

IBM System Storage DCS3700



# Installation, User, and Maintenance Guide



IBM System Storage DCS3700



# Installation, User, and Maintenance Guide

**Note:**

Before using this information and the product it supports, be sure to read the general information in the “Safety” on page xi and “Notices” on page 159 sections.

**First Edition (May 2011)**

**Printed in the U.S.A.**

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## Safety

The caution and danger statements that this document contains can be referenced in the multilingual *IBM® Safety Information* document that is provided with your IBM System Storage® DCS3700 storage expansion enclosure. Each caution and danger statement is numbered for easy reference to the corresponding statements in the translated document.

- **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.
- **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.
- **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.

Before installing this product, read the following danger and caution notices.

### 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:
<ol style="list-style-type: none"><li>1. Turn everything OFF.</li><li>2. First, attach all cables to devices.</li><li>3. Attach signal cables to connectors.</li><li>4. Attach power cords to outlet.</li><li>5. Turn device ON.</li></ol>	<ol style="list-style-type: none"><li>1. Turn everything OFF.</li><li>2. First, remove power cords from outlet.</li><li>3. Remove signal cables from connectors.</li><li>4. Remove all cables from devices.</li></ol>

### Statement 2:



**CAUTION:**

When replacing the lithium battery, use only an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water
- Heat to more than 100° C (212° F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

Statement 3:



**CAUTION:**

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

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



**DANGER**

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

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




**Class 1 Laser statement**

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

IEC 825-11993 CENELEC EN 60 825

**Statement 4:**



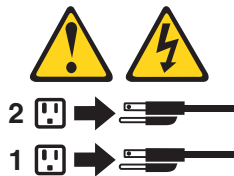
		
$\geq 18 \text{ kg (39.7 lb)}$	$\geq 32 \text{ kg (70.5 lb)}$	$\geq 55 \text{ kg (121.2 lb)}$

**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.

Statement 29:



**CAUTION:**

This equipment is designed to permit the connection of the earthed conductor of the dc supply circuit to the earthing conductor at the equipment.

This equipment is designed to permit the connection of the earthed conductor of the dc supply circuit to the earthing conductor at the equipment. If this connection is made, all of the following conditions must be met:

- This equipment shall be connected directly to the dc supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus to which the dc supply system earthing electrode conductor is connected.
- This equipment shall be located in the same immediate area (such as, adjacent cabinets) as any other equipment that has a connection between the earthed conductor of the same dc supply circuit and the earthing conductor, and also the point of earthing of the dc system. The dc system shall not be earthed elsewhere.
- The dc supply source shall be located within the same premises as this equipment.
- Switching or disconnecting devices shall not be in the earthed circuit conductor between the dc source and the point of connection of the earthing electrode conductor.

Statement 30:



**CAUTION:**

To reduce the risk of electric shock or energy hazards:

- This equipment must be installed by trained service personnel in a restricted-access location, as defined by the NEC and IEC 60950-1, First Edition, The Standard for Safety of Information Technology Equipment.
- Connect the equipment to a reliably grounded safety extra low voltage (SELV) source. An SELV source is a secondary circuit that is designed so that normal and single fault conditions do not cause the voltages to exceed a safe level (60 V direct current).
- The branch circuit overcurrent protection must be rated 20 A.
- Use 12 American Wire Gauge (AWG) or 2.5 mm<sup>2</sup> copper conductor only, not exceeding 4.5 meters in length.
- Incorporate a readily available approved and rated disconnect device in the field wiring.



**CAUTION:**

This unit has more than one power source. To remove all power from the unit, all dc MAINS must be disconnected.





**Cable Warning:**

**WARNING:** Handling the cord on this product or cords associated with accessories sold with this product, will expose you to lead, a chemical known to the State of California to cause cancer, and birth defects or other reproductive harm. **Wash hands after handling.**



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## About this document

This document provides instructions for installing and customizing the configuration of your IBM System Storage DCS3700 Storage Subsystem and the DCS3700 expansion enclosure. It also provides maintenance procedures and troubleshooting information.

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## Who should read this document

This document is intended for system operators and service technicians who have extensive knowledge of Fibre Channel Serial Attached SCSI (SAS) and network technology.

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## How this document is organized

Chapter 1, “Introduction,” on page 1 describes the IBM System Storage DCS3700 Storage Subsystem and the DCS3700 expansion enclosure. This chapter includes an inventory checklist and an overview of the storage expansion enclosure features, operating specifications, and components.

Chapter 2, “Installing the DCS3700,” on page 23 contains information on how to install the DCS3700.

Chapter 3, “Cabling the DCS3700,” on page 41 contains information on how to cable the DCS3700.

Chapter 4, “Operating the DCS3700 storage system and expansion enclosure,” on page 67 contains information on how to power on and off the storage expansion enclosure, recover from an overheated power supply, troubleshoot the storage expansion enclosure, and interpret LEDs.

Chapter 5, “Replacing components,” on page 89 contains step-by-step instructions about how to install or remove customer replaceable units (FRUs), such as hard disk drives, power supplies, fan assemblies, environmental service modules (ESMs), drive drawers, and SFP modules.

Chapter 6, “Hardware maintenance,” on page 129 describes problems and symptoms that are specific to your storage expansion enclosure. It also provides a parts list for the DCS3700.

Appendix A, “Records,” on page 139 provides a table that you can use to record and update important information about your DCS3700, including serial number and device records. Whenever you add options to your DCS3700, be sure to update the information in this table.

Appendix B, “Rack mounting template,” on page 143 provides the rack mounting templates for installation of the DCS3700. If you want to tear out the templates from the document for use during installation, use these copies of the templates.

Appendix C, “Specifications for non-IBM rack installation,” on page 147 provides safety requirements and rack specifications for installing DS5000 storage subsystems and DS5000 storage expansion enclosures into non-IBM racks.

Appendix D, “Power cords,” on page 153 lists power cord information for the DCS3700.

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## 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 system, and whom to call for service, if it is necessary.

## Before you call

Before you call, take these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Check for technical information, hints, tips, and new device drivers at the IBM System Storage Disk Support Web site pages that are listed in this section.
- 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 DS Storage Manager 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 subsystems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

## Using the documentation

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

## Finding Storage Manager software, controller firmware, and README files

DS Storage Manager software and controller firmware versions are available on the product DVD and can also be downloaded from the Web.

**Important:** Before you install DS Storage Manager software, consult the README. Updated README files contain the latest device driver versions, firmware levels, limitations, and other information not found in this document.

Storage Manager README files are found on the Web, at the following address:

<http://www.ibm.com/support/entry/portal>

To access the documentation related to your storage subsystem, operating system, and DS Storage Manager version from the IBM Support Portal, complete the following steps:

1. Go to <http://www.ibm.com/support/entry/portal>.
2. Under **Choose your products**, click **Browse for a product** or **Search for a product**.
3. Under **Choose your task**, click **Documentation**.
4. Under **See your results**, click **View your page**.
5. In the **Product documentation box**, click the link for the publication that you want to access.

## IBM System Storage Productivity Center

The IBM System Storage Productivity Center (SSPC) is an integrated hardware and software solution that provides a single point of entry for managing IBM System Storage, IBM System Storage SAN Volume Controller clusters, and other components of your data storage infrastructure. Therefore, you can use the IBM System Storage Productivity Center to manage multiple IBM System Storage product configurations from a single management interface.

To learn how to incorporate the DS Storage Manager with the IBM System Storage Productivity Center, see the IBM System Storage Productivity Center Information Center at the following Web site:

[publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp](http://publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp)

## Essential Web sites for DCS3700 support information

The most up-to-date information about DCS3700 storage subsystems and DS Storage Manager, including documentation and the most recent software, firmware, and NVSRAM downloads, can be found at the following Web site:

1. Go to <http://www.ibm.com/support/entry/portal>.
2. Under **Choose your products**, click **Browse for a product** or **Search for a product**.
3. Under **Choose your task**, click **Downloads**.
4. Under **See your results**, click **View your page**.
5. In the **Downloads and fixes**, click the link for the download that you want to access.

## Software service and support

Through IBM Support Line, for a fee you can get telephone assistance with usage, configuration, and software problems. 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](http://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](http://www.ibm.com/services)
- [www.ibm.com/planetwide](http://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](http://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.



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## Chapter 1. Introduction

This chapter describes the operating specifications, features, and components for the IBM System Storage DCS3700 storage system and DCS3700 expansion unit.

This chapter also includes an inventory checklist and important information on best practices guidelines and product updates for your DCS3700.

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### Overview

The DCS3700 is designed to meet the storage needs of the highly scalable, data streaming applications in high performance computing environments. The storage subsystem offers you data access and protection to meet your existing high performance computing storage requirements and prepare for the future.

The DCS3700 is designed to provide solutions to meet the needs of midrange storage requirements, delivering high performance, advanced function, high availability, modular and scalable storage capacity, with SAN-attached 6 Gbps Serial Attached SCSI (SAS) and 8 Gbps Fibre Channel (FC) connectivity, and support for RAID levels 0, 1, 3, 5, and 6.

#### Note:

1. RAID 6 uses a P+Q design implementation.
2. When RAID level 1 is implemented and the number of drives increases to more than two, RAID level 10 is automatically implemented.

The DCS3700 Storage Subsystem supports attachment of the DCS3700 expansion enclosure. The DCS3700 supports configurations of SAS and Near-Line SAS disks, or a mix of these types of disk drives. For details on the maximum number of disk drives supported, maximum storage capacity, and other features of the storage subsystem, see “DCS3700 Features” on page 3.

The DCS3700 is a 4U rack-mountable storage enclosure that supports up to two redundant, dual-active RAID storage controllers or environmental service modules, depending on the model. The DCS3700 storage system RAID controllers come standard with two 6 Gbps x4 SAS host interface ports and a single 6 Gbps x4 SAS expansion port on the base controller. In addition, each controller has an additional slot that supports the installation of an optional Host Interface Card (HIC). The supported host interface cards are a four-port 8 Gbps Fibre Channel (FC) adapter or a two-port 6 Gbps SAS adapter. Either host interface card can be used in conjunction with the base SAS host interface; however, each controller must have the same type of host interface card installed.

Advanced DCS3700 storage management, copy service options, and optional advanced disaster recovery functions are available, including FlashCopy®, VolumeCopy, and Enhanced Remote Mirroring. The DS Storage Manager client is also available for the DCS3700 Storage Subsystem. This storage management software is designed to help centralize storage management, help simplify partitioning of the DCS3700 series storage into as many as 128 virtual servers, and strategically allocate storage capacity to maximize storage space.

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### SAS defined

The Serial Attached SCSI (SAS) is a point-to-point serial architecture that replaces the parallel SCSI bus technology but still retains usage of the standard SCSI command set. The SAS point-to-point architecture provides a dedicated, full-duplex channel, that can transfer data at 6 Gbps in each direction. The Serial SCSI Protocol (SSP) is used to support SAS-only drives.

Nearline SAS or NL-SAS drives are enterprise SATA drives that offer a native SAS interface. NL-SAS drives support dual I/O ports allowing for redundant data paths, a faster interface compared to SATA and the ability to support the SCSI command set.

## **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 that is 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.

## **Operating system support**

For supported operating systems, see the latest System README file and the IBM DCS3700 product at the following Web site for additional host operating system support:

[www.ibm.com/systems/support/storage/config/ssic/index.jsp](http://www.ibm.com/systems/support/storage/config/ssic/index.jsp)

See “Finding Storage Manager software, controller firmware, and README files” on page xviii to learn how to access the DCS3700 README files on the Web.



## DCS3700 Features

Table 1 summarizes the features of the DCS3700 storage subsystem and expansion enclosure. For a list of the operating specifications, such as weight, height, and heat output, see “Specifications” on page 17.

Table 1. DCS3700 features

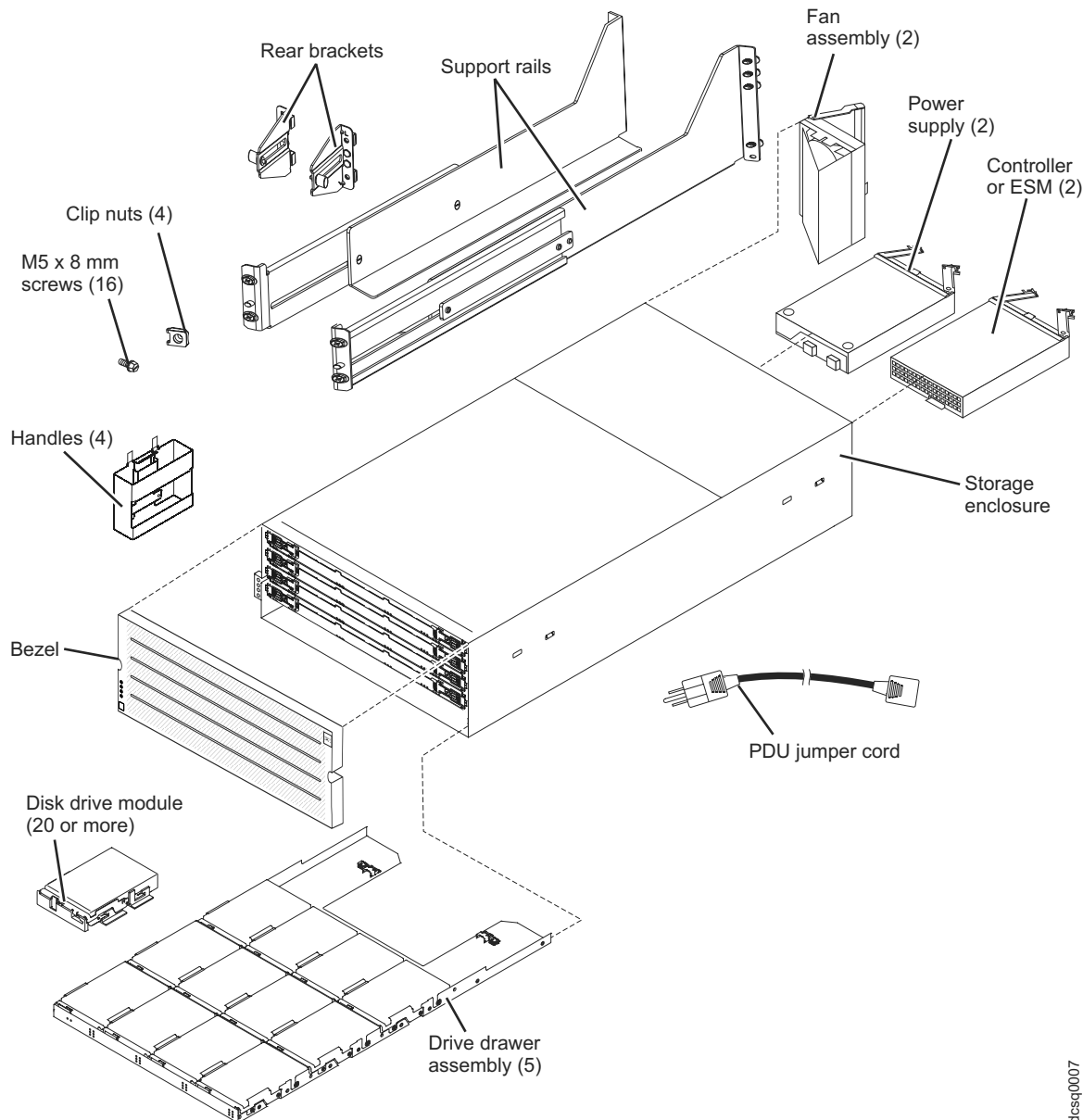
<p><b>General:</b></p> <ul style="list-style-type: none"> <li>• Modular components <ul style="list-style-type: none"> <li>– RAID storage controller modules</li> <li>– Environmental services modules (ESMs)</li> <li>– Power supplies</li> <li>– Fan assembly</li> <li>– High-capacity disk drives</li> </ul> </li> <li>• Technology <ul style="list-style-type: none"> <li>– Support for RAID 0, 1, 3, 5 and 6 disk arrays</li> <li>– Storage capacity up to 360 TB</li> <li>– Support for up to 180 SAS or NL-SAS disk drives when using two additional expansion enclosures</li> <li>– Controller cache size of 2 GB per controller for a total of 4 GB per storage subsystem</li> <li>– Cache memory upgradable to 4 GB per controller for a total of 8 GB per storage subsystem</li> <li>– Support for 6 Gbps SAS host interface on the controller</li> <li>– Each controller supports one host interface adapter. Support for: <ul style="list-style-type: none"> <li>- 6 Gbps SAS</li> <li>- 8 Gbps FC</li> </ul> </li> <li>– Redundant controllers or ESMs, power supply and fan assemblies</li> <li>– Hot-swap technology for controllers and power supply</li> </ul> </li> <li>• User interface <ul style="list-style-type: none"> <li>– Built-in power, activity, and fault LEDs, identification labeling on components, rear LEDs, and connectors</li> <li>– Easy-to-replace drives, power supplies, fan assemblies, controllers and ESMs</li> </ul> </li> </ul>	<p><b>Storage Subsystem:</b></p> <ul style="list-style-type: none"> <li>• <b>RAID controllers</b> <ul style="list-style-type: none"> <li>– Host interface: Two 26-pin, mini-SAS connectors per controller</li> <li>– Expansion: One 26 pin, mini-SAS connector per controller</li> <li>– Dual 1Gbps Ethernet management ports</li> <li>– Seven segment display</li> </ul> </li> <li>• <b>Power supply:</b> <ul style="list-style-type: none"> <li>– Two hot-swap 1755-watt (200 - 240V ac) standard</li> <li>– Provides redundant power</li> </ul> </li> <li>• <b>Premium Feature Options:</b> <ul style="list-style-type: none"> <li>– FlashCopy</li> <li>– VolumeCopy</li> <li>– Enhanced Remote Mirroring</li> </ul> </li> </ul>	<p><b>Storage expansion enclosure:</b></p> <ul style="list-style-type: none"> <li>• <b>ESM</b> <ul style="list-style-type: none"> <li>– Host interface: Two 26-pin, mini-SAS connectors per controller</li> <li>– Expansion: One 26 pin, mini-SAS connector per controller</li> <li>– Single 100Mbps Ethernet debug port</li> <li>– Seven segment display</li> </ul> </li> <li>• <b>Power supply:</b> <ul style="list-style-type: none"> <li>– Two hot-swap 1755-watt (200 - 240V ac) standard</li> <li>– Provides redundant power</li> </ul> </li> </ul>
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## Inventory checklist

The following illustration and inventory list show the items that you need to install the storage expansion enclosure in the rack cabinet. If any items are missing or damaged, contact your place of purchase.

### Notes:

1. The illustration might differ slightly from your hardware.
2. Depending on your DCS3700 order, your shipping box might contain additional materials that are not shown in the following illustration.



After you unpack the DCS3700, verify that you have the following items:

- 4U-high storage enclosure (1)
  - Drive drawer assemblies (5)
  - Fan assemblies (2)
  - Power supplies (2)
  - ESMs (2) (for 1818 80E)

- Controllers (2) (for 1818 80C)
- Handles (4), packaged in a smaller box inside the shipping box
- DDMs (20 or more, depending on your DCS3700 order), packaged in a smaller box inside the shipping box
- Bezel (1)
- Rack-mounting hardware kit (1), packaged in a smaller box inside the shipping box, including:
  - Rails (2), right and left assembly
  - Rear brackets (2)
  - M5 black hex-head slotted screws (16)

**Note:** The screws are either preinstalled in the support rails or packaged in a plastic bag.

- Washers (8)
- Clip nuts (4)

**Important:** The DCS3700 does not ship with region-specific ac power cords. You must obtain the IBM-approved power cords for your region. See Appendix D, “Power cords,” on page 153 for more information.

## Receiving product updates and support notifications

Be sure to download the latest versions of the following packages at the time of initial installation and when product updates become available:

- DS Storage Manager host software
- DCS3700 storage system controller firmware and NVSRAM
- DCS3700 expansion unit ESM firmware
- Drive firmware

### Important

Keep your system up-to-date with the latest firmware and other product updates by subscribing to receive support notifications.

For more information about how to register for support notifications, see the **Stay Informed** section of the IBM Disk Support Web site:

## Best practices guidelines

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

- Ensure that your system is in an optimal state before you shut it down. Never turn the power off if any Service Action Required LED is lit; be sure to resolve any error conditions before you shut down the system.
- Back up the data on your storage drives periodically.
- To maintain power redundancy, plug the DCS3700 right and left power supplies into two independent external power circuits through distribution units inside a rack cabinet or directly into external receptacles. This ensures that the DCS3700 storage system and all its attached expansion enclosures have power in the event that only one power circuit is available. In addition, having all the right or all the left power cables plugged into the same power circuit enables the storage devices in the configuration to power on simultaneously during an unattended restoration of power.

**Note:** Do not overload the circuits that power your storage subsystem and storage expansion enclosures. Use additional pairs of power distribution units (PDUs) if necessary. Refer to Table 9 on page 19

on page 19 for information on storage expansion enclosure power requirements. Contact your IBM service representative for additional information if needed.

- Before any planned system shutdown or after any system additions, removals, or modifications (including firmware updates, logical drive creations, storage partitioning definitions, hardware changes, and so on), complete the following tasks:
  1. Save the storage subsystem profile.
  2. Save the storage subsystem configuration.
  3. Save the Collect All Support Data (CASD).

Make sure that you save the files in a location other than in the logical drives that were created for the storage subsystem.

For more information on how to complete these tasks, check the DS Storage Manager online help or the DS Storage Manager guide for your operating system.

- During any maintenance or attended power-up procedure, carefully follow the power-up sequence listed in “Restoring power after an unexpected shutdown” on page 85. Check that each component of the subsystem is powered-on in the proper order during this entire power-up procedure to ensure the controller will be able to optimally access all of your storage subsystems.
- The storage subsystem supports simultaneous power-up to the system components; however, you should always follow the power-up sequence listed in “Restoring power after an unexpected shutdown” on page 85 during any attended power-up procedure.
- A storage system in an optimal state should recover automatically from an unexpected shutdown and unattended simultaneous restoration of power to system components. After power is restored, call IBM support if any of the following conditions occur:
  - The storage subsystem logical drives and subsystems are not displayed in the DS Storage Manager graphical user interface (GUI).
  - The storage subsystem logical drives and subsystems do not come online.
  - The storage subsystem logical drives and subsystems seem to be degraded.

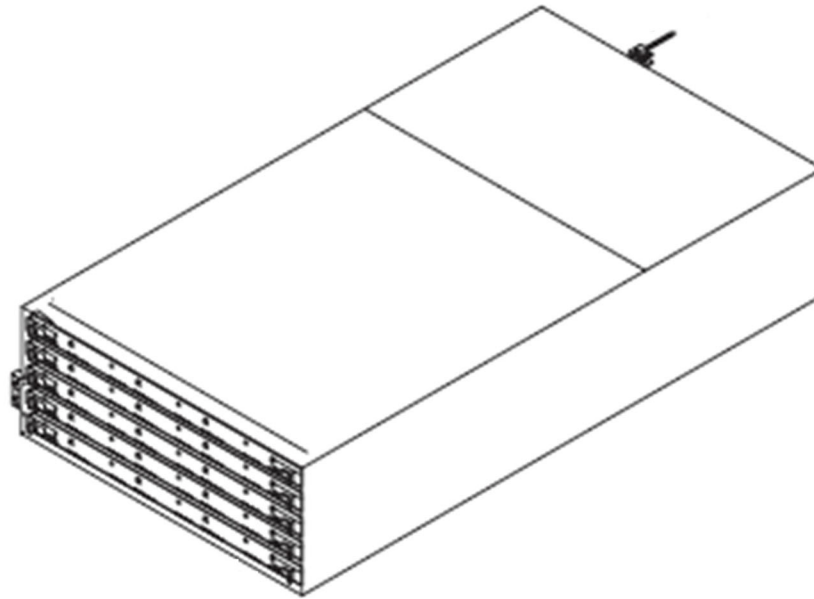
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## DCS3700 components

The DCS3700 storage system directs and manages the I/O activity between a host and the drives in a RAID array. The DCS3700 expansion unit provides additional storage capacity to the storage system.

Figure 1 on page 7 shows the DCS3700 unit without the front bezel in place.

**Note:** The illustration in this document might differ slightly from your hardware.



*Figure 1. Isometric view of the DCS3700*

The DCS3700 has the following removable components. These components, called field replaceable units (FRUs), are accessible from the front or back of the enclosure.

- Five drive drawers, including the right and left cable chains.
- 20 minimum to 60 maximum Disk Drive Modules (DDMs)
- Two RAID controllers (for the 1818-80C)
- Two environmental service modules (ESMs) (for the 1818-80E)
- Two power supplies
- Two fan assemblies

The hot-swap features of the DCS3700 enable you to remove and replace DDMs, power supplies, fan assemblies, ESMs, and Raid controllers without turning off the storage expansion enclosure. You can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

The DCS3700 expansion unit is the storage expansion enclosure specifically designed for use with the DCS3700 storage system. The DCS3700 can support up to two DCS3700 expansion enclosures for a total of 180 disk drive modules (DDM).

## **Drive drawers**

Both the DCS3700 storage system and DCS3700 expansion enclosure have five removable drive drawers that are accessible from the front of the enclosure (see Figure 2 on page 8). Each drive drawer can contain up to 12 disk drives (see Figure 3 on page 8). With the drive drawers fully populated, the DCS3700 can support up to 60 DDMs.

**Note:** Drive drawers might be also referred to as drive trays in other publications.

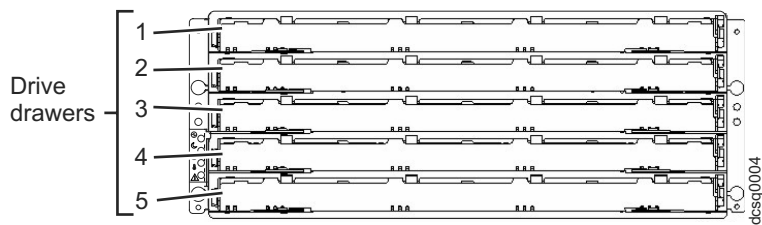


Figure 2. DCS3700 hot-swap drive drawers

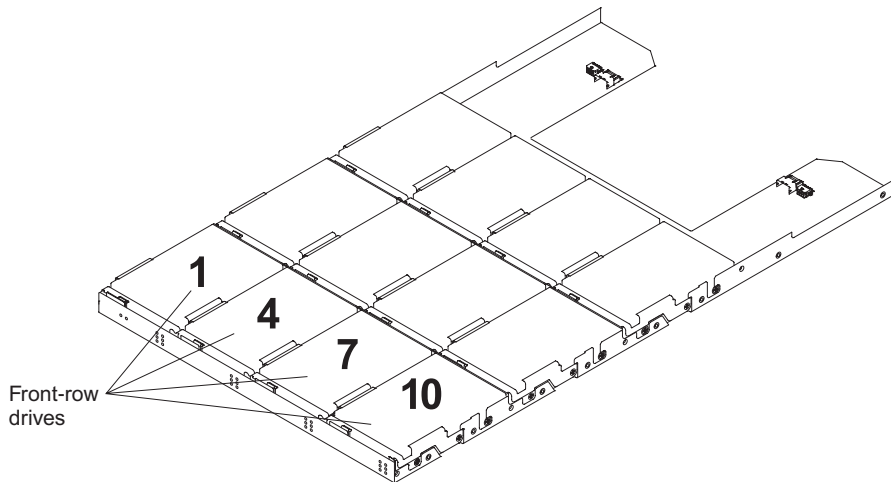


Figure 3. DCS3700 drive drawer

**Important:** The installation order within each drive drawer is from left to right in rows. Slots 1, 4, 7 and 10 must have a drive installed in these locations to make sure there is sufficient air flow to the drives (see Figure 3). To verify these slots, consult the overlay on the front of each of the five drive drawers. Make sure the four drives in each row are adjacent to each other. The long edge of each drive should touch the drive next to it. To maintain a uniform airflow across all drive drawers, the storage expansion enclosure must be configured with a minimum of 20 drives, with four drives in the front row of each of the five drive drawers.

## Disk Drive Modules (DDMs)

The DSC3700 supports up to 60 DDMs in five drive drawers that are accessible from the front of the storage expansion enclosure. The disk drawer planar board supports 6 Gbps SAS (Serial Attached SCSI) and Near-Line SAS drives.

**Attention:** The DSC3700 DDM and the EXP5060 SATA DDM are not compatible. Do not use the DSC3700 DDMs in an EXP5060 storage expansion enclosures. Similarly, do not use the EXP5060 SATA DDM in an DSC3700 enclosure

There are no servicable parts in a DDM FRU. If it fails, it must be replaced in its entirety. When replacing a DDM FRU, be sure to order and install the correct DDM FRU.

**Attention:**

1. After you remove a drive FRU, wait 90 seconds before replacing or reseating the drive FRU to allow the drive to properly spin down. Failure to do so may cause undesired events.
2. Never hot-swap a drive FRU when its associated green Activity LED is flashing. Hot-swap a drive FRU only when its associated blue Service Action Allowed LED is lit and the drive is inactive.

**Note:** If the DDM you want to remove is not in a failed or bypass state, always use the DS Storage Manager client program either to place the DDM in a failed state or to place the array that is associated with the DDM (or DDMs) in an offline state before you remove it from the enclosure.

## Controllers

The DCS3700 storage system (1818-80C) comes with two hot-swappable and redundant controllers. The controllers contain the storage subsystem control logic, interface ports, and LEDs. The controllers install from the rear of the storage enclosure. Controller A is installed in storage bridge bay slot A (SBB A) and controller B is installed in storage bridge bay slot B (SBB B). All connections to the hosts and the expansion enclosures are made through the controllers. Figure 4 shows the location of the controllers in the DCS3700.

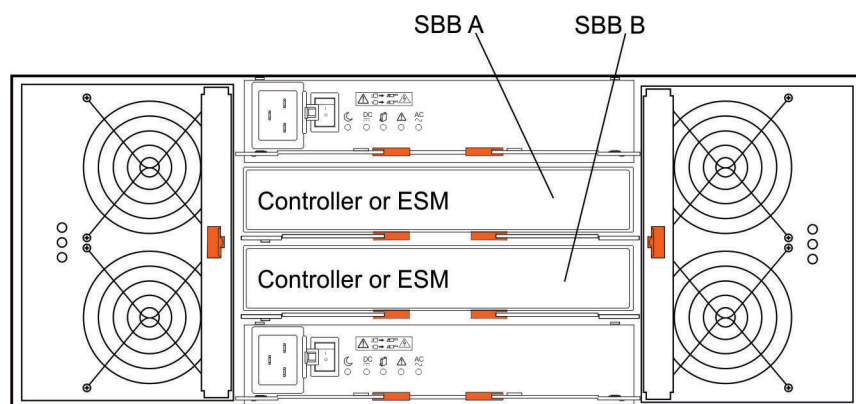


Figure 4. Location of the DCS3700 controllers

Information about the condition of the controllers is conveyed by indicator LEDs on the controller. See “Controller LEDs” on page 74 for more information on the LEDs found on the RAID controller.

## Controller cable connections

Each controller contains the following connections:

- Two 6 Gbps x4 SAS host ports
- One 6 Gbps x4 SAS expansion port to connect DCS3700 expansion enclosures
- Two RJ-45 Ethernet ports for subsystem management
- Support for one optional host interface card (HIC)
  - Two-port 6 Gbps SAS
  - Four-port 8 Gbps FC

**Attention:** The DCS3700 storage system controllers must be identical to each other in hardware (host port adapter and cache size) and firmware. If you install a host port adapter in one controller, you must install an identical host port adapter in the other controller.

Figure 5 on page 10 identifies the connectors found on the controller.



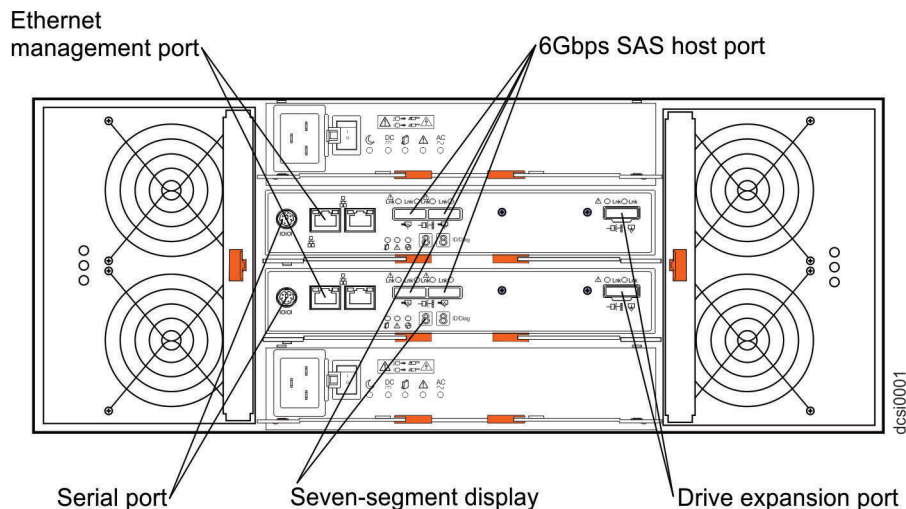


Figure 5. DCS3700 connectors

## Host ports

The DCS3700 storage system supports 6Gbps SAS on the base controller. The controller also contains an upgradable interface slot that can support an optional 6Gbps 2-port SAS host interface card or 8Gbps 4-port FC host interface card.

The controller host interface ports performs an automatic link speed negotiation when it is connected to a host or a switch. The host ports can operate at the following speeds:

- 6 Gbps SAS host ports can operate at either 3 or 6 Gbps
- 8 Gbps FC host ports can operate at 2, 4 or 8 Gbps

The controller performs link speed negotiation during the following events:

- Start-of-day
- Detection of a link-up event following a previous link-down event

## Expansion ports

Each controller has a single 6 Gbps x4 SAS expansion port that is used to connect expansion enclosures to the storage system. The two SAS expansion ports (one on each controller) are used to form a redundant drive channel.

## Ethernet management ports

The Ethernet connections provide for out-of-band management of the controller. Each controller has two RJ-45 Ethernet ports that support either 100Base-T or 1000Base-T connections.

One Ethernet port on each controller is used for daily management of the storage subsystem, while the second port is reserved for service personnel or as a backup port in the event the primary port fails.

The default IP addresses for the Ethernet ports are as follows:

- Port 1 on controller A is 192.168.128.101
- Port 2 on controller A is 192.168.129.101
- Port 1 on controller B is 192.168.128.102
- Port 2 on controller B is 192.168.129.102

The subnet mask for all Ethernet ports is 255.255.255.0.



## Serial port

The serial port located on each controller uses a 6-pin Mini-DIN connector. This port is intended to be used by *service personnel only* to provide diagnostic operations on the RAID controllers. The maximum baud rate is 115200 bps and the factory default baud rate is 38400 bps.

**Attention:** Incorrect use of the serial port can result in loss of data access and, in some cases, in loss of data. Do not make any connections to the serial port unless you do so under the direct guidance of IBM support personnel.

## Cache memory

Each RAID controller has data cache memory. The data cache memory is a buffer used to temporarily store hard disk drive data during data read and write operations. The Cache Active LED on the controller turns on when the cache contains data that has not been written to the hard disk drives. The Cache Active LED is off when there is no data stored in cache. The DCS3700 storage system is available with either 4 GB (2GB per controller) or 8GB (4GB per controller) of cache memory.

## Cache battery backup module

Each controller contains either 2048 MB or 4096 MB of cache memory. The controller also contains a sealed, rechargeable lithium ion battery that maintains data in the cache so that it can be transferred to flash memory in the event of a power failure.

Figure 6 shows the locations of the cache battery and memory cache DIMM in the controller.

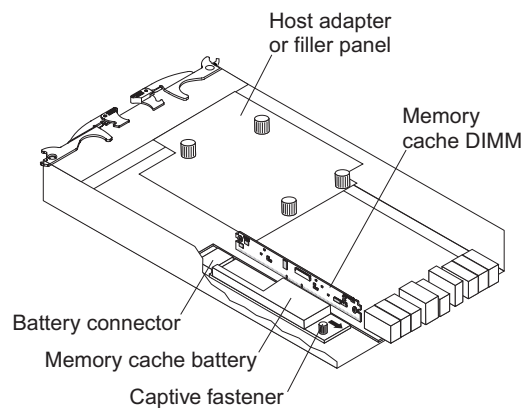


Figure 6. Cache battery and memory cache DIMM locations

The battery chargers in the power supplies perform a battery learn test when the storage subsystem is started for the first time and on a regularly scheduled interval thereafter. Data caching starts after the battery tests are completed.

The condition of the battery is indicated by an LED on the rear of the controller (see “Controller LEDs” on page 74 for the location of the battery fault LED and conditions that the LED indicates). You can also check the status of the battery using the Storage Manager client software.

## Environmental Service Modules (ESMs)

The DCS3700 has two hot-swappable and redundant ESM units. The ESMs are located at the back of the DCS3700 expansion enclosure. The ESM in SBB A is called ESM A, while the ESM in SBB B is called ESM B. One ESM continues to operate if the other ESM fails.

The ESMs contain the storage expansion enclosure control logic, interface ports, and LEDs. Each ESM has two 6Gbps x4 SAS IN ports and a single 6Gbps x4 SAS OUT port. The SAS IN ports are used to connect the ESM to a RAID controller or another ESM. The SAS OUT port is used to cascade that ESM to another enclosure. The use of both ports on each ESM results in a redundant drive connection.

Figure 7 shows the location of the SAS IN and OUT ports on the ESMs.

The DCS3700 ESMs support automatic ESM firmware synchronization. This function allows a new ESM with a different level of ESM firmware to be automatically synchronized with the ESM firmware version in the existing ESM in the enclosure. To enable automatic ESM firmware synchronization:

1. Verify that the DS Storage Manager Event Monitor is installed and running.
2. Verify that the storage subsystem attached is defined in the Enterprise Management window of the DS Storage Manager client (SMclient).

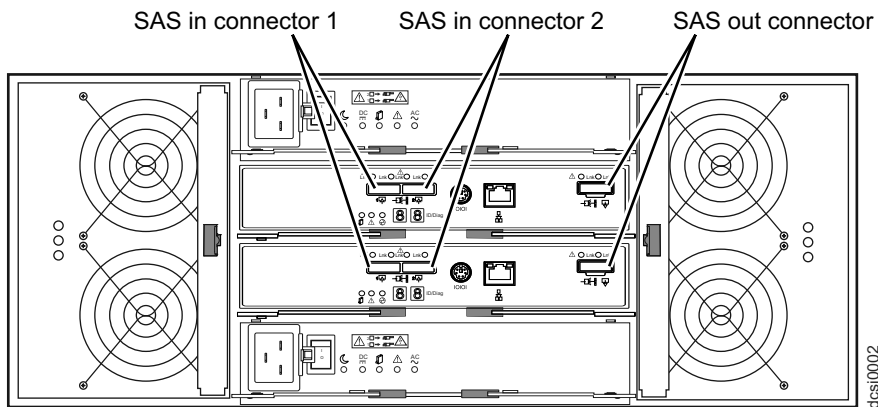


Figure 7. ESM SAS port locations

## Enclosure ID

Each controller and ESM contains two seven-segment numeric display LEDs. These are used to provide the enclosure identification but also they are used to provide diagnostic data.

