IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter

Installation and User's Guide

GC26-7737-00

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Note: Before using this information and the product it supports, be sure to read the general information under "Notices" on page 31.

First Edition (January 2005)

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Safety

Before installing this product, read the Safety information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

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 pečítaje 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.

Safety information

Before you service an IBM computer, you must be familiar with the following safety information.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
  1. Ensure that you can stand safely without slipping.
  2. Distribute the weight of the object equally between your feet.
  3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
  4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*
- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your tool case away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, approximately 8 centimeters (3 in.) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing. **Remember:** Metal objects are good electrical conductors.
- Wear safety glasses when you are doing any of the following: hammering, drilling soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Electrical safety

Important
Use only approved tools and test equipment. Some hand tools have handles that are covered with a soft material that does not insulate you when working with live electrical currents. Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

Observe the following rules when working on electrical equipment.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before doing any of the following tasks:
  - Performing a mechanical inspection
  - Working near power supplies
  - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
  - Ensure that another person, familiar with the power-off controls, is near you.

    Remember: Another person must be there to switch off the power, if necessary.
  - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

    Remember: There must be a complete circuit to cause electrical shock. By observing the previous rule, you might prevent a current from passing through your body.
  - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
  - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

  Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.
- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered-off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive and can cause personal injury and machine damage.

- Do not service the following parts (or similar units) *with the power on* when they are removed from their normal operating places in a machine. This practice ensures correct grounding of the units.
  - Power supply units
  - Pumps
  - Blowers and fans
  - Motor generators
- If an electrical accident occurs:
  - **Use caution; do not become a victim yourself.**
  - **Switch off power.**
  - **Send another person to get medical aid.**

Handling ESD-sensitive devices

Any computer part that contains transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person that is handling the part are all at the same charge.

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices that you use have been certified (ISO 9000) as fully effective.

Use the following precautions when handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

  Note: The use of a grounding system is desirable but not required to protect against ESD damage.
  - Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
  - Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
  - Use the round ground-prong of the ac plug on ac-operated computers.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.

Safety inspection procedure

Use this safety inspection procedure to identify potentially unsafe conditions on a product. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This procedure

addresses only those items. However, good judgment should be used to identify any potential safety hazards due to attachment of non-IBM features or options not covered by this inspection procedure.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock).
- Explosive hazards, such as a damaged cathode ray tube (CRT) face or bulging capacitor
- Mechanical hazards, such as loose or missing hardware

Complete the following checks with the power off, and with the power cord disconnected.

1. Check the exterior covers for damage (loose, broken, or sharp edges).
2. Check the power cord for the following conditions:
   a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
   b. The power cord should be the appropriate type as specified in the parts listings.
   c. Insulation must not be frayed or worn.
3. Remove the cover.
4. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
5. Check the inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
6. Check for worn, frayed, or pinched cables.
7. Check that the power supply cover fasteners (screws or rivets) have not been removed or tampered with.

About this document

This document provides instructions on how to install your IBM TotalStorage™ DS4000 FC2-133 Dual Port Host Bus Adapter and how to customize the configuration. It also provides information on how to troubleshoot installation problems.

The IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter (part number 25R0411) is hereafter referred to as the DS4000 FC2-133, or the adapter.

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.

FAStT product renaming

IBM is in the process of renaming some FAStT family products. Table 1 identifies each new DS4000 product name with its corresponding FAStT 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 FAStT products.

Table 1. Mapping of FAStT names to DS4000 Series names

Current FAStT Product Name	New DS4000 Product Name
IBM TotalStorage FAStT Storage Server	IBM TotalStorage DS4000
FAStT	DS4000
FAStT Family	DS4000 Mid-range Disk System
FAStT Storage Manager vX.Y (for example v9.10)	DS4000 Storage Manager vX.Y (for example v9.10)
FAStT100	DS4100
FAStT600	DS4300
FAStT600 with Turbo Feature	DS4300 Turbo
FAStT700	DS4400
FAStT900	DS4500
EXP700	DS4000 EXP700
EXP710	DS4000 EXP710
EXP100	DS4000 EXP100
FAStT FlashCopy	FlashCopy for DS4000
FAStT VolumeCopy	VolumeCopy for DS4000
FAStT Remote Mirror (RM)	Enhanced Remote Mirroring for DS4000
FAStT 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)

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 version of the DS4000 Storage Manager host software and any appropriate DS4000 product series 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.ibm.com/support/us/

Go to the **Personalized Support** section of the web page and 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**. Using the pull downs in the **Products** area, select **Storage** → **Computer Storage** → **Disk Storage Systems** → **TotalStorage DS4000 Midrange Disk Systems & FAStT Stor Srvrs**.
3. 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. Select **Add products**. The **My support** page reopens.
4. Select **Subscribe to email**. In the **Documents** area on the next page, use the pull down and select **Storage**.
5. On the next page, place a check in the following boxes:
   a. **Please send these documents by weekly email**
   b. **Downloads and drivers**
   c. **Flashes**

   and any others you may be interested in, and then click **Update**.

DS4000 installation process overview

Attention: For the latest product information, go to the following Web site: www.ibm.com/servers/storage/support/disk/

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.

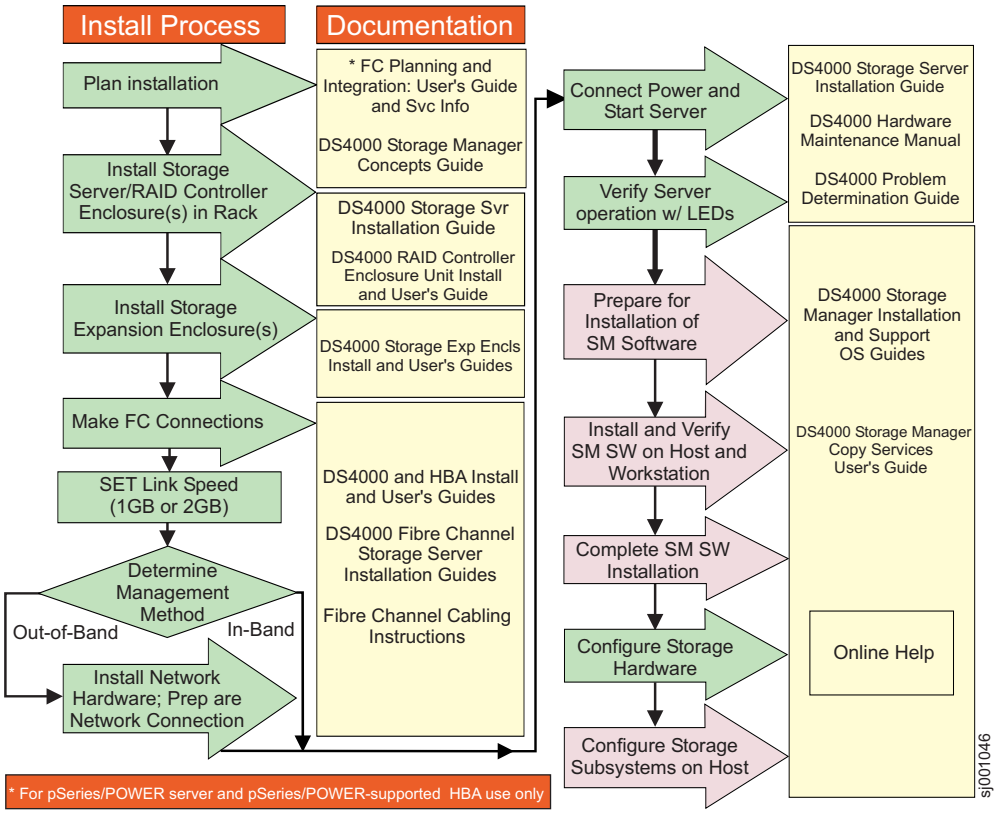

Figure 1. Installation process flow by current publications

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 xx associates each document in the DS4500 (previously FAStT900) 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**
IBM TotalStorage DS4500 Installation and Support Guide, GC26-7727	✓	✓		✓		
IBM TotalStorage DS4500 Fibre Channel Cabling Instructions, GC26-7729	✓	✓				
IBM TotalStorage DS4500 Storage Server User's Guide, GC26-7726				✓	✓	✓
IBM TotalStorage DS4500 Rack Mounting Instructions, GC26-7728	✓	✓				

