “DS4300 Model 6LU/6LX” on page 2
- “DS4300 Model 60U/60X” on page 3
- “DS4300 Turbo Model 60U/60X” on page 3

After you review the introductory information that is provided in this chapter, go to Chapter 2, “Installing and configuring the storage server,” on page 15 to begin the installation process.

Note: The figures used in this document are for illustrative purposes only. In some cases, the actual device might look different from the figure.

This applies particularly in cases where the DS4300 single-controller storage server (Model 6LU/6LX) differs from the DS4300 dual-controller storage server (Model 60U/60X).

Product updates

Important

In order to keep your system up to date with the latest firmware and other product updates, use the information below to register and use the **My support** web site.

Download the latest versions of the DS4000 Storage Manager host software, DS4000 storage server controller firmware, DS4000 drive expansion enclosure ESM firmware, and drive firmware at the time of the initial installation and when product updates become available.

To be notified of important product updates, you must first register at the IBM® Support and Download Web site:

www-1.ibm.com/servers/storage/support/disk/index.html

In the **Additional Support** section of the Web page, click **My support**. On the next page, if you have not already done so, register to use the site by clicking **register now**.

Perform the following steps to receive product updates:

1. After you have registered, type your user ID and password to log into the site. The **My support** page opens.
2. Click **add products**. A pull-down menu displays.
3. In the pull-down menu, select **Storage**. Another pull-down menu displays.
4. In the new pull-down menu, and in the subsequent pull-down menus that display, select the following topics:
 - **Computer Storage**
 - **Disk Storage Systems**
 - **TotalStorage DS4000 Midrange Disk Systems & FAS*T* Stor Srvrs**

Note: During this process a check list displays. Do not check any of the items in the check list until you complete the selections in the pull-down menus.

5. When you finish selecting the menu topics, place a check in the box for the machine type of your DS4000 series product, as well as any other attached DS4000 series product(s) for which you would like to receive information, then click **Add products**. The **My support** page opens again.
6. On the **My support** page, click the **Edit profile** tab, then click **Subscribe to email**. A pull-down menu displays.
7. In the pull-down menu, select **Storage**. A check list displays.
8. Place a check in each of the following boxes:
 - a. **Please send these documents by weekly email**
 - b. **Downloads and drivers**
 - c. **Flashes**and any other topics that you may be interested in, and then click **Update**.
9. Click **Sign out** to log out of My Support.

DS4300 Model 6LU/6LX

The DS4300 single-controller storage server (Model 6LU/6LX) includes one RAID controller, one power supply, and two cooling units. It also includes fourteen hot-swap internal disk drive slots, which support over 2 TBs of storage capacity when using 146 GB Fibre Channel disk drives. It does not support storage capacity expansion using external storage expansion enclosures.

You can use the following products to upgrade the DS4300 storage server (Model 6LU/6LX):

IBM DS4300 Model 6LU/6LX Upgrade (IBM P/N 24P8963)

Use this product to upgrade to the DS4300 Model 60U/60X, which provides dual redundant RAID controllers and power supplies, and supports storage capacity expansion using external DS4000 EXP storage expansion enclosures.

IBM DS4300 Model 6LU/6LX Turbo Upgrade (IBM P/N 24P8964)

Use this product to upgrade to the DS4300 Turbo option, which provides dual redundant RAID controllers and power supplies in addition to the following features:

- RAID controllers with 1 GB of memory, instead of the standard 256-MB memory
- Entitlements for IBM DS4000 Storage Manager and DS4300 controller firmware version 9.1.
- Ability to connect up to seven DS4000 EXP storage expansion enclosures
- Entitlement for eight partitions using the Storage Partitioning premium feature

DS4300 Model 60U/60X

The DS4300 dual-controller storage server (Model 60U/60X) includes two RAID controllers, two power supplies, and two cooling units and provides dual, redundant controllers, redundant cooling, redundant power, and battery backup of the RAID controller cache.

This DS4300 storage server is designed to provide maximum host- and drive- side redundancy. Each RAID controller supports direct attachment of one host containing one or two host adapters.

Note: You must make Fibre Channel connections to both DS4300 controllers to ensure full host-side redundancy.

Utilizing these features with the 14 internal disk drive modules, up to 112 disk drives can be attached to the DS4300 with individual drive module capacities ranging from 36.4 to 146.8 GB.

DS4300 Turbo Model 60U/60X

The standard DS4300 dual-controller storage server (Model 60U/60X) supports a maximum of three EXP storage expansion enclosures. In order to support up to seven EXP units, you must purchase the DS4300 Turbo option.

The DS4300 Turbo option consists of:

- Two 1-GB memory RAID controllers
- Storage Manager and firmware at 9.1 level
- License for connecting up to seven EXP storage expansion enclosures
- Entitlement for eight partitions using the Storage Partitioning premium feature

DS4000 EXP storage expansion enclosures

You can add up to seven DS4000 EXP storage expansion enclosures to the DS4300 dual-controller storage server (Model 60U/60X).

Notes:

1. The DS4300 single-controller storage server (Model 6LU/6LX) does not support DS4000 EXP storage expansion enclosures.
2. You do not need to purchase optional DS4000 storage expansion enclosure entitlements to attach EXP100s to DS4300 Turbo storage servers. In addition, you can now intermix Fibre Channel drives (DS4300 Turbo storage server, EXP700/710 storage expansion enclosures) and SATA drives (EXP100 storage expansion enclosures) if the following conditions are met:
 - You have purchased and installed the FC/SATA Enclosure Intermix premium feature

- You are using controller firmware version 6.1x.xx.xx or later on your DS4300 Turbo storage server

For more information on the cabling requirements and best practices for intermixing EXP100s, EXP710s and EXP700s in the same DS4000 Storage Server configuration, see the *IBM TotalStorage DS4000 Fibre Channel and Serial ATA Intermix Premium Feature Installation Overview* that ships with the FC/SATA Enclosure Intermix premium feature. You can also refer to the *IBM TotalStorage DS4000 Hard Drive and Storage Expansion Enclosure Installation and Migration Guide*.

For information about DS4000 EXP100 SATA storage expansion enclosures, see the *IBM TotalStorage DS4000 EXP100 Storage Expansion Enclosure Installation and User's Guide*.

Table 8 shows the optional EXP700/EXP710 attachment features.

Table 8. Additional EXP700/EXP710 storage features available for the DS4300 storage server

DS4000 EXP700/EXP710 storage expansion enclosures	Number of Drives	Feature Number	Part No.
Two EXP700/EXP710 storage expansion enclosures	15 to 42 drives	7360	24P8066
First additional EXP700/EXP710 storage expansion enclosure	15 to 28 drives	7361	24P8169
Second additional EXP700/EXP710 storage expansion enclosure	29 to 42 drives, can be purchased only after Feature number 7361	7362	24P8151
Third additional EXP700/EXP710 storage expansion enclosure	43 to 56 drives, can be purchased only after Feature number 7362	7363	24P8183
Three EXP700/EXP710 storage expansion enclosures	15 to 56 drives	7368	24P8180
Seven EXP700/EXP710 storage expansion enclosures (supported on the DS4300 as part of Turbo option only). Also include 1-GB memory controller upgrade and Storage Manager 9.1 client and controller firmware.	15 to 112 drives	2000 (for the 1722-60U) or 2010 (for the 1722-60X)	24P8215 (for the 1722-60U) 24P8216 (for the 1722-60X)

The DS4300 Turbo option enables you to intermix EXP700 and EXP710 enclosures in the same redundant drive loop.

For information on the cabling requirements and best practices for intermixing EXP100s, EXP710s and EXP700s in the same DS4000 Storage Server configuration, see the *IBM TotalStorage DS4000 Fibre Channel and Serial ATA Intermix Premium Feature Installation Overview* that ships with the FC/SATA Enclosure Intermix premium feature.

You can also refer to the *IBM TotalStorage DS4000 Hard Drive and Storage Expansion Enclosure Installation and Migration Guide*.

Features at a glance

Table 9 summarizes the features of the storage server. For a list of the operating specifications, such as weight, height, and heat output, see Table 10 on page 13.

Table 9. Features at a glance

<p>General</p> <ul style="list-style-type: none"> • Modular components: <ul style="list-style-type: none"> – High-capacity Fibre Channel disk drives – RAID controllers – Power supplies – Cooling fans • Technology: <ul style="list-style-type: none"> – Support for disk arrays – Support for clustering – Fibre-channel host interface – Redundant data storage, cooling system, power system, and RAID controllers (Model 60U/60X only) – Hot-swap technology for power supplies and RAID controllers (Model 60U/60X only) – Hot-swap technology for fibre-channel hard drives and fans (all models). <p>Attention: You will lose data if you attempt to hot swap the controller and power supply components in a DS4300 single-controller storage server (Model 6LU/6LX).</p>	<ul style="list-style-type: none"> • User interface: <ul style="list-style-type: none"> – Built-in power, activity, and fault light emitting diodes (LEDs) – Identification labeling on customer replaceable units (CRUs), rear LEDs, switches, and connectors – Easy-to-replace drives, power supplies, RAID controllers, and fans <p>Disk drive storage 2-Gbps Fibre Channel enclosure Maximum drives per storage server: 14</p> <p>Attached storage expansion enclosures For Model 60U/60X, attachment of DS4000 EXP700 storage expansion enclosures requires one or more EXP700 Attachment option (or feature) upgrades for the DS4300 2-Gbps connection only</p>	<p>RAID controllers</p> <ul style="list-style-type: none"> • Technology and interfaces: <ul style="list-style-type: none"> – Fibre Channel: 40-pin fibre-channel disk drives – Fibre Channel interface: <ul style="list-style-type: none"> - For Model 60U/60X, six small form-factor pluggable (SFP) modules for incoming and outgoing fibre-channel cables (three SFPs on each RAID controller). - For Model 6LU/6LX, four SFP modules for incoming fibre-channel cables (two SFPs on each RAID controller). – Two 2-Gbps fibre-channel host-side connections per controller
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Clustering support

Clustering is a means of sharing array groups among controllers to provide redundancy of controllers and servers. This redundancy is important if a hardware component fails. If a hardware component failure occurs in a cluster, another server takes ownership of the array group.

Clustering requires software specific to your operating system. For more information about clustering, go to the following Web site:

www.pc.ibm.com/us/compat/nos/matrix.shtml

Inventory checklist

After you unpack the storage server, verify that you have the following items:

Hardware

IBM DS4300 storage server comes with the following components:

- RAID controllers
 - 2 controllers on Model 60U/60X
 - 1 controller on Model 6LU/6LX
- Power supplies
 - 2 power supplies on Model 60U/60X
 - 1 power supply on Model 6LU/6LX
- Power cords
 - Two power cords on Model 60U/60X
 - One power cord on Model 6LU/6LX
- Two fan units
- 14 filler panels
- Rack-mounting hardware kit (1)
 - Two rails (right and left assembly)
 - Ten M6 screws
 - Ten M6 cage nuts
 - Ten M6 clip nuts
- LC wrap plug and coupler kit for Fibre Channel link diagnostics (for more information, see the *DS4000 Problem Determination Guide*)

Software and documentation:

- IBM DS4000 Storage Manager software according to the following options:
 - For the DS4300 standard option, IBM DS4000 Storage Manager Version 8.3 CD including client and firmware, and online help and publications in Adobe Acrobat Portable Document Format (PDF)
 - If the DS4300 storage server is shipped from the factory with the Turbo Option controllers preinstalled in the storage subsystem, IBM DS4000 Storage Manager Version 9.1 CD including client and firmware, and online help and publications in Adobe Acrobat Portable Document Format (PDF)

For a list of available IBM DS4000 publications, see “DS4000 Storage Server publications” on page xvii.

- Rack Mounting Assembly kit, including:
 - Rack mounting installation instructions
 - Rack mounting template (for aligning the rails properly)
 - White tape dots for marking the holes in the rack
- Fibre Channel cabling instructions

If an item is missing or damaged, contact your IBM reseller or your IBM marketing representative.

If you have not already done so, record your storage server serial number in the table in Appendix A, “Records,” on page 105.

Handling static-sensitive devices

Attention: Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective package until you are ready to install them.

To reduce the possibility of electrostatic discharge (ESD), observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully. Hold it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its static-protective package, you should hold the device and touch an unpainted metal part of the system unit for at least two seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it in its static-protective package. Do not place the device on your system unit cover or on a metal table.
- Take additional care when handling devices during cold weather because heating reduces indoor humidity and increases static electricity.

Best practices guidelines

To ensure optimal operation of your system, always follow these best practices guidelines:

- Back up the data on your storage drives periodically.
- Before any planned system shutdown or after any system changes (additions, removals, or modifications), save controller subsystem profiles as explained in the *IBM DS4000 Storage Manager Installation and User's Guide* for your operating system.
- Ensure that your system is in an optimal state before shutting down. Never turn the power off if any fault light is lit; be sure to resolve any error conditions before you shut down the system.
- During any maintenance or attended power-up procedure, carefully follow the power-up sequence listed in “Turning on the storage server” on page 46. Each component of the subsystem should be checked that it is powered-on in the proper order during this entire power-up procedure to ensure the controller will be able to optimally access all of your storage subsystems.
- The storage subsystem supports simultaneous power-up to the system components; however, you should always follow the power-up sequence listed in “Turning on the storage server” on page 46 during any attended power-up procedure.
- A storage system in an optimal state should recover automatically from an unexpected shutdown and unattended simultaneous restoration of power to system components. After power is restored, call IBM support if any of the following conditions occur:
 - The storage subsystem logical drives and arrays are not displayed in the Storage Manager graphical user interface (GUI).
 - The storage subsystem logical drives and arrays do not come online.

- The storage subsystem logical drives and arrays seem to be degraded.
- Using the DS4000 Storage Manager client, save the DS4000 subsystem configuration profile to a disk that is not affected every time you make changes to the DS4000 subsystem configuration (such as logical drive creation or modification, or storage partitioning changes).
- **DS4300 Model 60U/60X only:** To maintain power redundancy, plug the DS4300 dual-controller storage server's right and left power supplies into two independent external power circuits through ac distribution units inside a rack cabinet or directly into external receptacles. Similarly, the right and left power supplies of the DS4000 storage expansion enclosures attached to the DS4300 storage server should be plugged into the same two independent external power circuits as the DS4300 storage server. This ensures that the DS4300 storage server and all its attached storage expansion enclosures will have power if only one power circuit is available. In addition, having all the right or all the left power supplies plugged into the same power circuit will enable the components in the storage subsystem to power on simultaneously during an unattended restoration of power. See Figure 40 on page 41 for an example of redundant power connections.

Storage server components

The topics in this section show the components of the DS4300 storage server.

All DS4300 storage server models support hot-swap Fibre Channel hard drive CRUs and cooling fan CRUs, so you can remove and replace these components without turning off the storage server. In addition, the DS4300 storage server models 60X/60U support hot-swap power supplies and RAID controller CRUs.

Attention: You will lose data if you attempt to hot-swap a power supply or RAID controller in a DS4300 single-controller (Model 6LU/6LX).

Front view

Figure 2 shows the components and controls on the front of the storage server.

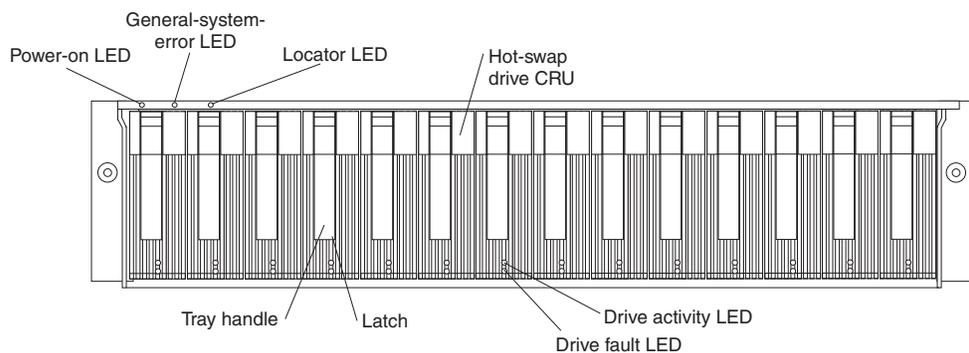


Figure 2. Front controls and components

Power-on LED

When on, this green light indicates that the unit has good dc power.

General-system-error LED

When on, this amber LED indicates that the storage server has a fault, such as in a power supply, fan unit, or hard disk drive.

Exception: Because a DS4300 single-controller storage server (Model 6LU/6LX) has only one power supply, this LED cannot light up when its power supply fails.

Note: If the General-system-error LED is on continuously (not flashing), there is a problem with the storage server. Use the Storage Manager client to diagnose and repair the problem. For more information, see “Checking the LEDs” on page 51.

Locator LED

When on, this blue light indicates the storage-management software is locating the server.

Hot-swap drive CRU

You can install up to 14 hot-swap drive CRUs in the storage server. Each drive CRU consists of a hard disk drive and tray.

Filler panel

The storage server comes without drives installed and contains filler panels in the unused drive bays. Before installing new drives, you must remove the filler panels and save them. Each of the 14 bays must always contain either a filler panel or a drive CRU to ensure proper cooling, air ventilation, and EMI compliance.

Drive activity LED

Each drive CRU has a green Drive activity LED. When flashing, this green LED indicates drive activity. When on continuously, this green LED indicates that the drive is properly installed.

Drive fault LED

Each drive CRU has an amber Drive fault LED. When on, this amber LED indicates a drive failure. When flashing, this amber LED indicates that a drive identify is in progress.

Latch This multipurpose blue latch releases or locks the drive CRU in place.

Tray handle

You can use this multipurpose handle to insert and remove a drive CRU in the bay.

For information on how to install and replace drive CRUs, see “Working with hot-swap drives” on page 74. For more information about the LEDs, see “Checking the LEDs” on page 51.

Back view

Figure 3 on page 10 shows the components at the back of the DS4300 dual-controller storage server (Model 60U/60X).

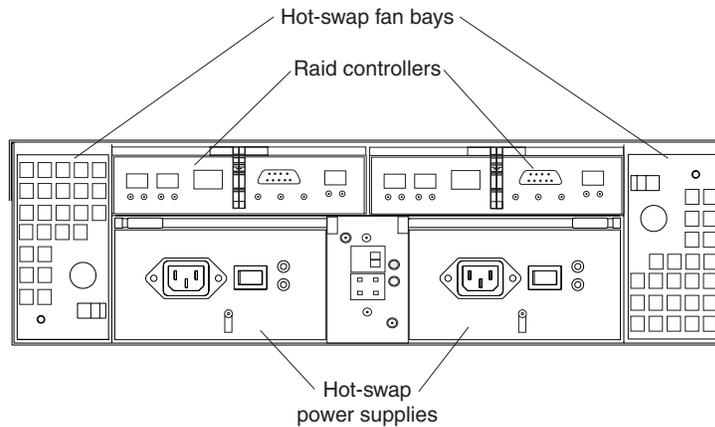


Figure 3. Back view of DS4300 storage server (Model 60U/60X)

Figure 4 shows the components at the back of the DS4300 single-controller storage server (Model 6LU/6LX).

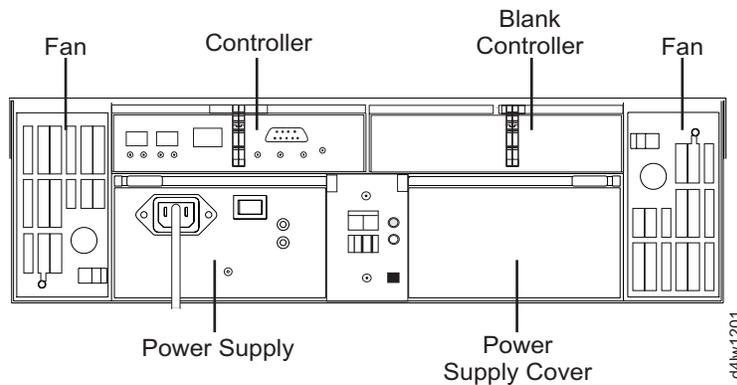


Figure 4. Back view of DS4300 storage server (Model 6LU/6LX)

RAID controller

Each RAID controller contains ports for SFP modules that connect to the Fibre Channel cables. Two of the SFP ports (Host 1 and Host 2) are for host server attachment. On the DS4300 Model 60U/60X, each RAID controller also has an additional port that connects DS4000 EXP storage expansion enclosures to the storage server.

Each RAID controller also contains a battery to maintain cache data in the event of a power failure. For more information, see “Cache memory and RAID controller battery” on page 55.

Hot-swap fans

The storage server has two interchangeable hot-swap and redundant fan CRUs. Each fan CRU contains two fans. If one fan CRU fails, the second fan CRU continues to operate. Both fan CRUs must be installed to maintain proper cooling within the storage server, even if one fan CRU is not operational.

Hot-swap power supplies

The storage server includes two hot-swap power supplies. Both power supplies must be installed to maintain proper cooling.

Exception: The DS4300 single-controller storage server (Model 6LU/6LX) has only one power supply. To maintain proper cooling, keep the cover on the second power supply bay.

Interface ports and switches

Figure 5 shows the ports and switches on the back of the DS4300 dual-controller storage server (Model 60U/60X).

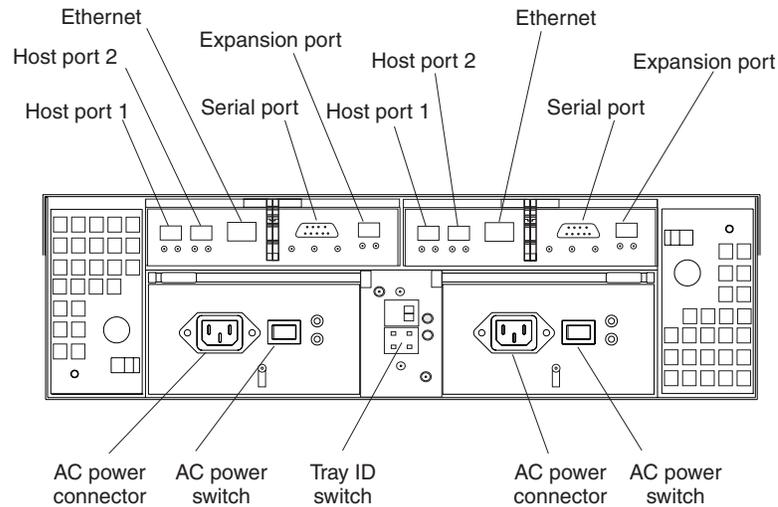


Figure 5. Model 60U/60X: Interface ports and switches

Figure 6 shows the ports and switches on the back of the DS4300 single-controller storage server (Model 6LU/6LX).

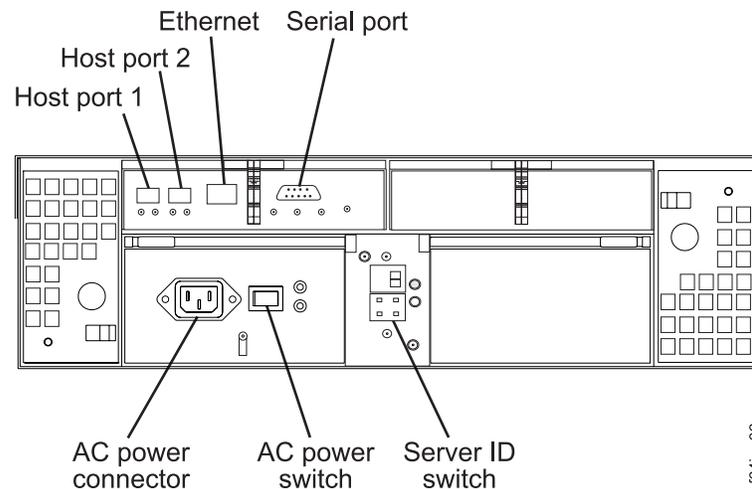


Figure 6. Model 6LU/6LX: Interface ports and switches

RAID controller

Each RAID controller contains several connectors and LEDs. Each controller has ports for SFP modules that connect to the Fibre Channel cables. Two of the ports are for host server attachment. (Each RAID controller on the DS4300 Model 60U/60X also has an additional port that

connects DS4000 EXP storage expansion enclosures to the storage server.) You first insert SFPs into the ports and then connect the Fibre Channel cables.

Host ports

The host ports are used to connect a Fibre Channel cable from the host systems. You first insert an SFP into the port and then connect a Fibre Channel cable. The two host ports in each controller are independent. They are not connected in the controller module as they would be in a hub configuration.

Ethernet port

The Ethernet port is for an RJ-45 10BASE-T or 100BASE-T Ethernet connection. Use the Ethernet connection to directly manage storage subsystems.

Expansion port (Model 60U/60X only)

The expansion port is used to connect up to three DS4000 EXP storage expansion enclosures to the RAID controllers. You first insert a SFP into the port and then connect a fibre channel cable.

Note: If you want to connect up to seven DS4000 EXP storage expansion enclosures, you must purchase the DS4300 Turbo option. See Table 8 on page 4 for more information.

Serial port

The serial port is used by service personnel to perform diagnostic operations on the RAID controllers.

Server/Enclosure ID switch

The Server ID switch settings range from 0 through 7, and you can set unique IDs ranging from 00 through 77.

Note: DS4300 storage server and the DS4000 EXP storage expansion enclosures are shipped with their Server ID/Enclosure ID switches set to 0 as the default. If you want to connect a DS4300 to one or more EXP storage expansion enclosures, you must set the Enclosure IDs of the EXPs to unique values (other than 0 or the current Server ID setting of the DS4300 storage server).

Note: For controller firmware version 05.33.xx.xx, both host and expansion ports operate at 2 Gbps only. For controller firmware version 05.34.xx.xx and higher, the host ports can operate at either 1 or 2 Gbps (the expansion port speed is still locked at 2 Gbps only).

Operating specifications

Table 10 summarizes the operating specifications of the storage server.

Table 10. DS4300 storage server operating specifications

<p>Size (with front panel and without mounting rails)</p> <ul style="list-style-type: none"> • Depth: 59.7 cm (23.6 in.) • Height: 13.2 cm (5.2 in.) • Width: 48 cm (18.9 in.) <p>Heat output</p> <ul style="list-style-type: none"> • 390 watts (1330 BTU/hr) <p>Weight</p> <ul style="list-style-type: none"> • Standard storage server as shipped: <ul style="list-style-type: none"> – Model 60U/60X: 39.10 kg (86.2 lb) – Model 6LU/6LX: 34.34 kg (75.7 lb) • Unit weight: <ul style="list-style-type: none"> – Model 60U/60X: 31.48 kg (69.4 lb) – Model 6LU/6LX: 26.71 kg (58.9 lb) <p>Electrical input</p> <ul style="list-style-type: none"> • Sine-wave input (50 to 60 Hz) is required • Input voltage: <ul style="list-style-type: none"> – Low range: <ul style="list-style-type: none"> - Minimum: 90 V ac - Maximum: 136 V ac – High range: <ul style="list-style-type: none"> - Minimum: 198 V ac - Maximum: 264 V ac – Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> - Minimum configuration: 0.06 kVA - Maximum configuration: 0.37 kVA 	<p>Environment</p> <ul style="list-style-type: none"> • Air temperature: <ul style="list-style-type: none"> – Storage server on: <ul style="list-style-type: none"> 10° to 35°C (50° to 95°F) Altitude: 0 to 914 m (3000 ft.) – Storage server on: <ul style="list-style-type: none"> 10° to 32°C (50° to 90°F) Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.) • Humidity: <ul style="list-style-type: none"> – 8% to 80% – Noncondensing 	<p>Acoustical noise emissions values For open bay (0 drives installed) and typical system configurations (14 hard disk drives installed).</p> <ul style="list-style-type: none"> • Sound power (idling): <ul style="list-style-type: none"> – 6.3 bels (open bay) – 6.5 bels (typical) • Sound power (operating): <ul style="list-style-type: none"> – 6.3 bels (open bay) – 6.8 bels (typical) • Sound pressure (idling): <ul style="list-style-type: none"> – 47 dBA (open bay) – 49 dBA (typical) • Sound pressure (operating): <ul style="list-style-type: none"> – 47 dBA (open bay) – 53 dBA (typical) <p>These levels are measured in controlled acoustical environments according 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.</p>
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Heat output, airflow, and cooling

The maximum heat output of the DS4300 is 390 watts (1330 BTU/hr). Each DS4300 (Model 60U/60X) and DS4000 EXP storage expansion enclosures rack-mounted unit requires an airflow of 2.5 m³ per minute (87 ft³ per minute). The input air temperature to all racks is recommended to be in the range 10°C through 35°C (50°F through 95°F), with a recommended operating temperature of 22°C (72°F).

When racks that contain many DS4300 units are to be installed together, the following requirements must be met to ensure that the DS4300 units are adequately cooled:

- Air enters at the front of the rack and leaves at the back. To prevent the air that is leaving the rack from entering the intake of another piece of equipment, racks must be positioned in alternate rows, back-to-back and front-to-front. This arrangement is known as “Cold Aisle / Hot Aisle” and is shown in Figure 7 on page 14.
- Where racks are in rows, each rack must touch the rack that is next to it to reduce the amount of hot air that can flow around from the back of the rack into the intakes of the DS4300 units that are in that rack. It is recommended that

Suite Attach Kits be used to completely seal any gaps that remain between the racks. For details of Suite Attach Kits, contact your marketing representative.

- Where racks are in rows front-to-front or back-to-back, a gap of at least 1220 mm (48 in.) must separate the rows across the cold aisle.
- To ensure correct airflow in each rack, the rack filler plates must be installed in unused positions. Also, all the gaps in the front of the racks must be sealed, including the gaps between the DS4300 units.

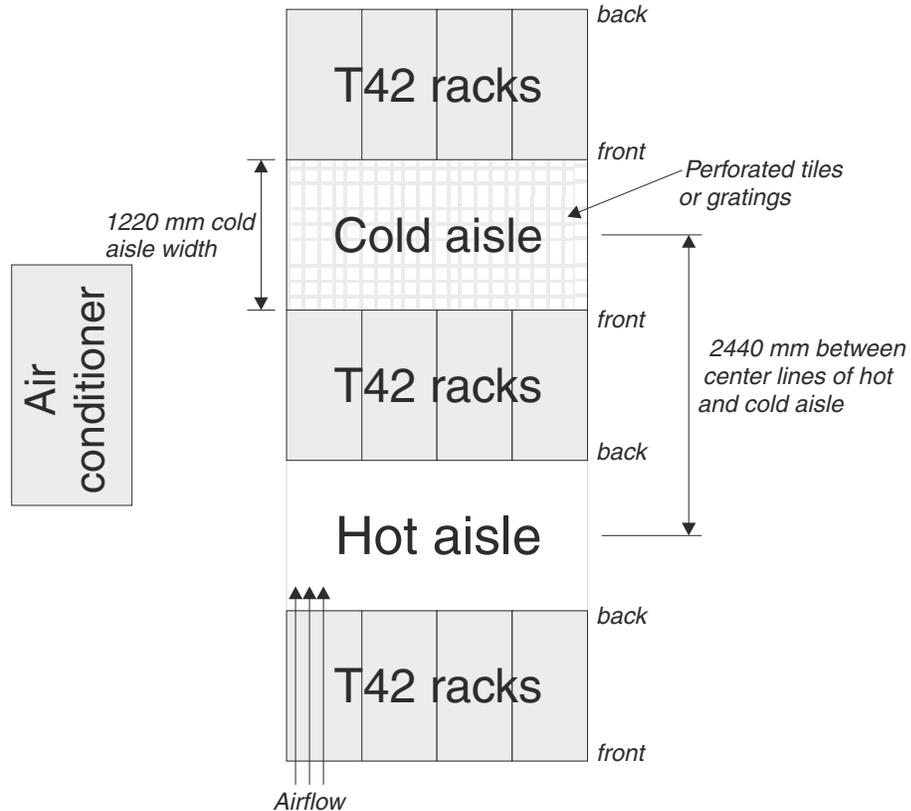


Figure 7. Example of Cold Aisle/Hot Aisle Rack Configuration

Chapter 2. Installing and configuring the storage server

This chapter contains information about how to prepare, install, and configure the storage subsystem.