The two digits that comprise the enclosure ID are referred to as x10 and x1 digits. The enclosure ID provides a unique identifier for each enclosure in the storage subsystem.

The storage management software automatically sets the enclosure ID for each controller. You can only change the enclosure ID setting through the Storage Manager software. There are no switches on the enclosure to manually set the enclosure ID. Both controllers or ESMs in an enclosure have enclosure IDs that are identical under normal operating conditions.

Figure 8 on page 13 shows the seven-segment numeric display on the storage expansion enclosure. For more information regarding the enclosure ID, see “Enclosure ID Settings” on page 42 or “Seven-segment numeric display LEDs” on page 79.

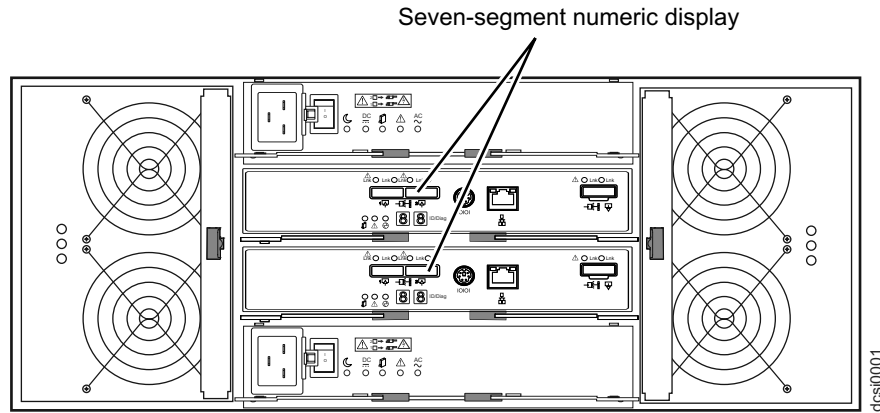


Figure 8. Location of seven-segment numeric display on ESM

## Power supplies

The storage expansion enclosure has two removable power supplies. The power supplies provide power to the internal components. If one power supply is turned off or malfunctions, the other power supply maintains electrical power to the storage expansion enclosure.

**Note:** To preserve the optimal airflow, do not remove a failed power supply FRU from the DCS3700 chassis until you are ready to replace it with a new FRU.

Figure 9 shows the power supply controls, LEDs, and connectors.

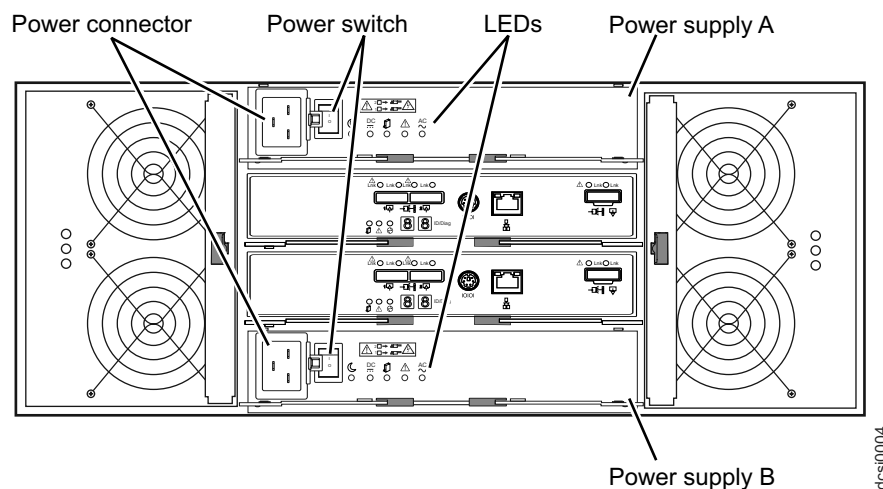


Figure 9. Power supply components

## Fan assemblies

The storage expansion enclosure has two removable fan assemblies. Each fan assembly contains two fans. The fan assemblies pull air through the enclosure from front to back across the drives. The fans provide redundant cooling, which means that if one of the fans fails, the remaining fan assembly continues to provide sufficient cooling to operate the storage expansion enclosure. The fan will operate at maximum speed under the following conditions:

- During the first few minutes after power is applied to the DCS3700 enclosure

- When one of the disk drawers is pulled out or not in the closed/latched position
- When one of the fan assemblies has failed or is removed from the enclosure

**Note:** To preserve the optimal airflow, do not remove a failed fan assembly FRU from the chassis until you are ready to replace it with a new FRU.

Figure 10 shows the location of the fan assemblies. See “Fan assembly LEDs” on page 76 for information about the fan assembly status LEDs.

**Note:** Although both fan assemblies (left and right) are identical, they are seated in the enclosure in opposite orientations. If the fan assembly cannot be fully inserted in the fan assembly bay, rotate it 180 degrees and reinsert it. In addition, there are notches on the top and bottom of the fan assembly bay. Make sure that the slits on the top and bottom of the fan assembly line up with these two notches before the fan assembly is fully inserted in the fan bay.

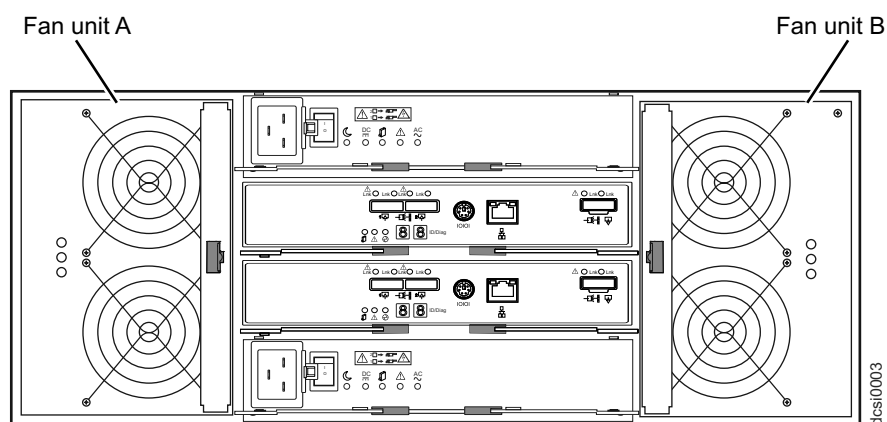


Figure 10. Fan assembly components

Figure 11 shows fan assembly airflow through the storage expansion enclosure.

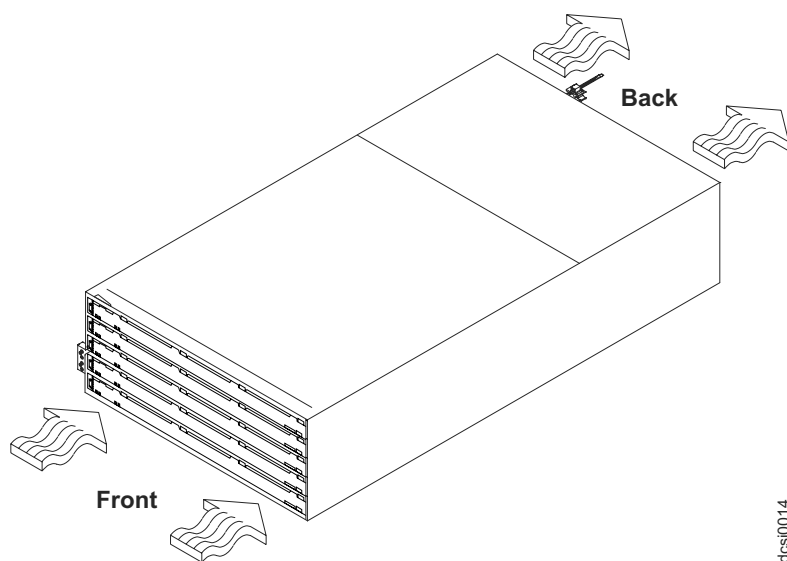


Figure 11. Storage expansion enclosure airflow

## Small Form-Factor Pluggable (SFP) modules

The DCS3700 storage system controllers support the optional 8Gbps fibre channel host interface card. The fibre channel host interface card contains four host port interface connectors. You must install a Small Form-factor Pluggable (SFP) module in each interface connector on the controller where a fibre optic cable is to be installed.

Figure 12 shows an SFP module with fibre optic cable.

**Note:** The SFP module shown might look different from those shipped with your fibre channel host daughter card option. The differences does not affect transceiver performance.

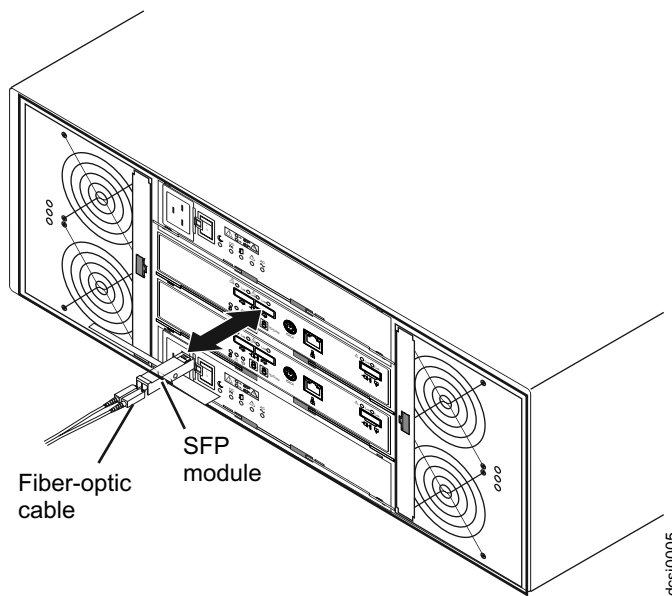


Figure 12. SFP module and fibre optic cable

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## Software and hardware compatibility and upgrades

The latest DCS3700 controller firmware and NVSRAM, expansion enclosure ESM firmware, and the drive firmware must be installed to ensure optimal functionality, manageability, and reliability.

Unless stated otherwise, you can find the latest publications, firmware, and host software at [www.ibm.com/support/entry/portal](http://www.ibm.com/support/entry/portal).

## Software and firmware support code upgrades

To enable support for the DCS3700, you must ensure that your system's software and firmware are at the latest levels. Table 2 shows the minimum supported software and firmware levels.

Table 2. Minimum DCS3700 software and firmware levels

Software/firmware	Level
DS Storage Manager software	10.77.xx.xx or higher
DCS3700 controller firmware and NVSRAM	07.77.18.00 and N1818D37R0777V05 or higher
ESM firmware	0343

Table 2. Minimum DCS3700 software and firmware levels (continued)

Software/firmware	Level
Drive firmware	You can find the latest software and firmware at the IBM System Storage Support Web site:  <a href="http://www.ibm.com/servers/storage/support/disk/">www.ibm.com/servers/storage/support/disk/</a>

To find the latest Storage Manager software, controller firmware, NVSRAM, ESM firmware, and drive firmware, check the firmware readme files.

See the *IBM System Storage DS® Storage Manager Version 10 Installation and Host Support Guide* for your operating system for instructions that describe how to install the DS Storage Manager host software.

If you need further assistance, please contact your IBM reseller or IBM representative to find out which controller firmware to use for DCS3700 attachment.

For more information about the DCS3700 parts replacement procedure and problem troubleshooting, please refer to “Solving problems” on page 129.

## Determining firmware levels

There are two different methods to determine the DCS3700 storage system and DCS3700 expansion enclosure firmware versions. Each method uses the DS Storage Manager client that manages the DCS3700 storage subsystem with the attached storage expansion enclosure.

### Method One:

Go to the Subsystem Management window and select **View → Storage Subsystem Profile**. When the Storage Subsystem Profile window opens, select the **All** tab and scroll through Profile For Storage Subsystem to locate the following information.

**Note:** The Profile For Storage Subsystem windows contains all the profile information for the entire subsystem. Therefore, it may be necessary to scroll through a large amount of information to locate the firmware version numbers.

#### DSC3700 storage system

- NVSRAM version
- Firmware version

#### Drives

- Drive Firmware version

#### DCS3700 expansion unit

- ESM card firmware version

### Method Two:

Complete the appropriate procedure to obtain the specified firmware version.

#### To obtain the controller firmware version:

Click on the Controller icon in the left pane of the Physical View tab of the Subsystem Management window. The properties of the controller will be displayed in the right pane of the Physical view tab.

You must perform this step for each individual controller.

**To obtain the drive firmware version:**

Click on the drive icon in the left pane of the Physical View tab of the Subsystem Management window. The properties of the drive will be displayed in the right pane of the Physical view tab.

You must perform this step for each individual drive.

**To obtain the ESM and drive enclosure component firmware versions:**

1. In the left pane of the Physical View tab in the Subsystem Management window, click the Drive Enclosure Component icon for the enclosure that you want to check the firmware version. The Drive Enclosure Component Information window opens.
2. Click the ESM icon in the left pane. The ESM information displays in the right pane of the Drive Enclosure Component Information window.
3. Locate the firmware version of each ESM in the drive enclosure.

---

## Specifications

This section provides site specifications for the storage expansion enclosure. Before installing a storage expansion enclosure, you must either verify that your planned installation site meets these requirements, or prepare the site so that it does meet these requirements. Preparations might involve meeting area requirements, environmental requirements, and electrical requirements for storage expansion enclosure installation, service, and operation.

### Area requirements

The floor space at the installation site must provide enough strength to support the weight of the storage subsystem and associated equipment; sufficient space to install, operate, and service the storage subsystem; and sufficient ventilation to provide a free flow of air to the unit.

### Dimensions

The DCS3700 conforms to the 19-inch rack standard. Table 3 shows the dimensions of the DCS3700, with all components installed including the bezel.

*Table 3. DCS3700 storage expansion enclosure dimensions*

Height	Width	Depth <sup>1</sup>
6.93 in. (17.6 cm)	19 in. (48.3 cm)	34.1 in. (86.6 cm)

<sup>1</sup> Enclosure full depth including a cable bend radius of 2.7 inches is 36.8 inches (93.5 cm).

### Weight

The total weight of the storage enclosure depends on the configuration of the unit. Table 4 lists the maximum, empty, and shipping weights for the DCS3700 in different configurations. Table 5 on page 18 lists the weight of each component.

*Table 4. DCS3700 weights*

Unit	Weight		
	Maximum <sup>1</sup>	Empty <sup>2</sup>	Shipping <sup>3</sup>
DCS3700 storage system	102.1 kg (225.2 lb)	57.5 kg (126.8 lb)	100 kg (220 lb)
DCS3700 expansion unit	101.0 kg (222.6 lb)	56.3 kg (124.2 lb)	

<sup>1</sup> Chassis with all FRUs and 60 drives.

<sup>2</sup> Chassis without drives but with midplane and all FRUs.

<sup>3</sup> Includes the DCS3700, support rails, power cords, publications, 20 drives, shipping material, and the pallet.

Table 5. DCS3700 component weights

Unit	Weight
DCS3700 storage expansion enclosure with midplane only (all FRUs removed)	19.5 kg (43 lb)
Drive drawer (includes cable chains but no drives)	5.2 kg (11.5 lb)
3.5in Disk drive module	0.7 kg (1.6 lb)
Power supply	2.5 kg (5.5 lb)
Fan assembly	1.1 kg (2.4 lb)
ESM	1.5 kg (3.4 lb)
Controller with cache battery backup, no HIC	2.0 kg (4.5 lb)

## Shipping dimensions

The DCS3700 is shipped on a pallet. Table 6 lists shipping carton dimensions.

Table 6. DCS3700 shipping carton dimensions

Width	Depth	Height <sup>1</sup>
24 in. (61 cm)	39.75 in. (101 cm)	29.5 in. (74.9 cm)

<sup>1</sup> The height shown includes the height of the pallet.

## Environmental requirements and specifications

This section describes the environmental requirements and specifications for the storage expansion enclosure, including temperature and humidity, altitude, airflow and heat dissipation, shock and vibration requirements, and acoustic noise levels.

### Temperature and humidity

Table 7 lists the acceptable temperature and humidity ranges for the DCS3700 storage expansion enclosure when in storage or in transit.

**Note:** Substantial deviations from the suggested operating range, in either direction, if sustained for extended periods of time, will expose the unit to greater risk of failure from external causes.

Table 7. Temperature and humidity requirements for storage expansion enclosure when in storage or in transit

Condition	Parameter	Requirement
Temperature	Operating range	10° - 35° C (50° - 95° F)
	Maximum rate of change	10° C (18° F) per hour
	Storage range	-10° - 65° C (14° - 149° F)
	Maximum rate of change	15° C (27° F) per hour
	Transit range	-40° C to 65° C (-40° F to 149° F)
	Maximum rate of change	20° C (36° F) per hour
Relative humidity (no condensation)	Operating range	20% to 80%
	Storage range	10% to 90%
	Transit range	5% to 95%
	Maximum dew point	26° C (79° F)
	Maximum gradient	10% per hour



## Altitude

Table 8 lists the acceptable altitudes for operating, storing, and shipping the DCS3700.

Table 8. DCS3700 altitude ranges

Environment	Altitude
Operating	30.5 m (100 ft.) below sea level to 3000 m (9,840 ft) above sea level
Storage	30.5 m (100 ft.) below sea level to 3000 m (9,840 ft) above sea level
Transit	30.5 m (100 ft.) below sea level to 12,000 m (40,000 ft.) above sea level

## Airflow and heat dissipation

Figure 13 shows the intended airflow for the DCS3700. Allow at least 30 inches in front of the storage subsystem and at least 24 inches behind the storage subsystem for service clearance, proper ventilation, and heat dissipation.

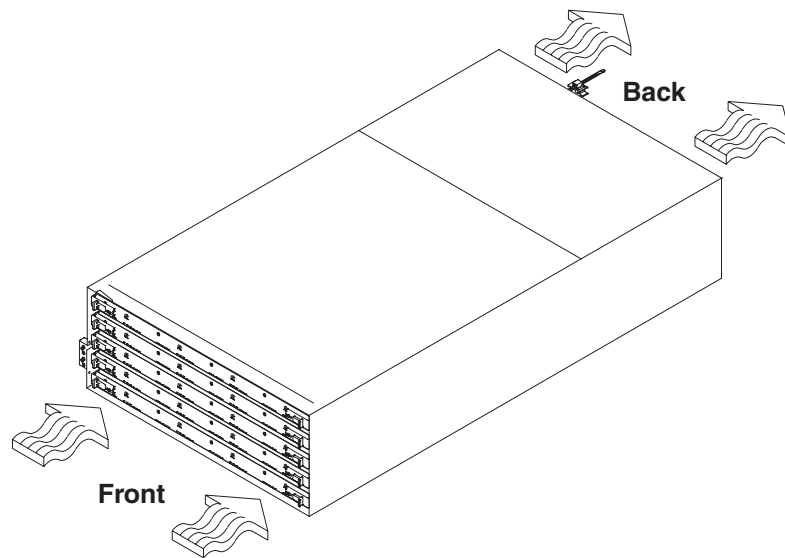


Figure 13. DCS3700 airflow

Table 9 lists the KVA, watts, and Btu calculations. These values assume the power supplies have a 88 percent efficiency and a power factor of 0.99. These tabulated power and heat dissipation values are typical for the storage subsystem. Maximum configuration units are typically operated at higher data rates, have larger random access memory (RAM) capacities, or have different host interface boards.

Table 9. DCS3700 power and heat dissipation

Parameter	KVA	Watts (ac)	Btu per hour
DCS3700 storage system	.929	896	3057
DCS3700 expansion unit	.895	802	2736

## Shock and vibration requirements

Operational shock and operational vibration requirements are shown in this section.

**Operational Shock:** The DCS3700 will be able to withstand the following shock. Subjecting the equipment to a single shock pulse with the following characteristics will simulate this level of shock:

- Velocity change = 20 inches per second
- Wave form = 1/2 Sine, 10g @5ms

**Operational Vibration (Random):** While in its normal operating position, the DCS3700 will continue operating when subjected to a random vibration test using the criteria shown in Table 10. This test uses the indicated spectral power density for 30 minutes in each of the three axes.

Table 10. Random vibration power spectral density

Hz	5	17	150	200	500
$\text{g}^2/\text{Hz}$	$9.0 \times 10^{-5}$	$3.0 \times 10^{-4}$	$3.0 \times 10^{-4}$	$9.0 \times 10^{-5}$	$9.0 \times 10^{-5}$

## Acoustic noise

Table 11 lists the maximum sound levels emitted by the storage subsystem.

Table 11. DCS3700 sound levels

Measurement	Level
Sound power (normal operation)	7.0 bels

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

## Electrical requirements

This section provides information regarding site power and wiring, storage subsystem ac power requirements, and power cord routing instructions.

Consider the following information when preparing the installation site:

- Protective ground – Site wiring must include a protective ground connection to the ac power source.

**Note:** Protective ground is also known as safety ground or chassis ground.

- Circuit overloading – Power circuits and associated circuit breakers must provide sufficient power and overload protection. To prevent possible damage to the unit, isolate its power source from large switching loads (such as air conditioning motors, elevator motors, and factory loads).
- Power failures – If a total power failure occurs, the unit automatically performs a power-up recovery sequence without operator intervention after power is restored.

**Attention:** The DCS3700 does not support 90-136V AC sources. It supports 200-240V AC sources only. Ensure that the AC input is appropriate for the DCS3700 before turning the power switches to the on position.

Table 12. DCS3700 ac power requirements

AC Power Requirements	Range
Nominal Voltage	180 to 264 VAC
Frequency (Hertz)	50 to 60 Hz
Idle Current	4.27 A <sup>a</sup>
Maximum Operating Current	4.10 A <sup>a</sup>
Maximum Surge Current	7.82 A <sup>a</sup>

<sup>a</sup>. Typical voltage: 220 V AC, 50 Hz

## Power and site wiring requirements for models with power supply and fan units

The storage expansion enclosure uses wide-ranging redundant power supplies that automatically accommodate voltages to the power source. The power supplies operate within the ranges specified in Table 12 on page 20. The power supplies meet standard voltage requirements for both domestic (inside USA) and international (outside USA) operation. They use standard industrial wiring with line-to-neutral or line-to-line power connections.

The agency voltage and current ratings for the DCS3700 storage expansion enclosure are 200 VAC - 240 VAC and 7.56 A - 6.30 A.

**Power recovery after a power failure:** After a total power failure, after normal power is restored, the storage expansion enclosure performs power-up recovery procedures automatically without operator intervention.

**Power cords and receptacles:** The DCS3700 ships with two jumper cords with IEC C19 plug on one end and IEC C14 plug on the other end that are used to connect to the rack PDU outlets. It is not shipped with the power cords that can be used to connect it directly to an electrical outlet in the destination country. You must purchase the power cords that are appropriate for use in a typical outlet in the destination country. See Appendix D, “Power cords,” on page 153 for more information.

## Heat output, airflow, and cooling

See “Airflow and heat dissipation” on page 19 for heat output, airflow, and cooling specifications.

**Note:** In general, disk subsystem reliability tends to decrease as the ambient temperature of the environment in which it is being used increases.

When racks that contain many storage expansion enclosures are to be installed together, the following requirements must be met to ensure that the storage expansion enclosures 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 and hot aisle* and is shown in Figure 14 on page 22.
- 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 storage expansion enclosures 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 storage expansion enclosures.

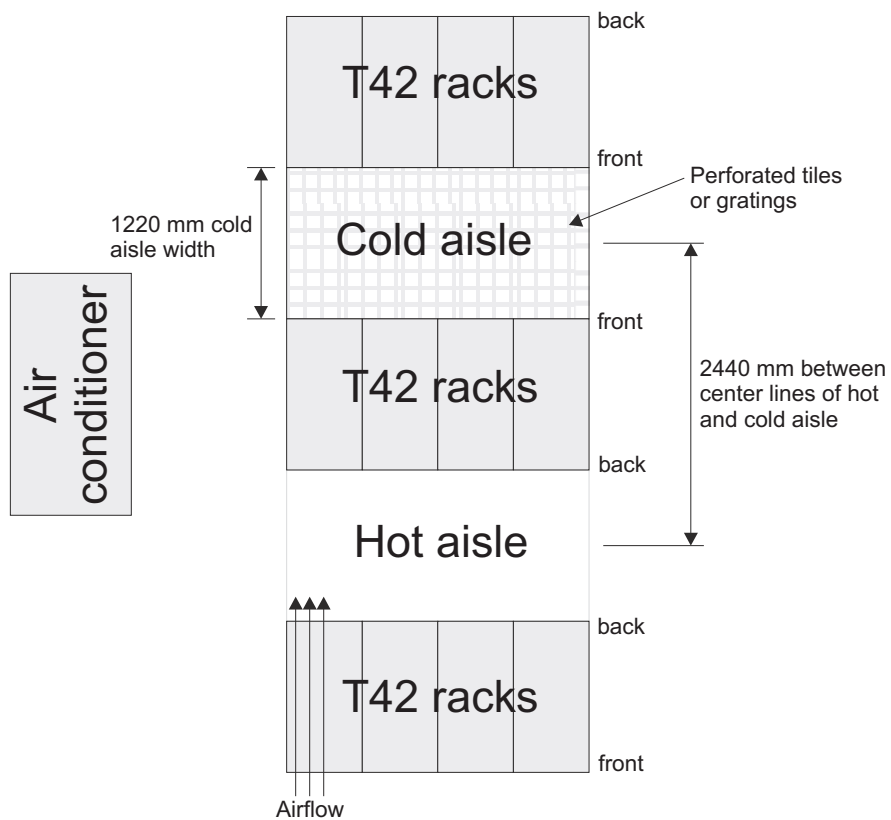


Figure 14. Example of cold aisle/hot aisle rack configuration

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## Chapter 2. Installing the DCS3700

This chapter provides the information that you need to prepare the storage enclosure for installation into a rack cabinet.

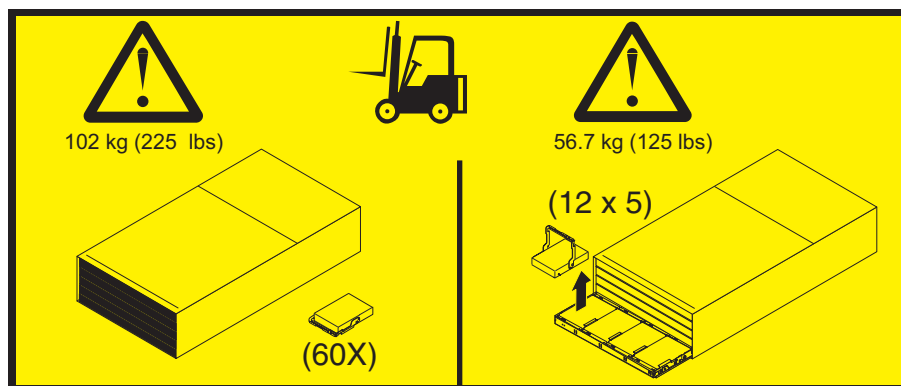
“Installation overview” provides an overview of the storage enclosure installation process. Read this overview before you begin the installation.

---

### Installation overview

This product is to be installed and serviced only by qualified IBM service representatives. The DCS3700 can be ordered pre-installed in the cabinet, or it can be added to an existing cabinet. The installation requires a minimum of two people for a safe installation.

**Attention:** Refer to “Safety” on page xi for general safety instructions and Appendix C, “Specifications for non-IBM rack installation,” on page 147 before performing any installation or service procedures.



#### CAUTION:

1. The weight of this unit in the drive-ready state (without drive modules installed) is 56.7 kg (125 lb). Fully configured (with 60 drive modules installed) the unit weighs 102.1 kg (225 lb). It takes two specially trained IBM personnel with a lifting device to safely lift this unit.
2. A fully populated DCS3700 weighs approximately 102.1 kg (225 lb). Before you install it, verify that the additional weight of the chassis does not exceed the rack's weight limit or unbalance the rack cabinet. When you calculate the additional weight, include the weights of all components that can potentially be added, to avoid overloading in the future.

### Ordering the lift tool

**Note:** The lift tool is required only when you install a DCS3700 or when you install or remove the DCS3700 from the cabinet. Make sure that the lift tool is available on location at the time of the installation. The ordering procedures for the lift tool vary depending on your location. You should direct questions about these procedures to your regional representative.

#### World trade locations

The following ordering procedures are for world trade locations:

- Order the lift tool by using the parts order system, like any other part.
- Use the following part numbers when you order: Lift tool: Part number 09P2481.
- You do not record parts usage.

- Return the lift tool to the parts center after you complete the installation or removal of the DCS3700.

## United States locations

In the United States, call UPS Logistics at 800-528-6070 to order the lift tool or visit the MTS/Test Equipment Service Center Web site on the IBM intranet at <http://pokgsa.ibm.com/~tstesc/public/> for additional information.

### Notes:

1. For the SSR branch and territory, the United States cannot order the lift tool through the parts order system. UPS Logistics are used to ship and return the lift tool. Use the following part numbers when you order: Lift tool: Part number 09P2481.
2. The MTS/Test Equipment Service Center Web site can be accessed only by IBM employees with access to the IBM intranet.

**Attention:** When you order the lift tool, you will receive an 18-inch load plate.

You must provide the following information when you order the lift tool. This information is necessary to ensure that the lift tool is delivered when you need it. Failure to provide this information might delay the completion of the order request and the shipping request. It might also result in a time and date to return the tool that is different from what you need.

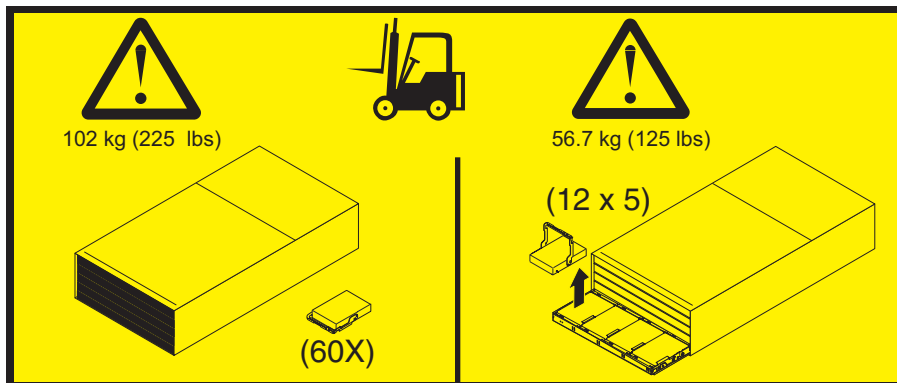
- Phone number and customer contact
- Account code: 98577
- Time and date of delivery
- Accurate destination address with zip code
- Time and date of return pickup

You must return the lift tool at the time that was scheduled with UPS Logistics. If you need to change the scheduled return time or date, contact UPS Logistics. You are responsible for ensuring that all of the paperwork and components are packed and restored in the lift tool shipping container. Make sure that the lift tool is functioning properly before you release the tool to UPS Logistics for return. You are accountable for the lift tool until UPS Logistics picks up the lift tool for return delivery to their parts storage facility. Contact your branch office tools coordinator or your region specialist if you have any questions or concerns.

## Installation sequence

The following sequence summarizes the installation steps you will perform in this chapter:

1. Prepare the installation site and the rack cabinet. Unpack the DCS3700 and other hardware from the shipping box. See “Preparing for installation” on page 26.



**Attention:**

- a. Because of the size and weight of the storage enclosure as shipped, a lift tool and two trained service technicians are required to push the enclosure out of its custom-designed package and onto the lift tool. If a lift tool is not available, see Appendix E, “Component weights,” on page 157 for additional information.
- b. Before you move or relocate a rack that contains DCS3700 storage enclosures, see “Relocating the DCS3700” on page 65 for additional information.

**Note:** For more information about how to use a lift tool, see the documentation that came with the lift tool.

2. Install the support rails in the rack. See “Installing the support rails” on page 30.
3. Install the DCS3700 storage enclosure in the rack. See “Installing the DCS3700 into a rack” on page 35.
4. Install disk drives in the DCS3700 storage enclosure. See “Installing the drives” on page 37.
5. If there are other DCS3700 storage enclosures to be installed in the same rack, repeat step 2 to step 4 for the other DCS3700 units.
6. Install the power supply cables to the DCS3700s. Make sure that the DCS3700 power supplies are connected to 240V AC sources only. See “Cabling the power supply” on page 65.
7. Cable the DCS3700 Storage system to any storage expansion enclosures. See Chapter 3, “Cabling the DCS3700,” on page 41.
8. Install the DS Storage Manager host software to manage the DCS3700 Storage system. See “Software and hardware compatibility and upgrades” on page 15 for the appropriate version. Refer to the *IBM System Storage DS Storage Manager Version 10 Installation and Host Support Guide* for your operating system for instructions on how to install the DS Storage Manager host software.
9. Turn on the DCS3700 (if you have not done so already). See “Powering on the DCS3700” on page 68.
10. Upgrade the controller firmware. See “Finding Storage Manager software, controller firmware, and README files” on page xviii for more information.

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## 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.

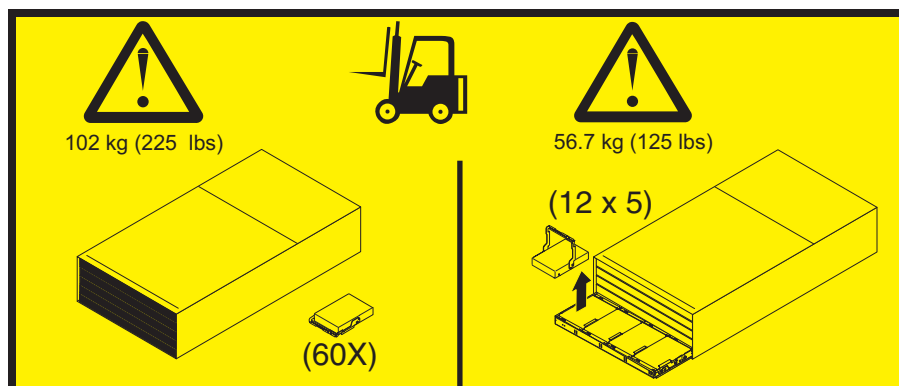
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## Preparing for installation

Before installing the storage enclosure, create a detailed plan of how this unit will be used in your storage configuration. The plan should include determining RAID levels, fallover requirements, operating systems to be used, and total storage capacity requirements.

Complete the following steps to prepare the storage enclosure for installation into a rack cabinet:

1. Prepare the site to meet all area, environmental, power, and site requirements. For more information, see “Specifications” on page 17.
2. Move the storage enclosure to the site.



### Attention:

- a. Because of the size and weight of the storage enclosure as shipped, a lift tool and two trained service technicians are required to push the enclosure out of its custom-designed package and onto the lift tool. If a lift tool is not available, see Appendix E, “Component weights,” on page 157 for additional information.
- b. Before you move or relocate a rack that contains DCS3700 storage enclosures, see “Relocating the DCS3700” on page 65 for additional information.

**Note:** For more information about how to use a lift tool, see the documentation that came with the lift tool.

3. Remove the storage enclosure from its shipping container and check the contents (see “Unpacking the shipping box”). If any items are missing, contact your IBM reseller before proceeding.
4. Verify that you have the correct version of the IBM DS Storage Manager software.
5. Continue with “Preparing the site” on page 29.

## Unpacking the shipping box

**Important:** Do not remove the storage enclosure from the shipping box until the support rails are installed in the rack cabinet. You must install the support rails in the rack cabinet before you install the storage enclosure.

The disk drive modules (DDMs) that come with the storage enclosure are packaged in a smaller box inside the shipping box. To unpack the shipping box, complete the following steps:

1. Remove the following items from the shipping box. Do not remove the DCS3700 from the shipping box at this time.
  - Six full or empty boxes of DDMs



**Note:** The DDMs are packaged ten per box. The minimum order is 20 DDMs, so at least two of the boxes are full. If you ordered less than the maximum number of 60 DDMs, one or more of the boxes are empty.

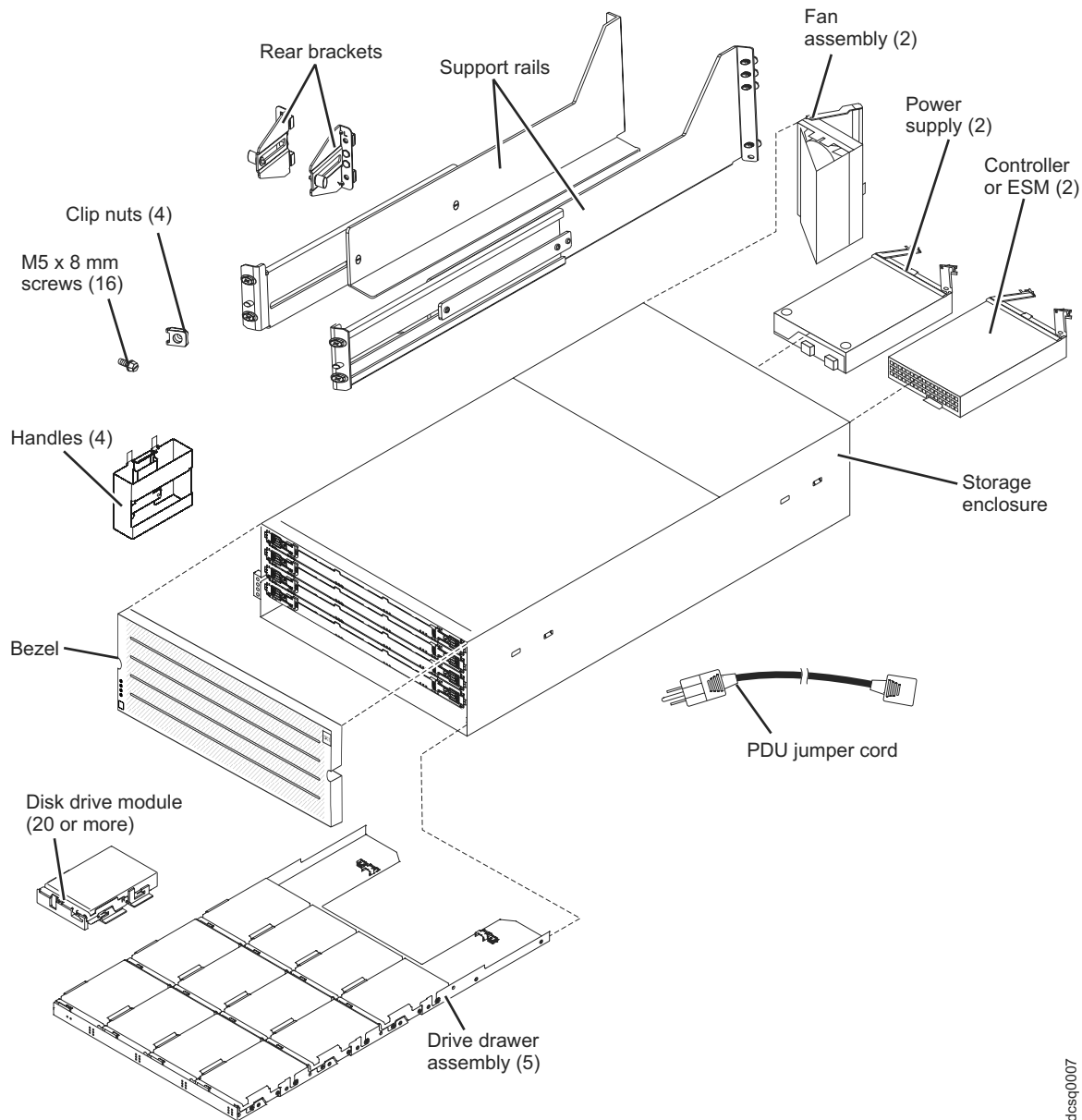
- Box containing the mounting hardware kit
  - Box containing storage enclosure handles
  - Box containing the power cords and documentation
2. Check the items in the preceding list to make sure that you received all the necessary parts. See the “Inventory list” on page 28 for the parts that are included with the storage enclosure.

