IBM TotalStorage FAStT EXP700 and EXP710 Storage Expansion Units

Installation, User's, and Maintenance Guide

gc26-7647-00

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Note: Before using this information and the product it supports, be sure to read the general information in “Notices” on page 103.

Second Edition (September 2004)

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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.

Statement 1:

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	To Disconnect:
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Statement 3:

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

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

DANGER

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

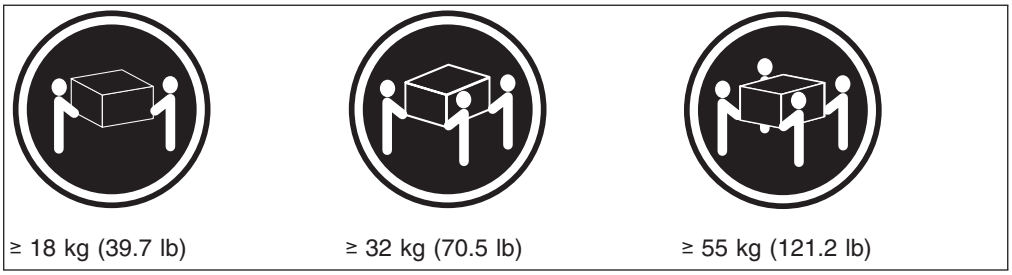
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Class 1 Laser statement

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

IEC 825-11993 CENELEC EN 60 825

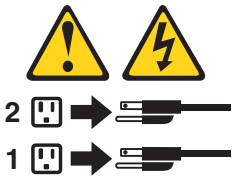
Statement 4:



CAUTION:
Use safe practices when lifting.

Statement 5:

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



Statement 8:

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

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

About this document

This document provides instructions for installing and customizing the configuration of your IBM® TotalStorage® FAStT EXP700 (Machine Type 1740, Models 1RU, 1RX) and FAStT EXP710 (Machine Type 1740, Model 710) Storage Expansion Units. It also provides hardware maintenance and troubleshooting information.

Who should read this document

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

How this document is organized

Chapter 1, “Introduction,” on page 1 describes the IBM TotalStorage FAStT EXP700 and FAStT EXP710 Storage Expansion Units. This chapter includes an inventory checklist and an overview of the storage expansion unit features, operating specifications, and components.

Chapter 2, “Installing and cabling the storage expansion unit,” on page 17 contains the instructions to install the expansion unit in a standard rack cabinet, setting the interface options, cabling the expansion unit, and power cord routing. In addition, this chapter contains instructions for turning on and turning off the expansion unit during normal and emergency situations.

Chapter 3, “Installing and replacing devices,” on page 65 contains step-by-step instructions for installing and removing customer replaceable units (CRUs), such as hard disk drives, power supplies, environmental services monitors (ESMs), and fan units.

Chapter 4, “Hardware maintenance,” on page 75 contains problems, symptoms, and error messages that are specific to your expansion unit.

Appendix A, “Records,” on page 81 provides a table to record and update important information about your storage expansion unit, including serial number and device records. Whenever you add options to your storage expansion unit, be sure to update the information in this appendix.

Appendix B, “Upgrading ESMs with the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit,” on page 83 provides instructions for upgrading your FAStT EXP700s with ESMs that have the same internal switched capabilities as the FAStT EXP710. The ESM upgrade is a feature of the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit (P/N 25R0166).

Appendix C, “Upgrading the controller firmware for FAStT600, FAStT700, and FAStT900 (FAStT EXP710 only),” on page 93 provides instructions for performing the manual firmware upgrade required if you are attaching one or more FAStT EXP710s to a FAStT700 or FAStT900 storage server. The manual firmware upgrade is also required if you are attaching one or more FAStT EXP710s to a FAStT600 without any internal hard disk drives.

Appendix D, “Power cords,” on page 101 lists power cord information for the storage expansion unit.

“Notices” on page 103 provides product notices.

Notices and statements used in this document

The caution and danger statements used in this document also appear in the multilingual *Safety Information* document provided with your IBM TotalStorage FAStT EXP700 or EXP710 Storage Expansion Unit. Each caution and danger statement is numbered for easy reference to the corresponding statements in the safety document.

The following types of notices and statements are used in this document:

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

Figures used in this document

The figures used in this document are for illustrative purposes only. In some cases, the actual device might look different from the figure. This applies particularly in cases where the FAStT EXP710 differs from the FAStT EXP700.

FAStT installation process overview

The following flow chart gives an overview of the FAStT hardware and the FAStT 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.

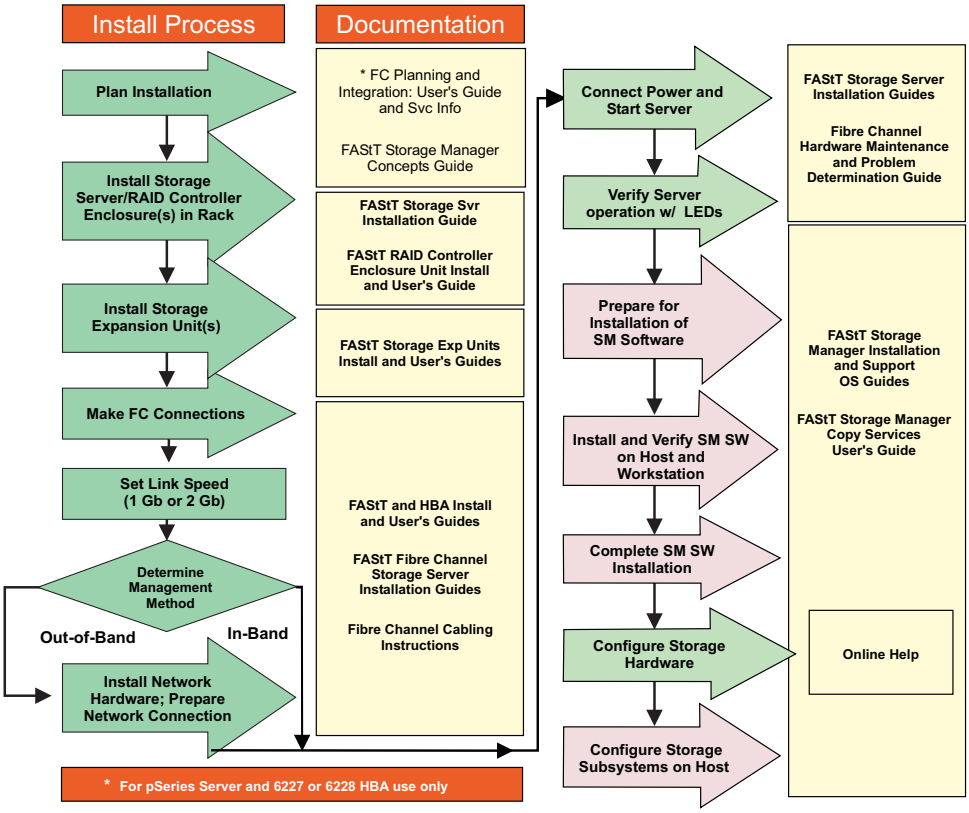


Figure 1. Installation process flow by current publications

FAStT Storage Server publications

The following tables present an overview of the FAStT900, FAStT700, FAStT600, and FAStT100 Fibre Channel 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. Click on active links in the tables to access those documents currently available on the Internet. You can access documentation for the other FAStT products at the following Web site:

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

FAStT900 Fibre Channel Storage Server library

Table 1 associates each document in the FAStT900 Fibre Channel Storage Server library with its related common user tasks.

Table 1. TotalStorage FAStT900 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 FAStT900 Installation and Support Guide, GC26-7530	✓	✓		✓		

Table 1. TotalStorage FAStT900 Fibre Channel Storage Server document titles by user tasks (continued)

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage FAStT900 Fibre Channel Cabling Instructions, 24P8135	✓	✓				
IBM TotalStorage FAStT900 Storage Server User's Guide, GC26-7534				✓	✓	✓
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM TotalStorage FAStT900 Rack Mounting Instructions, 19K0900	✓	✓				
IBM Fibre Channel Planning and Integration: User's Guide and Service Information, SC23-4329	✓	✓			✓	✓
IBM FAStT Management Suite Java User's Guide, 32P0081					✓	✓
*IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual,*GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓

FAStT700 Fibre Channel Storage Server library

Table 2 associates each document in the FAStT700 Fibre Channel Storage Server library with its related common user tasks.

Table 2. TotalStorage FAStT700 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 FAStT700 Installation, User's and Maintenence Guide, GC26-7647	✓	✓		✓		
IBM FAStT700 Fibre Channel Cabling Instructions, 32P0343	✓	✓				
IBM FAStT700 Fibre Channel Storage Server User's Guide, 32P0341				✓	✓	✓
IBM FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
IBM FAStT Management Suite Java User's Guide, 32P0081					✓	✓
*IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual,*GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓

FAStT600 Fibre Channel Storage Server library

Table 3 associates each document in the FAStT600 Fibre Channel Storage Server library with its related common user tasks.

Table 3. TotalStorage FAStT600 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 FAStT600 Fibre Channel Storage Server Installation and User's Guide, GC26-7531	✓	✓		✓		
*IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual,*GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM TotalStorage FAStT600 Rack Mounting Instructions, 24P8125	✓	✓				
IBM TotalStorage FAStT600 Fibre Channel Cabling Instructions, 24P8126	✓	✓				

FAStT100 Storage Server library

Table 4 associates each document in the FAStT100 Storage Server library with its related common user tasks.

Table 4. TotalStorage FAStT100 Storage Server document titles by user tasks

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage FAStT100 Installation, User's and Maintenance Guide, GC26-7641	✓	✓		✓		✓

Table 4. TotalStorage FAStT100 Storage Server document titles by user tasks (continued)

Title	User Tasks					
	Planning	**Hardware Installation**	**Software Installation**	**Configuration**	**Operation and Administration**	**Diagnosis and Maintenance**
IBM TotalStorage FAStT100 Cabling Guide, 24P8973	✓	✓				
IBM TotalStorage FAStT FC2-133 Dual Port Host Bus Adapter Installation and User's Guide, GC26-7532		✓			✓	
IBM FAStT FC2-133 Host Bus Adapter Installation and User's Guide, 48P9823		✓			✓	
*IBM TotalStorage FAStT Fibre Channel Hardware Maintenance Manual,*GC26-7640						✓
IBM TotalStorage FAStT Fibre Channel Problem Determination Guide, GC26-7642						✓

FAStT-related hardware publications

Table 5 associates each of the following documents related to FAStT operations with its related common user tasks.

Table 5. TotalStorage FAStT 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 FAStT EXP100 Storage Expansion Unit Release Notes, GC26–7619	✓	✓				
IBM TotalStorage FAStT EXP100 Storage Expansion Unit Installation and Users Guide, GC26–7601	✓	✓		✓	✓	✓
Fibre Channel Solutions - IBM FAStT EXP500 Installation and User's Guide, 59P5637	✓	✓		✓	✓	✓
IBM TotalStorage FAStT EXP700 and EXP710 Storage Expansion Units Installation, User's, and Maintenance Guide, GC26–7647	✓	✓		✓	✓	✓
IBM TotalStorage FAStT Fibre Channel Hard Drive and Storage Expansion Enclosure Installation and Migration Guide, GC26–7639	✓	✓				
IBM Netfinity Fibre Channel Cabling Instructions, 19K0906		✓				
IBM Fibre Channel SAN Configuration Setup Guide, 25P2509	✓		✓	✓	✓	

FAStT Storage Manager Version 9 publications

Table 6 associates each document in the FAStT Storage Manager library with its related common user tasks.

Table 6. TotalStorage FAStT 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 FAStT Storage Manager 9 Installation and Support Guide for Intel-based Operating System Environments, GC26-7649	✓		✓	✓		
IBM TotalStorage FAStT Storage Manager 9 Installation and Support Guide for AIX, UNIX, Solaris and Linux on Power, GC26-7648	✓		✓	✓		
IBM TotalStorage FAStT Storage Manager Copy Services User's Guide, GC26-7561	✓		✓	✓	✓	
IBM FAStT Storage Manager Script Commands (see product CD)				✓		
IBM TotalStorage FAStT Storage Manager Concepts Guide, GC26-7560	✓	✓	✓	✓	✓	✓

Getting information, help, and service

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

Before you call

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

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.

- Use the troubleshooting information in your system documentation and use the diagnostic tools that come with your system.
- Check for technical information, hints, tips, and new device drivers at the following Web site:

  www.ibm.com/storage/techsup.htm
- Use an IBM discussion forum on the IBM Web site to ask questions.

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

Using the documentation

Information about the xSeries or IntelliStation system and preinstalled software, if any, is available in the documents that come with your system. This includes printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions on 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 FAStT information, go to the following Web site:

  www.ibm.com/storage/techsup.htm

  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.ibm.com/pc/intellistation/

- For the latest information about operating system and HBA support, clustering support, SAN fabric support, and Storage Manager feature support, see the TotalStorage FAStT Interoperability Matrix at the following Web site:

  www.storage.ibm.com/disk/fastt/supserver.htm

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.

"Storage expansion unit operating specifications" on page 13 lists the environmental specifications for the FAStT EXP700 and EXP710.

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

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

International Business Machines Corporation
Information Development
Dept. GZW
9000 South Rita Road
Tucson, AZ 85744–0001
U.S.A.

Chapter 1. Introduction

This chapter describes the IBM TotalStorage Fibre Array Storage Technology (FAStT) EXP700 and FAStT EXP710 Storage Expansion Unit operating specifications, features, and components. This chapter also includes a list of hardware that comes with the storage expansion unit.

Note: Throughout this document, the IBM TotalStorage FAStT EXP700 Storage Expansion Unit is referred to as the *FAStT EXP700*. The IBM TotalStorage FAStT EXP710 Storage Expansion Unit is referred to as the *FAStT EXP710*. When information in this document applies to both the FAStT EXP700 and FAStT EXP710, the generic term *storage expansion unit* is used.

Overview

The IBM TotalStorage FAStT EXP700 (Machine Type 1740, Models 1RU and 1RX) and FAStT EXP710 (Machine Type 1740, Model 710) Storage Expansion Units provide high-capacity, fibre channel disk storage. Both storage expansion units deliver fast, high-volume data transfer, retrieval, and storage functions for multiple drives, to multiple hosts. The expansion units provide continuous, reliable service, using hot-swap technology for easy replacement without shutting down the system. Both the FAStT EXP700 and FAStT EXP710 support redundant, dual-loop configurations. External cables and Small Form-Factor Pluggable (SFP) modules connect the controller to the expansion unit.

The FAStT EXP710 Fibre Channel Storage Expansion Unit provides improved reliability and efficiency, utilizing internal switch technology to attach to each disk drive within the FAStT EXP710 enclosure. Within the EXP710, the redundant enclosure service modules (ESMs) utilize a fibre channel switched technology attaching directly to each of the dual ported disk drive modules for additional redundancy and high availability.[1]

The FAStT EXP710 Fibre Channel Storage Expansion Unit offers the following diagnostic and performance benefits:

- Improved diagnostic capabilities
  - Provides full isolation of drives
  - Eliminates the risk of a single drive disrupting the loop, causing other drives on the loop to fail
  - Enables selective diagnosis of fibre channel errors
  - Provides a platform for future enhanced diagnostic and serviceability capabilities
- Performance
  - Improves performance in large configurations by reducing node delays (loop latency)

1. The FAStT EXP710 uses *switched JBOD* (or switched drive expansion enclosure) technology to enable an enhanced version of the 2 Gb/s fibre channel JBOD. The primary difference between a switched JBOD and a JBOD is that the switched JBOD contains a fibre channel ″Loop Switch″ Application-Specific Integrated Circuit (ASIC). The Loop Switch ASIC allows the switched JBOD drives and any connected initiator to operate as though they were on a private Fibre Channel Arbitrated Loop (FC-AL), but to have the performance and diagnostic advantages of fibre channel fabric. The Loop Switch ASIC allows FC-AL devices to communicate directly with each other using a non-blocking crossbar switch, which reduces the loop latency inherent in a true arbitrated loop. Because fibre channel communication is essentially point-to-point with the Loop Switch ASIC, diagnosis and isolation of loop problems is greatly simplified. The advent of switched JBOD drive enclosures is expected to be a significant improvement in fibre channel based storage diagnostic and performance.

– Drive isolation frees up bandwidth to improve drive rebuild times

The FAStT EXP710 is currently supported by FAStT600 Turbo Option, FAStT700, and FAStT900 storage servers only. Additional FAStT storage server support for the FAStT EXP710 might be available in the future. Contact your IBM reseller or representative for more information.

Attention

Before you attach the FAStT EXP710 to a supported storage server, you must verify that the controller firmware is updated to firmware version 6.10.xx.xx or later. This firmware is provided with Storage Manager 9.1 and must be installed before attaching the FAStT EXP710.

Storage Manager 9.1 software and the controller firmware version 6.10.xx.xx can be downloaded from the FAStT support Web site:

www.ibm.com/storage/support/fastt

The FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit (P/N 25R0166) is available to upgrade FAStT EXP700s in existing configurations with ESMs that have the same internal switched capabilities as the FAStT EXP710. The ESM upgrade process is described in this document in Appendix B, “Upgrading ESMs with the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit,” on page 83.

After you upgrade the FAStT EXP700 ESMs, you are required to return the original FAStT EXP700 1740 ESMs (FRU 19K1287) to IBM. Use the packaging materials from the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit for repacking and sending the replaced ESMs. For full details on how and where to return the original FAStT EXP700 ESMs, see the *FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit Instructions* (P/N 25R0184), which is included with the upgrade kit.

Note: The upgrade option is not available for storage expansion units connected to FAStT200 or FAStT500 storage servers. Additionally, the upgrade option cannot be used to upgrade FAStT EXP700 storage expansion units connected to FAStT storage servers that are configured with drive loops that intermix FAStT EXP500 and FAStT EXP700 storage expansion units.

You can connect multiple FAStT EXP700s or FAStT EXP710s together to support a large number of disk drives on a fibre channel loop. You can also intermix FAStT EXP700s and FAStT EXP710s together in a fibre channel drive loop. However, when intermixing FAStT EXP700s and FAStT EXP710s in a fibre channel drive loop, the FAStT EXP710s must be grouped together. For more information, see “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43.

Note: You can also intermix FAStT EXP700s with FAStT EXP500s in a fibre channel loop. You cannot intermix FAStT EXP710s with FAStT EXP500s in a fibre channel loop. When you attach FAStT EXP710 enclosures, you must remove any 1 Gb/s FAStT EXP500 Storage enclosures from the drive loop and you must set the fibre channel speed of the drive loop to 2 Gb/s. See “Connecting storage expansion units in a loop with FAStT EXP500s (FAStT EXP700 only)” on page 48.

Fibre channel defined

Fibre channel technology is outlined in the *SCSI-3 Fibre Channel Protocol* (SCSI-FCP) standard. Fibre channel is a high-speed data transport technology used for mass storage and networking.

Using a Fibre Channel Arbitrated loop (FC-AL), more than 100 fibre channel devices can be supported, compared to 15 small computer system interface (SCSI) devices.

The FAStT EXP700 and FAStT EXP710 are 2 Gb/s fibre channel devices that support data transfer rates up to 200 MB per second half-duplex and 400 MB per second full-duplex on optical interfaces.

Product Updates

You should download the latest version of the FAStT Storage Manager host software and the FAStT storage server controller 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/storage/support/fastt

Go to the **Personalized Support** section of the web page and click **My Support**. On the next page, go to the **We use IBM Registration** section. To register to use this site, click **Register**.

Perform the following steps to receive product updates:

1. Once you have registered, type your user ID and password to log into the site. The Welcome page opens.
2. In the Select a Product Family pull-down menu, scroll down to the listing of hardware topics and select **Computer Storage**. Click **Go**. The Computer Storage page opens.
3. Scroll down to the Disk Storage Systems category and check the box for Machine Type 1740 (and for the storage servers you are connecting to your storage expansion unit). Check the boxes for any other FAStT products for which you would like to receive information. Scroll to the bottom of the page and select **Save and Return**. The main page opens.
4. Select your mail preferences. Select **Flashes and Downloadable files** to receive important information about product updates. Click **Submit**. You should see a confirmation at the bottom of the page that indicates that your profile was successfully updated.

Inventory checklist

The storage expansion unit comes with the following items:

- **Hardware**
  - Power cables
    - **FAStT EXP700 Model 1RU:** Two U.S. power cables
    - **FAStT EXP700 Model 1RX:** None
    - **FAStT EXP710 Model 710:** None

  - Two line cord jumpers
  - One rack-mounting hardware kit
  - Two rails (right and left assembly)
  - Ten M6 black hex-head screws
  - Ten M6 cage nuts
  - 14 drive blank trays (shipped inside the storage expansion unit)

    Your storage expansion unit ships with 14 hard disk drives; any drive bays not containing hard disk drives will contain blank drive trays. Each of the 14 drive bays must always contain either a blank tray or a hard disk drive.
- **Documentation**
  - *IBM TotalStorage FAStT EXP700 and EXP710 Storage Expansion Unit Installation, User's, and Maintenance Guide*
  - *IBM Safety Information*
  - Rack Mounting Template
  - IBM License Agreement for Machine Code
  - Statement of Limited Warranty

To connect your storage expansion unit to other devices, use the following options:

- IBM Small Form-Factor Pluggable (SFP) module
- IBM LC-LC Fibre Channel cable

For FAStT EXP700 only: Depending on your configuration, you might also need the following options:

- IBM LC-SC Fibre Channel Cable Adapter
- Gigabit Interface Converter (GBIC)

Note: For some storage expansion unit models, you must order these options separately.

Storage expansion unit components

The storage expansion unit has the following removable components, called customer replaceable units (CRUs). All CRUs are accessible from the front or back of the storage expansion unit.

- FAStT 2 Gb/s fibre channel hard disk drives
- Environmental services monitors (ESMs) (comes with two)

  Note: The FAStT EXP700 and FAStT EXP710 ESMs are not interchangeable. In addition, you cannot mix FAStT EXP700 and FAStT EXP710 ESMs in the same storage expansion unit. Always verify that you have the correct FRU P/N before you order replacement ESMs or insert replacement ESMs in the storage expansion unit.
- Power supplies (comes with two)
- Fans (comes with two)

Note: The figures used in this document are for illustrative purposes only. In some cases, the actual device might look different from the figure. This applies particularly in cases where the FAStT EXP710 differs from the FAStT EXP700.

Storage expansion unit bays

This section shows the location of storage expansion unit hot-swap CRU bays and describes the functionality of each CRU. The hot-swap features of the storage expansion unit enable you to remove and replace FAStT 2 Gb/s fibre channel hard disk drives, power supplies, ESMs, and fan units without turning off the expansion unit. You can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

Hot-swap drive bays

The hot-swap drive bays that are accessible from the front of your expansion unit are shown in Figure 2.

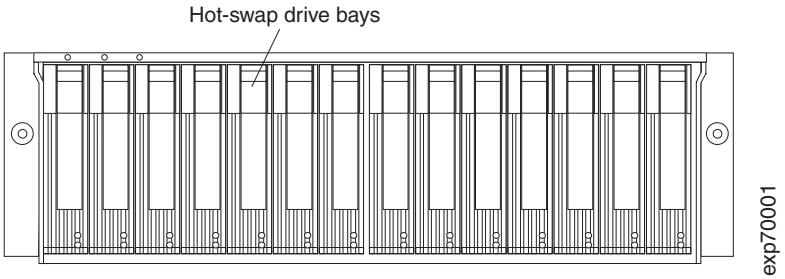


Figure 2. Hot-swap drive bays

The storage expansion unit supports up to 14 FAStT 2 Gb/s fibre channel hard disk drives or later versions. These drives come preinstalled in drive trays. This drive-and-tray assembly is called a drive CRU. You install the drive CRUs in the 14 drive bays on the front of the expansion unit.

Note: FAStT 2 Gb/s fibre channel hard disk drives must be used in the storage expansion unit even if the system is set to a 1 Gb per second rate. 1 Gb/s hard disk drives are not supported.

Attention: Never hot-swap a drive CRU when its green Activity LED is flashing. Hot-swap a drive CRU when its amber Fault LED is lit and not flashing or when the drive is inactive and the green Activity LED is lit and not flashing.

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

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

Fan, ESM, and power-supply bays

The location of the hot-swap fan bays, hot-swap ESM bays, and hot-swap power supply bays are shown in Figure 3 on page 6.

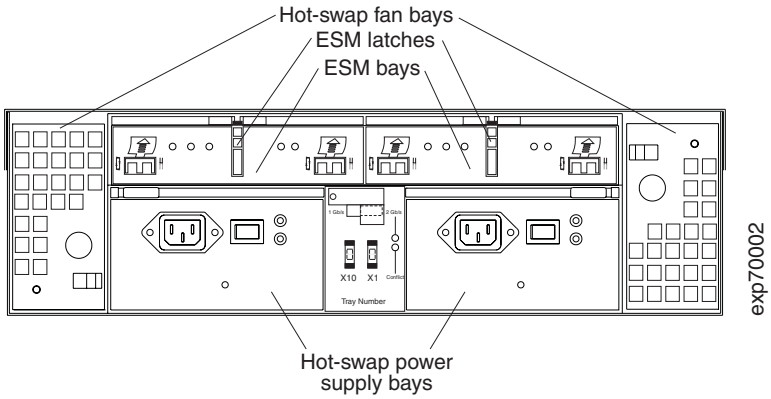


Figure 3. Hot-swap fan, ESM, and power supply bays

- **Hot-swap fan bays:** Your expansion unit comes with two interchangeable hot-swap and redundant fan units. These two fan units are located in the hot-swap fan bays. Each fan unit contains two fans. If one fan unit fails, the second fan unit continues to operate. Both fan units must be installed to maintain proper cooling within your expansion unit, even if one fan unit is not operational.

  Attention: The fans in your expansion unit draw in fresh air and force out hot air. These fans are hot-swappable and redundant; however, *when one fan fails, the failed fan unit must be replaced within 48 hours* to maintain redundancy and optimum cooling. When you remove the failed unit, be sure to install the replacement fan unit within 10 minutes to prevent overheating.
- **ESM bays:** Your expansion unit comes with two hot-swappable ESMs, which are located in the ESM bays. The ESMs monitor the overall status of the expansion unit. The FAStT EXP700 ESMs provide a 1 Gb/s or 2 Gb/s fibre channel interface to the FAStT storage server drive loop ports. The FAStT EXP710 provides a 2 Gb/s fibre channel interface only to the FAStT storage server drive loop ports.

  Attention: After you remove an ESM, wait 70 seconds before reseating or replacing the ESM. Failure to do so may cause undesired events.

  Each ESM has two SFP module connector ports for connecting your expansion unit to the controller or connecting two or more storage expansion units together. The ESMs provide redundancy when both of them are configured into redundant fibre channel loops. See your fibre channel controller documentation to determine if the controller supports this redundancy function.

  Note: The FAStT EXP700 and FAStT EXP710 ESMs are not interchangeable. In addition, you cannot mix FAStT EXP700 and FAStT EXP710 ESMs in the same storage expansion unit. Always verify that you have the correct FRU P/N before you order replacement ESMs or insert replacement ESMs in the storage expansion unit.

  Your expansion unit ESMs come with locking latches to secure the ESMs to the expansion unit bays. The latch must be unlocked before the ESM can be removed from the expansion unit.
- **Hot-swap power-supply bays:** Your expansion unit comes with two hot-swap and redundant power supplies. The power supplies are located in the hot-swap power-supply bays. Both power supplies must be installed in your expansion unit, even if one power supply is not operational.

Front controls and indicators

This section describes the primary controls on the front of the expansion unit. The location of these primary controls are shown in Figure 4.

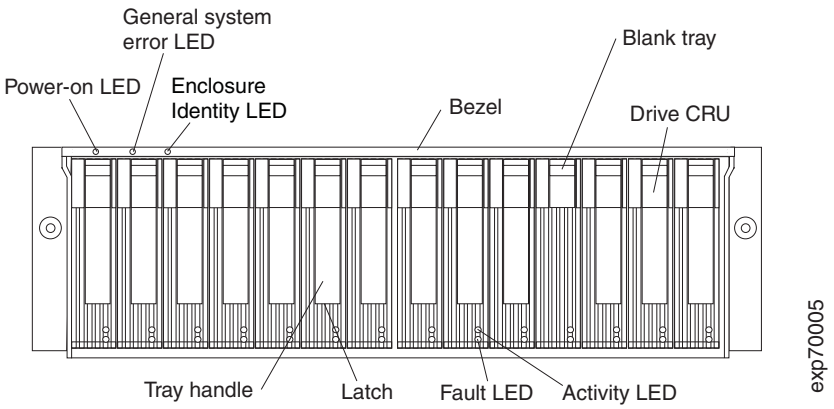


Figure 4. Front controls and indicators

- **Drive Activity LED:** Each drive CRU has a DriveActivity LED. When flashing, this green LED indicates drive activity. When lit, this green LED indicates the drive is properly installed and powered on.
- **Blank tray:** Expansion units come with blank trays in the unused drive bays. To begin installing new drives, you must first remove the blank trays and save them. Each of the 14 bays must always contain either a blank tray or a drive CRU to ensure proper air flow across the drives and to comply with regulatory electromagnetic emission limits.
- **Drive CRU:** You can install up to 14 hot-swap drive CRUs in the expansion unit.
- **Drive Fault LED:** Each drive CRU has a DriveFault LED. When lit, this amber LED indicates a drive failure. When flashing, this amber LED indicates that a drive identify or rebuild process is in progress.
- **General system error LED:** When lit, this amber LED indicates that the unit has a power supply, fan unit, ESM, or hard disk drive error.
- **Power-on LED:** When lit, this green LED indicates that the expansion unit has dc power.
- **Enclosure identity LED:** When lit, this blue LED indicates that the unit is being identified by the controller. This LED is also lit when the devices that are part of a fibre channel loop are identified.