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**
IBM DS4400 Fibre Channel Storage Server User's Guide, GC26-7730	✓	✓		✓	✓	✓
IBM DS4400 Fibre Channel Storage Server Installation and Support Guide, GC26-7731	✓	✓		✓	✓	
IBM DS4400 Fibre Channel Cabling Instructions, GC26-7732	✓	✓				

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**
IBM TotalStorage DS4300 Fibre Channel Storage Server Installation and User's Guide, GC26-7722	✓	✓		✓		
IBM TotalStorage DS4300 Rack Mounting Instructions, GC26-7724	✓	✓				
IBM TotalStorage DS4300 Fibre Channel Cabling Instructions, GC26-7725	✓	✓				
IBM TotalStorage DS4300 SCU Base Upgrade Kit, GC26-7740		✓	✓			
IBM TotalStorage DS4300 SCU Turbo Upgrade Kit, GC26-7741		✓	✓			
IBM TotalStorage DS4300 Turbo Models 6LU/6LX Upgrade Kit, GC26-7723		✓	✓			

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**
IBM TotalStorage DS4100 Installation, User's and Maintenance Guide, GC26-7733	✓	✓		✓	✓	✓
IBM TotalStorage DS4100 Cabling Guide, 24P8973		✓				

DS4000 Storage Manager Version 9 publications

Table 6 associates each document in the DS4000 Storage Manager (previously FAStT 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**
IBM TotalStorage DS4000 Storage Manager Version 9 Installation and Support Guide for Windows 2000/Server 2003, NetWare, ESX Server, and Linux, GC26-7706	✓		✓	✓		
IBM TotalStorage DS4000 Storage Manager Version 9 Installation and Support Guide for AIX, HP-UX, Solaris and Linux on POWER, GC26-7705	✓		✓	✓		
IBM TotalStorage DS4000 Storage Manager Version 9 Copy Services User's Guide, GC26-7707	✓		✓	✓	✓	
IBM TotalStorage DS4000 Storage Manager Version 9 Concepts Guide, GC26-7734	✓	✓	✓	✓	✓	✓

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

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**
IBM TotalStorage DS4000 EXP700 and EXP710 Storage Expansion Enclosures Installation, User's, and Maintenance Guide, GC26-7735	✓	✓		✓	✓	✓
IBM TotalStorage DS4000 Hard Drive and Storage Expansion Enclosures Installation and Migration Guide, GC26-7704	✓	✓				
IBM DS4000 Management Suite Java User's Guide, 32P0081					✓	✓
IBM Netfinity® Fibre Channel Cabling Instructions, 19K0906		✓				
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	✓		✓	✓	✓	

How this document is organized

Chapter 1, "Preparing and installing the DS4000 FC2-133," on page 1 includes an overview of the DS4000 FC2-133 features and contains the information and instructions needed to prepare and install the DS4000 FC2-133.

Chapter 2, "Updating the DS4000 FC2-133 BIOS code and installing device drivers," on page 9 provides information for how to update the DS4000 FC2-133 BIOS code.

Chapter 3, "Configuring the DS4000 FC2-133 with Fast!UTIL," on page 19 provides detailed configuration information about how to customize the configuration of the DS4000 FC2-133 and any fibre-channel devices that connect to the DS4000 FC2-133.

Chapter 4, "Adapter operating environment and specifications," on page 25 contains the DS4000 FC2-133 operating environment and specification information.

Chapter 5, "Troubleshooting," on page 27 provides information about the types of installation problems that can cause the DS4000 FC2-133 to function incorrectly.

"Accessibility," on page 29 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.

Notices used in this document

The caution and danger statements that this document uses also appear in the multilingual Safety Information document that is provided with your DS4000 Storage Server. Each caution and danger statement is numbered for easy reference to the corresponding statements in the safety document.

This document can contain the following notices that are 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.

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 IBM Support Web site:

  www.ibm.com/servers/storage/support/disk/
- 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 your 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 about how to use 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.ibm.com/servers/storage/support/disk/

  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 the following Web site:

  www.elink.ibmlink.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 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-132.ibm.com/content/home/store_IBMPublicUSA/en_US/IntelliStation_workstations.html
- For the latest information about operating system and HBA support, clustering support, SAN fabric support, and Storage Manager feature support, see the TotalStorage DS4000 Interoperability Matrix at the following Web site:

  www.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.

How to send your comments

Your feedback is important in helping us to provide the most accurate and high-quality information. If you have comments or suggestions for improving this publication, you can send us comments electronically by using these addresses:

- Internet: starpubs@us.ibm.com
- IBMLink from U.S.A.: STARPUBS at SJEVM5
- IBMLink from Canada: STARPUBS at TORIBM
- IBM Mail Exchange: USIB3WD at IBMMAIL

  Be sure to include the name and order number of the document and, if applicable, the specific location of the text you are commenting on, such as a page number or table number.

You can also mail your comments by using the Reader Comment Form in the back of this manual or direct your mail to:

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Information Development
Department GZW
9000 South Rita Road
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U.S.A.

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Chapter 1. Preparing and installing the DS4000 FC2-133

This chapter contains instructions on how to prepare and install the DS4000 FC2-133. It also describes the adapter components.

Overview

The DS4000 FC2-133 is a 2 Gbps high-performance, direct memory access (DMA), bus master, fibre channel (FC) host bus adapter that is designed for high-end systems. The function and performance are derived from the ISP2312 chip (see Figure 2 on page 2), making the DS4000 FC2-133 a leading-edge host bus adapter.

The ISP2312 chip combines a powerful, reduced instruction set computer (RISC) processor, a fibre-channel protocol manager (FPM) with two 2 Gbps fibre-channel transceivers, and a peripheral component interconnect (PCI) or peripheral component interconnect-extended (PCI-X) local bus interface in a single-chip solution. The DS4000 FC2-133 supports all fibre-channel peripheral devices that support private-loop direct attach (PLDA) and fabric-loop attach (FLA).

The DS4000 FC2-133 connects the following hardware:

- Mainframe computers
- Super computers
- Workstations
- Storage devices
- Servers

Overview of fibre channel

Fibre channel is a high-speed data transport technology used for mass storage and networking. By using a fibre-channel arbitrated loop (FC-AL), 126 fibre-channel devices can be supported, compared to 15 small computer system interface (SCSI) devices with Ultra SCSI.

The DS4000 FC2-133 uses multimode shortwave optical interfaces for distances up to 550 m (1804 ft.) when operating at 1 Gbps or up to 300 m (984 ft.) when operating at 2 Gbps. The DS4000 FC2-133 supports data transfer rates up to 200 MBps half-duplex and 400 MBps full-duplex on optical interfaces.

For more information about fibre channel technology, see the SCSI-3 Fibre Channel Protocol (SCSI-FCP) standard.

DS4000 FC2-133 features

The DS4000 FC2-133 has the following features:

- Compliance with the following standards and specifications:
  - Intel® PCI Local Bus version 2.2 specification
  - PCI-X addendum, revision 1.0 to the Intel PCI Local Bus version 2.2 specification
  - Third Generation Fibre Channel Physical and Signaling Interface (PC-PH-3), revision 9.2
  - Fibre-channel arbitrated loop (FC-AL-2) standard
  - U.S. and international safety and emissions standards

- Supports direct memory access (DMA)
- Supports bus master
- Uses the Fast!UTILbasic input/output system (BIOS) utility program to customize the configuration parameters on the DS4000 FC2-133 and attached drives
- Supports fibre channel protocol SCSI (FCP-SCSI) and fibre channel Internet protocol (FCP-IP)
- Supports point-to-point fabric connection (F_PORT FABRIC LOGIN)
- Supports fibre channel service (Classes 2 and 3)
- Contains two independent channels on a single HBA

DS4000 FC2-133 components

Figure 2 identifies the DS4000 FC2-133 components that are referred to in this document.