## Inventory list

The following illustration and inventory list show the items that you need to install the storage enclosure in the rack cabinet. If any items are missing or damaged, contact your place of purchase.

### Notes:

1. The illustration might differ slightly from your hardware.
2. Depending on your DCS3700 order, your shipping box might contain additional materials that are not shown in the following illustration.



After you unpack the DCS3700, verify that you have the following items:

- 4U-high storage enclosure (1)
  - Drive drawer assemblies (5)
  - Fan assemblies (2)
  - Power supplies (2)
  - Controllers (2), if you ordered 1818-80C
  - ESMs (2), if you ordered 1818-80E

- Handles (4), packaged in a smaller box inside the shipping box
- DDMs (20 or more, depending on your DCS3700 order), packaged in a smaller box inside the shipping box
- Bezel (1)
- Rack-mounting hardware kit (1), packaged in a smaller box inside the shipping box, including:
  - Rails (2), right and left assembly
  - Rear brackets (2)
  - M5 black hex-head slotted screws (16)

**Note:** The screws are either preinstalled in the support rails or packaged in a plastic bag.

- Washers (8)
- Clip nuts (4)

**Important:** The DCS3700 does not ship with region-specific ac power cords. You must obtain the IBM-approved power cords for your region. See Appendix D, “Power cords,” on page 153 for more information.

## Tools

Before you install the storage enclosure, the installation area must have an Internet connection, and you must have the following tools:

- A cart to hold the storage enclosure and its components
- Labels for the cable connectors
- A medium flat-blade screwdriver
- A No. 2 Phillips screwdriver or an M5 hex driver
- Anti-static protection

## Tools and hardware required

Gather the tools and equipment you will need for installation. These might include the following:

- A portable mechanized lift
- A number 2 Phillips screwdriver
- An M5 hex nut driver
- A medium flat-blade screwdriver
- Antistatic protection (such as a grounding wrist strap)
- The rack power jumper cords that are shipped with the storage enclosure
- Fibre channel (FC) and Ethernet interface cables and cable straps
- SFP modules
- Rack-mounting hardware that ships with the storage enclosure

## Preparing the site

This section lists the floor space requirements and weight information for the storage enclosure. For information on interface cables and connections, see Chapter 3, “Cabling the DCS3700,” on page 41.

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

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

**Weight:** The storage enclosure total weight depends on the number of components that are installed. A fully configured storage enclosure with two power supplies, two fan assemblies, two controllers or ESMs, and 60 hard disk drives installed weighs up to 225 lbs (102.1 kg). See Appendix E, “Component weights,” on page 157 for additional information.

**Other:** Consider the following important preparation activities:

- Install uninterruptible power supply (UPS) devices.
- Install host bus adapters (HBAs), switches, or other devices, if applicable.
- Route interface cables from the hosts or switches to the installation area.
- Route main power cords to the installation area.

Continue with “Preparing the rack.”

## Preparing the rack

**Important:** Before you install the storage enclosure in a rack, keep in mind the following considerations:

- When DCS3700 enclosures are to be plant or field integrated into the IBM racks, the rack must be configured with PDU power cords rated for 240 volt electrical service.
- IBM does not support the ruggedized rack feature for the 2101-200 rack when it is used with the DCS3700. The DCS3700 will not fit in the 2101-200 rack if the ruggedized rack feature is installed.
- Do not install the DCS3700 above EIA Unit position 32 in any rack. Installing the DCS3700 above U position 32 requires a ladder and is not supported.
- If you are using a non-IBM rack or cabinet, review the information in Appendix C, “Specifications for non-IBM rack installation,” on page 147.
- Do not extend more than one device out of the rack cabinet at the same time.
- 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 storage enclosure to a properly grounded outlet.

Complete the following steps to prepare the rack before you install the storage enclosure:

1. Move, unpack, and level the rack at the installation site (if needed).
2. Remove the external rack panels.
3. If necessary, stop all I/O activity to the devices in the rack.
4. If necessary, turn off all drive enclosure and rack power. Disconnect existing power, network, and other external cables.
5. Install any additional interface cables and power cables.

After you have completed these steps, continue with “Installing the support rails.”

---

## Installing the support rails

**Note:** Duplicate copies of the rack mounting templates are provided in Appendix B, “Rack mounting template,” on page 143. If you want to tear out the templates from this document for easier use, use the copies in Appendix B, “Rack mounting template,” on page 143 rather than the copies provided in this section.

Use the following templates (Figure 15 on page 31 and Figure 16 on page 32) to identify the proper locations for inserting M5 screws when mounting the support rails and DCS3700 to a rack. The locations for the M5 screws are highlighted in the templates.

The DCS3700 is 4U 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 mounting holes that are shown in the following templates are round. The holes in your rack might be round, square, or threaded.

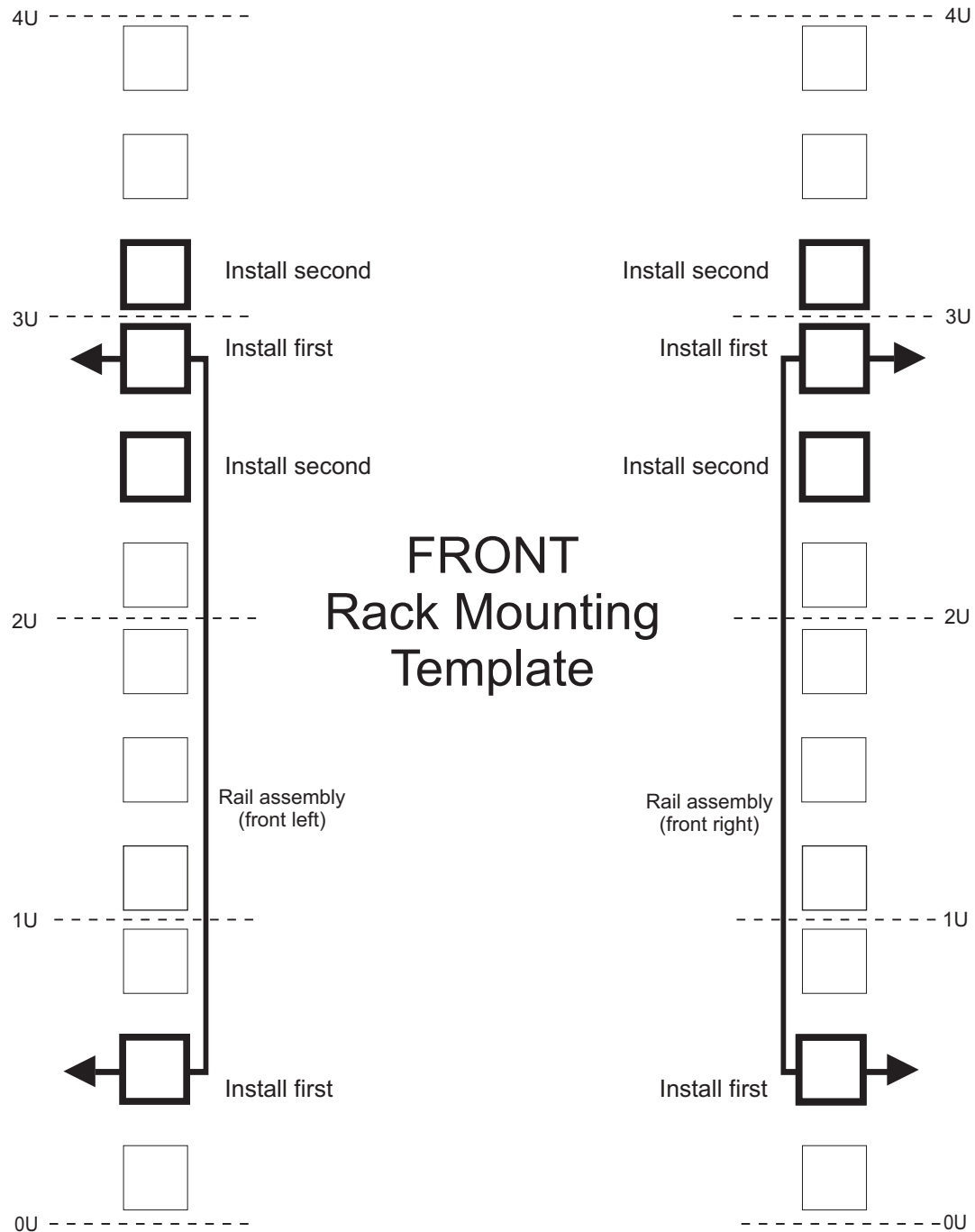


Figure 15. Front rack mounting template

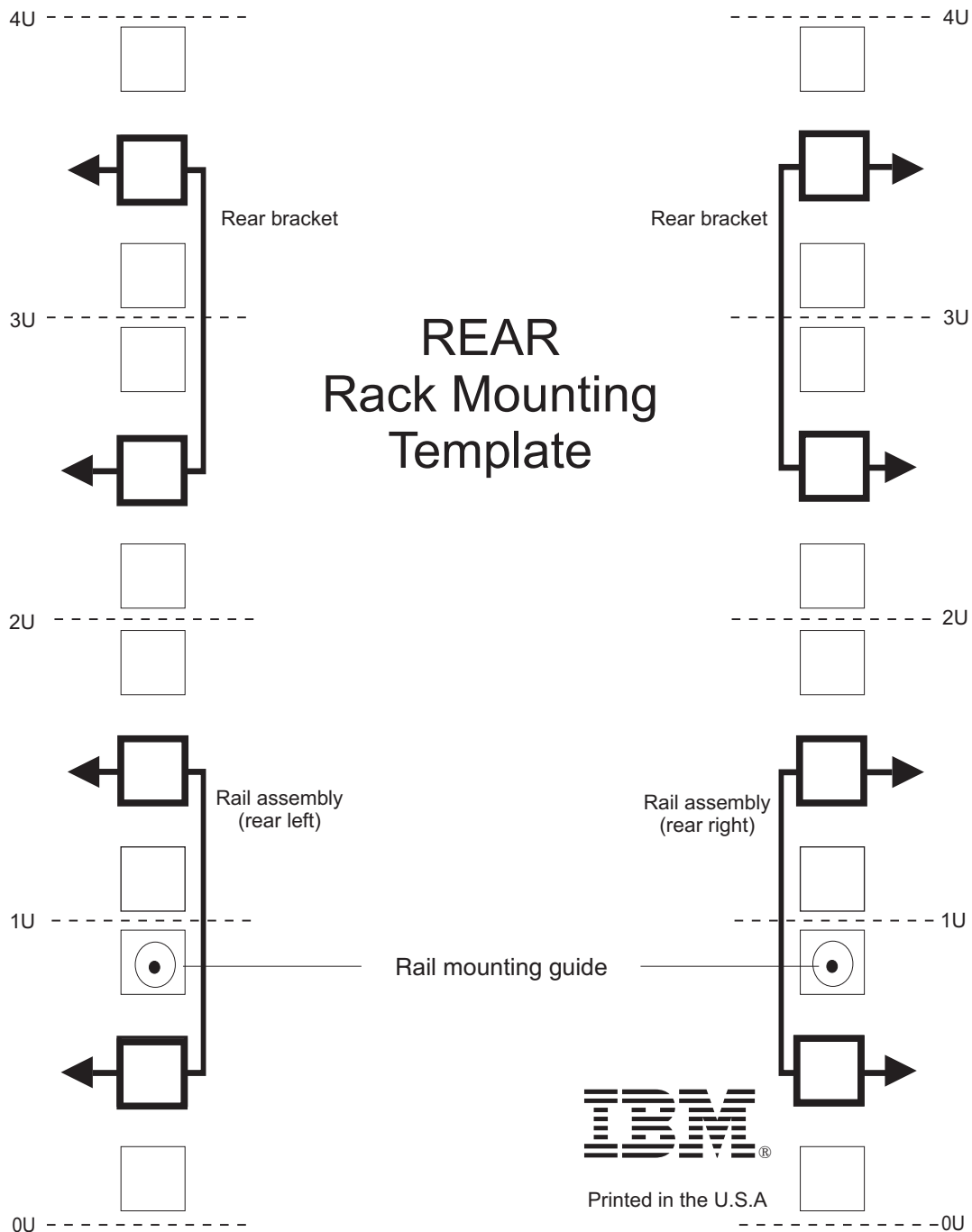


Figure 16. Rear rack mounting template

Before installing the DCS3700 in a rack, you must install the rails and rack-mounting hardware that come with your storage enclosure. The DCS3700 requires an Electronic Industries Association (EIA) 310-D Type A 19-inch rack cabinet. The distance between EIA rails, from the front to the rear of the rack, is 76 cm (30 in.) minimum and 81.28 cm (32 in.) maximum. This rack conforms to the EIA standard. Where you place the support rails in the rack depends on where you intend to position the storage enclosure.

Use the front and rear rack-mounting templates in Figure 15 on page 31 and Figure 16 to align the support rails and rear brackets with the correct rack holes. If the support rails will be installed above an

existing storage subsystem or storage enclosure, position the DCS3700 support rails directly above it. If the support rails will be installed below an existing storage subsystem or storage enclosure, allow 178 mm (7 in.) of vertical clearance for the DCS3700.

**Notes:**

1. For proper weight distribution, install the support rails as low in the rack cabinet as possible.
2. The rack cabinet must have a minimum depth of 100 cm (40 in.).
3. If you are using a non-IBM rack or cabinet, review the information in Appendix C, "Specifications for non-IBM rack installation," on page 147.

To install the left and right support rails in the rack cabinet, complete the following steps.

1. Make sure that the rack has already been installed.
2. Make sure that a stabilizer has been attached correctly to the bottom front of the rack to prevent the rack from tipping forward while the storage enclosure is being installed.

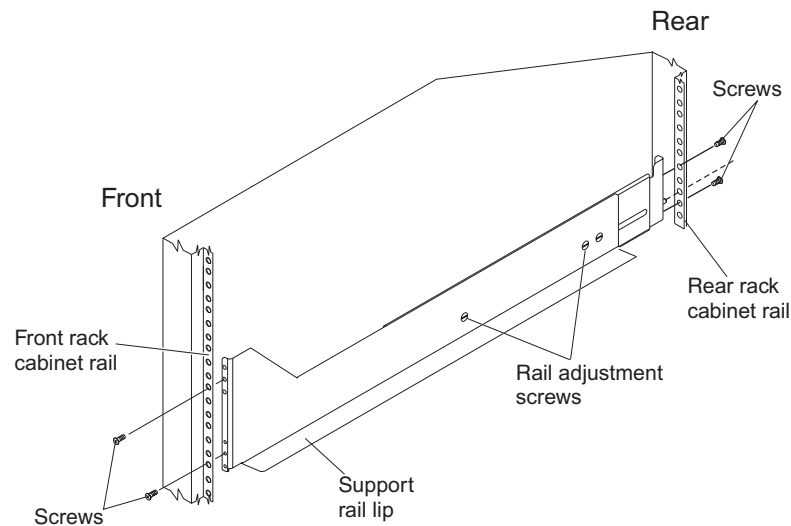
Refer to the installation and service guide, or equivalent, for the rack as required.

3. Locate the two support rails, eight M5 screws, and eight washers that are supplied with the storage enclosure.

**Note:** The screws and washers might already be attached to the support rails. If so, remove them from the support rails.

4. Starting with the left support rail, loosen the two rail adjustment screws with a medium flat-blade screwdriver. The adjustment screws are used to lock the support rails at a certain length.

**Note:** The support rails are not marked as left or right. However, each rail can be mounted correctly on only one side of the rack cabinet. The rails should be mounted with the alignment pin at the rear of the rack.



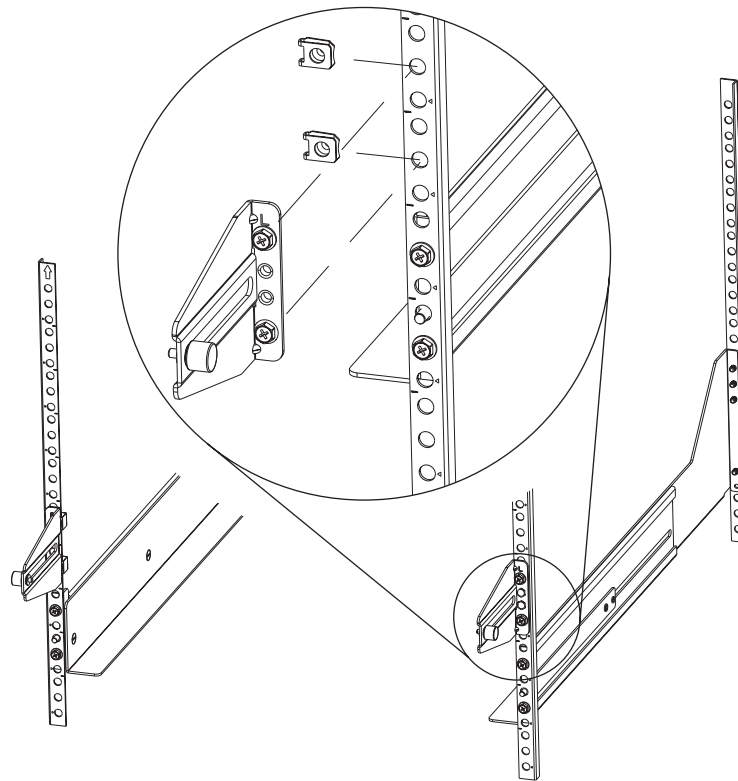
5. Hold the front of the left support rail against the inside of the front rack cabinet support flange, and extend the rear of the support rail until it makes contact with the rear rack cabinet support flange. The alignment pins at the rear of the support rail slide into the mounting holes at the rear of the rack cabinet. The wider end of the support rail must be positioned at the front of the rack cabinet.
6. From the front of the rack cabinet, with the support-rail flanges positioned inside the rack cabinet support rail assemblies, insert two M5 screws with washers through the front of the cabinet and screw them into the support rail front flange. Make sure that you use a washer when you install an M5 screw through a square hole on a rack-mounting flange.

**Attention:** Make sure that the screws are tight enough to support the weight of the storage enclosure, but do not completely tighten the screws yet.

7. Make sure that the holes in the rail above and below the top mounting screw are visible through the holes of the rack flange and tighten the two M5 screws to secure the front of the rail to the rack flange.
8. From the rear of the rack cabinet, insert two M5 screws with washers through the rear of the cabinet and screw them into the support rail rear flange.
9. Tighten the two rail adjustment screws with a medium flat-blade screwdriver.
10. Repeat steps 4 on page 33 through 9 for the right support rail.

**Note:** Because the mounting holes on the rack are not always the same size as the mounting screws, the lip of each of the support rails might not line up evenly. Make minor adjustments as needed to make sure that the lip of the left and right support rails are lined up evenly on the racks. Failure to do so will cause the storage enclosure to fit unevenly in the rack.

11. Locate the two rear brackets, four M5 screws, four washers, and four clip nuts that are supplied with the storage enclosure.
12. Install the rear brackets at the rear of the rack as shown in the following illustration, using the M5 screws, washers, and clip nuts to secure the brackets to the rack mounting holes. Do not tighten the screws until the DCS3700 is installed in the rack (see 8 on page 37).



13. Continue with “Installing the DCS3700 into a rack” on page 35.

---

## Installing and removing the handles

Install the handles on the storage enclosure before you move the unit onto the lift tool. After you install the storage enclosure in the rack cabinet and remove the handles, store the handles for future use.

### Installing the handles

Complete the following steps to install the handles on the storage enclosure:

1. Locate the box of handles.

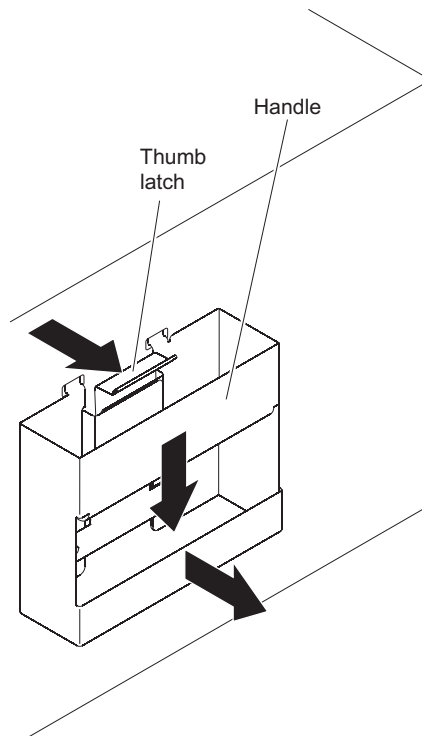


2. To install a handle on the storage enclosure, place notch at the bottom of the handle in the opening in the storage enclosure chassis, and push the handle in and up until the latch at the top of the handle secures the handle to the chassis.
3. Repeat step 2 for the three remaining handles.

## Removing the handles

Before you install the storage enclosure completely into a rack cabinet, you must remove the handles. Complete the following steps to remove the handles from the storage enclosure:

1. To remove a handle to the storage enclosure, release the latch with your thumb and pull down and away from the unit.
2. Repeat step 1 for the three remaining handles.



3. Store the handles for future use.

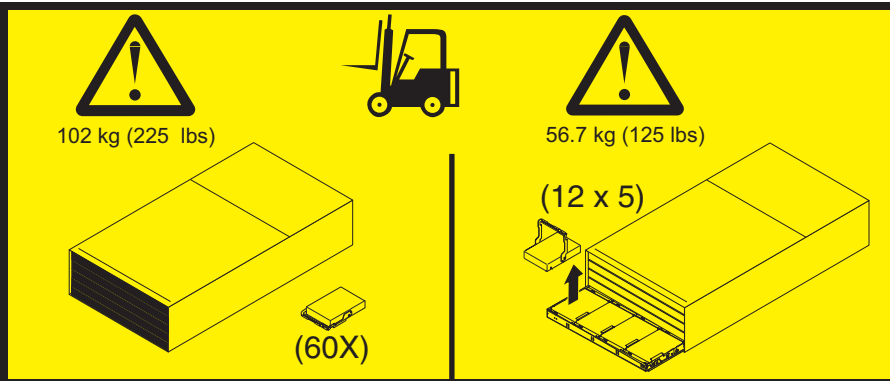
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## Installing the DCS3700 into a rack

To install the storage enclosure, complete the following steps.

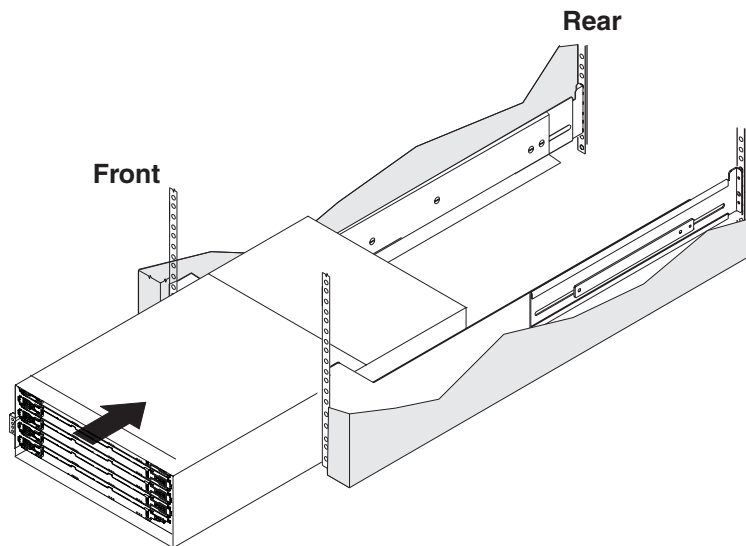
**Note:** For more information about how to use a lift tool, see the documentation that came with the lift tool.

1. Prepare the storage enclosure for installation:
  - a. Position the lift tool so that it is facing one side of the shipping box.
  - b. Remove the foam shipping material from the sides and ends of the storage enclosure.
  - c. If necessary, cut away sides of the shipping box so that the lift tool has access to the storage enclosure.
  - d. Open the plastic bag and tuck it under the storage enclosure. The plastic bag reduces friction and makes it easier to slide the unit off of the shipping box onto the lift tool, and off of the lift tool and into the rack cabinet.
  - e. Install the four handles on the sides of the storage enclosure. See "Installing and removing the handles" on page 34 for detailed instructions.

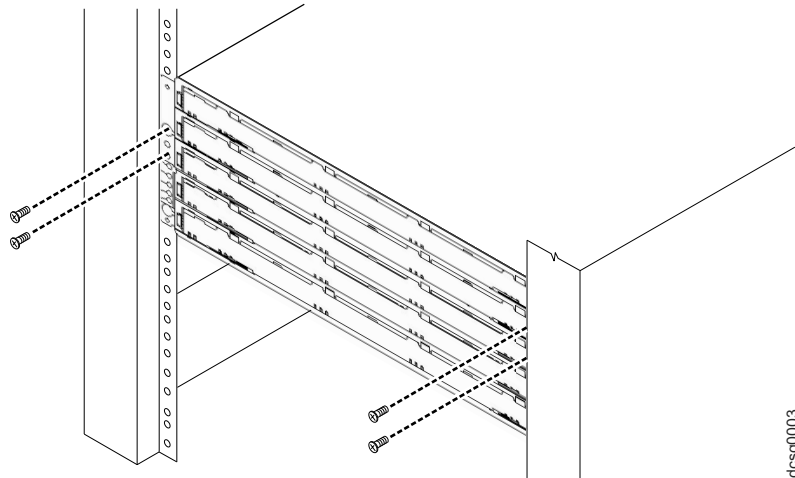


**Attention:**

- a. Because of the size and weight of the storage enclosure as shipped, a lift tool and a minimum of two trained service technicians are required to push the enclosure out of its custom-designed package and onto the lift tool. For more information about the lift tool, see “Installation overview” on page 23.
  - b. Before you move or relocate a rack that contains DCS3700 storage enclosures, see “Relocating the DCS3700” on page 65 for additional information.
2. With the help of a lift tool and a minimum of two trained service technicians, or a lift tool and professional movers, slide the storage enclosure off of the side of the shipping box and onto the lift tool. Align it in front of the rack.
  3. Put the rear edge of the storage enclosure on the support rails.
  4. Remove the two handles (one on each side) at the rear of the storage enclosure. Do not remove the front handles on both sides of the unit.
  5. Slide the storage enclosure halfway into the rack and remove the two handles (one on each side) at the front of the unit.



6. Install and tighten two M5 screws on each side of the rack, above and below the top M5 screws, in the front of the storage enclosure to secure the storage expansion .



dcsg0003

7. Turn the rear-bracket thumbscrews to attach the rear brackets to the sides of the storage enclosure. The screw holes are located about 51 mm (2 in.) from the rack flange.

**Note:** To align the thumbscrews with the holes in the unit, you might need to loosen the screws that attach the rear brackets to the rack cabinet.

8. Tighten all of the M5 screws to secure the rear bracket to the rack cabinet.
9. Continue with "Installing the drives."

---

## Installing the drives

### Attention:

1. **Potential damage to DDMs** - Repeatedly turning the power off and on without waiting for the DDMs to spin down can damage them. Always wait at least 90 seconds from when you turn off the power until you turn it on again.
2. The installation order within each drawer is from left to right in rows. Slots 1, 4, 7 and 10 must have a drive installed in these locations to make sure there is sufficient air flow to the drives (see Figure 17 on page 38). To verify these slots, consult the overlay on the front of each of the five drive drawers. Make sure the four drives in each row are adjacent to each other. The long edge of each drive should touch the drive next to it. To maintain a uniform airflow across all drive drawers, the storage enclosure must be configured with a minimum of 20 drives, with four drives in the front row of each of the five drive drawers.

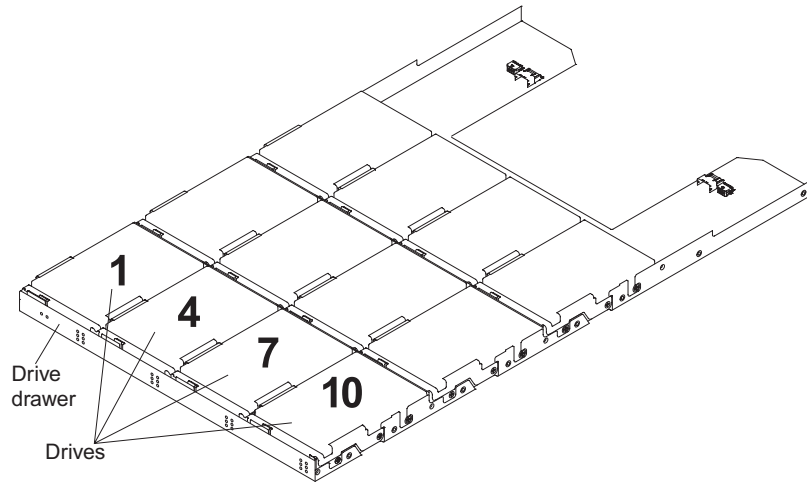
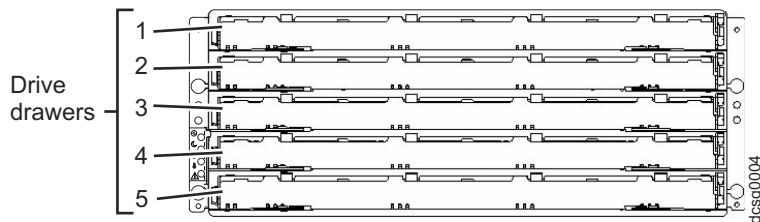


Figure 17. DCS3700 drive drawer with labeled disk drives

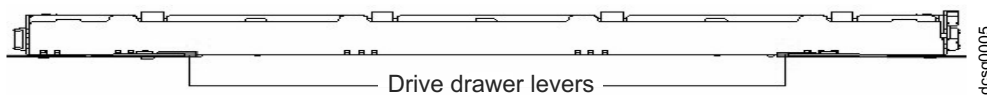
**Notes:**

1. The drive drawers are preinstalled in the DCS3700, but the DDMs are shipped separately from the drive drawers.
2. Make sure that you install the storage enclosure in the rack cabinet before you install DDMs in the storage enclosure.

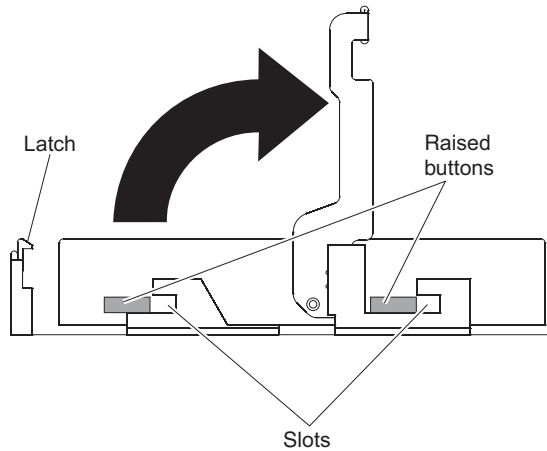


To install the DDMs in the drive drawers, complete the following steps:

1. Open the two release levers on the drawer as shown in the illustration. Starting with the top drive drawer in the storage enclosure, pull the levers on each side of the drawer out and cam away from the chassis to release the drawer.



2. With the release levers fully extended, slide the drawer out until it is fully extended, but do not remove it from the enclosure.
3. Starting with the first DDM, raise the DDM handle to the vertical position.



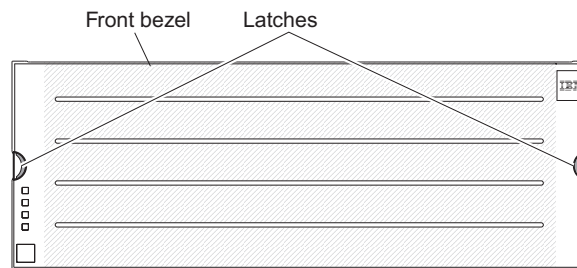
4. Align the raised buttons on the sides with the matching slots in the DDM channel on the drawer. Lower the DDM down onto the drawer, and rotate the DDM handle until the DDM snaps into place under the DDM release lever.

**Notes:**

- a. If the DDM does not seem not fully seated into the drive connector on the disk drawer, apply downward pressure to the rear of the drive as you install it.
  - b. If the storage enclosure is turned on, you must wait at least 90 seconds after you install each DDM in the drive drawer. Otherwise, the storage enclosure might not recognize the new DDM, recognize the DDM as failed, or recognize the drive as incompatible. If this happens, unlatch the DDM, wait 90 seconds, and latch the DDM again.
5. Install the other DDMs in rows from left to right until the drive drawer has a minimum of four DDMs in the front row of the drive drawer.
  6. Push the drive drawer into the storage enclosure until it clicks and close the levers on each side of the drawer.

**Attention:** Make sure you push both levers back against the drive drawer completely so that the drive drawer is closed. If the drive drawer is not completely closed, excess airflow through the unit might cause damage to the DDMs. If the drive drawer is not completely closed, you will not be able to open another drawer. If you try to force open another drawer, both drawers might be damaged.

7. Repeat steps 1 on page 38 through 6 for each drive drawer in the configuration.
8. Position the bezel in front of the storage enclosure as shown in the following illustration.



9. Align the tabs on the top and bottom of the bezel with the slots on the front of the storage enclosure, and align the pins on the side of the bezel with the holes in the storage enclosure. Push the bezel into the front of the unit until the latches on both sides of the bezel lock it in place.
10. Continue with "Cabling the DCS3700 Storage System" on page 41.



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## Chapter 3. Cabling the DCS3700

This chapter addresses the following cabling and configuration topics:

- “Enclosure ID Settings” on page 42
- “Cabling the DCS3700 Storage System”
- “Installing SFP modules” on page 44
- “Removing SFP modules” on page 46
- “Handling fibre-optic cables” on page 47
- “Using LC-LC Fibre Channel cables” on page 48
- “Cabling the DCS3700 expansion enclosure” on page 51
- “Cabling the power supply” on page 65

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### Cabling the DCS3700 Storage System

The section provides information and instructions for cabling the DCS3700 storage system. After the storage subsystem is installed in its permanent location, you must cable it to hosts, expansion units, and other external devices, depending on your hardware configuration.

#### Controller connectors (with SAS host port adapters)

Figure 18 shows the optional SAS host port adapter installed in both controllers at the rear of the storage subsystem.

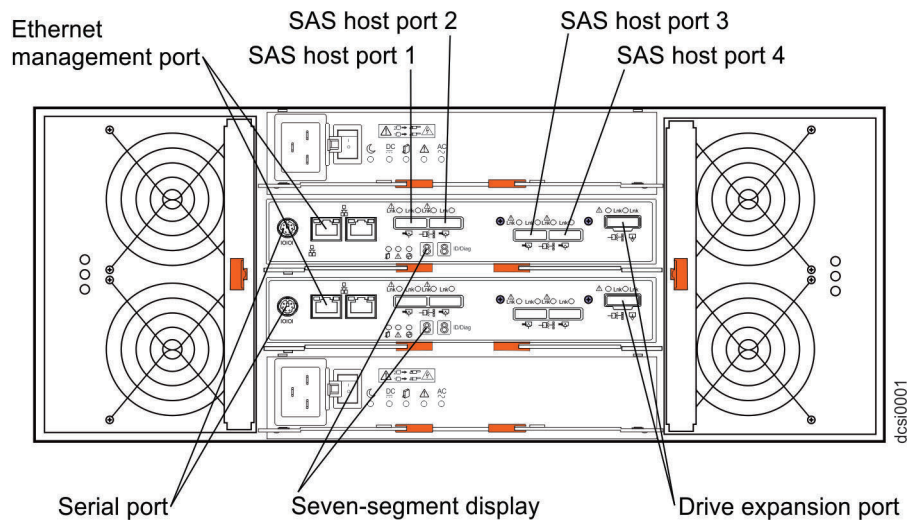


Figure 18. Dual-controller DCS3700 storage subsystem ports and controllers (with an optional SAS host port adapter)

#### SAS Host port 1, 2, 3, and 4

The DCS3700 host ports are each a x4 multilane, 6 Gbps universal mini-SAS port. Connect a SAS cable from your host system SAS host bus adapter to a host port on each controller.

#### Drive expansion port

The drive expansion port is a x4 multilane SAS port. Connect a SAS cable to this port and to a drive expansion enclosure.

## Controller connectors (with Fibre channel host port adapters)

Figure 19 shows the optional Fibre Channel host port adapter installed in both controllers at the rear of the storage subsystem.

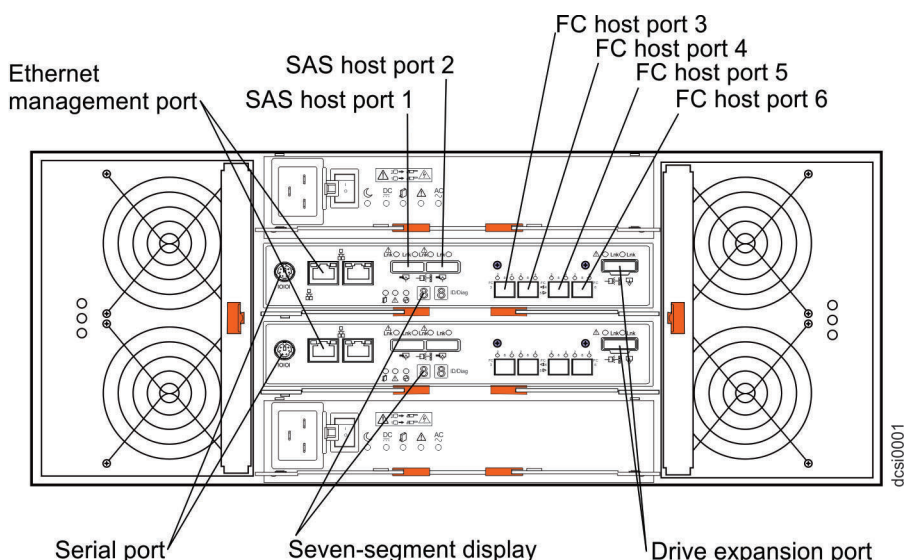


Figure 19. Dual-controller DS3700 storage subsystem ports and controllers (with an optional Fibre Channel host port adapter)

### SAS Host Ports 1 and 2

The DCS3700 SAS host ports are each a x4 multilane, 6 Gbps universal mini-SAS port. Connect a SAS cable from your host system SAS host bus adapter to a host port on each controller.