  Table 7 shows the Storage Manager and firmware versions required to support enclosure identity LED activity for the different storage servers that support the FAStT EXP700 and FAStT EXP710.

Table 7. Enclosure identity LED activity support requirements

Connected storage server	Storage Manager version	Firmware version
FAStT200, FAStT500, or FAStT700	8.21 or later	5.21 or later
FAStT600	8.33 or later	5.33 or later
FAStT900	8.30 or later	5.30 or later

- **Tray handle:** Use this multipurpose handle to insert and remove a drive CRU in the bay.
- **Latch:** This multipurpose blue latch releases or locks the drive CRU in place.

Rear controls, indicators, and connectors

Two hot-swap power-supply CRUs, two hot-swap fan CRUs, and two ESMs are accessible from the back of the expansion unit. These components contain several controls, indicators, and connectors.

Power-supply controls, indicators, and connectors

The storage expansion unit comes with two 400-Watt hot-pluggable, redundant power supplies. Each power supply has a power and a fault LED located on the back of the storage expansion unit. The green LED indicates that the power supply is detecting ac power. The amber fault LED is lit if the power supply is unable to deliver dc power. The storage expansion unit requires that both power supplies be installed to meet Electromagnetic Compatibility (EMC) and cooling requirements. Figure 5 shows their locations.

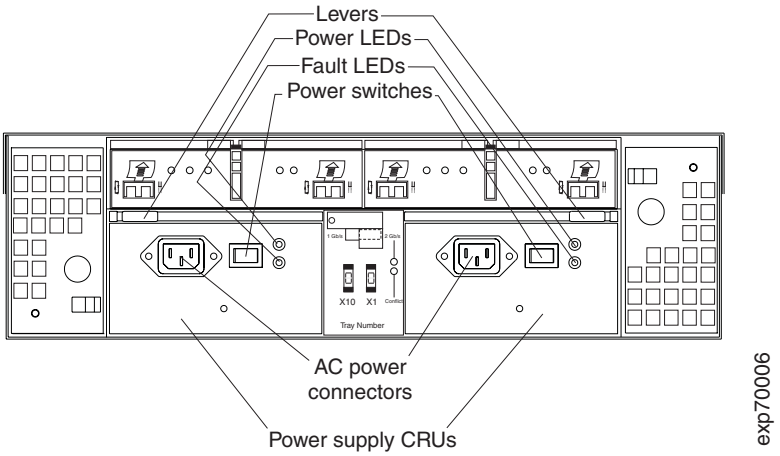


Figure 5. Power-supply controls, indicators, and connectors

- **Levers:** When you remove or install a power supply CRU, the levers located at the top of the power supply CRU must be unlocked.
- **Power LEDs:** These green power LEDs are lit when the expansion unit is turned on and receiving ac power.
- **Fault LED:** The amber power-supply fault LED is lit if a power-supply failure occurs.
- **Power switches:** The power switches are used to turn the power supplies on and off. You must turn on both switches to use the redundant power supplies.
- **AC power connectors:** To provide ac power to the expansion unit, power cables must be connected to the ac power connectors located on the back of the storage expansion unit.
- **Hot-swap power-supply CRUs:** The two hot-swap power supplies are located on the back of the storage expansion unit. Both power-supply CRUs must be installed, even if one power supply is not working.

Fan controls and indicators

The storage expansion unit comes with two fan units. Each expansion unit has two fans as shown in Figure 6 on page 9. The fan units in your storage expansion unit

are hot-swappable and redundant. One fan will continue to operate if the other fan fails. You can remove and replace the fan unit while the storage expansion unit is powered on and accessing drives.

Each fan has a temperature sensor built into the air inlet. This sensor maintains fan speed to provide the necessary air flow. If the speed of one of the fans drops to a level that is too low or stops, the Fault LED located on the back of the fan unit is lit, and the General system error LED on the front of the storage expansion unit is lit. For the locations of the LEDs on the front of the expansion unit, see Figure 4 on page 7. For the LEDs on the back of the expansion unit, see Figure 6.

Attention: The fans in your expansion unit draw in fresh air and force out hot air. These fans are hot-swappable and redundant; however, *when one fan fails, the failed fan unit must be replaced within 48 hours* to maintain redundancy and optimum cooling. When you remove the failed unit, be sure to install the replacement fan unit within 10 minutes to prevent overheating.

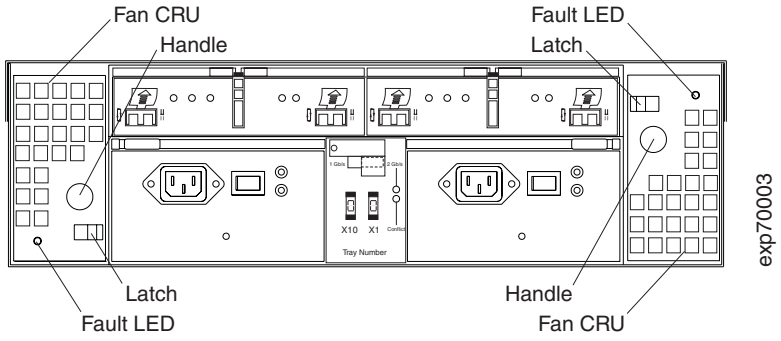


Figure 6. Fan controls and indicators

- **Fan CRUs:** The expansion unit comes with two fan CRUs. These fan units are hot-swappable and redundant.
- **Latches and handles:** Use the latches and handles to remove or install the fan CRUs.
- **Fault LED:** The amber fan fault LED is lit if a fan failure occurs.

ESMs and user controls

The ESMs and user controls on the FAStT EXP700 are shown in Figure 7 on page 10.

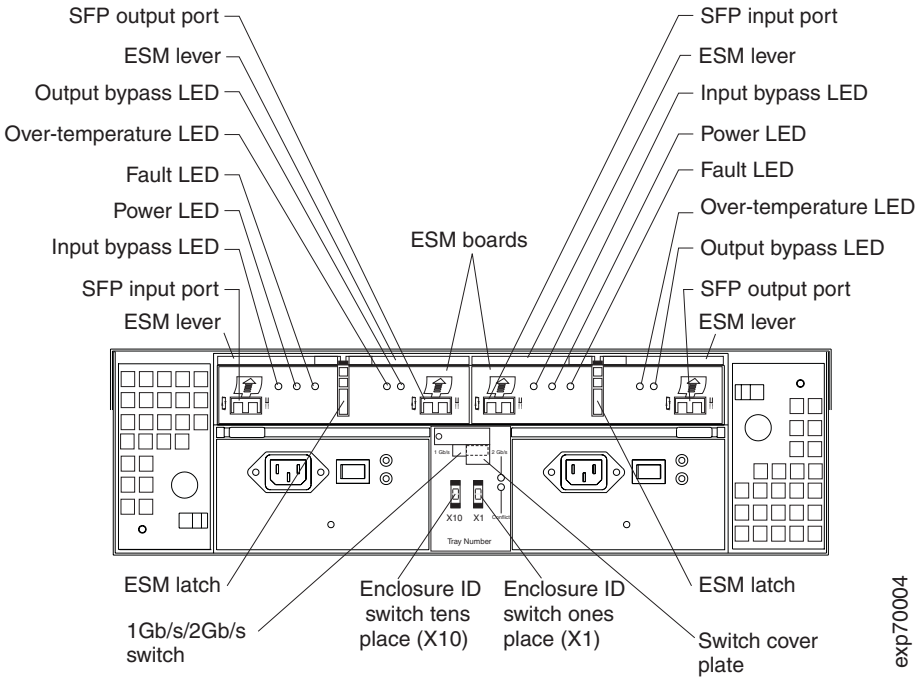


Figure 7. ESMs and user controls (FAStT EXP700)

The ESM LED positions are changed slightly in the FAStT EXP710, as shown in Figure 8.

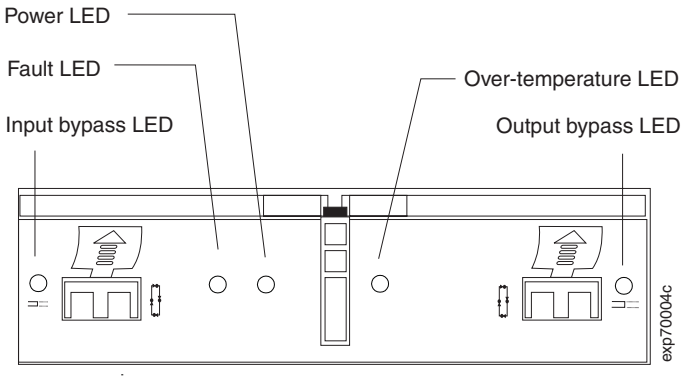


Figure 8. ESM LEDs on the FAStT EXP710

- **SFP module input/output ports:** Each ESM has two SFP module connector ports for connecting your expansion unit to the controller or connecting two or more storage expansion units together. Install an SFP module into the input and output ports. Fibre channel cables are used to connect the expansion unit to the controller or to additional expansion units.
- **ESM latch:** The ESM latch secures the ESM to the expansion unit.
- **ESM levers:** The ESM latch must be unlocked before you can use the ESM levers to remove the ESM from the expansion unit. When you are installing the ESM into the bay, use the ESM levers to guide the unit into the ESM bay.
- **ESMs:** The ESMs contain the expansion unit controls, switches, and LEDs. Each ESM has two SFP module ports for connecting the expansion unit to the controller.
- **Fault LED:** The amber ESM fault LED is lit when an ESM failure occurs.

- **Input/output bypass LEDs:** These amber LEDs are lit when a faulty SFP module or fiber-optic cable is installed. Both ports on the ESM are bypassed and the LEDs are lit in the event of an ESM fault. In this case, the ESM fault error LED is also lit. This LED is also lit if an SFP module is installed and not connected to another device.
- **Power LED:** The green power LED is lit when there is power to the ESM.
- **Over-temperature LED:** The ESM amber LED is lit if the expansion unit overheats.
- **Enclosure ID switches:** Two enclosure ID switches (x1 and x10) are located between the power supplies at the rear of the storage expansion unit. These switches are used to identify the storage expansion unit on a fibre channel loop and to assign physical addresses to the drives. The enclosure ID switch settings for each digit range from 0 through 7.

  Attention: When connecting storage expansion units to storage servers, it is recommended that you use only the ones digit (x1) setting to set unique server IDs or enclosure IDs. For more information, see “Enclosure ID settings” on page 30.
- **1 Gb/s 2 Gb/s switch:** Use the 1 Gb/s 2 Gb/s switch located on the back of the storage expansion unit to enable drive operation. The default setting is 2 Gb/s. Your switch setting will depend on your system configuration.

  Attention: The only speed setting allowed for the FAStT EXP710 is 2 Gb/s. In addition, if a storage expansion unit in a drive loop has the speed set to 1 Gb/s, all storage expansion units and FAStT storage servers in the same FAStT configuration must have their speeds set to 1 Gb/s.

  Note: To determine which speed the expansion unit must be set to, see Table 8 and Table 9 on page 12.

Storage-management software and hardware compatibility

Table 8 lists the FAStT EXP700 hardware and software compatibility and the maximum speed that the FAStT EXP700 can be set to when configured with other IBM FAStT hardware and software products.

Table 8. FAStT EXP700 hardware and software compatibility

Storage server / expansion unit	Storage-management software	Firmware	FAStT EXP700 FC drive loop port speed setting
FAStT500 RAID Controller Enclosure Unit	Storage Manager 8.21 or later	5.2x.xx.xx or later	1 Gb/s
FAStT EXP500 Storage Expansion Unit	n/a	n/a	1 Gb/s
FAStT200 Storage Server	Storage Manager 8.21 or later	5.20.07 or later	1 Gb/s
TotalStorage FAStT700 Fibre Channel Storage Server	Storage Manager 8.21 or later	5.2x.xx.xx or later	1 Gb/s or 2 Gb/s
TotalStorage FAStT600 Fibre Channel Storage Server	Storage Manager 8.33 or later	5.33.xx.xx or later	2 Gb/s
TotalStorage FAStT900 Fibre Channel Storage Server	Storage Manager 8.30 or later	5.30.xx.xx or later	1 Gb/s or 2 Gb/s

Table 9 on page 12 lists the FAStT EXP710 hardware and software compatibility and the maximum speed that the FAStT EXP710 can be set to when configured with other IBM FAStT hardware and software products.

Note: Additional FAStT storage server support for the FAStT EXP710 might be available in the future. Contact your IBM reseller or representative for more information.

Table 9. FAStT EXP710 hardware and software compatibility

Storage server / expansion unit	Storage-management software	Firmware	FAStT EXP710 FC drive loop port speed setting
TotalStorage FAStT600 Turbo Option Fibre Channel Storage Server	Storage Manager 9.1 or later	6.10.xx.xx or later	2 Gb/s
TotalStorage FAStT700 Fibre Channel Storage Server	Storage Manager 9.1 or later	6.10.xx.xx or later	2 Gb/s
TotalStorage FAStT900 Fibre Channel Storage Server	Storage Manager 9.1 or later	6.10.xx.xx or later	2 Gb/s
FAStT EXP700 Storage Expansion Unit	n/a	n/a	2 Gb/s

Note: For the latest information about supported servers and operating systems for the FAStT EXP700 and FAStT EXP710, go to the ServerProven® Web site at

www.ibm.com/pc/us/compat/

Storage expansion unit operating specifications

This section provides general information about the storage expansion unit. All components plug directly into the backplane.

Table 10. Storage Expansion Unit specifications

Size

- **Width**: 44.5 cm (17.52 in.)
- **Height**: 12.8 cm (5.03 in.)
- **Depth**: 56.3 cm (22.17 in.)

Weight: 30.12 kg (66.4 lb)

Electrical input

- Sine-wave input (50 to 60 Hz) is required
- Input voltage low range:
  - Minimum: 90 V ac
  - Maximum: 127 V ac
- Input voltage high range:
  - Minimum: 198 V ac
  - Maximum: 257 V ac
- Input kilovolt-amperes (kVA), approximately:
  - Minimum configuration: 0.06 kVA
  - Maximum configuration: 0.39 kVA

Environment

- Air temperature
  - Expansion unit on:
    - 10° to 35°C (50° to 95°F)
    - Altitude: 0 to 914 m (3000 ft)
  - Expansion unit off:
    - 10° to 32°C (50° to 90°F)
    - Altitude: 914 m (3000 ft) to 2133 m (7000 ft)
- Humidity
  - 8% to 80%
  - Noncondensing

Heat dissipation

- Fully configured expansion unit (14 FAStT 2 Gb/s hard disk drives)
  - 1,221 BTU per hour

Acoustical noise emission values

For open-bay (0 drives installed) and typical system configurations (Eight hard disk drives installed):

- Sound power (idling):
  - 5.9 bel (open bay)
  - 6.1 bel (typical)
- Sound power (operating):
  - 5.9 bel (open bay)
  - 6.2 bel (typical)
- Sound pressure (idling):
  - 44 dBA (open bay)
  - 46 dBA (typical)
- Sound pressure (operating):
  - 44 dBA (open bay)
  - 47 dBA (typical)

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

Storage expansion unit features

The following features are available with this product.

Table 11. Storage Expansion Unit features

Power supply • Two 400 W hot-pluggable power supplies • Power supplies are accessible from the rear using camming levers or latches. • Two ac line cords • Two 9-ft jumper cords • On/off switch on the back of each power supply • 14 disk drives run continuously from a single power supply. **Two fan units** • Hot pluggable fan units accessible from the rear of the expansion unit, one on each side • Two fan units, with two fans per unit, for a total of four fans. The fans are redundant, meaning that if one fan is disabled the remaining three fans continue to cool the storage expansion unit .	**Environmental services monitors** • Two ESMs are accessible from the back of the expansion unit. • ESMs are hot pluggable. • ESMs are redundant.

Heat output, airflow, and cooling

The maximum heat output of the storage expansion unit is 390 watts (1088 BTU/hr). Each rack-mounted storage expansion unit requires an airflow of 2.5 m^3 (87 ft^3) per minute. The input air temperature to all racks should be in the range 10° C - 35° C (50° F - 95° F).

Note: In general, disk subsystem reliability tends to decrease as the ambient temperature of the environment in which it is being used increases. The ambient temperature in the immediate area of the disk enclosure unit should be kept near 22 degrees C (72 degrees F), or lower, to provide better reliability.

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

- Air enters at the front of the rack and leaves at the back. To prevent the air that is leaving the rack from entering the intake of another piece of equipment, you must position the racks in alternate rows, back-to-back and front-to-front. This arrangement is known as “cold aisle/hot aisle” and is shown in Figure 9 on page 15.
- Where racks are in rows, each rack must touch the rack that is next to it to reduce the amount of hot air that can flow around from the back of the rack into the intakes of the expansion units that are in that rack. You should use Suite Attach Kits to completely seal any gaps that remain between the racks. For details about Suite Attach Kits, contact your marketing representative.
- Where racks are in rows front-to-front or back-to-back, a gap of at least 1220 mm (48 in.) must separate the rows across the cold aisle.

- To ensure correct airflow in each rack, the rack filler plates must be installed in unused positions. Also, all the gaps in the front of the racks must be sealed, including the gaps between the expansion units.

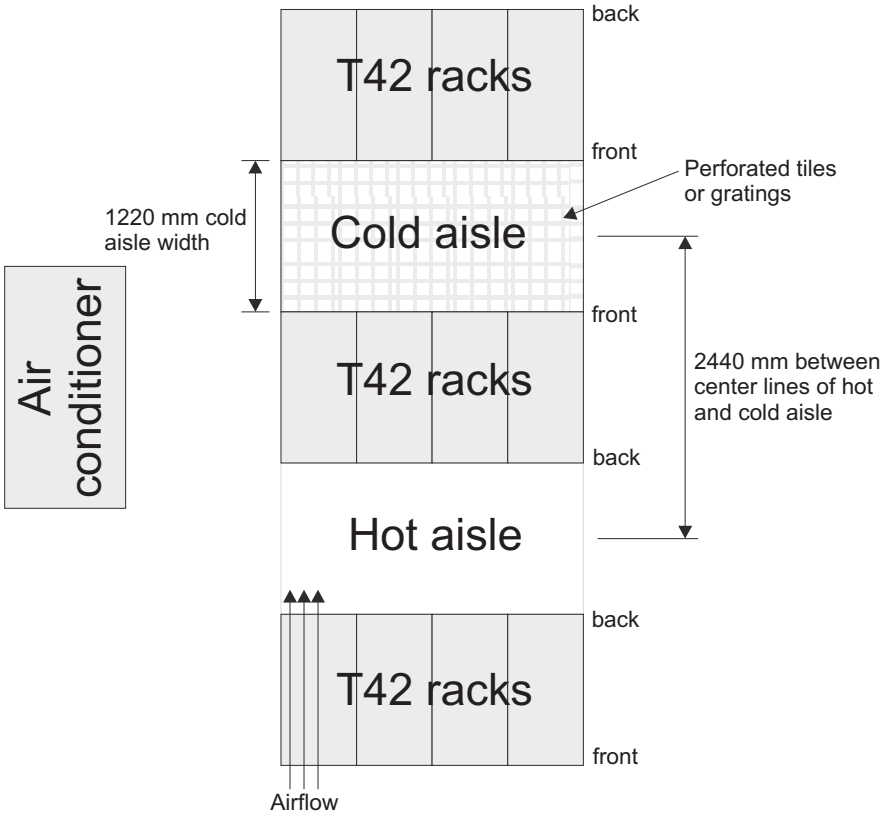


Figure 9. Example of cold aisle/hot aisle rack configuration

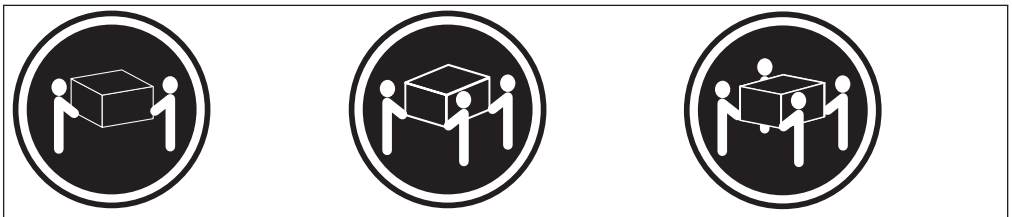
Chapter 2. Installing and cabling the storage expansion unit

This chapter provides the information needed for preparing the storage expansion unit for installation into a rack cabinet. This chapter also contains information about cabling, setting interface options, and installing optional cables.

Preparing for installation

Complete the following steps to prepare the storage expansion unit for installation into a rack cabinet.

Statement 4:



CAUTION:
Use safe practices when lifting.

Before you begin: The fully configured storage expansion unit weighs up to 40.8 kg (85.7 lbs). At least three persons are required to safely lift the storage expansion unit from the shipping box and place it in the rack. If desired, you can open the sides of the shipping box and remove the CRUs from the storage expansion unit before you lift it from the shipping box in order to reduce the weight of the storage server. See “Preparing the storage expansion unit” on page 19.

1. Prepare the site to meet all area, environmental, power, and site requirements. For more information, see “Storage expansion unit operating specifications” on page 13.
2. Move the storage expansion unit and its rack cabinet to the site.
3. Remove the storage expansion unit from its shipping container and check the contents (see “Inventory checklist” on page 3). If any items are missing, contact your IBM reseller before proceeding.
4. Assemble the tools and equipment you will need for installation. These might include:
   - Power cords
   - Number 2 Phillips and medium flat-blade screwdrivers
   - Antistatic protection (such as a grounding wrist strap)
   - Fibre channel (FC) and Ethernet interface cables and cable straps
   - Rack-mounting hardware (comes with the storage expansion unit)
   - Storage Manager software to configure the storage subsystems (comes with the FAStT storage server or downloadable from the Web)

5. Continue with “Handling static-sensitive devices.”

Handling static-sensitive devices

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

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

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

Continue with “Preparing the site.”

Preparing the site

This section lists the space requirements and weight information for the storage expansion unit. For information on interface cables and connections, see “Cabling the expansion unit” on page 31.

Floor space: The floor area at the installation site must provide the following:

- Enough stability to support the weight of the fully configured storage expansion unit and associated systems.
- Sufficient space to install the storage expansion unit.

Weight: The storage expansion unit total weight depends on the number of FAStT 2 Gb/s fibre channel hard disk drives that are installed. A fully configured storage expansion unit with two fans, two power supplies, two ESMs, and up to 14 fibre channel hard disk drives installed weighs 43.99 kg (97 lbs).

Continue with “Preparing the rack.”

Preparing the rack

To prepare the rack for installation, review the following list and complete all applicable preparatory procedures:

1. Move, unpack, and level the rack at the installation site.
2. Remove the external rack panels.
3. Stop all I/O activity to the devices in the rack (optional).

4. Turn off all drive enclosure and rack power, and disconnecting existing power, network, and other external cables (optional).
5. Install additional interface cables and power cables.
6. Install support rails for mounting the storage expansion unit. See the Rack mounting template and instructions that come with the storage expansion unit.
7. Remove, add, or reconfigure expansion units or devices in the rack cabinet.

Important: Before installing the storage expansion unit in a rack, it is important that you do the following:

- Review the documentation that comes with your rack enclosure for safety and cabling considerations.
- Install the storage expansion unit in a maximum 35°C (95° F) environment.
- To ensure proper airflow, do not block the air vents; 15 cm (6 in.) of air space is sufficient.
- To ensure rack stability, load the rack starting at the bottom.
- If you install multiple components in the rack, do not overload the power outlets.
- Always connect the expansion unit to a properly grounded outlet.
- Always connect redundant power supplies of devices in the rack into separate electrical circuits.

Continue with “Preparing the storage expansion unit.”

Preparing the storage expansion unit

You will need an antistatic wrist strap and a cart or level surface (to hold the CRUs). You will use the following procedure to prepare the storage expansion unit for installation. These instructions can be used after you have completed all applicable site, rack cabinet, and storage expansion unit preparations discussed in “Preparing for installation” on page 17.

The storage expansion unit comes with a rack-mounting hardware kit for installation into a rack cabinet. It is easier to lift the storage expansion unit and install it in a rack cabinet if you remove all CRUs first.

Attention: This section describes how to remove the CRUs in order to minimize the weight of the storage expansion unit before you install it in the rack. However, if you have three or more people available to lift and install the storage expansion unit in a rack, you might not find it necessary to remove the CRUs before you install the storage expansion unit. If this is the case, you can skip the CRU removal instructions provided in this section. Instead, continue with “Installing the support rails and the storage expansion unit into a rack cabinet” on page 22, and then skip the CRU replacement instructions provided in “Replacing the CRUs” on page 27.

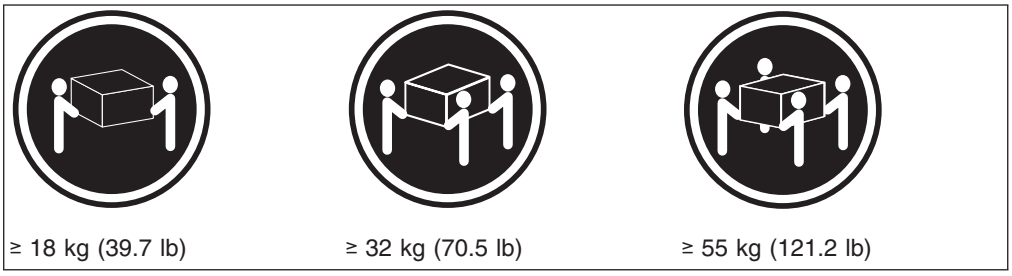
Remove the following CRUs from the expansion unit before installing it in the rack cabinet:

- ESMs
- Power supplies
- Fans
- Hot-swap hard disk drives

Note: You do not need to remove blank trays.

Use the following procedures to remove storage expansion unit CRUs. Removing the CRUs will reduce the overall weight of the storage expansion unit.

Statement 4:



CAUTION:
Use safe practices when lifting.

Attention: The expansion unit comes with the bezel attached to the front of the unit with two white plastic screws and nuts. This bezel protects the light pipes located above the drive trays. Leave the protective bezel in place until you are instructed to remove it.

Complete the following steps to remove an ESM:

1. Push down on the ESM latch and hold it the down position.
2. With the ESM latch in the down position, grasp the pull rings and pull out on the levers; then, remove the ESM from the bay as shown in Figure 10.

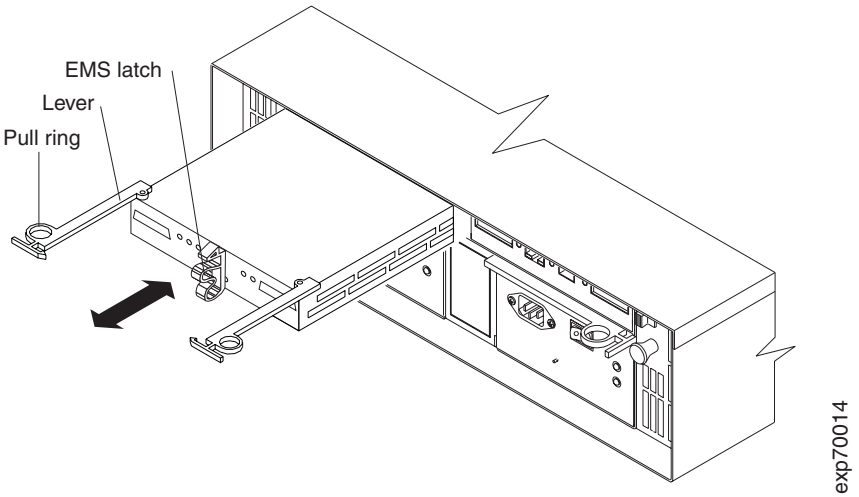


Figure 10. Removing an ESM

3. Place the ESM on a level surface.

Complete the following steps to remove a power supply CRU:

1. Grasp the pull-ring on the power-supply lever and squeeze the latch to release it.

2. Pull the lever open and remove the power supply as shown in Figure 11.

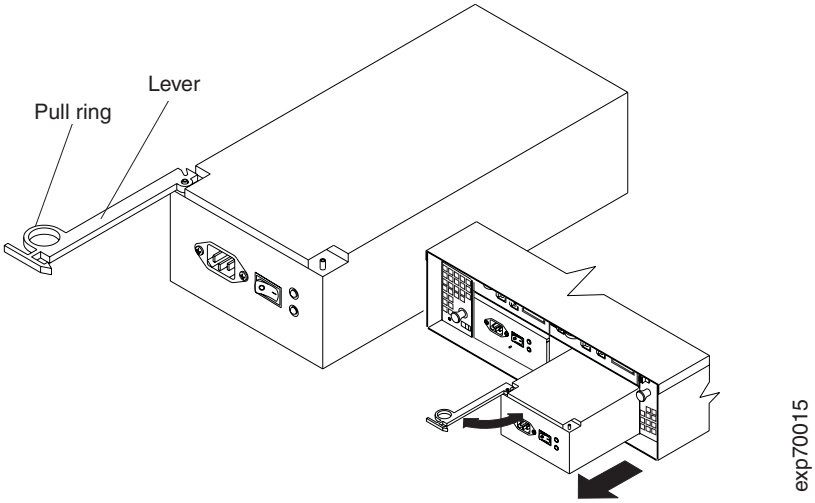


Figure 11. Removing a power supply CRU

3. Place the power supply on a level surface.

Complete the following steps to remove a fan CRU:

1. Unlock the latch by moving the latch towards the exterior of the storage enclosure unit (away from the power supply and ESM CRUs) and hold it in the open position.
2. Grasp the handle and pull the fan unit out of the bay as shown in Figure 12.