Getting started

Use the following list to prepare a storage server for installation:

1. Prepare the site to meet all area, environmental, power, and site requirements. For more information, see “Operating specifications” on page 13.
2. Move the storage server and its rack cabinet to the site.
3. Remove the storage server from its shipping container and check the contents (for a list of items, see “Inventory checklist” on page 6.) If any items are missing, contact your IBM reseller before you proceed.
4. Assemble the tools and equipment that you will need for installation. These might include:
 - Power cords (come with the storage server)
 - Screwdrivers (medium flat-blade and #2 Phillips)
 - Antistatic protection (such as a grounding wrist strap)
 - SFPs
 - Fibre Channel and Ethernet interface cables and cable straps
 - Rack-mounting hardware (comes with the storage server)
 - Storage-management software to configure the storage subsystems (comes with the storage server on the IBM TotalStorage DS4000 Storage Manager installation CD.)

Rack mounting instructions and a template for aligning the holes in the rails and the rack come with the storage server. If you have misplaced these items, see “Rack mounting template and instructions.”

After you install the storage server in the rack and configure the storage server, go to Chapter 3, “Cabling the storage server,” on page 33.

Rack mounting template and instructions

A rack mounting template and instructions come with the storage server. If you have misplaced these items, use the following template and instructions.

FRONT Rack Mounting Template

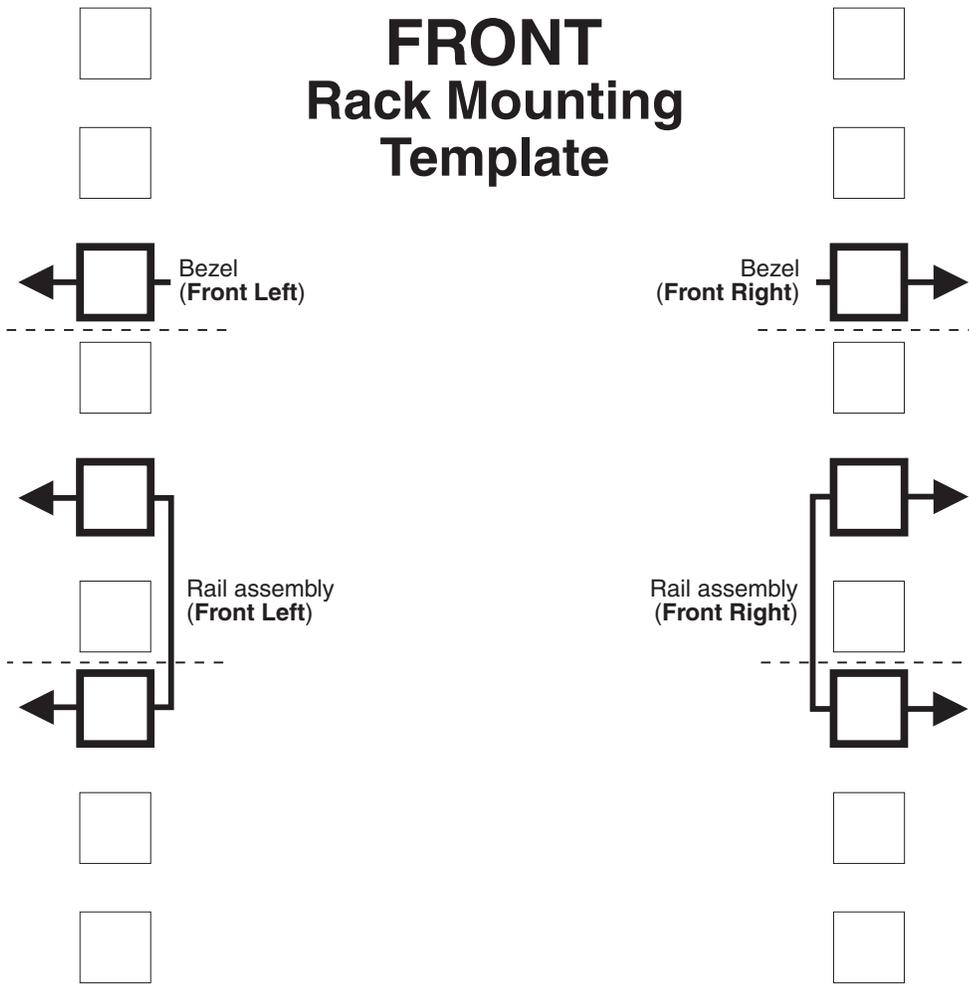


Figure 8. Front rack mounting template

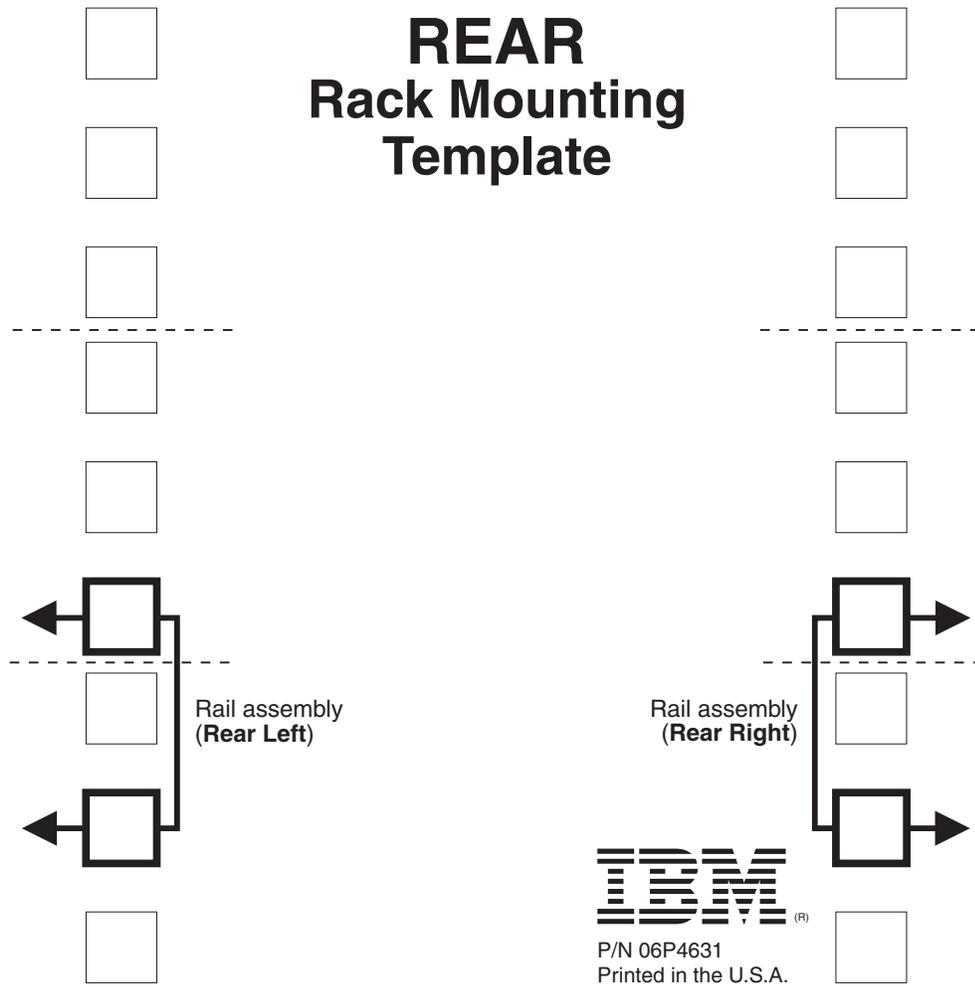


Figure 9. Rear rack mounting template

Installing the storage server in a rack

Review the documentation that comes with the rack cabinet for safety and cabling information. When you install the storage server in a rack, consider the following factors:

- Ensure that the room air temperature is below 35°C (95°F).
- Do not block any air vents. Usually, leaving 15 cm (6 in.) of air space provides proper airflow.
- Plan the device installation starting from the bottom of the rack.
- Do not extend more than one device out of the rack at the same time.
- Remove the rack doors and side panels to provide easier access during installation.
- Connect all power cords to properly wired and grounded electrical outlets.
- Take precautions to prevent overloading the power outlets when you install multiple devices in a rack.

Statement 4:



		
≥ 18 kg (39.7 lb)	≥ 32 kg (70.5 lb)	≥ 55 kg (121.2 lb)

CAUTION:

Use safe practices when lifting.

You will need a flat-blade and a Phillips screwdriver during the installation. The following items come with your option. If any items are missing or damaged, contact your place of purchase.

- Cage nuts (10)
- Clip nuts (10)
- M6 screws (10)
- Side rails (2)

Perform the following steps to install the storage server in a rack.

Before you begin: A DS4300 storage server with 14 drives installed can weigh up to 41 kg (92 lb). At least three persons are required to properly lift the storage server from the shipping box and place it in the rack. If you do not have enough people, perform the first four steps for the installation procedure, which involve removing some components from the storage server in order to reduce the weight of the storage server for easier installation.

1. To remove a RAID controller, push down on the latch centered on the controller; then, grasp the pull-rings on the levers and pull them to remove the RAID controller and set it aside for later installation.

If you have a second RAID controller, repeat this step for the second controller.

Caution: Observe ESD procedures when removing CRUs from the DS4300 storage server. See the storage server documentation for handling guidelines before removing any ESD-sensitive devices.

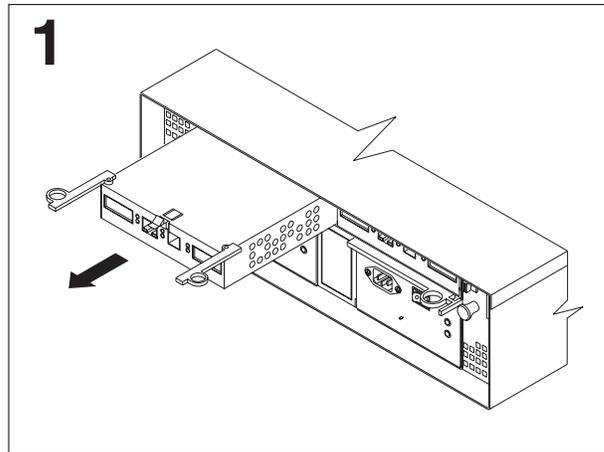


Figure 10. RAID controller removal

2. To remove a hot-swap fan, slide the latch on the fan to unlock it; then pull the handle and remove the fan from the storage server.

Repeat this step for the other fan and set both fans aside for later installation.

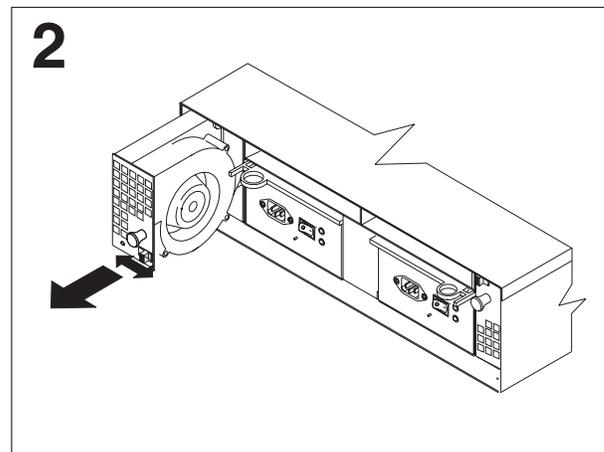


Figure 11. Hot-swap fan removal

3. To remove a power supply, grasp the pull-ring on the power supply lever and squeeze to release it; then pull the lever fully open and remove the power supply from the storage server.

Repeat this step for the other power supply; then set both power supplies aside for later installation.

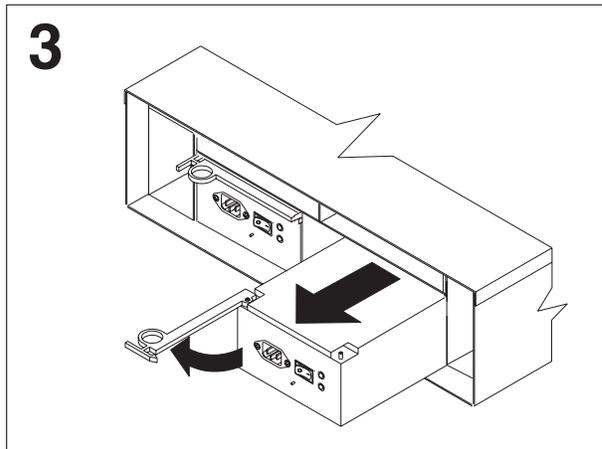


Figure 12. Power supply removal

4. To remove a hard disk drive **2**, press the blue latch **3** and pull the handle **1** upwards; then carefully pull the drive from the storage server.

Attention: Place the removed drives in a horizontal position, with the printed circuit boards facing down. Do not stack the drives on top of each other. Protect from vibrations or sudden shocks.

Note: Before you remove any hard disk drives, make sure that you mark their location so that you can reinstall them in the same location.

Repeat this step for all hard disk drives.

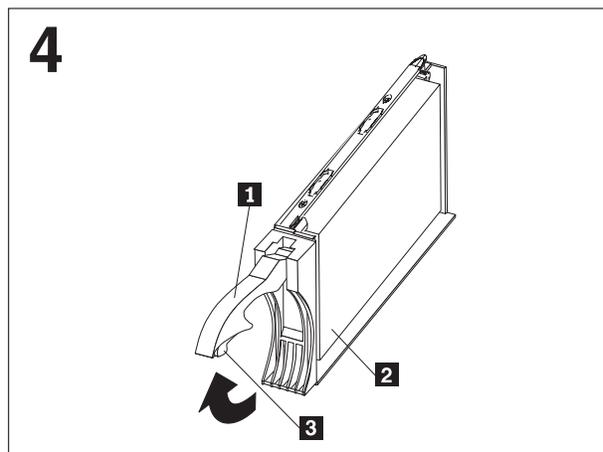


Figure 13. Hard disk drive removal

5. Use the attached template and stickers to mark the appropriate holes on the rack; then install clip nuts or cage nuts as required for the rack cabinet.

Note: Use the cage-nut-insertion tool or a flat-blade screwdriver to install cage nuts.

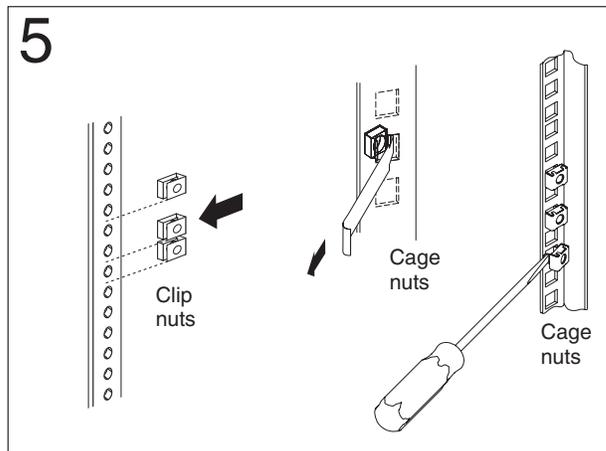


Figure 14. Rack nut installation

6. On the rail marked **R**, remove the 6/32 in. screw **3** and loosen the four screws **2**; then hold the front of the rail against the outside of the right rack-mounting-flange and loosely install two M6 screws **1**. Extend the rear of the rail outside of the rear rack-mounting-flange; then install and tighten two M6 screws **4**. Tighten the front screws **1** and repeat this step for the other rail.

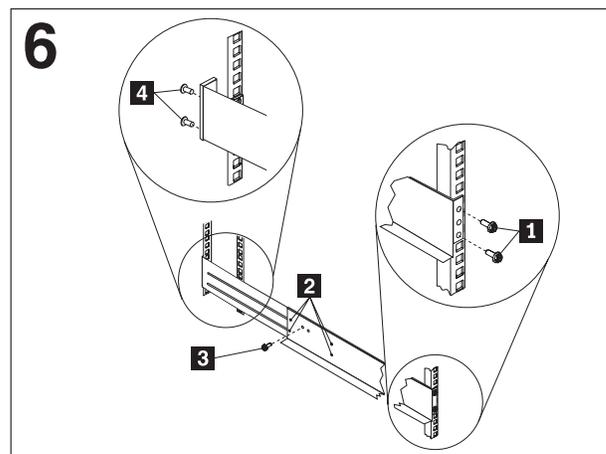


Figure 15. Rail extension

7. Tighten the rail adjustment screws **1** on both rails.

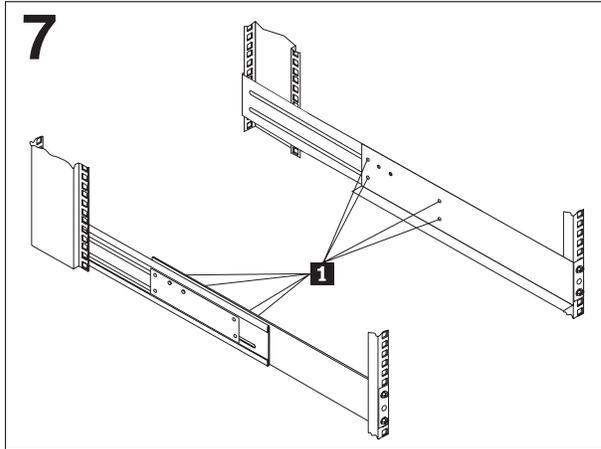


Figure 16. Rail adjustment screws

8. Remove the white screws and nuts **1** from the storage server bezel; then slide the storage server into the rack. Align the bezel locator pins and attach the bezel with two M6 screws **2**; then install and tighten the 6-32 in. screws **3**.

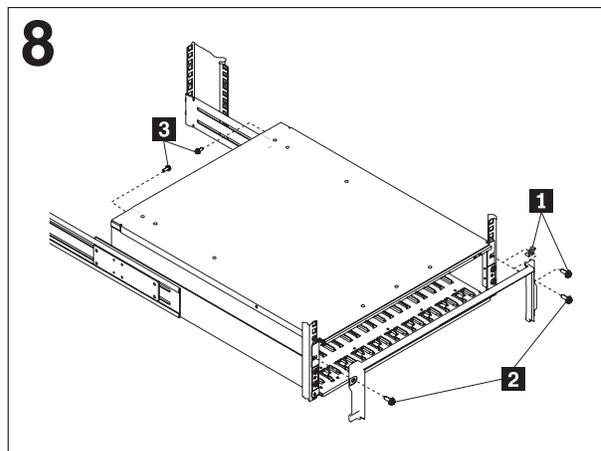


Figure 17. Server installation

9. Reverse step 1 through step 4 to reinstall the components that you removed. See your storage server documentation to complete your installation. Store this information with the storage server documentation for future use.

Setting server ID settings

The DS4300 storage server comes with a server ID switch that is used to identify the DS4300 on a Fibre Channel loop. The server ID switch is located on the back of the unit, as shown in Figure 18 on page 23.

Note: The Server ID switch is sometimes referred to as an “Enclosure ID” switch.

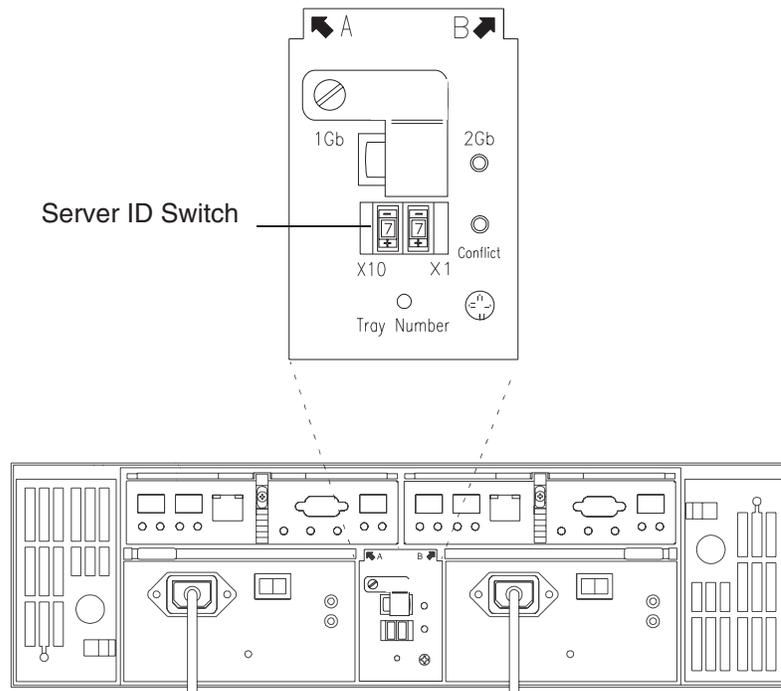


Figure 18. Setting the Server ID

Server ID switch settings set the server ID to a value from 00 - 77. Server ID switch X1 is for setting the ones position, and Server ID switch X10 is for setting the tens position. The settings of the two server ID switches, when used together, provide a two-digit ID of the server unit. The storage-management software uses the server ID to provide a correlation between the storage-management graphics and the physical storage unit. The ID indicates which physical unit corresponds to the storage-management software status.

Use Server ID switches X10 and X1 to set the server-unit ID to any value from 00 through 77.

Note: Each server unit should have a unique ID if it is going to be connected to other DS4000 EXP storage expansion enclosure through the storage expansion enclosure loop ports. The Server ID setting is only valid for the drive loop. The amber Conflict LED (located on the right-side of the switch) will be lit if there is another unit in the drive loop that has the same ID setting as the server ID. See your storage server documentation for more information.

Configuring the storage subsystem

You must configure the storage subsystem configuration after you install the storage server in a rack. Use the information in the following sections to configure your storage subsystem configuration.

Storage subsystem management methods

Before you configure the storage subsystem, determine which method of storage subsystem management you want to use. You can manage the storage subsystems in either of two ways: Host-agent management or Direct-management.

Note: If the operating system of the host server that the storage subsystem logical drive(s) is mapped to is not the Microsoft® Windows NT® platform, you have to make an out-of-band direct management connection to the storage subsystem to set the correct host type first. Then, the server will be able to recognize the storage subsystem correctly for in-band management.

Host-agent management method:

This method requires host-agent software that is installed on the host server. The host-agent software allows the DS4000 storage manager client program to manage the DS4000 storage subsystem using the same Fibre Channel connections between the host server and the storage subsystem. You must install at least one management station and a software-agent host. The management station can be the host or a workstation on the Ethernet network. A management station will have the client software installed. Figure 19 shows the host-agent management method.

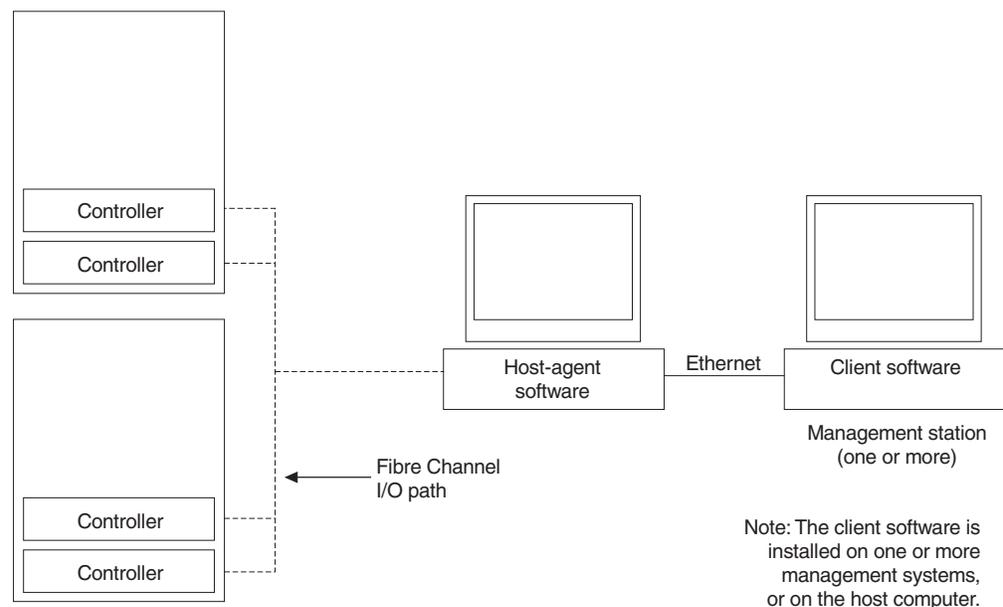


Figure 19. Host-agent managed storage subsystems

Direct-management method:

This method uses Ethernet connections from a management station to each controller. You must install at least one management station. The management station can be the host or a workstation on the Ethernet network. A management station will have the client software installed. Attach Ethernet cables to each management station (one pair per storage server). You will connect the cables to each controller later when you install the storage server. Figure 20 shows the direct management method.

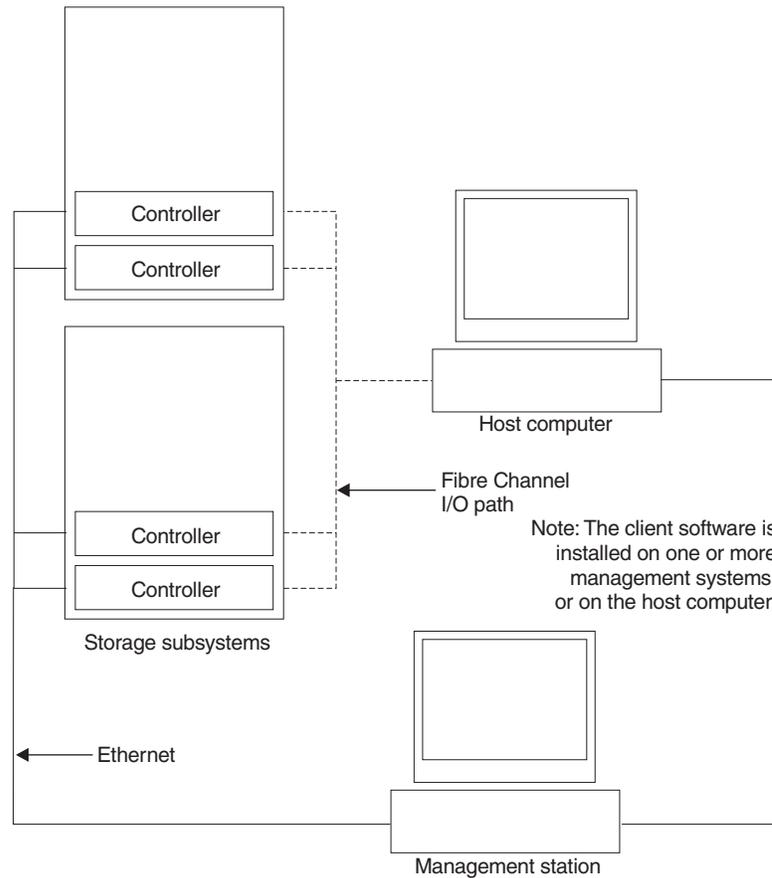


Figure 20. Direct-managed storage subsystems

Fibre Channel connections

DS4300 Fibre Channel connections consist of two host Fibre Channel loops and up to one drive Fibre Channel loop, depending on the storage server model. These Fibre Channel connections are made through three SFP ports, which are labeled "Host 1," "Host 2," and "Expansion."

Exception: The DS4300 single-controller storage server (Model 6LU/6LX) does not support drive loops or storage expansion enclosures.

The host Fibre Channel loop provides the fibre path for host attachment. It can consist of Fibre Channel cables, SFPs, host bus adapters, Fibre Channel switches, and RAID controllers. The expansion drive (or storage expansion enclosure) Fibre Channel loop provides the fibre path to the hard disk drives (HDDs) that are outside

the DS4300 storage server chassis. The drive Fibre Channel loop consists of Fibre Channel HDDs and optional DS4000 EXP storage expansion enclosures, Fibre Channel cables, and SFPs.

The DS4300 dual-controller storage server (Model 60U/60X) supports redundant disk-drive-loop configurations. You can build a redundant drive loop by connecting one or more DS4000 EXP storage expansion enclosures to the redundant RAID controllers. Then, use dual fiber-optic cables to connect one storage expansion enclosure to another in a daisy-chain. For more information about adding storage expansion enclosures, see “Connecting additional storage expansion enclosures” on page 42.

Fibre Channel loop configurations

You must determine how the host systems will connect to the storage server. You can connect up to two host systems directly to the storage server, or you can connect more than two hosts to the fibre channel storage server through switches. The illustrations in the following sections show common host system configurations.

Note: The default is one partition. Four-partition and eight-partition configurations are provided as option upgrades, as is the option of additional attachments to DS4000 EXP storage expansion enclosures. Contact your IBM resellers or marketing representatives for more information.

Redundant host and drive loops

This section provides examples of DS4300 host Fibre Channel configurations.

DS4300 dual-controller storage server (Model 60U/60X) configurations: This section includes the following examples of DS4300 dual-controller storage server (Model 60U/60X) configurations:

- Redundant host and drive loop Fibre Channel configuration (Figure 21 on page 27)
- Single SAN fabric zone configuration (Figure 22 on page 28)
- Dual SAN fabric zone configuration, with an additional DS4300 storage server and an EXP700 attached (Figure 23 on page 28)
- Two clusters (Figure 24 on page 29)

Note: These configurations have host and drive path failover protection and are recommended for high availability.