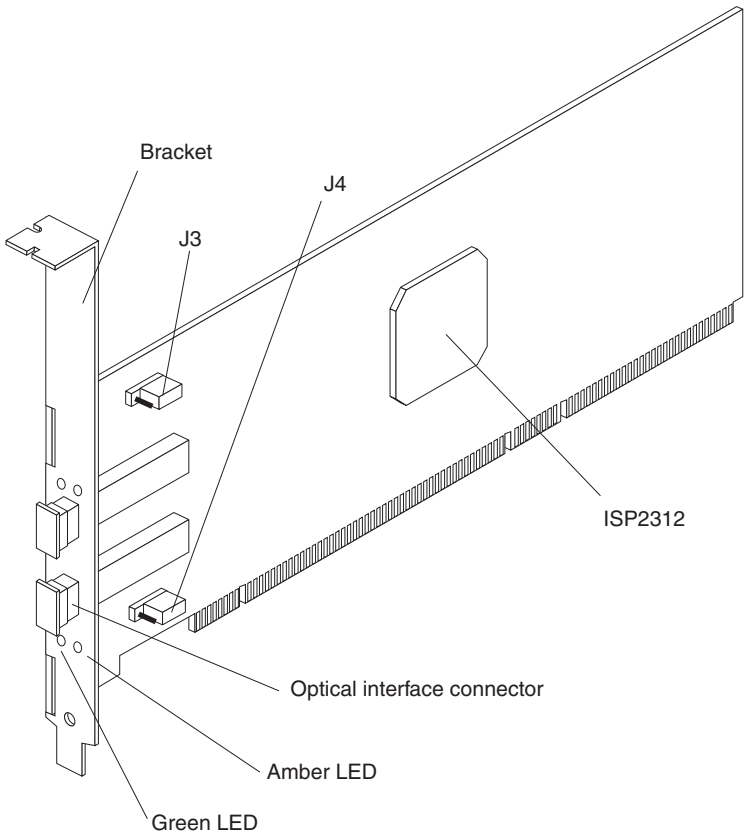

Figure 2. DS4000 FC2-133 components

Each port has its own set of status light emitting diodes (LEDs). Table 8 on page 3 describes the green and amber LEDs and the activity that is indicated by the LEDs. For more information about the DS4000 FC2-133 LED activity and troubleshooting, see the installation, user's and maintenance guide for your particular storage server or *IBM TotalStorage DS4000 Problem Determination Guide*.

Table 8. DS4000 FC2-133 Adapter activity

Green LED	Amber LED	Activity	Description
Off	Off	Power off	The server adapter is not receiving power. The server is powered off.
On	On	Power	The FC2-133 Adapter is receiving power from the PCI or PCI-X slot but is not initialized by the adapter firmware.
On	Off	Online	The FC2-133 Adapter is successfully initialized by the adapter firmware and is in a ready state. The adapter firmware is initialized when the adapter BIOS code is loaded, Ctrl-Q is pressed, or the operating system driver is loaded.
Off	On	Signal acquired	The FC2-133 Adapter firmware is performing or waiting to perform Fibre Channel loop initialization.
Off	Flashing twice per second	Loss of synchronization	The FC2-133 Adapter has detected a loss of synchronization condition from the adapter Fibre Channel receiver and is attempting to resynchronize. A loss of synchronization condition might occur when a degraded optical signal is received from the LC-LC Fibre Channel cable or optical interface connector.
Flashing twice per second	Flashing twice per second	Firmware error	The FC2-133 Adapter firmware has detected an unrecoverable error condition.
Off	Flashing once per second	Beacon	The adapter is responding to a Beacon command from a HBA management program.

The jumpers on the HBA set the default state of the laser and are set at the factory with a jumper plug on pins 2-3 of the J3 and J4 jumpers.

Attention: Changing the jumper settings can result in the HBA being inoperable.

Preinstallation procedures

Complete the following tasks before you begin the installation:

- Read “Handling static-sensitive devices” on page 4.
- Read “What you need for the installation” on page 5.
- Write down the serial number of the DS4000 FC2-133. Each adapter has a unique serial number. If the nonvolatile random access memory (NVRAM) (also referred to as NOVRAM) is damaged, the system prompts you for the DS4000 FC2-133 serial number. Figure 3 on page 4 shows the location of the serial number label.

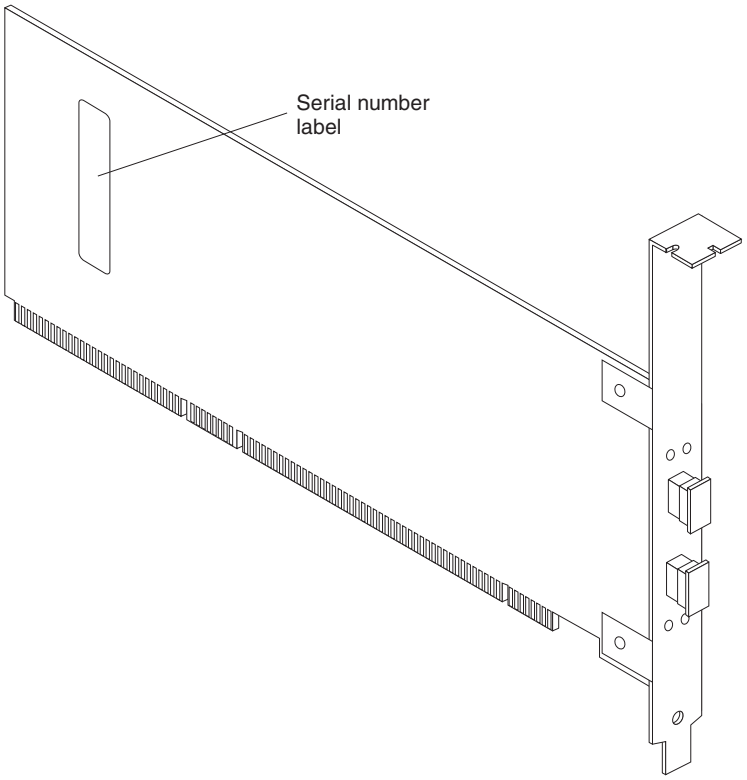

Figure 3. DS4000 FC2-133 serial number label

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, 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, you should hold the device and touch an unpainted metal part of the system unit for at least 2 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.

What you need for the installation

To install the DS4000 FC2-133 in your server, you will need a small Phillips screwdriver. Depending on your configuration, you might need the following two items:

- An LC-LC fibre channel cable[1]. This cable enables you to connect fibre-channel nodes to a loop.
- LC-SC fibre channel cable[1]. This cable enables you to connect an LC-LC fibre-channel cable to a device that requires an SC connector.

Installing the DS4000 FC2-133

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

- Do not route the cable along a folding cable-management arm.
- When you attach fiber-optic cables to a fibre-channel device on slide rails, leave enough slack in the cables so that they do not bend to an angle smaller than 38 mm (1.5 in.) when they are extended or so that they do not become pinched when retracted.
- Route the cable away from places where it can snag on other fibre-channel devices in the rack.
- Do not overtighten the cable straps or bend the cables to an angle smaller than 38 mm (1.5 in.).
- Do not put excess weight on the cable at the connection point and be sure that the cable is well-supported.

The DS4000 FC2-133 comes with an attached standard 3U adapter bracket, as shown in Figure 2 on page 2. A Low Profile 2U bracket also comes with the adapter. Before you install the DS4000 FC2-133, check the size of the storage server to verify whether you need the Low Profile 2U adapter bracket. If you need to install the Low Profile 2U bracket, go to step 1. Otherwise, go to step 2.

1. Complete the following steps to install the Low Profile 2U adapter bracket:
   a. Remove your DS4000 FC2-133 from the static-protective package. Set it down on a nonconductive, static-protected surface (place it component side up). Do not place the adapter on your system unit cover or on a metal table.
   b. Using a small Phillips screwdriver, carefully remove the two bracket screws from the 3U adapter (you will reuse the two adapter screws). Remove the 3U adapter bracket and set it aside.
   c. Align the two screw holes in the 2U adapter bracket with the two screws holes on the adapter. Using the two screws that you removed in step 1b, secure the bracket to the adapter.
   d. Return the adapter to the static-protective package until you are ready for installation.
2. Check the system board and make any configuration changes that are needed to accommodate the DS4000 FC2-133.