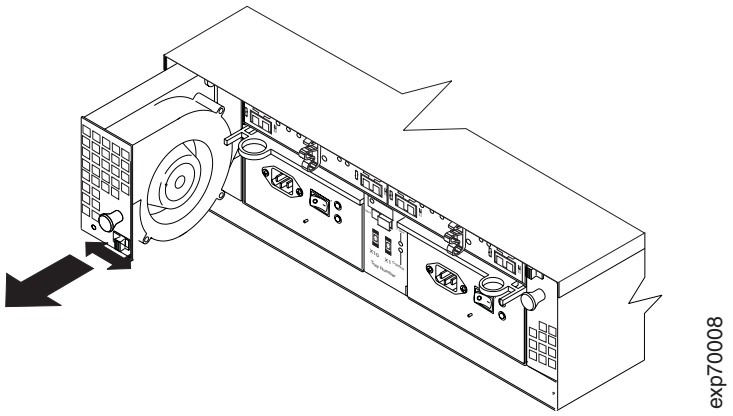


Figure 12. Removing a fan CRU

3. Place the fan unit on a level surface.

Complete the following steps to remove a hot-swap hard disk drive:

Note: The hard disk drive comes installed in a drive tray. Do not attempt to detach the drive from the tray.

1. Use Table 19 on page 81 to record the location and identify your FAStT 2 Gb/s fibre channel hard disk drives. This record is required for replacing the hard disk drives in the original order before they were removed.

2. Release the blue latch on the drive CRU by pressing on the inside of the bottom of the tray handle.
3. Pull the handle on the tray out so that it is in the open position and pull the drive out of the bay as shown in Figure 13.

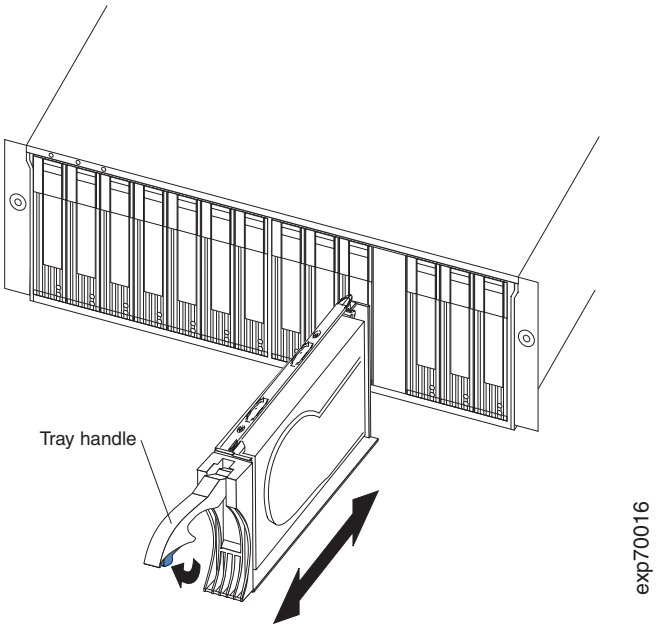


Figure 13. Removing drive CRUs

4. Place the drive CRU horizontally on a level surface, with the printed circuit boards facing down.

   Attention: Do not stack drive CRUs on top of one another. Protect the drive CRUs from vibrations or sudden shocks.
5. Repeat step 1 through step 4 for additional drive CRUs.

Continue with “Installing the support rails and the storage expansion unit into a rack cabinet.”

Installing the support rails and the storage expansion unit into a rack cabinet

To install the storage expansion unit in a rack cabinet, use the rails and rack-mounting hardware that come with your expansion unit. The storage expansion unit requires an EIA 310-D Type A 19-inch rack cabinet. This required rack cabinet has a minimum and maximum rack depth of 24 inches and 32 inches respectively, which is the distance between EIA rails, from the front of the rack cabinet to the rear of the rack cabinet. This rack cabinet conforms to the Electronic Industries Association (EIA) standard. Where you place the support rails in the cabinet depends on where you intend to position the expansion unit.

Use the following templates (Figure 14 on page 24 and Figure 15 on page 25) to identify the proper locations for inserting M6 screws when mounting the support rails and storage expansion unit to a rack. The locations for the M6 screws are highlighted in the templates.

The storage expansion unit is 3 U high. Align the template with the rack at a U boundary. U boundaries are shown as horizontal dashed lines in the rack mounting templates.

Note: The following templates and rack mounting installation instructions are also included in the rack mounting assembly package that comes with the expansion unit to locate the rack mounting holes and install the unit into a rack cabinet. Instructions for removing and replacing the bezel are also included in the Rack Mounting Template that comes with the expansion unit.

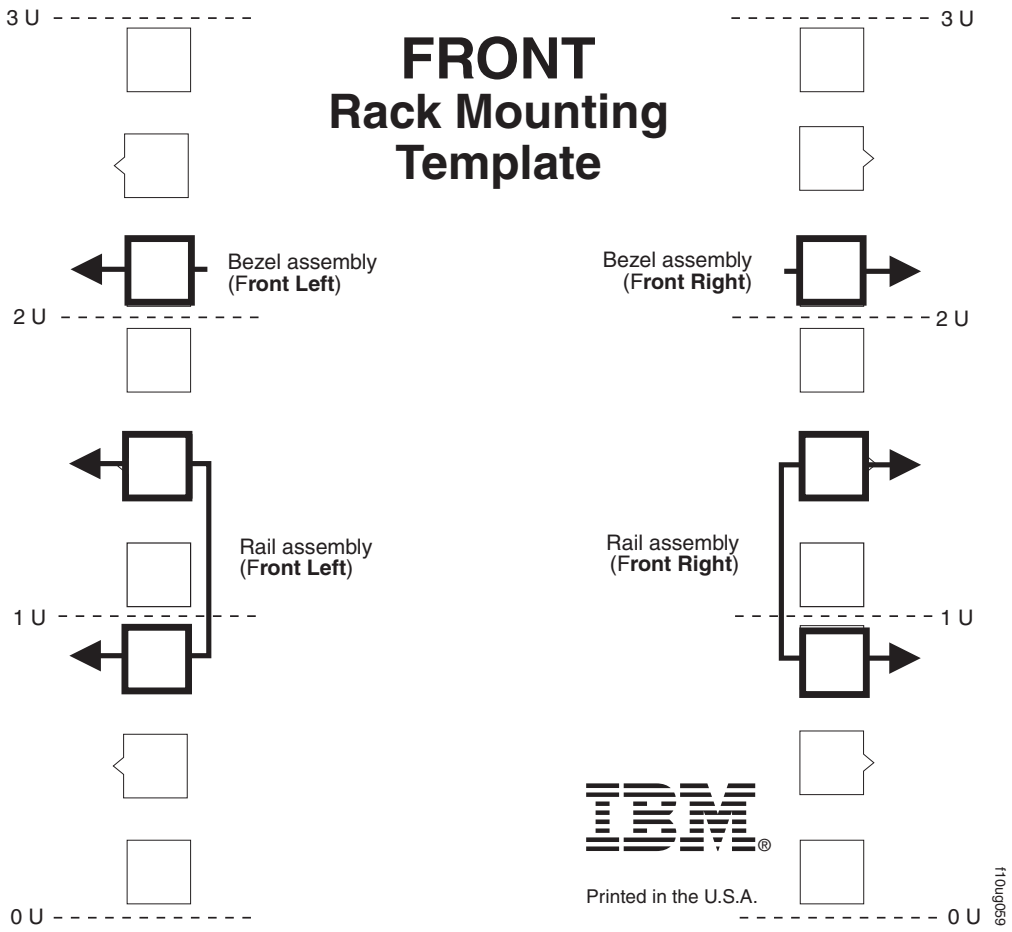


Figure 14. Front rack mounting template

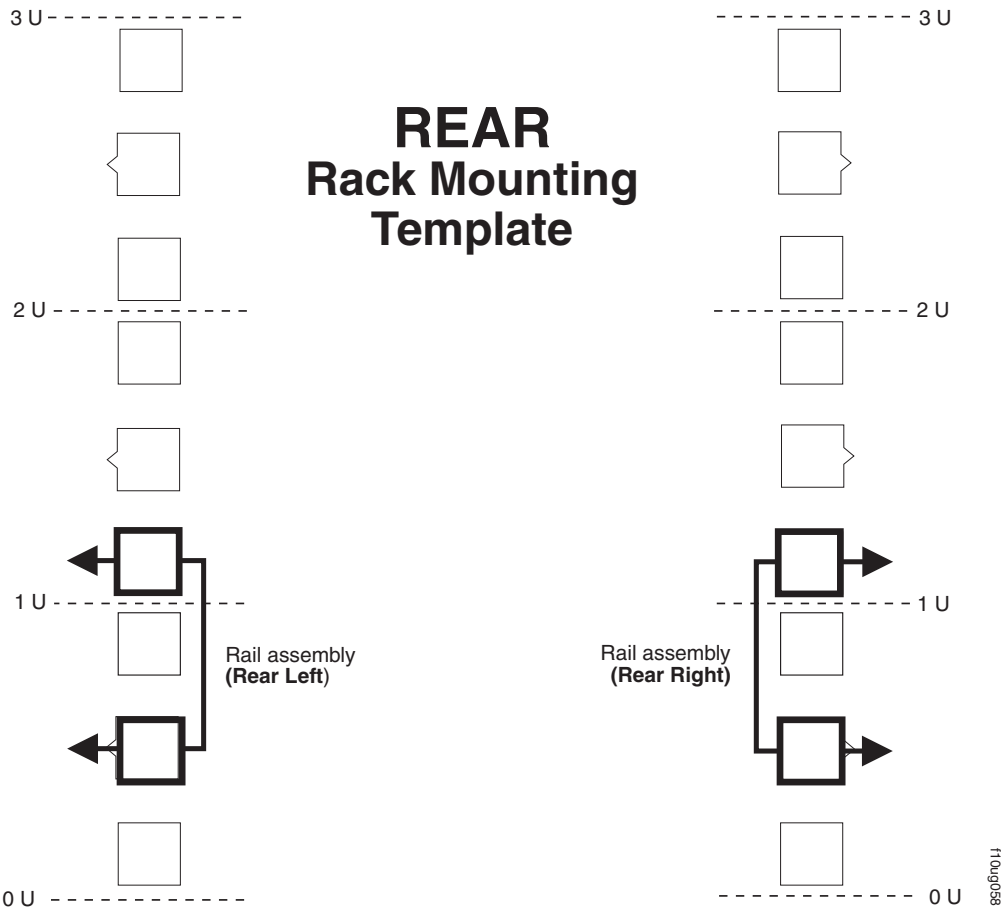
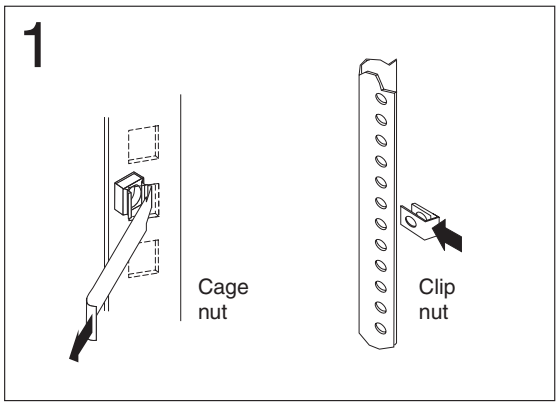


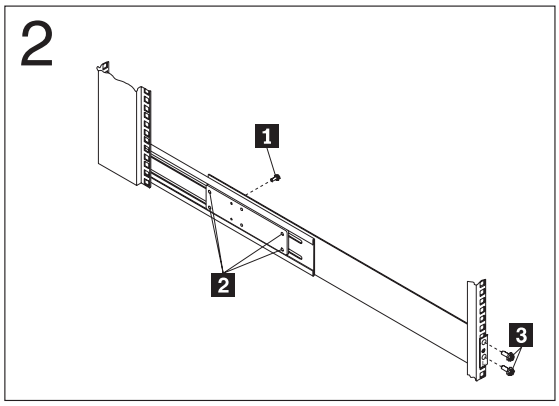
Figure 15. Rear rack mounting template

To install the support rails and the storage expansion unit into a rack cabinet, perform the following steps:

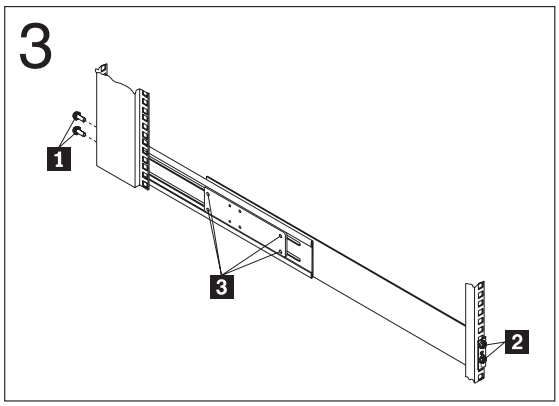
1. Align arrows on the front and rear of the template with rack holes to guide cage nut or clip nut installations.



2. On the rail marked ″L″, remove and save the small screw (1); then, loosen the four large screws (2). Hold the rail against the outside of the left rack mounting flange and loosely insert the front black hex screws (3).

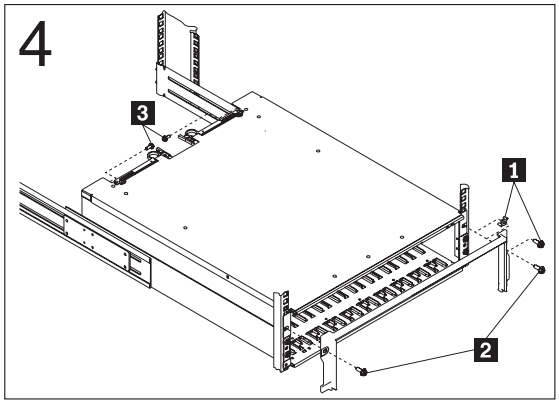


3. Extend the rail outside of the rear rack mounting flange; then, install and tighten both rear black hex screws (1). Tighten the front screws (2) and the four large screws (3). Repeat steps 2 and 3 for the rail marked ″R″ on the right side of the rack.



4. Slide the device into the rack; then, remove and discard both white screws and wingnuts (1) from the bezel. Align the bezel locator pins; then, secure the bezel with two black hex screws (2). Secure the rear of the device with two small

screws (3) (removed in step 2).



After you install the storage expansion unit in a rack cabinet, continue with "Replacing the CRUs."

Replacing the CRUs

Complete the following steps to replace the ESM CRUs that you removed:

1. Slide one ESM into the empty slot in the expansion unit. Be sure the levers are pulled straight out as you slide it in, as shown in Figure 16.

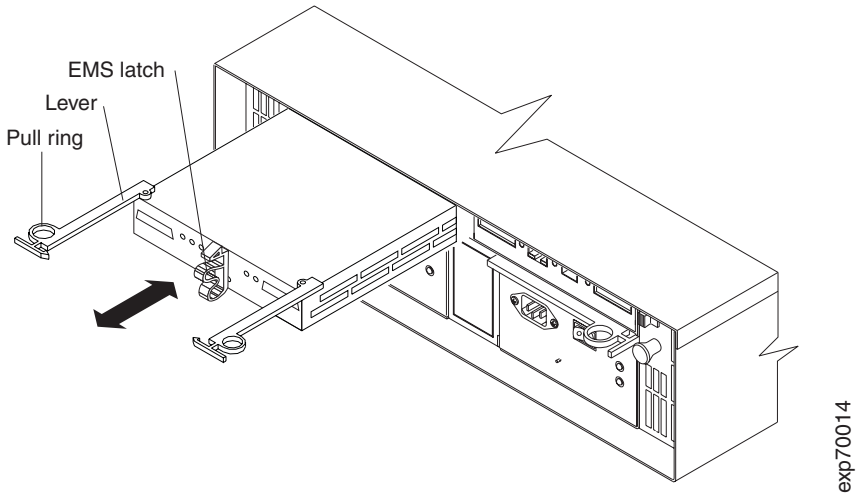


Figure 16. Replacing an ESM

2. After you install the ESM into the bay, the ESM latch will lock into place. Close the levers until the pull-ring latch locks in place. Make sure the levers lock into place in the expansion-unit chassis.
3. Repeat steps 1 and 2 to replace the second ESM.

Complete the following steps to replace the power-supply CRUs that you removed:

1. Slide one power supply into the expansion unit. Be sure the levers are pulled straight out as you slide the power supply into the expansion unit, as shown in Figure 17 on page 28.

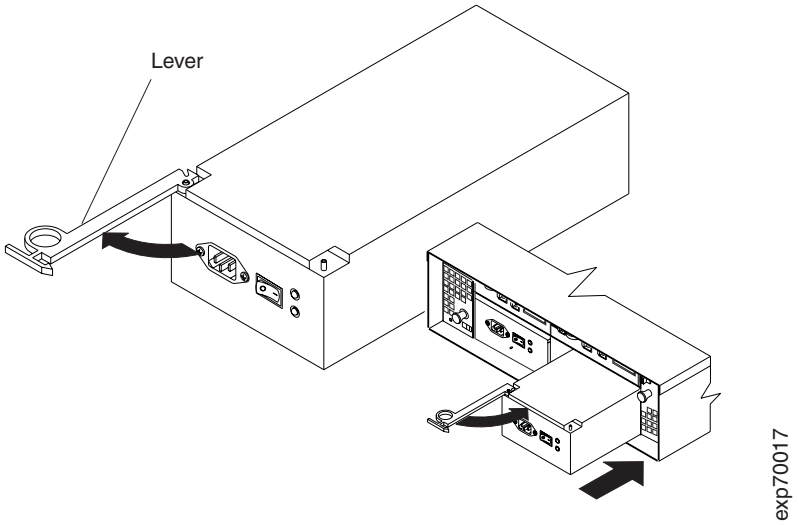


Figure 17. Replacing a power-supply CRU

2. Close the lever until the pull-ring latch locks in place. Make sure the lever locks into place in the expansion-unit chassis.
3. Repeat steps 1 and 2 to replace the second power supply.

Complete the following steps to replace the fan unit CRUs that you removed:

1. Place the fan CRU in front of the fan bay.
2. Ensure that you move the fan latch towards the exterior of the storage enclosure unit (away from the power supply and ESM CRUs) before you insert the fan. Hold the latch in the open position while inserting the fan unit into the fan bay.

   The open side of the fan CRU faces the power supply and ESM CRUs. If the fan does not go into the bay, rotate it 180°. (See Figure 18.)

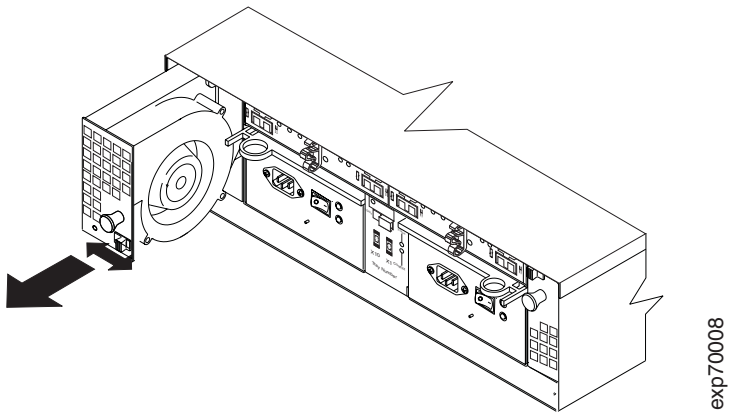


Figure 18. Replacing a fan CRU

3. If the latch does not automatically lock when you have successfully inserted the fan unit into the bay, pull back on the fan slightly and then push it in again until the latch snaps into place.
4. Repeat steps 1 through 3 to replace the second fan.

Complete the following steps to replace the hot-swap hard disk drives that you removed:

1. Lift up on the handle and gently push the drive CRU into the empty bay until the tray handle touches the expansion-unit bezel.
2. Push the tray handle down into the closed (latched) position as shown in Figure 19.

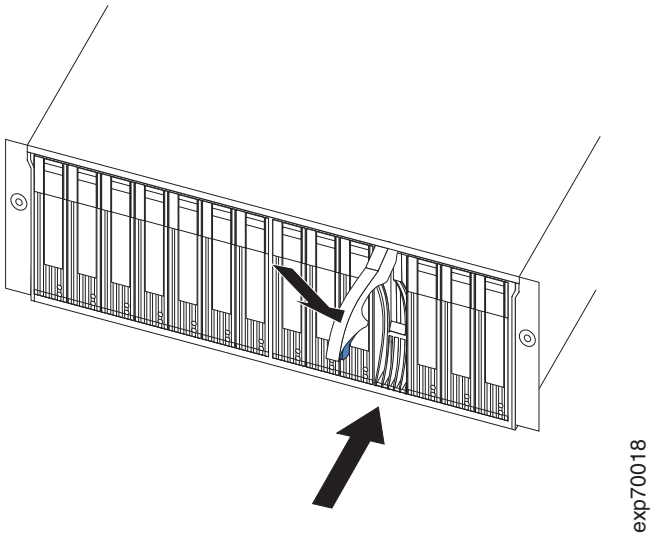


Figure 19. Replacing hot-swap hard disk drives

3. Repeat steps 1 and 2 to replace additional drives.

Continue with “Setting the interface options.”

Setting the interface options

The storage expansion unit comes with two enclosure ID switches that are used to identify the storage expansion unit on a fibre channel loop, and to assign physical addresses to the drives. The enclosure ID switches are located on the back of the expansion unit, as shown in Figure 20 on page 30.

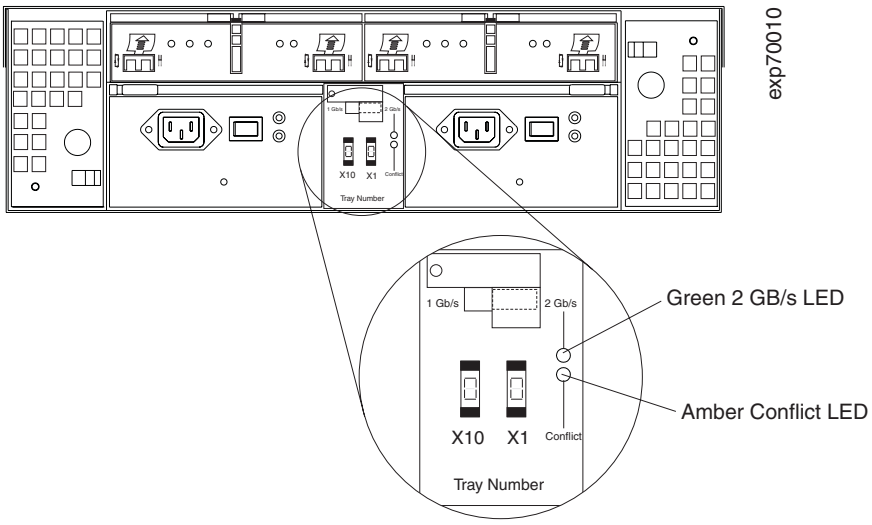


Figure 20. Setting the interface options

Fibre channel loop and ID settings

When you install a hard disk drive in the expansion unit, the drive tray plugs into a printed circuit board called the *midplane*. The midplane sets the fibre channel loop ID automatically, based on the enclosure ID switch setting and the physical location (bay) of the hard disk drive.

Enclosure ID settings

Each drive enclosure in a FAStT storage subsystem drive loop must have a unique drive enclosure ID. FAStT controllers use a combination of the enclosure ID and the number of the physical slot that a fibre channel hard drive occupies to create a unique fibre channel loop address or arbitrated loop physical address (AL_PA) for each drive in a fibre channel drive loop. The enclosure ID consists of two digits, a tens digit (x10) and ones digit (x1).

Attention: When connecting the storage expansion unit to a storage server, DO NOT use the tens digit (x10) setting. Use only the ones digit (x1) setting to set unique server IDs or enclosure IDs.

Give each drive expansion enclosure in a redundant drive loop a unique ones digit (x1) ID. This setting will enforce hard AL_PAs (unchangeable between fibre channel Loop Initializations [LIPs]) for the drives and facilitate drive loop problem troubleshooting in the event of an error. If the ones digits are not unique, two or more devices will have the same hard AL_PA. In such a case, the controller will use soft AL_PAs for the devices that have identical hard AL_PAs.

The problem with soft addressing is that addresses may change between LIPs. This possibility increases the difficulty of troubleshooting drive loop problems, since one cannot easily ascertain whether the same device with a different address or different device may be causing a problem.

Note: The storage expansion unit is shipped with 00 as the default server ID setting. When you connect the storage expansion unit to a storage server, you must set the storage expansion unit enclosure ID setting to a value other than 00. Each server unit should have a unique ID if it is going to be

connected to other drive expansion units through the drive loop ports. The Server ID setting is only valid for the drive loop. The amber Conflict LED (located on the right-side of the switch) will be lit if another unit in the drive loop has the same ID setting as the server ID.

Expansion unit speed settings

The default switch setting is 2 Gb per second. Be sure that you have read "Storage-management software and hardware compatibility" on page 11 to determine the correct operating speed *before* you complete the following steps to access and enable drive operation to 1 Gb per second.

Attention

Do *not* change the expansion unit speed setting from the default 2 Gb/s for the FAStT EXP710. 2 Gb/s is the only expansion unit speed setting allowed for the FAStT EXP710.

1. Using a Phillips screwdriver, loosen the screw that secures the switch cover plate to the expansion unit; then, remove the switch cover plate.
2. To enable 1 Gb per second drive operation, press on the left side of the switch to 1 Gb/s (when set to 1 Gb/s, the green LED to the right of the switch is off).
3. Replace the switch cover plate.
4. Continue with "Cabling the expansion unit."

Cabling the expansion unit

The storage expansion unit provides ports for connections to two redundant drive loops. A redundant drive storage expansion unit loop consists of one or more expansion units connected to a storage server using two sets of fibre channel cables. If one fibre channel loop fails, the storage server uses the other drive storage expansion unit loop to maintain input/output to the storage expansion unit array group. Usually, there are two RAID controllers in a storage server. Use the Fibre Channel Cabling Instructions that comes with your storage server for the specific information about cabling the storage expansion unit. Before cabling the expansion unit, read the following information:

- **Fibre channel loop:** A fibre channel loop consists of fibre channel disk drives connected to each other and to one or more RAID controllers. A loop can support multiple RAID controllers, a large number of disk drives, and other addressable entities such as system-management logic chips. Refer to your storage server documentation for information about controller-dependent hardware configuration details. Some controllers might have restrictions on the maximum number of disk drives supported on a loop, cabling restrictions, and other requirements.
- **SFP module ports:** Your storage expansion unit supports large, complex, and redundant disk drive loop configurations. Each ESM has two SFP module ports. Each SFP module has an input and output port. A loop is created by connecting one or more storage expansion units to one or more RAID controllers. You then use dual fiber-optic cables to connect one storage expansion unit to another.
- **Fibre channel cable restrictions:** RAID controllers use specific IBM fibre channel options. Refer to the Fibre Channel Cabling Instructions that come with your storage server for the cable option that is required for your configuration.
- **Power cabling:** The expansion unit uses two standard power cables. You can connect the power cables to a primary power unit inside the rack cabinet, such

as a properly grounded ac distribution unit or uninterruptible power supply (UPS). You can also connect the power cable to an external source, such as a properly grounded electrical outlet.

Installing SFP modules

The storage expansion unit requires SFP modules. SFP modules are used to convert electrical signals to optical signals that are required for fibre channel transmission to and from RAID controllers. After you install the SFP modules, you will use fiber-optic cables to connect the storage expansion unit to a FAStT storage server.

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

- Do not mix long-wave SFPs and short-wave SFPs on a single storage server. Use either long-wave SFPs or short-wave SFPs. You can use the Storage Manager client to view the Storage Subsystem Profile in order to verify that you are not mixing long-wave and short-wave SFPs.

  Attention: In addition, do not use long-wave SFPs or GBICs in any of the FC ports in the FC drive loops. (Long-wave SFPs and GBICs are not supported for use in the drive ports of storage expansion units. Long-wave SFPs and GBICs are only supported in the host ports of the FAStT storage server).
- The SFP module housing has an integral guide key designed to prevent you from inserting the SFP module improperly.
- Use minimal pressure when inserting an SFP module into an SFP port. Forcing the SFP module into a port could cause damage to the SFP module or the port.
- You can insert or remove the SFP module while the port is powered on.
- The operational or redundant loop performance is not affected when you install or remove an SFP module.
- You must insert the SFP module into a port before you connect the fiber-optic cable.
- You must remove the fiber-optic cable from the SFP module before you remove the SFP module from the port. Refer to “Removing SFP modules” on page 34 for more information.

Complete the following steps to install an SFP module:

Statement 3:

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

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

DANGER

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

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

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 18.