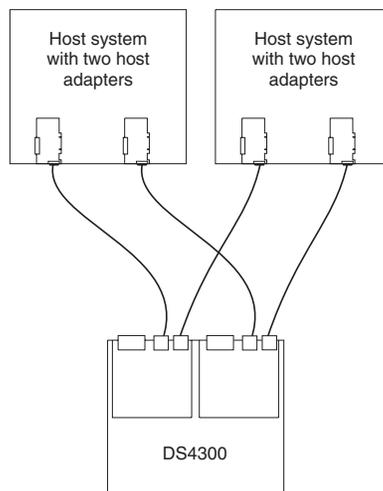
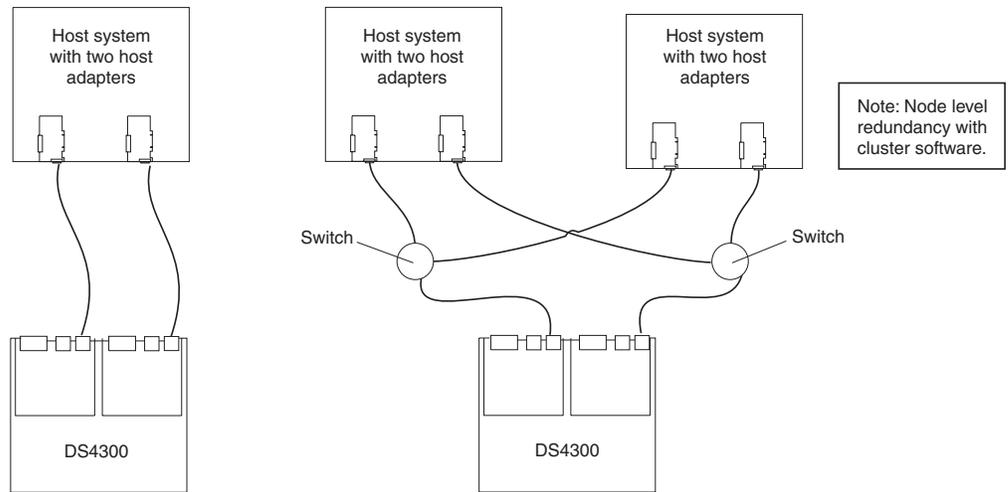


Figure 21. Redundant host and drive Fibre Channel loop configurations (Model 60U/60X)

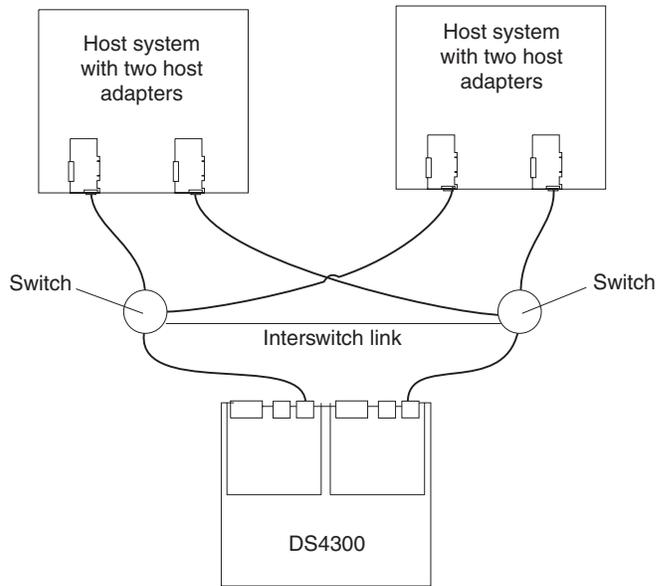


Figure 22. Example of a single-SAN fabric zone configuration (Model 60U/60X)

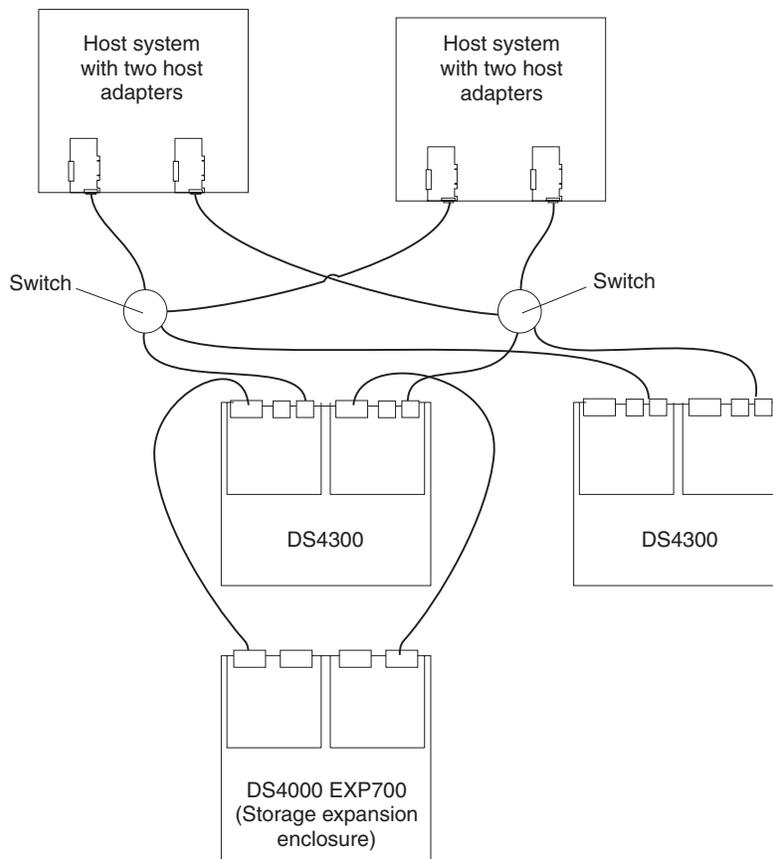


Figure 23. Example of a dual-SAN fabric zone configuration (Model 60U/60X)

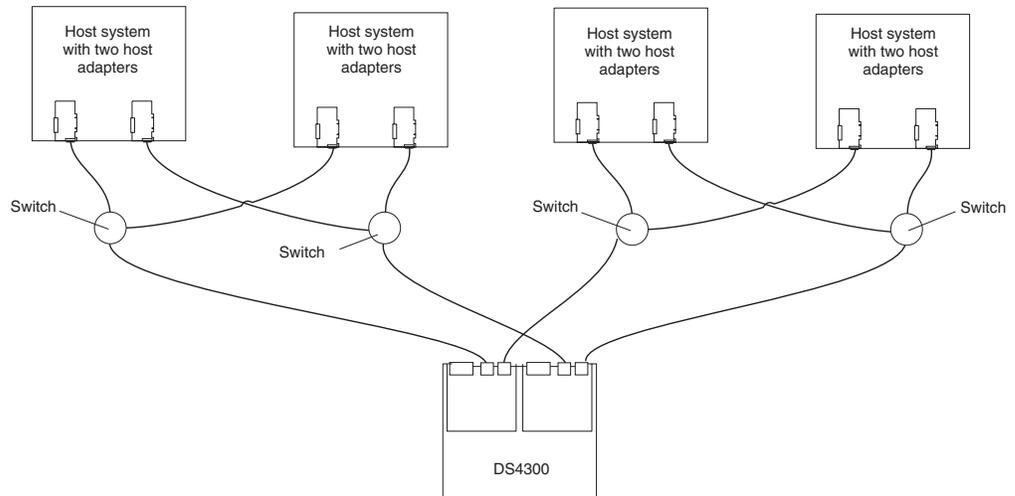


Figure 24. Example of a two-cluster configuration (Model 60U/60X)

DS4300 single-controller storage server (Model 6LU/6LX) configurations: This section includes the following examples of DS4300 single-controller storage server (Model 6LU/6LX) configurations:

- Single server configuration with one adapter (Figure 25)
- Single server configuration with two adapters (Figure 26 on page 30)
- Dual-server configuration with one adapter on each server (Figure 27 on page 30)
- Dual-server, single-SAN fabric zone configuration with one adapter on each server (Figure 28 on page 31)
- Dual-server, dual-SAN fabric zone configuration with two adapters per server (Figure 29 on page 31)

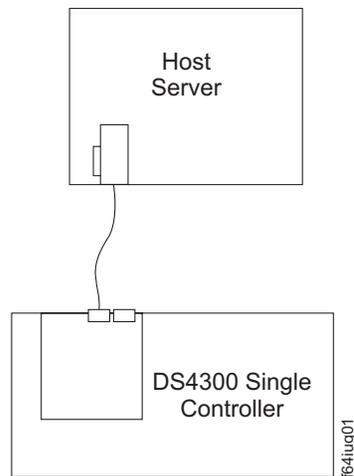


Figure 25. Example of a single server configuration with one adapter (Model 6LU/6LX)

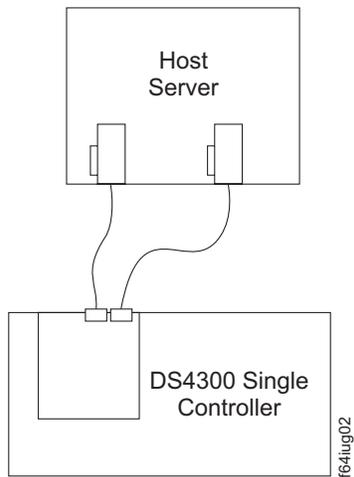


Figure 26. Example of a single server configuration with two adapters (Model 6LU/6LX)

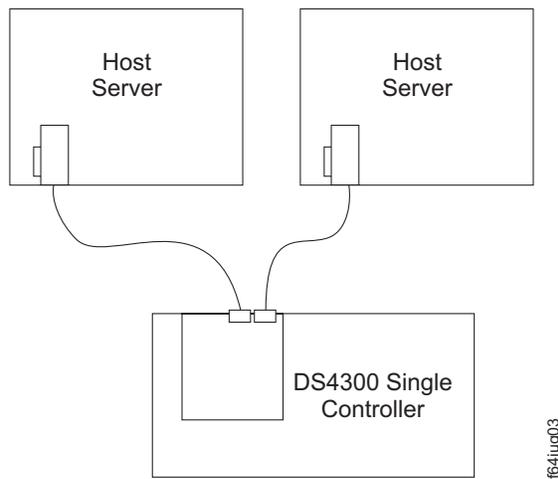


Figure 27. Example of a dual-server configuration with one adapter on each server (Model 6LU/6LX)

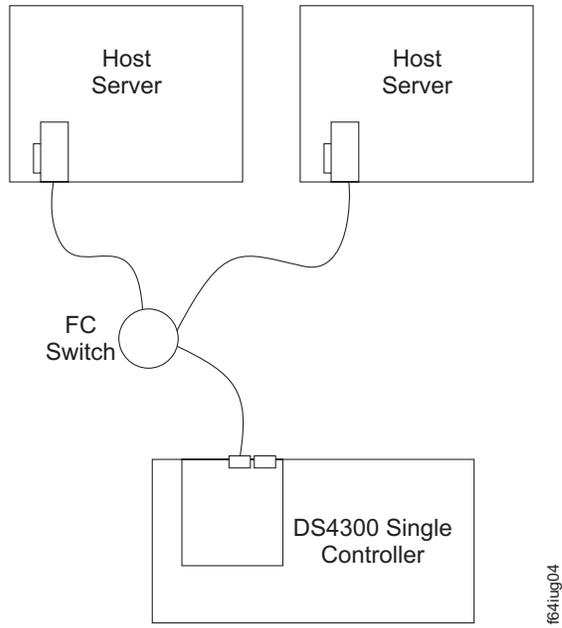


Figure 28. Example of a dual-server, single-SAN fabric zone configuration with one adapter on each server (Model 6LU/6LX)

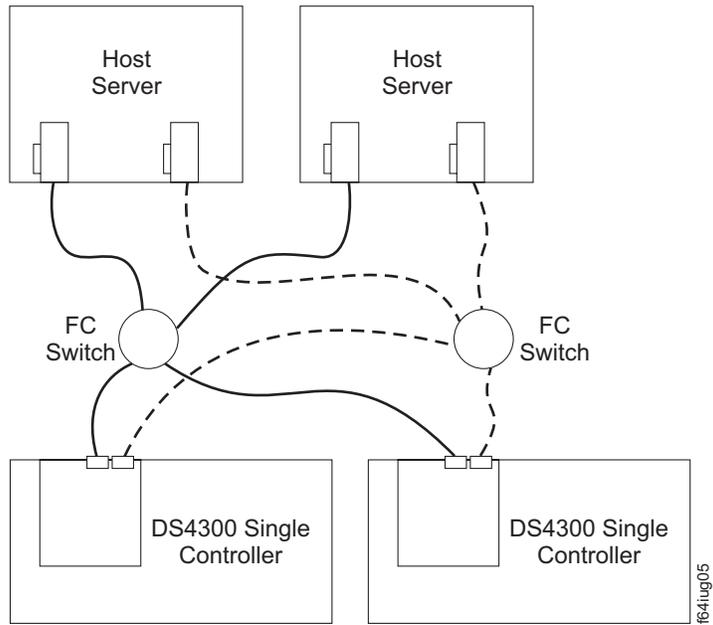


Figure 29. Example of a dual-server, dual-SAN fabric zone configuration with two adapters per server (Model 6LU/6LX)

Installing the storage subsystem configuration

Using the information gathered in the previous sections, install the host systems and host adapters.

Notes:

1. See the documentation provided with your host adapters for installation requirements and procedures.
2. Use the correct host adapter driver. For the latest supported host adapters and drivers, go to the following Web site:
www.pc.ibm.com/support

Attach fiber-optic interface cables to each host adapter. You will connect the other end of the cables to the controller later in the installation process. For more information about handling fiber-optic cables, see “Installing fiber-optic cables” on page 37.

Note: Do not install the storage-management software at this time, if it is not already installed. Install the storage server completely before you install the software because you cannot test the software installation until the hardware is connected.

Chapter 3. Cabling the storage server

This chapter provides Fibre Channel and power cabling information for the storage server.

After you attach the storage server power cables, use the instructions that are provided in “Turning the storage server on and off” on page 45 for the initial startup of the storage server.

Working with SFPs and fiber-optic cables

Each RAID controller CRU contains ports for SFP modules that connect to the fiber-optic cables. Two of the SFP ports are for host server attachment. On the DS4300 Model 60U/60X, each RAID controller also has an additional port that connects DS4000 EXP storage expansion enclosures to the storage server.

First, insert the SFP into the port, and then insert a fiber-optic cable into the SFP. The other end of the fiber-optic cable connects to an external device. Note that SFPs are laser products.

Statement 3



CAUTION:

When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.



Danger

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Handling fiber-optic cables

Before using fiber-optic cables, read the following precautions.

Attention: To avoid damage to the fiber-optic cables, follow these guidelines:

- Do not route the cable along a folding cable-management arm.
- When attaching to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius of less than 38 mm (1.5 in.) when extended or become pinched when retracted.

- Route the cable away from places where it can be snagged by other devices in the rack.
- Do not overtighten the cable straps or bend the cables to a radius of less than 38 mm (1.5 in.).
- Do not put excess weight on the cable at the connection point. Be sure that the cable is well supported.

Installing SFP modules

The DS4300 Storage Server host ports require SFP Modules. SFP modules are used to convert electrical signals to optical signals that are required for Fibre Channel transmission to and from RAID controllers. The DS4300 Storage Server supports two types of SFP modules; one with a plastic pull-tab latch and one with a metal or plastic wire latch. After you install the SFP modules, you will use fiber-optic cables to connect the DS4300 Storage Server to other Fibre Channel devices.

Before you install SFP modules and fiber-optic cables, read the following information:

- The SFP module housing has an integral guide key designed to prevent you from inserting the SFP module improperly.
- Use minimal pressure when you insert the SFP module into a port. Forcing the SFP module into a port could cause damage to the SFP module or the port.
- You can insert or remove the SFP module while the port is powered on.
- The operational loop performance is not affected when you install or remove an SFP module.
- You must insert the SFP module into a port before you connect the fiber-optic cable.
- You must remove the fiber-optic cable from the SFP module before you remove the SFP module from the port. See “Removing SFP modules” on page 36 for more information.
- Do not mix long-wave SFPs and short-wave SFPs on a single storage server. Use either long-wave SFPs or short-wave SFPs. You can use the DS4000 Storage Manager client to view the Storage Subsystem Profile in order to verify that you are not mixing long-wave and short-wave SFPs.

To install an SFP module, complete the following steps.

Statement 3:



CAUTION:

When laser products (such as CD-ROMs, DVD drives, fiber-optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.



DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 7.

1. Remove the SFP module from its static-protective package.
2. Remove the protective cap from the SFP module, as shown in Figure 30. Save the protective cap for future use.

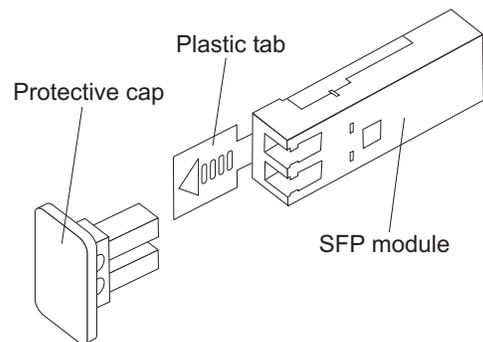


Figure 30. SFP Module

3. Remove the protective cap from the host port. Save the protective cap for future use.
4. Insert the SFP module into the host port until it clicks into place. See Figure 31 on page 36.

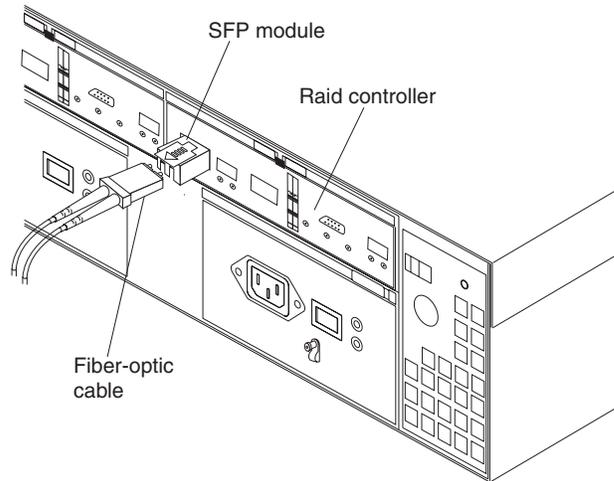


Figure 31. Installing an SFP module into the host port

5. Connect a Fibre Channel cable.

Removing SFP modules

To remove the SFP module from the host port, perform the following steps.

Attention: To avoid damage to the cable or the SFP module, make sure you unplug the LC-LC Fibre Channel cable *before* you remove the SFP module.

1. Remove the LC-LC Fibre Channel cable from the SFP module. For more information, see “Handling fiber-optic cables” on page 33.
2. Unlock the SFP module latch:
 - For SFP modules containing plastic tabs, unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in Figure 32.

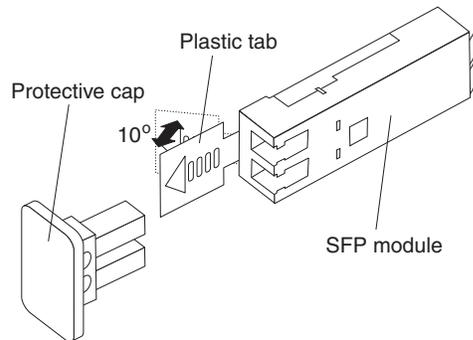


Figure 32. Unlocking the SFP module latch - plastic variety

- For SFP modules containing wire tabs, unlock the SFP module latch by pulling the wire latch outward 90°, as shown in Figure 33 on page 37.

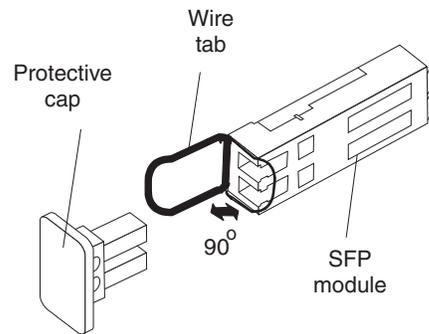


Figure 33. Unlocking the SFP module latch - wire variety

3. With the SFP latch in the unlocked position, extract the SFP module.
 - For SFP modules containing plastic tabs, slide the SFP module out of the port.
 - For SFP modules containing wire tabs, grasp the wire latch and pull the SFP module out of the minihub port.
4. Replace the protective cap on the SFP module.
5. Place the SFP module into a static-protective package.
6. Replace the protective cap on the port.

Installing fiber-optic cables

To connect the fiber-optic cables, perform the following steps.

1. Remove the protective cap from the fiber-optic cable. See Figure 34.

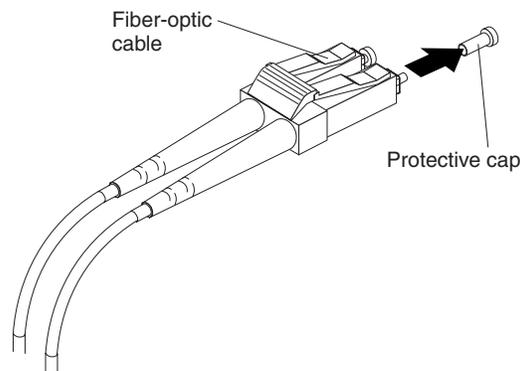


Figure 34. Removing caps from fiber-optic cables

2. Connect the fiber-optic cable to the installed SFP, as shown in Figure 35 on page 38.

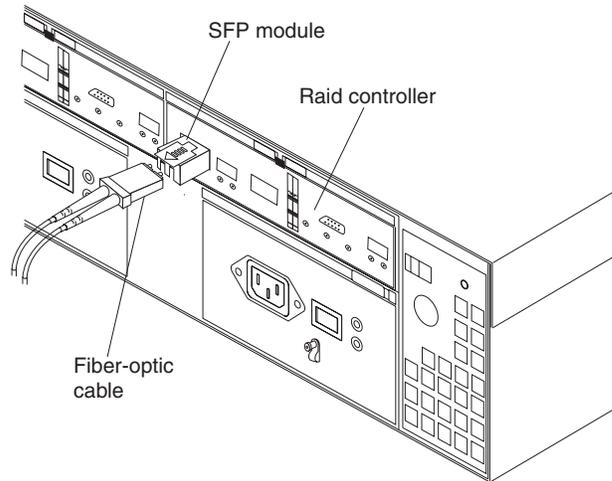


Figure 35. Connecting cables to the installed SFP

3. Check the LEDs on the RAID controller. When the RAID controller is operating properly, the amber Fault LED is off. For information about the status of the RAID controller LEDs, see Table 12 on page 53.
4. To remove the fiber-optic cables, gently pull the fiber-optic cable from the SFP; then replace the protective caps.

Connecting hosts to the RAID controllers

Complete the procedure that is appropriate for your storage server:

- “Steps for connecting hosts to a DS4300 dual-controller storage server (Model 60U/60X)”
- “Steps for connecting hosts to a DS4300 single-controller storage server (Model 6LU/6LX)” on page 39

Steps for connecting hosts to a DS4300 dual-controller storage server (Model 60U/60X)

To connect a host adapter to a DS4300 dual-controller storage server (Model 60U/60X), complete the following steps:

1. Install an SFP in a host port on the RAID controller.
2. Connect the host-system Fibre Channel cables between the RAID controller host ports and the HBA ports or Fibre Channel switch ports. Figure 36 on page 39 shows the location on the RAID controllers where the host-system cables connect.

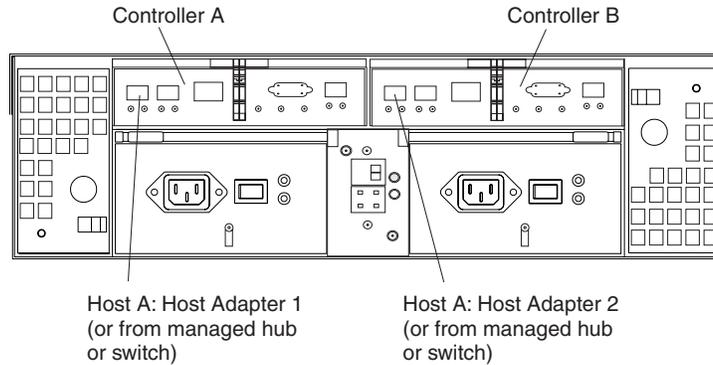


Figure 36. Location of host cables (Model 60U/60X)

For examples of redundant, partially redundant, and nonredundant host and drive loop configurations, see “Fibre Channel loop configurations” on page 26.

Steps for connecting hosts to a DS4300 single-controller storage server (Model 6LU/6LX)

To connect a host adapter to a DS4300 single-controller storage server (Model 6LU/6LX), complete the following steps:

1. Install an SFP into a host port on the RAID controller.
2. Connect the host-system Fibre Channel cables between the RAID controller host ports and the HBA ports or Fibre Channel switch ports. Figure 37 shows the location on the RAID controller where the host-system Fibre Channel cables connect.

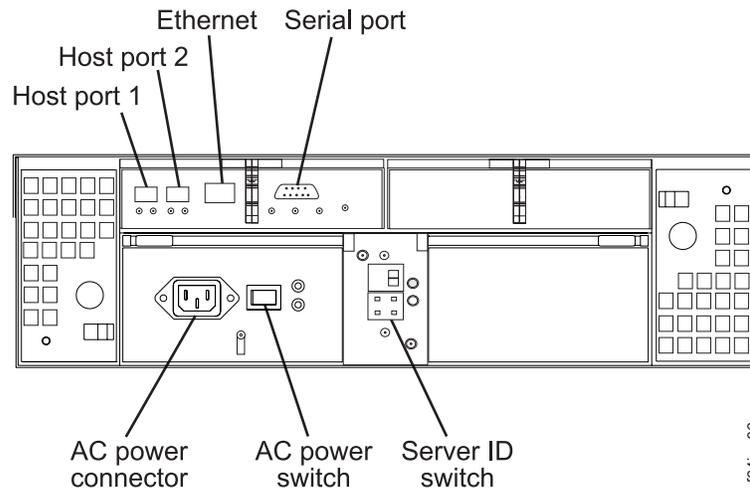


Figure 37. Location of host cables (Model 6LU/6LX)

Connecting secondary interface cables

Use the Ethernet interface ports on the back of the storage server to connect the controllers for direct management of the storage subsystems.

DS4300 single-controller storage server (Model 6LU/6LX)

Connect an Ethernet cable from the storage-management station to the Ethernet port of the controller.

DS4300 dual-controller storage server (Model 60U/60X)

Connect a pair of Ethernet cables from the storage-management station to the Ethernet ports for Controller A (located on the left) and Controller B (located on the right) on the back of the storage server. Figure 38 shows the location of the ports.

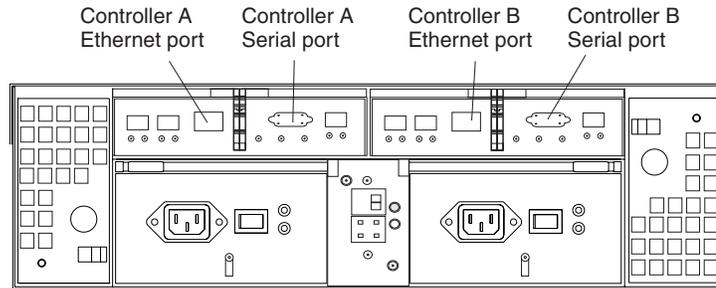


Figure 38. Ethernet and serial port locations

Important: The serial interface ports are intended to be used by service technicians to perform diagnostic operations on the storage server. Inappropriate use will result in loss of system availability, loss of data, or both.

Power cabling

The DS4300 dual-controller storage server (Model 60U/60X) uses two standard power cords, and the single-controller storage server (Model 6LU/6LX) uses only one.

You can connect the power cords to a primary power unit inside the rack, such as a properly grounded ac distribution unit, or to an external source, such as a properly grounded electrical outlet.

If you have not already done so, attach the power cords, using the following illustration for the location of the component parts.

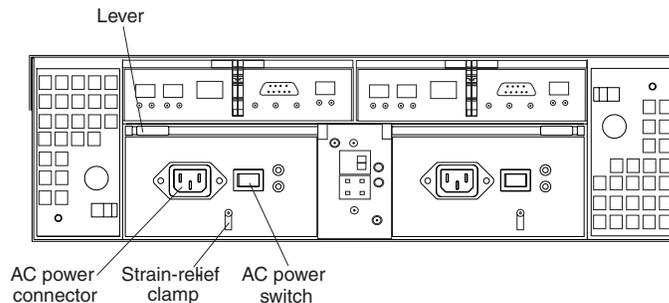


Figure 39. Power cord locations

Complete the following steps to attach the power cords.

1. Wrap the strain-relief clamp around the power cord approximately 20 cm (8 in.) from the power supply connection end.
2. Attach the power-supply nut, and tighten it securely.
3. Connect the power cord to the power supply.
4. Plug the power cord into a properly grounded electrical outlet.

Note: To maintain power redundancy on the DS4300 dual-controller storage server (Model 60U/60X), plug the storage server's right and the left power supplies into two independent external power circuits through ac distribution units inside a rack cabinet or directly into external receptacles. Similarly, the right and left power supplies of the DS4000 storage expansion enclosures attached to the DS4300 storage server should be plugged into the same two independent external power circuits as the DS4300 storage server. See Figure 40 for an example of redundant power cabling.

Exception: The DS4300 single-controller storage server (Model 6LU/6LX) has only one power supply, so it does not support power redundancy.

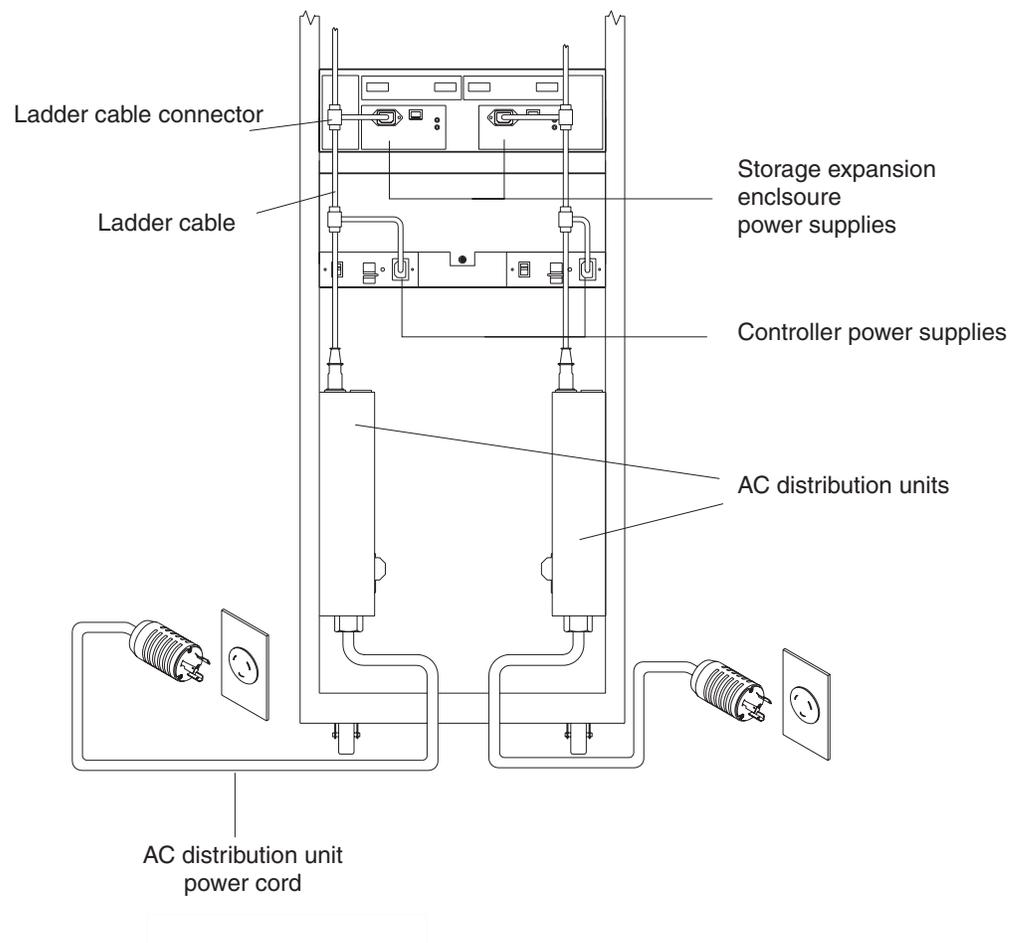


Figure 40. Redundant ac power connections to controllers and storage expansion enclosures

For details about power requirements, see “Operating specifications” on page 13.