   Note: The DS4000 FC2-133 is self-configuring; however, some system boards require manual configuration. For example, some systems have a PCI Device Configuration menu in the system board setup BIOS code where you must enable host bus adapters, bus-master slots, and interrupt request (IRQ) levels. If the system board supports triggering, use level

1. These cables do not come with the DS4000 FC2-133 Dual Port Host Bus Adapter. You must order them separately.

triggering for the DS4000 FC2-133. For system specific configuration, see the documentation that comes with your server, or contact your IBM technical support representative to determine if your system board requires configuration.

3. Turn off the peripheral devices. Then turn off the server.
4. Disconnect the power cords.
5. Remove the server cover.
6. Choose a PCI bus-master slot that supports bus mastering. Most system boards automatically assign an IRQ level and interrupt line. If your system board does not automatically assign an IRQ level and interrupt line, you must assign an IRQ level and use interrupt line A for this PCI bus-master slot. Before you install the adapter into a PCI bus-master slot, note the following points:
   - Some system boards have two kinds of PCI bus slots: master and subordinate. The DS4000 FC2-133 must be in a PCI bus-master slot. (Some system boards have PCI bus-master slots that are shared with on-board devices. The DS4000 FC2-133 does not work in shared PCI bus-master slots.)
   - PCI connectors vary among system board manufacturers. The DS4000 FC2-133 is a 64-bit PCI device that can function in a 32-bit PCI bus-master slot.
   - The DS4000 FC2-133 is designed and tested to operate at PCI bus speeds up to 66 MHz and PCI-X bus speeds up to 133 MHz.
   - PCI and PCI-X slots look the same. If the server contains both PCI and PCI-X bus-master slots, see the documentation that comes with the server to determine the slot type.
7. Remove the expansion slot cover. Before you remove the cover, see the documentation that comes with the server for specific removal instructions.

   Attention: If you try to install the DS4000 FC2-133 into a PCI bus-master slot that does not conform to the PCI specification, you might damage the DS4000 FC2-133.
8. Align the adapter with the expansion slot. Carefully press it into the PCI bus-master slot until it is fully seated and secure.
9. Connect one end of an LC-LC fibre-channel cable to one of the optical interface connectors on the DS4000 FC2-133. Connect the other end of the cable to a fibre-channel device. You can connect another device to the unused optical interface connector.
10. Carefully install and secure the server cover.
11. Connect the power cables.
12. Turn on all external fibre-channel devices. Then turn on the server. The following information is displayed when the server processor architecture is Intel Architecture 32 bit (IA-32), Intel Extended Memory 64 Technology (EM64T) or the Advance Micro Devices 64 bit (AMD-64):

```
QLogic Corporation QLA2312 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1993-2002 All Rights Reserved. www.qlogic.com
Press <Ctrl+Q> for Fast!UTIL BIOS for Adapter 0 is disabled ROM BIOS not installed
```

Note: This BIOS banner does not display when the adapter is in a server with an Intel 64 bit processor (IA-64) or a Sun SPRAC processor architecture.

To display the fibre-channel devices, press Ctrl+Q, and then use the Fast!UTIL program. See Chapter 3, “Configuring the DS4000 FC2-133 with Fast!UTIL,” on page 19 for detailed information about Fast!UTIL.

If the information that is displayed is correct, go to Chapter 2, “Updating the DS4000 FC2-133 BIOS code and installing device drivers,” on page 9 for detailed instructions on how to update the DS4000 FC2-133 BIOS code.

If the information that is displayed is not correct and you have checked the adapter configuration, go to Chapter 5, “Troubleshooting,” on page 27 for problem solving information.

Chapter 2. Updating the DS4000 FC2-133 BIOS code and installing device drivers

Important: The information in this section is applicable when the server processor architecture is Intel Architecture 32 bit (IA-32), Intel Extended Memory 64 Technology (EM64T) or the Advance Micro Devices 64 bit (AMD-64). It does not apply when the server processor architecture is Intel Architecture 64 bit. When the adapter is installed in a server with an Intel 64 bit processor (IA-64), see the readme in the FC2-133 HBA EFI driver package for instructions about how to load the EFI driver (instead of BIOS code) and update the adapter NVRAM settings.

After you install the DS4000 FC2-133, you must update the BIOS code, update the nonvolatile random access memory (NVRAM), and install the device drivers.

Important: The BIOS Update Utility treats each of the two fibre-channel ports of the DS4000 FC2-133 as a separate port. This means that if you program the flash or NVRAM using the I/O address of one DS4000 FC2-133 port, you must repeat the same process to program the other DS4000 FC2-133 port.

You can update the adapter BIOS code either by using the BIOS Update Utility from the support CD that comes with the adapter (see "Updating the BIOS code and NVRAM from the support CD") or by creating and using a BIOS Update Utility diskette (see "Updating the BIOS code and NVRAM from the BIOS Update Utility diskette" on page 12).

To install the device drivers, see "Installing the DS4000 FC2-133 device drivers" on page 15.

Note: For the latest information about supported operating systems, versions of device drivers, utilities, and documentation, go to the following Web site: www.ibm.com/pc/support/

Updating the BIOS code and NVRAM from the support CD

To update the DS4000 FC2-133 BIOS code and NVRAM using the BIOS Update Utility on the support CD, choose one of the following methods:

- flasutil command prompt. Use this method to type in command-line options. See "Using the flasutil command prompt."
- flasutil BIOS Update Utility menu. Use this method to select a command-line option from the menu. See "Using the flasutil BIOS Update Utility menu" on page 11.

Using the flasutil command prompt

Complete the following steps to update the DS4000 FC2-133 BIOS code and NVRAM using the command line:

1. Insert the IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter Support CD into the CD-ROM drive. Restart the server. Your server displays a DOS prompt.
2. Update the BIOS code in the flash utility by typing the following command:

   ```
   flasutil /f
   ```

   Press **Enter**.
3. Update the NVRAM by typing the following command:

```
flasutil /l
```

Press **Enter**.

4. Update the standard BIOS defaults in the flash utility to the new defaults from the NVRAM files by typing the following command:

   ```
   flasutil /u
   ```

   Press **Enter**.
5. To review additional command-line options that you can use, go to “Additional command-line options.” Then return to step 6.
6. Remove the support CD from the CD-ROM drive and restart the server.
7. Go to “Installing the DS4000 FC2-133 device drivers” on page 15.

Additional command-line options

This section describes additional command-line options that you can use. Complete the following steps to review these command-line options:

1. At the DOS prompt, type the following command: `flasutil /?`
2. Press **Enter**.

   The following command-line options display:

```
/F xxxx = Write Flash, adapter address = xxxx
 If no address specified then write Flash to all adapters
/W xxxx = Copy Flash to file: QLxxRIM.SAV, adapter type = xxxx
/O <filename.ext> = Use <filename.ext> instead of QLxxROM.BIN
/I = Ignore Subsystem ID /P = Program all adapters
/M = Don't prompt for I/O address
/Q = Quiet Mode, no messages will be displayed
/S xxxx = Display serial number of adapter at address xxxx
 If no address specified then display the serial number of all adapters
/V xxxx = Display current version number of BIOS on adapters at address xxxx
 If no address specified then display the BIOS version of all adapters
/C xxxx = Verify Flash of adapter at address xxxx
 If no address specified verify the Flash of all adapters
/Y xxxx = Display port name of adapter at address xxxx
 If no address specified then display port name of all adapters
/L xxxx = Write NOVRAM, adapter address = xxxx
 If no address specified then write NOVRAM to all adapters
/D xxxx = Copy NOVRAM to file: QL1xNVRM.SAV, adapter address = xxxx
/U xxxx = Update BIOS NOVRAM defaults, adapter address = xxxx
 If no address specified then write then update all adapters
/N <filename.ext> = Use <filename.ext> instead of NVRMxx0.DAT
/T = Multiport Fibre Channel adapter
/X xxxx = Verify NOVRAM of adapter at address xxxx
```

Notes:

1. All of the listed options are supported and you can run them from the command line. Options /L, /D, /U, /N, /T, and /X might not display.
2. The command-line option is not case-sensitive. Either /f or /F can be used to initiate the adapter flash BIOS update.