1. Remove the SFP module from its static-protective package.
2. Remove the protective cap from the SFP module, as shown in Figure 21. Save the protective cap for future use.

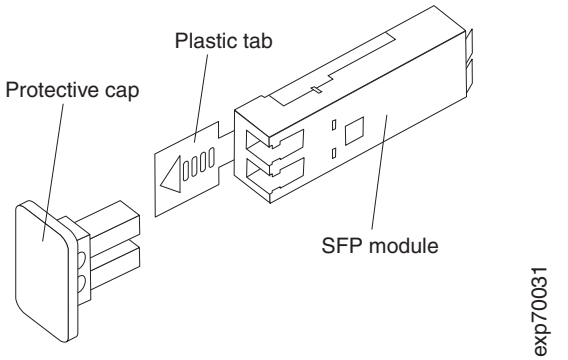


Figure 21. Small Form-Factor Pluggable (SFP) module

3. Remove the protective cap from the SFP port. Save the protective cap for future use.
4. Insert the SFP module into the host port until it clicks into place. See Figure 22.

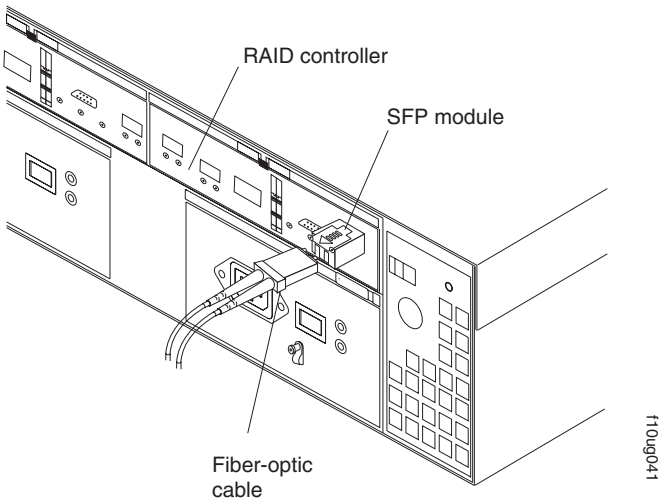


Figure 22. Installing an SFP module into the host port

5. Connect an LC-LC fibre channel cable. For information about the LC-LC cable, see “Using LC-LC fibre channel cables” on page 35.

Removing SFP modules

Complete the following steps to remove the SFP module from the SFP port:

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

1. Remove the LC-LC fibre channel cable from the SFP module. For more information, see “Handling static-sensitive devices” on page 18 and “Using LC-LC fibre channel cables” on page 35.
2. Unlock the SFP module latch:
   - For SFP modules that contain plastic tabs, unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in Figure 23.

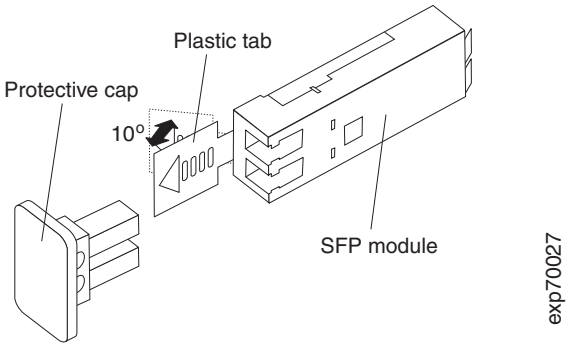


Figure 23. Unlocking the SFP module latch - plastic variety

   - For SFP modules that contain wire tabs, unlock the SFP module latch by pulling the wire latch outward 90°, as shown in Figure 24.

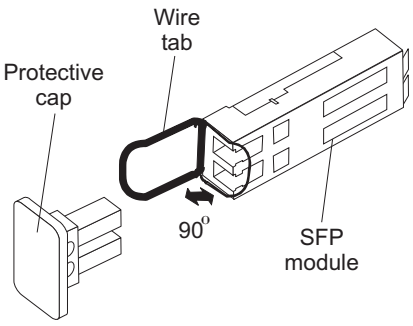


Figure 24. Unlocking the SFP module latch - wire variety

3. With the SFP latch in the unlocked position, slide the SFP module out of the port.
4. Replace the protective cap on the SFP module.
5. Place the SFP module into a static-protective package.

Handling fiber-optic cables

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

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

- Do not route the cable along a folding cable-management arm.

- When connecting cables to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius of less than 38 mm (1.5 in.) when extended or become pinched when retracted.
- Route the cable away from places where it can be snagged by other devices in the rack.
- Do not overtighten the cable straps or bend the cables to a radius of less than 38 mm (1.5 in.).
- Do not put excess weight on the cable at the connection point. Be sure that the cable is well supported.

Using LC-LC fibre channel cables

The LC-LC fibre channel cable, shown in Figure 25, is a fiber-optic cable that is used to connect into one of the following devices:

- SFP module installed in a storage expansion unit
- SFP module installed in a FAStT storage server

For more information about cabling these devices, see the documentation that comes with the LC-LC fibre channel cable.

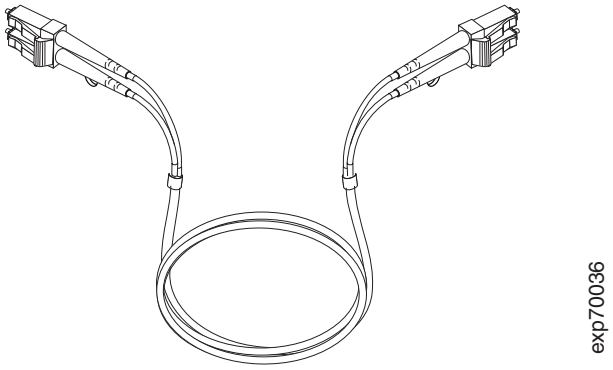


Figure 25. LC-LC fibre channel cable

Note: **FAStT EXP700 only:** If you are connecting the FAStT EXP700 to an IBM FAStT500 or to an IBM FAStT200, you must also use an LC-SC fibre channel cable adapter. You also need the LC-SC cable adapter when connecting a FAStT EXP700 to a FAStT EXP500. For more information about using the fibre channel cable adapter, see “Using LC-SC fibre channel cable adapters” on page 38.

Connecting an LC-LC cable to an SFP module

Complete the following steps to connect an LC-LC fibre channel cable to an SFP module:

Statement 3:

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

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

DANGER

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

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

1. Read the information in “Handling fiber-optic cables” on page 34.
2. If necessary, remove the protective cap from the SFP module, as shown in Figure 21 on page 33. Save the protective cap for future use.
3. Remove the two protective caps from one end of the LC-LC cable, as shown in Figure 26. Save the protective caps for future use.

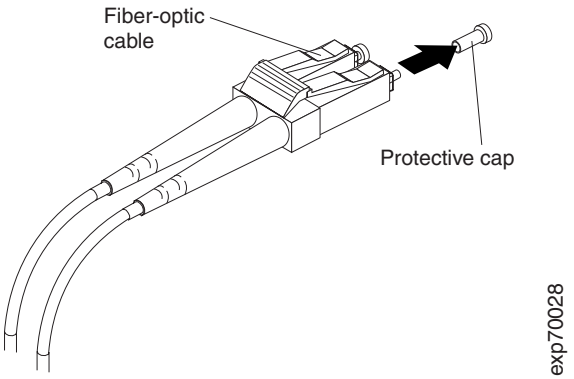


Figure 26. Removing fiber-optic cable protective caps

4. Carefully insert that same end of the LC-LC cable into an SFP module that is installed in the storage expansion unit. The cable connector is keyed to ensure it is inserted into the SFP module correctly. Holding the connector, push in the cable until it clicks into place, as shown in Figure 27 on page 37.

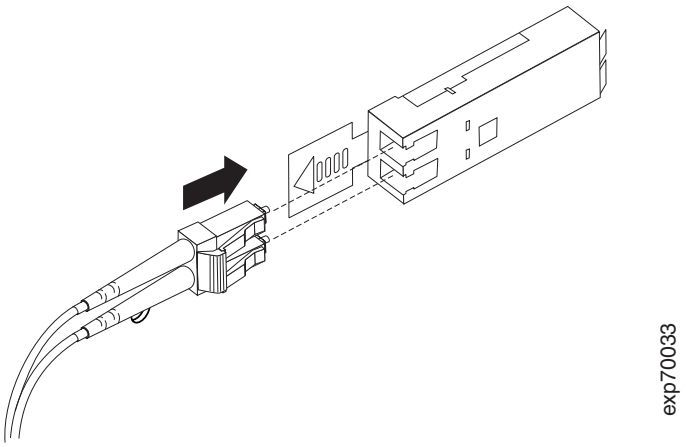


Figure 27. Inserting an LC-LC fibre channel cable into an SFP module

5. Remove the two protective caps from the other end of the LC-LC cable. Save the protective caps for future use.
6. Connect the LC-LC cable to one of the following devices:
   - SFP module that is installed in a separate storage expansion unit
   - SFP module that is installed in a FAStT storage server
   - LC-SC fibre channel cable adapter (for information about using an LC-SC cable adapter, see "Using LC-SC fibre channel cable adapters" on page 38)

Removing an LC-LC fibre channel cable

Complete the following steps to remove an LC-LC fibre channel cable:

Attention: To avoid damaging the LC-LC cable or SFP module, make sure you press and hold the lever to release the latches before you remove the cable from the SFP module. Ensure that the levers are in the released position when removing the cable. When removing the cable from the SFP module, make sure you do not grasp the SFP module plastic tab.

1. On the end of the LC-LC cable that connects into the SFP module or host bus adapter, press down and hold the lever to release the latches, as shown in Figure 28.

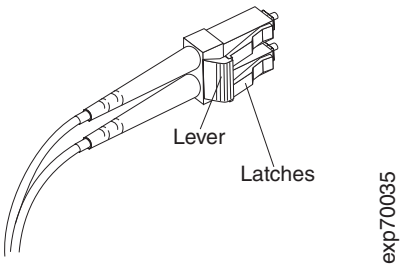


Figure 28. LC-LC fibre channel cable lever and latches

2. Carefully pull on the connector to remove the cable from the SFP module as shown in Figure 29 on page 38.

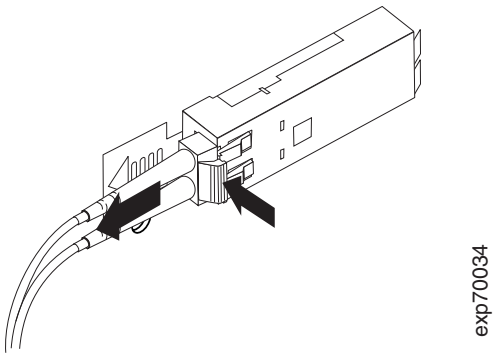


Figure 29. Removing the LC-LC fibre channel cable

3. Replace the protective caps on the cable ends.
4. Replace the protective cap on the SFP module.

Using LC-SC fibre channel cable adapters

The LC-SC fibre channel cable adapter is a fiber-optic cable that is used to connect an LC connector into one of the following devices that require SC connectors:

- IBM FAStT200 Storage Server
- IBM FAStT EXP500 Expansion Unit
- IBM FAStT500 RAID Controller Enclosure Unit

Note: The LC-SC fibre channel cable adapter is required only in some configurations with the FAStT EXP700. No configurations that include the FAStT EXP710 will require the use of an LC-SC fibre channel cable adapter.

For more information about connecting to these devices, see the documentation that comes with the LC-SC fibre channel cable adapter.

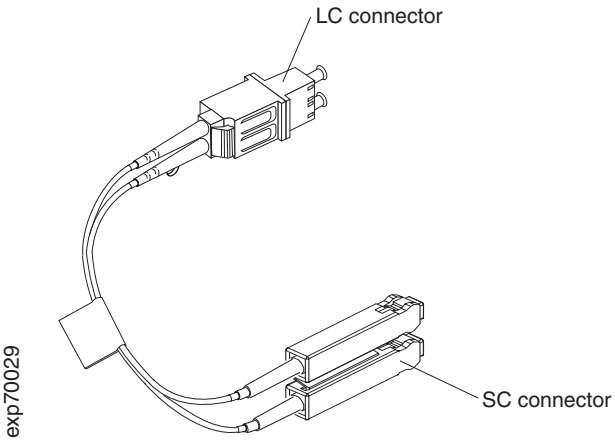


Figure 30. LC-SC fibre channel cable adapter

The following sections provide the procedures for properly connecting and removing an LC-SC fibre channel cable.

Connecting an LC-SC cable adapter to a device

Complete the following steps to connect an LC-SC fibre channel cable adapter to a device:

Statement 3:

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

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

DANGER

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

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

1. Read the information in “Handling fiber-optic cables” on page 34.
2. Connect one end of an LC-LC cable to an SFP module in the FAStT EXP700. For instructions, see “Installing SFP modules” on page 32.
3. Remove the two protective caps from the LC connector end of the LC-SC cable adapter as shown in Figure 31. Save the protective caps for future use.

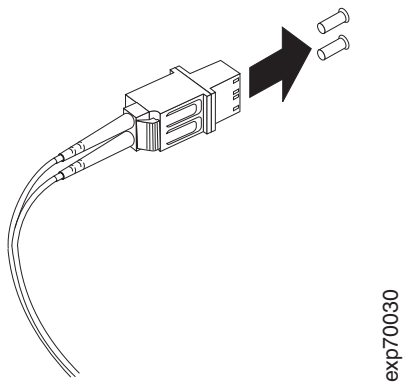


Figure 31. Removing the LC-SC cable adapter protective caps

4. Carefully insert the other end of the LC-LC cable into the LC connector end of the LC-SC cable adapter as shown in Figure 32. Push in the connector until it clicks into place.

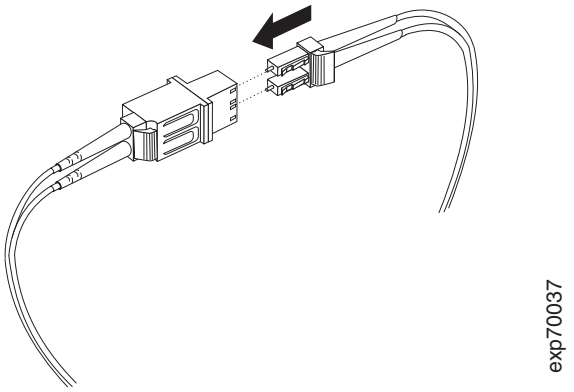


Figure 32. Connecting an LC-LC cable into the LC-SC cable adapter

5. If you are connecting the FAStT EXP700 to a FAStT200, FAStT500, or FAStT EXP500, connect the SC connector end of the LC-SC cable adapter to a Gigabit Interface Converter (GBIC) that is installed in a FAStT200 or FAStT EXP500. For more information about connecting to these devices, see the documentation that comes with the device.

Removing an LC-LC cable from an LC-SC cable adapter

Complete the following steps to remove an LC-LC cable from an LC-SC cable adapter:

Attention: To avoid damaging the LC-LC cable, make sure you press and hold the lever to release the latches before you remove the cable from an LC-SC cable adapter. Ensure that both levers are in the released position when removing the cable. When removing the cable from the SFP module, make sure you do not grasp the SFP module plastic tab.

1. On the end of the cable that connects into the LC connector end of the LC-SC cable adapter, press down and hold the lever to release the latches. Figure 33 shows the location of the lever and latches.

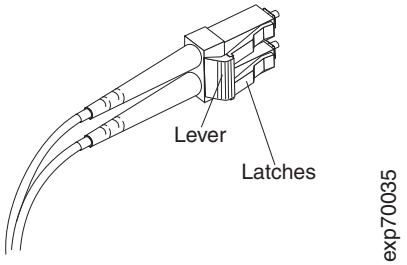


Figure 33. LC-LC fibre channel cable lever and latches

2. Carefully pull on the connector to remove it. Make sure you grasp the connector and not the cable when removing the LC-LC cable from the LC-SC cable adapter as shown in Figure 34.

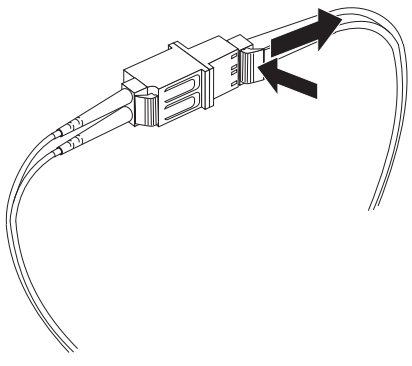


Figure 34. Removing the LC-LC fibre channel cable from an LC-SC fibre channel cable adapter

3. Replace the protective caps on the cable ends.

Cabling storage expansion units to a FAStT storage server

Attention: The following instructions apply to configurations that involve a new FAStT storage server installation only. For additions to an existing FAStT storage server installation, refer to the *IBM TotalStorage FAStT Fibre Channel Hard Drive and Storage Expansion Enclosure Installation and Migration Guide*.

This section discusses the procedure for cabling the FAStT EXP700 and FAStT EXP710 storage expansion units to supported FAStT storage servers. It provides cabling instructions and diagrams for creating redundant fibre-channel loops, and it also provides cabling instructions and illustrations for connecting single expansion units or expansion unit loops to your FAStT storage server.

The following steps summarize the procedure for setting up a storage subsystem that includes a FAStT storage server and one or more FAStT EXP700 or FAStT EXP710 storage expansion units. Each step in the following summary is described in detail in the following sections.

1. **Important:** Review the following planning considerations as they apply to your planned configuration:
   - Storage server connectivity requirements for the FAStT EXP700 and FAStT EXP710. See “Storage server compatibility” on page 42.
   - Requirements for connecting FAStT EXP700s and FAStT EXP710s in the same drive loop. See “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43.
   - Requirements for connecting FAStT EXP700s and FAStT EXP500s in the same drive loop. See “Connecting storage expansion units in a loop with FAStT EXP500s (FAStT EXP700 only)” on page 48.
2. Following the applicable requirements described in “Planning considerations” on page 42, install the storage expansion unit or units in the rack. See “Installing the support rails and the storage expansion unit into a rack cabinet” on page 22.

3. If you are connecting more than one storage expansion unit, cable together the storage expansion units as described in “Cabling the storage expansion units in a redundant loop” on page 49.

   Note: If you are connecting only one storage expansion unit to the storage server, continue instead with “Cabling the storage expansion units to the storage server” on page 54.
4. Connect the storage expansion unit or storage expansion unit loop to the storage server as described in “Cabling the storage expansion units to the storage server” on page 54.
5. Power on the storage subsystem.
6. Install the Storage Manager host software. Use the Storage Manager client GUI to verify the storage server status. Upgrade the FAStT storage server controller and drive expansion enclosure ESM firmware as needed.

   Note: The FAStT storage server controller firmware must be at 6.10.xx.xx or higher to enable the FAStT storage server to recognize the FAStT EXP710s. If the FAStT storage server controller firmware is not 6.10.xx.xx or higher and there are only EXP710s in the drive loop, see Appendix C, “Upgrading the controller firmware for FAStT600, FAStT700, and FAStT900 (FAStT EXP710 only),” on page 93 for upgrading instructions.

If you are adding a new FAStT EXP700 or FAStT EXP710 to an existing drive loop, see “Adding a new storage expansion unit to a loop” on page 58.

Planning considerations

Review the following important planning considerations as they apply to your planned configuration:

- “Storage server compatibility”
- “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43
- “Connecting storage expansion units in a loop with FAStT EXP500s (FAStT EXP700 only)” on page 48

Storage server compatibility

You can cable the FAStT EXP700 to a FAStT200 Storage Server, FAStT500 RAID Controller Enclosure Unit, FAStT600 Fibre Channel Storage Server, FAStT700 Fibre Channel Storage Server, or FAStT900 Fibre Channel Storage Server.

You can cable the FAStT EXP710 to a FAStT600 (Turbo only) Fibre Channel Storage Server, FAStT700 Fibre Channel Storage Server, or FAStT900 Fibre Channel Storage Server.

Note: Connections to other storage servers might be supported in the future. Check the IBM FAStT storage support Web site (www.ibm.com/storage/support/fastt) and the Installation, User’s, and Maintenance Guide of your storage server to verify its compatibility with the FAStT EXP700 or FAStT EXP710.

To cable the FAStT EXP700 to a FAStT200 or FAStT500, you need optional LC-LC and LC-SC cable adapters. You must also set the enclosure speed switch to 1Gb/s.

Table 12 on page 43 provides a matrix that details the storage servers that can connect to the FAStT EXP700, FAStT EXP710, and FAStT EXP500.

Table 12. Storage expansion unit connectivity matrix

	FAStT EXP700	FAStT EXP710	FAStT EXP500
FAStT200	Yes (requires an LC-SC cable adapter; drive loop speed must be set to 1 Gb/s)	No	Yes
FAStT500	Yes (requires an LC-SC cable adapter; drive loop speed must be set to 1 Gb/s)	No	Yes
FAStT600	Yes	Yes (FAStT600 Turbo option only)	No
FAStT700	Yes	Yes	Yes (requires an LC-SC cable adapter; drive loop speed must be set to 1 Gb/s)
FAStT900	Yes	Yes	Yes (requires an LC-SC cable adapter; drive loop speed must be set to 1 Gb/s)
FAStT100	No	No	No

Intermixing FAStT EXP700s and FAStT EXP710s in the same loop

You can intermix FAStT EXP700s and FAStT EXP710s in the same drive loop, but all FAStT EXP710s in the redundant drive loop must be grouped together. Figure 35 on page 44 though Figure 37 on page 46 show three acceptable FAStT EXP700 and FAStT EXP710 intermixing cabling configurations in which all FAStT EXP710s are grouped together. Figure 38 on page 47 and Figure 39 on page 48 show two unacceptable intermixed configurations in which all FAStT EXP710s are not grouped together.

These intermixing requirements must also be met if you are upgrading some (but not all) of the FAStT EXP700s in a drive loop with the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit (P/N 25R0166). See Appendix B, “Upgrading ESMs with the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit,” on page 83.

Important

Failure to follow these intermixing requirements for drive loops that include both FAStT EXP700s and FAStT EXP710s might result in drive loop performance degradation that could cause loss of data access and possibly loss of data.

Figure 35 on page 44 though Figure 37 on page 46 show three acceptable FAStT EXP700 and FAStT EXP710 intermixing cabling configurations in which all FAStT EXP710s are grouped together. Note that in Figure 37 on page 46, the FAStT EXP710s are grouped together even though the FAStT EXP700s are not grouped together.

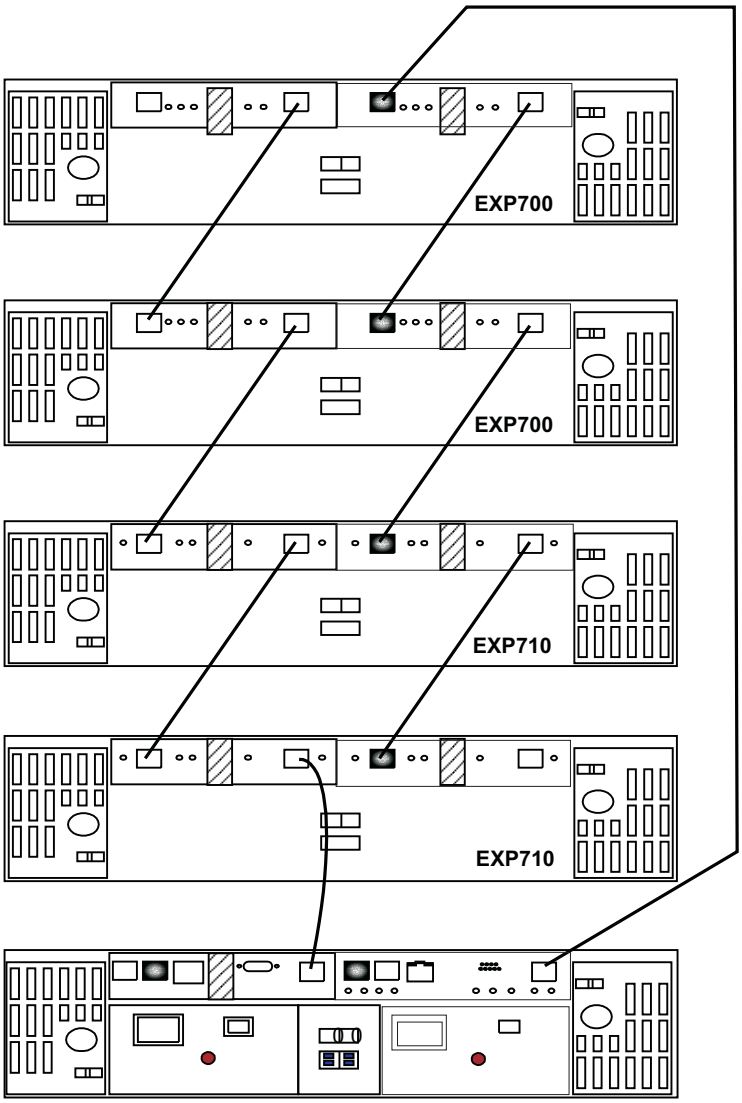


Figure 35. Acceptable intermixed FAStT EXP700 and FAStT EXP710 loop configuration

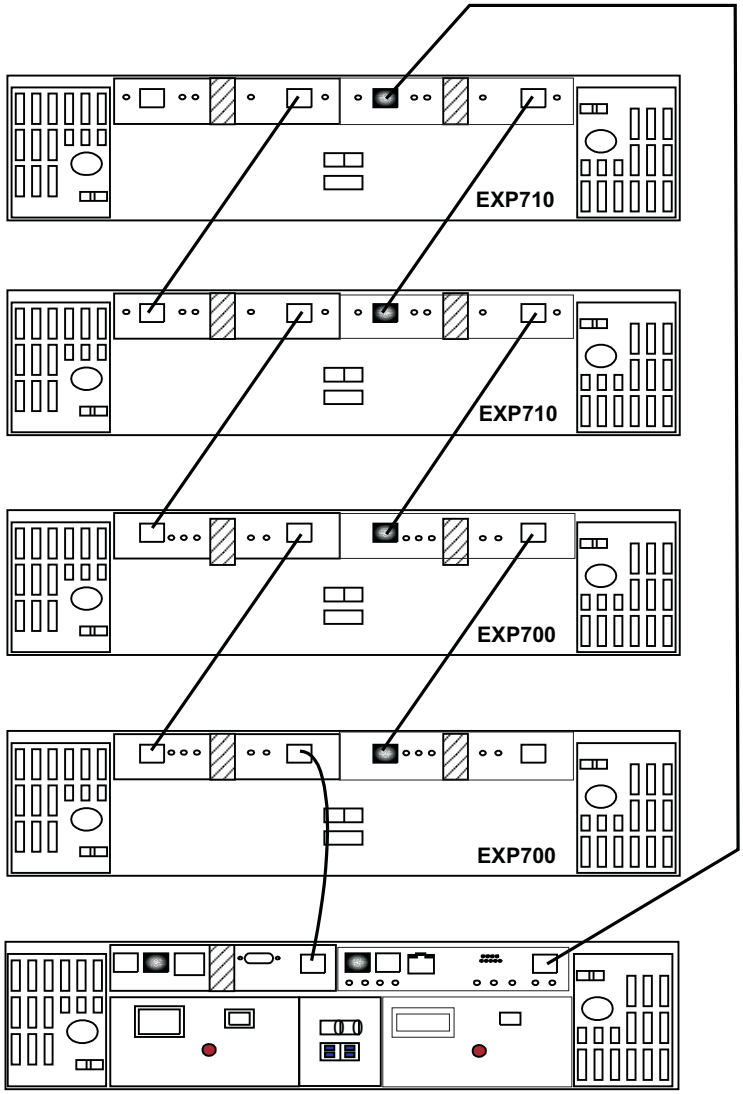


Figure 36. Acceptable intermixed FAStT EXP700 and FAStT EXP710 loop configuration

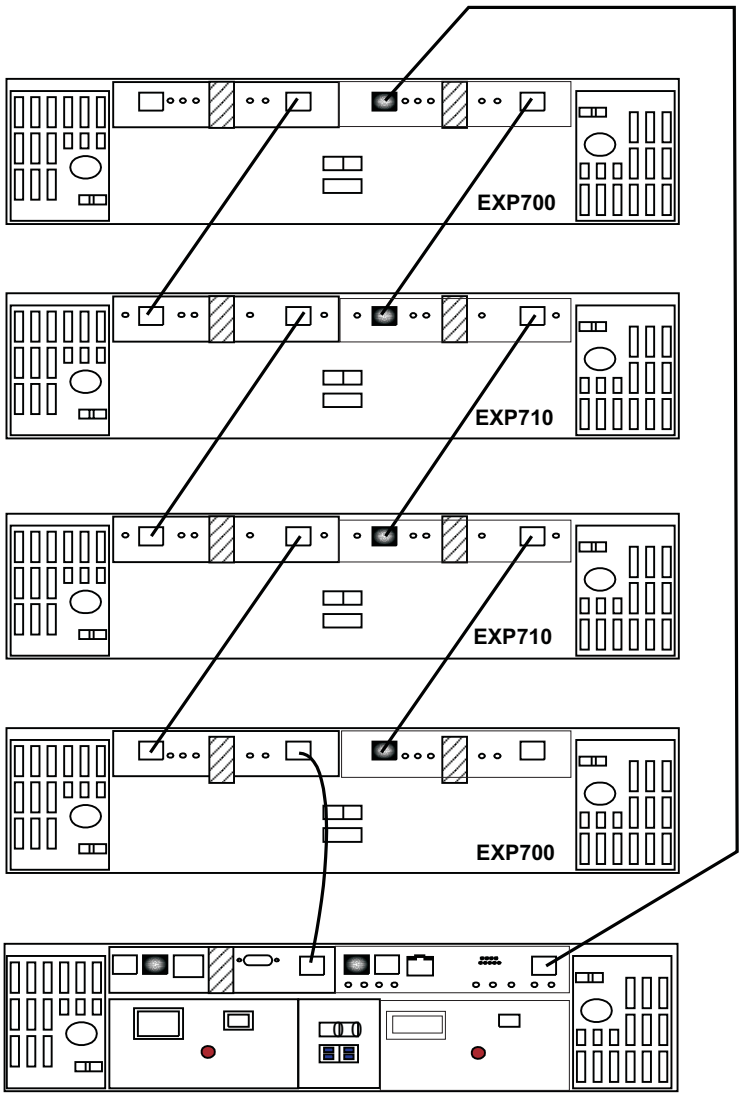


Figure 37. Acceptable intermixed FAStT EXP700 and FAStT EXP710 loop configuration

In Figure 38 on page 47 and Figure 39 on page 48, the intermixed configurations shown are unacceptable because the FAStT EXP710s in the redundant drive loop are not grouped together.