5. Go to “Turning the storage server on and off” on page 45 for the initial startup of the storage server.

Installing the storage-management software

Install the storage-management software by using the procedures in the *IBM DS4000 Storage Manager Installation and Support Guide* for your operating system. Use that document and the online help to configure the logical drives, partitions, and so on for the RAID controllers. Use your operating system documentation to make the new logical drives accessible to the operating system.

Note: Make sure that you start the storage-management software to continuously monitor the status of the storage server. For information about the importance of this information, see “Monitoring status through software” on page 50.

Connecting additional storage expansion enclosures

After you install the DS4300 dual-controller storage server (Model 60U/60X), you can connect DS4000 EXP storage expansion enclosures

Note: You cannot connect storage expansion enclosures to the DS4300 single-controller storage server (Model 6LU/6LX). If you are using the DS4300 single-controller storage server, skip this section.

You can connect storage expansion enclosures any time after you install the storage server, even while it is turned on and processing data. You can even install one storage expansion enclosure now and an additional storage expansion enclosure later.

Note: The standard DS4300 dual-controller storage server (Model 60U/60X) supports up to three DS4000 EXP storage expansion enclosures. (For EXP700 storage expansion enclosures, you must also purchase the appropriate EXP700 storage expansion enclosure attachment options, as shown in Table 8 on page 4.)

Note: If you want to connect up to seven storage expansion enclosures, you must purchase the Turbo option. Contact your IBM resellers or marketing representatives for more information.

Attention: You can add only *new* storage expansion enclosures to the storage server. This means that there must be no existing configuration information on the storage expansion enclosure that you want to install. If the storage expansion enclosure that you want to install currently contains logical drives or configured hot spares, and you want them to be part of the DS4300 storage server, you must contact IBM for information. Improper drive migration might cause loss of configuration and other storage server problems.

To connect an additional storage expansion enclosure, perform the following steps.

Note: The following procedure is for “cold-case” (the DS4300 storage server is powered down when storage expansion enclosures are connected).

1. Follow the instructions in your storage expansion enclosure installation manual to set up and mount the new storage expansion enclosure.
2. Use the following procedure and Figure 41 to connect a single storage expansion enclosure to the storage server:
 - a. Ensure that the Enclosure ID switch is set to a value different from the one set for the DS4300 server and other storage expansion enclosures in the loop. Also, ensure that the link speeds of the storage expansion enclosures are set to 2 Gb.
 - b. Use a fiber-optic cable to connect to the FC-Expansion Units port on the left RAID controller in the storage server to the In port on the left ESM board of the storage expansion enclosure.
 - c. Use a second fiber-optic cable to connect the FC-Expansion Units port on the right RAID controller in the storage server to the Out port on the right ESM board of the storage expansion enclosure.

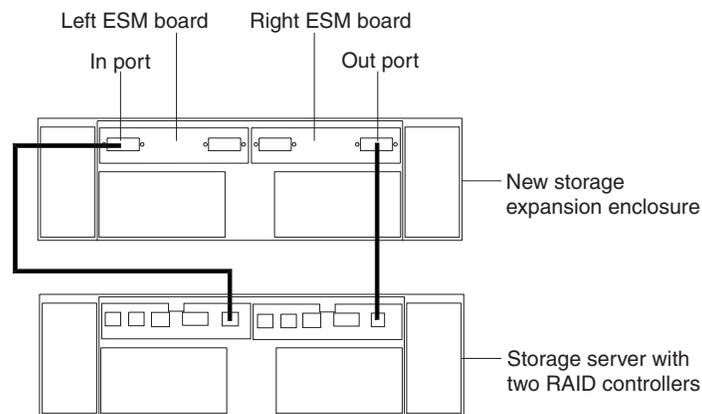


Figure 41. Adding a storage expansion enclosure

3. Remove the blank filler trays and insert drive trays. Connect power to the storage expansion enclosure first, then connect power to the DS4300 storage server. After the storage server is powered-on, the storage server locates the new drives.
4. Use the storage-management software to check the status of the new drives, correct any errors found, and configure the new drives.

Use the following procedure and Figure 42 on page 44 to connect a second storage expansion enclosure to the storage server after previously adding the first storage expansion enclosure:

1. Turn off the DS4300 storage server first, and then turn off the attached DS4000 EXP storage expansion enclosure. (See “Turning the storage server on and off” on page 45 for the correct procedure.)
2. Ensure that the enclosure ID switch is set to a value different from one set for the DS4300 server and other storage expansion enclosures in the loop. Also, ensure that the link speeds of the storage expansion enclosures are set to 2 Gb.
3. Disconnect cable **1** from its current connection and connect it to the In port on the left ESM board on the new storage expansion enclosure.
4. Connect cable **2** to the In port you disconnected in step 1 and the Out port on the left ESM board on the new storage expansion enclosure.

- Connect a third cable **3** to the In port on the right ESM board on the first storage expansion enclosure and the Out port on the right ESM board on the new storage expansion enclosure.

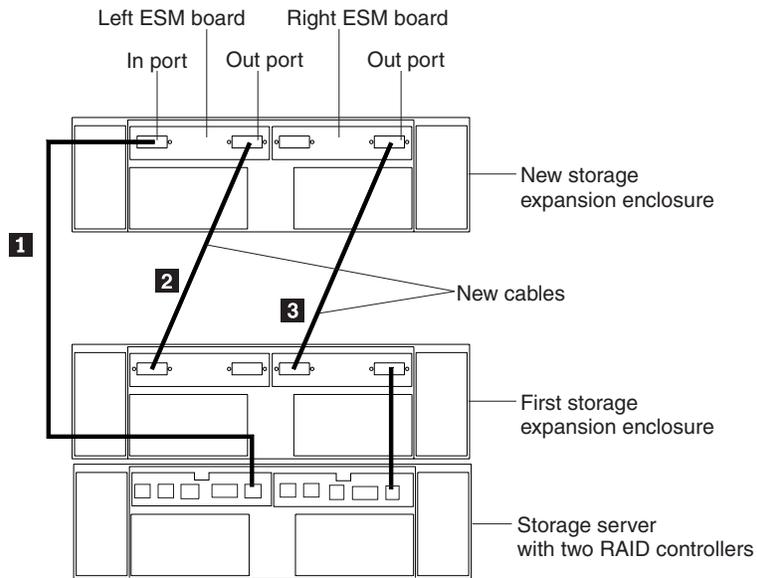


Figure 42. Adding a second storage expansion enclosure

- If you are connecting additional storage expansion enclosures, repeat step 3 through step 5 for each additional storage expansion enclosure.
- Remove the blank filler trays and insert drive trays. Connect power to the storage expansion enclosures first, then connect power to the DS4300 storage server. After the storage server is powered-on, the storage server locates the new drives.
- Use the storage-management software to check the status of the new drives, correct any errors found, and configure the new drives.

For additional information about how to cable the storage server and storage expansion enclosures, see the DS4300 Fibre Channel Cabling Instructions that come with the storage server.

Chapter 4. Operating the storage server

To ensure optimal operation of your system, always follow these best practices guidelines:

- Periodically, perform a full backup of the data on your storage drives.
- Before any planned system shutdown or after any system changes (additions, removals, or modifications), save controller subsystem profiles as explained in the Storage Manager guide for your operating system.
- Ensure that your system is in an optimal state before shutting down. Never turn the power off if any fault light is lit; be sure to resolve any error conditions before you shut down the system.
- During any maintenance or attended power-up procedure, carefully follow the power-up sequence listed in “Turning on the storage server” on page 46. Each component of the subsystem should be checked that it is powered-on in the proper order during this entire power-up procedure to ensure the controller will be able to optimally access all of your storage subsystems.
- The storage subsystem supports simultaneous power-up to the system components; however, you should always follow the power-up sequence listed in “Turning on the storage server” on page 46 during any attended power-up procedure.
- A storage system in an optimal state should recover automatically from an unexpected shutdown and unattended simultaneous restoration of power to system components. After power is restored, call IBM support if any of the following conditions occur:
 - The storage subsystem logical drives and arrays are not displayed in the Storage Manager client.
 - The storage subsystem logical drives and arrays do not come online.
 - The storage subsystem logical drives and arrays seem to be degraded.
- Using the DS4000 Storage Manager client, save the DS4000 subsystem configuration profile to a disk that is not affected every time you make changes to the DS4000 subsystem configuration (such as logical drive creation or modification, or storage partitioning changes).
- **DS4300 models 60U/60X only:** To maintain power redundancy, plug the DS4300 storage server’s right and left power supplies into two independent external power circuits through ac distribution units inside a rack cabinet or directly into external receptacles. Similarly, the right and left power supplies of the DS4000 storage expansion enclosures attached to the DS4300 storage server should be plugged into the same two independent external power circuits as the DS4300 storage server. This ensures that the DS4300 storage server and all its attached storage expansion enclosures will have power if only one power circuit is available. In addition, having all the right or all the left power supplies plug into the same power circuit will enable the components in the storage subsystem to power on simultaneously during an unattended restoration of power. See Figure 40 on page 41 for an example of redundant power connections.

Turning the storage server on and off

This section contains instructions for turning the storage server on and off under normal and emergency situations.

If you are turning on the storage server after an emergency shutdown or power outage, see “Restoring power after an emergency shutdown” on page 49.

Turning on the storage server

Important: You must turn on the storage expansion enclosures and verify that the storage expansion enclosures' FC connections are optimal by checking the indicator lights *before* you turn on the DS4300 storage server. The controllers might not recognize the correct configuration if the hard disk drives are powered up after the DS4300 storage server. For instructions on powering up the storage expansion enclosures, refer to the storage expansion enclosure documentation.

Note: Always wait at least 30 seconds between the time you turn off a power switch and the time you turn on the power again.

Use this procedure to turn on the power for the initial startup of the storage server:

1. Verify that:
 - a. All communication and power cables are plugged into the back of the storage server and a properly grounded ac electrical outlet
 - b. All hard disk drives are locked securely in place. For more information, see "Installing hot-swap drives" on page 75.

Note: At least one drive must be present before you start the DS4300 storage server.

Attention: If you are restarting the system after a normal shutdown, wait at least 10 seconds before you turn on the power by using the power-on sequence in step 2.

2. Check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:
 - a. Turn on the power to the supporting devices (for example, Ethernet switches and management stations) before the storage server.

Attention: If you will be directly managing the storage array, you must set up the Dynamic Host Configuration Protocol (DHCP) or BOOT-P server before turning on the power. Setting up the server allows the controllers to obtain the corresponding IP address when you turn on the power to the array module. For more information, see the software installation guide for your operating system.

- b. You must turn on the storage expansion enclosures before the storage server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on powering up the storage expansion enclosures, see the storage expansion enclosure documentation.
 - c. Turn on the power to the storage server; then restart or turn on the power to the host.

Note: Depending on your operating system, you might not have to restart the host. For more information, see the software installation guide for your operating system.

3. Turn on the power to each device, based on the power-on sequence in step 2. To turn on power to the storage server, turn on the power-supply switches on the back of the storage server. You must turn on both power-supply switches to take advantage of the redundant power supplies.
4. Use the storage-management software and the Fault LEDs to check the overall status of the storage server and its components. All LEDs should be green on

the front of the storage server. If they are not, use the storage-management software to diagnose the problem (see “Monitoring status through software” on page 50).

Note: The green Drive active LED and amber Drive fault LED below the drive CRUs might flash intermittently as the drives spin-up. Wait until the storage server is finished powering up before checking the LEDs on the front of the storage server. For more information, see “Checking the LEDs” on page 51.

Turning off the storage server

Attention: Except in an emergency, never turn off the power if any storage server Fault LEDs are on. Correct the fault before you turn off the power. Use the storage-management software and the Fault LEDs to check the overall status of the storage server and its components. All LEDs should be green on the front of the storage server. If they are not, use the storage-management software to diagnose the problem (see “Monitoring status through software” on page 50). This ensures that the storage server will power up correctly later. For more information, see “Troubleshooting” on page 100.

The storage server is designed to run continuously, 24 hours a day. After you turn on the storage server, do not turn it off. Turn off the power only when:

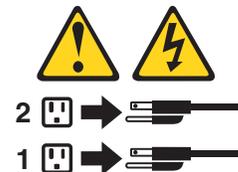
- Instructions in a hardware or software procedure require you to turn off the power.
- A service technician tells you to turn off the power.
- A power outage or emergency situation occurs (see “Performing an emergency shutdown” on page 49).

Statement 5



CAUTION:

The power control button on the device and the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Use this procedure to turn off the power:

1. Before proceeding, use the storage-management software to determine the status of the system components and special instructions. The operating system software might require you to perform other procedures before you turn off the power.
2. Use the storage-management software to check the status of the storage server. Correct problems that are reported before you turn off the power.
3. Perform the following steps:

- a. Stop all I/O activity to the storage server and attached storage expansion enclosures. Make sure that:
 - All of the green Drive active LEDs on the front of the storage server (and on all attached storage expansion enclosures) are not flashing.
 - The green Cache active LEDs on the back of the storage server are off.
- b. Before the storage server is powered off, use the operating system software to either disconnect the storage server logical drives from the host or to flush the logical drive data cache in the host server memory.

Attention: To turn off all power to the storage server, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 4 for the proper shutdown sequence.

4. Turn off the power to each device based on the following shutdown sequence:
 - a. Turn off power to the host before the storage server. If the host must stay powered on to support an existing network, see the operating system documentation for information about disconnecting the storage server logical drives from the host before the storage server is powered off.
 - b. Turn off power to the storage server before you turn off power to the storage expansion enclosures. Turn off both power supply switches on the back of the storage server.
 - c. Turn off power to other supporting devices (for example, management stations, fibre-channel switches, or Ethernet switches).

Note: You do not need to perform this step if you are servicing only the storage server.

5. After you perform the necessary maintenance procedures, turn on the power using the procedure in “Turning on the storage server” on page 46.

Restoring power after an unexpected shutdown

The storage server might shut down unexpectedly under any of the following conditions:

Attention: There might be data loss in each of the following cases:

- The internal temperature of the storage server exceeds the maximum operating temperature (an over-temperature condition).

If both fan CRUs fail or are unable to maintain an internal temperature below 70°C (158°F), one or both of the power supplies in the storage server will shut down. If both power supplies shut down, the unit is inoperable.

The storage-management software warns you if the temperature of the unit is rising, before it has risen sufficiently to shut down the power supplies. The first warning comes when the storage server internal temperature exceeds 45°C (113°F). The storage server shuts down if the temperature rises to 70°C (158°F).

- There is a general power failure or a loss of power to the unit.
- You are forced to shut down the storage server without performing the normal shutdown procedures (listed in “Turning off the storage server” on page 47) because of an emergency situation.

Attention: To avoid damage to the hardware, take special care when restarting the system after an unexpected shutdown.

If the storage server shuts down unexpectedly, go to “Restoring power after an over-temperature shutdown.” Otherwise, go to “Restoring power after an emergency shutdown.”

Note: Unattended restoration of power is supported; however, if power restoration is attended, you should follow the best practices guidelines and the power restoration sequence in “Turning on the storage server” on page 46.

Performing an emergency shutdown

Attention: Emergency situations might include fire, flood, extreme weather conditions, or other hazardous circumstances. If a power outage or emergency situation occurs, always turn off all power switches on all computing equipment. This will help safeguard your equipment from potential damage due to electrical surges when power is restored. If the storage server loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Troubleshooting” on page 100).

Use this procedure to shut down the storage server during an emergency:

1. If you have time, stop all I/O activity to the storage server by shutting down the host or disconnecting the storage server logical drives through the host.
2. Check the LEDs (front and back). Make note of any Fault LEDs that are on so you can correct the problem when you turn on the power again.
3. Turn off all power-supply switches; then unplug the power cords from the storage server.

Restoring power after an emergency shutdown

Use this procedure to restart the storage server if you turned off the power-supply switches during an emergency shutdown, or if a power failure or a power outage occurred:

1. After the emergency situation is over or power is restored, check the storage server for damage. If there is no visible damage, continue with step 2; otherwise, have your system serviced.
2. After you have checked for damage, ensure that the power-supply switches are off; then plug in the storage-server power cords.
3. Complete step 2 on page 46 to determine the proper power-on sequence for your system.
4. Complete steps 3 and 4 on page 46 to turn on power to the devices in your system and to check the status of the storage server.

Restoring power after an over-temperature shutdown

Use this procedure to restart the storage server after an unexpected shutdown due to an over-temperature condition:

1. Make sure that the power-supply switches on the back of the storage server are turned off.
2. Do whatever is necessary to cool the unit (replace the fans, use external fans to cool the room, and so on).
3. Check all components and cables for visible damage. *Do not start the storage server if you find evidence of damage.*
4. Complete step 2 on page 46 to determine the proper power-on sequence for your system.

5. When the internal temperature of the storage server is below 35°C (95°F), complete steps 3 and 4 on page 46 to turn on power to the devices in your system and to check the status of the storage server.

Monitoring status through software

Use the storage-management software to monitor the status of the storage server. Run the software constantly, and check it frequently.

Notes:

1. You can only monitor storage servers that are within the management domain of the storage-management software.
2. If you do not install the Event Monitor service as part of the storage-management software installation, the Enterprise Management window of the storage-management software must remain open. (If you close the window, you will not receive any alert notifications from the managed storage subsystems.)

For more information, see the Enterprise Management online Help.

The storage-management software provides the best way to diagnose and repair storage-server failures. The software can help you:

- Determine the nature of the failure
- Locate the failed component
- Determine the recovery procedures to repair the failure

Although the storage server has fault LEDs, these lights do not necessarily indicate which component has failed or needs to be replaced, or which type of recovery procedure you must perform. In some cases (such as loss of redundancy in various components), the fault LED does not turn on. Only the storage-management software can detect the failure.

For example, the recovery procedure for an IBM Predictive Failure Analysis® (PFA) flag (impending drive failure) on a drive varies depending on the drive status (hot spare, unassigned, RAID level, current logical drive status, and so on). Depending on the circumstances, a PFA flag on a drive can indicate a high risk of data loss (if the drive is in a RAID 0 volume) or a minimal risk (if the drive is unassigned). Only the storage-management software can identify the risk level and provide the necessary recovery procedures.

Note: For PFA flags, the General-system-error LED and Drive fault LEDs do not turn on, so checking the LEDs will not notify you of the failure, even if the risk of data loss is high.

Recovering from a storage-server failure might require you to perform procedures other than replacing the component (such as backing up the logical drive or failing a drive before removing it). The storage-management software gives these procedures.

Attention: Not following the software-recovery procedures can result in data loss.

Firmware updates

In order to ensure the optimal operation of the DS4300 storage server and its attached storage expansion enclosures, the storage expansion enclosure ESM firmware, the DS4300 storage server controller firmware, the hard drive firmware, and the NVSRAM (for controllers only) must be up to date. Go to the following Web site to get the latest updates.

<http://www-1.ibm.com/servers/storage/support/disk/>

Apply the necessary updates before configuring the DS4300 arrays and logical drives. Subscribe to My Support for automatic notifications of firmware or storage manager software updates or any important information about your DS4000 subsystems (see “Product updates” on page 1).

Attention: Read the Readme file that is included in each firmware or DS4000 Storage Manager software package for any limitations, subsystem firmware prerequisites, or download-sequence information. For example, the controller firmware code might require the storage expansion enclosure ESM firmware to be upgraded first to a particular version, or the controller firmware download might require the halting of I/Os to the DS4300 storage server’s logical drives. Failure to observe the limitations, prerequisites, and dependencies in the Readme file might result in a loss of data access.

Checking the LEDs

The LEDs display the status of the storage server and components. Green LEDs indicate a normal operating status; amber LEDs indicate a possible failure.

It is important to check all the LEDs on the front and back of the storage server when you turn on the power. In addition to checking for faults, you can use the LEDs on the front of the storage server to determine if the drives are responding to I/O transmissions from the host.

For information about the LEDs on the front of the storage server, see:

- Figure 43 on page 52
- Table 11 on page 52

For information about the LEDs on the back of the storage server, see:

- Figure 45 on page 54
- Table 12 on page 53
- Table 13 on page 55

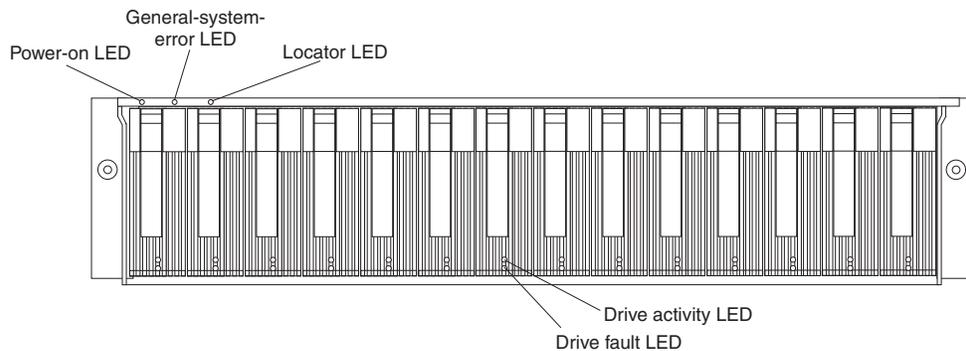


Figure 43. Storage server LEDs (front)

Table 11. Storage server LEDs (front)

LED	Color	Operating states ¹
Drive active	Green	<ul style="list-style-type: none"> • On - Normal operation. • Flashing - The drive is reading or writing data. • Flashing every 5 seconds - The drive has not spun up or the drive is bad. • Off - One of the following situations has occurred: <ul style="list-style-type: none"> – The storage server has no power. – The drive is not properly seated in the storage server.
Drive fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • Flashing - The storage-management software is locating a drive, logical drive, or storage subsystem. • On - The drive has failed, or a user failed the drive.
Power	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off - One of the following situations has occurred: <ul style="list-style-type: none"> – The storage server has no power. – Both power supplies have failed. – There is an over-temperature condition.
General system error	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On - A storage server component has failed².
Locator	Blue	<ul style="list-style-type: none"> • On - When on, this blue LED indicates that the user had initiated a storage-management software function to locate the storage server. • Off - Normal operation.

¹ Always use the storage-management software to identify the failure.

² Not all component failures turn on this LED. For more information, see “Monitoring status through software” on page 50.

Figure 44 on page 53 shows the locations of the LEDs on the DS4300 storage server.

Exception: The DS4300 single-controller storage server (models 6LU/6LX) does not have the expansion port and the expansion port bypass LED.

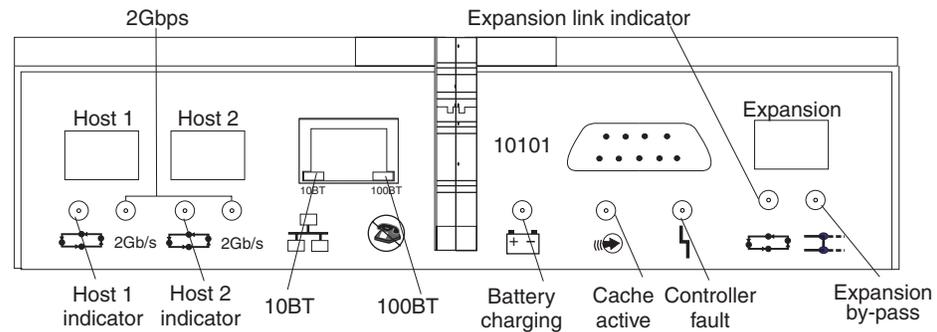


Figure 44. RAID controller LEDs

Table 12. RAID controller LEDs

Icon	LED	Color	Operating states ¹
	Fault	Amber	<ul style="list-style-type: none"> Off - Normal operation. On - One of the following situations has occurred: <ul style="list-style-type: none"> The RAID controller has failed. The RAID controller was placed offline. The controller battery had failed (in conjunction with the battery LED in off state).
	Host loop	Green	<ul style="list-style-type: none"> On - Normal operation. Off - One of the following situations has occurred: <ul style="list-style-type: none"> The host loop is down, not turned on, or not connected. A SFP has failed, or the host port is not occupied. The RAID controller circuitry has failed, or the RAID controller has no power.
	Cache active	Green	<ul style="list-style-type: none"> On - There is data in the RAID controller cache. Off - One of the following situations has occurred: <ul style="list-style-type: none"> There is no data in cache. There are no cache options selected for this array. The cache memory has failed, or the battery has failed.
	Battery	Green	<ul style="list-style-type: none"> On - Normal operation. Flashing - The battery is recharging or performing a self-test. Off - The battery or battery charger has failed.

Table 12. RAID controller LEDs (continued)

Icon	LED	Color	Operating states ¹
	Expansion port bypass (Model 60U/60X only)	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On - One of the following situations has occurred: <ul style="list-style-type: none"> – An SFP module is inserted in the drive loop port and the fibre-channel cable is not attached to it. – The fibre-channel cable is not attached to an storage expansion enclosure. – The attached storage expansion enclosure is not turned on. – An SFP has failed, a fibre-channel cable has failed, or an SFP has failed on the attached storage expansion enclosure.
	Drive expansion loop	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off - The RAID controller circuitry has failed, or the RAID controller has no power.
2Gbps	2Gbps	Green	<ul style="list-style-type: none"> • On - Normal operation (host connection is at 2 Gbps). • Off - Host connection is at 1 Gbps (which is not supported for controller firmware 05.33.xx.xx).
10BT	10BT	Green	<ul style="list-style-type: none"> • If the Ethernet connection is 10BASE-T- The 10BT LED is on, 100BT LED flashes faintly. • If the Ethernet connection is 100BASE-T- 10BT LED is off, 100BT LED is on. • If there is no Ethernet connection - Both LEDs are off.
100BT	100BT		
¹ Always use the storage-management software to identify the failure.			

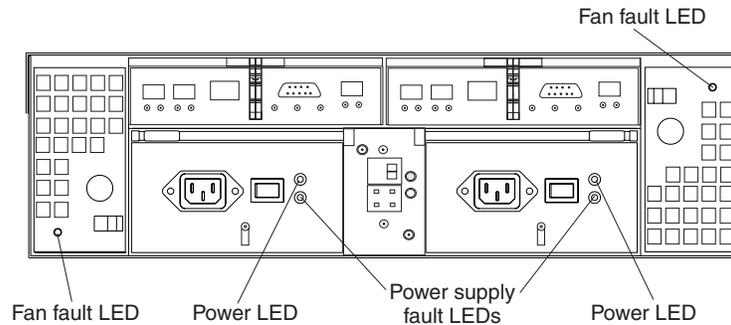


Figure 45. Fan and power supply LEDs

Table 13. Fan LED

LED	Color	Operating states ¹
Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On - The fan CRU has failed.
¹ Always use the storage-management software to identify the failure.		

Table 14. Power supply LEDs

LED	Color	Operating states ¹
Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On - One of the following situations has occurred: <ul style="list-style-type: none"> – The power supply has failed. – An over-temperature condition has occurred.
Power	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off - One of the following situations has occurred: <ul style="list-style-type: none"> – The power supply is disconnected. – The power supply is seated incorrectly. – The storage server has no power. – The power supply is turned off.
¹ Always use the storage-management software to identify the failure.		

Cache memory and RAID controller battery

Each RAID controller in the DS4300 standard storage server contains 128 MB of cache memory. Each controller in the DS4300 Turbo storage server contains 896 MB of cache memory.

Each controller also contains a rechargeable battery that maintains data in the cache for up to three days in the event of a power failure. The following sections describe these features and their associated LEDs.

Cache memory

Cache memory is memory that is used for intermediate storage of read and write data on the DS4300 dual-controller storage server's RAID controllers (Model 60U/60X). Using cache memory can increase system performance. The data for a read operation from the host might be in the cache memory from a previous operation (thus eliminating the need to access the drive itself), and a write operation is completed when data is written to the cache, rather than to the drives.

Note: On the DS4300 single-controller storage server (Model 6LU/6LX), the RAID controller's cache memory is used for storing read data only. The controller firmware ignores a "write-cache enabled" setting. This protects data in the event of a controller failure, which would cause the cache to be inaccessible.

See the storage-management software documentation for information on setting cache memory options.

The RAID controller has a Cache active LED that displays the current status of the cache. The LED is on if there is data in the cache, and it is off if there is no data in the cache.

If caching is enabled and the Cache active LED never comes on during I/O activity, it indicates that the cache memory has failed or the battery has failed (the green Battery LED will be off).

Note: Always use the storage-management software to check your cache memory settings before assuming a hardware failure.

Figure 46 shows the location of the Cache active LED on the front of the RAID controller.

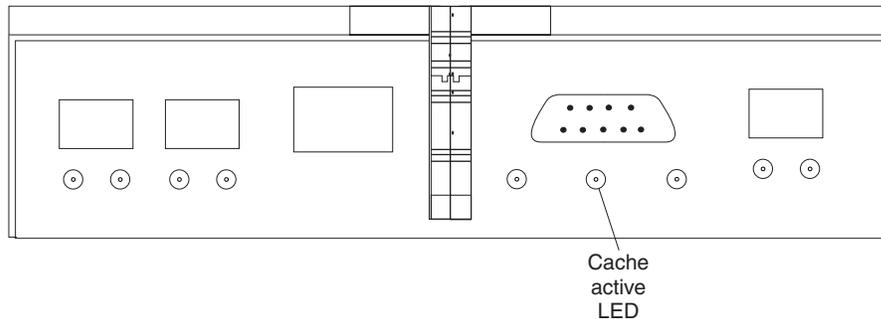


Figure 46. Cache active LED

RAID controller cache battery

Each RAID controller contains a sealed, rechargeable 4-volt lead-acid battery. This battery provides cache backup for up to three days in the event of a power loss.

The service life of the battery is three years, after which time the battery must be replaced. See the storage-management software for information on how to view and set the battery expiration date.

Each RAID controller has a green Battery LED on the back that indicates the battery status, as follows:

- The LED is on and remains steady when the battery is fully charged.
- The LED flashes when the battery is charging or performing a self-test.
- The LED is off if the battery or the battery charger has failed.

The battery performs a self-test at startup and every 25 hours thereafter (during which time the Battery LED flashes). If necessary, the battery begins recharging at that time. If the battery fails the self-test, the Battery LED turns off, indicating a battery fault.