Table 9 on page 11 shows additional command-line options that you can use, along with an explanation of each option.

Table 9. Examples of flasutil command-line options

Command	Description
flasutil /L	Write NVRAM on all DS4000 host bus adapters in a system without being prompted for an I/O address.
flasutil /W F600	Save the existing flash code to file QL2312RM.SAV.
flasutil /L f400	Write NVRAM to the adapter at I/O address f400.
flasutil /L f800 /F f800	Write NVRAM and flash an adapter at I/O address f800.
flasutil /L /F	Write NVRAM and flash all adapters.
flasutil /D	Save NVRAM to file QL23NVRM.SAV.
flasutil /U	Update BIOS NVRAM defaults.
flasutil /X	Verify NVRAM in all adapters.

Using the flasutil BIOS Update Utility menu

Complete the following steps to update the DS4000 FC2-133 BIOS code and NVRAM by using the flasutil BIOS Update Utility menu:

1. Insert the IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter Support CD into the CD-ROM drive. Restart the server. Your server displays a DOS prompt.
2. Type the following command: `flasutil`

   Press **Enter**.
3. A list of adapters and I/O addresses displays. At the command prompt, type the appropriate I/O address and press **Enter**.
4. The following option menu displays:

```
F = Write Flash
W = Copy Flash to file: QLxxROM.SAV
S = Display serial number
V = Display current BIOS version
C = Verify Flash
Y = Display port name
L = Write NOVRAM
A = Write NOVRAM and defaults
D = Copy NOVRAM to file:QLxxNVRM.SAV
U = Update BIOS NOVRAM defaults
X = Verify NOVRAM
```

   Notes:

   a. All of the listed options are supported and you can run them from the command line. Options L, A, D, U, and X might not display. The command-line option is not case-sensitive.

   b. You can configure each adapter with more than one option.
5. Type the letter for the option that you want and press **Enter**.
6. If you have additional adapters installed, if you want to program the other port of the adapter, or if you want to configure your adapter with more than one option, continue with step 7. Otherwise, go to step 8.
7. Repeat steps 2 through 5 for each additional adapter or port.
8. Remove the CD from the CD-ROM drive and restart the server.
9. Go to “Installing the DS4000 FC2-133 device drivers” on page 15.

Updating the BIOS code and NVRAM from the BIOS Update Utility diskette

If you cannot use the support CD to update the adapter BIOS code, you can create a diskette using the support CD. The following sections describe how to create and use the diskette.

Note: For a Novell NetWare environment, you will need to unpack the BIOS Update Utility diskette using a server that is running a Microsoft® Windows NT®, Windows® 2000, or Linux operating system.

Creating the BIOS Update Utility diskette

Create the BIOS Update Utility diskette by copying the image you need from the IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter Support CD or by downloading the image from the following Web site:

www.ibm.com/pc/support

For Microsoft Windows NT or Windows 2000

Complete the following steps to create a BIOS Update Utility diskette for Microsoft Windows NT or Windows 2000 from the IBM TotalStorage DS4000 FC2-133 Host Bus Adapter Support CD:

1. Insert the support CD into the CD-ROM drive.
2. Insert a diskette into the diskette drive.
3. At the command prompt, type the following command:

   ```
   d:\tools\dsk4w32 d:\images\biosnvrm\23x0\2342_xxx.img a:
   ```

   Where *d* is the CD-ROM drive and *a* is the diskette drive.
4. Press **Enter**.
5. Remove the support CD from the CD-ROM drive.
6. Remove the diskette from the diskette drive and label the diskette appropriately.

For Linux

Complete the following steps to create a BIOS Update Utility diskette for Linux from the IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter Support CD:

1. Insert the support CD into the CD-ROM drive and restart the server.
2. Insert a diskette into the diskette drive.
3. At the command prompt, type the following command: `mount -t iso9660/dev/cdromdevicefile /mnt`

   Where *cdromdevicefile* is the specific device file for the CD-ROM block device.
4. Press **Enter**.
5. Type: `dd if=/mnt/images/biosnvrm/23x0/2342_xxx.img of=/dev/diskettedevicefile bs=32`

   Press **Enter**.
6. Unmount the CD-ROM by typing the following command: `unmount /mnt`
7. Remove the support CD from the CD-ROM drive.
8. Remove the diskette from the diskette drive and label the diskette appropriately.

Updating the BIOS code and NVRAM from the diskette

Use one of the following methods to update the BIOS code and NVRAM using the BIOS Update Utility from the diskette:

- flasutil command prompt. Use this method to type in command-line options. See "Using the flasutil command prompt."
- flasutil BIOS Update Utility menu. Use this method to select a command-line option from the menu. See "Using the flasutil BIOS Update Utility menu" on page 14.

Important: The BIOS Update Utility treats each of the two fibre-channel ports of the DS4000 FC2-133 adapter as a separate port. This means that if you program the flash or NVRAM using the I/O address of one DS4000 FC2-133 port, you must repeat the same process to program the other DS4000 FC2-133 port.

Using the flasutil command prompt

Complete the following steps to update the BIOS code and NVRAM using the flasutil command prompt:

1. Insert the BIOS Update Utility diskette that you created into the diskette drive and restart the server. Your server displays a DOS prompt.
2. Update the BIOS in the flash utility by typing the following command: `flasutil /f`

   Press **Enter**.
3. Update the NVRAM by typing the following command: `flasutil /l`

   Press **Enter**.
4. Update the standard BIOS defaults in the flash utility to the new defaults from the NVRAM files by typing the following command: `flasutil /u`

   Press **Enter**.
5. To review additional command-line options that you can use, continue with "Command-line options." Otherwise, continue with step 6.
6. Remove the diskette from the diskette drive and restart the server.
7. Go to "Installing the DS4000 FC2-133 device drivers" on page 15.

Command-line options: This section describes additional command-line options that you can use. Complete the following steps to review these command-line options:

1. At the DOS prompt, type the following command: `flasutil /?`
2. Press **Enter**.

The following command-line options display:

```
/F xxxx = Write Flash, adapter address = xxxx
 If no address specified then write Flash to all adapters
/W xxxx = Copy Flash to file: QLxxRIM.SAV, adapter type = xxxx
/O <filename.ext> = Use <filename.ext> instead of QLxxROM.BIN
/I = Ignore Subsystem ID /P = Program all adapters
/M = Don't prompt for I/O address
/Q = Quiet Mode, no messages will be displayed
/S xxxx = Display serial number of adapter at address xxxx
 If no address specified then display the serial number of all adapters
/V xxxx = Display current version number of BIOS on adapters at address xxxx
 If no address specified then display the BIOS version of all adapters
/C xxxx = Verify Flash of adapter at address xxxx
 If no address specified verify the Flash of all adapters
/Y xxxx = Display port name of adapter at address xxxx
 If no address specified, then display port name of all adapters
/L xxxx = Write NOVRAM, adapter address = xxxx
 If no address specified then write NOVRAM to all adapters
/D xxxx = Copy NOVRAM to file: QL1xNVRM.SAV, adapter address = xxxx
/U xxxx = Update BIOS NOVRAM defaults, adapter address = xxxx
 If no address specified then write then update all adapters
/N <filename.ext> = Use <filename.ext> instead of NVRMxx0.DAT
/T = Multiport Fibre Channel adapter
/X xxxx = Verify NOVRAM of adapter at address xxxx
```

Notes:

a. All of the listed options are supported and you can run them from the command line. Options /L, /D, /U, /N, /T, and /X might not display.

b. The command-line option is not case-sensitive. Either /f or /F can be used to initiate the adapter flash BIOS update.