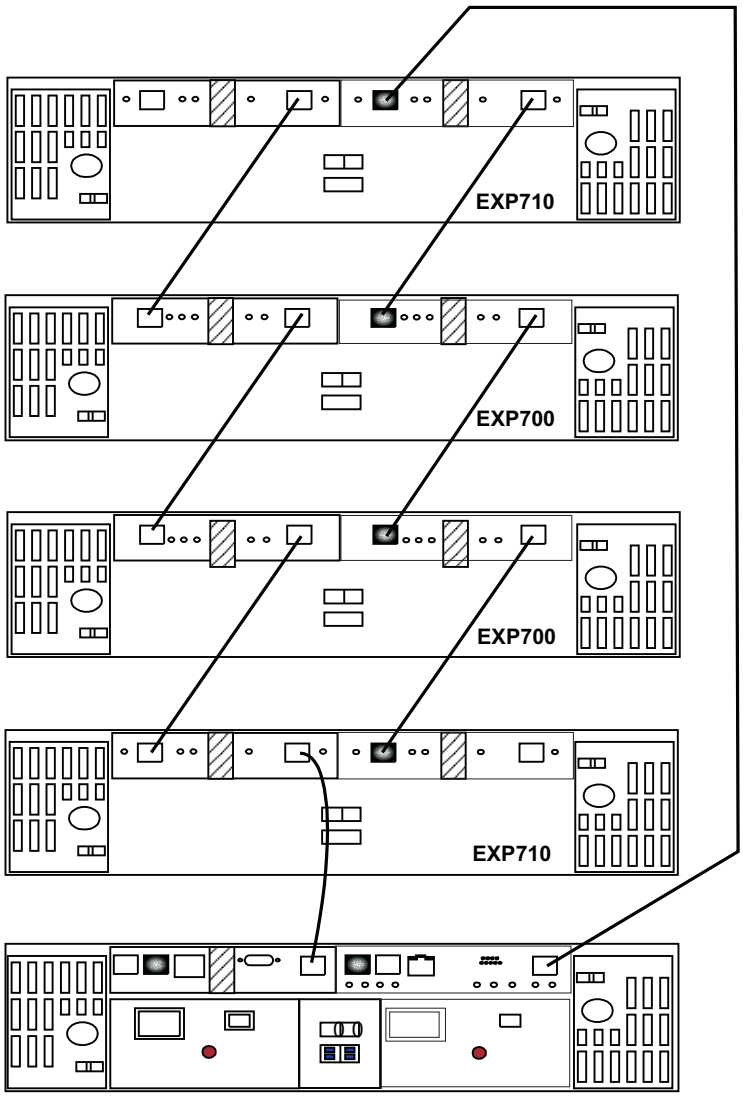


Figure 38. Unacceptable intermixed FAStT EXP700 and FAStT EXP710 loop configuration

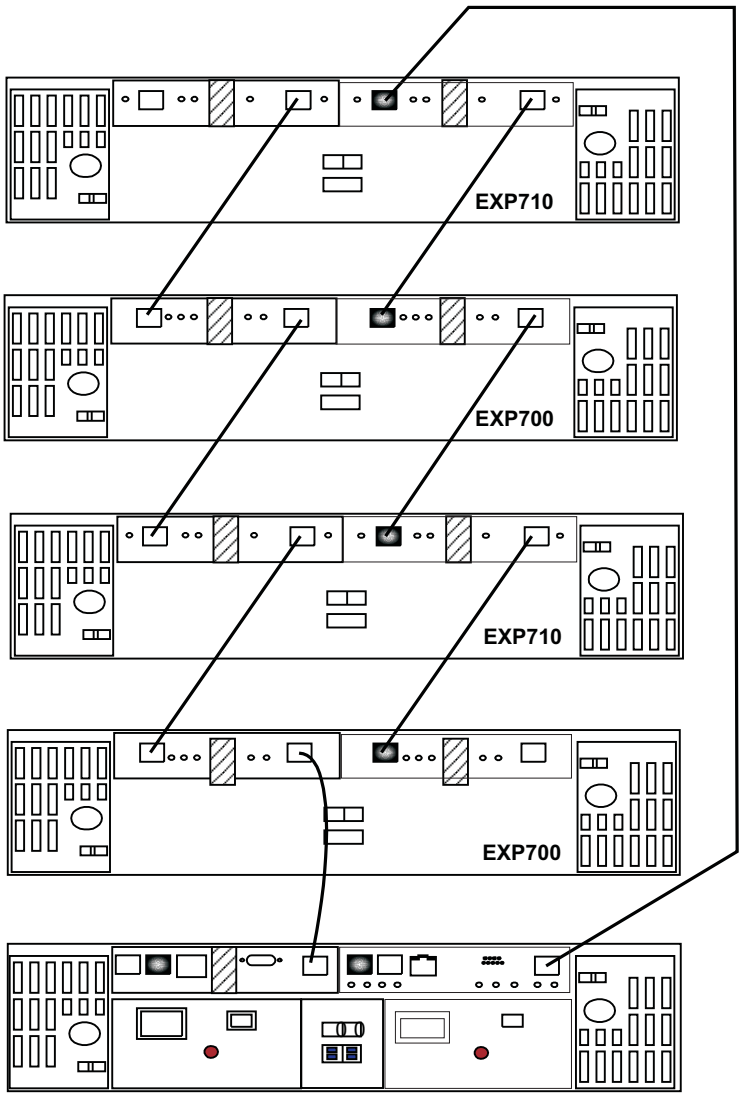


Figure 39. Unacceptable intermixed FAStT EXP700 and FAStT EXP710 loop configuration

Connecting storage expansion units in a loop with FAStT EXP500s (FAStT EXP700 only)

You can connect both FAStT EXP500 and FAStT EXP700 storage expansion units to FAStT200, FAStT500, FAStT700, and FAStT900 storage servers. The FAStT600 does not support the FAStT EXP500. Use Table 13 on page 49 and Table 14 on page 49 to determine the number of expansion units that you can connect to a FAStT storage server redundant loop (drive loop pair).

Attention: You cannot mix the FAStT EXP710 with FAStT EXP500s in a drive loop with any storage server.

In addition, with a FAStT storage server that supports redundant drive loops (such as the FAStT700 and FAStT900), if a FAStT EXP710 is included in one drive loop, no FAStT EXP500s can be present in the other drive loop (because the storage server does not support mixed drive loop speeds).

Table 13 on page 49 shows the number of FAStT EXP500 and FAStT EXP700 expansion units that you can connect to one FAStT500 or FAStT700 storage server.

In addition, it shows the maximum number of hard disk drives that are supported in each configuration.

Table 13. FAStT EXP700 configurations with the FAStT500, FAStT700, and FAStT900

Storage server[1]	Number of FAStT EXP500 expansion units	Number of FAStT EXP700 expansion units	Maximum number of hard disk drives
1-FAStT500 or 1-FAStT700 or 1–FAStT900	9	1	104
	8	2	108
	7	3	112
	6	3	102
	5	4	106
	4	5	110
	3	6	114
	2	6	104
	1	7	108
	0	8	112

[1] Running FAStT Storage Manager 9.1 and firmware version 05.21.xx.xx or higher. For more information, see Table 8 on page 11.

Table 14 shows the number of FAStT EXP500 and FAStT EXP700 expansion units that you can connect to one FAStT200 HA (dual RAID controllers). In addition, it shows the maximum number of hard disk drives that are supported in each configuration.

Table 14. FAStT EXP700 configurations with the FAStT200

Storage server[1]	Number of FAStT EXP500 expansion units	Number of FAStT EXP700 expansion units	Maximum number of hard disk drives
1-FAStT200 HA	3	1	54
	2	2	58
	1	2	48
	0	3	52
	1	3	62
	0	4	66

[1] Running Storage Manager 9.1 and firmware version 05.20.07.xx or higher. For more information, see Table 8 on page 11.

Cabling the storage expansion units in a redundant loop

If you are attaching a loop of storage expansion units to your storage server, you should cable the units together before connecting the loop to the storage server.

Note: If you are attaching only a single storage expansion unit to the storage server, you do not need to review this section. Continue instead with “Cabling the storage expansion units to the storage server” on page 54.

Storage expansion unit loop redundancy

Both the FAStT EXP700 and FAStT EXP710 provide redundant loop support when the second ESM is configured, and when both loops (called A and B) are connected

to a storage server that supports redundant loops. Figure 40 shows a redundant loop. If an ESM, cable, or SFP module fails on drive loop A, drive loop B provides redundancy, which is an alternate path to your disk drives.

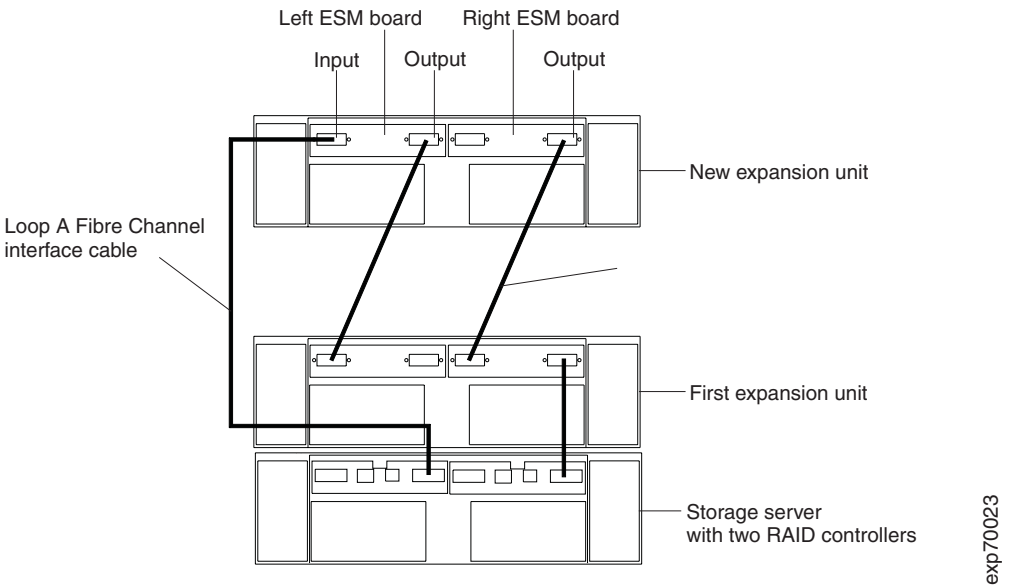


Figure 40. Redundant loop configuration

IBM fibre channel disk drives are dual-ported, providing individual access from two fibre channel loops to the same disk drive. When configuring the ESMs, configure the second ESM the same way you configured the first ESM. Refer to the Fibre Channel Cabling Instructions that come with your storage server for more information about dual-loop support and implementation.

Each ESM has an SFP module input port and an SFP module output port. As you cable storage expansion units together, connecting input ports to output ports can improve diagnostic capability by decreasing the risk of making fibre channel cabling errors and simplifying troubleshooting procedures (because cabling connections are more easily identified). Refer to your storage server documentation and the Fibre Channel Cabling Instructions for cabling connections between input and output ports.

Redundant loop cabling examples

Figure 41 on page 52 through Figure 44 on page 53 show four options for cabling a redundant loop of storage expansion units. *Figure 41 on page 52 shows the preferred cabling configuration.* Figure 42 on page 52, Figure 43 on page 53, and Figure 44 on page 53 show alternate acceptable cabling configurations. All four figures show redundant loops of storage expansion units consisting of only FAStT EXP710s, but you can intermix FAStT EXP700s and FAStT EXP710s or FAStT EXP700s and FAStT EXP500s in a drive loop according to the requirements listed in “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43 and “Connecting storage expansion units in a loop with FAStT EXP500s (FAStT EXP700 only)” on page 48.

Attention: It is strongly recommended that you choose one scheme of cabling when connecting your storage expansion units together and apply that scheme to all your fibre channel cabling connections. Mixing cabling schemes can increase the risk of making fibre channel cabling errors and complicate troubleshooting procedures in the event of drive loop problems.

All four figures show examples of cabling configurations with both integrated drive and RAID controller FAStT storage server models (such as the FAStT600) on the left and with standalone RAID controller FAStT storage server model (such as the FAStT700 or FAStT900) on the right. The numbers provided in the figures correspond to the following cabling instructions and show the order in which cables should be attached.

Note: Unlike the FAStT600, the ports on the FAStT700 and FAStT900 are marked *Input* and *Output*. For more information on these ports, see the appropriate Installation and User's Guide for your FAStT storage server.

To create the redundant loops shown in Figure 41 on page 52 through Figure 44 on page 53, you would perform the following steps:

1. Make two fibre-channel connections from the first expansion unit to the second expansion unit (connections 1 and 2).
2. Make two fibre-channel connections from the second expansion unit to the third expansion unit (connections 3 and 4).
3. Continue making fibre-channel connections in this manner until you have connected all new expansion units.

   Note: For the FAStT700 and FAStT900, the maximum number of FAStT EXP700 and FAStT EXP710 storage expansion units in a single drive loop is eight. For the FAStT600, the maximum number of FAStT EXP700 and FAStT EXP710 storage expansion units in a single drive loop is seven. (With the FAStT700 and FAStT900, when you mix FAStT EXP500 and FAStT EXP700s, the maximum number of storage expansion units in the same drive loop is increased.)

The following two steps describe connecting the storage expansion units. They are described in greater detail in "Cabling the storage expansion units to the storage server" on page 54.

4. Make a fibre-channel connection from the FAStT storage server drive port to the **OUT** port in the left ESM of the first expansion unit in the redundant drive loop (connection 5).
5. Make a fibre-channel connection from the FAStT storage server drive port to the **IN** port in the right ESM of the last expansion unit in the redundant drive loop (connection 6).

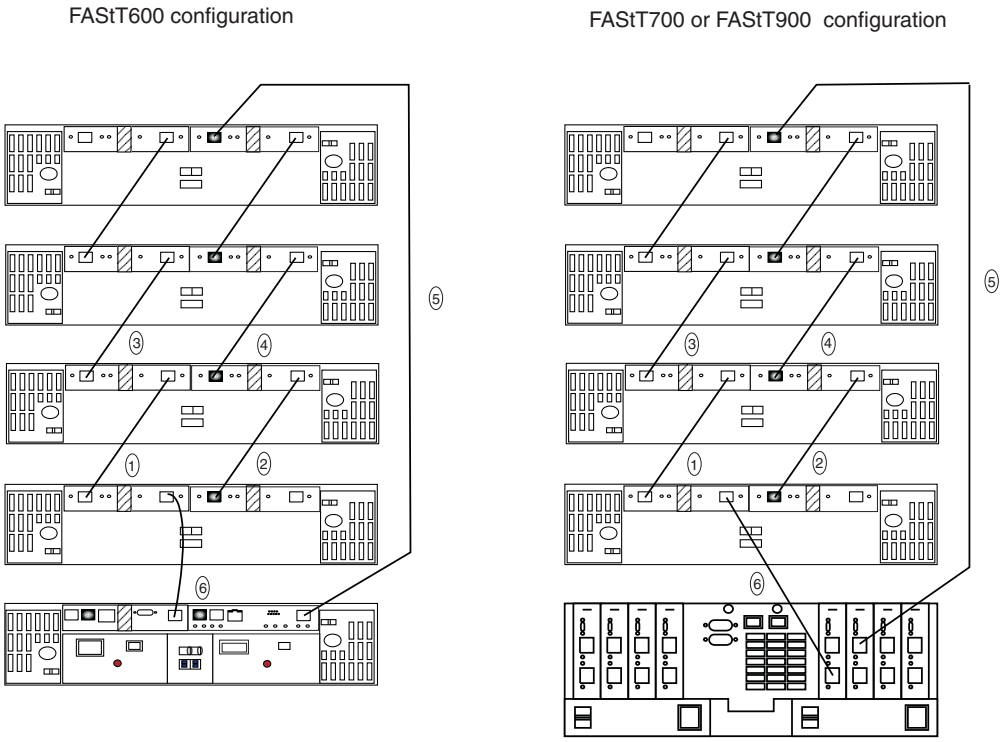


Figure 41. Preferred storage expansion unit redundant loop configuration

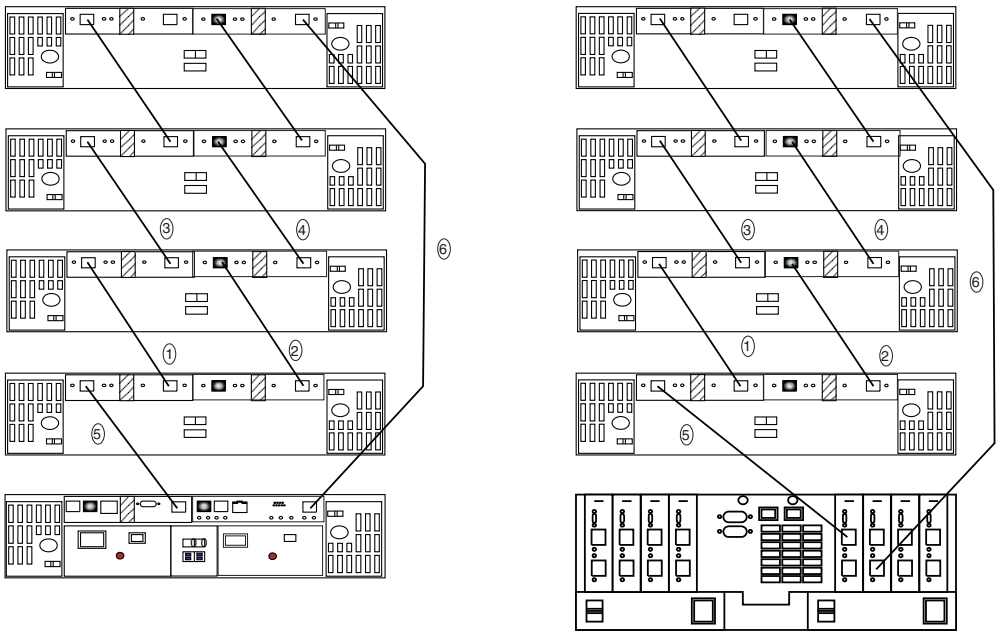


Figure 42. Alternate storage expansion unit redundant loop configuration 1

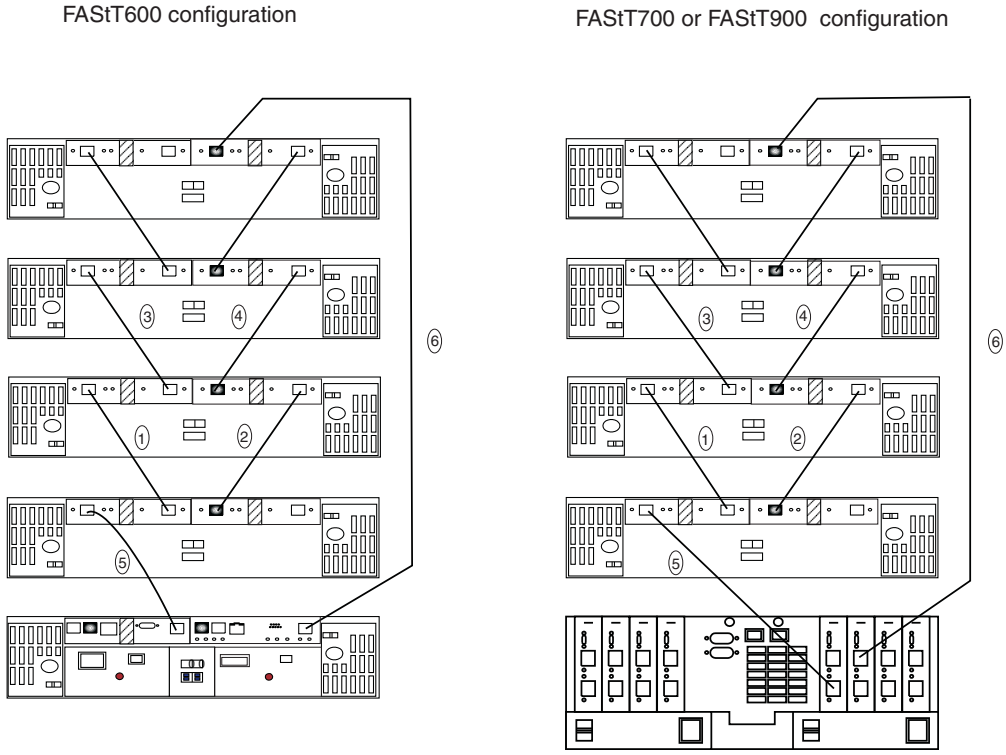


Figure 43. Alternate storage expansion unit redundant loop configuration 2

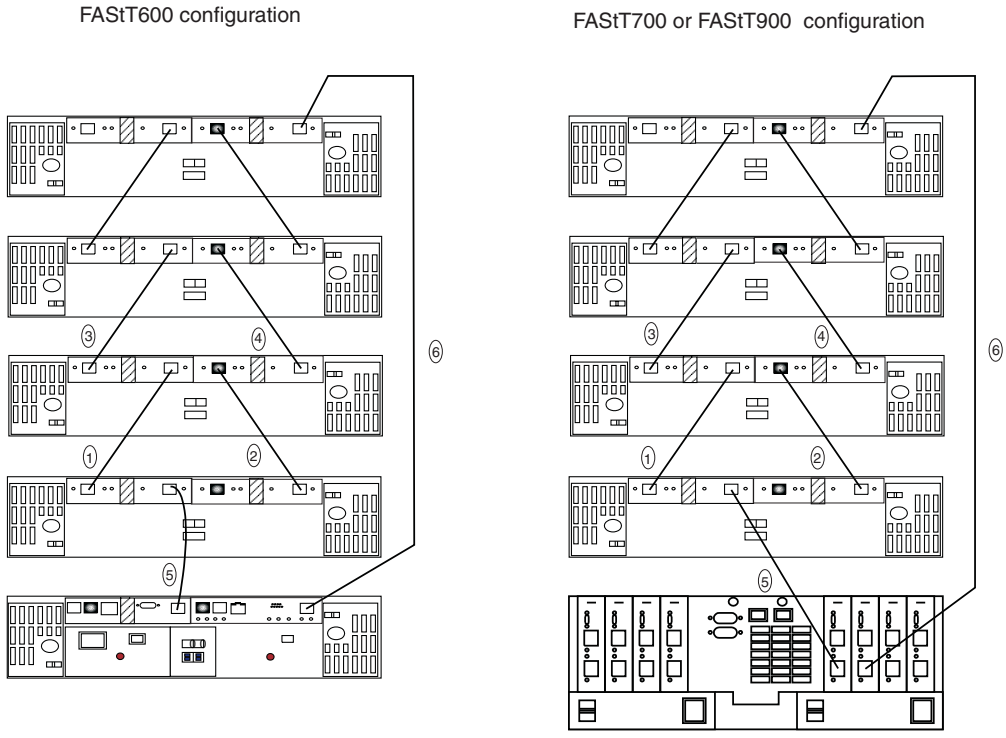


Figure 44. Alternate storage expansion unit redundant loop configuration 3

Cabling the storage expansion units to the storage server

The following sections describe the procedure for connecting a single storage expansion unit or a storage expansion unit loop to the storage server:

- "Cabling the storage expansion unit to a FAStT200 or FAStT600 Storage Server"
- "Cabling the FAStT EXP700 to a FAStT500 RAID Controller Enclosure Unit" on page 55
- "Cabling the storage expansion unit to a FAStT700 or FAStT900" on page 57

Cabling the storage expansion unit to a FAStT200 or FAStT600 Storage Server

Complete the following steps to cable the storage expansion unit to a FAStT200 or FAStT600:

Attention: You cannot connect the FAStT EXP710 to a FAStT200. The FAStT200 instructions apply only to connections with the FAStT EXP700.

1. Insert a GBIC into the expansion port located on the back of a FAStT200 or FAStT600 and remove the protective cap, as shown in Figure 45.

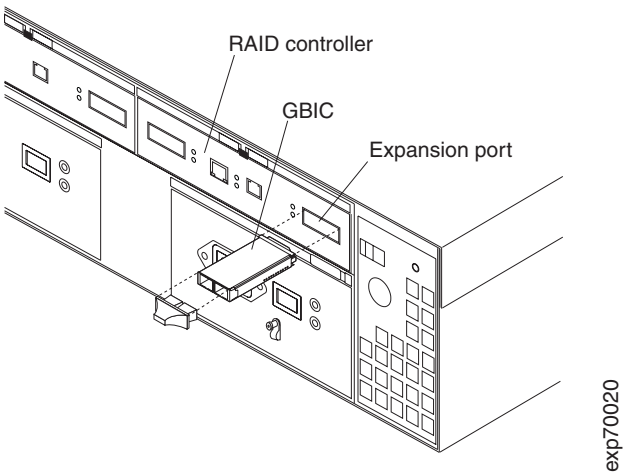


Figure 45. Installing a GBIC in a FAStT200

2. **For FAStT200 (FAStT EXP700 only):** Using Figure 46 on page 55 as a guide, complete the following steps to connect the FAStT200 to the FAStT EXP700:
   a. Connect the SC end of an LC-SC cable adapter to the GBIC.
   b. Connect one end of an LC-LC cable to the LC end of the LC-SC cable adapter.
   c. Insert an SFP module into the SFP port located on the back of the FAStT EXP700; then, connect the other end of the LC-LC cable to the SFP module.
3. **For FAStT600:** Using Figure 46 on page 55 as a guide, complete the following step to connect the FAStT600 to the storage expansion unit:
   a. Insert an SFP module into the SFP port located on the back of the storage expansion unit; then, connect the other end of the LC-LC cable to the SFP module.

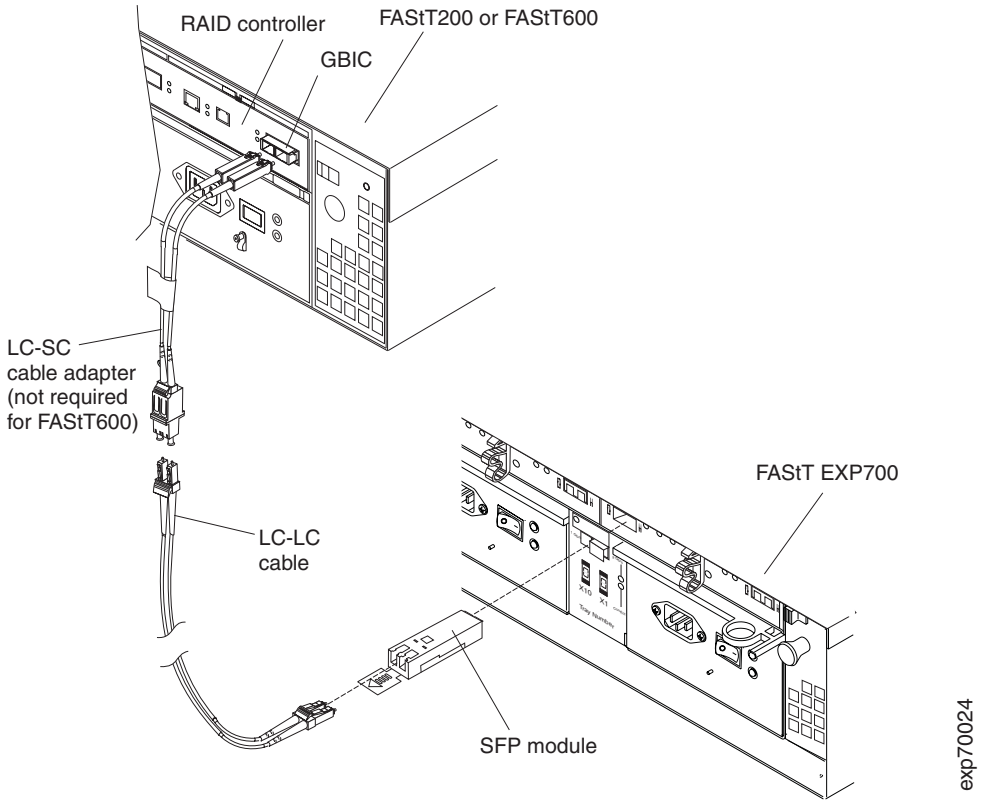


Figure 46. Connecting the FAStT200 or FAStT600 to the storage expansion unit

Cabling the FAStT EXP700 to a FAStT500 RAID Controller Enclosure Unit

Complete the following steps to cable the FAStT EXP700 to a FAStT500.