Data caching starts after the battery completes the startup tests.

Figure 47 on page 57 shows the location of the Battery LED on the front of the RAID controller.

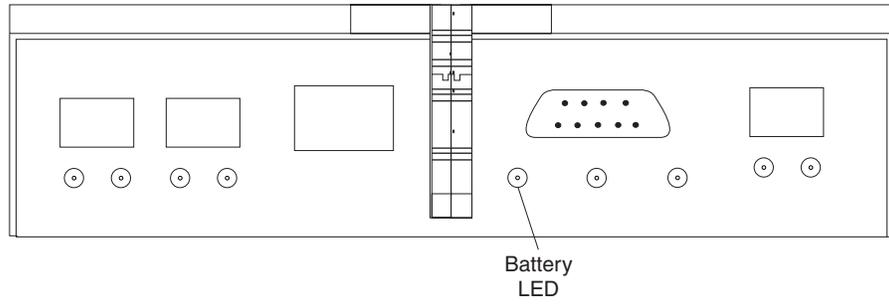


Figure 47. Battery LED

Chapter 5. Installing and replacing components

This chapter provides instructions to help you install or remove customer replaceable units (CRUs), such as hot-swap drives, fans, RAID controllers, and power supplies.

For more field-replaceable unit (FRU) and Option part number information, see the following Web site:

www.ibm.com/storage/techsup.htm

Handling static-sensitive devices

Attention: Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them.

To reduce the possibility of electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the storage server for at least two seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into your storage server without setting it down. If it is necessary to set the device down, place it in its static-protective package. Do not place the device on your storage server cover or any metal surface.
- Take additional care when handling devices during cold weather because heating reduces indoor humidity and increases static electricity.

Upgrading your RAID controllers

This section describes the following upgrades:

- “Upgrading DS4300 Model 6LU/6LX to Model 60U/60X”
- “Upgrading the DS4300 Model 60U/60X from standard to Turbo option” on page 63

Upgrading DS4300 Model 6LU/6LX to Model 60U/60X

To upgrade from the DS4300 single-controller storage server (Model 6LU/6LX) to the DS4300 dual-controller storage server (Model 60U/60X), you must purchase one of the following upgrade kits:

- IBM DS4300 Model 6LU/6LX Upgrade, IBM part number 24P8963
- IBM DS4300 Model 6LU/6LX Turbo Upgrade, IBM part number 24P8964

See “DS4300 Model 6LU/6LX” on page 2 for a description of the differences between the two upgrade kits.

The upgrade kits contain two DS4300 controller CRUs, with cache memory battery installed, and one power supply. You must purchase additional SFPs and Fibre Channel cables separately to make Fibre Channel connections to the host ports on the second DS4300 controller.

Use the following procedure for both upgrade kits.

Steps for upgrading from DS4300 Model 6LU/6LX to Model 60U/60X

Before you begin:

- Schedule downtime for the upgrade.
- If you purchase additional storage capacity at the same time as the controller upgrade kit, do not connect the new drives or storage expansion enclosures to the DS4300 controllers until you complete the following tasks:
 - Finish the upgrade process
 - Verify that the upgraded storage server is in optimal state
- If you have premium features enabled in the existing DS4300 storage server, ensure that you have access to the premium features key files before you begin the upgrade process. You will need to re-enable your premium features during the process.
- Ensure that you have installed the latest version of DS4000 Storage Manager. For more information, see the *IBM DS4000 Storage Manager Installation and Support Guide* for your operating system, or see the following Web site:

www-1.ibm.com/servers/storage/support/disk/

- Use the Storage Manager Client to determine whether the system is in an optimal state. If it is not, fix the problem to return the system to an optimal state before you attempt the upgrade.
- After the new controllers complete the boot process, the WWNN of the DS4300 controllers will change. If you have any applications that rely on the previous WWNNs, such as FC switch zoning definitions, you must update the applications with the new WWNNs.

Complete the following steps to upgrade from DS4300 Model 6LU/6LX to Model 60U/60X, using either the standard or the Turbo option upgrade kit:

1. In the Storage Manager Client, open a management connection to the DS4300 that you are upgrading.
2. Save the storage server profile to a disk location that is *not* in the DS4300 that you are upgrading. In the Subsystem Management window, select **View** → **Storage Subsystem Profile**. When the Storage Subsystem Profile window opens, click **Save As**. The Save Profile window opens. Select an appropriate directory and choose a file name for the profile, then click **Save**.
Click **Close** to close the Storage Subsystem Profile window.
3. Complete any necessary server preparation tasks, because the disks will not be available during the upgrade process. For example, stop all programs, services or processes in the host servers that access the logical drives.

Note: Make sure that you stop any background programs, services or processes that write data to the logical drives. For example, Microsoft MSCS periodically writes to the Quorum disk.

4. Stop I/O to the storage server.
5. Unmount any mapped LUNs from the storage server.

Note: In a Microsoft Windows® environment, remove the drive letter or the mount points of the mapped LUNs instead of unmounting the file systems.

6. If applicable, remove the controller WWNN from the Fibre Channel switch fabric zone definitions or any applications that use this WWNN info.
7. Wait one minute, then turn off the DS4300 storage server that you are upgrading.
8. Label each cable that connects to the existing RAID controller CRU host ports to ensure that all cables will be properly reconnected to the new RAID controller CRU.

Attention: Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 38 mm (1.5 in.).

9. Remove the fibre-channel cables from the SFPs on the RAID controller CRU. (After removing the fibre-channel cables, insert their protective caps.)
10. Remove the DS4300 single controller CRU, as follows:
 - a. Push down on the latch (centered above the RAID controller), then pull both levers at the same time out of the locked position.
 - b. Grasp the pull-rings, then pull on the levers and remove the RAID controller.
11. Unpack and insert the first upgrade DS4300 controller CRU into the left-hand controller slot, which is marked “Controller A.”, as follows:
 - a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.
12. Remove the SFPs from host ports of the DS4300 single-controller CRU and insert them into the host ports of the new DS4300 controller CRU, which you installed in step 11. (Use the instructions in “Removing SFP modules” on page 36 and “Installing SFP modules” on page 34.)
13. Remove the controller CRU blank from the right-hand controller slot, which is marked “Controller B.”
14. Insert the new RAID controller into the slot marked “Controller B.”
15. Unpack the additional SFPs and insert them in the host ports of controller B.
16. Remove the power supply blank from the right-hand power supply slot. Unpack and insert the upgrade power supply CRU into the slot (See “Installing a hot-swap power supply” on page 86 for more information about installing power supplies.)
17. Reconnect the fibre-channel cables to their original host port locations in Controller A, using the instructions in “Installing fiber-optic cables” on page 37. Using the new fibre-channel cables, make the necessary fibre-channel connections to the host ports of controller B.
18. If DHCP/BootP was used to automatically set the IP address of the controller, complete the following steps:
 - a. Record the MAC address of the upgrade controller
 - b. Modify the existing DHCP/BootP record of the RAID controller to be upgraded with the new MAC address

Notes:

- a. Failure to modify the DHCP/BootP record will result in problems trying to manage the storage server using the existing IP address.

- b. You must complete this step before you insert the upgrade controller into the DS4000 storage server. For more information, see the instructions the appropriate *IBM DS4000 Storage Manager version 9.1x Installation and Support Guide*.
 - c. If you have created a DHCP/BootP record for controller A, you must add one for controller B. Otherwise, you might not be able to manage controller B using the Ethernet network.
19. Connect the power cord to the ac connector of the newly-added power supply CRU.
 20. Plug the power cord into a properly grounded electrical outlet.
 21. Turn on the power supply switches. Make sure that the green Power LED on the new power supply CRU is on, and that the amber Fault LED is off.
 - If the Power LED is off, the power-supply CRU might not be installed correctly. Remove it, and then reinstall it.
 - Ensure that the electrical outlet is hot.
 - If the Fault LED is on, or if the Power LED stays off, contact your IBM support representative.

Note: To maintain power redundancy on the DS4300 dual-controller storage server (Model 60U/60X), plug the right and the left power supplies into two independent external power circuits through ac distribution units (inside a rack cabinet or directly into external receptacles).

Similarly, plug the right and left power supplies of any attached DS4000 EXP storage expansion enclosures into the same two independent external power circuits as the DS4300 storage server. See Figure 40 on page 41 for an example of redundant power cabling.

22. Wait a few minutes for the new controllers to complete the boot process.
23. If applicable, update the Fibre Channel switch fabric-zone definitions with the newly generated controller World Wide Node Name (WWNN).

Note: If you have any other applications that rely on the previous DS4300 controller WWNN, then you must also update the applications with the new WWNNs.

24. Using the Storage Manager client, open a management connection to the DS4300 storage server.
25. Verify that the storage server does not have any errors (beside the battery failed/charging error). If there are missing LUNs, configurations, failed fibre-channel hard drives or fibre-channel hard drives that display the “need attention” icon, contact your IBM support representative.
26. Set the enabled premium features back into an enabled and optimal state, using the existing premium features key files for the RAID controller that you removed from the original storage server.

Note: Before you complete this step, the premium features might display as enabled, but they will be “out of compliance.”

27. If this is the Turbo upgrade option, use the Storage Manager Client to verify the firmware and NVSRAM. If the current versions are earlier than the versions that are included on the Turbo Option CD, reload the firmware and NVSRAM to the CD versions. Then, check the IBM Web site for any firmware or NVSRAM updates.

28. Enable full controller redundancy by making appropriate FC connections between controller B's host ports and the HBA ports in the servers that are connected to controller A. You must also install the LUN failover driver in the host server.

Note: If the failover driver is already installed, you might have to reconfigure the failover settings, reboot the server, or both—depending upon which failover driver you used. If you do not install or reconfigure the failover driver, you will not have controller redundancy protection.

29. In the host server, reestablish the I/O connections to the mapped LUNs by mounting the file systems or adding drive letter/mount points.

Note: You may have to reboot servers that use Microsoft Windows operating systems to enable them to recognize the drives.

30. If this is the Turbo upgrade option, follow the Web activation instructions provided in the upgrade kit to activate the Storage Partitioning Premium Feature and register the ability to attach seven additional DS4000 EXP storage expansion enclosures.

Upgrading the DS4300 Model 60U/60X from standard to Turbo option

If you have purchased the DS4300 Turbo option, you must replace your existing 256-MB memory controllers to 1-GB memory controllers shipped as part of the option. You should perform this upgrade with the power on as a hot-swap. It is also possible to perform this procedure as a cold-swap.

Note: A controller hot-swap replacement is when the controllers are replaced one at a time while the storage server is powered on. Care must be exercised to ensure a successful upgrade. Hot-swap is the preferred method for upgrading your controllers. A controller cold-swap replacement is when both controllers are replaced at the same time after the storage server is powered off. Power is turned back on to the storage server after the controllers are replaced.

This section contains the following procedures:

- “Steps for hot-swap RAID controller upgrade”
- “Steps for cold-swap RAID controller upgrade” on page 69

Steps for hot-swap RAID controller upgrade

Important:

- You cannot hot-swap the RAID controller of a DS4300 single-controller storage server (Model 6LU/6LX).
- You must install the latest version of Storage Manager client software in the management workstation or in the host server connected to the DS4300 that will be upgraded before you replace the old controller with the new controller. For more information, see *IBM DS4000 Storage Manager Installation and Support Guide* for your operating system, or the following Web site:

www-1.ibm.com/servers/storage/support/disk/

- This procedure must be done when the DS4300 system is at a low I/O state. It is preferred that no I/Os are made to the DS4300 server while the storage server is being upgraded.

- The upgrade should be performed when the system is in an optimal state. If it is not, fix the problem before attempting the upgrade. Use the Storage Manager client to determine if the system is in an optimal state.
- You must have a management connection to the controller before attempting the upgrade because you need to use the Storage Manager client to set the controller to certain states before replacing it, and to verify its operating condition status.

You need to use the Storage Manager client to properly set the controller state by completing the following steps:

1. Disable controller caching.
 2. Set the controller to offline state before replacing it.
 3. Set the controller to online state after inserting the new controller.
 4. Verify controller operating condition status after the new controller is brought online.
- Save the configuration/profile before upgrading.

Each RAID controller fits into the back of the storage server and has the following components:

- Battery
- Cache memory
- Two host ports and one expansion port
- One Ethernet port
- One serial port

Each RAID controller has a unique hardware Ethernet address, which is printed on a label on the front. There is also a label giving the cache battery manufacturing and installation dates on the top of the controller unit. Figure 48 shows the location of these items.

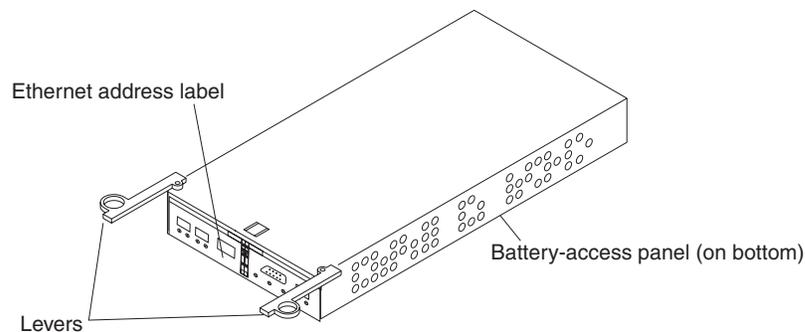


Figure 48. RAID controller levers and labels

For information about the RAID controller cache memory and rechargeable battery, see “Cache memory and RAID controller battery” on page 55.

You must replace both controllers. Replace one controller at a time. To upgrade your RAID controller, complete the following steps:

1. Open a management connection to the DS4300 using the Storage Manager client.

2. Save the storage server profile to a disk location that is *not* in the DS4000 storage server that you are upgrading. In the Subsystem Management window, select **View-->Storage Subsystem Profile**. When the Storage Subsystem Profile window opens, click **Save As**. The Save Profile window opens. Select an appropriate directory and choose a file name for the profile, then click **Save**.

Click **Close** to close the Storage Subsystem Profile window.

3. Use the Storage Manager client to flush and disable the read/write cache on both controllers, using the following steps. Either check that the cache LED on the back of the controller is off or wait two to three minutes.
 - a. In the Logical/Physical View of the Subsystem Management window, right-click any of the logical drive tree nodes and select **Change-->Cache Settings**. A Change Cache Settings window opens.
 - b. Click **Select All** to select all logical drives, and clear all of the Cache Setting Enable check boxes, then click **OK**. Click **OK** when the Confirmation window opens.

Note: A progress window shows the modification progress. After the cache setting modification complete, click **OK** to close the progress window and return to the Subsystem Management window.

Refer to the Storage Manager client online Help panels for more details on disabling cache.

4. Place the controller in an offline state, using the following steps:
 - a. In the Logical/Physical View of the Subsystem Management window, right-click the controller icon and select **Place-->Offline**. Click **Yes** when the Controller Offline Confirmation window opens.

Verify that the controller amber fault LED is lit. In the Storage Manager client, the controller will be displayed with a red "X" icon.

5. Label each cable that connects to the RAID controllers. This ensures that all cables will be properly reconnected to the new RAID controllers.

Attention: Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 38 mm (1.5 in.).

6. From the first RAID controller to be upgraded, remove the fibre-channel cables from the SFPs. The location of these components is shown in Figure 49 on page 66.

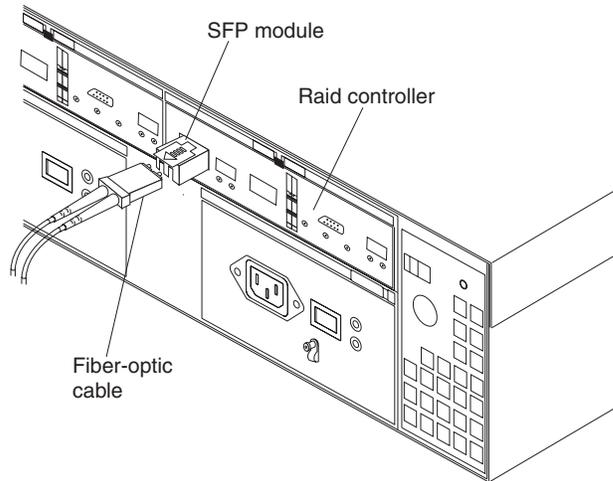


Figure 49. Location of SFPs and fiber-optic cables

After removing the fibre-channel cables, insert the protective caps.

7. Use the following procedure to remove the SFPs from the RAID controller to be upgraded.
 - a. Remove the LC-LC fibre-channel cable from the SFP module. For more information, see "Handling fiber-optic cables" on page 33.
 - b. Unlock the SFP module latch:
 - For SFP modules that contain plastic tabs, unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in Figure 50.

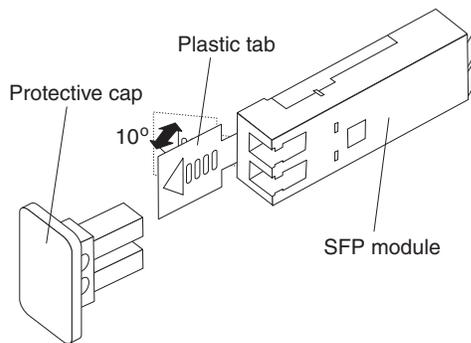


Figure 50. Unlocking the SFP module latch - plastic variety

- For SFP modules that contain wire tabs, unlock the SFP module latch by pulling the wire latch outward 90°, as shown in Figure 51 on page 67.

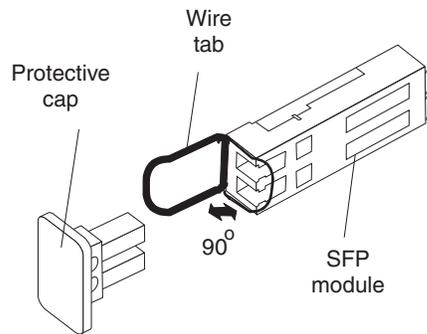


Figure 51. Unlocking the SFP module latch - wire variety

- c. With the SFP latch in the unlocked position, extract the SFP module.
 - For SFP modules that contain plastic tabs, slide the SFP module out of the port.
 - For SFP modules that contain wire tabs, grasp the wire latch and pull the SFP module out of the minihub port.
- d. Replace the protective cap on the SFP module.
- e. Place the SFP module into a static-protective package.
- f. Replace the protective cap on the port.
8. Remove the RAID controller to be upgraded, as follows:
 - a. Push down on the latch (centered above the RAID controller). Pull both levers at the same time out of the locked position.
 - b. Grasp the pull-rings (see Figure 52), then pull on the levers and remove the RAID controller.

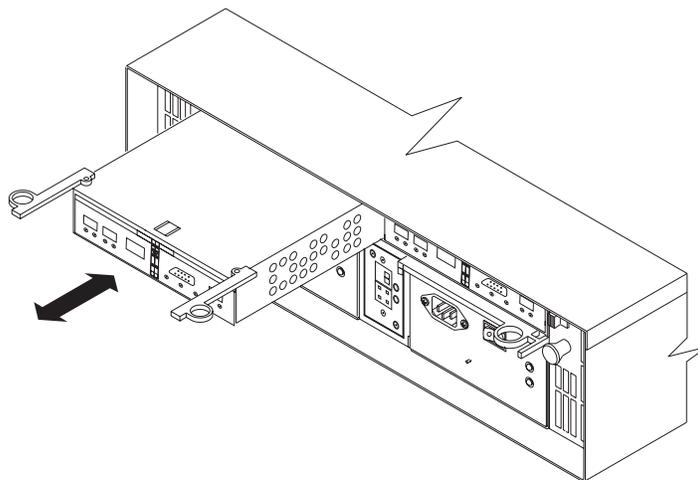


Figure 52. Pull-rings for removing a controller

9. Unpack the new RAID controller with the 1-GB memory. Verify that the battery is in the controller by opening the DS4300 controller CRU, using step 6 through step 9 of “Replacing the battery in the RAID controller” on page 94. If there is no battery in the new DS4300 controller, remove the battery from the old controller and install it in the new controller.

Set the RAID controller on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the RAID controller.

10. If DHCP/BootP was used to automatically set the IP address of the controller, record the MAC address of the upgrade controller and modify the existing DHCP/BootP record of the RAID controller to be upgraded with the new MAC address. Failure to modify the DHCP/BootP record will result in problems trying to manage the storage server using the existing IP address. This step must be performed before you insert the upgrade controller into the DS4000 storage server.
11. Install the new RAID controller, as follows:
 - a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.

Attention: When you replace the old RAID controller, the storage-management software automatically synchronizes the firmware between the existing controller and the new controller. After you replace a controller, always use the storage-management software to verify the firmware levels and nonvolatile storage random access memory (NVS RAM) files.

12. Insert the SFPs according to the instructions in “Installing SFP modules” on page 34.
13. Connect the fibre-channel cables to their original locations, according to the instructions in “Installing fiber-optic cables” on page 37.
14. Wait approximately one minute, and then check the green Host Loop LED, green Expansion Loop LED, and amber Fault LED on the new RAID controller.

Note: If the Expansion Loop LED is off, the RAID controller might not be inserted correctly. Remove the RAID controller and reinsert it.

15. Bring the controller online by completing the following steps:
 - a. In the Physical View of the Subsystem Management window, right-click the controller icon and select **Place-->Online**.
 - b. Click **Yes** when the Controller Online Confirmation window opens.
16. Check that the controller is online. Use either of the two following methods:
 - Use the Storage Manager client to verify that the controller is online (up) and running by selecting the menu option to display the properties of the controller that has just been replaced. If the controller is not up, you will get a controller-connection error window instead of the Controller Properties window. Wait a minute and retry until you get the properties window.
 - Check the LEDs at the back of the controller. All Fault LEDs should be off and the Host Loop and Expansion Loop LEDs should be on.
17. If the Fault LED is on, the Host Loop LED and the Expansion Loop LED stay off, or any other Fault LED is on, see the Storage Manager client for problem determination.

Note: The battery LED may be flashing indicated battery charging is in progress.

18. Repeat step 4 through step 17 for the second controller. However, do not continue with this step if the new controller is not in online and optimal state due to reasons other than battery charging and controller cache memory not matching.
19. Enable controller caching by completing the following steps:

- a. In the Logical/Physical View of the Subsystem Management window, right-click any of the logical drive tree node and select **Change-->Cache Settings**. A Change Cache Settings window opens.
- b. Click **Select All** to select all of the logical drives. Select the appropriate check boxes to enable the read/write caching options that you want, then click **OK**.
- c. Click **OK** when the confirmation window opens.

Note: A progress window shows the modification progress. After the cache setting modification completes, click **OK** to close the window and return to the Subsystem Management window.

20. Verify firmware and NVSRAM. Reload the firmware and NVSRAM to the version shipped on the Turbo option CD. Then, check the IBM Web site for any firmware updates.

Steps for cold-swap RAID controller upgrade

Important:

- You must install the latest version of Storage Manager client software in the management workstation or in the host server connected to the DS4300 that will be upgraded before you replace the old controller with the new controller. For more information, see *IBM DS4000 Storage Manager Installation and Support Guide* for your operating system, or the following Web site:

www-1.ibm.com/servers/storage/support/disk/

- Schedule downtime for the upgrade.
- The upgrade should be performed when the system is in an optimal state. If it is not, fix the problem before attempting the upgrade. Use the Storage Manager client to determine if the system is in an optimal state.
- Save the configuration/profile before upgrading.
- If you have premium features enabled in the existing DS4300 storage server, ensure that you have access to the premium features key files before you begin this procedure. You will need to re-enable your premium features during the procedure.
- After the new controllers complete the boot process, the WWNN of the DS4300 controllers will change. If you have any applications that rely on the previous WWNNs, such as FC switch zoning definitions, you must update the applications with the new WWNNs.

Each RAID controller fits into the back of the storage server and has the following components:

- Battery
- Cache memory
- Two host ports and one expansion port
- One Ethernet port
- One serial port

Each RAID controller has a unique hardware Ethernet address, which is printed on a label on the front. There is also a label giving the cache battery manufacturing

and installation dates on the top of the controller unit. Figure 53 shows the location of these items.

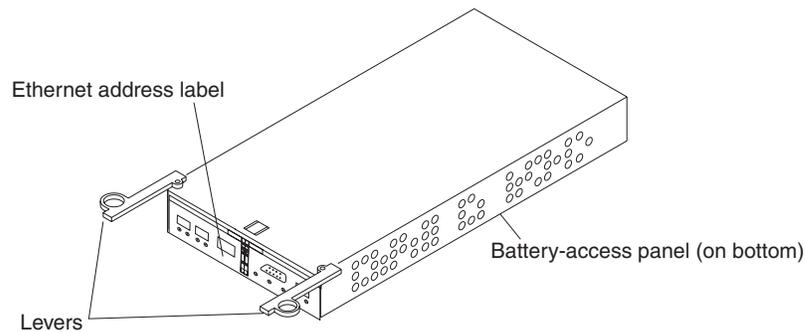


Figure 53. RAID controller levers and labels

For information about the RAID controller cache memory and rechargeable battery, see “Cache memory and RAID controller battery” on page 55.

Replace both controllers at the same time. To upgrade your RAID controllers, complete the following steps.

Before you begin: Schedule the upgrade to take place at a convenient time, because the storage server will be powered down during the upgrade process.

1. Open a management connection to the DS4300 using the Storage Manager client.
2. Save the storage server profile to a disk location that is *not* in the DS4000 storage server that you are upgrading. In the Subsystem Management window, select **View-->Storage Subsystem Profile**. When the Storage Subsystem Profile window opens, click **Save As**. The Save Profile window opens. Select an appropriate directory and choose a file name for the profile, then click **Save**.
Click **Close** to close the Storage Subsystem Profile window.
3. Complete any necessary server preparation tasks, because the disks will not be available during the upgrade process. For example, stop all programs, services or processes in the host servers that access the logical drives.

Note: Make sure that you stop any background programs, services or processes that write data to the logical drives. For example, Microsoft MSCS periodically writes to the Quorum disk.

4. Use the Storage Manager client to flush and disable the read/write cache on both controllers, using the following steps. Either check that the cache LED on the back of the controller is off or wait two to three minutes.
 - a. In the Logical/Physical View of the Subsystem Management window, right-click any of the logical drive tree nodes and select **Change-->Cache Settings**. A Change Cache Settings window opens.
 - b. Click **Select All** to select all logical drives, and deselect all of the Cache Setting Enable check boxes, then click **OK**. Click **OK** when the Confirmation window opens.

Note: A progress window shows the modification progress. After the cache setting modification complete, click **OK** to close the progress window and return to the Subsystem Management window.

Refer to the Storage Manager client online Help panels for more details on disabling cache.

5. Stop I/O to the storage server.
6. Unmount any mapped LUNs from the storage server.
7. Turn off the DS4300 Storage Server.
8. Label each cable that connects to the RAID controllers. This ensures that all cables will be properly reconnected to the new RAID controllers.

Attention: Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 38 mm (1.5 in.).

9. From both RAID controllers to be upgraded, remove the fibre-channel cables from the SFPs. The location of these components is shown in Figure 54.

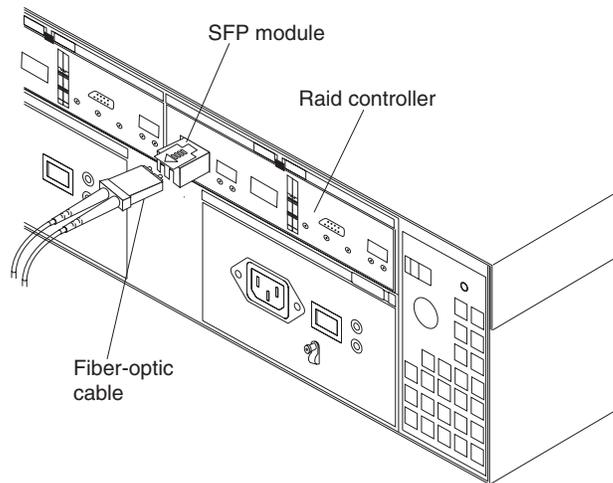


Figure 54. Location of SFPs and fiber-optic cables

After removing the fibre-channel cables, insert the protective caps.

10. Use the following procedure to remove the SFPs from the RAID controllers to be upgraded.
 - a. Remove the LC-LC fibre-channel cable from the SFP module. For more information, see "Handling fiber-optic cables" on page 33.
 - b. Unlock the SFP module latch:
 - For SFP modules that contain plastic tabs, unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in Figure 55 on page 72.

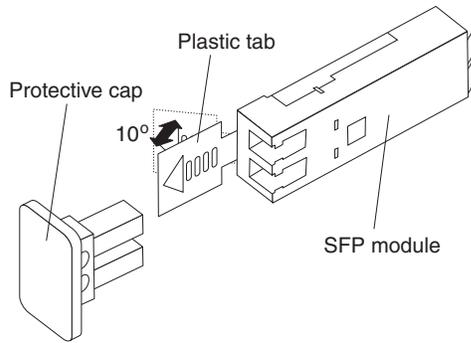


Figure 55. Unlocking the SFP module latch - plastic variety

- For SFP modules that contain wire tabs, unlock the SFP module latch by pulling the wire latch outward 90°, as shown in Figure 56.

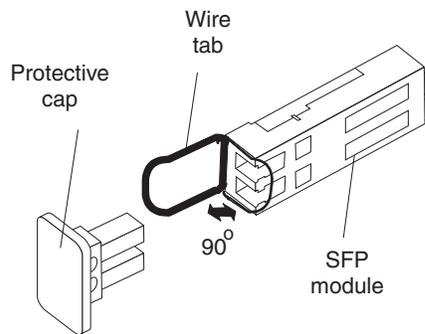


Figure 56. Unlocking the SFP module latch - wire variety

- c. With the SFP latch in the unlocked position, extract the SFP module.
 - For SFP modules that contain plastic tabs, slide the SFP module out of the port.
 - For SFP modules that contain wire tabs, grasp the wire latch and pull the SFP module out of the minihub port.
 - d. Replace the protective cap on the SFP module.
 - e. Place the SFP module into a static-protective package.
 - f. Replace the protective cap on the port.
11. Remove each RAID controller to be upgraded, as follows:
- a. Push down on the latch (centered above the RAID controller). Pull both levers at the same time out of the locked position.
 - b. Grasp the pull-rings (see Figure 57 on page 73), then pull on the levers and remove the RAID controller.