### Fibre Channel Host Ports 3, 4, 5, and 6

Each Fibre Channel host port supports a small-form-factor pluggable (SFP) transceiver and is capable of operating at 8 Gbps, 4 Gbps, or 2 Gbps.

### Drive expansion port

The drive expansion port is a x4 multilane SAS port. Connect a SAS cable to this port and to a drive expansion enclosure.

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## Enclosure ID Settings

The enclosure ID is a unique two-digit identifier for each enclosure in the storage subsystem configuration. In a dual controller or ESM configuration, both enclosure IDs are identical under normal operating conditions. Each DCS3700 storage system and DCS3700 expansion enclosure in the storage subsystem configuration must have a unique storage enclosure ID.

The controller automatically sets the enclosure ID. You can change the setting through the DS Storage Manager software, if necessary. The range of supported enclosure ID settings is 0 through 99. The enclosure ID is normally set to a value of 00 at the factory.

The enclosure ID is displayed on the seven-segment numeric display located on the back of each controller and ESM.

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## Working with SAS cables

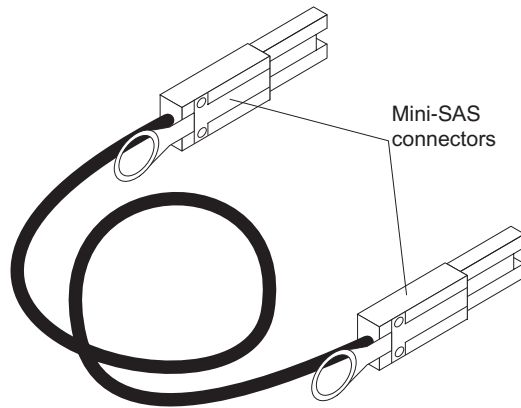
Each storage controller has up to four x4 multilane SAS host ports and a single x4 multilane SAS port for drive channel connections.



Use a 1M or 3M (1-meter or 3-meter) SAS cable with a mini-SAS 4x multilane SAS connector on each end to connect a controller host port to a host HBA and to connect the drive expansion port to an storage enclosure.

The following illustration shows the 1M and 3M mini-SAS cable.

Illustration of mini-SAS cable



*Figure 20. Mini-SAS cable*

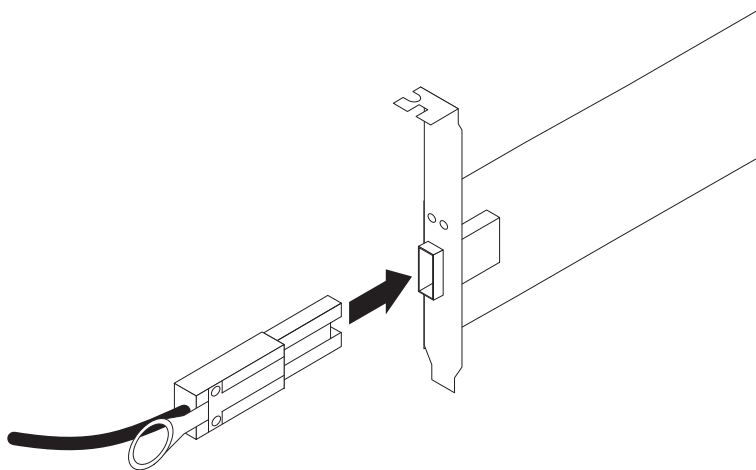
The 1M and 3M SAS cables have a universal key connector that enables the cable to be used in all mini-SAS ports.

**Attention:** To avoid damage to the SAS cables, consider the following precautions:

- When you route the cable along a folding cable-management arm, leave enough slack in the cable.
- Route the cable away from places where it can be damaged by other devices in the rack.
- Do not put excess weight on the cable at the connection point. Make sure that the cable is well supported.

To connect a mini-SAS cable, insert the mini-SAS connector into a mini-SAS port. Make sure that it locks into place.

Illustration showing how to connect a mini-SAS cable



*Figure 21. Connecting a mini-SAS cable*

To remove a mini-SAS cable, complete the following steps:

1. Put one finger into the hole on the blue plastic tab on the mini-SAS connector and gently pull on the tab to release the locking mechanism.

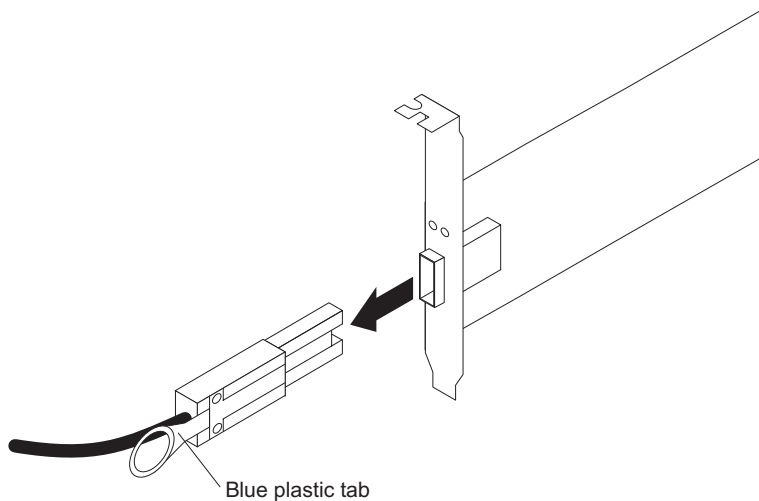


Figure 22. Removing a mini-SAS cable

2. As you pull on the tab, pull out the connector to remove it from the port.

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## Installing SFP modules

SFP modules 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 use fibre-optic cables to connect the DSC3700 storage system to hosts with FC host bus adapters or FC switches.

**Important:** IBM SFP options have been tested and approved for the IBM DS storage products. For optimal performance and compatibility, always use IBM SFP options when installing the IBM DS products.

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

- Do not mix long-wave SFPs and short-wave SFPs on a single storage subsystem. Use either long-wave SFPs or short-wave SFPs. You can use the DS 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 in any of the FC ports in the FC drive loops. (Long-wave SFPs are not supported for use in the drive ports of storage expansion enclosures.)
- The SFP module housing has an integral guide key that is 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 to 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 fibre-optic cable.
- You must remove the fibre-optic cable from the SFP module before you remove the SFP module from the port. Refer to “Removing SFP modules” on page 46 for more information.
- Make sure that you use the correct speed Fibre channel SFPs. There is no physical identification to indicate the speed capability of an SFP other than the SFP label. Use the part number indicated on the SFP label to determine the speed capability of the SFP.

Statement 3:



**CAUTION:**

When laser products (such as CD-ROMs, DVD drives, fibre 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 25.

Complete the following steps to install an SFP module:

1. Remove the SFP module from its static-protective package.
2. Remove the protective cap from the SFP module, as shown in Figure 23. Save the protective cap for future use.

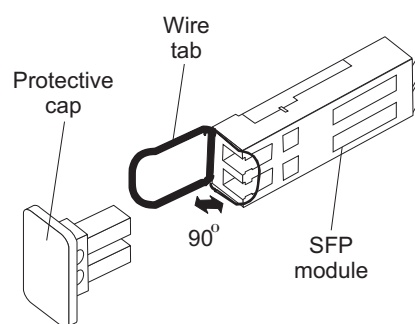


Figure 23. SFP module and protective cap

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 24 on page 46.

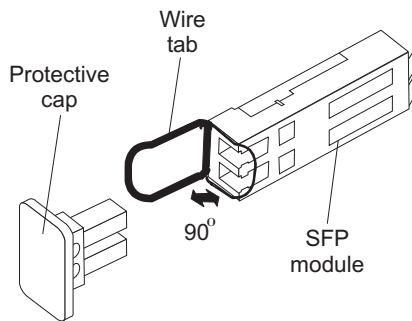


Figure 24. Installing an SFP module into the host port

5. Connect an LC-LC Fibre Channel cable. For information about the LC-LC cable, see “Using LC-LC Fibre Channel cables” on page 48.

## Removing SFP modules

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

**Attention:** To avoid damage to the cable or to the SFP module, make sure that 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 fibre-optic cables” on page 47.
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 25.

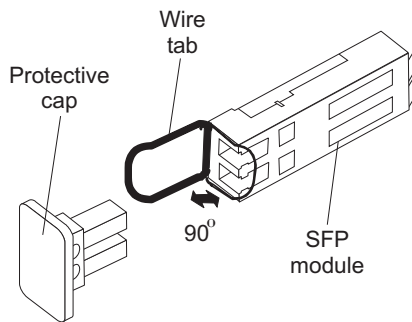


Figure 25. Unlocking the SFP module latch - plastic variety

- For SFP modules that contain wire tabs, unlock the SFP module latch by pulling the wire latch outward 90°, as shown in Figure 26 on page 47.

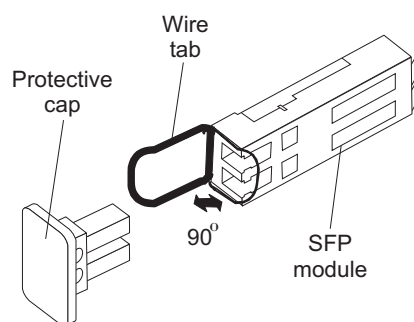


Figure 26. Unlocking the SFP module latch - wire variety

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

## Handling fibre-optic cables

**Important:** IBM Fibre Channel (FC) cable options have been tested and approved for the IBM DS storage products. For optimal performance and compatibility, always use IBM FC cable options when installing the IBM DS products.

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

- For devices on slide rails, leave enough slack in the cables so they do *not* bend to a diameter of less than 76 mm (3 in.), or a radius less than 38 mm (1.5 in.), when extended or become pinched when retracted.
- Do not overtighten the cable straps or bend the cables to a diameter of less than 76 mm (3 in.), or a radius less than 38 mm (1.5 in.).
- When storing excess or unused fibre-optic cables, do not bend the cables to a diameter of less than 76 mm (3 in.), or a radius less than 38 mm (1.5 in.) or wrap them around themselves. See Figure 27 on page 48.
- Loop diameter of 76 mm (3 in.) and bend radius of 38 mm (1.5 in.) for fibre optic cable are IBM DCS3700 recommended minimums. Loops or bends smaller than this recommendation may cause damage to your fibre optic cables. It is best practice to use loop diameters and bend radii that are greater than these recommended minimums.
- Do not route the cable along a folding cable-management arm.
- Route the cable away from places where it can be damaged by other devices in the rack cabinet.
- Do not put excess weight on the cable at the connection point. Be sure that the cable is well supported.
- Do not use plastic cable ties in place of the provided cable straps.
- The following are the supported maximum cable lengths:
  - 1 Gbps: 500 meters 50/125 um fibre, 300 meters 62.5/125 um fibre
  - 2 Gbps: 300 meters 50/125 um fibre, 150 meters 62.5/125 um fibre
  - 4 Gbps: 150 meters 50/125 um fibre, 70 meters 62.5/125 um fibre

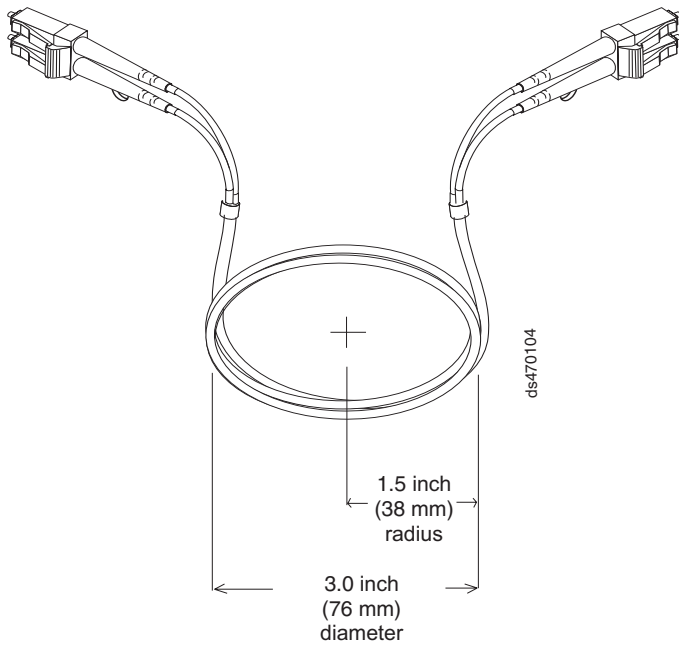


Figure 27. Recommended bending and looping specifications for fibre-optic cables

## Using LC-LC Fibre Channel cables

The LC-LC Fibre Channel cable is a fibre-optic cable that you use to connect into one of the following devices:

- An SFP module installed in an a DCS3700 fibre channel host interface adapter.
- An SFP module installed in a fibre channel switch port or fibre channel host bus adapter port.

See Figure 28 for an illustration of the LC-LC Fibre Channel cable.

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

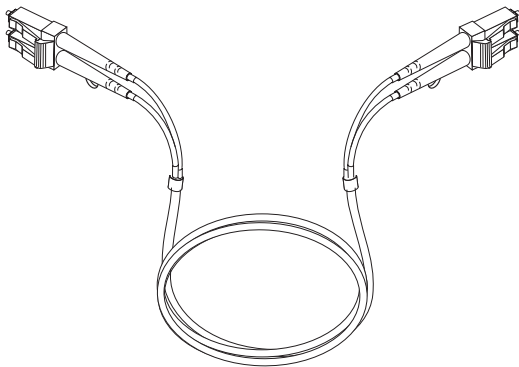


Figure 28. LC-LC Fibre Channel cable

## 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, fibre 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 fibre-optic cables” on page 47.
2. If necessary, remove the protective cap from the SFP module, as shown in Figure 23 on page 45. 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 29. Save the protective caps for future use.

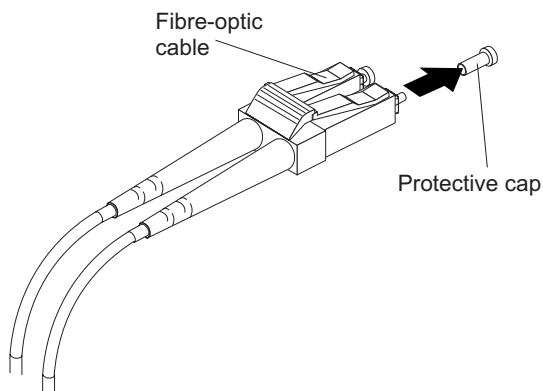
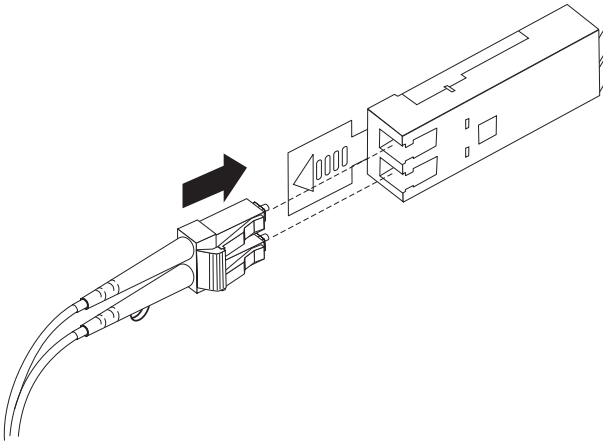


Figure 29. Removing fibre-optic cable protective caps

4. Carefully insert this end of the LC-LC cable into an SFP module that is installed in the DCS3700. 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 30 on page 50.



*Figure 30. Inserting an LC-LC Fibre Channel cable into an SFP module*

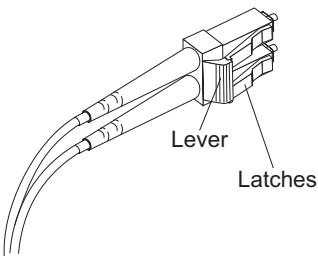
5. Remove the two protective caps from the other end of the LC-LC cable. Save the protective caps for future use.
6. Connect this end of the LC-LC cable to an SFP module that is installed in a separate DCS3700 or other DS5000 storage expansion enclosures.

## 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 that you observe the following precautions:

- 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 you remove the cable.
  - Do not grasp the SFP module plastic tab when you remove the cable.
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 31.



*Figure 31. 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 32 on page 51.



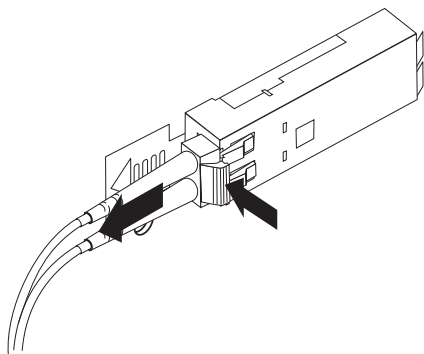


Figure 32. Removing the LC-LC Fibre Channel cable

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

## Cabling the DCS3700 expansion enclosure

The DCS3700 expansion enclosure is a dual ESM unit which provides additional storage capacity when attached to the DCS3700 storage system.

### ESM connectors

The following illustration shows the connectors on the ESM.

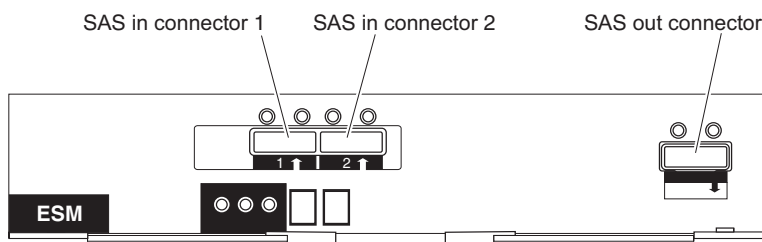


Figure 33. ESM connectors

#### SAS In connector 1

Connect a SAS cable to this connector and to either the drive expansion port on the DCS3700 controller or the SAS Out (↓) connector of another DCS3700 expansion enclosure.

#### SAS In connector 2

Connect a SAS cable to this connector and to either the drive expansion port on the DCS3700 controller or the SAS Out (↓) connector of another DCS3700 expansion enclosure.

#### SAS Out connector

Connect a SAS cable to this connector and to the SAS In (↑) connector of another DCS3700.

**Note:** Each ESM contains two SAS In connectors. You can use either SAS In connector but only one SAS In connector can be used at a time.

## Connecting the DCS3700 expansion enclosure

The DCS3700 storage system supports up to two DCS3700 expansion enclosures per physical expansion port, so multiple DCS3700 expansion enclosures can be connected by chaining them together.

To connect the DCS3700 storage system RAID controllers A and B to a single DCS3700 expansion enclosure, complete the following steps:

1. Connect the DCS3700 expansion enclosure to controller A:
  - a. Connect one end of a SAS cable to the drive expansion port on controller A.
  - b. Connect the other end of the SAS cable to one of the In (↑) SAS connectors on the ESM located in SBB slot A in the DCS3700 expansion enclosure.
2. Connect the DCS3700 expansion enclosure to controller B:
  - a. Connect one end of a SAS cable to the drive expansion port on controller B.
  - b. Connect the other end of the SAS cable to one of the In (↑) SAS connectors on the ESM located in SBB slot B in the DCS3700 expansion enclosure.

Figure 34 on page 53 shows a DCS3700 storage system configured with a single DCS3700 expansion unit.

To connect the DCS3700 storage system RAID controllers A and B to multiple DCS3700 expansion enclosures, complete the following steps:

1. Connect the DCS3700 expansion enclosure to controller A:
  - a. Connect one end of a SAS cable to the drive expansion port on controller A.
  - b. Connect the other end of the SAS cable to one of the In (↑) SAS connectors on the ESM located in SBB slot A in the first DCS3700 expansion enclosure.
2. Connect the of the DCS3700 expansion enclosure to the next DCS3700 expansion enclosure in the chain:
  - a. Connect one end of a SAS cable to the Out (↓) SAS connector on the ESM located in SBB slot A of the DCS3700 expansion enclosure that you just connected.
  - b. Connect the other end of the SAS cable to one of the In (↑) SAS connectors on the ESM located in SBB slot A in the next DCS3700 expansion enclosure in the chain.
3. Connect the last DCS3700 expansion enclosure in the chain to controller B:
  - a. Connect one end of a SAS cable to the drive expansion port on controller B.
  - b. Connect the other end of the SAS cable to one of the In (↑) SAS connectors on the ESM located in SBB slot B in the last DCS3700 expansion enclosures of the chain that you created.
4. Connect the second DCS3700 expansion enclosure to the first DCS3700 expansion enclosure.
  - a. Connect one end of a SAS cable to the Out (↓) SAS connector on the ESM located in SBB slot B of the second DCS3700 expansion enclosure.
  - b. Connect the other end of the SAS cable to one of the In (↑) SAS connectors on the ESM located in SBB slot A of the first DCS3700 expansion enclosure.

Figure 35 on page 54 shows a DCS3700 storage system configured with two DCS3700 expansion units.

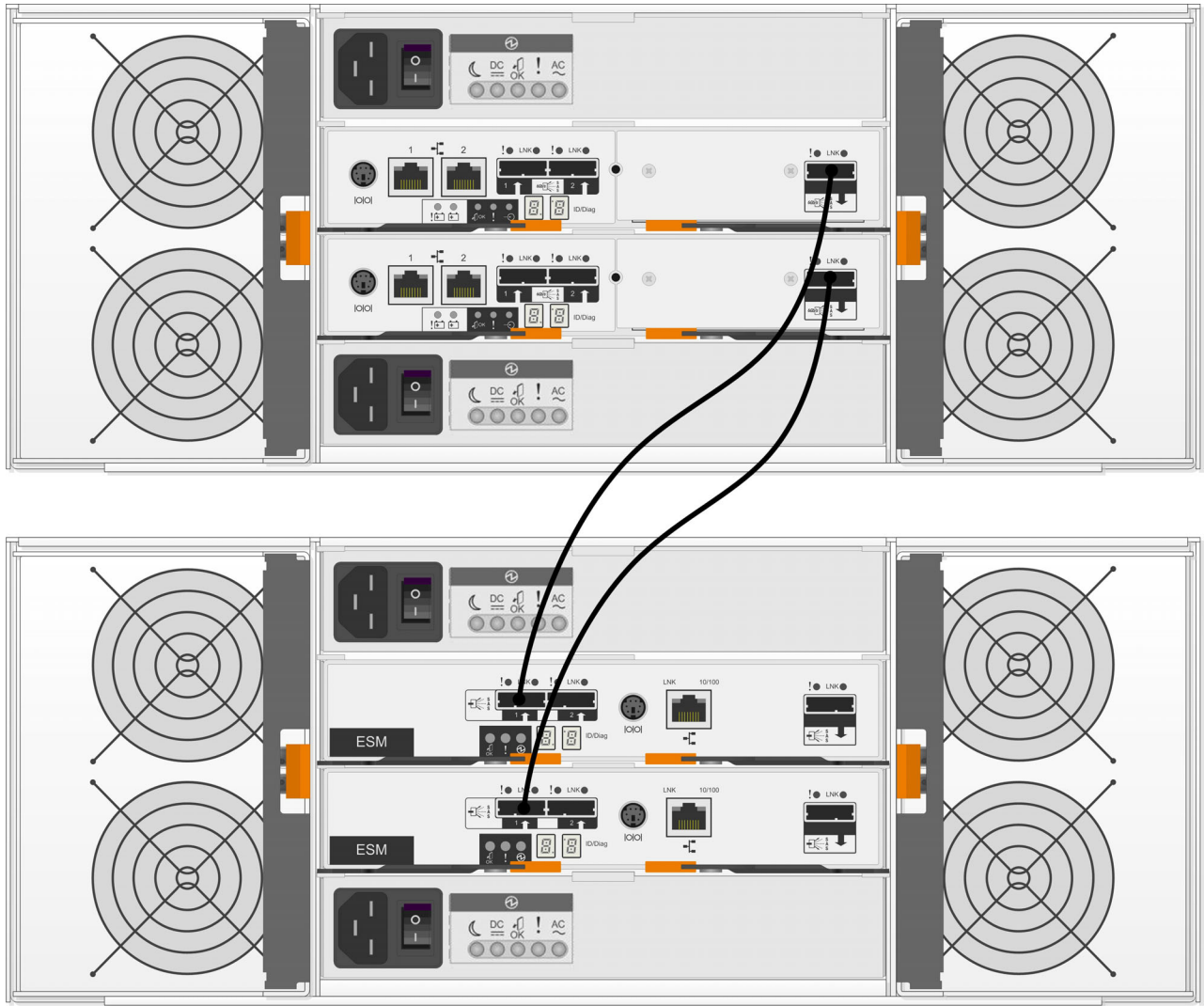


Figure 34. Single Expansion Enclosures

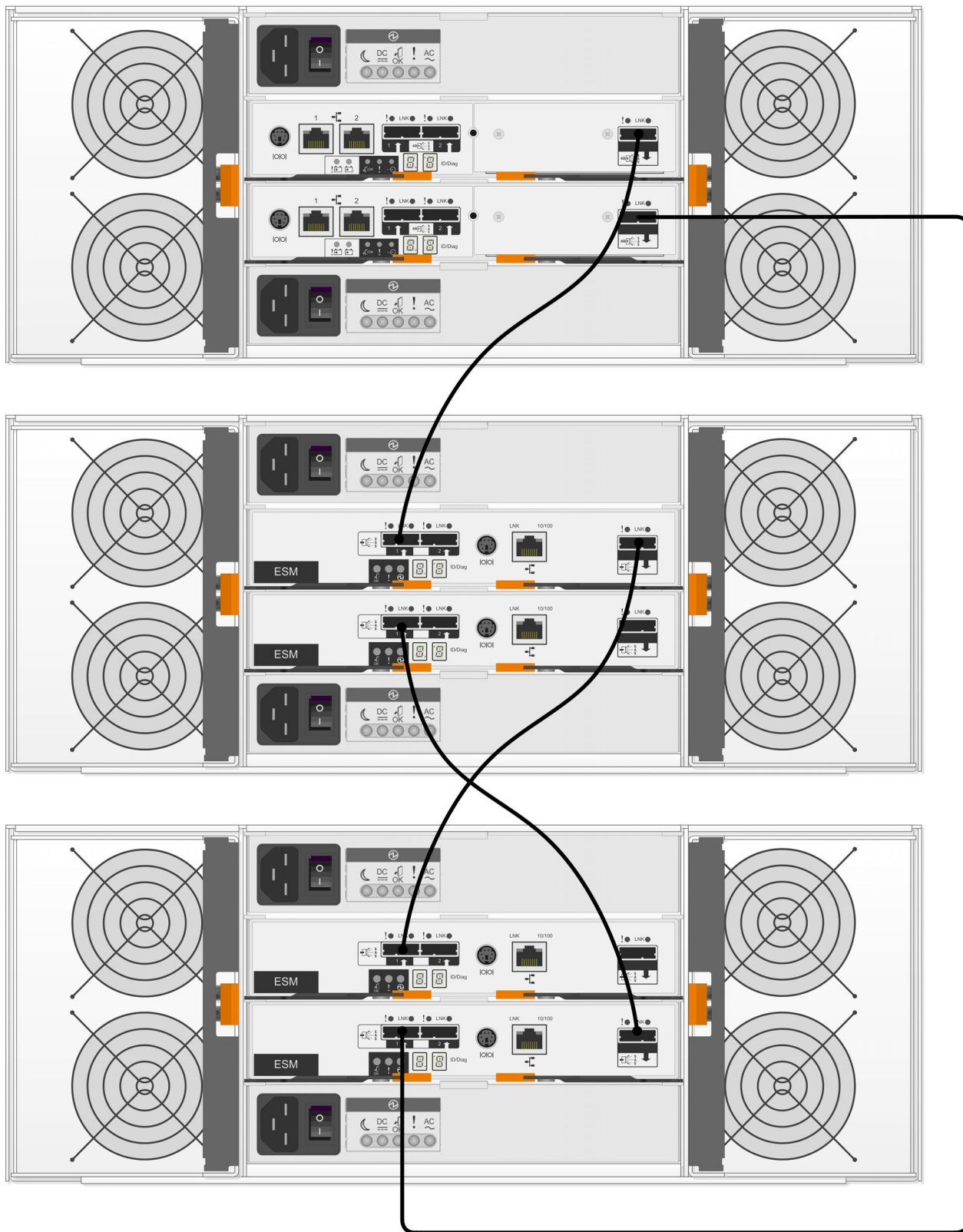


Figure 35. Dual Expansion Enclosures

## Redundant drive channel pair

Each storage controller on the DCS3700 storage system has a drive expansion channel that contains an x4 SAS port. The storage expansion enclosures that are connected to this connector form a drive channel. The maximum number of drives that can be installed in one drive channel is 180. In a dual-controller DCS3700, one drive channel from each controller combines to form a redundant drive-channel pair. If any component of the drive channel fails, the controllers can still access the storage enclosures in the redundant drive-channel pair.

## Connecting secondary interface cables

This section applies to direct (out-of-band) management configurations only. If your configuration uses host-agent (in-band) management, skip this section. Use the Ethernet management port on the rear of the DCS3700 system storage controllers for direct management of the storage subsystems (see Figure 37 on page 57).

### Important::

1. To minimize security risks, do not connect the DCS3700 to a public LAN or public subnet. Use a local private network for the DCS3700 and the storage management station Ethernet connectors.
2. For proper EMI shielding, always use quality braided and if necessary, shielded cables.

Connect an Ethernet cable from the management station to the Ethernet connector on controller A and controller B on the rear of the DCS3700 storage system.

## Configuring the storage subsystem

After you install the DCS3700 storage system and DCS3700 expansion enclosures in a rack, it is necessary to configure the storage subsystem. Use the information in the following sections to configure your storage subsystem.

### Storage subsystem management methods

Before you configure the storage subsystem, determine which method of storage subsystem management you want to use. You can manage the storage subsystems in either of two ways: host-agent (in-band) management or direct (out-of-band) management.

**Note:** For information about any in-band limitations or restrictions that are associated with particular combinations of controller and host bus adapter, see the Storage Manager readme file.

For more information about setting up in-band or out-of-band management connections, see the *DS Storage Manager 10 Installation and Host Support Guide* for the operating system of the host server that you will use to manage the DCS3700 storage subsystem. The document is in the Documentation folder on the IBM Storage Manager v10.xx DVD.

**Important::** If the operating system of the host server that the storage subsystem logical drives are mapped to is not Microsoft Windows Server 2003 or Windows Server 2008, you must make a direct (out-of-band) management connection to the storage subsystem to set the correct host type first. Then, the server will be able to recognize the storage subsystem correctly for host-agent (in-band) management.

**Host-agent (in-band) management method:** This method requires that host-agent software be installed on the host server. The host-agent software enables the Storage Manager software client program to manage the storage subsystem by using the same connections between the host server and the storage subsystem. You must install at least one management station and a software agent host. The management station can be the host or a workstation on the Ethernet network. The client software is installed on the management station. The following illustration shows the host-agent (in-band) management method.

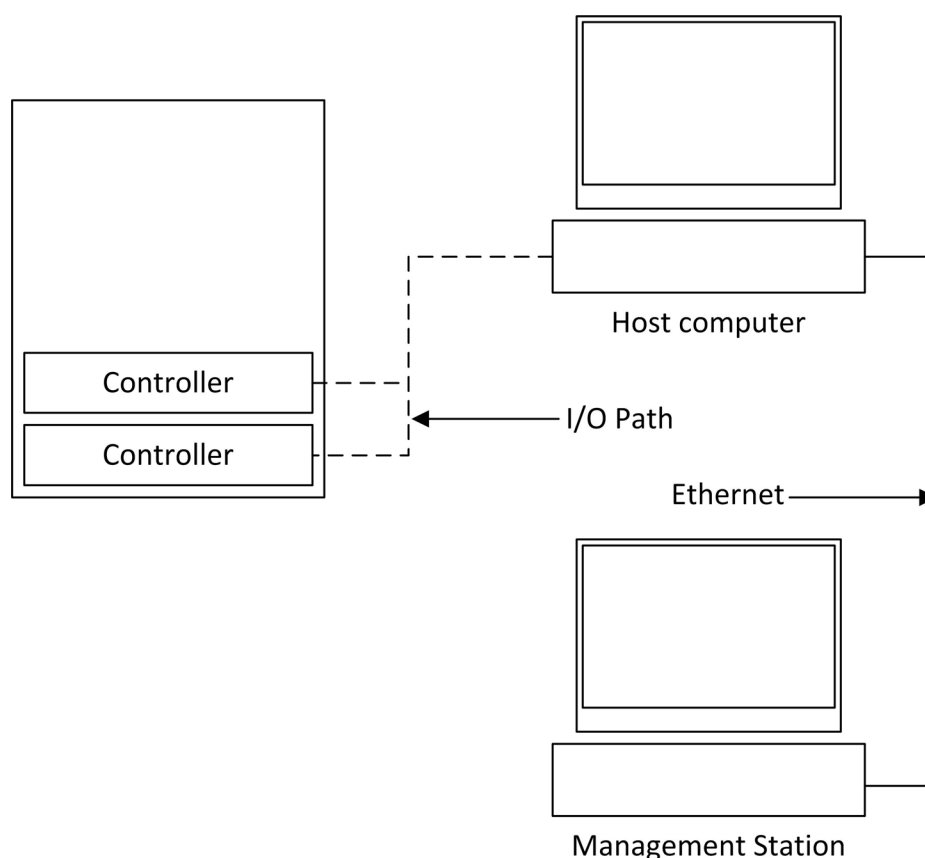


Figure 36. Host-agent (in-band) management

**Direct (out-of-band) management method:** This method uses Ethernet connections from a management station to each controller in the storage subsystem. You must install at least one management station. The management station can be the host or a workstation on the Ethernet network. The client software is installed on the management station. Attach Ethernet cables to each management station (one pair per storage subsystem). You will connect the cables to each storage system controller later when you install the storage subsystem. Figure 37 on page 57 shows the direct (out-of-band) management method.

**Note:** Do not connect the DCS3700 storage subsystem Ethernet ports to a public network or public subnet. To minimize security risks, create a private network between the DCS3700 storage subsystem and the management station.

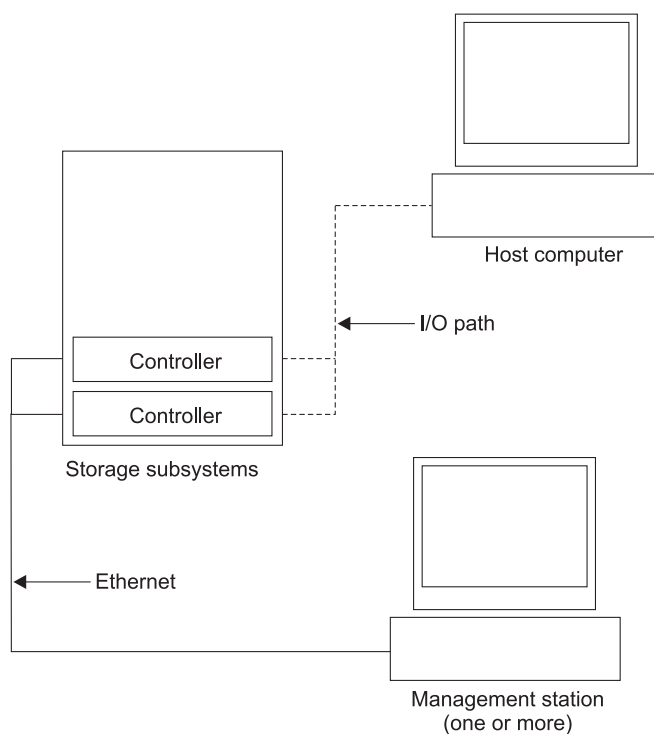


Figure 37. Direct (out-of-band) management method

## Installing the storage subsystem configuration

Before attempting to attach hosts to the storage subsystem, make sure that the host systems and host bus adapters (HBAs) are installed correctly and updated with the latest firmware and drivers.

### Notes:

1. See the documentation that comes with the HBA for installation requirements and procedures.
2. Use the correct HBA firmware and device driver. For the latest supported HBAs and device drivers, consult the readme that comes with the DCS3700 controller firmware.

For a SAS attached host, attach a SAS cable to each HBA. Continue with “Connecting SAS hosts to the DCS3700” to connect the other end of each cable to a controller.

For a Fibre Channel attached host, attach a fibre channel cable to each HBA. Continue with “Connecting Fibre Channel hosts to the DCS3700” on page 60 to connect the other end of each cable to the controller.

## Connecting SAS hosts to the DCS3700

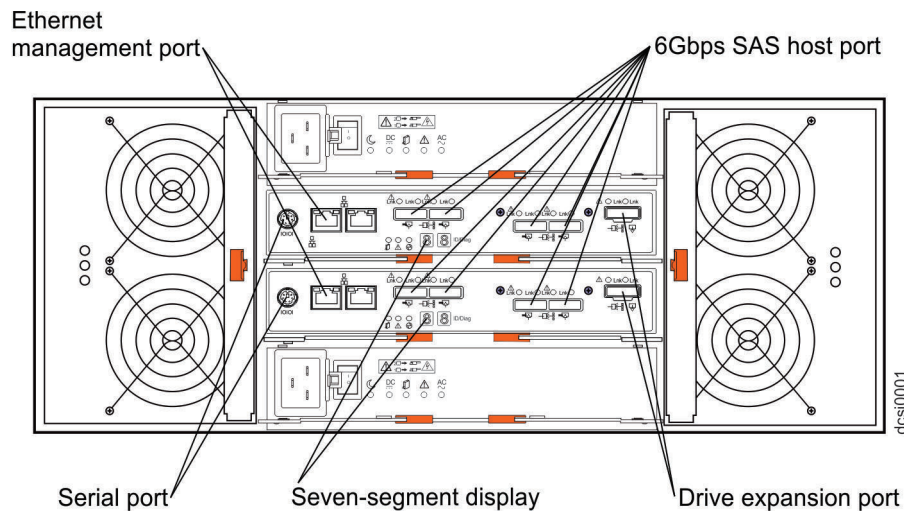
The DCS3700 can support up to 28 hosts when attached to the SAS Connectivity Module for IBM BladeCenter and up to four hosts in a direct attached host environment. The number of supported hosts depends on the number of host ports installed on the controller. To protect against the loss of any one path from the host servers to the DCS3700 storage subsystem, use redundant host connections.

**Note:** The DCS3700 ships with eight storage partitions by default. For additional storage partitions, purchase an optional Storage Partition Premium Feature upgrade. Contact your IBM reseller or marketing representative for more information.

To connect a SAS host bus adapter (HBA) to the storage subsystem, complete the following steps:

1. Connect a SAS cable from the controller A host port to the SAS HBA that is in the host.

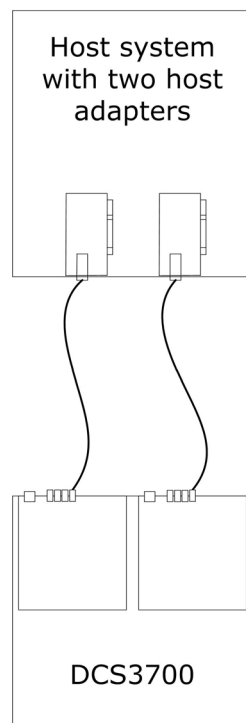




2. Create a redundant host connection by connecting a second SAS cable from a second SAS HBA (or a second SAS port in the HBA) to a host port on controller B in the DCS3700 storage system.  
 The DCS3700 can support a maximum of two redundant host connections to a base DCS3700 storage system. With the optional 6Gbps 2 port host interface card installed in each controller, a maximum of four redundant host connection are supported.