Attention: You cannot connect the FAStT EXP710 to a FAStT500. The FAStT500 instructions apply only to connections with the FAStT EXP700.

1. Insert a GBIC into a drive mini-hub port located on the back of a FAStT500, as shown in Figure 47 on page 56.

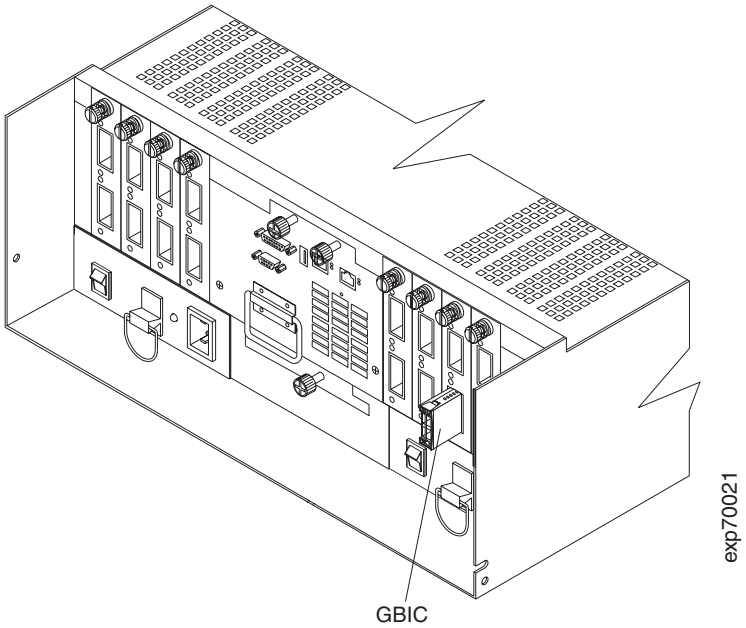


Figure 47. Installing a GBIC in a FAStT500

2. Using Figure 48 on page 57 as a guide, complete the following steps to connect the FAStT EXP700 to a FAStT500 RAID controller:
   a. Connect the SC end of an LC-SC cable adapter to the GBIC.
   b. Connect one end of an LC-LC cable to the LC end of the LC-SC cable adapter.
   c. Insert an SFP module into the SFP port located on the back of the FAStT EXP700; then, connect the other end of the LC-LC cable to the SFP module.

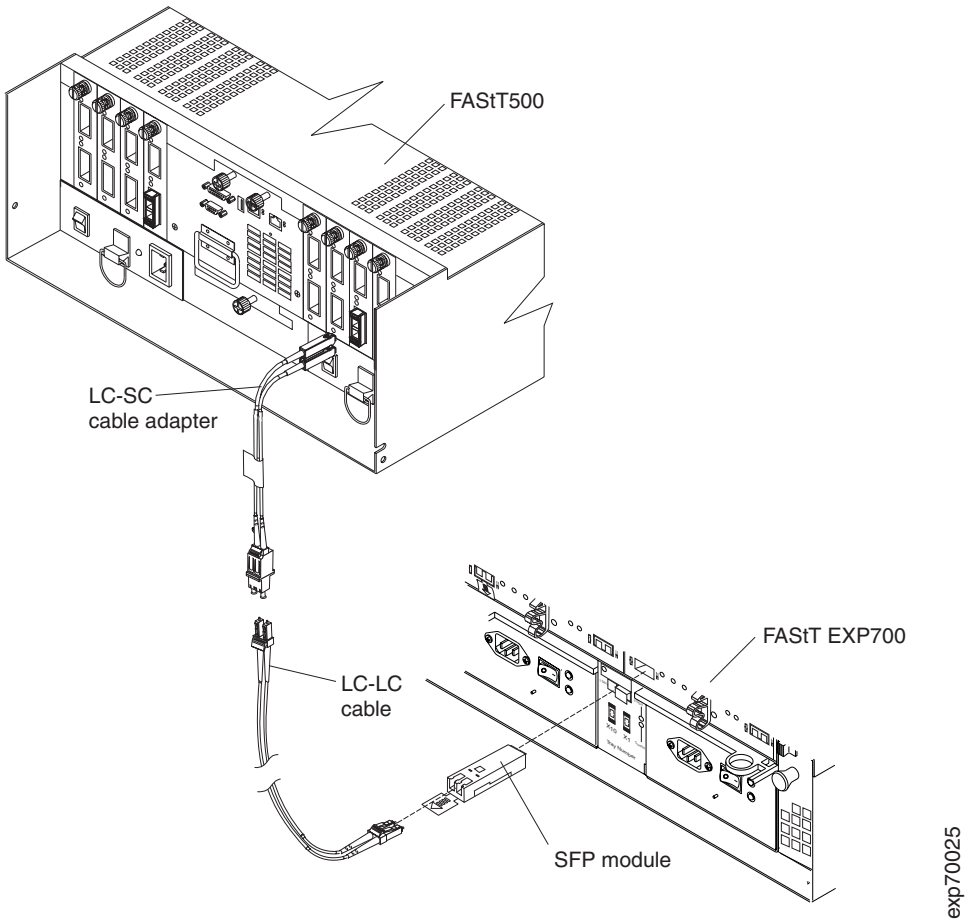


Figure 48. Connecting the FAStT500 to the FAStT EXP700

Cabling the storage expansion unit to a FAStT700 or FAStT900

Complete the following steps to cable the FAStT EXP700 or FAStT EXP710 storage expansion unit to a FAStT700 or FAStT900 Fibre Channel Storage Server:

1. Install an SFP module in the drive mini-hub port on the back of a FAStT700 or FAStT900 Fibre Channel Storage Server.
2. Connect an LC-LC fiber-optic cable into the SFP module, as shown in Figure 49 on page 58.

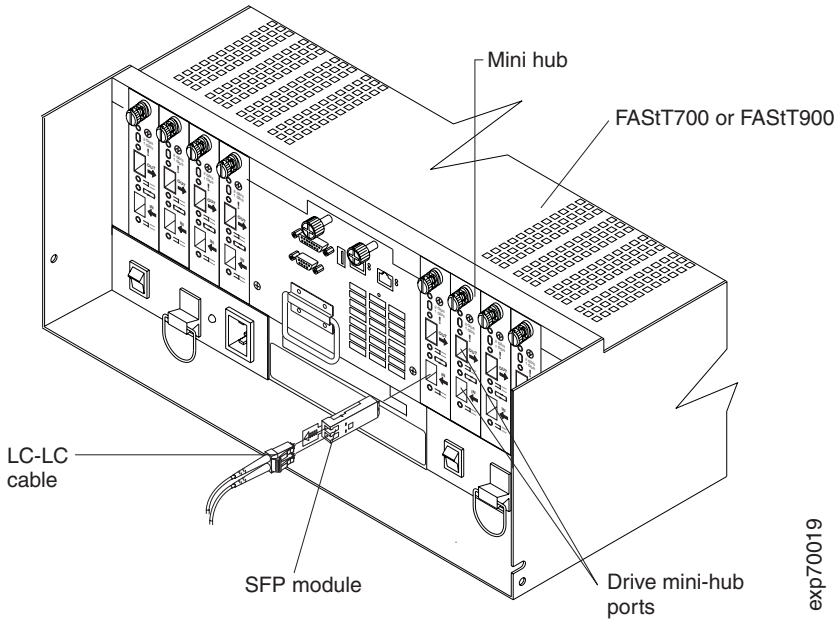


Figure 49. Installing an SFP module and LC-LC cable in a FAStT700 or FAStT900

3. Install an SFP module in the SFP port on the back of the storage expansion unit; then, connect the other end of the LC-LC cable into the SFP module, as shown Figure 50.

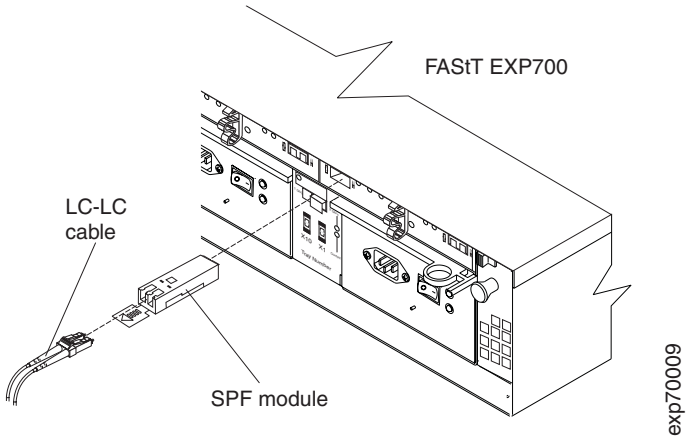


Figure 50. Installing an SFP module and connecting an LC-LC cable to the storage expansion unit

Adding a new storage expansion unit to a loop

You can add a new storage expansion unit to an existing fibre channel drive loop.

Important

- Always add a new storage expansion unit to the end of a drive loop, as described in this section.

  Exception when intermixing FAStT EXP700s and FAStT EXP710s: Depending on the model of the last storage expansion unit in the existing drive loop and the model of the storage expansion unit to be added, you might not be able to add a new storage expansion unit to the end of a drive loop if you are already intermixing FAStT EXP700s and FAStT EXP710s in the same drive loop. To minimize problems that could arise during the addition of a new storage expansion unit in a redundant drive loop environment that intermixes FAStT EXP700s and FAStT EXP710s, it is strongly recommended that the addition of new storage expansion units be performed when the configuration is offline (all applications have been stopped and the FAStT configuration has been powered down). Contact IBM support for help if required.
- If you are intermixing FAStT EXP700s and FAStT EXP710s in the same drive loop, review the requirements discussed in “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43.
- If you are intermixing FAStT EXP500s and FAStT EXP700s in the same drive loop, review the requirements discussed in “Connecting storage expansion units in a loop with FAStT EXP500s (FAStT EXP700 only)” on page 48.

Figure 51 on page 60 shows an example of a fully configured storage server with the maximum number of drive loops that are supported. Before you cable a new storage expansion unit to a loop, refer to the Fibre Channel Cabling Instructions that come with your storage server for specific instructions.

To add a storage expansion unit to a fibre channel loop, cable the SFP module input port on an existing ESM (shown as ″Last drive enclosure″ in Figure 51 on page 60) to an SFP module output port (shown as ″New FAStT EXP700″). You can cable additional storage expansion units until the loop reaches the maximum defined by the storage server. The storage server might also have cabling configuration information or restrictions that you must follow. The numbers provided in Figure 51 on page 60 indicate the proper cabling order for adding a new storage expansion unit.

Note: Figure 51 on page 60 shows only one example of redundant loop cabling. Other examples are provided in “Cabling the storage expansion units in a redundant loop” on page 49.

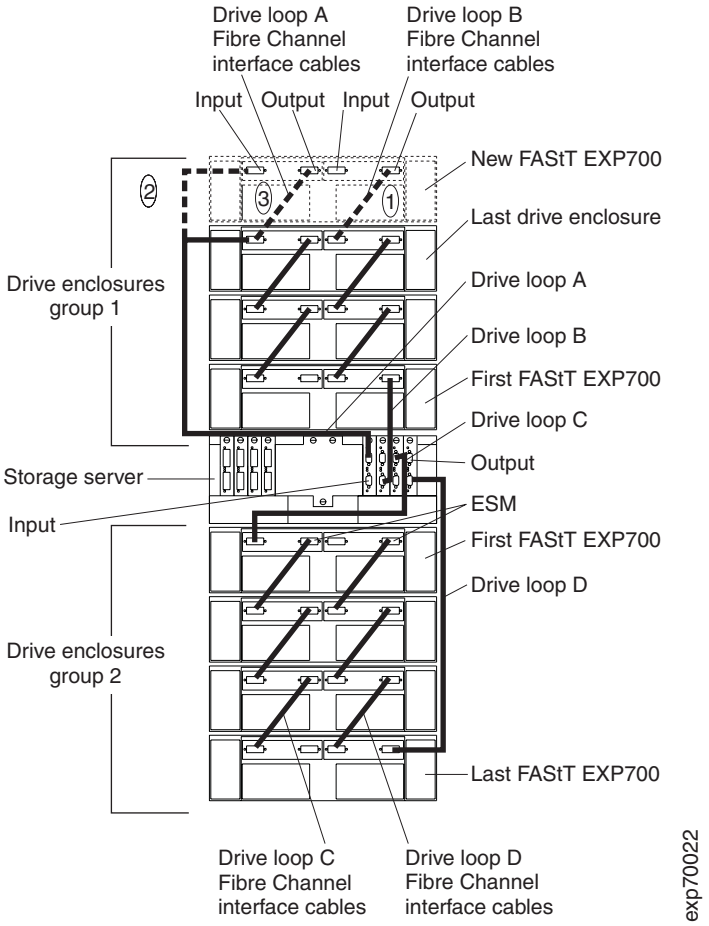


Figure 51. Cabling a new storage expansion unit to a redundant loop

For more detail on the process of adding a new storage expansion unit to an existing loop, refer to the *IBM TotalStorage FAStT Fibre Channel Hard Drive and Storage Expansion Enclosure Installation and Migration Guide*.

Cabling the power supply

Complete the following steps to connect the power-supply cable:

1. Wrap the strain-relief clamp around the power cable approximately 20 cm (8 in.) from the power supply connection end.
2. Attach the power-supply nut and tighten it securely.
3. Connect the power cable to the power supply.
4. Plug the supply power cable into a properly grounded electrical outlet.
5. Continue with “Turning the expansion unit on and off” for the initial startup of the expansion unit.

Turning the expansion unit on and off

When you turn on and turn off the expansion unit, be sure to use the startup sequence in this section.

Turning on the expansion unit

Use the following startup sequence to turn on the power for the initial startup of the expansion unit:

1. Verify that:
   - All communication and power cables are plugged into the back of the expansion unit and all power cables are connected to an ac power outlet.
   - All hard disk drives are locked securely in place.
   - The enclosure IDs on the expansion unit are set correctly. (See “Setting the interface options” on page 29 for more information.)
2. Check the system documentation for all the hardware devices you intend to turn on and determine the proper startup sequence.

   Note: Be sure to turn on the storage expansion unit before or at the same time as you turn on the storage server.
3. Turn on the power to each device, based on the startup sequence.

   Attention: If you are restarting the system after a normal shutdown, wait at least 10 seconds before you turn on the power-supply switches.
4. Turn on both power-supply switches on the back of the unit. The expansion unit might take a few seconds to turn on. During this time, you might see the amber and green LEDs on the expansion unit flash intermittently. When the startup sequence is complete, only the green LEDs on the front and back are lit. If other amber LEDs remain lit, see Chapter 4, “Hardware maintenance,” on page 75.

   Note: If any FAStT EXP710 enclosures are present in the drive loop and the FAStT controller firmware is not at version 6.10.xx.xx or higher, the Enclosure ID conflict LED on the FAStT EXP710s will light (even if the Enclosure ID is set to a unique value among the storage expansion units and the FAStT storage server in the same drive loop). After you upgrade the controller firmware to version 06.10.xx.xx, the Enclosure ID conflict LED will become unlit.

Turning off the expansion unit

Use this procedure to turn off the power for the expansion unit.

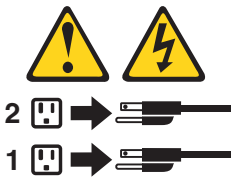
Attention: Except in an emergency, never turn off the power if any Fault LEDs are lit on the expansion unit. Correct the fault before you turn off the power, using the proper troubleshooting or servicing procedure. This will ensure that the expansion unit will start correctly later.

The expansion unit is designed to run continuously. After you turn on the expansion unit, do not turn it off. Turn off the power only in the following situations:

- Instructions in a hardware or software procedure require that you turn off the power.
- An IBM technical-support representative instructs you to turn off the power.
- A power outage or emergency situation occurs, see “Restoring power after an emergency” on page 62.

Statement 5:

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



Complete the following steps to turn off the power:

1. Check the system documentation for all hardware devices you want to turn off and determine the proper shutdown sequence.
2. Make sure that all input/output activity has stopped.
3. Make sure that all amber Fault LEDs are off. If any Fault LEDs are lit (drives, power supplies, or fans), correct the problem before you turn off the power.

   Note: Be sure to turn off the storage expansion unit after or at the same time as you turn off the storage server.
4. Turn off both power-supply switches on the back of the expansion unit.

Performing an emergency shutdown

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

Complete the following steps to shut down the system during an emergency:

1. Stop all activity and check all of the LEDs. Make a note of any Fault LEDs that are lit so that you can correct the problem when you turn on the power.
2. Turn off all power-supply switches; then, unplug the power cables from the expansion unit.

Restoring power after an emergency

Complete the following steps to restart the expansion unit if you turned off the power-supply switches during an emergency shutdown, or if a power failure or power outage occurred:

1. After the emergency situation is over or power is restored, check the expansion unit for damage. If there is no visible damage, continue with step 2; otherwise, have your system serviced.
2. After you check the expansion unit for damage, ensure that the power switches are in the off position; then plug in the expansion-unit power cables.
3. Check the system documentation of the hardware devices that you want to turn on and determine the proper startup sequence.

   Note: Turn on the storage expansion unit before or at the same time as the controller.

4. Turn on the power to each device, based on the startup sequence.
5. Turn on both of the power supply switches on the storage expansion unit. The green LEDs on the front and the back of the expansion unit should remain lit. If other amber Fault LEDs are lit, see Chapter 4, “Hardware maintenance,” on page 75.

Chapter 3. Installing and replacing devices

This chapter contains information about installing and replacing devices.

Working with hot-swap hard disk drives

This section explains how you can increase the expansion unit capacity by adding more hard disk drives or replacing existing drives with ones containing a larger capacity. Before you begin:

- Read the safety and handling guidelines provided in “Safety” on page xi and in “Handling static-sensitive devices” on page 18.
- Ensure that your current system configuration is working properly.
- Back up all important data before you make changes to data storage devices.

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

- **Blank trays:** An expansion unit without a full set of drives (14) contains blank trays in the unused drive bays. Before installing new drives, you must remove these empty trays. Save the empty trays for future use. Each of the 14 bays must always contain either a blank tray or a hot-swap hard disk drive.
- **Drive CRUs:** Your expansion unit supports IBM 2 Gb/s fibre channel hard disk drives.
- **Drive CRU labels:** A label is provided on the front of each hard disk drive. Use this label to record the location information for each drive before you remove it. Ensure that you keep track of the drives and their corresponding bays. Also, record the location information in Table 19 on page 81. (If you install a drive in the wrong bay, you might lose data.)
- **Drive LEDs:** Each drive tray has two LEDs, which indicate the status for that drive. See Table 15 for the drive LED states and descriptions.

Table 15. Drive LED activity

LED	LED state	Descriptions
Activity LED	Green flashing	The green LED flashes to indicate fibre channel activity to the drive.
Activity LED	Green lit	The green LED is lit to indicate the drive is properly installed.
Fault LED	Amber flashing	The amber LED flashes to indicate a drive rebuild is underway, or that a drive has been identified by the software.
Fault LED	Amber lit	The amber LED is lit to indicate a drive failure.

- **Fibre channel loop IDs:** When you install a hard disk drive in the expansion unit, the drive tray connects into a printed circuit board called the *midplane*. The midplane sets the fibre channel loop ID automatically, based on the setting of the enclosure ID switch and the physical location (bay) of the drive CRU.
- **Hot-swap hardware:** Your expansion unit contains hardware that enables you to replace a failed hard disk drive without turning off the expansion unit. You can continue to operate your system while a hard disk drive is removed or installed. These drives are known as hot-swap hard disk drives.

Installing hot-swap hard disk drives

You can install hard disk drives while the expansion unit is turned on and running. Complete the following steps to install hot-swap hard disk drives in the expansion unit.

1. Read the documentation that comes with the hard disk drive.
2. Check for Fault LEDs shown in Figure 52. If any amber LEDs are lit, see Chapter 4, “Hardware maintenance,” on page 75.

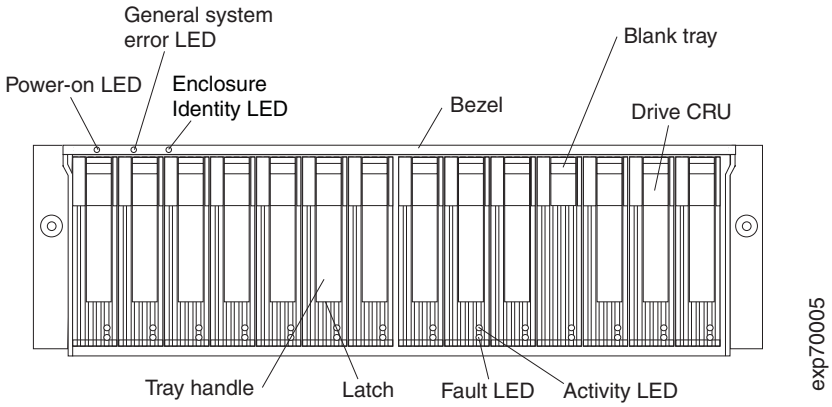


Figure 52. Hot-swap hard disk drive LEDs

3. Determine the bay into which you want to install the drive.
4. Remove the blank tray:
   a. Insert a finger into the square hole at the top of the blank tray to grip and pull the tray out of the drive bay.
   b. Save the blank tray for later use.
5. Install the hard disk drive:

   Note: The hard disk drive comes installed in a drive tray. Do not attempt to detach the drive from the tray.

   a. Release the blue latch on the drive CRU by pressing on the inside of the bottom of the tray handle.

b. Pull the handle on the tray out so that it is in the open position, as shown in Figure 53.

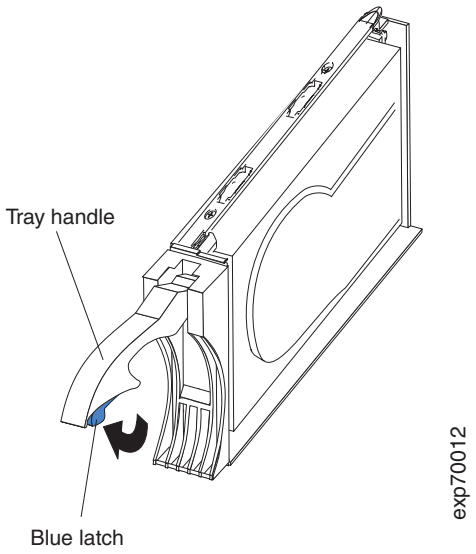


Figure 53. Drive CRU latch

c. Slide the drive CRU into the empty bay until the tray handle touches the expansion-unit bezel.
d. Push the tray handle down into the closed (latched) position, as shown in Figure 54.

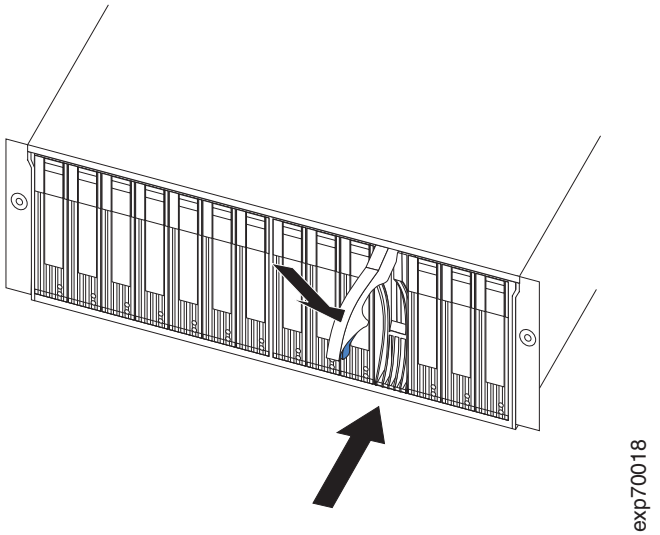


Figure 54. Closing the hot-swap hard disk drive tray handle

Replacing hot-swap hard disk drives

Drive problems include any malfunctions that delay, interrupt, or prevent successful input/output activity between the hosts and the hard disk drives in the expansion unit. This includes transmission problems between the host controllers, the ESMs, and the drives. This section explains how to replace a failed hard disk drive.

Attention: Failure to replace the hard disk drives in their correct bays might result in loss of data. If you are replacing a hard disk drive that is part of a RAID level 1 or RAID level 5 logical drive, ensure that you install the replacement hard disk drive in the correct bay. Check the hardware and software documentation provided with your system to see if there are restrictions regarding hard disk drive configurations. Some system fibre channel configurations might not allow mixing different drive capacities or types within an array.

Complete the following steps to replace a hot-swap hard disk drive:

1. Determine the location of the drive that you want to remove.

   Attention: Never hot-swap a drive CRU when its green Activity LED is flashing. Hot-swap a drive CRU only when its amber Fault LED is lit and not flashing or when the green Activity LED is lit and flashing at one-second intervals.
2. Remove the drive CRU:
   a. Press on the inside of the bottom of the tray handle to release the blue latch as shown in Figure 53 on page 67.
   b. Pull the tray handle out into the open position.
   c. Lift the drive CRU partially out of the bay.
   d. To avoid possible damage to the drive, wait at least 70 seconds before fully removing the drive CRU from the expansion unit to allow the drive to stop (spin down).
   e. Verify that there is proper identification (such as a label) on the drive CRU, and then slide it completely out of the expansion unit.
3. Install the new drive CRU:
   a. Gently push the drive CRU into the empty bay until the tray handle touches the expansion-unit bezel.
   b. Push the tray handle down into the closed (latched) position, as shown in Figure 54 on page 67.
4. Check the drive LEDs:
   - When a drive is ready for use, the green Activity LED is lit and the amber Fault LED is off.
   - If the amber Fault LED is lit and not flashing, remove the drive from the unit and wait 10 seconds; then, install the drive again.

Replacing a failed hot-swap ESM

This section describes the removal and replacement procedure for a failed hot-swap ESM.

Note: The FAStT EXP700 and FAStT EXP710 ESMs are not interchangeable. In addition, you cannot mix FAStT EXP700 and FAStT EXP710 ESMs in the same storage expansion unit. Always verify that you have the correct FRU P/N before you order replacement ESMs or insert replacement ESMs in the storage expansion unit. (The P/N for the FAStT EXP700 ESM is 19K1287; the P/N for the FAStT EXP700 ESM is 25R0186.)

If you have ordered the FAStT EXP700 Models 1RU/1RX Upgrade Kit (P/N 25R0166) and are upgrading your FAStT EXP700 with ESMs that have the same internal switched capabilities as the FAStT EXP710, see Appendix B, “Upgrading ESMs with the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit,” on page 83.

Complete the following steps to remove and replace a failed ESM:

1. Check the storage-management software online help for instructions on ESM failure-recovery procedures. Follow the steps provided before continuing to step 2.
2. Label each cable to ensure that all cables are properly connected to the new ESM.
3. Label the SFP modules when you remove them. You must install the SFP modules in the same positions on the new ESM.
4. Remove the SFP modules and fibre channel cables from the failed ESM.

   Attention: Be careful not to bend the fibre channel cables at a sharp angle or pinch them with objects. This can decrease the performance or cause data loss.
5. Be sure the Fault indicator LED is lit; then, push down on the ESM latch as shown in Figure 55.

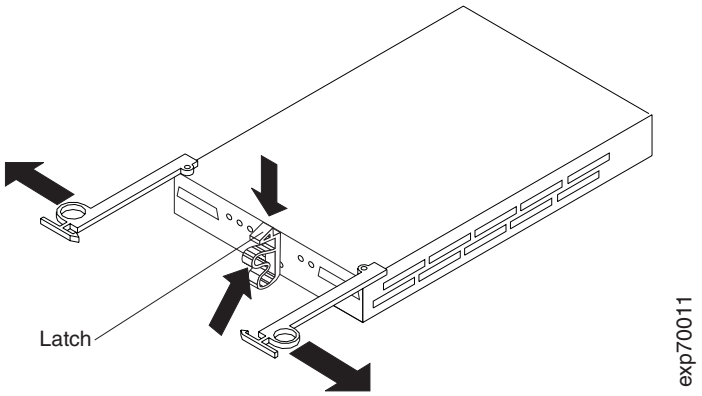


Figure 55. Removing the failed ESM

6. With the ESM latch in the down position, grasp the pull-rings and pull out on the levers; then, remove the ESM.

   Attention: After you remove an ESM, wait 70 seconds before replacing or reseating the ESM. Failure to do so may cause undesired events.
7. Install the new ESM by sliding it into the empty slot. Be sure the levers are pulled straight out as you slide the ESM into the expansion unit. When you install the ESM into the bays, the ESM latch will lock into place.
8. Close the levers until the pull-ring latch locks in place. Make sure the levers lock into place in the expansion-unit chassis.
9. Reconnect the SFP modules and fibre channel cables to their original locations.
10. Check the input and output bypass LEDs at both ends of the reconnected cables. If the input and output bypass LEDs are lit, reconnect the cables and SFP modules.
11. Check the Power and Fault indicator LEDs on the new ESM:
    - If the Power indicator LED is off, the ESM might not be inserted correctly.
    - If the Fault indicator LED is lit, the Power indicator LED is off, or if any other Fault indicator LEDs are lit, see Chapter 4, “Hardware maintenance,” on page 75.
12. See your storage-management software online help for instructions for enabling the ESM.