Table 9 on page 11 describes examples of additional command-line options that you can use.

Using the flasutil BIOS Update Utility menu

Complete the following steps to update your BIOS code and NVRAM using the flasutil BIOS Update Utility:

1. Insert the BIOS Update Utility diskette into the diskette drive and restart the server. Your server displays a DOS prompt.
2. From the DOS prompt, type: `flasutil`
3. Press **Enter**.
4. A list of adapters and I/O addresses displays. At the command prompt, type the appropriate I/O address and press **Enter**.
5. The following option menu displays:

```
F = Write Flash
W = Copy Flash to file: QLxxROM.SAV
S = Display serial number
V = Display current BIOS version
C = Verify Flash Y = Display port name
L = Write NOVRAM A = Write NOVRAM and defaults
D = Copy NOVRAM to file: QLxxNVRM.SAV
U = Update BIOS NOVRAM defaults
X = Verify NOVRAM
```

Notes:

a. All of the listed options are supported and you can run them from the command line. Options L, A, D, U, and X might not display. The command-line option is not case-sensitive.

b. You can configure each adapter with more than one option.

6. Type the letter for the option that you want and press **Enter**.
7. If you have additional adapters installed, if you want to program the other port of the adapter, or if you want to configure your adapter with more than one option, continue with step 8. Otherwise, go to step 9.
8. Repeat steps 2 through 5 for each additional adapter or port.
9. Remove the CD from the CD-ROM drive and restart the server.
10. Go to "Installing the DS4000 FC2-133 device drivers."

Installing the DS4000 FC2-133 device drivers

The device drivers and installation instructions for the following supported operating systems are provided on the IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter Support CD:

- Microsoft Windows 2000 and 2003
- Novell NetWare
- Linux

The device driver installation instructions are in a readme file located in the appropriate operating system directory.

Note: For the latest supported operating systems, versions of the device drivers, utilities, and documentation, go to the following Web site:

www.ibm.com/pc/support

Using IBM FastT-MSJ utility

This section provides an overview of the IBM FastT-MSJ (Management Suite Java) utility that can be used by advanced users to customize the configuration of the IBM FC2-133 HBA when it is installed in a server. For more detailed information, see the IBM DS4000 Management Suite Java User's Guide version 1.0 or later that is available at the following Web site: www.ibm.com/servers/storage/support/disk/

Overview of the IBM FAStT MSJ utility

The FAStT-MSJ utility is used to configure a storage area network (SAN) environment made up of DS4000 Fibre Channel HBAs. It is a network-capable application that can connect to and configure remote systems, enabling centralized management and configuration of an entire SAN containing HBA components, storage devices, and host systems.

You can use FAStT-MSJ to manage and control one or more DS4000 Fibre Channel HBAs that are installed on local or remote systems. The FAStT-MSJ utility is used, along with problem determination procedures (PDPs), on new or existing installations to help diagnose Fibre Channel (FC) subsystem problems in adapters, controllers, and devices that are attached to the FC fabric or loop.

You can also perform the following operations using the FAStT-MSJ utility to configure devices in your system:

Disable (unconfigure) a device on a host bus adapter
When a device is set as unconfigured, it is not recognized by the HBA and is not accessible to the HBA on that system.

Enable a device
This operation adds a device and makes it accessible to the HBA on that system.

Designate a path as an alternate or preferred path (for Linux operating system enviroments only)
When a device is accessible from more than one adapter in the same system, you can assign one path as the preferred path and the other path as an alternate path. If the preferred path fails, the system switches to the alternate path to make sure that the transfer of data is not interrupted.

Note: The diagnostic functions of the FAStT-MSJ utility are available for all supported operating systems. The configuration functions of the FAStT-MSJ utility are available only for Linux operating systems.

Installation and System Requirements

Make sure that you are using the latest version of the DS4000 FastT-MSJ for the IBM DS4000 Host Bus Adapters. For the latest information about the FastT-MSJ utility, go to the IBM DS4000 Support Web site:

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

The latest instructions and system requirements are in the documentation that come with the utility.

Features

The FAStT-MSJ utility lets you:

- Set the FAStT-MSJ utility options
- Connect to hosts
- Disconnect from a host
- View detailed event and alarm-log information
- Use host-to-host SAN configuration policies
- Configure port devices
- Use logical unit number (LUN) level configuration
- Monitor in real-time to see when failovers occur, using the Failover Watcher
- Control host-side agent operations, including setting of the host agent polling interval
- Review host adapter information, including:
  - General information
  - Statistics
  - Information about attached devices
  - Link status for attached device
- Perform adapter functions, including:
  - Configuring the adapter NVRAM settings
  - Executing fibre diagnostics (read/write buffer loopback tests)
  - Perform flash updates on an adapter
  - Perform NVRAM updates on an adapter

- Manage configurations:
  - Save configurations for off-line policy checks and SAN integrity
  - Load configurations from a file if the host is off-line for policy checks and SAN integrity
- Confirm security

Utilities

Using the Utilities section of the FastT-MSJ utility you can update I/O expansion card firmware and perform adapter-level configurations on a host-connected adapter.

Note: You may be prompted for a password. The default password is *config*.

Update flash

When you click **Update Flash** in the Utilities section of the FastT-MSJ utility, and the adapter accepts the update, the application prompts for the file name of the new flash BIOS firmware. The latest version of DS4000 FC2-133 HBA flash BIOS firmware is available from the IBM Support Web site at:

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

The flash BIOS firmware file name ends with .bin (for example, QL2312RM.bin).

After you enter a valid flash BIOS firmware file name, click **OK** to complete with the update, or click **Cancel** to abort. When you click **OK**, the FAStT-MSJ utility verifies the file name and format of the new file. If the file is valid, the application then compares the version of the file with the adapter flash version that is currently installed. If the installed adapter version is the same or newer than the file flash version you are trying to install, the application asks if you still want to update the flash.

If the firmware update fails, an error message displays.

Update NVRAM

When you click **Update NVRAM** in the Utilities section of the FastT-MSJ utility, and the adapter accepts the update, the application prompts for the file name of the new NVRAM firmware. The latest version of the DS4000 FC2-133 HBA NVRAM firmware is available from the following Web site:

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

The NVRAM firmware file name ends with .dat (for example, nvram23.dat).

After you enter a valid NVRAM firmware file name, click **OK** to complete with the update, or click **Cancel** to abort. When you click **OK**, the FAStT-MSJ utility verifies the content of the new file and then updates the firmware.

If the firmware update fails, an error message displays.

Note: Updating NVRAM firmware resets the configuration to default settings. After updating NVRAM firmware, all custom configuration settings will need to be entered again.

Chapter 3. Configuring the DS4000 FC2-133 with Fast!UTIL

This chapter provides detailed configuration information for advanced users who want to customize the configuration of the DS4000 FC2-133 and the connected fibre-channel devices. You can configure the adapter using the Fast!UTIL utility.

Starting Fast!UTIL

When the adapter is installed in the server with an Intel 32 bit processor(IA-32), an Intel Extended Memory 64 bit Technology (EM64T) processor, or an Advance Micro Devices 64 bit (AMD-64) architecture only, you can access Fast!UTIL by pressing Ctrl+Q during the BIOS initialization; it might take a few seconds for the Fast!UTIL menu to display. Fast!UTIL prompts you to select the adapter that you want to configure. After you change the settings that are described in the “Host bus adapter settings” on page 20 section,Fast!UTIL restarts the system to enable the new parameters. When the adapter is installed in a server with an Intel 64 bit processor (IA-64), see the readme in the FC2-133 HBA EFI driver package for instructions about how to modify the NOVRAM adapter settings.

Important: If the configuration settings are incorrect, the DS4000 FC2-133 will not function properly. Do not modify the default configuration settings unless you are instructed to do so by an IBM technical support representative or by the installation instructions. The default settings are for a typical Microsoft Windows installation. See the DS4000 FC2-133 device driver readme file of the appropriate operating system for the required NVRAM setting modifications for that operating system.