See “Direct-attached dual-controller connections” for illustrations of host connections.

**Direct-attached dual-controller connections:** The following illustration shows a direct-attached connection from each controller to a single HBA in the same host (redundant host connection).



*Figure 38. Dual-controller direct-attached Fibre Channel connection to two HBAs in the same host (redundant host connection)*



The following illustration shows multiple redundant direct-attached SAS host connections. This configuration is also the configuration to use for a dual-node cluster configuration. Up to four hosts can be direct attached to the DCS3700 when the optional 6Gbps 2 port SAS host interface card is installed in each controller.

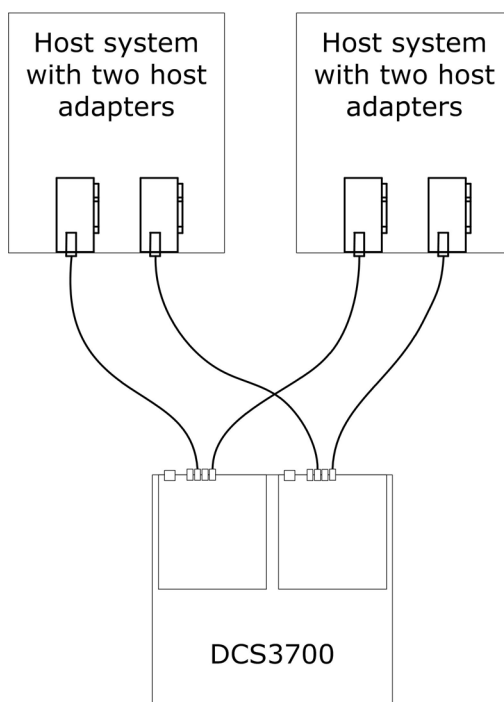


Figure 39. Dual-controller direct-attached Fibre Channel connections to multiple HBAs in multiple hosts

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## Overview of installing an IBM BladeCenter configuration to connect to a DCS3700

This section gives an overview and guidelines for installing an IBM BladeCenter configuration to connect to a DCS3700 storage system.

Before you install the BladeCenter configuration, consider the following information:

- Make sure that the BladeCenter chassis, blade server, SAS connectivity module, and SAS expansion card are supported. Go to <http://www.ibm.com/systems/support/storage/ssic/interoperability.wss> and check the System Storage Interoperation Center for details of the hardware supported by the DCS3700 storage system.
- Make sure that an Advanced Management Module is installed in the BladeCenter chassis. The latest level of management-module firmware is available at <http://www.ibm.com/bladecenter/>.
- For the latest SAS connectivity module firmware, SAS expansion card firmware, blade server BIOS code, and device drivers, see <http://www.ibm.com/systems/support/>.

## Installing the BladeCenter configuration

To install the IBM BladeCenter SAS Expansion Card (CFFv), IBM BladeCenter SAS Connectivity Module, and blade server, complete the following general steps:

1. Install an IBM BladeCenter SAS Expansion Card (CFFv) in each blade server that you want to connect to the DCS3700. See the documentation that comes with the SAS expansion card for installation requirements and procedures.
2. Install the blade servers in the BladeCenter chassis. See the documentation that comes with the blade server for installation requirements and procedures.

3. Install the IBM BladeCenter SAS Connectivity Modules in the I/O bays in BladeCenter unit. See the documentation that comes with the SAS connectivity modules for installation requirements and procedures.
4. Go to “Connecting BladeCenter hosts to the DCS3700.”

## Connecting BladeCenter hosts to the DCS3700

The dual-controller DCS3700 comes with two SAS host connectors on each controller, enabling up to 28 blade servers in two BladeCenter units to be redundantly connected to the storage subsystem.

To protect against the loss of any one path from the host blade servers to the DCS3700, use redundant host connections.

To connect a SAS expansion card that is installed in a blade server to the DCS3700, complete the following steps:

1. Connect a SAS cable from the SAS host connector on the DCS3700 storage system to any SAS port on an IBM BladeCenter SAS Connectivity Module that is installed in a BladeCenter unit (port 3 is recommended).
2. To create a redundant host connection, connect a SAS cable from a second SAS connectivity module to a host connector on the other controller in the DCS3700. You can only create a maximum of two redundant host connections in a dual-controller DCS3700, one connection each from the blade center to the DCS3700 controller host port as shown in Figure 40.

**Attention::** You can connect only one DCS3700 to the BladeCenter SAS Connectivity Module. No other external devices can be connected to the SAS connectivity module.

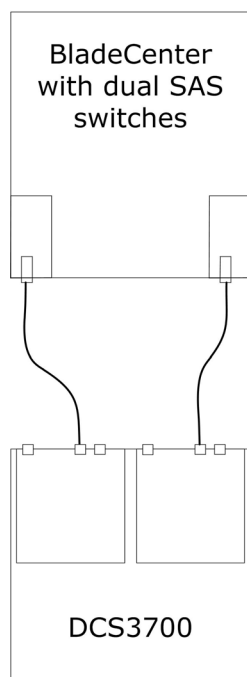


Figure 40. Example of DCS3700 connected to a single BladeCenter unit

## Connecting Fibre Channel hosts to the DCS3700

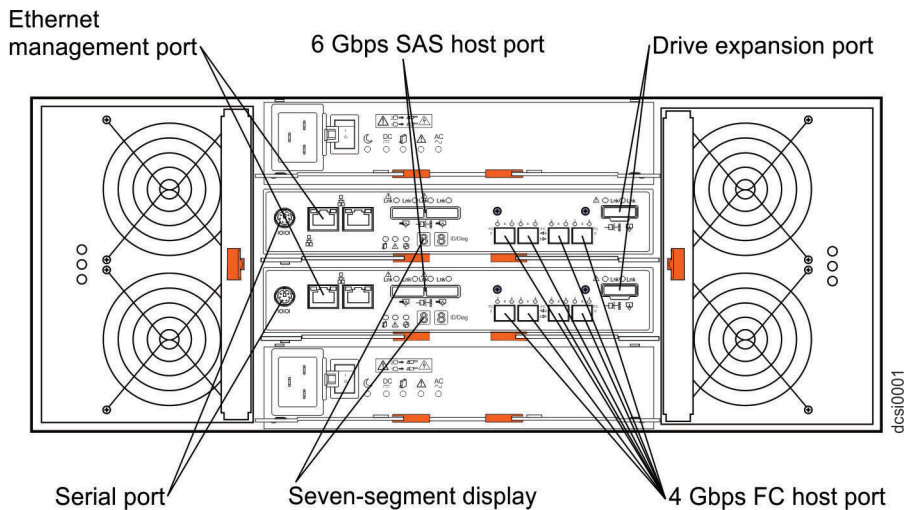
Using Fibre Channel switches, up to 128 hosts can be redundantly attached to the DCS3700 storage subsystem in a Fibre Channel storage area network (SAN) fabric.

**Notes:**

1. The DCS3700 ships with eight storage partitions by default. For additional storage partitions, purchase an optional Storage Partition Premium Feature upgrade. Contact your IBM reseller or marketing representative for more information.
2. Installation of the optional 8Gbps 4 port Fibre Channel host interface card is required in both controllers in order to support fibre channel host connections.

To connect a fibre channel host to the controllers, complete the following steps:

1. Install SFP modules in the host ports on controllers A and B.
2. Connect the Fibre Channel cables to the SFP modules in the controller host ports and to either the SFP modules in the Fibre Channel switch or the optical interface connector on the host bus adapters.



3. Repeat steps 1 and 2 for an additional redundant host connection. In a direct connection configuration, you can create a maximum of four redundant host connections for the storage subsystem.

See "Direct-attached dual-controller connections:" and "SAN fabric dual-controller, redundant connections" on page 63 for illustrations of host connections.

**Direct-attached dual-controller connections:**

The following illustration shows a direct-attached connection from each controller to a single HBA in the same host (redundant host connection).

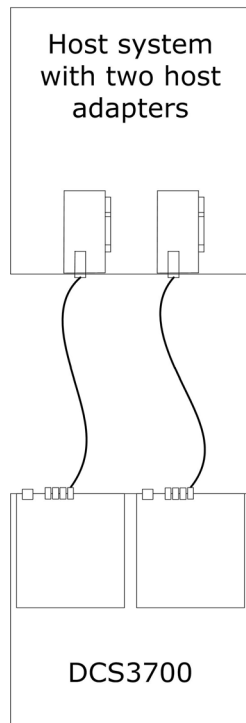


Figure 41. Dual-controller direct-attached Fibre Channel connection to two HBAs in the same host (redundant host connection)

The following illustration shows multiple redundant direct-attached host connections.

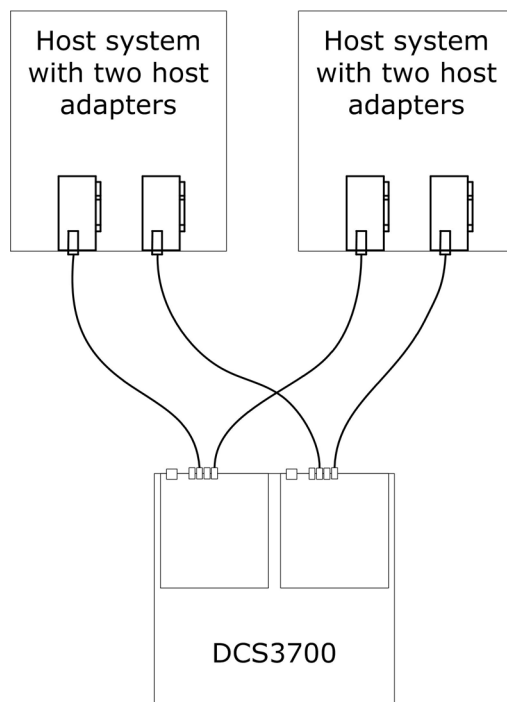


Figure 42. Dual-controller direct-attached Fibre Channel connections to multiple HBAs in multiple hosts

## SAN fabric dual-controller, redundant connections

The following illustrations show a redundant SAN fabric, fibre channel connection from each controller to multiple HBAs in the same host (redundant host connection).

The Fibre Channel switches are connected together through the Inter-Switch Link (ISL) to form a single SAN fabric.

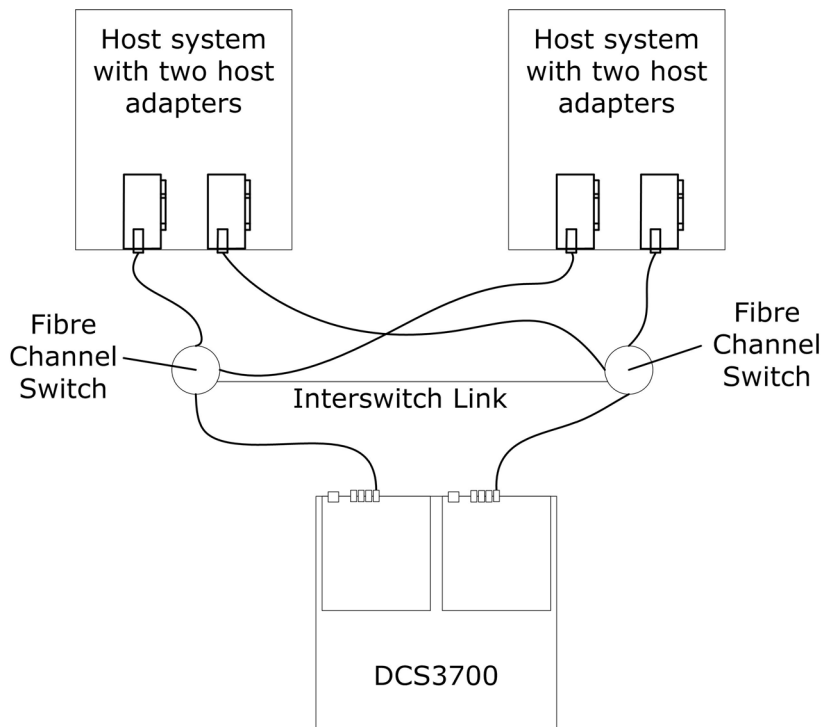


Figure 43. Example of a single Fibre Channel SAN fabric configuration

In the following illustration, the Fibre Channel switches are not connected together through an ISL. Each switch forms its own SAN fabric. This configuration is also the configuration to use for a dual-node cluster configuration.

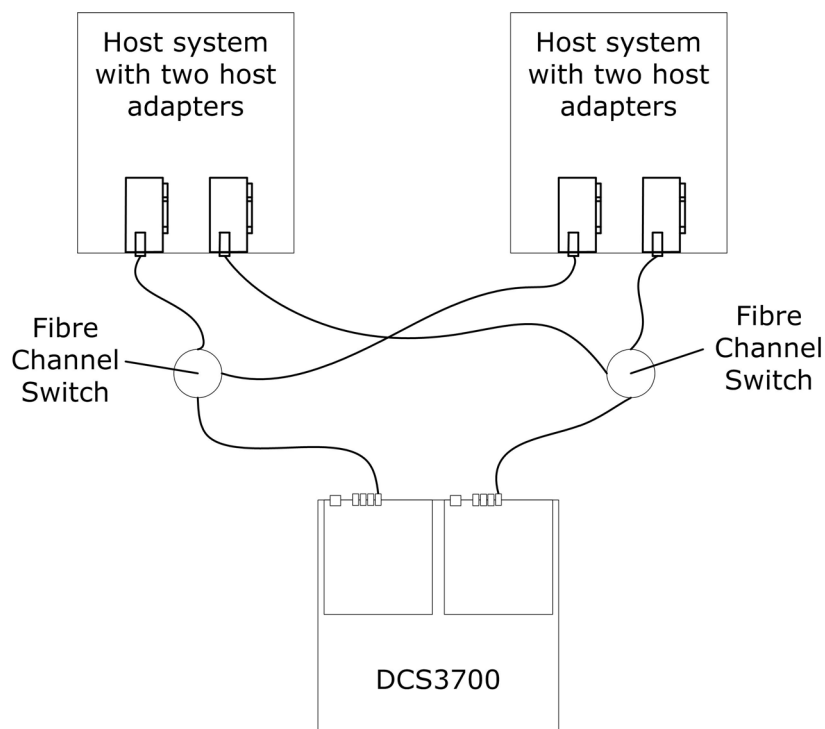


Figure 44. Example of a dual Fibre Channel SAN fabric configuration

In the following illustration, the Fibre Channel switches are not connected together. Each switch forms its own SAN fabric.

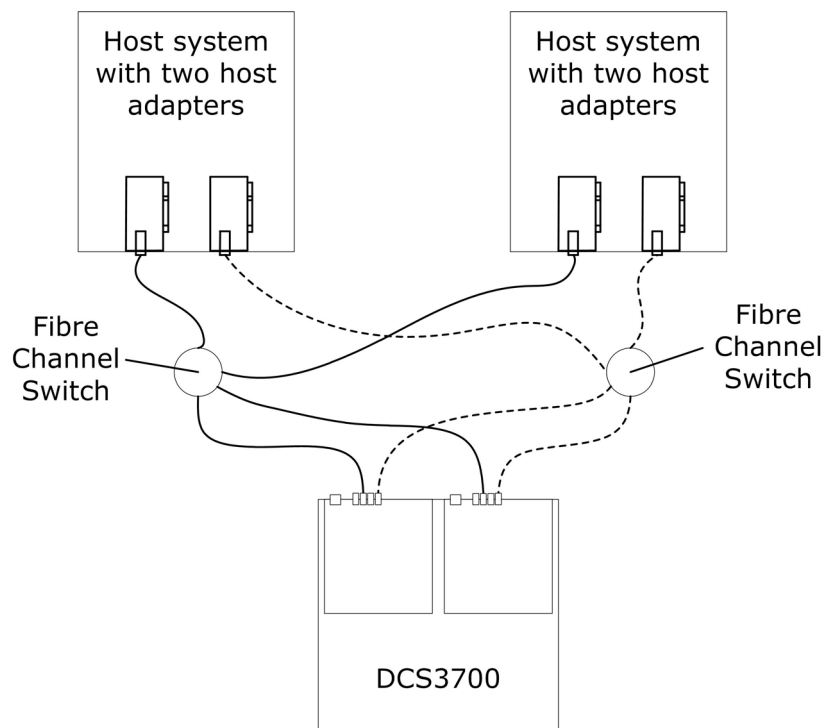


Figure 45. Example of two storage subsystems in a dual Fibre Channel SAN environment

The following illustration shows an example of a multiple-host, multiple-port, and multiple-fabric (Fibre Channel and SAS) configuration

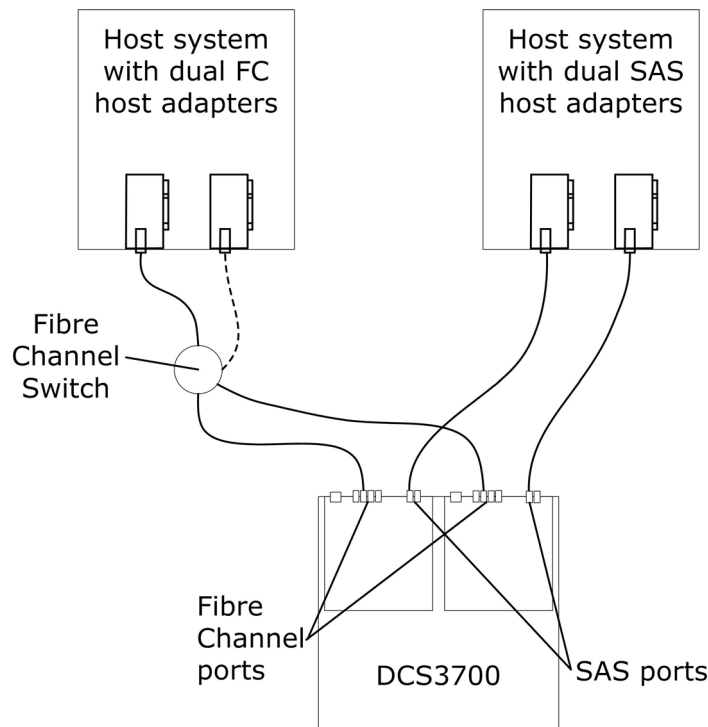


Figure 46. Example of a multiple-host, multiple-port, and multiple-fabric (Fibre Channel and SAS) configuration

**Note:** The DCS3700 does not support a multiple-fabric (Fibre Channel and SAS) configuration where both fibre channel and SAS host adapter are located in the same host system.

---

## Cabling the power supply

Complete the following steps to connect the power supply cable.

**Attention:** The DCS3700 requires 200-240V AC power. Make sure that it is connected only to the correct AC supply voltage. If there are multiple DCS3700 units to be connected, check the AC source and the rack Power Distribution Unit current ratings to make sure that they are sufficient to support the DCS3700 operating and surge current requirements.

1. Using the strap that comes off the power supply, tie the power supply cord to the strap to provide strain relief and to prevent the power cord from accidentally being unplugged.
2. Connect the power cable to the power supply.
3. Continue with “Powering on the DCS3700” on page 68 for the initial startup of the storage expansion enclosure.

---

## Relocating the DCS3700

Before you move an DCS3700 with populated hard drive drawers, either by itself or as part of the rack that it is mounted in, you must obtain a rack relocation kit. Follow the instructions provided with the relocation kit to avoid potential damage to the DCS3700:

- You must remove the drives from the DCS3700 and place them in the boxes that come with the relocating kit.
- You must label the drives using the labels that come with the relocating kit.
- A lift tool must be used if the DCS3700 is going to be removed from the rack.





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## Chapter 4. Operating the DCS3700 storage system and expansion enclosure

This chapter describes operating procedures for the DCS3700 storage system and expansion enclosure.

To ensure optimal operation of your DCS3700 storage system and expansion enclosure, see “Best practices guidelines” on page 5.

---

### Performing the DCS3700 Health Check process

Use the health check process to help you verify and maintain the optimal performance of the storage configuration. The information that you collect in these steps also helps provide IBM Service with important information that is needed during a service call.

Perform the following health check tasks after the initial configuration of the storage subsystem and after all configuration sessions.

1. Monitor the Recovery Guru in the Storage Manager software for any obvious storage subsystem errors or problem conditions.
2. Gather and save the following storage subsystem event logs for review by IBM Service. These event logs should be gathered periodically for regular health check monitoring regardless of the state of the Recovery Guru. (You can collect all these logs at once and compress them into a single file by clicking the **Support** tab and then **Gather Support Information** in the Subsystem Management window.)
  - DCS3700 storage subsystem management event log (MEL)
  - Storage Subsystem Profile or DCS3700 Profile
  - SAS PHY error log

In addition, you should also collect event logs for the host servers that have mapped logical drives from the storage subsystem.

**Attention:** Save these event-log files to a server disk that will remain accessible in the event of a DCS3700 storage configuration failure. Do not save these event log files only to a LUN in the DCS3700 storage subsystem.

3. Use the Storage Subsystem Profile or DCS3700 Profile to make sure that the following firmware levels are at the latest versions:
  - Controller firmware
  - ESM firmware
  - Drive firmware

If the firmware is not up-to-date, upgrade the firmware and software to the latest level that is applicable to the storage configuration. See “Software and hardware compatibility and upgrades” on page 15 for information about where to find the latest firmware and software.

**Attention:** You must resolve Recovery Guru errors or problems before you upgrade firmware.

Save the storage subsystem profile before you perform any controller or ESM firmware upgrades. Save the storage subsystem profile and all .cfg files to a server disk that will remain accessible in the event of a DCS3700 storage configuration failure.

4. Use the Storage Subsystem Profile or DCS3700 Profile to make sure that the following functions are enabled:
  - For the DCS3700, enable Media Scan both at the controller level and at the LUN level.
  - For the DCS3700, enable the read/write cache. In addition, use the Storage Subsystem Profile to make sure that cache is matched between the controllers.

Set a regular schedule of periodic health check evaluations to keep the firmware levels current and to preserve optimal data access and performance.

---

## Hardware inspection

In addition to the health check process, regular hardware inspection and maintenance helps to support the optimal performance of the storage configuration. Periodically inspect the components of the storage configuration.

For best results, follow these guidelines:

- Maintain an up-to-date storage subsystem profile for the storage configuration. Save the profile to a server disk that will remain accessible in case of a DCS3700 storage configuration failure. Do not save the profile only to a LUN in the storage subsystem.
- Develop a change-management plan. The plan should include schedules for updating subsystem firmware and server host software.

**Note:** Some updates might require storage subsystem downtime.

- Use applicable IBM-approved cables for all situations. Note in the configuration documentation whether any cables are not IBM-approved.
- Create and maintain a cabling diagram of the current configuration. Keep this diagram updated as you make configuration changes, and keep the cabling diagram available for review.
- Create and maintain a list of other components that are being used within the cabling diagram (such as the host system and other attached devices).
- Make sure that all controllers and ESMs are correctly seated.
- Make sure that all drives are correctly seated.
- Make sure that cables are managed correctly.
- Ensure proper air flow and temperature for all components in the storage configuration.

You can find details about many of these inspection and maintenance responsibilities in other sections of this document.

In addition to these inspection and maintenance responsibilities, conduct training for staff that support storage configurations. Although training is not a part of the health check process, training reduces the potential for configuration problems and contributes to the correct operation of the system.

---

## Powering on the DCS3700

This section contains instructions for turning on the storage subsystem under normal situations. “Turning off the storage subsystem” on page 83 contains instructions for turning off the storage subsystem under normal and emergency situations. When you turn on and turn off the storage subsystem, be sure to use the startup sequence that is described in this section. If you are turning on the storage subsystem after an emergency shutdown or power outage, see “Restoring power after an unexpected shutdown” on page 85.

The following procedure addresses two situations:

- The entire storage subsystem has been shut down (the main circuit breakers for the rack are off).
- Some storage enclosures are being powered-on while others remain online (the main circuit breakers for the rack are on). You might encounter this if you are adding an expansion enclosure to increase storage capacity.

**Attention:**

1. Repeatedly turning the power off and on without waiting for the drives to spin down can damage the drives. Always wait at least 90 seconds after you turn off the power before you turn it on again.
  2. If you are connecting a power cord to a storage subsystem enclosure, turn off the power switches first. If the main circuit breaker is off, make sure that both power switches are off on each storage enclosure in the rack before you turn on the main circuit breakers.
  3. Turn on the power to the supporting devices (for example, Ethernet switches and management stations) before powering on the storage subsystem enclosures.
1. Are the main circuit breakers turned on?
    - **Yes:** Turn off *both* power switches on each enclosure that you intend to connect to the power.
    - **No:** Turn off *both* power switches on *all* enclosures in the storage subsystem.
  2. Make sure that all power cords are connected.

**Note:** If the power cords are not connected, turn off both power switches on all modules in the configuration before you connect power cords or turn on the main circuit breakers.

3. If the main circuit breakers are turned off, turn them on.

**Attention:** You must turn on power to each attached expansion enclosure before you turn on power to the storage system so that the controllers recognize all drives in the configuration during the startup process.

4. Depending on the number of storage enclosures in the configuration, the storage subsystem might take up to 10 minutes to fully power-on. While each storage enclosure powers-on, the green and amber LEDs on the front and rear of the storage enclosure turn on and off intermittently. The cache battery backup self-test might take up to an additional 15 minutes to be completed. During this time, the LEDs on the front and rear of the storage subsystem might flash intermittently.

Check the LEDs on the front and rear of all the storage enclosures. Make sure that no amber LEDs are lit on any of the storage enclosures.

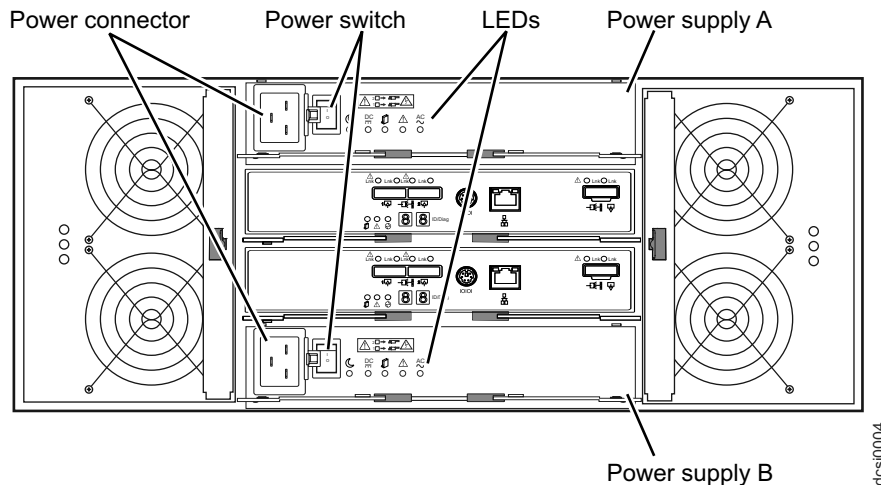


Figure 47. Power-supply switches and connectors for DS3500 dc models

5. Determine the status of all the components in the storage subsystem configuration by completing the following steps:
  - a. Check all LEDs on each component in the DCS3700 expansion enclosures. Make sure that all the LEDs show normal status. For more information about LED status for expansion enclosures, see "Checking the LEDs" on page 73.
  - b. Check all LEDs on each component in the DCS3700 storage system. Make sure that all the LEDs show normal status. For information about LED status, see "Checking the LEDs" on page 73 or "Solving problems" on page 129.

- c. Open the Storage Manager Subsystem Management window, and display the status of the storage subsystem.
6. Are the LEDs indicating normal operation, and is the Storage Manager GUI status Optimal on all the configuration components?
  - **Yes:** The procedure is complete.
  - **No:** Go to step 7.
7. Diagnose and correct the fault by completing the following steps:
  - a. Run the Storage Manager Recovery Guru by clicking **Recovery Guru** in the Subsystem Management window toolbar.
  - b. Complete the recovery procedure.

If the Recovery Guru directs you to replace a failed component, use the individual LEDs on the storage subsystem to locate the specific failed component. For troubleshooting procedures, see “Solving problems” on page 129.
  - c. When the recovery procedure is completed, select **Recheck** in the Recovery Guru. This action runs the Recovery Guru again to make sure that the problem is corrected.
  - d. If the problem remains, contact your IBM technical-support representative.

---

## Installing the Storage Manager Client

See the *DS Storage Manager 10 Installation and Host Support Guide* for the applicable operating system for instructions for installing the Storage Manager software. The document is in the Documentation folder on the *IBM Support Software* DVD. Use that document and the online help to configure the arrays, logical drives, and host partitions for the controllers. Follow the instructions in the operating-system documentation to make the new logical drives accessible to the operating system. Do not proceed with the configuration setup until you have completed the Storage Manager installation.

Assemble any additional items in preparation for software installation. These items might include the following items:

- HBA device drivers
- Controller firmware
- IP addresses for controllers (for out-of-band management only)
- Additional documentation for hosts, HBAs, and other storage components.

Before any planned system shutdown or after any system additions, removals, or modifications (including firmware updates, logical drive creations, storage partitioning definitions, hardware changes, and so on), save the storage subsystem profile as explained in the *DS Storage Manager 10 Installation and Host Support Guide* for the operating system. Save the profile in a location other than the logical drives that are created for the storage subsystem.

Always see the readme file that is included with the DCS3700 storage subsystem firmware package (whether the firmware is accessed by the Web or a DVD) for any special requirements or restrictions that apply to that firmware version.

**Note:** Be sure to install the Storage Manager event monitoring service to enable continuous monitoring of the status of the storage subsystem. For more information about the importance of this information, see “Monitoring status through software” on page 71.

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## Monitoring status through software

Use the Storage Manager software to monitor the status of the storage subsystem. Run the software constantly, and check it frequently.

**Note:**

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

For more information, see the Enterprise Management online help.

**Important:** See the *DS Storage Manager 10 Installation and Host Support Guide* for the applicable operating system for instructions for installing the Storage Manager software. The document is in the Documentation folder on the *IBM Support Software* DVD.

To download the latest version of the Storage Manager software, controller firmware, NVSRAM firmware, and the latest ESM firmware, go to <http://www.ibm.com/servers/storage/support/disk/>.

The Storage Manager software provides the best way to diagnose and repair storage-subsystem failures. The software can help you:

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

Amber (needs attention) LEDs do not necessarily indicate which component has failed or must be replaced or which type of recovery procedure you must perform. In some cases (such as when a drive exceeds its Predictive Failure Analysis [PFA] threshold), the amber LED is not lit. Only the Storage Manager software can detect the failure.

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

**Note:** For PFA flags, the system-error LED and drive status LEDs are not lit, so checking the LEDs will not notify you of the failure, even if the risk of data loss is high.

Recovering from a storage subsystem failure might require you to perform procedures other than replacing the component (such as backing up the logical drive). The Storage Manager software provides these procedures.

**Attention:** Not following the software-recovery procedures can result in data loss. In addition, always replace a failing component as soon as possible to minimize additional failures that might occur, causing loss of data access.

## Firmware updates

**Attention:** Save the storage subsystem profile before you perform any controller or ESM firmware upgrades. Save the profile and all configuration (.cfg) files to a server disk that will remain accessible in the event of a DCS3700 storage configuration failure. Do not save these files only to a LUN in the storage subsystem.

To ensure the optimal operation of the storage subsystem and its attached storage enclosures, the ESM firmware, controller firmware, drive firmware, and the NVSRAM firmware must be up-to-date. Go to <http://www.ibm.com/servers/storage/support/disk/> to get the latest updates.

Always see the readme files that are included with the firmware packages for the most up-to-date information about firmware prerequisites, firmware update instructions, download-sequence information, and host I/O restrictions, if any. Apply the necessary updates before you configure the storage subsystem arrays and logical drives. Subscribe to My Support for automatic notifications of firmware or Storage Manager software updates or any important information about the DCS3700 storage subsystems (see “Receiving product updates and support notifications” on page 5).

**Attention:** Failure to observe the limitations, prerequisites, sequences, and dependencies in the readme file might result in a loss of data access.

Unless the readme file contains special requirements for the sequence in which you upgrade firmware, perform firmware upgrades in the following sequence:

1. ESM firmware for the expansion enclosures
2. Controller firmware
3. Controller NVSRAM
4. Drive firmware

## Troubleshooting the storage subsystem

The Storage Manager software is the best way to monitor the storage subsystem, diagnose a problem, and recover from a hardware failure. Run the Storage Manager software continuously, and frequently check the configuration status.

To check the status of and identify a problem with the storage subsystem, complete the following steps. If a problem has occurred, use the Storage Manager software and the LEDs on the storage subsystem to help locate a failed component.

1. Open the Subsystem Management window.
2. Click the **Summary** tab, and view the status of the storage subsystem.
3. Does any storage subsystem have a Needs Attention status?
  - **Yes:** Go to step 4.
  - **No:** All components are Optimal. Go to step 5.
4. Click **Recovery Guru** on the toolbar. Perform the procedure in the Recovery Guru to correct the problem. The Recovery Guru might direct you to replace the failed component. If so, go to step 5.

**Attention:** If the fault requires you to power-off an enclosure in your storage subsystem, you might have to cycle the power on the DCS3700 storage system and all remaining expansion enclosures that are part of the storage subsystem. Contact your IBM technical-support representative before you power-off any other component of the storage subsystem.
5. Check the LEDs on the front and the rear of the storage enclosure. A green LED indicates a normal status; an amber LED indicates a hardware fault.
6. Is an amber LED lit?
  - **Yes:** Locate and troubleshoot the failed components. See “Checking the LEDs” on page 73.



- **No:** You are finished with this procedure. If you are still experiencing a problem with the storage subsystem, create, save, and print a storage subsystem profile, and contact your IBM technical-support representative for assistance. When the recovery procedure is completed, select **Recheck** in the Recovery Guru to run the Recovery Guru again to make sure that the problem is corrected.

## Checking the LEDs

The LEDs indicate the status of the storage subsystem and components. Green LEDs indicate a normal operating status; amber LEDs indicate a possible failure; a blue LED on a component indicates that it is safe to remove the component.

The DCS3700 also has a blue system locator LED that is lit when the menu function is selected in the Subsystem Management window, causing the Locate command to be sent to the DCS3700.

Check all the LEDs on the front and rear of the storage subsystem when you turn on the power. During power-on, the LEDs flash intermittently as the storage subsystem and components complete the power-on process. In addition to checking for faults, you can use the LEDs on the front of the storage subsystem to determine whether the drives are responding to I/O transmissions from the host.

## Front LEDs

This section describes the primary LEDs and controls on the front of the DCS3700.

The front LEDs and controls for the DCS3700 storage system or expansion unit is shown in Figure 48.

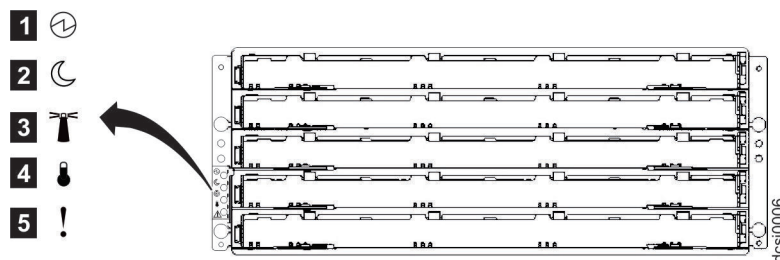


Figure 48. DCS3700 front LEDs and controls

Figure 49. DS3524 storage subsystem and EXP3524 storage enclosure front LEDs

- 1 Power-on LED (green)**  
LED is lit, it indicates that the power supply is turned on and is supplying both 5-volt and 12-volt dc power.
- 2 Standby power LED (green)**  
Future use only.
- 3 System locator LED (blue)**  
This blue LED can be lit by the Storage Manager software to aid in visually locating the storage subsystem.
- 4 Overtemperature LED (amber)**  
When this amber LED is lit, it indicates that the storage subsystem is in an over temperature condition.

## 5 System error LED (amber)

When this amber LED is lit, it indicates that the unit has a fault, such as in a power supply, controller, or drive.

## Controller LEDs

This section describes the controller LEDs on the rear of the storage subsystem.

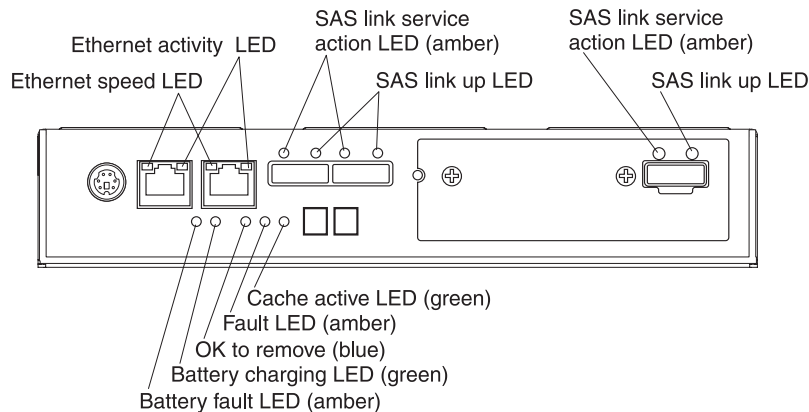


Figure 50. Controller LEDs

### Ethernet speed LED

When this LED is lit, it indicates that the Ethernet speed between the controller and the management workstation is 1000 Mbps. When this LED is off, it indicates that the Ethernet speed is 100 Mbps.

### Ethernet activity LED

When this LED is lit, it indicates that the link is established between the controller and the management workstation. When this LED is flashing, there is activity between the controller and the management workstation. When this LED is off, no link is established between the controller and the management workstation.

### SAS link service action LED (amber)

When this LED is lit, it indicates a problem with the SAS link that requires service action. The normal condition of this LED is off.

### SAS link up LED (green)

When this LED is lit, it indicates that the link is established between the controller and a host. When this LED is flashing, it indicates activity on the link. When this LED is off, no link is established.

### Cache active LED (green)

When this LED is lit, it indicates that battery backup has been enabled and data is in the memory cache. When this LED is blinking, cache offload is in process. When this LED is off, caching is turned off and no data is in the memory cache.

### Fault LED (amber)

When this LED is lit, it indicates that a fault has occurred in the controller and the controller must be replaced. The normal condition of this LED is off.

### OK to remove LED (blue)

When this LED is lit, it indicates that it is safe to remove the controller from the DCS3700; no activity is taking place, and no data remains in the memory cache. The normal condition of this LED is off.



**Battery charging LED (green)**

When this LED is lit, the battery is fully charged. When this LED is blinking, the battery is charging. When this LED is off, the battery either failed or has been removed from the controller.

**Battery fault LED (amber)**

When this LED is lit, it indicates that the battery fails to hold a charge and should be replaced. The normal condition of this LED is off.

If the optional Fibre Channel host port adapter is installed in the controller, the host port adapter contains four additional Fibre Channel host connectors with LEDs.