Working with hot-swap power supplies

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

- Use only the supported power supplies for your specific expansion unit.
- Both power supplies must always be installed to maintain proper cooling.

Statement 8:

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

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

Removing the failed hot-swap power supply

Complete the following steps to remove the failed hot-swap power supply:

1. Turn the power-supply switch to the off position.
2. Unplug the power-supply cable from the electrical outlet.
3. Disconnect the power cable from the power supply ac connector.
4. Remove the nut and clamp from the rear of the power-supply.
5. Remove the power supply from the expansion unit:
   a. Grasp the pull-ring on the power supply lever and squeeze the latch to release it.
   b. Pull the lever open and remove the power supply.

Replacing the failed hot-swap power supply

This section describes the procedure for replacing the failed hot-swap power supply.

Note: When you replace the failed power supply, ensure that the new power-supply lever is attached to the side of the power supply that faces the middle of the expansion unit. If it is not, remove the lever screw, flip the lever over, and tighten the screw on the opposite side as shown in Figure 56 on page 71.

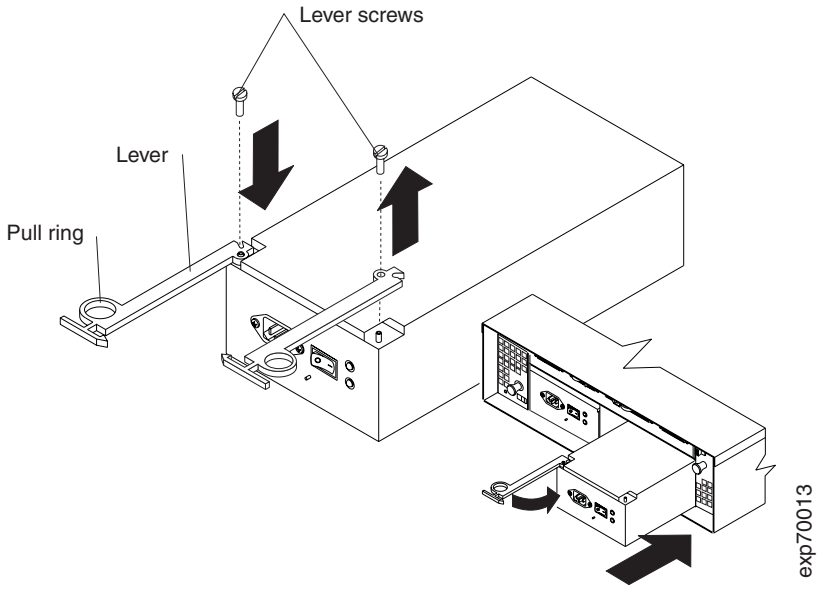


Figure 56. Moving the power-supply lever and replacing the failed hot-swap power supply

Complete the following steps to replace the failed hot-swap power supply.

Statement 8:

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

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

1. Ensure that the ac power switch on the power supply you are installing is in the off position.
2. Install the power supply in the expansion unit:
   a. Slide the power supply into the expansion unit. Be sure the lever is pulled straight out as you slide the power supply into the expansion unit (see Figure 56).
   b. Close the lever until the pull-ring latch locks in place. Make sure the lever locks into place in the expansion-unit chassis.
3. Wrap the strain relief clamp around the power cable approximately 20 cm (8 in.) from the power-supply connection end.

4. Attach the power-supply nut and tighten it securely.
5. Connect the power cable to the power supply ac connector.

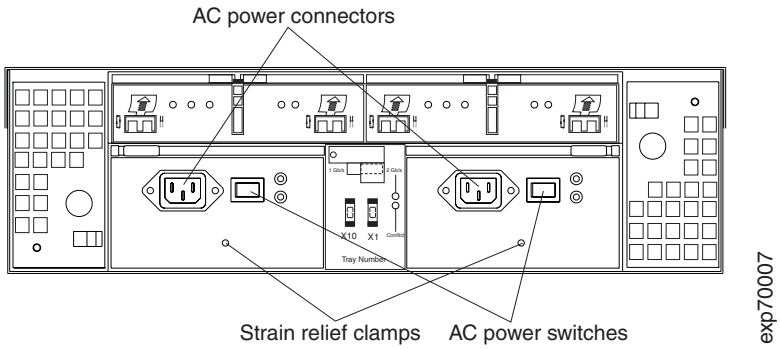


Figure 57. Connecting the power supply

6. Plug the supply power cable into a properly grounded electrical outlet.
7. Turn the power supply switch to the on position.

Replacing a failed hot-swap cooling fan

Attention: Do not run the expansion unit without adequate ventilation and cooling. Improper ventilation might cause damage to the internal components and circuitry.

The fans are interchangeable and replaceable and do not require preventive maintenance. The fans help maintain proper air circulation across the components inside the expansion unit. Air flows through the expansion unit from the front to the back.

You can hot-swap the fans (replace them while the expansion unit is turned on and running), provided that you complete the exchange within 10 minutes. This time limit applies only to the total time that a fan is out of the expansion unit, beginning when you remove the failed unit and ending when you reseat the new one. This does not include the time it takes you to perform this entire procedure (checking LEDs, unpacking the new fan, and so on).

For any period of time exceeding ten minutes, both fan units must always be in place, even if one is not functioning properly. This is necessary to maintain proper cooling.

Complete the following steps to replace a hot-swap fan:

1. Check the LEDs on the back of the expansion unit.
2. If the fan amber Fault LED is lit, remove the failed fan:
   a. Unlock the fan latch by moving the latch towards the exterior of the storage enclosure unit (away from the power supply and ESM CRUs) and hold it in the open position.
   b. Use the handle (black knob) to pull the fan from the fan bay as shown in Figure 58 on page 73.

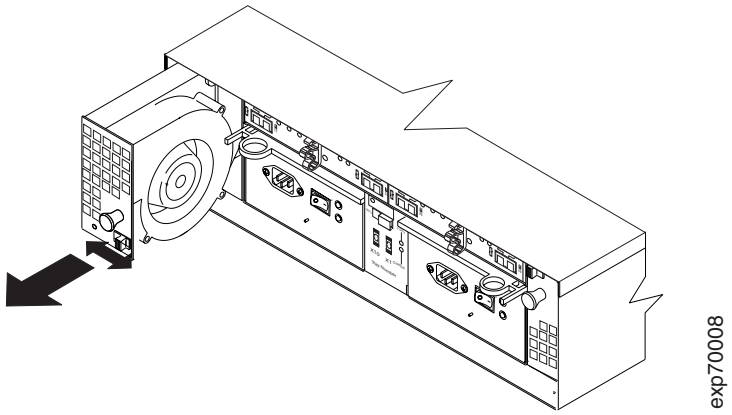


Figure 58. Replacing a hot-swap cooling fan

3. Install the new fan unit:
   a. Place the fan CRU in front of the fan bay.
   b. Ensure that you move the fan latch towards the exterior of the storage enclosure unit (away from the power supply and ESM CRUs) before you insert the fan. Hold the latch in the open position while inserting the fan unit into the fan bay.
   c. Ensure that you move the latch in the same direction as the arrow before you slide the fan all the way into the bay.

      The open side of the fan CRU faces the power supply and ESM CRUs. If the fan does not go into the bay, rotate it 180°. (See Figure 58.)
   d. If the latch does not automatically lock when you have successfully inserted the fan unit into the bay, pull back on the fan slightly, and then push it in again until the latch snaps into place.
4. Check the LEDs. The Fault LEDs should no longer be lit after a few seconds; if they remain on, see Chapter 4, “Hardware maintenance,” on page 75.

Chapter 4. Hardware maintenance

This chapter contains information to help you solve some of the problems you might have with your expansion unit. It contains the problem symptoms and error messages along with suggested actions to take to resolve problems.

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

Note: See the *IBM TotalStorage FAStT Problem Determination Guide* for additional troubleshooting and debugging procedures.

General checkout

Use the indicator lights, the Symptom-to-FRU index, and the connected server HMM to diagnose problems.

The PD maps found in the *IBM TotalStorage FAStT Problem Determination Guide* provide you with additional diagnostic aids.

Attention: If you configure a storage subsystem with a FAStT700 or FAStT900 (or a FAStT600 without internal hard disk drives) that is attached to FAStT EXP710 only and the storage expansion unit drives fail to spin up, you must use an out-of-band management connection to verify that the controller firmware level is at 6.10.xx.xx or higher. Refer to the *IBM TotalStorage FAStT Storage Manager Version 9 Installation and Support Guide* for your operating system for additional information on establishing an out-of-band management connection. If the firmware version is correct, the problem is likely a hardware issue.

Solving problems

Table 16. Symptom-to-FRU index

Problem indicator	Component	Possible cause	Possible solutions
Amber LED is lit	Drive CRU	Drive failure	Replace failed drive.
	Fan CRU	Fan failure	Replace failed fan.
	ESM over-temperature LED	Subsystem is overheated	Check fans for faults. Replace failed fan if necessary.
		Environment is too hot	Check the ambient temperature around the expansion unit. Cool as necessary.
		Defective LED or hardware failure	If you cannot detect a fan failure or overheating problem, replace the ESM.
	ESM Fault LED	ESM failure	Replace the ESM. See your controller documentation for more information.
	ESM Bypass LED	No incoming signal detected	Reconnect the SFP modules and fibre channel cables. Replace input and output SFP modules or cables as necessary.
		ESM failure	If the ESM Fault LED is lit, replace the ESM.
	Front panel	General machine fault	A Fault LED is lit somewhere on the expansion unit (check for Amber LEDs on CRUs).
		SFP transmit fault	Check that the CRUs are properly installed. If none of the amber LEDs are lit on any of the CRUs, this indicates an SFP module transmission fault in the expansion unit. Replace the failed SFP module. See your storage-manager software documentation for more information.
Amber LED is lit and green LED is off	Power-supply CRU	The power switch is turned off or there is an ac power failure	Turn on all power-supply switches. Reseat or replace power supply. Replace the power cord.
Amber and green LEDs are lit	Power-supply CRU	Power-supply failure	Replace the failed power-supply CRU.

Table 16. Symptom-to-FRU index (continued)

Problem indicator	Component	Possible cause	Possible solutions
All green LEDs are off	All CRUs	Subsystem power is off	Check that all expansion-unit power cables are plugged in and the power switches are on. If applicable, check that the main circuit breakers for the rack are powered on.
		AC power failure	Check the main circuit breaker and ac outlet.
		Power-supply failure	Replace the power supply.
		Midplane failure	Contact an IBM technical-support representative to service the expansion unit.
Amber LED is flashing	Drive CRUs	Drive rebuild or identity is in process	No corrective action needed.
Amber Conflict ID is lit	Rear panel	The same enclosure ID is being shared by several enclosures.	Using the x1 digit only, set the enclosure ID for each storage expansion unit in a drive loop to a unique number 00 to 07.
		FAStT EXP710 only: The FAStT EXP710 is set up in a configuration with incorrect controller firmware.	Verify that the controller firmware is at version 6.10.xx.xx or later
One or more green LEDs are on	Drive CRUs	There is no activity to the drive.	**Note:** This can indicate normal activity.
One or more green LEDs are blinking slowly	Drive CRUs		Replace the SFP.
One or more green LEDs are off	Power supply CRUs	Power cable is unplugged or switches are turned off	Make sure the power cable is plugged in and the switches are turned on.
	All drive CRUs	Midplane failure	Replace the midplane (contact an IBM technical-support representative).
	Several CRUs	Hardware failure	Replace the affected CRUs. If this does not correct the problem, have the ESMs replaced, followed by the midplane. Contact an IBM technical-support representative.
	Front panel	Power-supply problem	Make sure that the power cables are plugged in and that the power supplies are turned on.
		Hardware failure	If any other LEDs are lit, replace the midplane. Contact an IBM technical-support representative.

Table 16. Symptom-to-FRU index (continued)

Problem indicator	Component	Possible cause	Possible solutions
Intermittent or sporadic power loss to the expansion unit	Some or all CRUs	Defective ac power source or improperly connected power cable	Check the ac power source. Reseat all installed power cables and power supplies. If applicable, check the power components (power units or UPS). Replace defective power cables.
		Power-supply failure	Check the power supply Fault LED on the power supply. If the LED is lit, replace the failed CRU.
		Midplane failure	Have the midplane replaced.
Unable to access drives	Drives and fibre channel loop	Incorrect expansion unit ID settings	Ensure that the fibre channel optical cables are undamaged and properly connected. Check the expansion unit ID settings. **Note:** Change switch position only when your expansion unit is powered off.
		ESM failure	Have one or both ESMs replaced.
Random errors	Subsystem	Midplane feature	Have the midplane replaced.
		SFP	Replace the SFP
		Optical board	Have the optical board replaced.
		Switch harness	Have the switch harness replaced.
Hard disk drive is not visible in RAID management software	Subsystem		Check the HDD, FC cable, SFP, and ESM. Have the midplane replaced.
Amber temperature LED is enabled in the RAID management software.	ESM board		Check for the fan Fault LED.
			The unit overheating; check the temperature.
			Replace the ESM board.
Amber conflict LED is lit. **Note:** It is normal for the LED to be lit when no SFP or FC cable is installed.	ESM board	The enclosure IDs of two or more storage expansion units on the same drive loop are set to identical values.	Using the x1 digit only, set the enclosure ID for each storage expansion unit in a drive loop to a unique number 00 to 07.

Parts listing

Figure 59 on page 79 and the following tables provide parts listings for the FAStT EXP700 and FAStT EXP710.

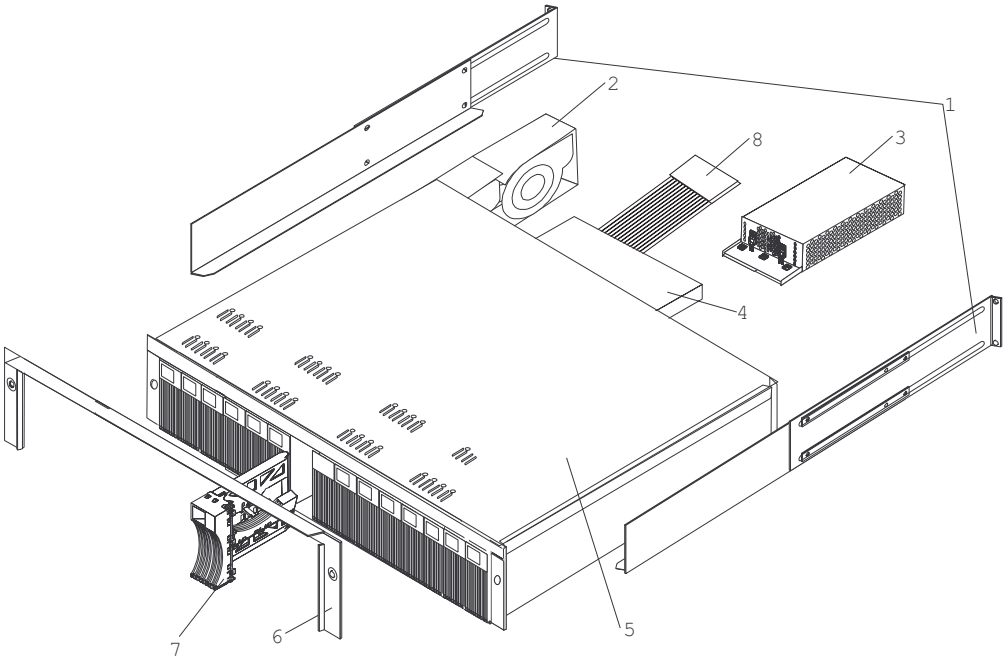


Figure 59. TotalStorage FAStT EXP700 and FAStT EXP710 storage expansion unit parts list

Table 17. Parts listing (TotalStorage FAStT EXP700 storage expansion unit)

Index	FAStT EXP700 storage expansion unit (1740, Model 1RU/1RX)	FRU P/N
1	rail kit	37L0067
2	blower ASM FRU	19K1293
3	power supply FRU, 400 W	19K1289
4	CDPOP, FC ESM, 2 Gb/s	19K1287
5	Frame, Midplane	19K1288
6	bezel ASM FRU	19K1285
7	tray, blank	19K1291
8	switch, harness	19K1297
	Miscellaneous hardware	09N7288
	cable, FRU-1M	19K1265
	cable, FRU-5M	19K1266
	cable, FRU-25M	19K1267
	cable, FRU Adapter	19K1268
	FRU, SFP LC (shortwave)	19K1280
	FRU, SFP LC (longwave)	19K1281
	power cord, 2.8M	36L8886
	power cord	6952300

Table 18. Parts listing (TotalStorage FAStT EXP710 storage expansion unit)

Index	FAStT EXP710 storage expansion unit (1740, Model 710)	FRU P/N
1	rail kit	37L0067

Table 18. Parts listing (TotalStorage FAStT EXP710 storage expansion unit) (continued)

Index	FAStT EXP710 storage expansion unit (1740, Model 710)	FRU P/N
2	blower ASM FRU	19K1293
3	power supply FRU, 400 W	19K1289
4	CDPOP, FC ESM, 2 Gb/s	25R0186
5	Frame, Midplane	25R0226
6	bezel ASM FRU	25R0228
7	tray, blank	19K1291
8	switch, harness	19K1297
	Miscellaneous hardware	09N7288
	cable, FRU-1M	19K1265
	cable, FRU-5M	19K1266
	cable, FRU-25M	19K1267
	cable, FRU Adapter	19K1268
	FRU, SFP LC (shortwave)	19K1280
	FRU, SFP LC (longwave)	19K1281
	power cord, 2.8M	36L8886
	power cord	6952300

Appendix D, “Power cords,” on page 101 lists the required power cords for the storage expansion unit by country and region.

Appendix A. Records

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

Identification numbers

Record and retain the following information.

Product name:	IBM TotalStorage FAStT EXP700 Storage Expansion Unit
Machine type:	1740
Model number:	1RU, 1RX
Serial number:	

Product name:	IBM TotalStorage FAStT EXP710 Storage Expansion Unit
Machine type:	1740
Model number:	710
Serial number:	

The expansion unit serial number is located on the bottom inside surface on the rear and on the bottom right on the front.

Installed device records

Use the following table to record the number of the hard disk drives that you replaced and the corresponding bay number.

Attention: If you replace a hard disk drive in the wrong drive bay it might cause a loss of data.

Table 19. Hard disk drive record

Bay Number	Hard disk drive serial number	Replaced hard disk drive serial number

Table 19. Hard disk drive record (continued)

Bay Number	Hard disk drive serial number	Replaced hard disk drive serial number

Appendix B. Upgrading ESMs with the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit

You can upgrade your FAStT EXP700s with ESMs that have the same internal switched capabilities as the FAStT EXP710 by ordering and installing the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit (P/N 25R0166).

Attention: If you are upgrading more than one FAStT EXP700 in a redundant drive loop, perform all the upgrades at the same time.

The upgrade option can be used to upgrade FAStT EXP700 storage expansion units that are connected to FAStT700, FAStT900, and FAStT600 (Turbo option only) storage servers.

Important

The upgrade option *cannot* be used to upgrade FAStT EXP700 storage expansion units connected to FAStT200 or FAStT500 storage servers. Additionally, the upgrade option *cannot* be used to upgrade FAStT EXP700 storage expansion units connected to FAStT storage servers that are configured with drive loops that intermix FAStT EXP500 and FAStT EXP700 storage expansion units.

After you upgrade the FAStT EXP700 ESMs, you are required to return the original FAStT EXP700 1740 ESMs (FRU 19K1287) to IBM. Use the packaging materials from the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit for repacking and sending the replaced ESMs. For full details on how and where to return the original FAStT EXP700 ESMs, see the *FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit Instructions* (P/N 25R0184), which is included with the upgrade kit.

Switched-ESM Option Upgrade Overview

Attention: Do not dispose of the packaging materials from the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit. You are required to return the replaced ESMs to IBM and you should use these packaging materials to return the replaced ESMs.

Upgrade preparations requirements

1. Perform a full system backup before the upgrade.
2. Save the storage subsystem profile.
3. Upgrade the FAStT storage manager client host software to FAStT Storage Manager version 9.1 or later and the FAStT storage server controller firmware to version 6.10.xx.xx or higher.

Two upgrade methods are possible when you perform the ESM upgrade:

- Cold-case upgrade — The FAStT EXP700s and connected storage server are powered down when ESMs are replaced.

Note: The cold-case ESM upgrade procedure is recommended if you are intermixing FAStT EXP700s and FAStT EXP710s in the same drive loop or if your production environment allows the scheduling of downtime for maintenance purposes.

- Hot-case upgrade — The FAStT EXP700s and connected storage server remain powered on when ESMs are replaced. Because the FAStT storage server drive loops/channels will be disturbed during the upgrade, you should schedule the upgrade during non-peak I/O period. Use the FAStT Storage Manager performance monitor function to determine the non-peak I/O load time if required.

  Note: It is recommended that you schedule the hot-case ESM upgrade during a non-peak (low-usage) I/O period for the following reasons:
  - The FAStT storage server drive loops/channels will be disturbed with FC Loop Initialization events every time the ESM is replaced.
  - One of the drive loops in the drive loop will be down during the upgrade, reducing the maximum data bandwidth to the drives by one-half.

Important

After a FAStT EXP700 is upgraded with the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit, it is considered a FAStT EXP710 for purposes of cabling your drive loop. Therefore, if you are not upgrading all the FAStT EXP700 storage expansion units in a drive loop, you *must* follow the intermixing requirements for redundant drive loops that include both FAStT EXP700s and FAStT EXP710s. These requirements state that all FAStT EXP710s in a redundant drive loop must be grouped together. See “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43.

Cold-case ESM upgrade procedure

In the cold-case ESM upgrade procedure, you must power down the storage subsystem before upgrading the FAStT EXP700 ESMs. If your environment does not allow you to power down the storage subsystem in a non-emergency situation, use the “Hot-case ESM upgrade procedure” on page 86.

Note: The cold-case ESM upgrade procedure is recommended if you are intermixing FAStT EXP700s and FAStT EXP710s in the same drive loop.

Attention: If you are not upgrading all of the FAStT EXP700s in the redundant drive loop, or if you are upgrading additional FAStT EXP700s in redundant drive loop that includes both FAStT EXP700s and FAStT EXP710s, you *must* follow the intermixing requirements for drive loops that include both FAStT EXP700s and FAStT EXP710s. See “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43. Failure to do so can result in drive loop performance problems due to excessive time-outs and LIPs.

1. Before you begin the upgrade procedure, perform a full system backup and save the storage subsystem profile.
2. Upgrade the Storage Manager client to version 9.1 or later.
3. Upgrade the controller firmware to version 6.10.xx.xx or later.

   Attention: No I/O activity can be present during the firmware upgrade from version 5.4x.xx.xx or earlier to version 6.10.xx.xx or later.

4. After you have upgraded the Storage Manager client and controller firmware, verify that the storage server is in optimal condition. Use the Recovery Guru function in the Storage Manager client Subsystem Management window for information on how to fix any non-optimal conditions.

   Note: Correct any faults before you turn off the power to the storage subsystem using the proper troubleshooting or servicing procedures. This will help ensure that the storage expansion units will operate correctly after the upgrade.

5. Stop the applications in the server and then power down your storage subsystem.

   Note: Power down the FAStT storage server first and then power down the drive expansion enclosures. For more information, see the Installation, User's, and Maintenance Guide for your FAStT storage server.

6. Whether you are upgrading one or multiple FAStT EXP700s in a drive loop, complete the disconnection, upgrade, and reconnection process described in the following steps for each storage expansion unit before upgrading the next storage expansion unit. Disconnecting, upgrading, and reconnecting one FAStT EXP700 at time greatly reduces the possibility of making a fibre channel cabling error.

   Note: Before upgrading the ESMs, review the guidelines in "Handling static-sensitive devices" on page 18.

   a. Disconnect all fibre channel cables from the left ESM in the first storage expansion unit that you will upgrade.
   b. Replace the left ESM with the upgrade ESM CRU that you received in the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit. Follow the steps for replacing an ESM in "Replacing a failed hot-swap ESM" on page 68.
   c. Reconnect the fibre channel cables to the upgraded ESM in the first storage expansion unit.
   d. Repeat steps a through c for the right ESM in the first storage expansion unit that you will upgrade.
   e. Replace the FAStT EXP700 bezel with the new bezel you received in the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit.
   f. Repeat steps a through e for each FAStT EXP700 that you are upgrading. Complete the process for each FAStT EXP700 before you continue with the next storage expansion unit.

7. Power on your storage subsystem. Use the LEDs to verify that the FAStT configuration is operating normally. Correct any Fault LED errors and verify that the ESM port bypass LEDs are not lit (if they are, remove the fibre channel cables and the SFPs and reinsert them).

   Note: Power up the drive expansion enclosures first and then power up the FAStT storage server. For more information, see the Installation, User's, and Maintenance Guide for your FAStT storage server.

8. Use the Storage Manager client Subsystem Management window to verify that the FAStT storage server configuration is in an optimal state and that no ESM Redundancy Lost errors or drive errors are being reported. Use the Recovery Guru function in the Storage Manager client Subsystem Management window for information on how to fix any non-optimal conditions.

If you experience any of the following drive failure conditions, call IBM support for help:

- The Empty Drive Slot icon () displayed for drive slots that contain drives.
- The Failed Unconfigured Drive icon () displayed for drive slots that contain drives.
- The Failed Configured Drive icon () displayed for drive slots that contain drives.

9. Restore I/O activity to the FAStT storage server.
10. After you have completed the ESM upgrade process, you are required to return the original FAStT EXP700 1740 ESMs (FRU 19K1287) to IBM. Use the packaging materials from the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit for repacking and sending the replaced ESMs. For full details on how and where to return the original FAStT EXP700 ESMs, see the *FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit Instructions* (P/N 25R0184), which is included with the upgrade kit.

Hot-case ESM upgrade procedure

In the hot-case ESM upgrade procedure, you upgrade the FAStT EXP700 ESMs while the storage subsystem remains powered on.

Note: It is recommended that you schedule the hot-case ESM upgrade during a non-peak (low-usage) I/O period for the following reasons:

- The FAStT storage server drive loops/channels will be disturbed with FC Loop Initialization events every time the ESM is replaced.
- One of the drive loops in the redundant drive loop will be down during the upgrade, reducing the maximum data bandwidth to the drives by one-half.

Attention: The hot-case ESM upgrade procedure requires that both loops (drive channels) in the redundant drive loop that contains the FAStT EXP700s that you are upgrading be in an optimal state. If you perform the upgrade process with one drive loop (drive channel) in non-optimal state, your arrays might fail, causing loss of data access and possibly loss of data. If you not sure that your drive loops are optimal, or if your environment allows you to power down the storage subsystem in a non-emergency situation, it is recommended that you use the “Cold-case ESM upgrade procedure” on page 84 instead of the hot-case ESM upgrade procedure. Contact IBM support for help if required.

Note: You must perform the hot-case upgrade procedure one redundant drive loop at a time.

Attention: If you are not upgrading all of the FAStT EXP700s in the redundant drive loop, or if you are upgrading additional FAStT EXP700s in redundant drive loop that includes both FAStT EXP700s and FAStT EXP710s, you *must* follow the intermixing requirements for drive loops that include both FAStT EXP700s and FAStT EXP710s. See “Intermixing FAStT EXP700s and FAStT EXP710s in the same loop” on page 43. Failure to do so can result in drive loop performance problems due to excessive time-outs and LIPs and possibly failed drives.

1. Before you begin the upgrade procedure, perform a full system backup and save the storage subsystem profile.
2. Upgrade the FAStT Storage Manager client to version 9.1 or later.
3. Upgrade the controller firmware to version 6.10.xx.xx or later.

   Attention: No I/O activity can be present during the firmware upgrade from version 5.4x.xx.xx or earlier to version 6.10.xx.xx or later.
4. Verify that the drive channels are in an optimal state. Monitor the status of the storage subsystem for several days with the Storage Manager client and FAStT storage server event logs. It is recommended that you periodically monitor the Read-Link status and drive channels for two to three days looking for any excessive increase in error counts. Use the Recovery Guru function in the Storage Manager client Subsystem Management window for information on how to fix any non-optimal conditions.

   In addition, you can also manually force one drive loop/channel in the redundant drive loop to be upgraded into a Degraded state in the Drive Channel (Summary) window. With one loop in a Degraded state, monitor the error counts in the other (Optimal) drive loop/channel in the redundant drive loop (for 20 minutes) with I/O activity present. Then set the Degraded drive loop/channel back into Optimal state. Wait at least 20 minutes and repeat the process for the other drive loop/channel in the redundant drive loop to be upgraded. If there are excessive errors counts (in the tens or hundreds), do not perform the ESM upgrade until you have first resolved the errors using the drive path diagnostics described in the *IBM TotalStorage FAStT Problem Determination Guide*.

   Attention: Resolve any non-optimal conditions *before* continuing with the next step.
5. Disconnect the fibre channel cable that connects the right-hand storage server controller drive port to the first storage expansion unit. In Figure 60 on page 88, this cable is shown with a dashed line and marked *1*. Mark the cable for later use. You will not reconnect this cable until you have replaced all the ESMs to be upgraded in the disconnected drive loop.