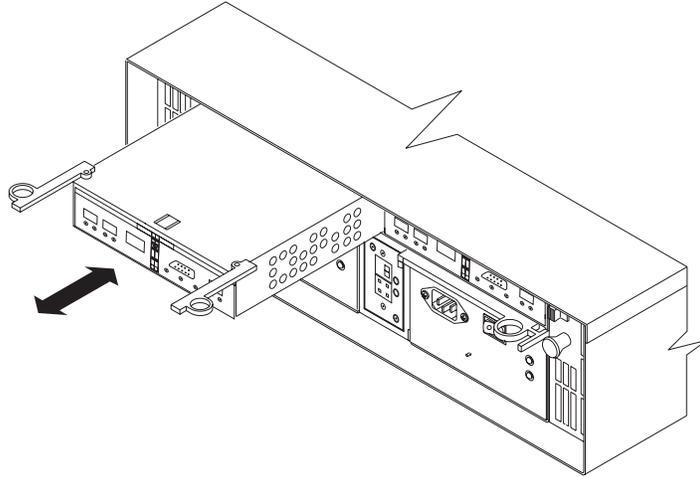


Figure 57. Pull-rings for removing a controller

12. Unpack the new RAID controller with the 1-GB cache. Verify that the battery is in the controller by opening the DS4300 controller CRU, using step 6 through step 9 of “Replacing the battery in the RAID controller” on page 94. If there is no battery in the new DS4300 controller, remove the battery from the old controller and install it in the new controller.

Set the RAID controllers on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the RAID controllers.

13. If DHCP/BootP was used to automatically set the IP address of the controller, record the MAC address of the upgrade controller and modify the existing DHCP/BootP record of the RAID controller to be upgraded with the new MAC address. Failure to modify the DHCP/BootP record will result in problems trying to manage the storage server using the existing IP address. This step must be performed before you insert the upgrade controller into the DS4000 storage server.
14. Install each of the new RAID controllers, as follows:
 - a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.
15. Insert the SFPs according to the instructions in “Installing SFP modules” on page 34.
16. Connect the fibre-channel cables to their original locations on both of the upgraded controllers, according to the instructions in “Installing fiber-optic cables” on page 37.
17. Turn on the DS4300 Storage Server.
18. Wait approximately one minute, and then check the green Host Loop LED, green Expansion Loop LED, and amber Fault LED on the new RAID controllers.

Note: If the Host Loop LED or the Expansion Loop LED is off, the RAID controller might not be inserted correctly. Remove the RAID controller and reinsert it.

19. Check that the controller is online. Use either of the two following methods:
 - Use the Storage Manager client to verify that the controllers are online (up) and running by selecting the menu option to display the properties of the

controllers that have just been replaced. If the controllers are not up, you will get a controller-connection error window instead of the controller properties window. Wait a minute and retry until you get the properties window.

- Check the LEDs at the back of each controller. All Fault LEDs should be off and the Host Loop and Expansion Loop LEDs should be on.
20. If the Fault LED is on, the Host Loop LED and the Expansion Loop LED stay off, or any other Fault LED is on, see the Storage Manager client for problem determination.

Note: The battery LED may be flashing indicated battery charging is in progress.

21. After the controllers finish rebooting, their WWNNs will change. If you have applications that rely on the previous DS4300 controller WWNNs (such as Fibre Channel switch zoning definitions) you must update the applications with the new WWNNs.
22. Enable caching on both controllers.
23. Verify firmware and NVSRAM. Reload the firmware and NVSRAM to the version shipped on the Turbo option CD. Then, check the IBM Web site for any firmware updates.
24. If applicable, re-enable your premium features using the premium features key files of the controllers that you replaced.

Working with hot-swap drives

This section explains how you can increase the storage-server capacity by adding more drives or replacing existing drives with ones containing a larger capacity.

Figure 58 shows the location of the hot-swap drive bays that are accessible from the front of the storage server. To maintain proper cooling within the storage server, always keep a filler panel in each drive bay that does not contain a drive CRU.

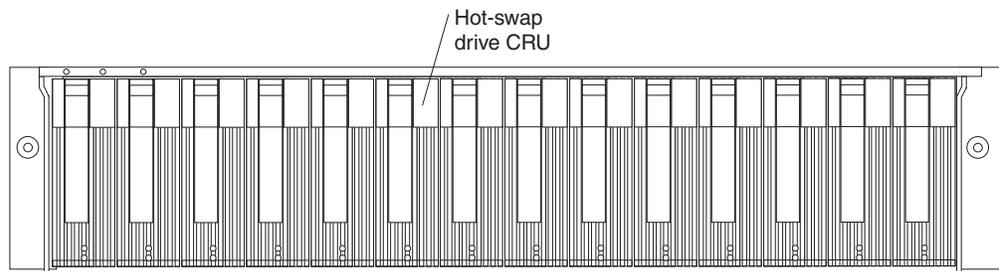


Figure 58. Location of hot-swap drives

Attention:

1. Never hot-swap a drive CRU when its green Activity LED is flashing. Hot-swap a drive CRU only when its amber Fault LED is completely on and not flashing or when the drive is inactive with the green Activity LED on and not flashing.
2. After you remove a drive CRU, wait 70 seconds before replacing or reseating the drive CRU to allow the drive to properly spin down. Failure to do so may cause undesired events.

Before you install or remove drive CRUs, review the following information:

Filler panels

Storage servers without a full set of drives (14) contain filler panels in the unused drive bays. Before installing new drives, you must remove the filler panels. Save the filler panels for future use. Each of the 14 bays must always contain either a filler panel or a drive CRU.

Drive CRUs

The RAID controller supports up to 14 (half-high or slim) 40-pin fibre-channel hard disk drives. These drives come preinstalled in drive trays. This drive-and-tray assembly is called a *drive CRU*. You can install the drive CRUs in the 14 drive bays on the front of the storage server.

Drive LEDs

Each drive CRU has two LEDs, which indicate the status for that particular drive. For information about the drive LED operating states and descriptions, see Figure 43 on page 52 and Table 11 on page 52.

Fibre-channel loop IDs

When you install a drive CRU in the storage server, the drive CRU connects into a printed circuit board called the *midplane*. The midplane automatically sets the fibre-channel loop ID to the default value 00.

Hot-swap hardware

The storage server contains hardware that you can use to replace a failed hard disk drive without turning off the storage server. Therefore, you can continue operating the system while a hard disk drive is removed or installed. These drives are known as *hot-swap* drives.

Slim drives

You can install slim, hot-swap drive CRUs.

Installing hot-swap drives

Before you begin: Take the following precautions.

- Read the safety and handling guidelines that are provided in “Safety” on page iii and “Handling static-sensitive devices” on page 59.
- Ensure that the current system configuration is working properly.
- Back up all important data before you make changes to storage devices, such as hard disk drives.

Use the following procedure to install hot-swap drives in the storage server. You can install additional drives while the storage server is powered up and running.

Note: If you are replacing a drive, see “Replacing hot-swap drives” on page 77.

1. Read the instructions that come with the drive CRU.
2. Check for Fault LEDs. If any amber LEDs are lit, see “Checking the LEDs” on page 51 and “Troubleshooting” on page 100.
3. Determine the bay into which you want to install the drive.
4. Install the drive CRU:

Note: The hard disk drive comes with a tray already attached. Do not attempt to detach the drive **4** from the tray **3**. See Figure 59 on page 76.

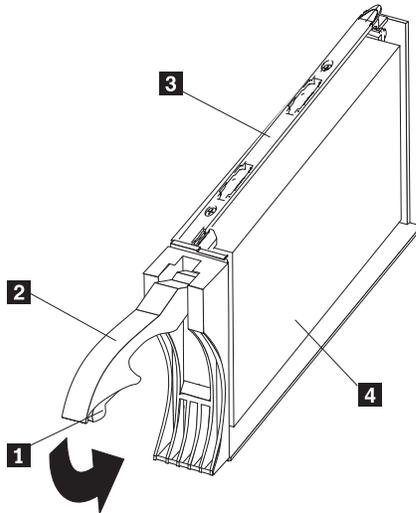


Figure 59. Releasing the drive latch

- a. Release the blue latch **1** on the drive CRU by pressing on the inside of the bottom of the tray handle. See Figure 59.
- b. Pull the handle **2** on the tray out into the open position.
- c. Slide the drive CRU into the empty bay until the tray handle **2** touches the storage-server bezel.
- d. Push the tray handle **2** down into the closed (latched) position.
5. Check the drive LEDs.
 - a. When a drive is ready for use, the green Activity LED is either continuously on or rapidly flashing, and the amber Drive fault LED is off.
 - b. If the amber Drive fault LED is completely on and not flashing, remove the drive from the unit and wait 10 seconds; then reinstall the drive.
6. Use the Storage Manager client to configure the drive.
7. Update the information in Appendix A, "Records," on page 105.

Replacing hot-swap drives

Drive problems include any malfunctions that delay, interrupt, or prevent successful I/O activity between the hosts and the hard disk drives. This includes transmission problems between the host controllers, the RAID controllers, and the drives. This section explains how to replace a failed drive.

Attention:

1. Failure to replace the drives in their correct bays might result in loss of data. If you are replacing a drive that is part of a RAID level 1 or RAID level 5 logical drive, ensure that you install the replacement drive in the correct bay.
2. After you remove a drive CRU, wait 70 seconds before replacing or reseating the drive CRU to allow the drive to properly spin down. Failure to do so may cause undesired events.

Use the following procedure to replace hot-swap drives:

1. Check the hardware and software documentation that is provided with the system to see if there are restrictions regarding hard disk drive configurations. Some system fibre-channel configurations might not allow mixing different drive capacities or types within an array.
2. Check the Storage Manager client online help for recovery procedures for a drive that has failed. Follow the steps in the software procedure before you continue with this procedure.
3. Determine the location of the drive that you want to remove.

Attention: Never hot-swap a drive CRU when its green Activity LED is flashing. Hot-swap a drive CRU only when its amber Drive fault LED is on and not flashing or when the drive is inactive with the green Activity LED on and not flashing.

If the drive is not in a failed state (as indicated by a lit amber LED), manually fail the drive using the Storage Management client before attempting to remove it from the drive slot.

4. Remove the drive CRU.
 - a. Press on the inside of the bottom of the tray handle to release the blue latch **1**. See Figure 60 on page 78.
 - b. Pull the handle **2** on the tray **3** out into the open position.
 - c. Lift the drive CRU partially out of the bay.
 - d. To avoid possible damage to the drive **4**, wait at least 20 seconds before you fully remove the drive CRU from the storage server to allow for the drive to spin down.

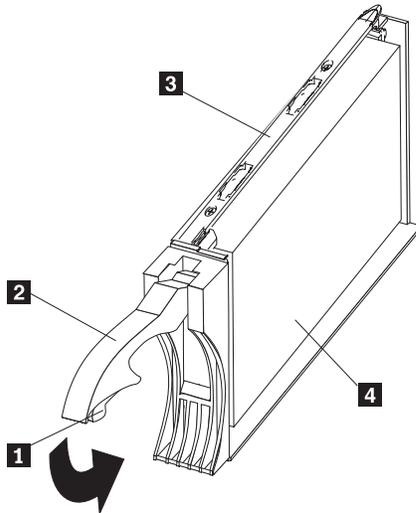


Figure 60. Drive latch on a hot-swap drive

- e. Verify that there is proper identification (such as a label) on the drive CRU, and then slide it completely out of the storage server.
5. Install the new drive CRU.

Attention: After you remove a drive CRU, wait 70 seconds before replacing or reseating the drive CRU to allow the drive to properly spin down. Failure to do so may cause undesired events.

 - a. Gently push the drive CRU into the empty bay until the tray handle **2** touches the storage-server bezel.
 - b. Push the tray handle **2** down into the closed (latched) position.
6. Check the drive LEDs.
 - a. When a drive is ready for use, the green Activity LED is either on continuously or rapidly flashing, and the amber Drive fault LED is off.
 - b. If the amber Drive fault LED is on and not flashing, remove the drive from the unit and wait 10 seconds; then reinstall the drive.
7. If the drive is part of a defined RAID array, the array reconstruction (without hot-spare) or copy-back (with hot-spare) operation automatically starts.

Upgrading drives

You can upgrade drives in the following two ways:

- By adding drives to empty slots in the storage server (see “Installing hot-swap drives” on page 75)
- By replacing existing drives with larger capacity drives

Adding larger-capacity drives

This section provides guidelines for upgrading the drives in the storage server. Read the software documentation and this entire section to determine if you should use this procedure, use a modified version of this procedure, or use a different procedure that is provided by your operating system. *Instructions that are provided with your software should supersede anything stated in this document.*

There are two methods for upgrading drives:

- **Replacing all the drives at the same time**

This method requires that you back up the data on the affected drives and then turn off the storage server. After replacing all the drives, you must reconfigure the new drives and restore data from backup. See the procedure in “Replacing all drives at the same time.”

This is the safest way to exchange drives without losing data. However, this method might take a long time to complete because of the backup, reconfiguration, and restoration processes. In addition, other users are not able to use the storage server (or any storage expansion enclosures attached to the storage server) until you finish the procedure. You must use this method on RAID 0 logical drives.

- **Replacing the drives one at a time**

In this method, you manually fail each drive, replace it, and wait for the system to restore data to the new drive before installing the next drive. After you install the new drives, you can configure them to make the additional drive space available. See the procedure in “Replacing the drives one at a time” on page 81.

Using this method, you can replace the drives while the storage server is running, eliminating the down time that is required if you replace all the drives at once. However, this method is more risky because you can lose data if the drive restoration or storage subsystem reconfiguration process fails. In addition, the reconstruction process might take a long time. This method works only on redundant logical drives (RAID 1, 3, or 5). You cannot use this method with any drives containing RAID 0 logical drives.

Consider backing up your data if you use this method. This safeguards your data if the restoration and reconfiguration process fails or the new drive malfunctions.

The method you use depends on the following considerations:

- Which method most closely matches the recommended drive upgrade procedure that is provided in the operating system or the storage-management software documentation
- Which RAID level is used on the affected drives (RAID 0 requires you to replace all the drives at the same time)
- How much downtime is acceptable as you swap the drives
- The number of drives in an array. Replacing drives one at a time is better suited for arrays consisting of 3 to 5 drives. If you have more than 10 drives, consider replacing all drives at the same time, as described in the next section.

Replacing all drives at the same time

Use this procedure to replace all drives at the same time. You must use this method if you are upgrading drives containing RAID 0 logical drives. All the data currently on the drives is lost when you replace the drives; therefore, you must back up all data that is currently on the drives. This procedure also requires you to turn off the storage server, which makes the storage server (and any attached storage expansion enclosures) inaccessible to other users.

To replace all the drives at the same time, perform the following steps:

1. Read the following information:
 - The information in “Adding larger-capacity drives” on page 78, particularly the paragraphs that discuss the differences between the two possible upgrade procedures
 - The information in your software documentation regarding drive upgrades and installation
 - The documentation that comes with the new drives

Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the drives and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine if you need to modify this procedure.

2. Use the Storage Manager client to check the status of the storage server. Correct any problems that are reported.

3. Perform a complete backup of the drives that you are replacing.

You need the backup to restore data on the drives later in this procedure.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 59.

4. Unpack the new drives.

Set the drives on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the drives.

5. Perform the following steps:

- a. Stop all I/O activity to the storage server and attached storage expansion enclosures. Make sure that:

- 1) All of the green Drive activity LEDs on the front of the storage server (and on all attached storage expansion enclosures) are not flashing.
- 2) The green Cache active LEDs are off on the front of the RAID controllers.

- b. If applicable, use the operating system software to disconnect the storage server logical drives from the host before you power off the storage server.

Attention: To turn off all power to the storage server, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 6 for the proper shutdown sequence.

6. Turn off the power to each device based on the following shutdown sequence:

- a. Turn off power to the host before you turn off power to the storage server. If the host must stay powered on to support an existing network, see the operating system documentation for information about disconnecting the storage server logical drives from the host before the storage server is powered off.
- b. Turn off power to the storage server before you turn off power to the storage expansion enclosures. Turn off both power supply switches on the back of the storage server.
- c. Turn off power to other supporting devices (for example, management stations, fibre-channel switches, or Ethernet switches).

Notes:

- 1) You do not need to perform this step if you are servicing only the storage server.
 - 2) Depending on your operating system, you might not have to restart the host. For more information, see the software installation guide for your operating system.
7. Use the procedures in “Replacing hot-swap drives” on page 77 to remove the drives that you want to replace. Use the procedures in “Installing hot-swap drives” on page 75 to install the new drives into the storage server.
 8. After you install all the new drives, check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:

- a. Turn on the power to the supporting devices (for example, Ethernet switches and management stations) before you turn off power to the storage server.
 - b. You must turn on the storage expansion enclosures before the storage server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on powering up the storage expansion enclosures, see the storage expansion enclosure documentation.
 - c. Turn on the power to the storage server; then restart or turn on the power to the host.
9. Turn on the power to each device, based on the power-on sequence in step 8 on page 80. To turn on power to the storage server, turn on the power-supply switches on the back of the storage server. You must turn on both power-supply switches to take advantage of the redundant power supplies.
 10. Check the green Drive activity LED and the amber Drive fault LED below the new drive CRUs.

Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

Note: The Drive fault LEDs might flash intermittently while the drives spin up.

- If the Drive activity LED is off, the drive CRU might not be installed correctly. Remove the drive CRU, wait 70 seconds, and then reinstall it.
 - If the Drive fault LED stays on or the Drive activity LED stays off, the new drive might be faulty. See the Storage Manager client for problem determination.
11. Use the Storage Manager client to configure the new drives. See the Storage Manager client online Help for detailed instructions.
 12. Restore the data from backup to all the drives.

Replacing the drives one at a time

Use this procedure to replace all the drives one at a time. You cannot use this procedure on RAID 0 logical drives (use the procedure in “Replacing all drives at the same time” on page 79).

Note: If your storage subsystem has hot spares assigned, you might want to unassign the hot spares while you perform this procedure. If you do not, reconstruction might start on the hot spare before you insert the new drive. The data on the new drive is still rebuilt, but the process takes longer for each drive. Remember to reassign the hot spares when you are finished with this procedure.

To replace the drives one at a time, perform the following steps:

1. Read the following information:
 - “Adding larger-capacity drives” on page 78, particularly the paragraphs that discuss the differences between the two possible upgrade procedures
 - Your software documentation regarding drive upgrades and installation
 - The documentation that comes with the new drives

Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the drives and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine if you need to modify this procedure.

2. Use the Storage Manager client to check the status of the unit. Correct any problems that are reported.
3. Back up the data on the drives that you are replacing.
Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 59.
4. Unpack the new drives.
Set the drives on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the drives.
5. Use the Storage Manager client to ensure that the array that was defined using these drives is in optimal (not degraded) state before manually failing the first drive you want to replace. If the array is in degraded state, use the recovery procedures to bring the array into the optimal state.

Make sure that:

- You fail only one drive
- The software status display shows a failed status for the appropriate drive
- The amber Drive fault LED (on the front bezel below the drive) is on

Attention: Removing the wrong drive can cause data loss. Make sure that you remove only the failed drive CRU. The Drive fault LED below the failed drive CRU should be on.

If you remove an active drive accidentally, wait at least 70 seconds and then reinstall it. Because you failed two drives in a RAID array, the array might be marked failed by the controller. This array will not be available to the host for I/O. See the Storage Manager client online Help for further recovery instructions. Do not attempt to replace any drives until the array is brought back to optimal state.

After you remove a drive CRU, wait 70 seconds before replacing or reseating the drive CRU to allow the drive to properly spin down. Failure to do so may cause undesired events.

6. Use the procedures in “Replacing hot-swap drives” on page 77 to remove the failed drive. Use the procedures in “Installing hot-swap drives” on page 75 to install the new drives into the storage server.

The new drive automatically reconstructs the data after you install it in the drive slot.

During data reconstruction, the amber Drive fault LED might come on for a few minutes, then turn off when the green Drive activity LED begins flashing. A flashing Drive activity LED indicates that data reconstruction is in progress.

Note: If your storage subsystem has active hot spares, data might not start copying to the new drive until the data is reconstructed on the hot spare. This increases the time that is required to complete the procedure.

7. Check the green Drive activity LED and the amber Drive fault LED below the new drive CRUs.

Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

Note: The Drive fault LEDs might flash intermittently while the drives spin up.

- If the Drive activity LED is off, the drive CRU might not be installed correctly. Remove the drive CRU, wait 30 seconds, and then reinstall it.

- If the Drive fault LED stays on or the Drive activity LED stays off, the new drive might be faulty. See the Storage Manager client for problem determination.
8. Use the Storage Manager client to monitor the status of the new drive and the progress of the data reconstruction. Wait for data reconstruction to finish (the Drive activity LED stops flashing).
- Note:** The Drive activity LED will continue to flash after reconstruction is finished if there is I/O activity to that drive. In that case, use the host software to determine if the data reconstruction is finished.
9. When reconstruction is finished on the new drive, repeat step 5 on page 82 through step 8 for each additional drive that you want to install.
 10. Use the Storage Manager client to configure the additional space on the new drives.

Working with hot-swap cooling fans

The storage server cooling system consists of two fan CRUs, each containing two fans. The fan CRUs circulate air inside the unit by pulling in air through the vents on the front of the drive CRUs and pushing out air through the vents in the back of each fan CRU. See Figure 61.

If two fans fail, or the fans cannot maintain an internal temperature below 70°C (158°F), the power supplies in the unit will automatically shut down (an over-temperature condition). If this occurs, you must cool the unit and restart it. See “Restoring power after an over-temperature shutdown” on page 49.

Attention: The fans in the storage server draw in fresh air and force out hot air. These fans are hot-swappable and redundant; however, when one fan fails, you must replace the fan CRU within 48 hours to maintain redundancy and optimum cooling. When you replace the failed fan CRU, be sure to install the second fan CRU within 10 minutes to prevent any overheating due to the lack of the additional fan CRU.

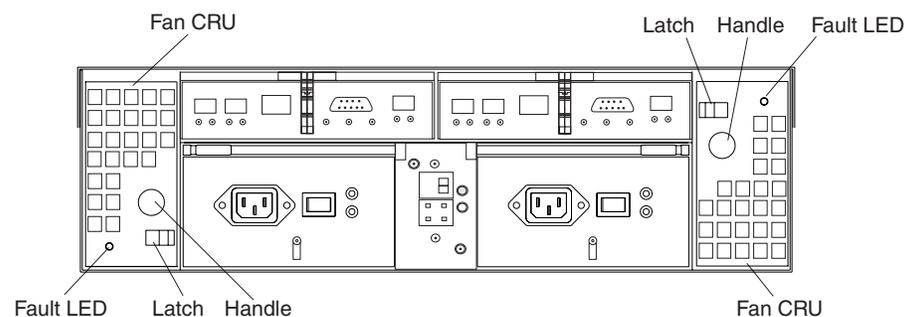


Figure 61. Fan locations

Fan CRUs

The two fan CRUs are hot-swappable and redundant.

Fault LEDs

These amber LEDs light when a fan failure occurs.

Latches and handles

Use the latches and handles to remove or install the fan CRUs.

Attention: Do not run the storage server without adequate ventilation and cooling, because it might cause damage to the internal components and circuitry.

Both fan units must always be in place, even if one is not functioning properly, to maintain proper cooling.

Use the following procedure to replace a hot-swap fan:

1. Check the LEDs on the back of the storage server.
2. If the amber Fault LED is on, remove the fan CRU that has failed.
 - a. Slide the latch to unlock the fan CRU.
 - b. Use the handle (black knob) to pull the fan from the storage server. See Figure 62.

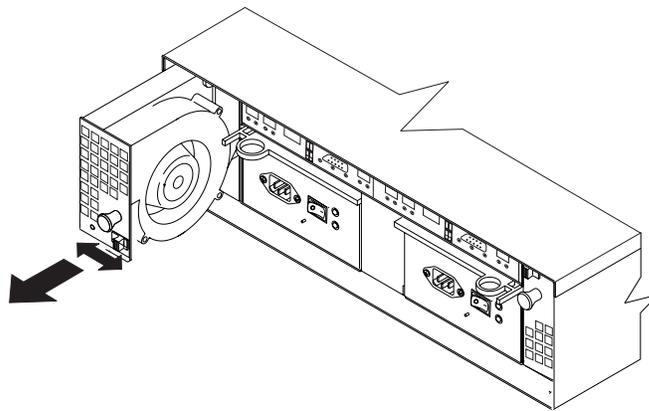


Figure 62. Removing a fan

3. Install the new fan unit.
 - a. Place the fan CRU in front of the fan slot.
 - b. Hold the latch open, and slide the fan all the way into the slot. If the fan does not go into the bay, rotate it 180°. Ensure that the latch is on the side closest to the center of the storage server.
 - c. Release the latch. If the lever remains open, pull back on the fan slightly, and then push it in again until the latch snaps into place.
4. Check the LEDs.

The Fault LEDs turn off after a few seconds. If they remain on, see “Troubleshooting” on page 100.

Working with hot-swap power supplies (dual-controller models only)

The storage server power system consists of two power supply CRUs.

Exception: The DS4300 single-controller storage server (Model 6LU/6LX) has only one power supply CRU. Therefore, you cannot hot swap the power supply.

The power supply CRUs provide power to the internal components by converting incoming ac voltage to dc voltage. One power supply CRU can maintain electrical power to the unit if the other power supply is turned off or malfunctions. The power supply CRUs are interchangeable (by reversing the locking levers).

Each power supply CRU has a built-in sensor that detects the following conditions:

- Over-voltage
- Over-current
- Overheated power supply

If any of these conditions occurs, one or both power supplies will shut down. All power remains off until you cycle the power switches (turn the power switches off, wait at least 30 seconds, then turn the power switches on). For more information, see “Restoring power after an unexpected shutdown” on page 48 and “Restoring power after an over-temperature shutdown” on page 49.

The power supplies are customer replaceable units (CRUs) and do not require preventive maintenance.

- Always keep the power supplies in their proper places to maintain proper controller-unit cooling.
- Use only the supported power supplies for your specific storage server.

The power-supply controls on the rear of the storage server are shown in Figure 63.

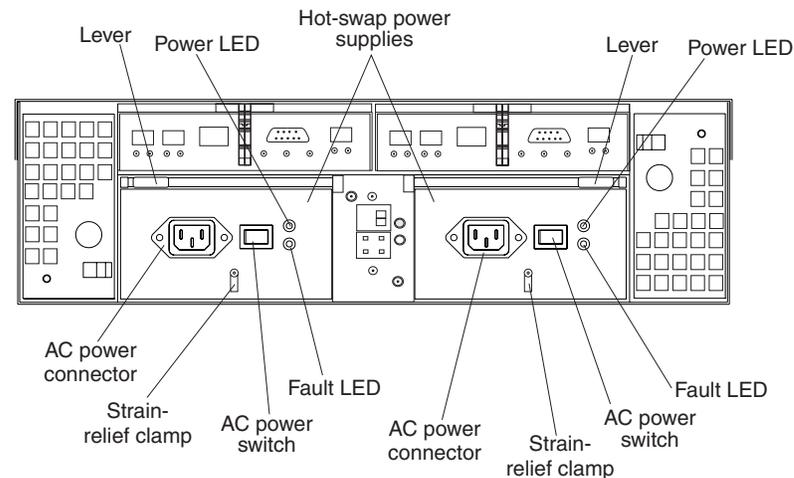


Figure 63. Power supply controls

Levers

Use these locking handles to remove or install a power supply.

Power LED

These green LEDs light when the storage server is turned on and receiving ac power.

Fault LEDs

These amber LEDs light if a power supply failure occurs or if the power supply is turned off.

AC power switches

Use these switches to turn the power supplies on and off. You must turn on both switches to take advantage of the redundant power supplies.

AC power connectors

This connection is for the ac power cord.

Strain-relief clamp

Use this clamp to provide strain relief on the power cord.

Removing a hot-swap power supply

Statement 8



CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

To remove a hot-swap power supply, perform the following steps:

1. Turn off the ac power switch. See Figure 64.

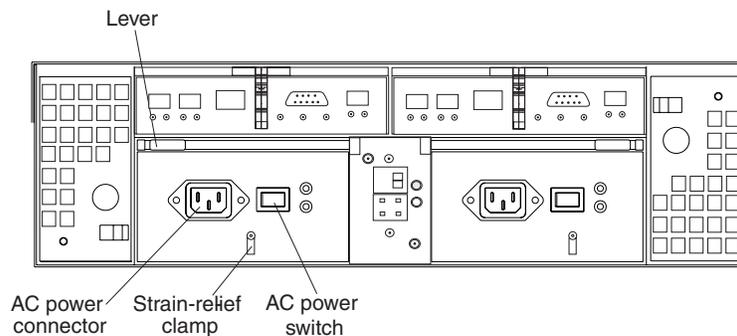


Figure 64. Lever for power supply removal

2. Unplug the power cord from the electrical outlet.
3. Disconnect the power cord from the ac power connector on the power supply.
4. Remove the nut and strain-relief clamp from the rear of the power supply.
5. Remove the power supply from the storage server, as follows:
 - a. Grasp the pull-ring on the power-supply lever and squeeze the latch to release it.
 - b. Pull the lever open and remove the power supply.

Installing a hot-swap power supply

Note: When you replace a power supply that has failed, ensure that the power supply latch is mounted on the side of the power supply that faces the

middle of the storage server. If it is not, remove the lever screw, flip the lever over, and tighten the screw on the opposite side.

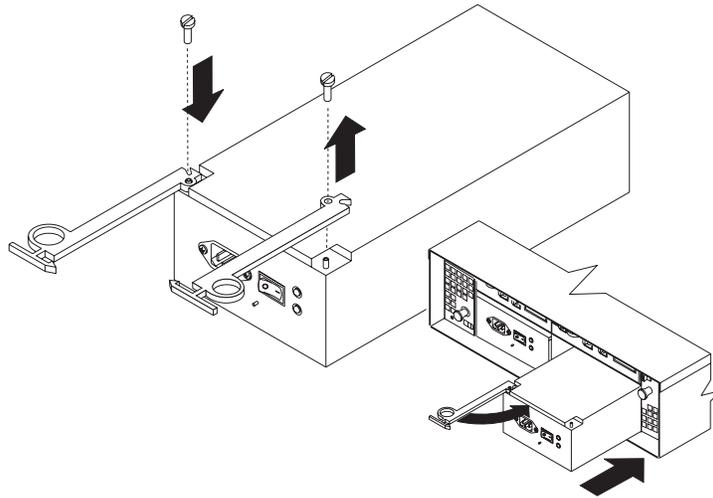


Figure 65. Installing a hot-swap power supply

To install a hot-swap power supply, perform the following steps:

Statement 8



CAUTION:

Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

1. Ensure that the ac power switch is off on the power supply that you are installing.
2. Install the power supply in the storage server, as follows:
 - a. Slide the power supply into the storage server. Make sure that the lever is pulled straight out as you slide the power supply into the storage server.
 - b. Close the lever until the pull-ring latch locks in place. Make sure that the lever locks into place in the storage-server chassis.
3. Wrap the strain-relief clamp around the power cord approximately 20 cm (8 in.) from the power-supply connection end.
4. Attach the power-supply nut and tighten it securely.
5. Connect the power cord to the AC power connector. See Figure 66 on page 88.