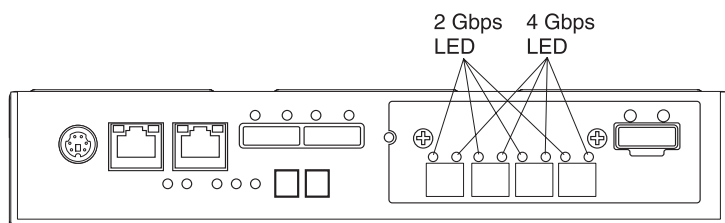


Figure 51. Fibre Channel host port adapter LEDs

**Fibre Channel speed LEDs 2 Gbps and 4 Gbps**

These LEDs in combination indicate the speed of the Fibre Channel host port.

Table 13. Fibre Channel port LEDs

2 Gbps LED	4 Gbps LED	Host port speed
On	Off	2 Gbps
Off	On	4 Gbps
On	On	8 Gbps
Off	Off	No SFP module is present or the SFP module is faulty

If the optional SAS host port adapter is installed in the controller, the host port adapter contains two additional SAS host connectors with LEDs.

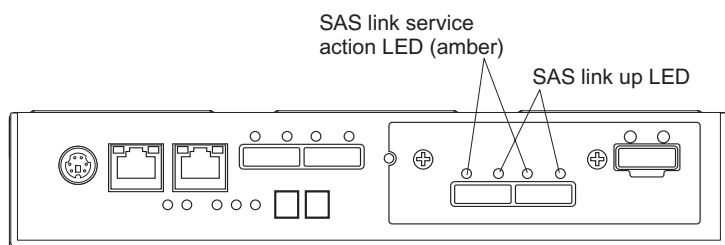


Figure 52. SAS host port adapter LEDs

**SAS link service action LED (amber)**

When this LED is lit, it indicates a problem with the SAS link that requires service action. The normal condition of this LED is off.

### SAS link up LED (green)

When this LED is lit, it indicates that the link is established between the controller and a host. When this LED is flashing, it indicates activity on the link. When this LED is off, no link is established.

## ESM LEDs

This section describes the ESM LEDs. Figure 53 shows the LEDs on the ESM.

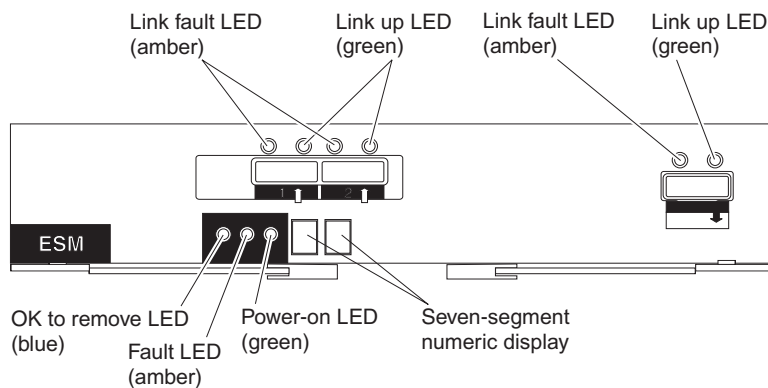


Figure 53. ESM LEDs

### Link fault LED (amber)

When this amber LED is lit, it indicates that the link through the SAS cable is not successful.

### Link up LED (green)

When this green LED is lit, it indicates that the link through the SAS cable is successful.

### OK to remove LED (blue)

This LED is supported only when the EXP3500 is attached to a DS3500 controller. Do not remove the ESM unless this blue LED is lit.

### Fault LED (amber)

When this amber LED is lit, it indicates that the ESM has failed.

### Power-on LED (green)

When this green LED is lit, it indicates that the ESM is receiving power.

## Fan assembly LEDs

This section describes the storage expansion enclosure fan assembly LEDs.

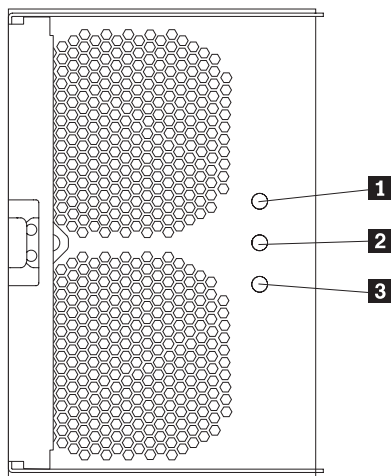





Figure 54. Fan assembly LEDs

Table 14. Fan assembly LEDs

Number	LED	Normal Status	Problem Status
1	Power 	On (Green)	Off: No power to fan assembly
2	Service Action Required (Fault) 	Off	On (Amber): A fault exists within the fan assembly
3	Service Action Allowed 	Off	On (Blue): The fan assembly can be removed

## AC power-supply LEDs

This section describes the primary LEDs on the DCS3700 ac power supplies.

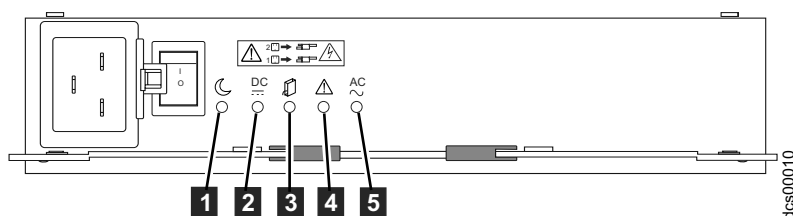


Figure 55. AC power-supply LEDs

### 1 Standby power LED (green)

Future use only.

### 2 DC power LED (green)

When this green LED is lit, it indicates that the DCS3700 is turned on and is supplying 5-volt, 12-volt, and 48-volt dc power.

### 3 Service Action Allowed LED (blue)

When this blue LED is lit, it indicates that it is safe to remove the power supply.

#### 4 Fault LED (amber)

When this amber LED is lit, it indicates that a power supply or fan has failed or that a redundant power supply is not turned on.

#### 5 AC power LED (green)

When this green LED is lit, it indicates that the storage subsystem is receiving ac power.

## Drive drawer LEDs

This section describes the LEDs on storage expansion enclosure drive drawers.

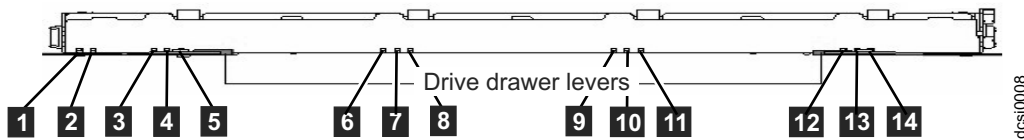





Figure 56. Drive drawer LEDs

Table 15. Drive drawer LEDs

Number	LED	Normal Status	Problem Status
1	Service Action Allowed 	Off	On (Blue): The drive drawer can be removed  The drawer Service Action Allowed LED is also lit when a Service Action Allowed LED on one of the drives in the drawer is lit.
2	Service Action Required (Fault) 	Off	On (Amber): A fault exists within the drive drawer
3 - 14	Drive Activity (for drives 1 to 12 in the drawer)  <b>Note:</b> The associated disk drive is indicated by a number (1 to 12) that is displayed inside the Drive Activity icon.	On (Green): Power is on, drive is operating normally  Blinking (Green): Indicates drive I/O activity	Off: No power to the drive or a drive is not installed

## Disk drive LEDs

This section describes the service LEDs on the disk drives. The drive power/drive activity LEDs are located on the front of the drive drawer. See “Drive drawer LEDs” for more information.

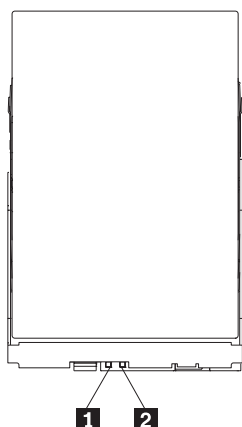


Figure 57. Disk drive LEDs

Table 16. Disk drive LEDs



Number	LED	Normal Status	Problem Status
1	Service Action Allowed 	Off	On (Blue): The disk drive can be removed
2	Service Action Required (Fault) 	Off	On (Amber): A fault exists within the disk drive

Table 17. Drive state indicated by the LEDs

Drive State	Drive Power LED (Green)	Drive Service Action Required LED (Amber)	Drive Service Action Allowed LED (Blue)
Power is not applied	Off	Off	Off
Normal operation: The power is turned on but there is no drive I/O activity	On	Off	Off
Normal operation: Drive I/O activity is occurring	Blinking	Off	Off
Service Action Required: A fault condition exists and the drive is offline	On	On	On
Power is applied but drives are spun-down because they are offline, are part of an "Exported - Ready to import" array, or are incompatible or not certified.	Off	Off	On

## Seven-segment numeric display LEDs

The seven-segment numeric display LEDs provide information about enclosure identification and diagnostics. Figure 58 on page 80 shows the numeric display LEDs.

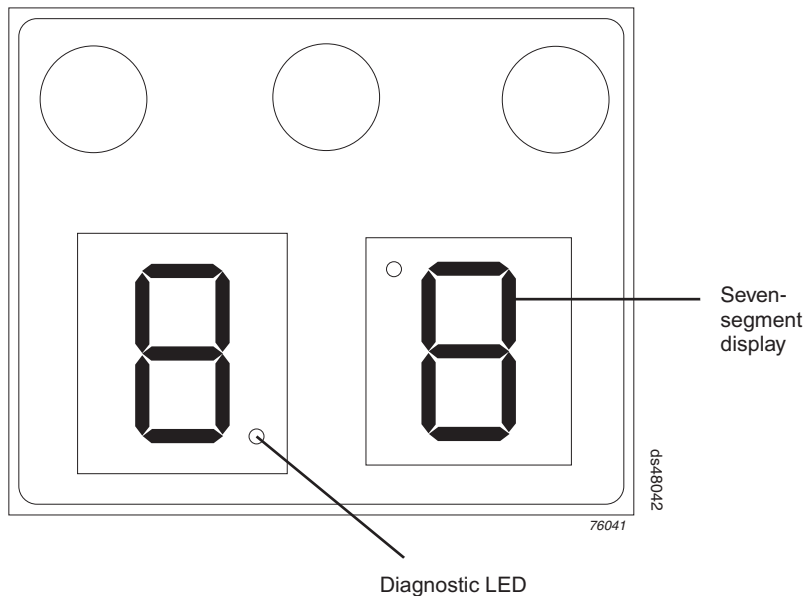


Figure 58. Numeric display LEDs

When you turn on the power to the storage or storage enclosure, the numeric display LEDs cycle through various codes as the controller or ESM firmware starts to boot.

When the storage subsystem is operating normally, the numeric display shows the enclosure identification (enclosure ID) for that individual enclosure.

If an error has occurred and the Needs Attention LED is on, the numeric display shows diagnostic information. The numeric display indicates the information is diagnostic by illuminating an LED that appears as a decimal point between the display numbers. The diagnostic LED turns off when the numeric display shows the enclosure ID. The numeric display shows various diagnostic codes as the enclosures perform the startup process after each power cycle or reset. After diagnostics are complete, the current storage subsystem enclosure ID is displayed.

Diagnostic codes in the form of Lx or Hx, where x is a hexadecimal digit, indicate storage subsystem state information. In general, these codes are displayed only when the storage subsystem is in a non-operational state. The storage subsystem might be non-operational due to a configuration problem (such as mismatched types), or it might be non-operational due to hardware faults. If the storage subsystem is non-operational due to system configuration, the storage subsystem Needs Attention LED is off. If the storage subsystem is non-operational due to a hardware fault, the storage subsystem Needs Attention LED is on. The definitions for Lx diagnostic codes are listed in Table 18.

Table 18. Controller numeric display diagnostic codes

Value	Description
L0	Mismatched controller board ID.
L1	Missing interconnect canister.
L2	Persistent memory errors.
L3	Persistent hardware errors.
L4	Persistent data protection errors.
L5	ACS failure.
L6	Unsupported host card.
L7	Submodel identifier not set or mismatched.

Table 18. Controller numeric display diagnostic codes (continued)

Value	Description
L8	Memory configuration error.
L9	Link speed mismatch.
LA	Reserved.
LB	Host card configuration error.
LC	Persistent cache backup configuration error.
LD	Mixed cache memory DIMMs.
LE	Uncertified cache memory DIMM sizes.
LF	Lockdown with limited SYMBol support.
LH	Controller firmware mismatch.

Table 19. ESM numeric display diagnostic codes

Value	Description
FF	ESM Boot Diagnostic executing.
88	This ESM is being held in Reset by the other ESM.
AA	ESM-A application is booting up.
bb	ESM-B application is booting up.
L0	Mismatched ESM types.
L2	Persistent memory errors.
L3	Persistent hardware errors.
L9	Over Temperature.
LL	Cannot read midplane EEPROMs.
LP	Missing Drive Port Mapping table.
Ln	ESM not valid for enclosure.
H2	Invalid/Incomplete Configuration.
LF	Lockdown with limited SYMBol support.
LH	Controller firmware mismatch.
H3	Maximum Reboot Attempts Exceeded.
H4	Cannot Communicate with Other ESM.
H5	Midplane Harness Failure.
H6	Firmware Failure.
H9	Non-Catastrophic HW. ESM operational, but in a degraded mode.
J0	Incompatible module.

## Cache memory and cache battery

Each storage controller in the DCS3700 storage subsystem contains 2 GB or 4 GB of cache memory to store read and write operations. In a dual controller configuration, both controllers in the DCS3700 must have the same amount of cache memory. The battery unit contains enough charge to back up the cached data in each controller to a flash drive in the event of a DCS3700 power failure.

## Cache memory

The controller has a cache active LED that indicates the current status of the cache. The LED is lit when there is data in the cache, and it is off when there is no data in the cache.

If caching is enabled and the cache active LED is not lit during I/O activity, it indicates one of the following conditions:

- The cache memory from either controller A or controller B has failed
- The cache sizes in controller A and controller B are not the same
- The battery has failed

**Note:** Always use the Storage Manager client to check the cache memory settings before you assume that a hardware failure has occurred.

See “Controller LEDs” on page 74 for the location of the cache active LED on a controller.

## Controller cache battery

The backup battery unit provides power to back up the cache memory of each controller onto flash drives in the event of a power failure. Each battery unit contains a sealed, rechargeable SMART lithium ion battery.



### CAUTION:

**The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C007)**

Replace the battery units in the DCS3700 storage system when they are identified as failing by the Storage Manager Subsystem Management window, or when the battery fault LEDs light. See “Controller LEDs” on page 74 for the location of the battery fault LED.

Replace only the battery unit that is indicated as failed by the LEDs or in the Storage Manager Subsystem Management window. In a dual controller configuration, you do not need to replace both battery units when the Battery fault LEDs indicate that only one battery unit has failed. Each controller has a green Battery charging LED that indicates the status of the battery unit.

- The LED is on when the battery is fully charged
- The LED flashes when the battery is charging or performing a self-test
- The LED is off when the battery or the battery charger has failed or is missing

## Cache battery learn cycle

The battery performs a learn cycle the first time the storage subsystem is turned on, and again every eight weeks thereafter, to assess the charge capacity of the battery. If the battery fails the learn cycle or takes too much time to reach full charge, the Battery charging LED turns off, the Battery fault LED turns on and the Storage Manager identifies the battery as failed.

The learn cycle takes up to three hours. During this time, the cache will be active if the battery is in optimal condition. If the learn cycle is interrupted, the current learn cycle will be terminated and the battery will perform a new learn cycle at the next scheduled interval (eight weeks from the current learn cycle). A learn cycle interruption is caused by removing the battery from the controller chassis, resetting the power to the storage subsystem, or if an storage enclosure or battery overheats.



Data caching starts after the battery is charged to the programmed voltage level, which occurs when the storage subsystem power is first turned on, when a new battery is installed to replace a failed battery, or when the subsystem power is turned on after months of inactivity.

**Attention:** Write caching is suspended while a battery pack is either charging or self-testing.

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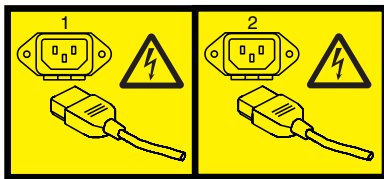
## Turning off the storage subsystem

The DCS3700 is designed to run continuously. After you turn it on, 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 unexpected shutdown” on page 85*.

**Attention::** Except in an emergency, never turn off the power if any amber (needs attention) LEDs are lit. Correct the fault before you turn off the power. Use the Storage Manager software and the amber LEDs to check the overall status of the DCS3700. All LEDs should be green on the front of the storage subsystem. If they are not, use the Storage Manager software to diagnose the problem so that the DCS3700 will power-on correctly later.

(L003)



or





**Attention::** Turning off and turning on power without waiting for the storage subsystem disk drives to spin down can damage the drives and might cause data loss. Always wait at least 90 seconds after you turn off the power before you turn on the power again.

### Power-off overview

Review the following information before you continue with the power-off procedure:

Turn off the power to each device according to the following shutdown sequence:

1. Turn off power to the host before the storage subsystem. If the host must stay powered-on to support a network, see the operating-system documentation for information about disconnecting the storage subsystem logical drives from the host before the storage subsystem is powered-off.
2. Turn off power to the storage system before you turn off power to the expansion enclosures. Turn off both power-supply switches on the rear of the enclosures.
3. Turn off power to other supporting devices (for example, management stations).

**Note:** You do not have to perform this step if you are servicing only the storage subsystem.

To turn off power to one or more components of the storage subsystem for a planned shutdown, complete the steps in the following procedure. To turn off power for an unplanned shutdown, see “Restoring power after an unexpected shutdown” on page 85.

Figure 9 on page 13 shows the locations of the power switches on a storage subsystem.

Before you proceed, use the Storage Manager software to determine the status of the storage subsystem components and special instructions. The operating-system software might require you to perform other procedures before you turn off the power.

1. Stop all I/O activity to each storage subsystem.
2. Determine the status of all storage subsystems components in the configuration by completing the following steps:
  - a. Check all LEDs on each component in the expansion enclosures. Make sure that all the LEDs show normal status.
  - b. Check all LEDs on each component in the storage system. Make sure that all the LEDs show normal status.
  - c. Review the status of the configuration in the Subsystem Management window by clicking the **Summary** tab.

The status is either Optimal or Needs Attention.

3. Do the LEDs indicate normal operation, and is the status Optimal on all configuration components?
  - Yes: Go to step 5 on page 85.
  - No: Go to step 4.
4. To diagnose and correct the fault, complete the following steps:
  - a. Run the Recovery Guru by clicking Recovery Guru in the toolbar in the Subsystem Management window.
  - b. Complete the recovery procedure.

If the Recovery Guru directs you to replace a failed component, use the individual LEDs to locate the failed component.

- c. When the recovery procedure is completed, click **Recheck** in the Recovery Guru. This action runs the Recovery Guru again to make sure that the problem is corrected.
  - d. If the problem has not been corrected, contact your IBM technical-support representative. Do not turn off power until all problems are corrected.
5. Check the cache active LED, and make sure that it is off.  
If the cache active LED is lit, the cache contains data. Wait for the data to clear from cache memory before you turn off the power.
  6. Check the LEDs of the disk drive drawer to make sure that all drive activity LEDs are off.  
If one or more LEDs are flashing, data is being written to or from the drives. Wait for all activity LEDs to stop flashing.
  7. Turn off the ac power switch on the rear of the DCS3700 storage system in the storage subsystem.  
  
**Note:** Until the power switch on each power supply is turned off, power remains turned on for both controllers.
  8. Turn off both power switches on the rear of each storage expansion enclosure in the configuration.
  9. After you perform the necessary maintenance procedures, turn on the power, using the procedure in “Powering on the DCS3700” on page 68.

---

## 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 helps to safeguard your equipment from potential damage due to electrical surges when power is restored. If the storage subsystem loses power unexpectedly, it might be due to a hardware failure in the power system or in the midplane.

To shut down the system during an emergency, complete the following steps:

1. If you have time, stop all I/O activity to the storage subsystem by shutting down the host or disconnecting the storage subsystem logical drives through the host.
2. Check the LEDs. Make note of any amber LEDs that are lit so that you can correct the problem when you turn on the power again.
3. Turn off all power-supply switches, starting with the DCS3700 storage system first and followed by the DCS3700 expansion enclosures. Then, disconnect the power cables from the storage subsystem.

---

## Restoring power after an unexpected shutdown

To restore power to the storage subsystem after an unplanned shutdown, complete the following steps.

### DANGER

<b>Never turn on any equipment when there is evidence of fire, water, or structural damage.</b>
---

1. After the emergency situation is over or power is restored, visually check the storage subsystem for damage. Is there evidence of damage to any of the storage subsystem components, cables, or equipment that is attached to the storage subsystem?
  - **Yes:** Do not continue with this procedure. Contact your IBM technical-support representative for assistance. Depending on the current service agreements, you might have to return the equipment to the factory or local service center for repair.
  - **No:** Go to step 2 on page 86.

**Attention:** To avoid potential data loss, make sure that the storage system and the expansion enclosure power switches are turned off before you reset circuit breakers in the rack. Resetting circuit breakers after an emergency situation while the storage system and the expansion enclosure power switches are turned on can cause data loss, because the configuration components might not be powered-on in the correct sequence. See “Powering on the DCS3700” on page 68 for details about the correct power-on sequence.

2. After you check the storage subsystem for damage, make sure that the power switches are off; then connect the DCS3700 power cables, if required.
3. Check the system documentation of the hardware devices that you want to turn on and determine the correct startup sequence.
4. Turn on both of the power-supply switches on DCS3700 expansion enclosures and make sure that no ESM or power-supply fault LEDs are lit before you power on the DCS3700 storage system.

In addition, consider the following items:

- The storage subsystem supports simultaneous power-on of the system components; however, always check the system documentation of the hardware devices that you want to turn on and determine the correct startup sequence.
  - A storage subsystem in an optimal state recovers automatically from an unexpected shutdown and unattended simultaneous restoration of power to system components. After power is restored, contact your IBM technical-support representative if any of the following conditions occur:
    - The storage subsystem logical drives and arrays are not displayed in the Storage Manager graphical user interface.
    - The storage subsystem logical drives and arrays do not come online.
    - The storage subsystem logical drives and arrays seem to be degraded.
5. Turn on both of the power-supply switches on the DCS3700 storage system. See “Solving problems” on page 129.

---

## Recovering from an overheated power supply

Each storage enclosure contains two power supplies. Each power supply contains a built-in temperature sensor to prevent the power supply from overheating. Under normal operating conditions, with an ambient air temperature range of 10°C to 40°C (50°F to 104°F), the fans in the power supplies maintain a suitable operating temperature inside the module.

If the internal temperature reaches 65°C (149°F), the power supply shuts down automatically. If both power supplies shut down because of overheating, the storage subsystem has no power, and all LEDs are off.

The following factors can cause the power supplies to overheat:

- An unusually high room temperature
- Fan failures in the power supplies
- Defective circuitry in a power supply
- Blocked air vents
- Failures in other devices in the configuration or rack

If a fan failure causes overheating, the system-error LED and overtemperature LEDs on the front bezel are lit. The fault LED on the power supply might also be lit. “Checking the LEDs” on page 73 shows the location of the LEDs on the DCS3700.

If the storage subsystem temperature exceeds 45°C (113°F), the storage management software displays a Needs Attention icon in the Subsystem Management window. If the air temperature inside the rack reaches 65°C (149°F), the power supplies automatically shut down. If event monitoring is enabled and event notification is configured, the software issues two critical-problem notifications.

- If *one* power supply shuts down, the storage management software displays a Needs Attention status in the Subsystem Management window.
- If *both* power supplies shut down, the storage subsystem shuts down, and the storage management software displays a Not Responding status in the Array Management window.

**Attention:** To prevent damage to the storage subsystem components when the power supplies automatically shut down, immediately remove all rack panels to help reduce the rack air temperature.

To resume normal operation after a power-supply shutdown, complete the following steps:

1. Did you use the procedure “Troubleshooting the storage subsystem” on page 72 to identify an overheating problem?
  - **Yes:** Go to step 2
  - **No:** Perform the procedure in “Troubleshooting the storage subsystem” on page 72 to make sure that the power supplies have shut down because of an overheating problem, and then go to step 2
2. Stop I/O activity to the storage system and all attached expansion enclosures.
3. Take all or some of the following measures to alleviate the overheating problem:
  - Remove all panels from the rack immediately.
  - Use external fans to cool the area.
  - Shut down the power to the storage enclosure, using the procedure that is described in “Performing an emergency shutdown” on page 85.
4. Wait for the air in and around the storage subsystem to cool.  
 After the temperature inside the power supplies drops to below 65°C (149°F), the storage subsystem is capable of power-on recovery without operator intervention. After the air has cooled, the power supplies should turn on automatically. If the power supplies restart automatically, the controllers will reset and return to normal operation.
5. Did the power supplies restart automatically?
  - **Yes:** Go to step 8
  - **No:** Go to step 6
6. Turn off both power switches on the DCS3700 storage system (see Figure 9 on page 13 and then power-off all connected DCS3700 expansion enclosures. Wait 1 minute and then turn on power to all connected DCS3700 expansion enclosures.  
 While the expansion enclosure powers-on, the LEDs on the front and the rear of the enclosure flash intermittently. Depending on your configuration, the expansion enclosure can take between 20 seconds and several minutes to power-on.
7. Turn on both power switches on the rear of the DCS3700 storage system.  
 The storage system can take up to 10 minutes to power-on and up to 15 minutes for the battery self-test to be completed. During this time, the LEDs on the front and the rear of the storage system flash intermittently.
8. Check the LEDs on the front and rear of the storage system and each attached expansion enclosure (a green LED indicates a normal status; an amber LED indicates a hardware fault); then, check the array status in the Subsystem Management window.
  - Open the Subsystem Management window for the storage array.
  - Click the **Summary** tab and review the status of the configuration.
 The status is either Optimal or Needs Attention.
9. Does each module (controller, power supply, ESM) display green status LEDs only, and is the status Optimal for each module component?
  - **Yes:** Go to step 11 on page 88
  - **No:** Go to step 10
10. Diagnose and correct the fault.

- a. To run the Recovery Guru, click Recovery Guru in the toolbar in the Subsystem Management window.
  - b. Complete the recovery procedure.  
If the Recovery Guru directs you to replace a failed component, locate and troubleshoot that component. See “Checking the LEDs” on page 73.
  - c. When the procedure is completed, select **Recheck** in the Recovery Guru. This runs the Recovery Guru again to make sure that the problem is corrected.
  - d. If the problem remains, contact your IBM technical-support representative.
11. Replace the bezel on the storage enclosure, if applicable.

---

## Chapter 5. Replacing components

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### Replacing components

This chapter contains information about replacing components or installing optional devices in the DCS3700 storage system and DCS3700 expansion unit.

**Attention:** To avoid overheating the storage enclosure and causing damage to its components, replace failed parts within 10 minutes, unless otherwise indicated. The Recovery Guru in the Storage Manager software identifies failed parts.

Do not remove the failed part from the storage enclosure until you:

- Review the replacement procedure for the failed part in this guide.
- Locate screw drivers or any other hand tools that you might need to replace the failed part.
- Receive the replacement part and are ready to install it in the enclosure.

---

### Service Action Allowed LED

Each controller, ESM, fan assembly, disk drive, disk drive drawer, and power supply has a blue Service Action Allowed LED. The purpose of the Service Action Allowed LED is to help ensure that a component is not removed before it is safe to do so. Do not remove any component unless the component Service Action Allowed LED is lit.

#### Attention

If you remove a controller, ESM, disk drive, disk drive drawer, or power supply when the Service Action Allowed LED is not lit, a loss of data availability can result. If an amber LED is lit and the associated Service Action Allowed LED is *not* lit, you must perform additional diagnostics *before* you can remove the indicated component. Use the Recovery Guru instructions in the Subsystem Management window or see the applicable component replacement instructions in this chapter for the additional diagnostics that are required in this case.

The Service Action Allowed LED automatically turns on or off as conditions change. Wait at least 2 minutes after you replace a component for the storage subsystem to recognize the new component and update the LED status. In most cases, when a single component fails, the Service Action Allowed LED stays lit when the amber LED is lit for the component.

---

### Working with controllers

This section describes how to remove a controller, remove and install a cover, install a controller, replace a controller, and dispose of the system-board battery on the controller.

**Attention:** To avoid overheating the storage enclosure and causing damage to its components, replace failed parts within 10 minutes. The Recovery Guru in the Storage Manager software identifies failed parts.

Do not remove the failed part from the storage enclosure until you:

- Review the replacement procedure for the failed part in this guide.
- Locate screw drivers or any other hand tools that you might need to replace the failed part.
- Receive the replacement part and are ready to install it in the enclosure.

---

## Removing a controller

### About this task

To remove a controller from the storage subsystem, complete the following steps:

### Procedure

1. Read the safety information and best practices information found in the prolog of this document.  
**Attention:** Never remove a controller unless the Service Action Allowed LED is lit. Doing so can result in a loss of data.
2. If the controller has failed, do not continue with this procedure. Instead, go to “Replacing a controller” on page 91.  
**Attention:** Handle and install cables correctly to avoid degraded performance or loss of communication with devices. See Chapter 3 “Cabling the DCS3700” in this document for more information.
3. Disconnect all attached interface cables from the controller. Be sure to label each cable so that you can reconnect it correctly.
4. Remove the controller from the chassis.

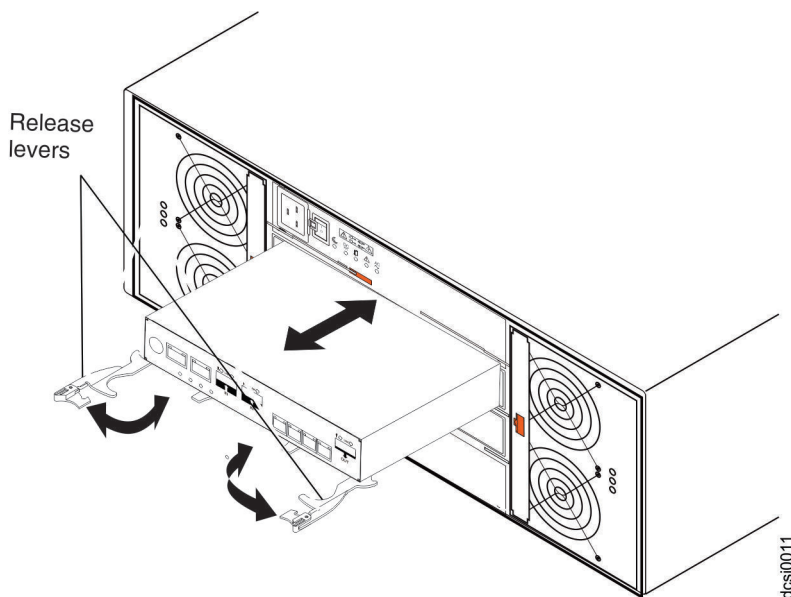


Figure 59. Removing a controller

- a. Open the two release levers as shown in the illustration. The controller moves out of the bay approximately 0.6 cm (0.25 inch).
- b. Pull the controller out of the bay.
- c. Place the controller on a level surface.

### Results

**Attention:** After you remove a controller, wait 90 seconds before you reseal or replace the controller. Failure to do so might cause unpredictable results.



---

## Removing and installing a cover

### About this task

To remove a cover from a controller, complete the following steps:

### Procedure

1. Read the "Safety" information and "Best practices" information found in the prolog and Chapter 1 of this document.
2. Press on the two release buttons and slide the cover toward the rear of the controller.

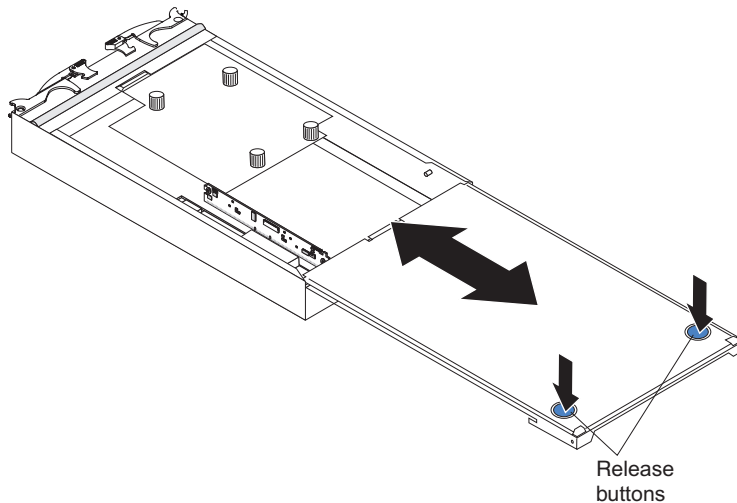


Figure 60. Removing the cover

3. Remove the cover and save it for future use.

### Results

To install a cover on a controller, complete the following steps:

1. Read the "Safety" information and "Best practices" information found in the prolog and Chapter 1 of this document.
2. Align the cover on the controller and slide it toward the front of the controller to install it.

---

## Replacing a controller

### About this task

**Attention:** Make sure that both power supplies are connected and powered-on and no amber LEDs are lit. Make sure that the power LEDs on both power supplies are lit. If the status of either of the power supplies is not Optimal, replace that power supply before you proceed with the controller replacement procedure.

To replace a controller in a DCS3700 storage system, complete the following steps.

**Attention:**

- If you are replacing a failed controller with a replacement controller from IBM Service, check to ensure that you have ordered the replacement controller that contains the same amount of cache memory that is installed in the failed controller. Also, transfer the cache backup battery and cache backup flash memory module to the replacement controller. Transfer the battery and flash memory exactly as described in this procedure; failure to remove and insert these items in the correct sequence can damage the controller.

**Procedure**

1. Read the "Safety" information and "Best practices" information found in the prolog and Chapter 1 of this document.
2. Use the Storage Manager software to print a storage subsystem profile. Move logical drive ownership to the other controller. If the controller that you are replacing has failed but is still operating, move the failed controller to the Offline state.

**Attention:** Never remove a controller unless the OK to remove LED is lit. Doing so can result in a loss of data.

3. Locate the failed controller by checking the amber LEDs on the controllers in the storage system.
4. Is the OK to remove LED lit?
  - **Yes:** Go to step 5.
  - **No:** Another component might require attention before you can remove the controller. Use the Recovery Guru in the Subsystem Management window to identify and correct any additional failures. If there are none, proceed with step 5 to replace the controller.

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

5. Unpack the new controller. Save all packing materials in case you have to return the new controller.
6. Determine whether the replacement controller will be controller A or controller B (controller A is installed in slot SBB A; controller B is installed in slot SBB B), and then apply the controller labels for host ports and drive expansion ports to the replacement controller. The controller labels and instructions are included with the replacement controller. Make sure that the labels are aligned correctly and do not cover any connectors or LEDs.

**Attention:** Handle and install cables correctly to avoid degraded performance or loss of communication with devices. See Chapter 3 "Cabling the DCS3700" for more information.

7. Disconnect all attached interface cables from the failed controller. Be sure to label each cable so that you can reconnect it correctly to the new controller.
8. Remove the controller from the chassis

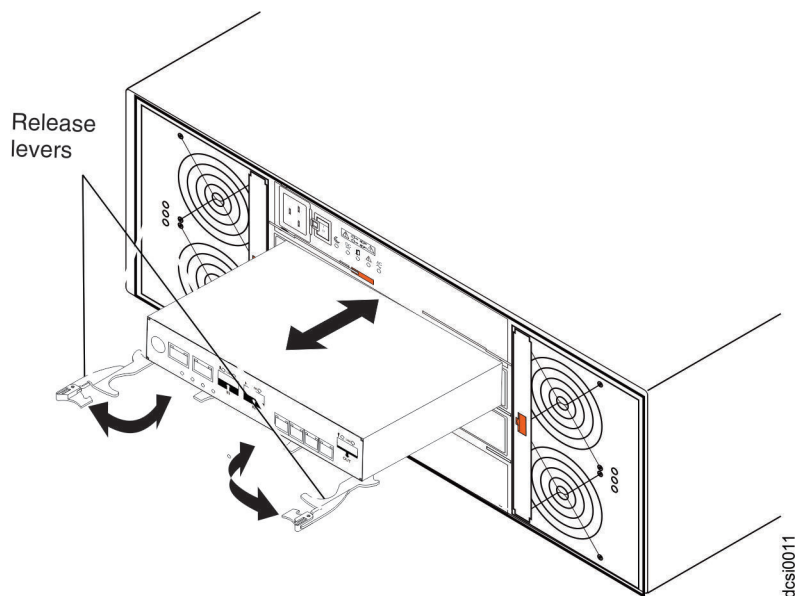


Figure 61. Removing and replacing a controller

- a. Open the two release levers as shown in the illustration. The controller moves out of the bay approximately 0.6 cm (0.25 inch).
- b. Pull the controller out of the bay.
- c. Place the controller on a level surface.

**Attention:** The DCS3700 replacement controller ships with a temporary filler. Place the temporary filler in the controller chassis bay after the failed controller is removed, to maintain proper airflow and cooling.

9. Remove the cover (see “Removing and installing a cover” on page 91).
10. If an optional SAS or Fibre Channel host daughter card is installed in the controller, remove the host daughter card and set it aside (see “Removing the optional host interface adapter”).
11. Remove the battery from the failed controller.

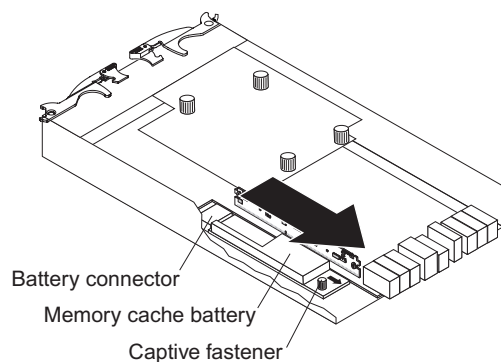
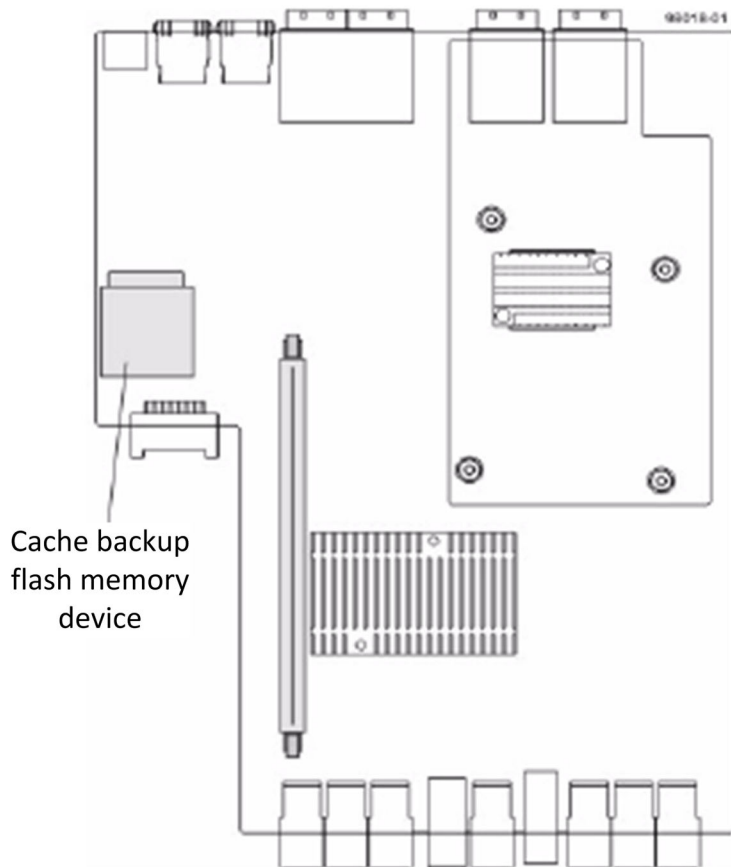


Figure 62. Removing the battery unit from the controller

- a. Loosen the blue captive fastener until the battery can move in the direction that is indicated by the arrow.
- b. Slide the battery unit out of the controller in the direction that is indicated by the arrow.
- c. Set the battery aside.