Note: An alternative method to update the BIOS and the adapter NOVRAM settings is to use the IBM FAStT Management Suite Java (FAStT-MSJ). FAStT-MSJ can be downloaded from the following Web site:

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

Accessing HBA settings through Fast!UTIL

The Fast!UTIL feature provides access to host bus adapter settings. To access this feature, simultaneously press and hold the ALT + Q keys or the Ctrl + Q keys during BIOS initialization. It may take a few seconds for the Fast!UTIL menu to appear. If more than one board is installed, Fast!UTIL prompts you to select a board to configure. After you change adapter settings, Fast!UTIL reboots your system to load the new parameters. Upon entering Fast!UTIL, the following selections are available on the Fast!UTIL Options menu:

- Configuration Settings
- Scan Fibre Devices
- Fibre Disk Utility
- Loopback Test
- Select Host Adapter
- Exit FASt!UTIL

You can access the host bus adapter settings through the Configuration Settings menu in Fast!UTIL. See “Host bus adapter settings” on page 20 and“Advanced Adapter Settings” on page 21 for detailed information on the settings.

Host bus adapter settings

You can modify most of the host bus adapter settings. The current default settings for the host bus adapter are listed in “Advanced Adapter Settings” on page 21. These settings are described following the table. You can modify the following default host bus adapter settings.

BIOS address

The BIOS address is the I/O address where the BIOS code is stored when you press Ctrl+Q or when you have the BIOS code enabled for starting from the root directory. This is the address of the BIOS code in ROM shadow memory. Multiple adapters can be installed in the server, but only one BIOS instance is loaded for all of the adapters.

Note: The BIOS code is loaded from the first port of the first adapter that the server recognizes. This code is used for all remaining DS4000 FC2-133 Single Port and DS4000 FC2-133 Dual Port adapters in the same bus or server. The level of BIOS code that is loaded does not affect other adapters with earlier BIOS code levels.

Revision

The BIOS revision is the revision number of the BIOS code that is loaded from the first DS4000 FC2-133 that the server recognizes. Each DS4000 FC2-133 in the server has the same BIOS code revision number because only one BIOS code instance is loaded.

Adapter serial number

The adapter serial number is located on the noncomponent side of the adapter. See Figure 3 on page 4 for the location of the serial number label.

Interrupt level

The interrupt level is the interrupt that is used by the DS4000 FC2-133. The interrupt level can change when the operating system is installed.

Adapter port name

This is the worldwide port name.

Host adapter BIOS

When this setting is `Disabled`, the ROM BIOS on the FC2-133 HBA is Disabled, freeing space in upper memory. This setting must be Enabled if you are booting from an fibre channel disk drive attached to the FC2-133 board. The default is Disabled.

Frame size

This setting specifies the maximum frame length supported by the FC2-133 HBA. The default size is 2048, which provides maximum performance for F-Port (point-to-point) connections.

Loop reset delay

After resetting the loop, the firmware refrains from initiating any loop activity for the number of seconds specified in this setting. The default is 5 seconds

Adapter hard loop ID

This setting forces the adapter to attempt to use the ID specified in the Hard Loop ID setting. The default is Enabled.

Hard loop ID

If the Adapter Hard Loop ID setting is Enabled, the adapter attempts to use the ID specified in this setting. The default ID is 125. You should set this ID to a unique value from 0-125 if there is more than one adapter connected to a FC-AL loop and the Adapter Hard Loop ID setting is Enabled.

Spin up delay

When this bit is set, the BIOS will wait up to 5 minutes to find the first drive. The default setting is Disabled.

Connection Options

This setting defines the type of connection (loop or point to point) or connection preference. The default is 2.

Fibre Channel Tape Support

This setting enables FCP-2 recovery. The default is Enabled. You should change this setting to Disabled if the HBA is connected to a DS4000 storage server. The DS4000 storage server does not support a tape device through the same Fibre-Channel HBA from the host server.

Data Rate

This setting determines the data rate. When this setting is 0, the FC2-133 HBA runs at 1 gbps. When this setting is 1, the FC2-133 HBA runs at 2 gbps. When this setting is 2, Fast!UTIL determines what rate your system can accommodate and sets the rate accordingly. The default is 2 (auto-configure).

Advanced Adapter Settings

Access the following advanced host bus adapter settings through the Configuration Settings menu in Fast!UTIL and select Advanced Adapter Settings. The default settings for the FC2-133 HBA are as follows:

Execution Throttle

This setting specifies the maximum number of commands executing on any one port. When the execution throttle of a port is reached, no new commands are executed until the current command finishes executing. The valid options for this setting are 1-256. The default is 255.

LUNs per Target

This setting specifies the number of LUNs per target. Multiple LUN support is typically for redundant array of independent disks (RAID) boxes that use LUNs to map drives. The default is 0. For host operating systems other than Microsoft Windows, one may need to change this setting to a value other 0 to allow the host to see more than one logical drive from the DS4000 Storage Server. Review the device driver README for the appropriate setting for environments other than Microsoft Windows Operating System.

Enable LIP Reset

This setting determines the type of loop initialization process (LIP) reset that is used when the operating system initiates a bus reset routine. When this setting is Yes, the driver initiates a global LIP reset to clear the target device reservations. When this setting is No, the driver initiates a global LIP reset with full login. The default is No.

Enable LIP Full Login

This setting instructs the ISP chip to re-login to all ports after any LIP. The default is Yes.

Enable Target Reset

This setting enables the drivers to issue a Target Reset command to all devices on the loop when a SCSI Bus Reset command is issued. The default is Yes.

Login Retry Count

This setting specifies the number of times the software tries to log in to a

device. The default is 30 retries for Microsoft Windows Operating System environment. Please review the device driver README for the correct setting in other operating system environments.

Port Down Retry Count
This setting specifies the number of seconds that the software waits before it retries a command to a port returning port down status. The default is 30 seconds. In a DS4000 storage server configuration with the maximum number of drive expansion enclosures, you should increase this setting to 70.

Link Down Timeout
This setting specifies the number of seconds the software that the software waits for a link down to come up. The default is 60 seconds.

Extended Error Logging
This setting provides additional error and debug information to the operating system. When enabled, events are logged into the Windows NT Event Viewer. The default is Disabled.

Operation Mode
This setting specifies the reduced interrupt operation (RIO) modes, if supported by the software driver. RIO modes allow posting multiple command completions in a single interrupt. The default is 0.

Interrupt Delay Timer
This setting contains the value (in 100-microsecond increments) that is used by a timer to set the wait time between accessing (DMA) a set of handles and generating an interrupt. The default is 0.

Selectable boot settings

When you set the Selectable Boot Settings option to Enabled, you can select the worldwide port name of the fibre-channel hard disk from which you want to start up (boot). When this option is set to Enabled, the node starts from the selected fibre-channel hard disk, ignoring any IDE or SCSI hard disks that are attached to your server. When this option is set to Disabled, the Boot ID and Boot LUN parameters have no effect.

The BIOS code in some new systems supports selectable start up, which supersedes the Fast!UTIL selectable start up setting. To start from a fibre-channel hard disk that is attached to the DS4000 FC2-133, select the attached fibre-channel hard disk from the system BIOS menu.

Note: The Selectable Boot Settings option for the DS4000 FC2-133 applies to only fibre-channel hard disk drives.

Restore default settings

You can use the Restore Default Settings option to restore the DS4000 FC2-133 default settings and NVRAM.

The default NVRAM settings are the adapter settings that were saved the last time an NOVRAM update operation was run from the BIOS Update Utility program (option U or command line /U switch). If the BIOS Update Utility program has not been used to update the default NOVRAM settings since the adapter was installed, the factory settings are loaded.

Note: After selecting Restore default settings, check the NVRAM settings (for example the host bus adapter and advanced adapter settings) against the values that are recommended in this document and in the device driver READMEs for the appropriate operating system.

Raw NOVRAM data

You can use the Raw NOVRAM Data option to display the adapter NVRAM contents in hexadecimal format. This is a troubleshooting tool. You cannot modify the data.