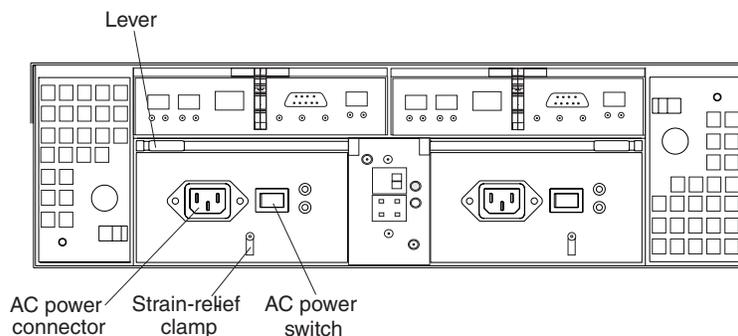


Figure 66. Connecting the power cord to the AC power connector

6. Plug the power cord into a properly grounded electrical outlet.
7. Turn on the power-supply switch.
8. Make sure that the green Power LED on the new power-supply CRU is on and the amber Fault LED is off.
 - If the Power LED is off, the power-supply CRU might not be installed correctly. Remove it and then reinstall it.
 - If the Fault LED is on or the Power LED stays off, see the Storage Manager client for problem determination.

For more information about the LEDs, see “Checking the LEDs” on page 51.

Working with hot-swap RAID controllers (dual-controller models only)

Each RAID controller fits into the back of the storage server and has the following components:

- Battery
- Cache memory
- Two host ports and one expansion port
- One Ethernet port
- One serial port

Exception: The DS4300 single-controller storage server (Model 6LU/6LX) has only one RAID controller. Therefore, you cannot hot swap the RAID controller.

Each RAID controller has a unique hardware Ethernet address, which is printed on a label on the front. There is also a label giving the cache battery manufacturing and installation dates on the top of the controller unit. Figure 67 on page 89 shows the location of these items.

Note: Each DS4300 controller type has a different FRU number, as follows:

DS4300 storage server type	Controller FRU part number (P/N)
Single-controller (Model 6LU/6LX)	24P8961
Dual-controller, standard (Model 60U/60X)	24P8059
Dual-controller, Turbo option with 1-GB cache (Model 60U/60X)	24P8225

Important: Please note the following information.

- The cache battery is not included with the controller FRU.
- Ensure that you replace the failed controller with the appropriate FRU. There are no protection mechanisms to block out an incorrect FRU from being inserted into DS4300 controller slots. Unpredictable results can occur when nonmatching controller FRUs are present in a single DS4300 chassis.
- After the new controller in a DS4300 single-controller storage server (Model 6LU/6LX) completes the boot process, its WWNN will change. If you have any applications that rely on the previous WWNNs, such as FC switch zoning definitions, you must update the applications with the new WWNNs.

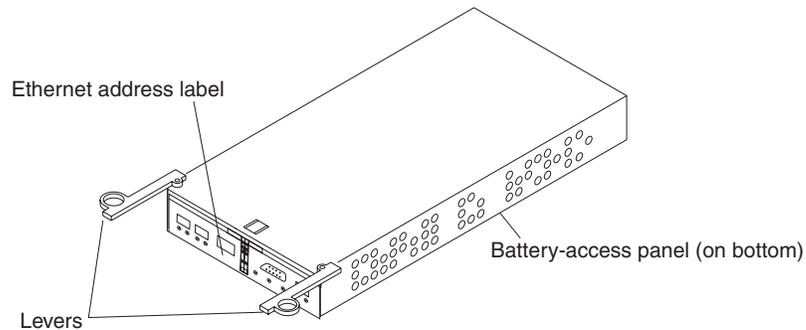


Figure 67. RAID controller levers and labels

For information about the RAID controller cache memory and rechargeable battery, see “Cache memory and RAID controller battery” on page 55.

Replacing a RAID controller

When instructed to do so by the storage-management software, replace a RAID controller that has failed.

Important: The replacement RAID controller CRU does not come with a RAID controller cache battery installed, nor the mounting hardware that holds the battery in place inside the RAID controller. You must remove the cache battery that is inside the existing RAID controller that you are replacing, and install that battery inside the replacement RAID controller CRU, using the battery unit mounting hardware taken from the existing controller. The steps to remove and replace the battery are included in the following procedure.

Note: Avoid operating the DS4300 Storage Server with controllers of different cache sizes. Operating the storage server with controllers of different cache size will disable caching and might adversely affect performance.

To replace a RAID controller, perform the following steps:

1. Check the Storage Manager client online Help for instructions on RAID controller failure-recovery procedures. Follow the steps provided in the software documentation before continuing with step 2.
2. Label each cable that connects to the RAID controller that has failed. This ensures that all cables will be properly reconnected to the new RAID controller.

Attention: Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 38 mm (1.5 in.).

3. From the RAID controller that has failed, remove the fibre-channel cables from the SFPs. The location of these components is shown in Figure 68.

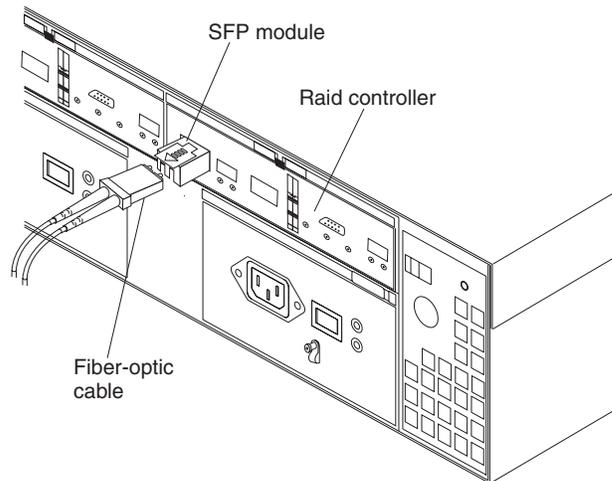


Figure 68. Location of SFPs and fiber-optic cables

After removing the fibre-channel cables, insert the protective caps.

4. Use the following procedure to remove the SFPs from the RAID controller that has failed.
 - a. Remove the LC-LC fibre-channel cable from the SFP module. For more information, see “Handling fiber-optic cables” on page 33.
 - b. Unlock the SFP module latch:
 - For SFP modules that contain plastic tabs, unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in Figure 69.

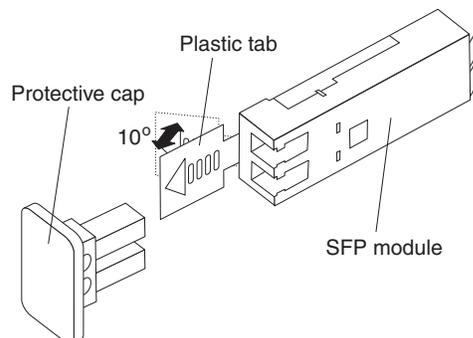


Figure 69. Unlocking the SFP module latch - plastic variety

- For SFP modules that contain wire tabs, unlock the SFP module latch by pulling the wire latch outward 90°, as shown in Figure 33 on page 37.

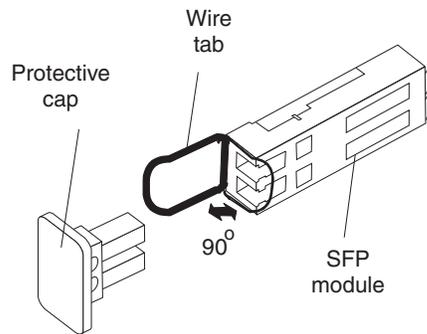


Figure 70. Unlocking the SFP module latch - wire variety

- c. With the SFP latch in the unlocked position, extract the SFP module.
 - For SFP modules that contain plastic tabs, slide the SFP module out of the port.
 - For SFP modules that contain wire tabs, grasp the wire latch and pull the SFP module out of the minihub port.
- d. Replace the protective cap on the SFP module.
- e. Place the SFP module into a static-protective package.
- f. Replace the protective cap on the port.
5. Remove the failed RAID controller (the Fault LED is on), as follows:
 - a. Push down on the latch (centered above the RAID controller). Pull both levers at the same time out of the locked position.

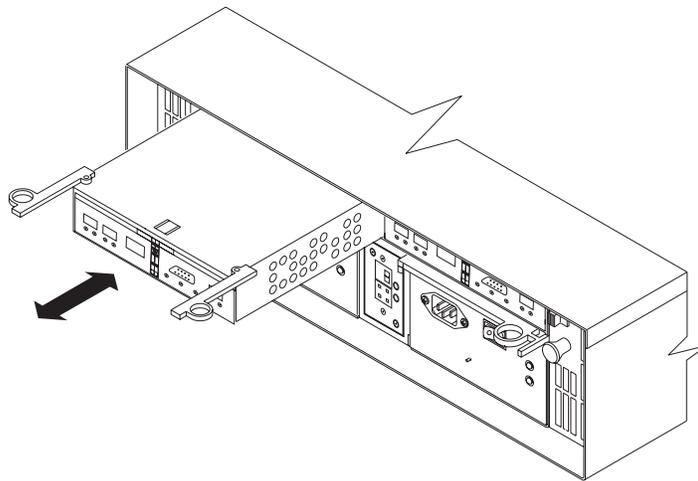


Figure 71. Pull-rings for removing a controller

- b. Grasp the pull-rings; then pull on the levers and remove the RAID controller.
6. To access the cache battery, place the RAID controller CRU bottom up on a flat surface. Using a #2 Phillips head screwdriver, remove the six screws (three on each side of the RAID controller) that hold the RAID controller bottom panel to the sides of the RAID controller, as shown in Figure 72 on page 92.

Note: Before you move the cache battery from your old controller to your replacement controller, read the detailed instructions in this procedure.

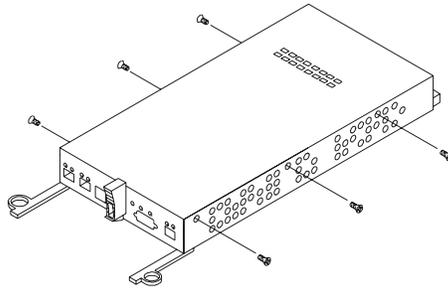


Figure 72. Controller battery-access panel screws

7. Slide the RAID controller bottom panel away from the front side of the RAID controller (away from the SFP slots and black center latch) to unlatch it from the side panels.
8. Carefully flip over the RAID controller bottom panel. Disconnect the battery harness on the battery from the two-pin connector on the controller board, as shown in Figure 73.

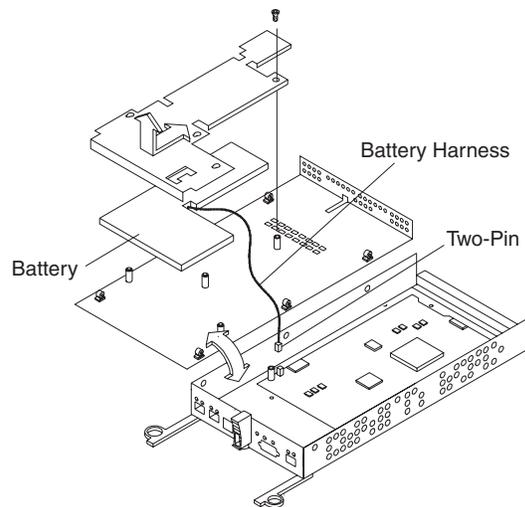


Figure 73. Removing the controller battery

9. Remove the screw that holds the battery access panel. Carefully slide the access panel toward the front to unlatch it from the three pins mounted on the RAID controller bottom panel.
10. Remove the battery unit and place it on a dry, level surface. If this is a battery replacement, then replace the old battery with the new one and go to step 17 on page 93.
11. Unpack the new RAID controller.
Set the RAID controller on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the RAID controller.
12. Place the replacement RAID controller CRU bottom up on a flat surface. Using a #2 Phillips head screwdriver, remove the six screws (three on each side of

the RAID controller) that hold the RAID controller bottom panel to the sides of the RAID controller, as shown in Figure 72 on page 92.

13. Slide the RAID controller bottom panel away from the front side of the RAID controller (away from the SFP slots and black center latch) to unlatch it from the side panels.
14. Carefully flip over the RAID controller bottom panel.
15. Remove the screw that holds the battery access panel. Carefully slide the access panel toward the front to unlatch it from the three pins mounted on the RAID controller bottom panel.
16. If DHCP/BootP was used to automatically set the IP address of the controller, record the MAC address of the upgrade controller and modify the existing DHCP/BootP record of the RAID controller to be upgraded with the new MAC address. Failure to modify the DHCP/BootP record will result in problems trying to manage the storage server using the existing IP address. This step must be performed before you insert the upgrade controller into the DS4000 storage server.
17. Position the battery inside the replacement RAID controller.
18. Reassemble the battery access panel to the RAID controller bottom panel by aligning it with the three pins on the RAID controller bottom panel. Slide the battery access panel toward the back until you can reinsert the screw that holds the battery access panel to the RAID controller bottom panel. Do not overtighten.
19. You must reconnect the battery harness to the two-pin connector on the controller board.

Note: The connector is keyed so that there is only one way to attach the harness to the connector. Do not force fit.

20. Flip the RAID controller bottom panel over and carefully place it on the controller sides. Push the RAID controller bottom panel toward the front to latch it to the side panels. If the controller bottom panel is placed correctly, you should be able to access the mounting holes for the six screws that you removed from step 6 on page 91. Reinsert the six screws. Do not overtighten.
21. Install the new RAID controller, as follows:
 - a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.

Attention: When you replace the failed RAID controller, the storage-management software automatically synchronizes the firmware between the existing controller and the new controller. After you replace a controller, always use the storage-management software to verify the firmware levels and NVSRAM files.

22. Insert the SFPs according to the instructions in “Installing SFP modules” on page 34.
23. Connect the fibre-channel cables to their original locations, according to the instructions in “Installing fiber-optic cables” on page 37.
24. Wait approximately one minute, and then check the green Host Loop LED, green Expansion Loop LED, and amber Fault LED on the new RAID controller.
 - If the Host Loop LED or the Expansion Loop LED is off, the RAID controller might not be inserted correctly. Remove the CRU and reinsert it.
 - If the Fault LED is on, the Host Loop LED and the Expansion Loop LED stay off, or any other Fault LED is on, see the Storage Manager client for problem determination, or contact IBM support.

25. See the Storage Manager client online Help for instructions on bringing the controller online.

Replacing the battery in the RAID controller

Each RAID controller contains a rechargeable battery that maintains the data in the cache memory for three days without power to the unit.

Important: If you are replacing the battery in a DS4300 single-controller storage server (Model 6IU/6LX), complete the following steps before beginning the replacement procedure:

- Schedule down time for the battery replacement, because the disk will not be available during the procedure.
- Complete any necessary server preparation tasks.
- Save the configuration/profile.
- Use the Storage Manager client to flush and disable the cache on the controller, using the following steps. Either check that the cache LED on the back of the controller is off, or wait two to three minutes.
 1. In the Logical/Physical View of the Subsystem Management window, right-click any of the logical drive tree nodes and select **Change-->Cache Settings**. A Change Cache Settings window opens.
 2. Click **Select All** to select all logical drives, and deselect all of the Cache Setting Enable check boxes, then click **OK**. Click **OK** when the Confirmation window opens.

Note: A progress window shows the modification progress. After the cache setting modification complete, click **OK** to close the progress window and return to the Subsystem Management window.

See the Storage Manager client online Help panels for more details on disabling cache.

- Stop I/O to the storage server.
- Unmount any mapped LUNs from the storage server.
- Power down the DS4300 single-controller storage server (Model 6LU/6LX).

Use the following procedure if the Storage Manager client instructs you to replace the battery because the current battery has failed or is nearing its expiration date. You can also use the Storage Manager client to check the status of the battery.

1. Check the Storage Manager client online Help for instructions on battery replacement procedures. If you are using write-cache mirroring, this might involve clearing cache memory on the RAID controller that contains the battery that has failed. This is done by either placing the controller offline before removing it from the DS4300 server or turning off caching in the DS4300 server, using the Storage Manager client. Follow the steps given in the software procedure before you continue with this procedure.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 59.

2. Unpack the new battery.

Set the new battery on a dry, level surface. Save all packing materials in case you need to return the battery.

Note: The battery comes with a new battery label. You will need this label later in the procedure.

3. Review all documentation that comes with the new battery for updated replacement procedures and other information.
4. Use the Storage Manager client to locate the RAID controller that contains the failed battery (the RAID controller Fault LED might be on).
5. Label each cable that connects to the RAID controller that contains the battery that has failed. This ensures that all cables will be properly reconnected to the RAID controller after you replace the battery.
6. Use the Storage Manager client to take offline the RAID controller that contains the battery that has failed.

Attention: On DS4300 single-controller storage server Model 6LU/6LX, you can not place the controller offline. Instead, you must power down the DS4300 storage server. For more information on preparation tasks, see the Important note in the beginning of this section.

7. Remove the fibre-channel cables and the SFPs from the RAID controller that contains the battery that has failed or is nearing its expiration date. For more information, see “Working with SFPs and fiber-optic cables” on page 33.
8. Remove the RAID controller, as follows:
 - a. Push down on the latch, which is centered above the RAID controller. Pull both levers at the same time out of the locked position.
 - b. Grasp the pull-rings; then pull on the levers and remove the RAID controller.
9. Place the RAID controller CRU bottom up on a flat surface. Using a #2 Phillips head screwdriver, remove the six screws (three on each side of the RAID controller) that hold the RAID controller bottom panel to the sides of the RAID controller, as shown in Figure 72 on page 92.
10. Slide the RAID controller bottom panel away from the front side of the RAID controller (away from the SFP slots and black center latch) to unlatch it from the side panels.
11. Carefully flip over the RAID controller bottom panel. Disconnect the battery harness on the battery from the two-pin connector on the controller board as shown in Figure 73 on page 92.
12. Remove the screw that holds the battery access panel. Carefully slide the access panel toward the front to unlatch it from the three pins mounted on the RAID controller bottom panel.
13. Remove the battery unit and place it on a dry, level surface. If this battery is a replacement battery, then replace the old battery with the new one.
14. Write the battery replacement information on the label on the battery pack.
 - Installed date – Write today’s date
 - Replacement Date – Write the date three years from today’s date

Note: The preferred method of checking for the battery operating age is through the Storage Manager client.



CONTAINS
SEALED LEAD
BATTERY.
BATTERY
MUST BE
RECYCLED.

Pb

CAUTION:

This product contains a sealed lead acid battery. The battery must be recycled or disposed of properly. In the United States, IBM has established a collection process for reuse, recycling, or proper disposal of used IBM sealed lead acid batteries. For information on proper disposal of these batteries, please contact IBM at 1-800-426-4333 your IBM representative. For information on disposal of sealed lead acid batteries outside the United States, go to www.ibm.com/ibm/environment/products/batteryrecycle.shtml or contact your local waste disposal facility. If the battery CRU is physically damaged or leaking electrolyte gel, *do not* ship it to a recycling center. The battery contains sealed lead-acid batteries that might be considered hazardous material. You must handle this unit in accordance with all applicable local and federal regulations.

15. Position the replacement battery inside the RAID controller.
16. Reassemble the battery access panel to the RAID controller bottom panel by aligning it with the three pins on the RAID controller bottom panel. Slide the battery access panel toward the back until you can reinsert the screw that holds the battery access panel to the RAID controller bottom panel. Do not overtighten
17. You must reconnect the battery harness to the two-pin connector on the controller board.

Note: The connector is keyed so that there is only one way to attach the harness to the connector. Do not force fit.

18. Flip the RAID controller bottom panel over and carefully place it on the controller sides. Push the RAID controller bottom panel toward the front to latch it to the side panels. If the controller bottom panel is placed correctly, you should be able to access the mounting holes for the six screws that you removed in step 6 on page 91. Reinsert the six screws. Do not overtighten.
19. Dispose of the used battery CRU according to local and federal regulations, which might include hazardous material handling procedures.

This product contains a sealed lead acid battery. The battery must be recycled or disposed of properly. In the United States, IBM has established a collection process for reuse, recycling, or proper disposal of used IBM sealed lead acid batteries. For information on proper disposal of these batteries, please contact IBM at 1-800-426-4333 your IBM representative. For information on disposal of sealed lead acid batteries outside the United States, go to www.ibm.com/ibm/environment/products/batteryrecycle.shtml or contact your local waste disposal facility.

20. Install the RAID controller, as shown in Figure 74 on page 97.

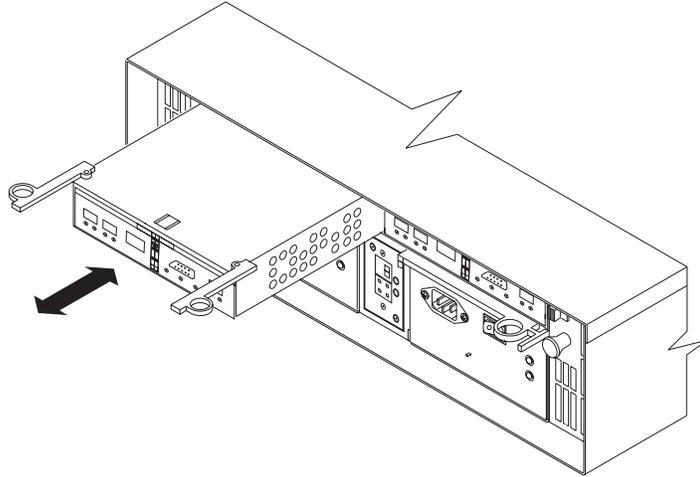


Figure 74. Installing a new RAID controller

- a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.
21. Install the SFPs and then connect the fibre-channel cables to their original locations.
 22. On the DS4300 single-controller storage server (Model 6LU/6LX), turn on power to the storage server and attached devices. For the proper power-on sequence, see “Turning on the storage server” on page 46.
 23. On the DS4300 dual-controller storage server (Model 60U/60X, standard and Turbo option), wait approximately one minute. Then, use the Storage Manager client to place the controller in online state (it was placed offline in step 6 on page 95).
- Note:** If the operation fails, repeat the command. If the operation fails again, reseal the controller and repeat this step.
24. Note that on all DS4300 models, it might take 15 minutes to a few hours for a new battery to become fully charged. The Storage Manager client will show the battery as failed until it is fully charged. Controller caching is automatically disabled until the new battery becomes fully charged.
 25. On the DS4300 single-server storage controller (Model 6LU/6LX), use the Storage Manager client to re-enable the read I/O caching setting.
 26. Use the Storage Manager client to monitor the status of the storage server and to reset the battery age.

Note: In the DS4300 dual-controller storage server (Model 60U/60X), there are two cache batteries (one for each controller). Make sure that you reset the age for the correct battery.

Installing SFPs and fiber-optic cables

Each RAID controller unit has two host ports and one expansion port. SFPs are inserted into the ports, and then fibre-channel cables are connected to the SFPs. For information on installing SFPs and fiber-optic cables, see “Working with SFPs and fiber-optic cables” on page 33.

Chapter 6. Solving problems

This chapter contains information to help you solve some of the simpler problems that you might have with your storage server. It contains the problem indicators and error messages along with suggested actions to take to resolve the problem.

For instructions on how to obtain service and technical assistance for your storage server and other IBM products, see “Getting information, help, and service” on page xxv

Note: See the *IBM TotalStorage DS4000 Hardware Maintenance Manual and Problem Determination Guide* for additional troubleshooting and debugging procedures.

Troubleshooting

Always use the storage-management software to diagnose storage server problems and component failures. You can use Table 15 to find solutions to problems that have definite indicators.

Table 15. Storage server troubleshooting

Problem indicator	Component	Possible cause	Possible solutions
Amber LED on	Drive CRU	Drive failure	Replace the drive that has failed.
	Fan CRU	Fan failure	Replace the fan that has failed.
	RAID controller Fault LED	RAID controller failure	If the RAID controller Fault LED is on, replace the RAID controller. If the RAID controller has been placed offline by the user, use storage management software to place it online. If the controller failed, replace the RAID controller.
	Expansion or host port bypass LED	SFP port empty	No corrective action is needed if this is a stand-alone storage server with no storage expansion enclosures attached, and if the system is properly configured. Otherwise, check to make sure that the storage expansion enclosure is powered on and the FC cables are attached properly.
		Fibre-channel cable is not attached to the storage expansion enclosure	Connect the fibre-channel cable to the enclosure port; check other connections.
		The HBA, switch, or storage expansion enclosures are set at 1Gb/s	The DS4300 supports 2Gb/s fibre-channel connections only using the 05.33.xx.xx firmware. Make appropriate hardware changes to ensure the DS4300 ports are connecting to ports that operate at 2Gb/s.
	No incoming signal detected	Reattach the SFPs and fibre-channel cables. Replace input and output SFPs or cables as necessary.	
	Front panel	General system error	Indicates that a Fault LED somewhere on the storage server has turned on. (Check for amber LEDs on CRUs.). Use Storage Manager software to diagnose server problems.
Amber LED is off and green LED off	Power-supply CRU	Power switch is turned off or ac power failure	Turn on all power-supply power switches.

Table 15. Storage server troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
Amber and green LEDs on	Power-supply CRU	Power supply failure	Replace the failed power-supply CRU.
All green LEDs off	All CRUs	Subsystem power is off	Check that all storage-server power cords are plugged in and the power switches are on. If applicable, check that the main circuit breakers for the rack are turned on.
		AC power failure	Check the main circuit breaker and ac outlet.
		Power supply failure	Replace the power supply.
		Midplane failure	Have the midplane replaced (service technician only).
Amber LED flashing	Drive CRUs	Drive identify is in process	No corrective action is needed.

Table 15. Storage server troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
One or more green LEDs off	Power supply CRUs	Power cord unplugged or switches turned off	Make sure that the power cord is plugged in and the power-supply switches are turned on.
	All drive CRUs	Midplane failure	Have the midplane replaced (service technician only).
	Front panel	Power supply problem	Make sure that the cords are plugged in and power supplies are turned on.
		Hardware failure	If any other LEDs are on, replace the midplane (service technician only).
	Battery	Battery failure	Replace the battery.
	Cache active	The cache is disabled	Use the storage-management software to enable the logical drive read and write cache settings.
		The cache memory has failed	Replace the RAID controller.
		The cache battery has failed	Use the storage-management software to check and replace the battery.
		There is no I/O	Generate I/O.
	Host loop	Host or switch is off or has failed	Check if host or switch is on. Replace attached devices that have failed.
		Fibre-channel cable has failed	Ensure that the fibre-channel cables are undamaged and properly connected.
		SFP has failed	Ensure SFP is seated properly; replace SFP.
		RAID controller has no power or has failed	Ensure that the unit is powered on. Replace RAID controller.

Table 15. Storage server troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
One or more green LEDs off (continued)	Expansion loop	Drives are improperly installed or not installed	Ensure that the drives are properly installed.
		RAID controller has no power or has failed	Ensure that the unit is powered on. Replace the RAID controller.
		Impending drive failure	A bad drive or drives can issue LIPs that cause the drive expansion loop to go down momentarily. Use the RLS function in the storage-management software to determine which drives are bad. Replace the bad drives.
		Externally attached expansion port device has failed	Replace the storage expansion enclosure SFP or fibre-channel cable.
Intermittent or sporadic power loss to the storage server	Some or all CRUs	Defective ac power source or partially plugged-in power cord	Check the ac power source; verify that the ac circuit that the storage server connects to is not being overloaded. Reseat all installed power cables and power supplies. If applicable, check the power components. Replace defective power cords.
		Power supply has failed	Check for a Fault LED on the power supply, and replace the failed CRU.
		Midplane has failed	Have the midplane replaced (service technician only).
Unable to access drives	Drives and expansion loop	Fibre-channel cabling has failed.	Ensure that the fibre-channel cables are undamaged and properly connected.
		RAID controller has failed	Replace the RAID controller.
		SFP has failed	Ensure SFP is seated properly; replace SFP.
Random errors	Subsystem	Midplane has failed	Have the midplane replaced (service technician only).

Appendix A. Records

Whenever you add options to your controller unit, be sure to update the information in this appendix. Accurate, up-to-date records make it easier to add other options and provide needed data whenever you contact technical support.

Identification numbers

Record and retain the following information.

Product name:	IBM DS4300 Storage Server
Machine:	
Model number:	_____
Serial number:	_____

The serial number is located on the front bottom-right corner of the chassis and on the rear of the storage server.

Installed-device records

Use the following table to keep a record of the options that are installed in or attached to your controller unit. This information can be helpful when you install additional options or if you ever need to report a hardware problem. Copy these tables before recording information in them, in case you need extra space to write new values later, when you update your system configuration.

Drive location	Drive part and model numbers	Drive serial number
Bay 1		
Bay 2		
Bay 3		
Bay 4		
Bay 5		
Bay 6		
Bay 7		
Bay 8		
Bay 9		
Bay 10		
Bay 11		
Bay 12		
Bay 13		
Bay 14		

Appendix B. Accessibility

This section provides information about alternate keyboard navigation, which is a DS4000 Storage Manager accessibility feature. Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

By using the alternate keyboard operations that are described in this section, you can use keys or key combinations to perform Storage Manager tasks and initiate many menu actions that can also be done with a mouse.

Table 16 defines the keyboard operations that enable you to navigate, select, or activate user interface components. The following terms are used in the table:

- *Navigate* means to move the input focus from one user interface component to another.
- *Select* means to choose one or more components, typically for a subsequent action.
- *Activate* means to carry out the action of a particular component.

Note: In general, navigation between components requires the following keys:

- **Tab** - Moves keyboard focus to the next component or to the first member of the next group of components
- **Shift-Tab** - Moves keyboard focus to the previous component or to the first component in the previous group of components
- **Arrow keys** - Move keyboard focus within the individual components of a group of components

Table 16. DS4000 Storage Manager alternate keyboard operations

Short cut	Action
F1	Open the Help.
F10	Move keyboard focus to main menu bar and post first menu; use the arrow keys to navigate through the available options.
Alt+F4	Close the management window.
Alt+F6	Move keyboard focus between dialogs (non-modal) and between management windows.
Alt+ underlined letter	Access menu items, buttons, and other interface components by using the keys associated with the underlined letters. For the menu options, select the Alt + underlined letter combination to access a main menu, and then select the underlined letter to access the individual menu item. For other interface components, use the Alt + underlined letter combination.
Ctrl+F1	Display or conceal a tool tip when keyboard focus is on the toolbar.
Spacebar	Select an item or activate a hyperlink.

Table 16. DS4000 Storage Manager alternate keyboard operations (continued)

Short cut	Action
Ctrl+Spacebar (Contiguous/Non-contiguous) AMW Logical/Physical View	<p>Select multiple drives in the Physical View.</p> <p>To select multiple drives, select one drive by pressing Spacebar, and then press Tab to switch focus to the next drive you want to select; press Ctrl+Spacebar to select the drive.</p> <p>If you press Spacebar alone when multiple drives are selected then all selections are removed.</p> <p>Use the Ctrl+Spacebar combination to deselect a drive when multiple drives are selected.</p> <p>This behavior is the same for contiguous and non-contiguous selection of drives.</p>
End, Page Down	Move keyboard focus to the last item in the list.
Esc	Close the current dialog (does not require keyboard focus).
Home, Page Up	Move keyboard focus to the first item in the list.
Shift+Tab	Move keyboard focus through components in the reverse direction.
Ctrl+Tab	Move keyboard focus from a table to the next user interface component.
Tab	Navigate keyboard focus between components or select a hyperlink.
Down arrow	Move keyboard focus down one item in the list.
Left arrow	Move keyboard focus to the left.
Right arrow	Move keyboard focus to the right.
Up arrow	Move keyboard focus up one item in the list.