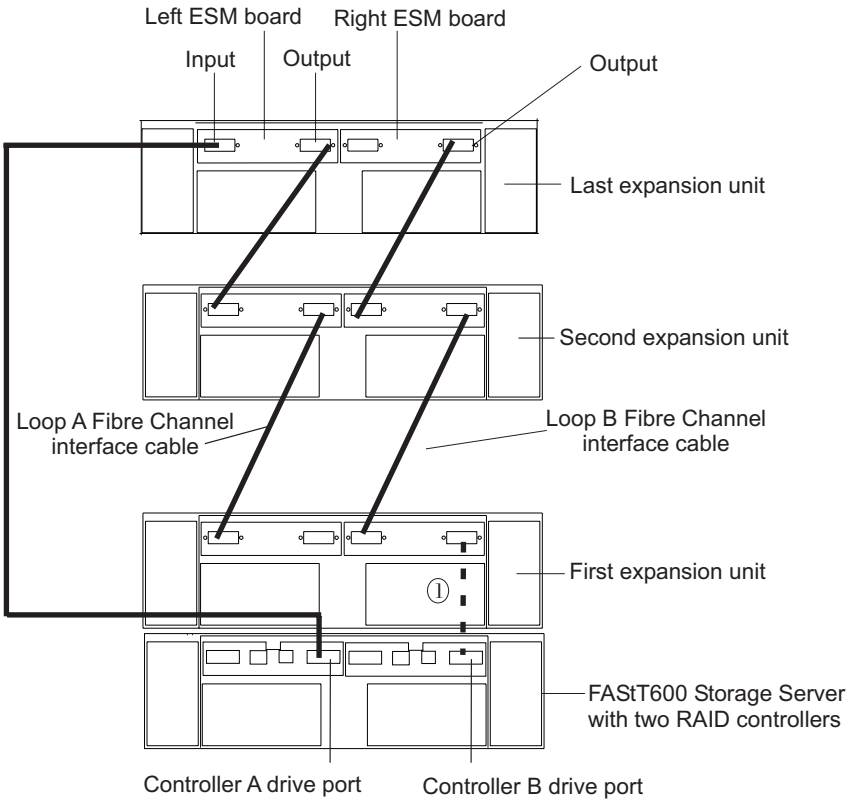


Figure 60. Disconnect the fibre channel cable from one storage server to the first FAStT EXP700

6. Whether you are upgrading one or multiple FAStT EXP700s in the disconnected drive loop, complete the disconnection, upgrade, and reconnection process described in the following steps for each ESM in the disconnected drive loop before upgrading the ESM in the next storage expansion unit. Disconnecting, upgrading, and reconnecting one ESM at time greatly reduces the possibility of making a fibre channel cabling error.
   a. Disconnect any fibre channel cables from the first ESM (marked *3* in Figure 61 on page 89) that you will replace in the disconnected drive loop. Leave in place the fibre channel cables connected to the other ESMs in the disconnected drive loop. In Figure 61 on page 89, the cable to be removed is shown with dashed lines and marked *2*.

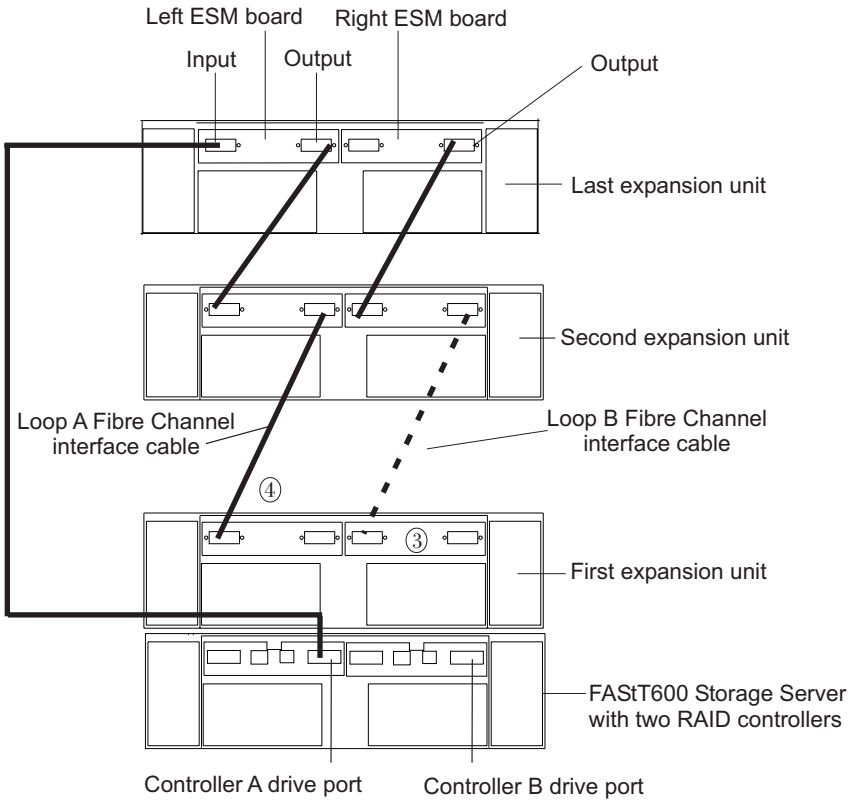


Figure 61. Disconnect the remaining fibre channel cables from the first ESM in the disconnected drive loop

b. Replace the disconnected FAStT EXP700 ESM (marked *3* in Figure 61) with one of the upgrade ESMs you received in the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit. Follow the steps for replacing an ESM in "Replacing a failed hot-swap ESM" on page 68.

c. Reconnect the fibre channel cables to the ESM that you replaced. Do not reconnect the cable to the storage server controller drive port that you disconnected in step 5.

d. Repeat steps a through c for each FAStT EXP700 that you upgrading (for the ESMs in the disconnected drive loop only). Complete the process for each FAStT EXP700 before you continue with the next storage expansion unit.

7. After you have upgraded and reconnected each ESM in the drive loop, reconnect the fibre channel cable from the controller drive port to the first EXP710 ESM port (disconnected in step 5.) In Figure 60 on page 88, this cable is shown with a dashed line and marked *1*.
8. Verify that none of the Port Bypass LEDs are lit. If any Port Bypass LEDs are lit, perform the following procedures in the order listed:
   - Remove and replace the fibre channel cable and SFP on the storage expansion unit with the lit Port Bypass LED.
   - Perform the fibre channel connection path diagnostic tests detailed in the *IBM TotalStorage FAStT Problem Determination Guide*.
   - If neither of the above procedures resolves the issue, contact IBM technical support.
9. Use Storage Manager to verify that no ESM Redundancy Lost errors are being reported.

If ESM Redundancy Lost errors are being reported, perform the following tasks to resolve the errors:

- Verify that the correct firmware version is installed (6.10.xx.xx)
- Follow the procedure suggested by the Recovery Guru.
- Call IBM support for help.

Do not proceed with the upgrade until the ESM Redundancy Lost errors are corrected.

Note: You might see errors reporting that ESM firmware or hardware is mismatched on every storage expansion unit in which you have upgraded the ESM. These errors are expected; they will stop being reported when you have replaced the other ESMs.

10. Open the Storage Manager Drive Channels (Summary) window, as shown in Figure 62 (from the Subsystem Management window, click **Advanced > Troubleshooting > Drive Channels**). Clear the error counts; then wait 15 minutes and view the error counts in the upgraded drive loop. If there are none or very few errors, proceed to the next step. Otherwise, wait another 15 minutes and then view the error counts again. If the errors continue to increase, call IBM support for help.

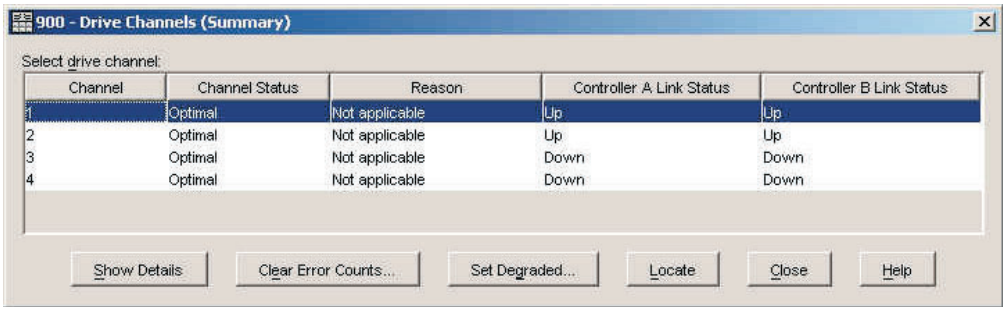


Figure 62. Drive Channels (Summary) window

11. Repeat steps 5 through 9 to upgrade the ESMs in the second drive loop. Begin by disconnecting the fibre channel cable that connects the left-hand storage server controller drive port to the first storage expansion unit (marked *4* in Figure 61 on page 89) . You will reconnect this cable only after you have replaced all the ESMs to be upgraded in the second drive loop.
12. For every storage expansion unit that you have upgraded, replace the FAStT EXP700 bezel with the new bezel you received in the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit.
13. After you have upgraded and reconnected each ESM in the second drive loop, verify that the system has returned to the same state as before the ESM upgrade. No ESM Redundancy Lost errors or hardware/firmware mismatch errors should be reported as a result of the mismatch of ESM hardware (that is, because both FAStT EXP700 and FAStT EXP710 ESM CRUs are inserted in the same drive expansion enclosure chassis).

    Note: You might receive ESM hardware/firmware mismatch errors due to mismatched ESM firmware versions. If this is the case, download the latest FAStT EXP710 ESM firmware version and upgrade the mismatched ESMs with this code, as described in the following step.

    If you experience any of the following drive failure conditions, call IBM support for help:

- The Empty Drive Slot icon () displayed for drive slots that contain drives.
- The Failed Unconfigured Drive icon () displayed for drive slots that contain drives.
- The Failed Configured Drive icon () displayed for drive slots that contain drives.

14. Check the ESM firmware and upgrade it to the latest level available on the IBM FAStT support Web site:

    www.ibm.com/storage/support/fastt

    You can perform the ESM firmware upgrade with I/O activity present if you select to upgrade one storage expansion unit at time in the ESM Firmware Download window. If you select all or multiple storage expansion units for upgrades, I/O activity must be stopped during the upgrade.

    Note: In either case, the storage expansion units are always updated one at a time.

15. After you have completed the ESM upgrade process, you are required to return the original FAStT EXP700 1740 ESMs (FRU 19K1287) to IBM. Use the packaging materials from the FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit for repacking and sending the replaced ESMs. For full details on how and where to return the original FAStT EXP700 ESMs, see the *FAStT EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit Instructions* (P/N 25R0184), which is included with the upgrade kit.

Appendix C. Upgrading the controller firmware for FAStT600, FAStT700, and FAStT900 (FAStT EXP710 only)

The instructions in this appendix are applicable to new storage subsystems that consist of a FAStT700 or FAStT900 storage server with controller firmware version 5.4x.xx.xx or earlier connected only to one or more FAStT EXP710s. You must perform the manual firmware upgrade procedure detailed in this appendix if you are attaching one or more FAStT EXP710s to a FAStT700 or FAStT900 storage server.

Attention: If you are connecting your storage expansion units to a FAStT600 that is populated with hard disk drives, its internal drive will start up normally after you have cabled the FAStT EXP710s. However, if none of the FAStT600 internal drive slots are populated, you must also follow the procedure in this appendix because a FAStT600 without any internal hard disk drives will not recognize any connected FAStT EXP710s.

Because FAStT700 and FAStT900 RAID controllers with controller firmware version 5.4x.xx.xx or earlier will not recognize the FAStT EXP710, the RAID controllers will not be able to spin up the drives in the FAStT EXP710 to complete the normal FAStT storage server boot process. As a result, the FAStT700 and FAStT900 RAID controllers A and B will not synchronize and thus will not be presented as a single identity in the FAStT Enterprise Management window when the new storage expansion units are connected.

FAStT EXP710 support requires that you upgrade any connected FAStT700 and FAStT900 Storage Servers with FAStT controller firmware and NVSRAM version 6.10.xx.xx or later. If you did not order your FAStT storage server from the factory with firmware version 6.10.xx.xx or later installed, you must upgrade the controller firmware manually from firmware version 5.4x.xx.xx or earlier.

Note: Storage Manager 9.1 software and controller firmware and NVSRAM version 6.10.xx.xx can be downloaded from the FAStT support Web site:

www.ibm.com/storage/support/fastt

Complete the following procedures to upgrade the controller firmware and synchronize the RAID controller versions:

Note: Refer to the *IBM TotalStorage FAStT Storage Manager Version 9 Installation and Support Guide* for your operating system for more information on this upgrade procedure and any system requirements.

Upgrading the firmware

Attention: The firmware upgrade procedure requires the out-of-band (Ethernet) management connections to both controllers in the connected FAStT storage server. You can define the controller TCP/IP addresses in the following three ways:

- By default (to 192.168.128.101 and 192.168.128.102 for Controllers A and B respectively)
- By a DHCP/BootP server
- By static definition. Existing FAStT controllers have stored TCP/IP addresses that can be used for static definition.

Use the following procedures to upgrade a FAStT Storage Server manually to controller firmware version 6.10.xx.xx.

1. Power off the FAStT storage server configuration and the FAStT EXP710s, if applicable.
2. With the FAStT storage server and the FAStT EXP710s powered off, establish all fibre-channel cabling connections and management Ethernet connections. Refer to "Cabling the expansion unit" on page 31.

   Note: Do not power on any units yet.
3. Install Storage Manager 9.1 in the management station.

   Refer to the *IBM TotalStorage FAStT Storage Manager Version 9 Installation and Support Guide* for your operating system for more information on this upgrade procedure and any system requirements.

   Attention: The management station must have an Ethernet connection to the same network as the two controllers in the FAStT storage server.
4. Remove Controller A from the FAStT storage server.

   Important: If you do not remove Controller A from the FAStT storage server, the new firmware may not be downloaded correctly on both controllers and the controllers will not recognize the disk drives.

   Refer to the appropriate FAStT storage server installation and user's guide for the location and the instructions on how to remove the controller in a FAStT storage server.

   Note: For the FAStT700 and FAStT900, Controller A is the top controller when looking at the front of the unit. For the FAStT600, Controller A is the left controller when looking at the back of the unit. Observe handling static-sensitive device precautions described in "Handling static-sensitive devices" on page 18 when removing the FAStT storage server controller.
5. Power on the FAStT storage server only. Both power supplies must be powered on for maximum protection against power loss.
6. Open a FAStT Storage Manger Client Enterprise Management window to manage the FAStT storage server for which you are upgrading the firmware. Refer to the *IBM TotalStorage FAStT Storage Manager Version 9 Installation and Support Guide* for the host operating system of your FAStT management station for more information.
7. Add the TCP/IP address for Controller B to the Enterprise Management window of the FAStT Storage Manager 9 client program.
   a. In the Enterprise Management Window, click **Edit → Add Device**.
   b. The Add Device window opens. Enter the TCP/IP address of Controller B in the Host name or IP address field and click **Add** to add the FAStT storage server in the FAStT Storage Manger Client management domain.

c. Click **Close** to close the Add Device window.

Note: If this is an upgrade from an existing FAStT storage server with version 5.4x.xx.xx firmware or earlier and there is an entry for this FAStT storage server in the FAStT Storage Manger Client Enterprise Management window, delete this entry before you add controller B to the Enterprise Management window.

To delete the entry, right-click the entry and select **Remove Device** from the pull-down menu. Click **Yes** when the Remove Device confirmation window opens.

When you are done, continue to "Downloading the firmware to controller B."

Downloading the firmware to controller B

Perform the following steps to download the firmware and NVSRAM to controller B of the FAStT Storage Server:

1. In the Enterprise Management window, right click the FAStT storage server name and select **Manage Device** to open the Subsystem Management window.

   Note: A Partially Managed Notice window might open, warning that the storage subsystem that you are trying to manage has a controller that has not yet been added to the Enterprise Management window. Click **Yes** to launch the Subsystem Management window for this FAStT controller anyway.
2. In the Subsystem Management window, click **Storage Subsystem → Download → NVSRAM** to load the NVSRAM file to Controller B. When the NVSRAM Download window opens.
3. Select the directory that contains the NVSRAM file, then select the name of the NVSRAM file. Click **OK** to close the window and continue.
4. Click **Yes** when the Confirm Download window opens. The Confirm Download window closes and the Downloading window opens and shows the status of the firmware download.
5. One of two windows displays:
   - If you receive the message `NVSRAM download successful` displayed in the Downloading window, click **Done** to close the Downloading window and then continue with step 6.
   - If you see an error window displaying a `Controller Download Timeout` error, power off and then power on the FAStT storage server. Then verify that the NVSRAM was downloaded correctly to Controller B of the storage server.

     To verify that the correct NVSRAM version was downloaded, click **View → Storage Subsystem Profile**. In the Storage Subsystem Profile window, look for the correct NVSRAM file version under the All tab.
     – If the NVSRAM was downloaded correctly, continue with step 6.
     – If the NVSRAM was not downloaded correctly, try the NVSRAM download again. If the problem persists after the second storage server power-cycle, call your IBM technical support representative.
6. Click **Done** to close the Downloading window.

7. In the Enterprise Management window, right-click the entry for Controller B and select **Manage Device** from the pop-up menu. The Subsystem Management window opens.
8. Click **Storage Subsystem → Download → Firmware**. The Firmware Download window opens.
9. Select the directory that contains the controller firmware file, then select the name of the controller firmware file. Click **OK** to close the window an continue.
10. Click **Yes** when the Confirm Download window opens. The Confirm Download window closes and the Downloading window opens and shows the status of the firmware download.
11. One of two windows displays:
    - If you receive the message `Firmware download is successful` in the Downloading window and the New Firmware Detected window displays, then continue with step 12.
    - If you see an error window displaying a `Controller Download Timeout` error, power off and then power on the FAStT storage server. Verify that the firmware was downloaded correctly to Controller B of the storage server.

      To verify that the correct firmware version was downloaded, perform the following steps:

      a. Right-click the Controller B icon in the Physical pane of the Subsystem Management window and select **Properties**.

      b. Look for the entries starting with ″Appware version″ and ″Bootware version″ when the Controller Properties window opens.

         – If the firmware was downloaded correctly, continue with step 13.

         – If the firmware was not downloaded correctly, try the firmware download again. If the problem persists after the second storage server power-cycle, call your IBM technical support representative.
12. Click **OK** to close the New Firmware Detected window and the Subsystem Management window.
13. Close the Subsystem Management window. In the Enterprise Management window, remove the Controller B entry from the Directly-Managed Storage Subsystem list. To delete the entry, perform the following steps:

    a. Right-click the entry and select **Remove Device** from the pull-down menu.

    b. Click **Yes** when the Remove Device confirmation window opens.
14. Before you connect any FAStT EXP710 units to the FAStT Storage Server, power off the FAStT storage server and make appropriate fibre-channel cable connections between the FAStT EXP710 unit and the FAStT Storage Server.

    Note: Do not re-insert Controller A to the FAStT Storage Server yet.

When you are done, continue to “Powering up the FAStT Storage Server with FAStT EXP710s attached.”

Powering up the FAStT Storage Server with FAStT EXP710s attached

Perform the following steps to power up the FAStT Storage Server with controller B only inserted and attached to the FAStT EXP710 expansion units.

1. Verify that the FAStT EXP710 is correctly cabled to the FAStT controller.

   For more information on cabling the FAStT EXP710, see “Cabling the expansion unit” on page 31.
2. Power on all of the FAStT EXP710 drive expansion units.

3. Wait for the green drive Activity LEDs on the drives in the FAStT EXP710 enclosures to stop flashing and the FAStT EXP710 ESM Fault LED to change from amber to unlit.

   Verify that the Port Bypass LEDs for all of the fibre-channel interconnect ports of the FAStT EXP710 drive expansion enclosures are not lit. The Port Bypass LED of the ports that are connected to the FAStT Storage drive ports will be lit.

4. Power on the FAStT storage server.

   Wait at least four minutes after all of the drives in the FAStT EXP710 enclosures have spun up. The drives will show solidly lit or rapidly flashing green drive Activity LEDs. Verify that the port bypass LED of the controller B drive port is not lit.

5. Add the TCP/IP address for Controller B to the Enterprise Management window of the FAStT Storage Manager 9 client program. Perform the following steps to add the TCP/IP address for Controller B.
   a. In the Enterprise Management Window, click **Edit → Add Device**.
   b. Enter the TCP/IP address of Controller B.
   c. Click **Add** when the Add Device window opens.
   d. If the Connection Problem window displays, continue with 5e. Otherwise, continue with 5g.
   e. Click **No** to close the window and return to the Add Device window.
   f. Wait a few minutes and click **Add** to try to add Controller B to the Enterprise Management window again.

      If the problem persists, power off the storage server and repeat steps 2 on page 96 through 5. Otherwise, continue with step 5g.

   g. Click **Close** to close the Add Device window.

      Note: A Partially Managed Notice window might open, warning that the storage subsystem that you are trying to manage has a controller that has not yet been added to the Enterprise Management window. Click **Yes** to launch the Subsystem Management window for this FAStT controller anyway.

6. In the Enterprise Management window, right-click the entry for Controller B (which you just added) and select **Manage Device** from the pop-up menu.
7. A Subsystem Management window opens. Verify that all of the FAStT EXP710 drive expansion enclosures and drives are shown in the Subsystem Management window.
8. Close the Controller B Subsystem Management window.

When you are done, continue with “Adding and synchronizing the firmware for controller A with the firmware for controller B.”

Adding and synchronizing the firmware for controller A with the firmware for controller B

Perform the following steps to add Controller A and synchronize its firmware with the version loaded into controller B.

1. While the FAStT Storage Server is powered on, hot-add the controller A CRU into the FAStT storage server chassis.

   Note: The FAStT storage server supports hot additions of CRUs like controllers, power supplies, and so forth. This controller will be started up

and its firmware and NVSRAM will synchronize automatically with the controller firmware and NVSRAM in Controller B. This process might take several minutes, depending on the number of FAStT EXP710 enclosures and drives in the FAStT storage server configuration. Wait at least five minutes (or 10 minutes in a large configuration; for example, one with 112 or more drives).

2. Perform the following steps to add Controller A to the Enterprise Management window using the TCP/IP address for Controller A.
   a. To add Controller A, click **Edit → Add Device**. The Add Device window opens.
   b. Enter the TCP/IP address of Controller A and click **Add**.
   c. If the Connection Problem window opens, click **No** to close the window and return to the Add Device window.

      Wait a few more minutes and click **Add** to try to add Controller A to the Enterprise Management window again. If the problem persists after a few attempts, call your IBM technical support representative.

When you are done, continue with "Completing the firmware upgrade procedure."

Completing the firmware upgrade procedure

Perform the following steps to complete the firmware upgrade procedure:

- If Controller A starts up successfully after synchronizing with the firmware and NVSRAM in Controller B, Controller A and Controller B will be displayed as a single entry under the Directly-Managed Storage Subsystem tree in the Enterprise Management window. Right-click the entry for Controller B and select **Manage Device**. A Subsystem Management window should open without being preceded by the Partially Manage Device window.

  When the Subsystem Management window opens, you can proceed with the other FAStT Storage Server management tasks, such as creating arrays, mapping logical drives to host partitions, and so on. Refer to the FAStT Subsystem Management online help for instructions.

  Attention: After you successfully upgrade the controller firmware, check whether new versions of the ESM firmware for the FAStT EXP710 exist on the IBM FAStT support Web site:

  www.ibm.com/storage/support/fastt

  Refer to the Storage Subsystem online help or the *IBM TotalStorage FAStT Storage Manager Version 9 Installation and Support Guide* for your operating system or the *IBM TotalStorage FAStT Storage Manager Concepts Guide* for more information on how to download the drive enclosure ESM firmware and drive firmware.
- If Controller A is added as a separate entry in the Enterprise Management window, perform the following steps:
  1. Close the Add Device window and delete the Controller A entry from the Enterprise Management window.
  2. Wait a few minutes and try to add Controller A again. (The problem might have been caused by Controller A not having had enough time to complete the sync-up with Controller B.)
- If Controller A is added as a separate entry in the Enterprise Management window again, perform the following steps:

1. Close the Add Device window and delete the Controller A entry from the Enterprise Management window.
2. Remove Controller A from the storage server chassis, wait a minute or so, and repeat step 2 on page 98.

If the problem persists, call your IBM technical support representative.

Appendix D. Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

IBM power cords for a specific country or region are usually available only in that country or region.

IBM power cord part number	Cord specifics	Used in these countries or regions
13F9940	250V/10A 2.8M	Australia, Fiji, Kiribati, Nauru, New Zealand, Papua New Guinea
13F9979	250V/10A 2.8M	Afghanistan, Albania, Algeria, Andorra, Angola, Armenia, Austria, Azerbaijan, Belarus, Belgium, Benin, Bosnia and Herzegovina, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Democratic Republic of), Congo (Republic of), Cote D'Ivoire (Ivory Coast), Croatia (Republic of), Czech Rep, Dahomey, Djibouti, Egypt, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, French Guyana, French Polynesia, Gabon, Georgia, Germany, Greece, Guadeloupe, Guinea, Guinea Bissau, Hungary, Iceland, Indonesia, Iran, Kazakhstan, Kyrgyzstan, Laos (Peoples Democratic Republic of), Latvia, Lebanon, Lithuania, Luxembourg, Macedonia (former Yugoslav Republic of), Madagascar, Mali, Martinique, Mauritania, Mauritius, Mayotte, Moldova (Republic of), Monaco, Mongolia, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Reunion, Romania, Russian Federation Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Slovakia, Slovenia (Republic of), Somalia, Spain, Suriname, Sweden, SSyrian Arab Replublic, Tajikistan, Tahiti, Togo, Tunisia, Turkey, Turkmenistan, Ukraine, Upper Volta, Uzbekistan, Vanuatu, Vietnam, Wallis and Futuna, Yugoslavia (Federal Republic of), Zaire
13F9997	250V/10A 2.8M	Denmark

IBM power cord part number	Cord specifics	Used in these countries or regions
14F0015	250V/10A 2.8M	Bangladesh, Lesotho, Maceo, Maldives, Namibia, Nepal, Pakistan, Samoa, South Africa, Sri Lanka, Swaziland, Uganda
14F0033	250V/10A 2.8M	Abu Dhabi, Bahrain, Botswana, Brunei Darussalam, Channel Islands, Cyprus, Dominica, Gambia, Ghana, Grenada, Guyana, Hong Kong S.A.R. of China, Iraq, Ireland, Jordan, Kenya, Kuwait, Liberia, Malawi, Malaysia, Malta, Myanmar (Burma), Nigeria, Oman, Qatar, Saint Kitts & Nevis, Saint Lucia, Saint Vincent and the Grenadines, Seychelles, Sierra Leone, Singapore, Sudan, Tanzania (United Republic of), Trinidad & Tobago, United Arab Emirates (Dubai), United Kingdom, Yemen, Zambia, Zimbabwe
14F0051	250V/10A 2.8M	Liechtenstein, Switzerland
14F0069	250V/10A 2.8M	Chile, Italy, Libyan Arab Jamahiriya
14F0087	250V/10A 2.8M	Israel
1838574	250V/10A 2.8M	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Caicos Islands, Canada, Cayman Islands, Costa Rica, Columbia, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Japan, Mexico, Micronesia (Federal States of), Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Taiwan, United States, Venezuela
36L8880	250V/10A 2.8M	Argentina, Paraguay, Uruguay
02K0546	250V/6A 2.8M	PRC (China)
6952300	125V/10A 2.8M	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Cayman Islands, Costa Rica, Columbia, Cuba, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Mexico, Micronesia (Federal States of), Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Taiwan, Thailand, Turks and Caicos Islands, United States, Venezuela
6952301	125V/10A 1.8M	

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

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

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

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

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

Maximum memory may require replacement of the standard memory with an optional memory module.

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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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

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Glossary

This glossary provides definitions for the terminology and abbreviations used in IBM TotalStorage FAStT 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 set of fibre-channel hard drives that are logically grouped together to form a redundant array of independent disks (RAID) set.

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*.

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 services monitor (ESM) canister. A component in a drive 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 services monitor canister*.

EXP. See *expansion unit*.

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

expansion unit (EXP). A feature that can be connected to a system unit to provide additional storage and processing capacity.

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 FAStT 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 FAStT 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*.

isolated group. A collection of isolated devices not connected to the storage area network (SAN) but discovered by the SANavigator tool. The isolated group displays with a gray background near the bottom of the Physical and Data Path maps.

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 groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path maps.

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.

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*.

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*.

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 that appears as a single volume to the server and are fault tolerant through mirroring or parity checking.

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 FAStT 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 FAStT 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 FAStT Storage Manager client software, which is a Java-based graphical user interface (GUI) that is used to configure, manage, and troubleshoot storage servers and expansion units in a FAStT 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 FAStT 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 time-out. The maximum amount of time the SANavigator tool will wait for a device to respond to a request. The specified time applies to one retry only.

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 FAStT Storage Manager host software (SMClient) to uniquely identify each managed storage server. The FAStT 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 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 FAStT 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.

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 groups are discovered by the SANavigator tool and displayed with a gray background on the Physical and Data Path maps.

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.

vendor. Property value that the SANavigator tool uses to launch third-party software. Vendor property might be discovered, but will always remain editable.

worldwide name (WWN). A unique identifier for a switch on local and global networks.

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. 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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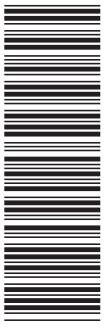

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