Scan fibre-channel devices

You can use the Scan Fibre Channel Devices option to scan the fibre-channel loop and list all the connected devices by loop ID. Information about each device is listed, for example, vendor name, product name, and revision. This information is useful when you are configuring your DS4000 FC2-133 and attached devices.

Fibre-channel disk utility

Attention: When you perform a low-level format, it removes all data on the disk.

You can use the Fibre Channel Disk Utility option to scan the fibre-channel loop bus and list all the connected devices by loop ID. You can select a disk device and perform a low-level format or verify the disk media or data.

Loopback data test

You can use the Loopback Data Test option to verify the basic transmit and receive functions of the adapter. A fibre-channel loopback connector option must be installed into the optical interface connector on the DS4000 FC2-133 before starting the test. See Figure 3 on page 2 for the location of the optical interface connector.

Select host adapter

You can use the Select Host Adapter option to select, configure, or view a specific adapter if you have multiple adapters in your system.

ExitFast!UTIL

After you complete the configuration, use the ExitFast!UTIL option to exit the menu and restart the system.

Chapter 4. Adapter operating environment and specifications

This chapter contains the DS4000 FC2-133 operating environment and specification information.

Table 10 provides information about the operating environment for the DS4000 FC2-133.

Table 10. DS4000 FC2-133 operating environment

Environment	Minimum	Maximum
Operating temperature	0°C (32°F)	55°C (131°F)
Storage temperature	-20°C (-4°F)	70°C (158°F)
Relative humidity (noncondensing)	10%	90%
Storage humidity (noncondensing)	5%	95%

Table 11 provides the specifications for the DS4000 FC2-133.

Table 11. DS4000 FC2-133 specifications

Type	Specification
Host bus	Conforms to Intel PCI Local Bus Specification, revision 2.2 and the PCI-X Addendum, revision 1.0.
PCI or PCI-X signaling environment	3.3 V and 5.0 V buses supported
PCI or PCI-X transfer rate	• Support for 32 bit and 64 bit PCI bus at 33 MHz and 66 MHz • Support for 64 bit PCI-X bus at 50 MHz, 100 MHz, and 133 MHz • PCI transfer rate 264 MBps maximum burst rate for 33 MHz operation (ISP2312 chip) • Support for dual address bus cycles
Fibre-channel specifications	• Fiber-optic media (shortwave multimode 50 micron cable) • Bus transfer rate: 200 MBps maximum at half-duplex and 400 MBps maximum at full-duplex • Interface chip: ISP2312 (PCI-X QLA23xx boards) • Support for both FCP-SCSI and IP protocols • Support for point-to-point fabric connection: F_port Fabric Login • Support for FCAL public loop profile: FL_port Login • Support for fibre-channel services class 2 and 3 • Support for FCP SCSI initiator and target operation • Support for full-duplex operation
Processor	Single-chip design that includes a RISC processor, fibre-channel protocol manager, PCI or PCI-X DMA controller, and integrated serializer/deserializer (SERDES) and electrical transceivers that can auto-negotiate a data rate of 2 Gbps.
Host data transfer	64-bit, bus-master DMA data transfers to 1056 MBps
RAM	256 KB of SRAM supporting parity protection

Table 11. DS4000 FC2-133 specifications (continued)

Type	Specification
BIOS ROM	128 KB of flash ROM in two 64 KB, software selectable banks. The flash is field programmable.
NVRAM	256 bytes, field programmable
Onboard DMA	Five-channel DMA controller: two data, one command, one auto-DMA request, and one auto-DMA response
Frame buffer FIFO	Integrated 4 KB transmit and 6 KB receive frame buffer first-in, first-out (FIFO) for each data channel
Connectors (external)	• Two LC-style connectors that support non-OFC, multimode fiber-optic cabling using a small form factor (SFF) fiber-optic transceiver module. • Support 50/125 FC cable length up to 550 m (1804 ft.) when operating at 1 Gbps or up to 300 m (984 ft.) when operating at 2 Gbps.
Form factor	5.15 cm x 16.93 cm (2.5 in. x 6.7 in.)
Operating power	Less than 15 watts

Chapter 5. Troubleshooting

The following four types of installation problems might cause your DS4000 FC2-133 to function incorrectly:

- Hardware problems
- Software problems
- System configuration problems
- Fibre channel problems

If you are having problems, use the following information to help you determine the cause of the problem and the action to take.

Note: See the installation, user's and maintenance guide for your storage server or see the *IBM TotalStorage DS4000 Problem Determination Guide* for additional troubleshooting and debugging procedures.

Hardware problems

To determine if your installation problem is caused by the hardware, perform the following tasks:

- Verify that all cables are attached securely to the correct connectors. Be sure that one end of the LC-LC fibre-channel cable is attached to the optical interface connectors (located at J1 and J2 on the adapter) and that the other end of the cable is connected to the fibre-channel device.
- Verify that the DS4000 FC2-133 is installed correctly and is fully seated in the expansion slot. Check for interference due to nonstandard PCI connectors.
- Verify that the Fast!UTIL data-rate setting is correct. The Fast!UTIL data-rate setting must match the speed of the device to which you are connected. See Chapter 3, "Configuring the DS4000 FC2-133 with Fast!UTIL," on page 19.
- Verify that all peripheral devices are turned on. See "Fibre channel problems" on page 28 for information about how to display the attached fibre-channel devices.

Software problems

To determine if your installation problem is caused by the software, perform the following tasks. These tasks are discussed in Chapter 2, "Updating the DS4000 FC2-133 BIOS code and installing device drivers," on page 9.

- Verify that the correct device driver is installed.
- Verify that your adapter is at the correct BIOS version.
- Verify that you have the correct adapter NVRAM settings for your Storage Area Network (SAN) and operating system.

System configuration problems

To determine if your installation problem is caused by the system configuration, check your server to ensure that it is configured properly. For more information, see "Host bus adapter settings" on page 20.

Note: All PCI-compliant and PCI-X-compliant systems automatically detect 32-bit or 64-bit adapters and set the appropriate bus speed (for example, 66 MHz or 133 MHz).

If you still have a system configuration problem, see the documentation that comes with your server, or contact your IBM technical support representative to determine if your system board requires special configuration.

Fibre channel problems

To determine if your installation problem is caused by an attached fibre-channel device, perform the following tasks:

- Verify that all of the fibre-channel devices were turned on before you turned on the server.
- Ensure that all cables are connected properly.
- Verify that you configured your RAID storage subsystems using the utilities that were provided by the manufacturer.
- If your fibre-channel switch supports zoning, make sure that your peripheral device is configured to the same switch zone as the DS4000 FC2-133. For more information, see your fibre-channel switch documentation.

Appendix. 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 12 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 12. 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 12. DS4000 Storage Manager alternate keyboard operations (continued)

Short cut	Action
Ctrl+Spacebar (Contiguous/Non-contiguous) AMW Logical/Physical View	Select multiple drives in the Physical View. 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. If you press Spacebar alone when multiple drives are selected then all selections are removed. Use the Ctrl+Spacebar combination to deselect a drive when multiple drives are selected. This behavior is the same for contiguous and non-contiguous selection of drives.
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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This device has been tested to the FCC limits and found compliant to the Class B limits when installed in a host system found compliant to the Class B limits.

Federal Communications Commission (FCC) statement

IBM TotalStorage DS4000 FC2-133 Dual Port Host Bus Adapter

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

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

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Responsible party:
International Business Machines Corporation
New Orchard Road
Armonk, NY 10504
Telephone: 1-919-543-2193

Tested To Comply
With FCC Standards
FOR HOME OR OFFICE USE

Industry Canada Class B emission compliance statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

Avis de conformité à la réglementation d'Industrie Canada

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

Australia and New Zealand Class A statement

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

Taiwan electrical emission statement

警告使用者:
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

Japanese Voluntary Control Council for Interference (VCCI) statement

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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*.

FAStT MSJ. See *FAStT Management Suite Java*.

FAStT Management Suite Java (FAStT 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 know 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 packed-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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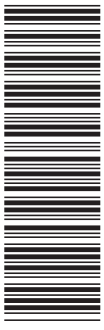

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