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Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD-ROM drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

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three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

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IBM power cord part number	Used in these countries and regions
13F9940	Argentina, Australia, China (PRC), New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa
13F9979	Afghanistan, Algeria, Andorra, Angola, Austria, Belgium, Benin, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Rep., Chad, Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Macao S.A.R. of China, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Senegal, Slovakia, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, former USSR, Vietnam, former Yugoslavia, Zaire, Zimbabwe
13F9997	Denmark
14F0015	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	Antigua, Bahrain, Brunei, Channel Islands, Cyprus, Dubai, Fiji, Ghana, Hong Kong S.A.R. of China, India, Iraq, Ireland, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Kingdom, Yemen, Zambia
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Ethiopia, Italy, Libya, Somalia
14F0087	Israel
1838574	Thailand
6952301	Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea (South), Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Suriname, Taiwan, Trinidad (West Indies), United States of America, Venezuela

Glossary

This glossary provides definitions for the terminology and abbreviations used in IBM TotalStorage DS4000 publications.

If you do not find the term you are looking for, see the *IBM Glossary of Computing Terms* located at the following Web site:

www.ibm.com/ibm/terminology

This glossary also includes terms and definitions from:

- *Information Technology Vocabulary* by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.
- *IBM Glossary of Computing Terms*. New York: McGraw-Hill, 1994.

The following cross-reference conventions are used in this glossary:

See Refers you to (a) a term that is the expanded form of an abbreviation or acronym, or (b) a synonym or more preferred term.

See also

Refers you to a related term.

Abstract Windowing Toolkit (AWT). A Java graphical user interface (GUI).

accelerated graphics port (AGP). A bus specification that gives low-cost 3D graphics cards faster access to main memory on personal computers than the usual peripheral component interconnect (PCI) bus. AGP reduces the overall cost of creating high-end graphics subsystems by using existing system memory.

access volume. A special logical drive that allows the host-agent to communicate with the controllers in the storage subsystem.

adapter. A printed circuit assembly that transmits user data input/output (I/O) between the internal bus of the

host system and the external fibre-channel (FC) link and vice versa. Also called an I/O adapter, host adapter, or FC adapter.

advanced technology (AT) bus architecture. A bus standard for IBM compatibles. It extends the XT bus architecture to 16 bits and also allows for bus mastering, although only the first 16 MB of main memory are available for direct access.

agent. A server program that receives virtual connections from the network manager (the client program) in a Simple Network Management Protocol-Transmission Control Protocol/Internet Protocol (SNMP-TCP/IP) network-managing environment.

AGP. See *accelerated graphics port*.

AL_PA. See *arbitrated loop physical address*.

arbitrated loop. One of three existing fibre-channel topologies, in which 2 - 126 ports are interconnected serially in a single loop circuit. Access to the Fibre Channel-Arbitrated Loop (FC-AL) is controlled by an arbitration scheme. The FC-AL topology supports all classes of service and guarantees in-order delivery of FC frames when the originator and responder are on the same FC-AL. The default topology for the disk array is arbitrated loop. An arbitrated loop is sometimes referred to as a Stealth Mode.

arbitrated loop physical address (AL_PA). An 8-bit value that is used to uniquely identify an individual port within a loop. A loop can have one or more AL_PAs.

array. A collection of fibre-channel or SATA hard drives that are logically grouped together. All the drives in the array are assigned the same RAID level. An array is sometimes referred to as a "RAID set." See also *redundant array of independent disks (RAID)*, *RAID level*.

asynchronous write mode. In remote mirroring, an option that allows the primary controller to return a write I/O request completion to the host server before data has been successfully written by the secondary controller. See also *synchronous write mode*, *remote mirroring*, *Global Copy*, *Global Mirroring*.

AT. See *advanced technology (AT) bus architecture*.

ATA. See *AT-attached*.

AT-attached. Peripheral devices that are compatible with the original IBM AT computer standard in which signals on a 40-pin AT-attached (ATA) ribbon cable followed the timings and constraints of the Industry Standard Architecture (ISA) system bus on the IBM PC AT computer. Equivalent to integrated drive electronics (IDE).

auto-volume transfer/auto-disk transfer (AVT/ADT).

A function that provides automatic failover in case of controller failure on a storage subsystem.

AVT/ADT. See *auto-volume transfer/auto-disk transfer*.

AWT. See *Abstract Windowing Toolkit*.

basic input/output system (BIOS). The personal computer code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

BIOS. See *basic input/output system*.

BOOTP. See *bootstrap protocol*.

bootstrap protocol (BOOTP). In Transmission Control Protocol/Internet Protocol (TCP/IP) networking, an alternative protocol by which a diskless machine can obtain its Internet Protocol (IP) address and such configuration information as IP addresses of various servers from a BOOTP server.

bridge. A storage area network (SAN) device that provides physical and transport conversion, such as fibre channel to small computer system interface (SCSI) bridge.

bridge group. A bridge and the collection of devices connected to it.

broadcast. The simultaneous transmission of data to more than one destination.

cathode ray tube (CRT). A display device in which controlled electron beams are used to display alphanumeric or graphical data on an electroluminescent screen.

client. A computer system or process that requests a service of another computer system or process that is typically referred to as a server. Multiple clients can share access to a common server.

command. A statement used to initiate an action or start a service. A command consists of the command name abbreviation, and its parameters and flags if applicable. A command can be issued by typing it on a command line or selecting it from a menu.

community string. The name of a community contained in each Simple Network Management Protocol (SNMP) message.

concurrent download. A method of downloading and installing firmware that does not require the user to stop I/O to the controllers during the process.

CRC. See *cyclic redundancy check*.

CRT. See *cathode ray tube*.

CRU. See *customer replaceable unit*.

customer replaceable unit (CRU). An assembly or part that a customer can replace in its entirety when any of its components fail. Contrast with *field replaceable unit (FRU)*.

cyclic redundancy check (CRC). (1) A redundancy check in which the check key is generated by a cyclic algorithm. (2) An error detection technique performed at both the sending and receiving stations.

dac. See *disk array controller*.

dar. See *disk array router*.

DASD. See *direct access storage device*.

data striping. See *striping*.

default host group. A logical collection of discovered host ports, defined host computers, and defined host groups in the storage-partition topology that fulfill the following requirements:

- Are not involved in specific logical drive-to-LUN mappings
- Share access to logical drives with default logical drive-to-LUN mappings

device type. Identifier used to place devices in the physical map, such as the switch, hub, or storage.

DHCP. See *Dynamic Host Configuration Protocol*.

direct access storage device (DASD). A device in which access time is effectively independent of the location of the data. Information is entered and retrieved without reference to previously accessed data. (For example, a disk drive is a DASD, in contrast with a tape drive, which stores data as a linear sequence.) DASDs include both fixed and removable storage devices.

direct memory access (DMA). The transfer of data between memory and an input/output (I/O) device without processor intervention.

disk array controller (dac). A disk array controller device that represents the two controllers of an array. See also *disk array router*.

disk array router (dar). A disk array router that represents an entire array, including current and deferred paths to all logical unit numbers (LUNs) (hdisks on AIX). See also *disk array controller*.

DMA. See *direct memory access*.

domain. The most significant byte in the node port (N_port) identifier for the fibre-channel (FC) device. It is not used in the fibre channel-small computer system interface (FC-SCSI) hardware path ID. It is required to be the same for all SCSI targets logically connected to an FC adapter.

DRAM. See *dynamic random access memory*.

Dynamic Host Configuration Protocol (DHCP). A protocol defined by the Internet Engineering Task Force that is used for dynamically assigning Internet Protocol (IP) addresses to computers in a network.

dynamic random access memory (DRAM). A storage in which the cells require repetitive application of control signals to retain stored data.

ECC. See *error correction coding*.

EEPROM. See *electrically erasable programmable read-only memory*.

EISA. See *Extended Industry Standard Architecture*.

electrically erasable programmable read-only memory (EEPROM). A type of memory chip which can retain its contents without consistent electrical power. Unlike the PROM which can be programmed only once, the EEPROM can be erased electrically. Because it can only be reprogrammed a limited number of times before it wears out, it is appropriate for storing small amounts of data that are changed infrequently.

electrostatic discharge (ESD). The flow of current that results when objects that have a static charge come into close enough proximity to discharge.

environmental service module (ESM) canister. A component in a storage expansion enclosure that monitors the environmental condition of the components in that enclosure. Not all storage subsystems have ESM canisters.

E_port. See *expansion port*.

error correction coding (ECC). A method for encoding data so that transmission errors can be detected and corrected by examining the data on the receiving end. Most ECCs are characterized by the maximum number of errors they can detect and correct.

ESD. See *electrostatic discharge*.

ESM canister. See *environmental service module canister*.

EXP. See *storage expansion enclosure*.

expansion port (E_port). A port that connects the switches for two fabrics.

Extended Industry Standard Architecture (EISA). A bus standard for IBM compatibles that extends the Industry Standard Architecture (ISA) bus architecture to 32 bits and allows more than one central processing unit (CPU) to share the bus. See also *Industry Standard Architecture*.

fabric. A Fibre Channel entity which interconnects and facilitates logins of N_ports attached to it. The fabric is responsible for routing frames between source and destination N_ports using address information in the

frame header. A fabric can be as simple as a point-to-point channel between two N_ports, or as complex as a frame-routing switch that provides multiple and redundant internal pathways within the fabric between F_ports.

fabric port (F_port). In a fabric, an access point for connecting a user's N_port. An F_port facilitates N_port logins to the fabric from nodes connected to the fabric. An F_port is addressable by the N_port connected to it. See also *fabric*.

FAST MSJ. See *FAST Management Suite Java*.

FAST Management Suite Java (FAST MSJ). A diagnostic and configuration utility that can be used on Linux, Microsoft Windows, and Novell NetWare host systems. In Linux, it is also used with the QLRemote agent to define preferred and non-preferred paths for logical drives.

FC. See *fibre channel*.

FC-AL. See *arbitrated loop*.

feature enable identifier. A unique identifier for the storage subsystem, which is used in the process of generating a premium feature key. See also *premium feature key*.

fibre channel (FC). A set of standards for a serial input/output (I/O) bus capable of transferring data between two ports at up to 100 Mbps, with standards proposals to go to higher speeds. FC supports point-to-point, arbitrated loop, and switched topologies.

Fibre Channel-Arbitrated Loop (FC-AL). See *arbitrated loop*.

Fibre Channel Protocol (FCP) for small computer system interface (SCSI). A high-level fibre-channel mapping layer (FC-4) that uses lower-level fibre-channel (FC-PH) services to transmit SCSI commands, data, and status information between a SCSI initiator and a SCSI target across the FC link by using FC frame and sequence formats.

field replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails. In some cases, a field replaceable unit might contain other field replaceable units. Contrast with *customer replaceable unit (CRU)*.

FlashCopy. A premium feature for DS4000 that can make an instantaneous copy of the data in a volume.

F_port. See *fabric port*.

FRU. See *field replaceable unit*.

GBIC. See *gigabit interface converter*

gigabit interface converter (GBIC). A transceiver that performs serial, optical-to-electrical, and

electrical-to-optical signal conversions for high-speed networking. A GBIC can be hot swapped. See also *small form-factor pluggable*.

Global Copy. Refers to a remote logical drive mirror pair that is set up using asynchronous write mode without the write consistency group option. This is also referred to as "Asynchronous Mirroring without Consistency Group." Global Copy does not ensure that write requests to multiple primary logical drives are carried out in the same order on the secondary logical drives as they are on the primary logical drives. If it is critical that writes to the primary logical drives are carried out in the same order in the appropriate secondary logical drives, Global Mirroring should be used instead of Global Copy. See also *asynchronous write mode*, *Global Mirroring*, *remote mirroring*, *Metro Mirroring*.

Global Mirroring. Refers to a remote logical drive mirror pair that is set up using asynchronous write mode with the write consistency group option. This is also referred to as "Asynchronous Mirroring with Consistency Group." Global Mirroring ensures that write requests to multiple primary logical drives are carried out in the same order on the secondary logical drives as they are on the primary logical drives, preventing data on the secondary logical drives from becoming inconsistent with the data on the primary logical drives. See also *asynchronous write mode*, *Global Copy*, *remote mirroring*, *Metro Mirroring*.

graphical user interface (GUI). A type of computer interface that presents a visual metaphor of a real-world scene, often of a desktop, by combining high-resolution graphics, pointing devices, menu bars and other menus, overlapping windows, icons, and the object-action relationship.

GUI. See *graphical user interface*.

HBA. See *host bus adapter*.

hdisk. An AIX term representing a logical unit number (LUN) on an array.

host. A system that is directly attached to the storage subsystem through a fibre-channel input/output (I/O) path. This system is used to serve data (typically in the form of files) from the storage subsystem. A system can be both a storage management station and a host simultaneously.

host bus adapter (HBA). An interface between the fibre-channel network and a workstation or server.

host computer. See *host*.

host group. An entity in the storage partition topology that defines a logical collection of host computers that require shared access to one or more logical drives.

host port. Ports that physically reside on the host adapters and are automatically discovered by the DS4000 Storage Manager software. To give a host computer access to a partition, its associated host ports must be defined.

hot swap. To replace a hardware component without turning off the system.

hub. In a network, a point at which circuits are either connected or switched. For example, in a star network, the hub is the central node; in a star/ring network, it is the location of wiring concentrators.

IBMSAN driver. The device driver that is used in a Novell NetWare environment to provide multipath input/output (I/O) support to the storage controller.

IC. See *integrated circuit*.

IDE. See *integrated drive electronics*.

in-band. Transmission of management protocol over the fibre-channel transport.

Industry Standard Architecture (ISA). Unofficial name for the bus architecture of the IBM PC/XT personal computer. This bus design included expansion slots for plugging in various adapter boards. Early versions had an 8-bit data path, later expanded to 16 bits. The "Extended Industry Standard Architecture" (EISA) further expanded the data path to 32 bits. See also *Extended Industry Standard Architecture*.

initial program load (IPL). The initialization procedure that causes an operating system to commence operation. Also referred to as a system restart, system startup, and boot.

integrated circuit (IC). A microelectronic semiconductor device that consists of many interconnected transistors and other components. ICs are constructed on a small rectangle cut from a silicon crystal or other semiconductor material. The small size of these circuits allows high speed, low power dissipation, and reduced manufacturing cost compared with board-level integration. Also known as a *chip*.

integrated drive electronics (IDE). A disk drive interface based on the 16-bit IBM personal computer Industry Standard Architecture (ISA) in which the controller electronics reside on the drive itself, eliminating the need for a separate adapter card. Also known as an Advanced Technology Attachment Interface (ATA).

Internet Protocol (IP). A protocol that routes data through a network or interconnected networks. IP acts as an intermediary between the higher protocol layers and the physical network.

Internet Protocol (IP) address. The unique 32-bit address that specifies the location of each device or workstation on the Internet. For example, 9.67.97.103 is an IP address.

interrupt request (IRQ). A type of input found on many processors that causes the processor to suspend normal processing temporarily and start running an interrupt handler routine. Some processors have several interrupt request inputs that allow different priority interrupts.

IP. See *Internet Protocol*.

IPL. See *initial program load*.

IRQ. See *interrupt request*.

ISA. See *Industry Standard Architecture*.

Java Runtime Environment (JRE). A subset of the Java Development Kit (JDK) for end users and developers who want to redistribute the Java Runtime Environment (JRE). The JRE consists of the Java virtual machine, the Java Core Classes, and supporting files.

JRE. See *Java Runtime Environment*.

label. A discovered or user entered property value that is displayed underneath each device in the Physical and Data Path maps.

LAN. See *local area network*.

LBA. See *logical block address*.

local area network (LAN). A computer network located on a user's premises within a limited geographic area.

logical block address (LBA). The address of a logical block. Logical block addresses are typically used in hosts' I/O commands. The SCSI disk command protocol, for example, uses logical block addresses.

logical partition (LPAR). (1) A subset of a single system that contains resources (processors, memory, and input/output devices). A logical partition operates as an independent system. If hardware requirements are met, multiple logical partitions can exist within a system. (2) A fixed-size portion of a logical volume. A logical partition is the same size as the physical partitions in its volume group. Unless the logical volume of which it is a part is mirrored, each logical partition corresponds to, and its contents are stored on, a single physical partition. (3) One to three physical partitions (copies). The number of logical partitions within a logical volume is variable.

logical unit number (LUN). An identifier used on a small computer system interface (SCSI) bus to distinguish among up to eight devices (logical units) with the same SCSI ID.

loop address. The unique ID of a node in fibre-channel loop topology sometimes referred to as a loop ID.

loop group. A collection of storage area network (SAN) devices that are interconnected serially in a single loop circuit.

loop port. A node port (N_port) or fabric port (F_port) that supports arbitrated loop functions associated with an arbitrated loop topology.

LPAR. See *logical partition*.

LUN. See *logical unit number*.

MAC. See *medium access control*.

management information base (MIB). The information that is on an agent. It is an abstraction of configuration and status information.

man pages. In UNIX-based operating systems, online documentation for operating system commands, subroutines, system calls, file formats, special files, stand-alone utilities, and miscellaneous facilities. Invoked by the **man** command.

MCA. See *micro channel architecture*.

media scan. A media scan is a background process that runs on all logical drives in the storage subsystem for which it has been enabled, providing error detection on the drive media. The media scan process scans all logical drive data to verify that it can be accessed, and optionally scans the logical drive data also.

medium access control (MAC). In local area networks (LANs), the sublayer of the data link control layer that supports medium-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer. The MAC sublayer includes the method of determining when a device has access to the transmission medium.

Metro Mirroring. This term is used to refer to a remote logical drive mirror pair which is set up with synchronous write mode. See also *remote mirroring*, *Global Mirroring*.

MIB. See *management information base*.

micro channel architecture (MCA). Hardware that is used for PS/2 Model 50 computers and above to provide better growth potential and performance characteristics when compared with the original personal computer design.

Microsoft Cluster Server (MSCS). MSCS, a feature of Windows NT Server (Enterprise Edition), supports the connection of two servers into a cluster for higher availability and easier manageability. MSCS can automatically detect and recover from server or

application failures. It can also be used to balance server workload and provide for planned maintenance.

mini hub. An interface card or port device that receives short-wave fiber channel GBICs or SFPs. These devices enable redundant fibre channel connections from the host computers, either directly or through a fibre channel switch or managed hub, over optical fiber cables to the DS4000 Storage Server controllers. Each DS4000 controller is responsible for two mini hubs. Each mini hub has two ports. Four host ports (two on each controller) provide a cluster solution without use of a switch. Two host-side mini hubs are shipped as standard. See also *host port*, *gigabit interface converter (GBIC)*, *small form-factor pluggable (SFP)*.

mirroring. A fault-tolerance technique in which information on a hard disk is duplicated on additional hard disks. See also *remote mirroring*.

model. The model identification that is assigned to a device by its manufacturer.

MSCS. See *Microsoft Cluster Server*.

network management station (NMS). In the Simple Network Management Protocol (SNMP), a station that runs management application programs that monitor and control network elements.

NMI. See *non-maskable interrupt*.

NMS. See *network management station*.

non-maskable interrupt (NMI). A hardware interrupt that another service request cannot overrule (mask). An NMI bypasses and takes priority over interrupt requests generated by software, the keyboard, and other such devices and is issued to the microprocessor only in disastrous circumstances, such as severe memory errors or impending power failures.

node. A physical device that allows for the transmission of data within a network.

node port (N_port). A fibre-channel defined hardware entity that performs data communications over the fibre-channel link. It is identifiable by a unique worldwide name. It can act as an originator or a responder.

nonvolatile storage (NVS). A storage device whose contents are not lost when power is cut off.

N_port. See *node port*.

NVS. See *nonvolatile storage*.

NVSRAM. Nonvolatile storage random access memory. See *nonvolatile storage*.

Object Data Manager (ODM). An AIX proprietary storage mechanism for ASCII stanza files that are edited as part of configuring a drive into the kernel.

ODM. See *Object Data Manager*.

out-of-band. Transmission of management protocols outside of the fibre-channel network, typically over Ethernet.

partitioning. See *storage partition*.

parity check. (1) A test to determine whether the number of ones (or zeros) in an array of binary digits is odd or even. (2) A mathematical operation on the numerical representation of the information communicated between two pieces. For example, if parity is odd, any character represented by an even number has a bit added to it, making it odd, and an information receiver checks that each unit of information has an odd value.

PCI local bus. See *peripheral component interconnect local bus*.

PDF. See *portable document format*.

performance events. Events related to thresholds set on storage area network (SAN) performance.

peripheral component interconnect local bus (PCI local bus). A local bus for PCs, from Intel, that provides a high-speed data path between the CPU and up to 10 peripherals (video, disk, network, and so on). The PCI bus coexists in the PC with the Industry Standard Architecture (ISA) or Extended Industry Standard Architecture (EISA) bus. ISA and EISA boards plug into an IA or EISA slot, while high-speed PCI controllers plug into a PCI slot. See also *Industry Standard Architecture*, *Extended Industry Standard Architecture*.

polling delay. The time in seconds between successive discovery processes during which discovery is inactive.

port. A part of the system unit or remote controller to which cables for external devices (such as display stations, terminals, printers, switches, or external storage units) are attached. The port is an access point for data entry or exit. A device can contain one or more ports.

portable document format (PDF). A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact; can be distributed globally by e-mail, the Web, intranets, or CD-ROM; and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

premium feature key. A file that the storage subsystem controller uses to enable an authorized premium feature. The file contains the feature enable identifier of the storage subsystem for which the

premium feature is authorized, and data about the premium feature. See also *feature enable identifier*.

private loop. A freestanding arbitrated loop with no fabric attachment. See also *arbitrated loop*.

program temporary fix (PTF). A temporary solution or bypass of a problem diagnosed by IBM in a current unaltered release of the program.

PTF. See *program temporary fix*.

RAID. See *redundant array of independent disks (RAID)*.

RAID level. An array's RAID level is a number that refers to the method used to achieve redundancy and fault tolerance in the array. See also *array, redundant array of independent disks (RAID)*.

RAID set. See *array*.

RAM. See *random-access memory*.

random-access memory (RAM). A temporary storage location in which the central processing unit (CPU) stores and executes its processes. Contrast with *DASD*.

RDAC. See *redundant disk array controller*.

read-only memory (ROM). Memory in which stored data cannot be changed by the user except under special conditions.

recoverable virtual shared disk (RVSD). A virtual shared disk on a server node configured to provide continuous access to data and file systems in a cluster.

redundant array of independent disks (RAID). A collection of disk drives (*array*) that appears as a single volume to the server, which is fault tolerant through an assigned method of data striping, mirroring, or parity checking. Each array is assigned a RAID level, which is a specific number that refers to the method used to achieve redundancy and fault tolerance. See also *array, parity check, mirroring, RAID level, striping*.

redundant disk array controller (RDAC). (1) In hardware, a redundant set of controllers (either active/passive or active/active). (2) In software, a layer that manages the input/output (I/O) through the active controller during normal operation and transparently reroutes I/Os to the other controller in the redundant set if a controller or I/O path fails.

remote mirroring. Online, real-time replication of data between storage subsystems that are maintained on separate media. The Enhanced Remote Mirror Option is a DS4000 premium feature that provides support for remote mirroring. See also *Global Mirroring, Metro Mirroring*.

ROM. See *read-only memory*.

router. A computer that determines the path of network traffic flow. The path selection is made from several paths based on information obtained from specific protocols, algorithms that attempt to identify the shortest or best path, and other criteria such as metrics or protocol-specific destination addresses.

RVSD. See *recoverable virtual shared disk*.

SAI. See *Storage Array Identifier*.

SA Identifier. See *Storage Array Identifier*.

SAN. See *storage area network*.

SATA. See *serial ATA*.

scope. Defines a group of controllers by their Internet Protocol (IP) addresses. A scope must be created and defined so that dynamic IP addresses can be assigned to controllers on the network.

SCSI. See *small computer system interface*.

segmented loop port (SL_port). A port that allows division of a fibre-channel private loop into multiple segments. Each segment can pass frames around as an independent loop and can connect through the fabric to other segments of the same loop.

sense data. (1) Data sent with a negative response, indicating the reason for the response. (2) Data describing an I/O error. Sense data is presented to a host system in response to a sense request command.

serial ATA. The standard for a high-speed alternative to small computer system interface (SCSI) hard drives. The SATA-1 standard is equivalent in performance to a 10 000 RPM SCSI drive.

serial storage architecture (SSA). An interface specification from IBM in which devices are arranged in a ring topology. SSA, which is compatible with small computer system interface (SCSI) devices, allows full-duplex packet multiplexed serial data transfers at rates of 20 Mbps in each direction.

server. A functional hardware and software unit that delivers shared resources to workstation client units on a computer network.

server/device events. Events that occur on the server or a designated device that meet criteria that the user sets.

SFP. See *small form-factor pluggable*.

Simple Network Management Protocol (SNMP). In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

SL_port. See *segmented loop port*.

SMagent. The DS4000 Storage Manager optional Java-based host-agent software, which can be used on Microsoft Windows, Novell NetWare, HP-UX, and Solaris host systems to manage storage subsystems through the host fibre-channel connection.

SMclient. The DS4000 Storage Manager client software, which is a Java-based graphical user interface (GUI) that is used to configure, manage, and troubleshoot storage servers and storage expansion enclosures in a DS4000 storage subsystem. SMclient can be used on a host system or on a storage management station.

SMruntime. A Java compiler for the SMclient.

SMutil. The DS4000 Storage Manager utility software that is used on Microsoft Windows, HP-UX, and Solaris host systems to register and map new logical drives to the operating system. In Microsoft Windows, it also contains a utility to flush the cached data of the operating system for a particular drive before creating a FlashCopy.

small computer system interface (SCSI). A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

small form-factor pluggable (SFP). An optical transceiver that is used to convert signals between optical fiber cables and switches. An SFP is smaller than a gigabit interface converter (GBIC). See also *gigabit interface converter*.

SNMP. See *Simple Network Management Protocol* and *SNMPv1*.

SNMP trap event. (1) (2) An event notification sent by the SNMP agent that identifies conditions, such as thresholds, that exceed a predetermined value. See also *Simple Network Management Protocol*.

SNMPv1. The original standard for SNMP is now referred to as SNMPv1, as opposed to SNMPv2, a revision of SNMP. See also *Simple Network Management Protocol*.

SRAM. See *static random access memory*.

SSA. See *serial storage architecture*.

static random access memory (SRAM). Random access memory based on the logic circuit known as flip-flop. It is called static because it retains a value as long as power is supplied, unlike dynamic random access memory (DRAM), which must be regularly refreshed. It is however, still volatile, meaning that it can lose its contents when the power is turned off.

storage area network (SAN). A dedicated storage network tailored to a specific environment, combining

servers, storage products, networking products, software, and services. See also *fabric*.

Storage Array Identifier (SAI or SA Identifier). The Storage Array Identifier is the identification value used by the DS4000 Storage Manager host software (SMClient) to uniquely identify each managed storage server. The DS4000 Storage Manager SMClient program maintains Storage Array Identifier records of previously-discovered storage servers in the host resident file, which allows it to retain discovery information in a persistent fashion.

storage expansion enclosure (EXP). A feature that can be connected to a system unit to provide additional storage and processing capacity.

storage management station. A system that is used to manage the storage subsystem. A storage management station does not need to be attached to the storage subsystem through the fibre-channel input/output (I/O) path.

storage partition. Storage subsystem logical drives that are visible to a host computer or are shared among host computers that are part of a host group.

storage partition topology. In the DS4000 Storage Manager client, the Topology view of the Mappings window displays the default host group, the defined host group, the host computer, and host-port nodes. The host port, host computer, and host group topological elements must be defined to grant access to host computers and host groups using logical drive-to-LUN mappings.

striping. Splitting data to be written into equal blocks and writing blocks simultaneously to separate disk drives. Striping maximizes performance to the disks. Reading the data back is also scheduled in parallel, with a block being read concurrently from each disk then reassembled at the host.

subnet. An interconnected but independent segment of a network that is identified by its Internet Protocol (IP) address.

sweep method. A method of sending Simple Network Management Protocol (SNMP) requests for information to all the devices on a subnet by sending the request to every device in the network.

switch. A fibre-channel device that provides full bandwidth per port and high-speed routing of data by using link-level addressing.

switch group. A switch and the collection of devices connected to it that are not in other groups.

switch zoning. See *zoning*.

synchronous write mode. In remote mirroring, an option that requires the primary controller to wait for the

acknowledgment of a write operation from the secondary controller before returning a write I/O request completion to the host. See also *asynchronous write mode*, *remote mirroring*, *Metro Mirroring*.

system name. Device name assigned by the vendor's third-party software.

TCP. See *Transmission Control Protocol*.

TCP/IP. See *Transmission Control Protocol/Internet Protocol*.

terminate and stay resident program (TSR program). A program that installs part of itself as an extension of DOS when it is executed.

topology. The physical or logical arrangement of devices on a network. The three fibre-channel topologies are fabric, arbitrated loop, and point-to-point. The default topology for the disk array is arbitrated loop.

TL_port. See *translated loop port*.

transceiver. A device that is used to transmit and receive data. Transceiver is an abbreviation of transmitter-receiver.

translated loop port (TL_port). A port that connects to a private loop and allows connectivity between the private loop devices and off loop devices (devices not connected to that particular TL_port).

Transmission Control Protocol (TCP). A communication protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communication networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP). A set of communication protocols that provide peer-to-peer connectivity functions for both local and wide-area networks.

trap. In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

trap recipient. Receiver of a forwarded Simple Network Management Protocol (SNMP) trap. Specifically, a trap receiver is defined by an Internet Protocol (IP) address and port to which traps are sent. Presumably, the actual recipient is a software application running at the IP address and listening to the port.

TSR program. See *terminate and stay resident program*.

uninterruptible power supply. A source of power from a battery that is installed between a computer system and its power source. The uninterruptible power supply keeps the system running if a commercial power failure occurs, until an orderly shutdown of the system can be performed.

user action events. Actions that the user takes, such as changes in the storage area network (SAN), changed settings, and so on.

worldwide port name (WWPN). A unique identifier for a switch on local and global networks.

worldwide name (WWN). A globally unique 64-bit identifier assigned to each Fibre Channel port.

WORM. See *write-once read-many*.

write-once read many (WORM). Any type of storage medium to which data can be written only a single time, but can be read from any number of times. After the data is recorded, it cannot be altered.

WWN. See *worldwide name*.

zoning. (1) In Fibre Channel environments, the grouping of multiple ports to form a virtual, private, storage network. Ports that are members of a zone can communicate with each other, but are isolated from ports in other zones. (2) A function that allows segmentation of nodes by address, name, or physical port and is provided by fabric switches or hubs.

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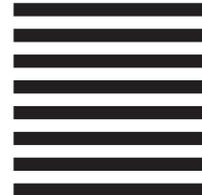
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