12. Remove the cache backup flash memory device from the controller and install in the new controller. Figure 63 shows the location of the of the cache backup flash memory device on controller board.
  - a. Release the flash memory device by gently pushing the memory farther into the slot. The slot will release the flash memory device and push the flash memory device out of the slot.
  - b. Carefully pull the flash memory device free from the slot.
  - c. Install the cache battery backup flash memory device into the empty slot location of the new controller by pressing the flash memory device into the slot until the flash memory is fully seated.



*Figure 63. Cache backup flash memory device location*

13. Install the battery from step 11 on page 93 into the new controller:
  - a. Slide the battery into the controller until the battery connector pins are firmly seated in the controller battery connector.
  - b. Turn the captive fastener clockwise to secure the battery in place.
14. If the controller contains the optional SAS or Fibre channel host interface card, install the host interface card into the new controller. (See "Installing an optional host interface adapter" on page 96).
15. Install the cover (see "Removing and installing a cover" on page 91)  
**Attention:** Remove the temporary filler before you install the replacement controller.
16. Install the new controller.
  - a. Make sure that the release levers on the controller are in the open position.
  - b. Slide the controller into the bay until it stops.

- c. Push the release levers to the closed position.
17. Connect the cables that you disconnected in step 7 on page 92.
18. Wait up to 5 minutes for the Storage Manager software to recognize the new controller.
19. Complete any remaining Recovery Guru procedures for controller replacement.
20. Check the LEDs on the new controller to make sure that the controller is fully operational.
21. Use the Subsystem Management window to check the status of all components in the storage subsystem.
  - If the new controller is online and the Subsystem Management window indicates normal operation, go to step 24.
  - If the new controller is online and the Subsystem Management window indicates a problem status, go to the Troubleshooting section of this document.
  - If the new controller is offline, continue with step 22.
22. If the newly inserted controller is in an offline state, see the Storage Manager online help for instructions on bringing the controller online. If necessary, open the Subsystem Management window and place the controller online; select the offline controller and click **Advanced** → **Recovery** → **Place controller online**.
23. Verify the state of the LEDs on the newly inserted controller. See the "Controller LEDs" section of this document. You can also use the Subsystem Management window to identify any new faults. Do any storage subsystems have a fault (Needs Attention) status?
  - **Yes:** Click **Recovery Guru** in the Subsystem Management window toolbar, and complete the recovery procedure. If the problem remains, contact your IBM technical-support representative.
  - **No:** Go to step 24.
24. Use the Storage Manager software to print a new storage subsystem profile.

---

## Removing and disposing of the system-board lithium battery

### About this task

When you disassemble the storage subsystem for disposal, use the information in this section to locate, remove, and dispose of the lithium batteries that are on the system boards in controller A and controller B.

#### Statement 2



#### CAUTION:

When replacing the lithium battery, use only an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

#### *Do not:*

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

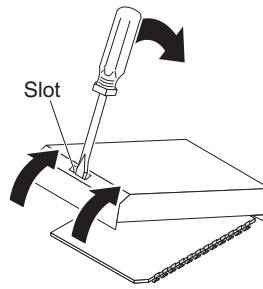
To remove the batteries for disposal, complete the following steps:

## Procedure

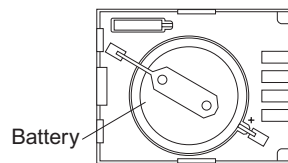
1. Locate the battery compartment on the system board in the controller.

### Note:

- a. The battery compartment is located near the edge of the controller system board next to the mounting posts for the optional host daughter cards.
  - b. If a host daughter card is installed on the controller, you must remove the card to gain access to the battery compartment.
2. Insert the flat blade of a small screwdriver into the slot on the battery-compartment cover.



3. Move the screwdriver as shown in the illustration until the cover is released from the battery-compartment base.
4. Lift the contact tab; then, slide the battery out of the battery compartment.



5. Repeat Steps 1 through 4 to locate and remove the lithium battery in Controller B; then, continue with Step 6.
6. Dispose of the batteries as required by local ordinances or regulations.

The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries outside the United States, see <http://www.ibm.com/ibm/environment/products/batteryrecycle.shtml> or contact your local waste disposal facility.

In the United States, IBM has established a return process for reuse, recycling, or proper disposal of used batteries. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333.

---

## Installing an optional host interface adapter

### About this task

**Attention:** If you install a host interface adapter in a controller and the storage system contains two controllers, you must make sure that an identical host interface adapter is installed in the other controller.

To install a host interface adapter, complete the following steps.

**Attention:** If new host interface adapters are being installed in both controllers, to prevent data loss, you must shut down the storage system before you remove the controller from the chassis. For the correct shutdown sequence, see "Turning off the storage system" in Chapter 4. If you are installing new host interface adapters, you need to schedule time to power down the storage subsystem. Failure to upgrade both controllers prior to powering on the system results in the controllers having mismatched host interface adapters. This causes the mismatched controllers to enter into a controller lock-down.

## Procedure

1. Read the "Safety" information and "Best practices" information found in the prolog and Chapter 1 of this document.
2. Turn off the storage subsystem.
3. Disconnect the cables that are connected to the controller.
4. Remove the controller from the chassis.

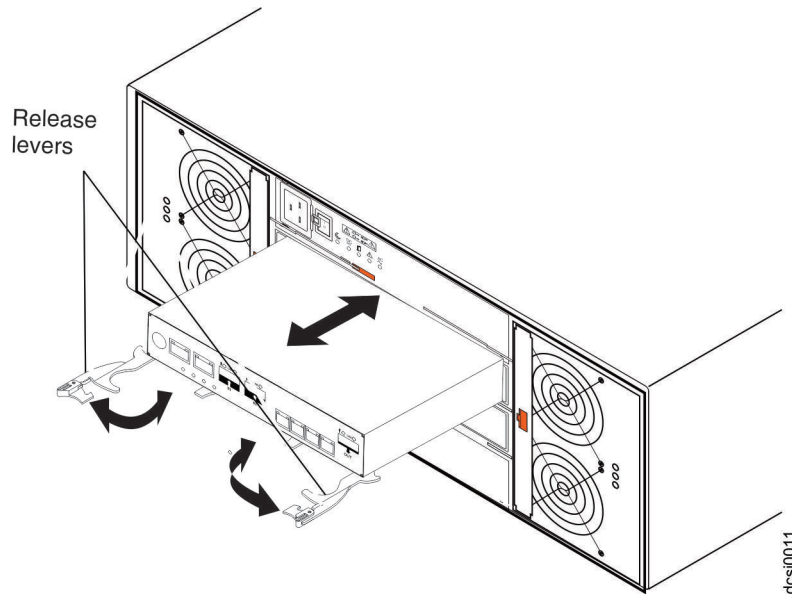
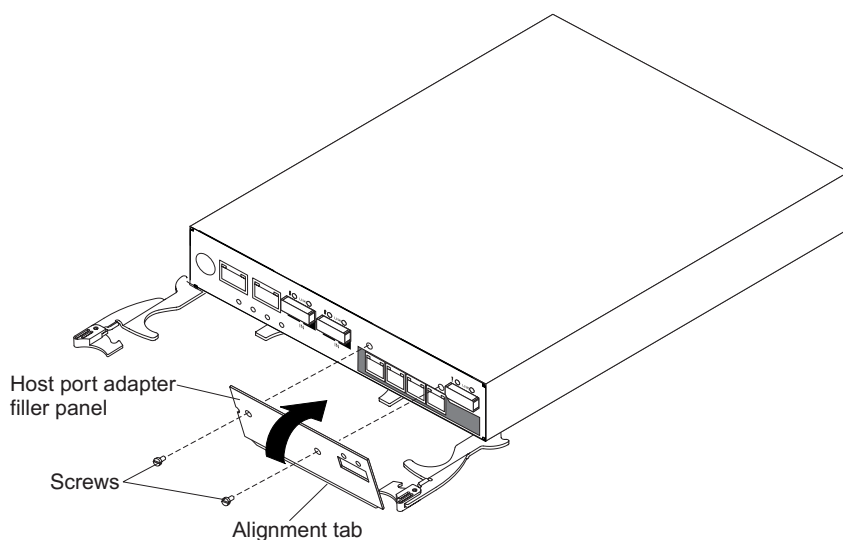


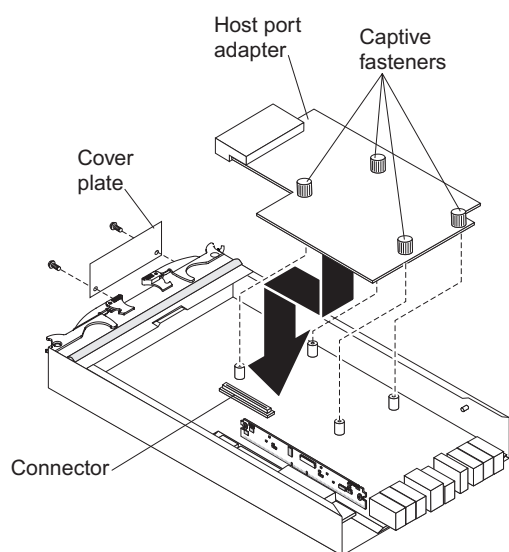
Figure 64. Removing a controller

- a. Open the two release levers as shown in the illustration. The controller moves out of the bay approximately 0.6 cm (0.25 inch).
  - b. Pull the controller out of the bay.
  - c. Place the controller on a level surface.
5. Remove the cover (see "Removing and installing a cover" on page 91).
  6. Remove the two screws from the cover plate. Rotate the cover plate to release the alignment tab and remove the cover plate from the controller.



*Figure 65. Removing the host port adapter filler panel*

7. Touch the static-protective package that contains the host port adapter to any unpainted metal surface on the storage subsystem; then, remove the adapter from the package.
8. Align the host port adapter as shown in the following illustration:



*Figure 66. Installing a host port adapter*

9. Press the card in the connector and tighten the four captive fasteners.
10. Use the alignment tab to align the cover plate that comes with the optional host port adapter.
11. Secure the cover plate with two screws.
12. Install the cover (see "Removing and installing a cover" on page 91).
13. Insert the controller into the chassis.
  - a. Make sure that the release levers on the controller are in the open position.
  - b. Slide the controller into the bay until it stops.
  - c. Push the release levers to the closed position.
14. Reconnect the cables that you disconnected in step 3 on page 97.
15. Turn on the storage subsystem.



16. Wait up to 5 minutes for the Storage Manager software to recognize the controller.
17. Check the LEDs on the controller to make sure that the controller is fully operational.
18. Use the Subsystem Management window to check the status of all components in the storage subsystem.
  - If the controller is online and the Subsystem Management window indicates normal operation, go to step 21.
  - If the controller is online and the Subsystem Management window indicates a problem status, go to the Troubleshooting section of this document.
  - If the controller is offline, continue with step 19.
19. If the newly inserted controller is in an offline state, see the Storage Manager online help for instructions on bringing the controller online. If necessary, open the Subsystem Management window and place the controller online; select the offline controller and click **Advanced → Recovery → Place controller online**.
20. Verify the state of the LEDs on the newly inserted controller. See the "Controlling LEDs" section in this document. You can also use the Subsystem Management window to identify any new faults. Do any storage subsystems have a fault (Needs Attention) status?
  - **Yes:** Click **Recovery Guru** in the Subsystem Management window toolbar, and complete the recovery procedure. If the problem remains, contact your IBM technical-support representative.
  - **No:** Go to step 21.
21. Use the Storage Manager software to print a new storage subsystem profile.

---

## Removing an optional host interface adapter

To remove a host interface adapter that is installed in a controller that is still installed in the storage subsystem, complete the following steps, otherwise, go to step 5 on page 100.

1. Before you remove a controller from the storage subsystem, read "Safety" on page xi.

**Attention:** If the host interface adapter is going to be removed from both controllers, then you will need to power off the subsystem. See "Turning off the storage subsystem" on page 83.
2. Disconnect the cables that are connected to the controller.
3. Remove the controller from the chassis.

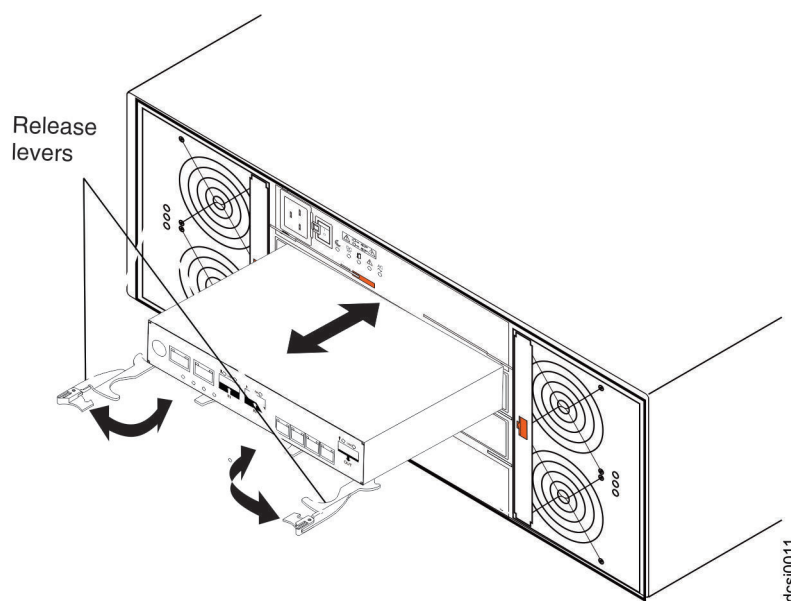


Figure 67. Remove controller from the chassis

4. Open the two release levers.
  - a. The controller moves out of the bay approximately 0.6 cm (0.25 inch).
  - b. Pull the controller out of the bay.
  - c. Place the controller on a level surface.
5. Remove the cover.
6. Remove the two screws from the cover plate. Rotate the cover plate to release the alignment tab and remove the cover plate from the controller.
7. Loosen the four captive fasteners on the card gently pull the card up off the connector and out of the controller.
8. If the controller is going to be replaced without the optional host interface adapter, then secure the cover plate back on the controller using two screws.
9. Install the cover.
10. Insert the controller into the chassis.
  - a. Make sure that the release levers on the controller are in the open position.
  - b. Slide the controller into the bay until it stops.
  - c. Push the release levers to the closed position.
11. Reconnect the cables that you disconnected.
12. If necessary, turn on the storage subsystem (see “Powering on the DCS3700” on page 68).

---

## Working with hot-swap DDMs

This section explains how you can increase the storage expansion enclosure capacity by adding more DDMs or by replacing existing DDMs with ones that have a larger capacity.

Before you begin, complete the following tasks:

- Read the safety and handling guidelines in “Safety” on page xi and in “Handling static-sensitive devices” on page 25.
- 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 DDM FRUs, review the following information:

- **DDM FRUs:**
  - When adding DDM FRUs, if you are not installing all 60 DDM FRUs into the DCS3700, install the DDM FRUs in each drive drawer in the front row (slots 1, 4, 7, and 10). To maintain uniform airflow across all drive drawers, the storage expansion enclosure must be configured with a minimum of 20 drives, with four drives in the front row of each of the five drive drawers (slots 1, 4, 7, and 10).
  - Use of non-supported drives in the storage expansion enclosures can cause the storage expansion enclosures to fail.
  - After you remove an DDM FRU, wait 90 seconds before replacing or reseating it to allow it to properly spin down. Failure to do so may cause undesired events.
- **Drive LEDs:** Each DDM FRU tray has three associated LEDs, a green drive power/drive activity LED, an amber Service Action Required LED, and a blue Service Action Allowed LED. These LEDs indicate the status for that DDM. See Table 20 for the drive LED states and descriptions.
- DDM FRUs are not interchangeable between the DCS3700 and the EXP5060 storage expansion enclosure.

*Table 20. Drive LED activity*

LED	LED state	Descriptions
Activity LED	Flashing green	The green LED flashes to indicate Fibre Channel activity to the drive.

Table 20. Drive LED activity (continued)

LED	LED state	Descriptions
Activity LED	Steady green	The green LED lights to indicate that the drive is properly installed and is spun up by the DS5000 controller.
Service Action Required LED	Flashing amber	The amber LED flashes to indicate that a drive has been identified by the software.
Service Action Required LED	Steady amber	The amber LED lights to indicate a drive failure. The drive can also be put in a failed state if the drive is not certified for the DCS3700 storage subsystem. Use the DS Storage Manager storage subsystem Management window to verify that this is the case and replace the drive with the drive option or FRU that is certified for that particular storage subsystem.
Activity and Service Action Required LEDs	All unlit	Check for and resolve the following situation: <ul style="list-style-type: none"> <li>DCS3700 is turned off.</li> </ul>
Activity LED	Off	Check for and resolve one of the following situations: <ul style="list-style-type: none"> <li>Drives are part of an exported array. Once the array is exported, the drives in the array are spun down in preparation for being removed from the enclosure.</li> <li>Drives are failed by the storage subsystem controllers.</li> <li>Failed drive drawer.</li> </ul>
Activity and Service Action Required LEDs	Flashing together in a certain pattern	Drive failure due to internal drive hardware failures.
Service Action Allowed LED	On (Blue)	The disk drive can be safely removed.

- **Hot-swap hardware:** The DCS3700 contains hardware that enables you to replace a failed DDM without turning off the storage expansion enclosure. You can continue to operate your system while an DDM is removed or installed. These DDMs are known as hot-swap DDMs.

## Installing hot-swap hard disk drives

With the exception of the DCS3700 storage subsystem initial power up, you should add DDMs while the storage expansion enclosure is turned on and running. Complete the following steps to install hot-swap DDMs in the storage expansion enclosure:

**Attention:** After you remove a DDM FRU, wait 90 seconds before replacing or reseating it to allow it to properly spin down. Failure to do so may cause undesired events.

1. Read the documentation that comes with the DDM.
2. Check for Service Action Required LEDs described in “Drive drawer LEDs” on page 78 and “Disk drive LEDs” on page 78. If any amber LEDs are lit, see “Solving problems” on page 129.
3. Determine the drive drawer and position into which you want to install the DDM.
4. Remove the bezel from the front of the storage expansion enclosure. See “Replacing the bezel” on page 118 for the steps to remove the bezel.
5. Open the drive drawer by completing the following steps:
  - a. Open the release levers on each side of the drawer and pull them out while coming the levers away from the chassis. This will release the drawer.
  - b. Pull on the extended levers to pull the drive drawer out to its full extension without removing it from the storage expansion enclosure.

**Note:** The fan assemblies spin-up to increase airflow through the enclosure when a drive drawer is open. This is normal and does not indicate a fault. Fan speed will return to normal after the drive drawer is closed.

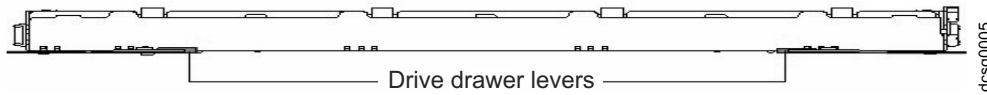


Figure 68. Opening the drive drawer

6. Install the DDM by completing the following steps:

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

- a. Raise the drive handle to the vertical position, as shown in Figure 69.

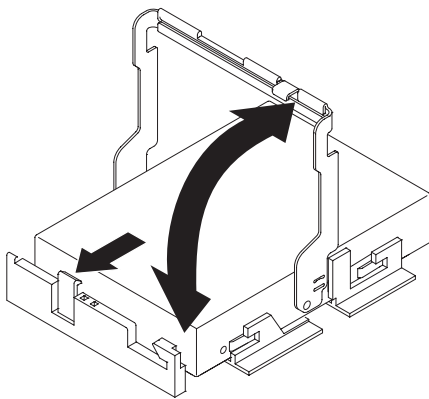


Figure 69. Raising the drive handle

- b. Align the two raised buttons on each side over the matching gap in the drive channel on the drawer, as shown in Figure 70.

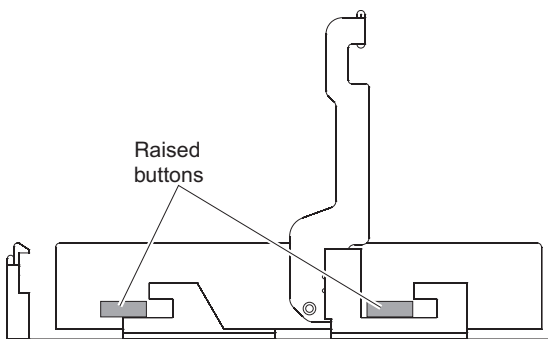


Figure 70. Aligning the drive

- c. Lower the drive straight down; then, rotate the drive handle down until the drive snaps into place under the drive release lever. See Figure 71 on page 103.

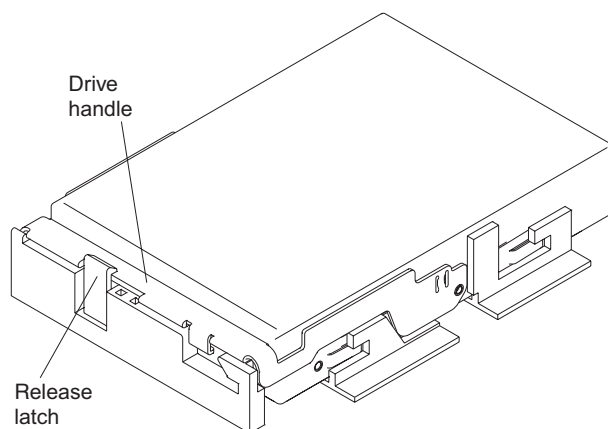


Figure 71. Locking the drive in place

7. Push the drive drawer all the way back into the storage expansion enclosure, closing the levers on each side of the drive drawer.
8. Install the bezel on the front of the storage expansion enclosure. See “Replacing the bezel” on page 118 for the steps to install the bezel.

## Replacing hot-swap hard disk drives

DDM problems include any malfunctions that delay, interrupt, or prevent successful I/O activity between the hosts and the DDMs in the storage expansion enclosure. This includes transmission problems between the controllers, the ESMs, and the DDMs. This section explains how to replace a failed DDM.

**Note:** If you want to remove an DDM that is not in a failed or bypass state, always use the DS Storage Manager client program either to place the DDM in a failed state or to place the array that is associated with the DDM (or DDMs) in an offline state before you remove it from the enclosure.

**Attention:** Failure to replace the DDMs in their correct drawer and position might result in loss of data. If you are replacing a DDM that is part of a configured array and logical drive, ensure that you install the replacement DDM in the correct drawer and position.

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

1. Use the Storage Management client software to print a new storage system profile.
2. Determine the location of the DDM that you want to remove.
 

**Attention:** Never hot-swap an DDM FRU when its associated green activity LED is flashing. Hot-swap an DDM FRU only when its associated blue Service Action Allowed LED is lit.
3. Put on antistatic protection.
4. Remove the bezel from the front of the storage enclosure. See “Replacing the bezel” on page 118 for the steps to remove the bezel.
5. Open the drive drawer by completing the following steps:
  - a. Release the levers on each side of the drawer by pulling both levers away from the enclosure.
  - b. Pull on the extended levers and cam them outward until they stop. Then pull the drive drawer out to its full extension without removing it from the storage expansion enclosure.

**Note:** The fan assemblies spin-up to increase airflow through the enclosure when a drive drawer is open. This is normal and does not indicate a fault. Fan speed will return to normal after the drive drawer is closed.

6. Remove the DDM by completing the following steps:
  - a. Press the drive release lever and raise the drive handle to the vertical position.

- b. Wait 90 seconds to allow the drive to properly spin down and the storage subsystem controller to properly recognize that an DDM is removed from the configuration.
  - c. Verify that there is proper identification (such as a label) on the DDM FRU, and then lift the drive up and remove it from the drive drawer.
7. Unpack the new DDM. Save all packing material in case you need to return it.
8. Install the new DDM FRU by completing the following steps:

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

- a. Raise the drive handle to the vertical position.
  - b. Align the two raised buttons on each side over the matching gap in the drive channel on the drawer.
  - c. Lower the drive straight down; then, rotate the drive handle down until the drive snaps into place under the drive release lever.
9. Push the drive drawer all the way back into the storage expansion enclosure, closing the levers on each side of the drive drawer.
10. Check the DDM LEDs for the following:
  - When an DDM is ready for use, the green Activity LED lights and the amber Fault LED is off.
  - If the amber Fault LED lights and is not flashing (the Service Action Allowed LED might also be lit), remove the DDM from the unit and wait 90 seconds; then, install the DDM again. If the problem persists, use the DS Storage Manager to verify the drive state and contact IBM support if necessary.
  - If the Service Action Allowed LED is lit and the Service Action Required LED is not lit, use the DS Storage Manager to check the drive state. The drive might be part of an exported array - ready for import, and also might be incompatible or uncertified. Use the Recovery Guru to diagnose the problem.
11. Use the DS Storage Manager subsystem management window to verify that the DDM is shown in the Storage Subsystem Management window.
12. Install the bezel on the front of the storage expansion enclosure. See “Replacing the bezel” on page 118 for the steps to install the bezel.

## Replacing multiple DDMs

This section provides guidelines for upgrading the DDMs in the storage expansion enclosure. Read the software documentation and this entire section to determine whether you should use this procedure, use a modified version of this procedure, or use a different procedure that is provided by your operating system.

**Note:** Instructions that are provided with your software should supersede anything stated in this document.

The following are methods for upgrading DDMs:

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

This method requires that you back up the data on the affected DDMs and then turn off the DCS3700 storage subsystem.

**Attention:** Turn off the DCS3700 storage system before you turn off the DCS3700 expansion enclosure.

After replacing all the DDMs, you must reconfigure the new DDMs and restore data from backup. See the procedure in “Replacing all DDMs at the same time” on page 105.

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

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

In this method, you manually fail each DDM, replace it, and wait for the system to restore data to the new DDM before installing the next DDM. After you install the new DDMs, you can configure them to make the additional DDM space available. See the procedure in “Replacing the drives one at a time” on page 107.

Using this method, you can replace the DDMs while the DCS3700 storage subsystem is running, eliminating the down time that is required if you replace all of them at once. However, this method is more risky because you can lose data if the drive restoration or storage subsystem reconfiguration process fails. In addition, the reconstruction process might take a long time. This method works only on redundant logical drives (RAID 1, 3, 5, or 6). You cannot use this method with any drives containing RAID 0 logical drives.

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

The method you use depends on the following considerations:

- Which method most closely matches the recommended drive upgrade procedure that is provided in the operating system or the storage-management software documentation.
- Which RAID level is used on the affected drives. (RAID 0 requires you to replace all the drives at the same time.)
- How much downtime is acceptable as you swap the DDMs.
- The number of DDMs in an array. Replacing DDMs one at a time is better suited for arrays consisting of 3 to 5 DDMs. If you have more than 10 DDMs, consider replacing all of them at the same time.
- How much risk of losing data is acceptable. Because the array will be in a degraded state during the RAID array reconstruction and copyback process as result of replacing an DDM in the array, any new DDM failure will cause the array to fail (causing a loss of data availability and even a loss of data). The duration of the reconstruction and copyback process can be quite long, depending on the size of the RAID array.
- How extensive are the changes to the data while the array is in a degraded state during the RAID array reconstruction and copyback process as result of replacing an DDM in the array. The more extensive the data changes, the more work that will need to be performed to restore the data in the event that the array failed because of an additional DDM failed while the array is in degraded state.

## **Replacing all DDMs at the same time**

Use this procedure to replace all DDMs at the same time. You must use this method if you are upgrading DDMs containing RAID 0 logical drives. All the data currently on the DDMs is lost when you replace them; therefore, you must back up all data that is currently on the DDMs. This procedure also requires you to turn off the DCS3700 storage subsystem, which makes the storage subsystem inaccessible to other users.

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

1. Read the following information:
  - The information in “Replacing multiple DDMs” on page 104, particularly the paragraphs that discuss the differences between the two possible upgrade procedures
  - The information in your software documentation regarding DDM upgrades and installation
  - The documentation that comes with the new DDMs

Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the DDMs and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine if you need to modify this procedure.
2. Use the DS Storage Manager software to check the status of the DCS3700. Correct any problems that are reported.
3. Perform a complete backup of the DDMs that you are replacing.



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

**Attention:** When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 25.

4. Unpack the new DDMs.

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

5. Perform the following steps:

- a. Stop all I/O activity to the storage subsystem and attached storage expansion enclosures. Make sure of the following:
  - 1) All of the green Drive activity LEDs on the front of the storage subsystem are not flashing.
  - 2) The Cache active LEDs are off. Refer to “Checking the LEDs” on page 73 for the location of the Cache active LEDs.
- b. If applicable, use the operating system software to disconnect the storage subsystem logical drives from the host before you power off the storage subsystem.

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

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

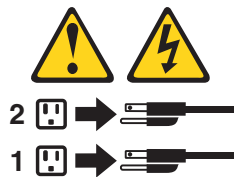
- a. Turn off power to the host before you turn off power to the storage subsystem. If the host must stay powered on to support an existing network, see the operating system documentation for information about disconnecting the storage subsystem logical drives from the host before the storage subsystem is powered off.
- b. Turn off power to the DCS3700 storage system before you power off the DCS3700 expansion enclosure. Turn off both power supply switches on the back of the storage subsystem.

**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.



- c. Turn off power to other supporting devices (for example, management stations, Fibre Channel switches, or Ethernet switches).
7. Use the procedures in “Replacing hot-swap hard disk drives” on page 103 to remove the DDMs that you want to replace. Use the procedures in “Installing hot-swap hard disk drives” on page 101 to install the new DDMs into the DCS3700.
8. After you install all the new DDMs, check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:



- a. Turn on the power to the supporting devices (for example, Ethernet switches and management stations) before you turn off power to the storage subsystem.
  - b. You must turn on the expansion enclosures before the storage system. The controllers might not recognize the correct configuration if the drives are powered up after the storage subsystem.
  - c. Turn on the power to the storage system; then restart or turn on the power to the host.
9. Turn on the power to each device, based on the power-on sequence in step 8 on page 106. To turn on power to the DCS3700 storage system and expansion enclosures, turn on the power-supply switches on the back of the enclosures. You must turn on both power-supply switches to take advantage of the redundant power supplies.
  10. Check the green Drive activity LEDs and the amber Drive fault LEDs above the new drive FRUs. Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

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

- If the Drive activity LED is off, the DDM FRU might not be installed correctly. Remove the DDM FRU, wait 30 seconds, and then reinstall it.
  - If the Drive fault LED stays on or the Drive activity LED stays off, the new DDM might be faulty. See the DS Storage Manager software for problem determination.
11. Use the DS Storage Manager software to configure the new DDMs. See the DS Storage Manager software online Help for detailed instructions.
  12. Restore the data from backup to all the DDMs.

## Replacing the drives one at a time

Use this procedure to replace all the drives one at a time. You cannot use this procedure on RAID 0 logical drives (use the procedure in “Replacing all DDMs at the same time” on page 105).

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

**Attention:** After you remove a DDM FRU, wait 90 seconds before replacing or reseating it to allow it to properly spin down. Failure to do so may cause undesired events.

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

1. Read the following information:
  - “Replacing multiple DDMs” on page 104, particularly the paragraphs that discuss the differences between the two possible upgrade procedures
  - Your software documentation regarding drive upgrades and installation
  - The documentation that comes with the new drives

Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the drives and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine if you need to modify this procedure.
2. Use the DS Storage Manager software to check the status of the unit. Correct any problems that are reported.
3. Back up the data in the arrays and logical drives that are configured using the DDMs that you are replacing.
 

**Attention:** When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 25.
4. Unpack the new DDMs.

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

5. Use the DS Storage Manager software to ensure that the array that was defined using these DDMs is in optimal (not degraded) state before manually failing the first DDM you want to replace. If the array is in degraded state, use the recovery procedures to bring the array into the optimal state.

Make sure of the following:

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

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

If you remove an active DDM accidentally, wait at least 30 seconds and then reinstall it. Because you failed two DDMs in a RAID array, the array might be marked failed by the controller. This array will not be available to the host for I/O. See the DS Storage Manager software for further recovery instructions. Do not attempt to replace any DDMs until the array is brought back to optimal state.

6. Use the procedures in “Replacing hot-swap hard disk drives” on page 103 to remove the failed drive. Use the procedures in “Installing hot-swap hard disk drives” on page 101 to install the new DDMs into the DCS3700.

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

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

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

7. Check the green Drive activity LED and the amber Drive fault LED above the new DDM FRUs. Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

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

- If the Drive activity LED is off, the DDM FRU might not be installed correctly. Remove the DDM FRU, wait 30 seconds, and then reinstall it.
  - If the Drive fault LED stays on or the Drive activity LED stays off, the new DDM might be faulty. See the DS Storage Manager software for problem determination.
8. Use the DS Storage Manager software to monitor the status of the new DDM and the progress of the data reconstruction. Wait for data reconstruction to finish. (The Drive activity LED stops flashing.)

**Note:** The Drive activity LED will continue to flash after reconstruction is finished if there is I/O activity to that DDM. In that case, use the host software to determine if the data reconstruction is finished.

9. When reconstruction is finished on the new DDM, repeat step 5 through step 8 for each additional DDM that you want to install.
10. Use the DS Storage Manager software to configure the additional space on the new DDMs.

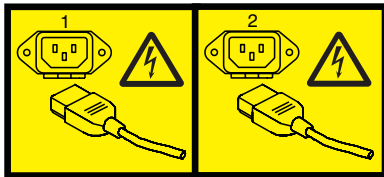
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## Replacing an ac power supply

### About this task



(L003)



or



The power supplies are customer replaceable units (CRUs) and do not require preventive maintenance. Use only the supported power supplies for the storage subsystem.

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

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

If any of these conditions occurs, one or both power supplies will shut down. If the power remains off (does not automatically restart), make sure that the environment is optimal (no overheating has occurred, all electrical receptacles are working, and so on).

If both power supplies fail or if the power supplies cannot maintain an internal temperature below 65°C (149°F), the power supplies will automatically shut down (an overtemperature condition). If this occurs, you must cool the storage subsystem and restart it.

**Attention:** Do not remove the failed power supply until you have the replacement power supply. When you do remove the failed power supply, be sure to install the second power supply within 5 minutes to prevent any overheating due to the interruption to the air flow that cools the storage subsystem.

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

To replace a power supply, complete the following steps.

**Attention:** To prevent damage to the storage subsystem components from overheating, replace a failed power supply within 5 minutes of removal. If replacing it will take longer than 5 minutes, stop all I/O activity to the storage subsystem and turn off the power until you complete the replacement. Do not remove the failed power supply from the storage enclosure until you:

- Review the replacement procedure in this section.
- Have the replacement power supply and are ready to install it in the enclosure.



(L001)



## Procedure

1. If necessary, use the Storage Manager software to print a storage system profile.
2. Read the safety information found in the prolog of this document.
3. Did the Recovery Guru direct you to replace a failed power supply?
  - **Yes:** Go to step 4.
  - **No:** Run the Recovery Guru to identify the failed component, and then go to step 4.
4. Unpack the new power supply. Save all packing material in case you have to return the failed power supply.
5. Turn off the power switch on the new unit.
6. Check the fault LED to locate the failed power supply. If a fault is detected, the amber fault LED is lit.
7. Make sure that the Service Action Allowed LED is lit. Do not remove the power supply if the LED is off. For more information about the Service Action Allowed LED, see “Service Action Allowed LED” on page 89.



## DANGER

When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- Connect power to this unit only with the provided power cord. Do not use the provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
- Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- 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 procedures when installing, moving, or opening covers on this product or attached devices.

To disconnect:

- a. Turn off everything (unless instructed otherwise).
- b. Remove the power cords from the outlets.
- c. Remove the signal cables from the connectors.
- d. Remove all cables from the devices.

To connect:

- a. Turn off everything (unless instructed otherwise).
- b. Attach all cables to the devices.
- c. Attach the signal cables to the connectors.
- d. Attach the power cords to the outlets.
- e. Turn on the devices.

(D005a)

8. Turn off the power switch and disconnect the power cord from the failed power supply.
9. Remove the power supply from the bay

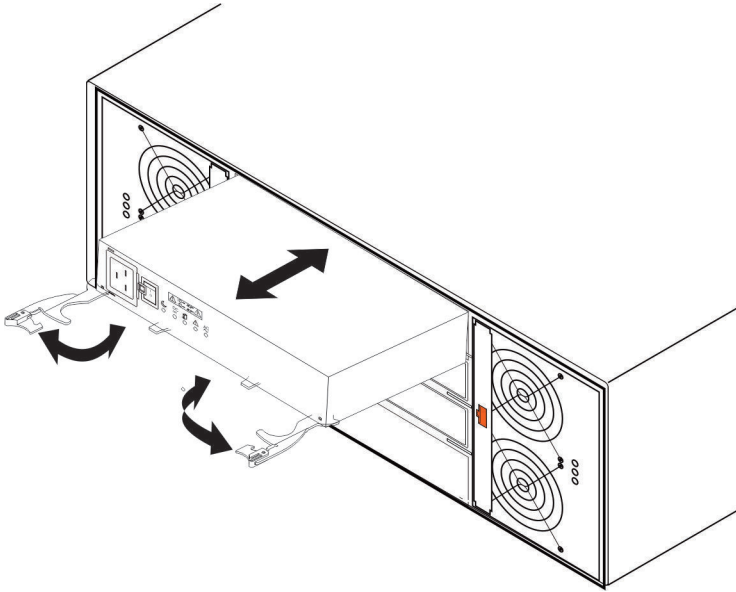


Figure 72. Replacing a power supply

- a. Open the two release levers as shown in the illustration. The power supply moves out of the bay approximately 0.6 cm (0.25 inch).
  - b. Slide the power supply out of the bay and set it aside.
10. Place the replacement power supply on a level surface.
11. Make sure that the release levers on the power supply are in the open position.
12. Slide the power supply into the bay until it stops.
13. Push the release levers to the closed position.
14. Connect the power cord and turn on the power.
15. Check the power and fault LEDs on the new unit.
16. According to the status of the power and fault LEDs, use one of the following procedures:
  - **The fault LED is lit and the ac and dc power LEDs are off:** The new unit might be installed incorrectly. The power-supply switch might not be turned on. The power cord connector might not be fully inserted into the power receptacle or the power-supply ac socket. There might not be any power to the receptacle that the power supply is connected to. The power cord might be faulty. Go to step 17.
  - **The fault and ac power LEDs are lit but the dc power LED is off:** The power supply is faulty. Turn off the power switch and contact your IBM technical-support representative for a replacement power supply.
  - **The ac and dc power LEDs are lit but the fault LED is off:** Go to step 18.
17. Perform the following task or tasks to solve the problem:
  - Make sure that the power switch is turned to the on position.
  - Make sure that there is power at the ac outlet and no circuit breaker has tripped.
  - Make sure that the power cord is working and fully seated into the electrical receptacle and the power supply ac connector.
  - Reinstall the power supply.

If these tasks do not solve the problem, contact your IBM technical-support representative.
18. Complete any remaining Recovery Guru procedures, if needed.
19. Check the status of each component in the storage subsystem.
20. Are any amber LEDs lit on any of the components?

- **Yes :** Click **Recovery Guru** in the Subsystem Management window toolbar and complete the recovery procedure. If a problem is still indicated, contact your IBM technical-support representative.
- **No:** Go to step 21.

21. Create, save, and print a new storage subsystem profile.

---

## Replacing a battery

### About this task

The controller in the DCS3700 storage system contains a rechargeable battery backup unit that provides power to back up the cache memory onto flash memory in the event of a power failure. Each battery unit contains a sealed, rechargeable SMART lithium ion battery. The cache battery is the only replaceable battery in the storage subsystem.

Use the following procedure if the Storage Manager software instructs you to replace the battery because the current battery has failed. You can also use the Storage Manager software to check the status of the battery. Because write-caching is disabled when the battery fails, replace the failed battery as soon as possible to minimize any performance impact due to the disabling of the write-caching function.

**Attention:** When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see the safety information in the prolog of this document.

**Attention:** To avoid overheating the storage enclosure and causing damage to its components, replace failed parts within 10 minutes. The Recovery Guru in the Storage Manager software identifies failed parts.

Do not remove the failed part from the storage enclosure until you:

- Review the replacement procedure for the failed part in this guide.
- Locate screw drivers or any other hand tools that you might need to replace the failed part.
- Receive the replacement part and are ready to install it in the enclosure.

To replace a battery unit, complete the following steps:

### Procedure

1. Use the Storage Manager software to print a storage subsystem profile.
2. Read the safety information found in the prolog of this document.
3. Locate the controller that contains the failed battery unit .
4. Remove the controller from the chassis.

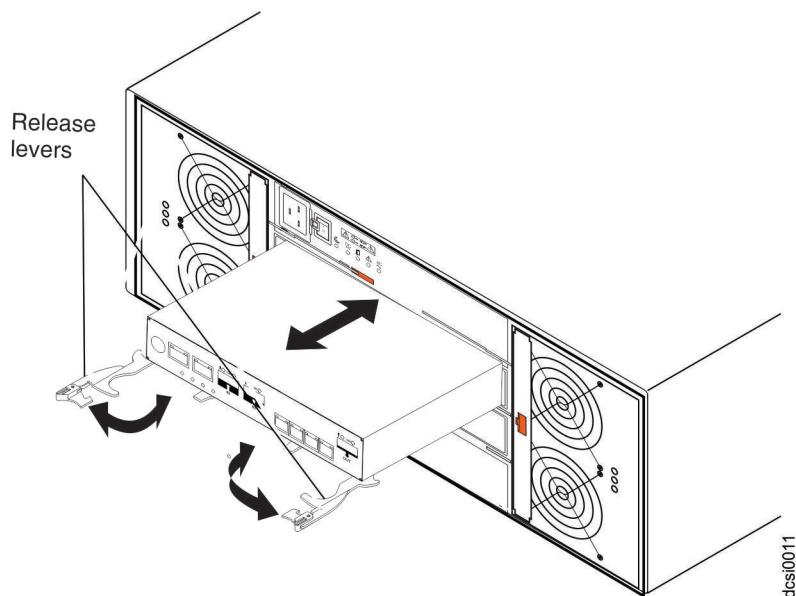


Figure 73. Removing a controller

- a. Open the two release levers as shown in the illustration. The controller moves out of the bay approximately 0.6 cm (0.25 inch).
- b. Pull the controller out of the bay.
- c. Place the controller on a level surface.
5. Remove the cover (see "Removing and installing a cover" on page 91).
6. Place the controller on a flat surface.
7. Remove the failed battery unit from the controller.

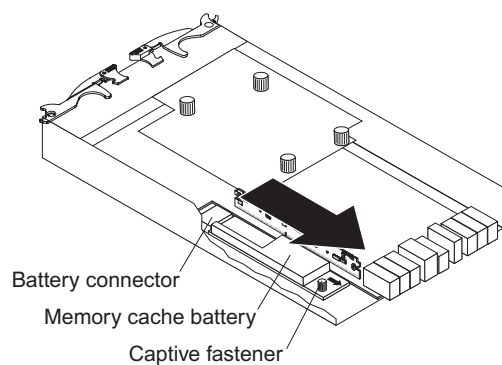


Figure 74. Removing a battery unit from the controller

- a. Loosen the blue captive fastener until the battery can move in the direction that is indicated by the arrow.
- b. Slide the battery unit out of the controller in the direction that is indicated by the arrow.
- c. Dispose of the battery as required by local ordinances or regulations. For more information, see the *IBM Systems Environmental Notices and User's Guide* on the support DVD that shipped with your unit.
8. Unpack the new battery unit. Set the new battery unit on a dry, level surface.  
Save all packing materials in case you have to return the new battery unit.
9. Insert the new battery unit into the controller chassis:



- a. Slide the battery pack into the controller until the battery-pack connector pins are firmly seated in the controller battery connector.
  - b. Tighten the captive fastener to secure the battery pack in place.
10. Install the cover (see “Removing and installing a cover” on page 91).
11. Insert the controller into the chassis.
  - a. Make sure that the release levers on the controller are in the open position.
  - b. Slide the controller into the bay until it stops.
  - c. Push the release levers to the closed position.

## Results

After you replace a controller cache battery, reset the battery age timer. For information about resetting the battery age timer, see the Storage Manager software online help.

---

## Replacing the memory cache DIMM

**Attention:** To avoid damage to the DIMM, you must first remove the memory cache battery and wait the required time period before you install or remove the DIMM. Follow the instructions in this procedure exactly.

**Attention:** To avoid overheating the storage enclosure and causing damage to its components, replace failed parts within 10 minutes. The Recovery Guru in the Storage Manager software identifies failed parts.

Do not remove the failed part from the storage enclosure until you:

- Review the replacement procedure for the failed part in this guide.
- Locate screw drivers or any other hand tools that you might need to replace the failed part.
- Receive the replacement part and are ready to install it in the enclosure.

Use these procedures if you are replacing a failed DIMM or if you are removing and installing the DIMM as directed in “Replacing a controller” on page 91.

The following illustration shows the location of the memory cache DIMM.

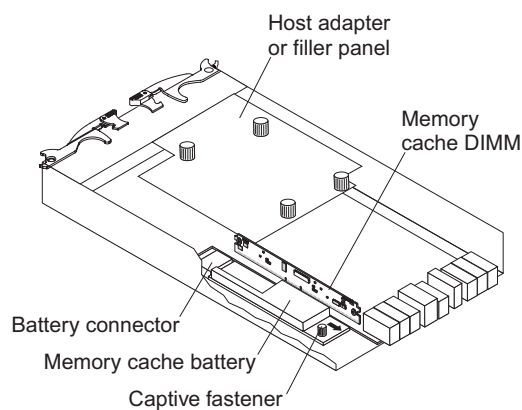


Figure 75. Memory cache DIMM location

---

## Removing the DIMM

### About this task

To remove the DIMM from the controller, complete the following steps:

### Procedure

1. Read the "Safety" information that begins on page xi and the "Best practices" information in Chapter 1 of this document.
2. Remove the controller from the chassis.

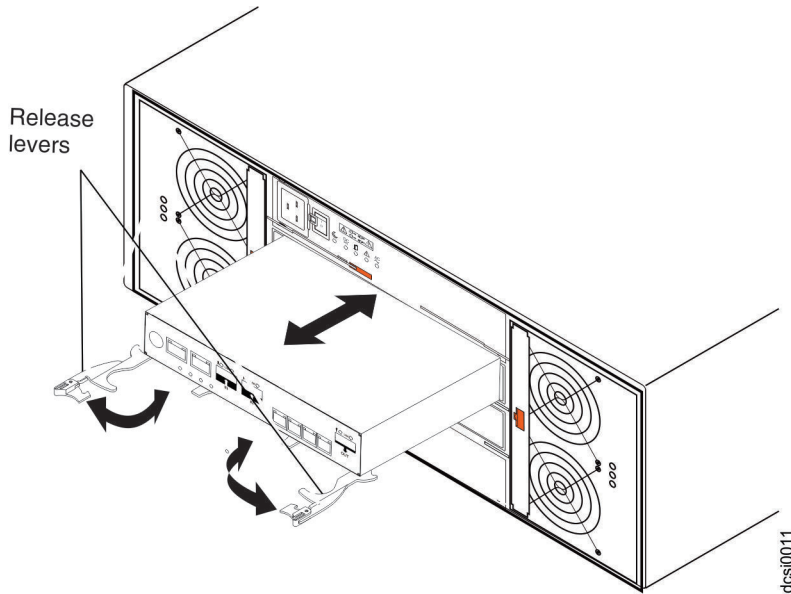


Figure 76. Removing a controller

- a. Open the two release levers as shown in the illustration. The controller moves out of the bay approximately 0.6 cm (0.25 inch).
  - b. Pull the controller out of the bay.
  - c. Place the controller on a level surface.
3. Remove the cover (see "Removing and installing a cover" on page 91).
  4. Remove the DIMM from the connector.

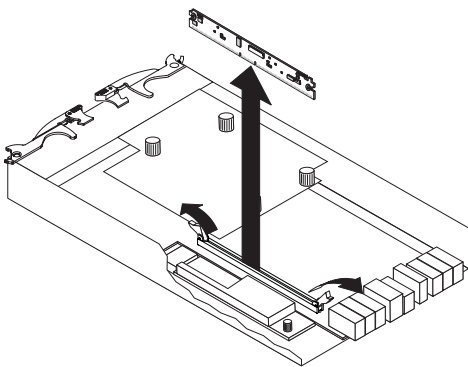


Figure 77. Removing the DIMM from the controller

- a. Open the retaining clip on each end of the DIMM connector.
  - b. Lift the DIMM out of the connector.
5. If the DIMM is functional, place the DIMM in a static-protective package until you are ready to install it.

---

## Installing the DIMM

### About this task

Complete the following steps to install the DIMM in the controller:

#### Procedure

1. Open the retaining clip on each end of the DIMM connector.
2. Touch the static-protective package that contains the DIMM to any unpainted metal surface on the storage subsystem. Then, remove the DIMM from the package.

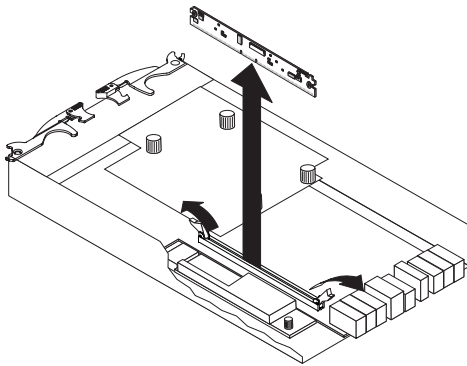


Figure 78. Installing the DIMM in the controller

3. Turn the DIMM so that the DIMM keys align correctly with the slot.
4. Match the angle of the DIMM with the angle of the connector.
5. Firmly press the DIMM into the connector. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector. If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.
6. Install the cover (see “Removing and installing a cover” on page 91).
7. Insert the controller into the chassis.
  - a. Make sure that the release levers on the controller are in the open position.
  - b. Slide the controller into the bay until it stops.
  - c. Push the release levers to the closed position.

**Attention:** After you remove a controller, wait 90 seconds before you reseal or replace the controller. Failure to do so might cause unpredictable results.

---

## Removing and replacing the cache backup flash memory device

Use these instructions to remove the cache backup flash memory device from the controller.

Figure 79 on page 118 shows the location of the of the cache backup flash memory device on controller board.

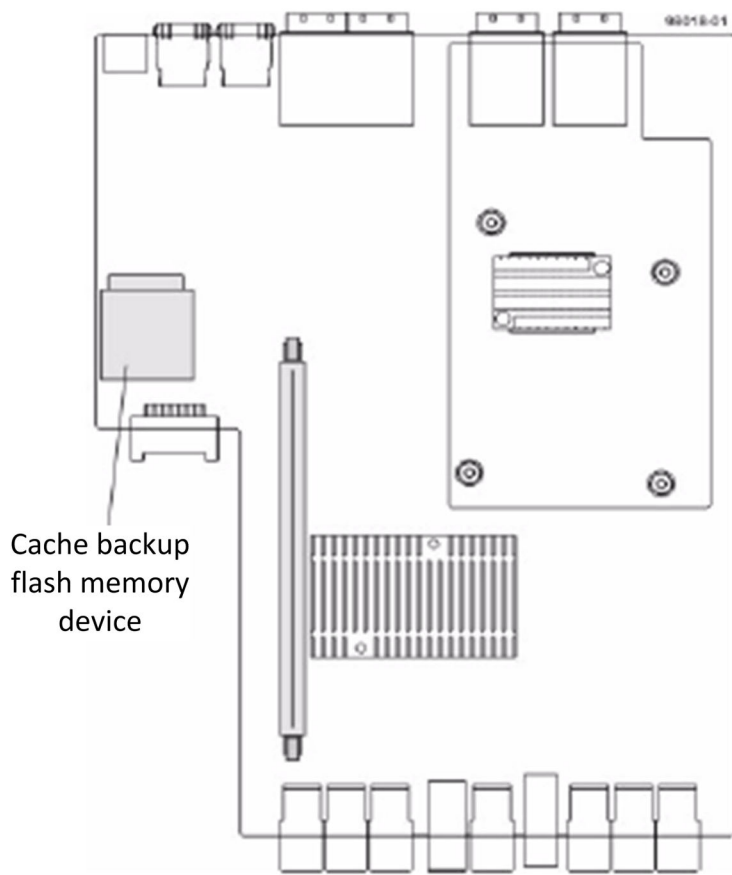


Figure 79. Cache backup flash memory device

1. Release the flash memory device by gently pushing the memory farther into the slot. The slot releases the flash memory device and pushes the flash memory device out of the slot.
2. Carefully pull the flash memory device free from the slot.

To replace the cache backup flash memory device:

1. Install the cache battery backup flash memory device into the empty slot location.
2. Press the flash memory device into the slot until the flash memory is fully seated.

---

## Replacing the bezel

Use this procedure to remove and replace the bezel on the front of the storage expansion enclosure. You must remove the bezel before you can access the drives drawers and disk drive modules.

1. Remove the bezel by completing the following steps:
  - a. At the front of the storage expansion enclosure, remove the bezel by pressing inward on the latches (see Figure 80 on page 119).

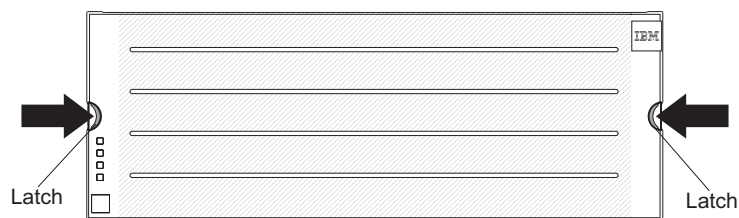


Figure 80. Removing the bezel

- b. Pull the bezel toward you to remove it from the enclosure.
2. Install the bezel by completing the following steps:
  - a. Orient the bezel to the front of the storage expansion enclosure (see Figure 80).
  - b. Press the bezel inward until both latches lock the bezel in place.

---

## Working with environmental service modules

This section describes how to replace an ESM.

**Attention:** To avoid overheating the storage enclosure and causing damage to its components, replace failed parts within 10 minutes. The Recovery Guru in the Storage Manager software identifies failed parts.

Do not remove the failed part from the storage enclosure until you:

- Review the replacement procedure for the failed part in this guide.
- Locate screw drivers or any other hand tools that you might need to replace the failed part.
- Receive the replacement part and are ready to install it in the enclosure.

---

## Replacing an ESM

### About this task

To replace an ESM, complete the following steps:

### Procedure

1. Read the safety information found in the prolog of this document.
2. Disconnect the SAS cables from the ESM.
3. Open the two release levers. The ESM moves out of the bay approximately 0.6 cm (0.25 inch).

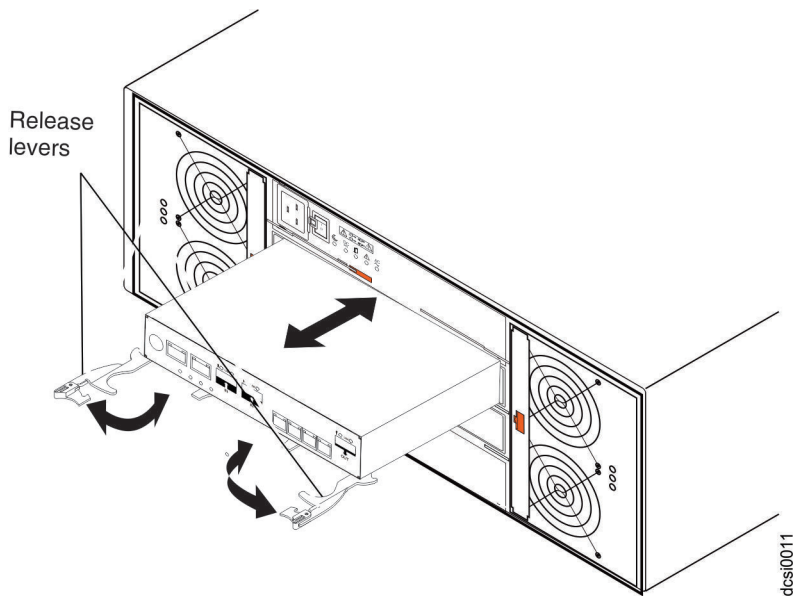


Figure 81. Removing an environmental service module

4. Slide the ESM out of the bay and set it aside.
5. Make sure that the release levers on the ESM are in the open position.
6. Slide the ESM into the bay until it stops.
7. Push the release levers to the closed position.
8. Connect the SAS cables to the ESM.
9. Turn on the power.
10. Go to <http://www.ibm.com/servers/storage/support/> to check for ESM code updates. For more information, see the download instructions on page 1.

## Replacing a fan assembly

Use this procedure to replace a failed fan assembly. To preserve the optimal airflow, do not remove a failed fan assembly FRU from the storage expansion enclosure until you are ready to replace it with a new FRU.

### Attention:

- To prevent damage from overheating, replace a failed fan assembly FRU within 5 minutes of removal. If replacing it will take longer than 5 minutes, stop all I/O activity to the storage expansion enclosure and turn off the power until you complete the replacement.
  - If one of the fan assemblies has failed, the remaining fan assembly will operate at maximum fan speed.
1. Remove the fan assembly to be replaced by completing the following steps:
    - a. At the rear of the storage expansion enclosure, remove the fan assembly (see Figure 82 on page 121) by pressing on the locking tab holding the fan assembly handle in place; then, pull the fan assembly handle toward you.

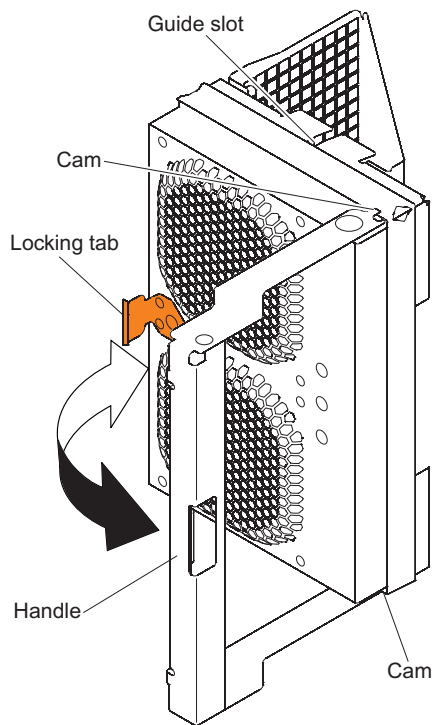


Figure 82. Removing a fan assembly

- b. Use the fan assembly handle to pull the fan assembly out of the enclosure.
2. Install a new fan assembly FRU by completing the following steps:

**Attention:** If you are performing this procedure with the power turned on, you must reinstall the fan assembly within 5 minutes. Otherwise, the equipment could overheat.

  - a. Orient the fan assembly to the fan assembly bay and push the fan assembly all the way into the bay.

**Note:** Although both fan assemblies (left and right) are identical, they are seated in the DCS3700 enclosure in opposite orientations. If the fan assembly cannot be fully inserted in the fan assembly bay, rotate it 180 degrees and reinsert it.
  - b. Make sure that cams on the fan assembly handle engage the corresponding slots in the enclosure; then, rotate the fan assembly handle to the closed position.
  - c. Press the fan assembly handle in until it latches in place.

---

## Replacing a drive drawer

Use this procedure to replace a failed drive drawer FRU. The disk drives in the drawer to be replaced must be removed and reinstalled in the replacement drive drawer. See “Replacing hot-swap hard disk drives” on page 103 for the steps to remove a DDM.

### Attention:

1. **Potential hardware damage** - Electrostatic discharge can damage sensitive components. To prevent electrostatic discharge damage to the storage expansion enclosure, use proper antistatic protection when handling components.
  2. **Potential loss of data access** - If the logical unit numbers (LUNs) have already been assigned and created, the location of the drives in drive drawer is critical. Record the location of the drives before removing the drives from the drawer.
  3. **Potential loss of data access** - Replacing a drawer will cause all of the drives in the replaced drawer to be unavailable to the controllers in the storage subsystem. If the arrays that have drives in the to-be-replaced drawer were created without drawer loss protection, you must schedule down time to replace the drawer because these arrays will fail when the drawer is replaced. Examples of arrays without drawer loss protection:
    - Raid 6 arrays with more than two drives in the to-be-replaced drawer
    - Raid 1, 3, or 5 arrays with more than one drive in the to-be-replaced drawer
    - Raid 0 array
  1. Prepare the drive drawer for removal by completing the following steps:
    - a. If possible, stop the I/O activity to the storage expansion enclosure. If it is not possible to stop the I/O activity, perform the drive drawer replacement during a period of low I/O activity.
    - b. Is power applied to the storage expansion enclosure?
      - **Yes** - Go to step 1c.
      - **No** - Go to step 3.
    - c. Use the Storage Manager Subsystem Management window to prepare the drive drawer for removal:
      - 1) Open the Subsystem Management window for the DCS3700 storage subsystem.
      - 2) Select **Advanced -> Troubleshooting -> Prepare for Removal**. A Prepare for Removal window displays.
      - 3) In the Prepare for Removal window, click the pull down list to select the appropriate enclosure; then, click the component pull down list to select the drive drawer that will be removed.
      - 4) Click the **Prepare for Removal** button.
      - 5) When the controller processes the request successfully, a confirmation window is displayed. Click **OK** to close this window and the Prepare for Removal window.
- Note:** Prepare for Removal turns on the blue Service Action Allowed LED located on the front of drive drawer, the Service Action Allowed LEDs located on each side of the drawer in the back, and lights the Service Action Allowed LED on all the installed drives in the drawer. It also prevents the controller from accessing the drives in the drawer.
2. Remove the bezel from the front of the storage expansion enclosure. See “Replacing the bezel” on page 118 for the steps to remove the bezel.
  3. Put on antistatic protection.
  4. Remove the cable chains from the rear of the drive drawer to be removed by completing the following steps:



- a. At the rear of the drive tray, remove the right fan assembly. See “Replacing a fan assembly” on page 120 for the steps to remove a fan assembly. Figure 83 shows the area with the fan assembly removed.

**Attention:** If you are performing this procedure with the power turned on, you must reinstall the fan assembly within 5 minutes. Otherwise, the equipment could overheat.

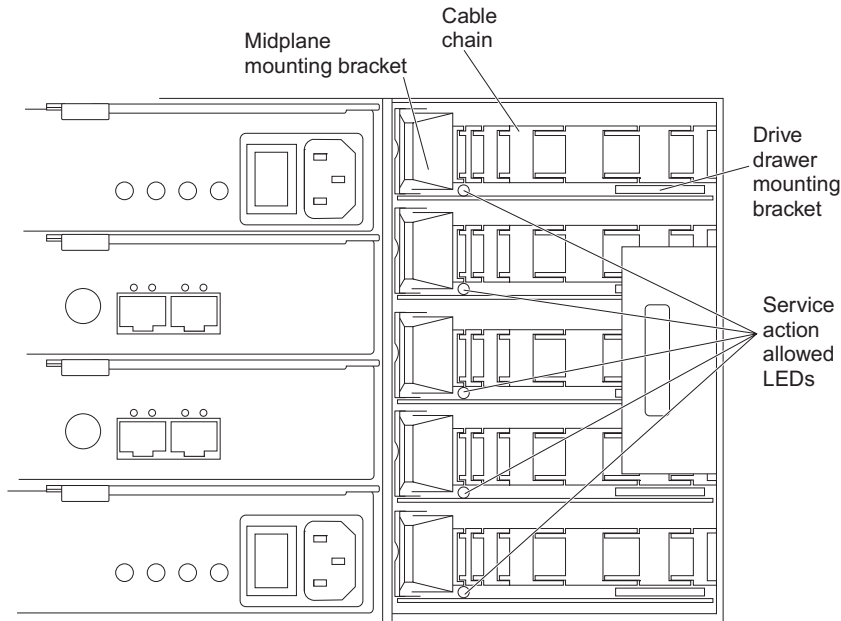


Figure 83. Rear view of the storage expansion enclosure with the right fan assembly removed

**Notes:**

- 1) Each cable chain has a vertical mounting bracket that connects to the midplane and a horizontal mounting bracket that connects to the drive drawer.
- 2) The left and right cable chains are not interchangeable.
- b. If power is applied and you performed step 1c on page 122, locate the drive drawer with the Service Action Allowed LED lit. If power is not applied, manually determine which cable chain you must disconnect. The top cable chain is attached to drive drawer 1. The bottom cable chain is attached to drive drawer 5.

**CAUTION:**

**Verify that you have identified the correct drive drawer before removing the cable chains. Removing the wrong drawer cable chains might cause loss of data access.**

- c. Disconnect the right cable chain mounting bracket from the midplane. Insert your finger into the orange circle (see Figure 84 on page 124), and pull the mounting bracket completely out of the storage expansion enclosure. If necessary, use a flashlight to see the orange circle.

**Note:** The vertical side of the cable chain (the end that is connecting the midplane) should be removed before the horizontal side of the cable chain (the end that is connecting to the drive drawer).

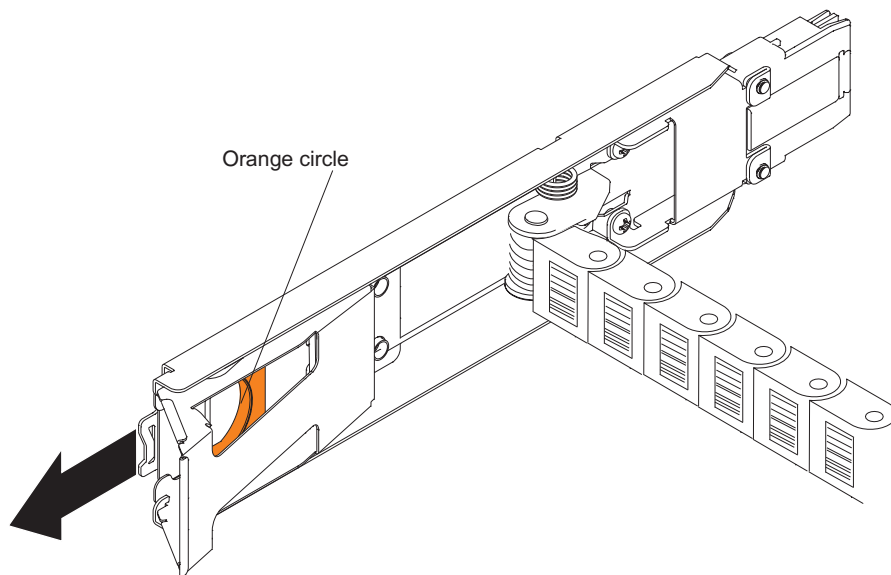


Figure 84. Vertical mounting bracket that connects to the midplane

- d. Disconnect the right cable chain mounting bracket from the drive drawer. Insert your finger into the orange circle (see Figure 85), and pull the mounting bracket completely out of the drive tray. Remove the right cable chain.

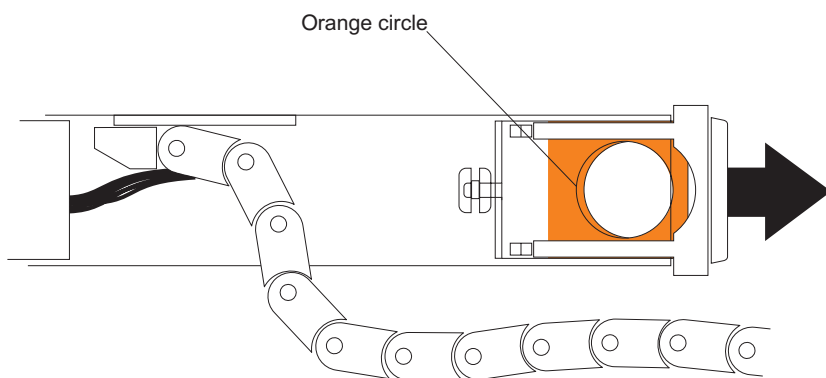


Figure 85. Horizontal mounting bracket that connects to the drive drawer

- e. Reinstall the right fan assembly. Wait until the fan speed slows down and the green Power LED is lit before proceeding to ensure that the right fan assembly is operating correctly before removing the left fan assembly. See "Replacing a fan assembly" on page 120 for the steps to install a fan assembly.
  - f. Remove the left fan assembly. See "Replacing a fan assembly" on page 120 for the steps to remove a fan assembly.
- Attention:** If you are performing this procedure with the power turned on, you must reinstall the fan assembly within 10 minutes. Otherwise, the equipment could overheat.
- g. Disconnect the left cable chain mounting bracket from the midplane. Insert your finger into the orange circle, and pull the mounting bracket completely out of the storage expansion enclosure.
  - h. Disconnect the left cable chain mounting bracket from the drive drawer. Insert your finger into the orange circle, and pull the mounting bracket completely out of the storage expansion enclosure. Remove the left cable chain.
  - i. Reinstall the left fan assembly. See "Replacing a fan assembly" on page 120 for the steps to install a fan assembly.

**Attention:** If you are performing this procedure with the power turned on, you must reinstall the fan assemblies before you remove the drive drawer. Otherwise, the equipment could overheat.

5. Remove the drive drawer by completing the following steps:

- a. At the front of the storage expansion enclosure, pull the handles on the drive drawer to be removed until the drive drawer stops. The drive drawer should not come completely out of the enclosure at this time.
- b. Label all of the disk drives in the drawer before you remove them, so that the drives can be reinstalled in the same slot in the replacement drive drawer.

**Attention:** If the logical unit numbers (LUNs) have already been assigned and created, the location of the drives in drive drawer is critical. You must record the location of the drives before removing them in the next step.

- c. Remove all of the disk drive modules from the drive drawer. See “Replacing hot-swap hard disk drives” on page 103 for the steps to remove a DDM.
- d. Slide the drive drawer release lever (see Figure 86) on both sides of the drive drawer toward you, and remove the drive drawer from the enclosure.

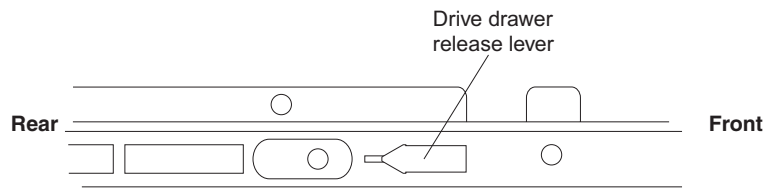


Figure 86. Drive drawer release lever on the side of the drive drawer

6. Install a new drive drawer FRU by completing the following steps:

**Attention:** Damage might occur if the lock-out tumbler is in the middle of the drawer guide.

- a. At the front of the storage expansion enclosure, install the new drive drawer into the slot, making sure the lock-out tumbler is located on the top of the drawer guide. The lock-out tumbler is a small alignment piece that is attached to the frame. Figure 87 on page 126 shows the location of the lock-out tumbler as shown from the front of the enclosure.

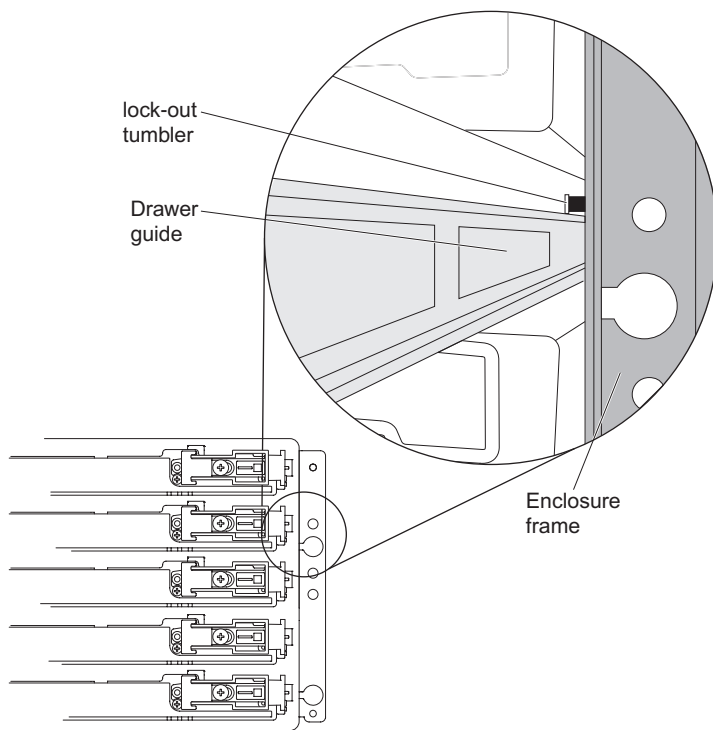


Figure 87. Lock-out tumbler located above the drawer guide

- b. Push the drive drawer all the way in until the latch fully engages.
7. Install the cable chains on the rear of the drive drawer by completing the following steps:
  - a. Remove the left fan assembly. See “Replacing a fan assembly” on page 120 for the steps to remove a fan assembly.
  - b. Connect the left cable chain mounting bracket to the drive drawer. Use a flashlight, if necessary, so that you can see the connector on the mounting bracket connect to the midplane connector.
  - c. Connect the left cable chain mounting bracket to the midplane.
  - d. Reinstall the left fan assembly. Wait until the fan speed slows down before proceeding to ensure that the left fan assembly is operating correctly before removing the right fan assembly. See “Replacing a fan assembly” on page 120 for the steps to install a fan assembly.
  - e. Remove the right fan assembly. See “Replacing a fan assembly” on page 120 for the steps to remove a fan assembly.
  - f. Use the handle to pull the right fan assembly out of the storage expansion enclosure.
  - g. Connect the right cable chain mounting bracket to the drive drawer.
  - h. Connect the right cable chain mounting bracket to the midplane. Use a flashlight, if necessary, so that you can see the connector on the mounting bracket connect to the midplane connector.
  - i. Reinstall the right fan assembly.
8. Install the disk drives in the new drive drawer FRU by completing the following steps:
  - a. Open the drive drawer by pulling the handles on the drive drawer towards you until the drive drawer stops.
  - b. Install the drives you that you removed previously in the drive drawer, one disk drive at a time. Wait at least 90 seconds or until each drive is recognized in the DS Storage Manager Physical View before inserting the next drive. If you do not wait until the drive is recognized by the DS Storage Manager, one or more drives will be marked as failed/bypassed or incompatible. If this occurs, you must remove the failed/bypassed drive, reinsert it, and wait at least 90 seconds or until it is recognized by the DS Storage Manager. See “Installing hot-swap hard disk drives” on page 101 for the steps to install the drives.

**Attention:** You must add the drives to the same location in the drive drawer that they were in before the drive drawer was replaced.

- c. Push the drive drawer all the way in until the latch fully engages.
9. Install the bezel on the front of the storage expansion enclosure. See “Replacing the bezel” on page 118 for the steps to install the bezel.
10. Remove the antistatic protection.
11. Is the storage expansion enclosure power turned on?
  - **No** - You are finished with the procedure, and you can turn on the power.
  - **Yes** - Go to step 12
12. The Service Action Allowed LED on the replaced drive drawer should be turned off automatically by the controllers. If it is not turned off automatically, open the script window for the DCS3700 storage subsystem, and execute the following SMcli script command:  
**set enclosure [enclosureID] drawer [drawerID] serviceAllowedIndicator=off;**  
Where:
  - [enclosureID] is the identifier of the storage expansion enclosure that contains the replaced drive drawer. Drive tray ID values are 0 to 99.
  - [drawerID] is the identifier of the replaced drive drawer. Drawer ID values are 1 to 5.This command turns off the blue Service Action Allowed LED that is located on the drive drawer and allows the controller to access the storage expansion enclosure.
13. Use the DS Storage Manager to verify that the new drive drawer is operating correctly.



---

## Chapter 6. Hardware maintenance

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

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

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### General checkout

Use the indicator lights, the diagnostics and test information, the symptom-to-FRU index, and the connected server HMM to diagnose problems.

The PD maps found in the *IBM System Storage DS5000 Problem Determination Guide* may provide you with additional diagnostic aids.

---

### Solving problems

This section contains information to help you solve some of the problems you might have with your DCS3700 storage system or DCS3700 expansion enclosure. The following table contains the problem, symptoms and error messages, along with suggested actions to take to resolve problems.

Always use the DS Storage Manager client to diagnose storage subsystem problems and component failures and find solutions to problems that have definite symptoms.

You can use the following table, which contains the problem symptoms and error messages, along with suggested actions as a guide for troubleshooting problems in addition to the DS Storage Manager Recovery Guru in the Subsystem Management window. Do not depend solely this table for a FRU replacement decision.

## Troubleshooting problems in the DCS3700 storage subsystem

Table 21. Troubleshooting

Problem indicator	Component	Possible cause	Possible solutions
Amber LED is lit	Drive (drive fault LED)	Drive failure	Replace the failed drive. See “Replacing components” on page 89 for more information.
		Drive uncertified	Verify the drive and part number to make sure that it is supported by the DCS3700. See <a href="http://www.ibm.com/systems/storage/disk">http://www.ibm.com/systems/storage/disk</a>
	storage controller (service action required LED)	controller failure	Replace the controller. See “Replacing components” on page 89 for more information.
		The controller was placed offline by a user or the other controller.	Use the Subsystem Management window to place the controller back online. If the controller continues going to an offline state after being placed online, replace the controller.
	storage controller (battery fault LED)	Battery unit failure	Use the Storage Manager software to confirm the failure; then, replace the failed battery unit.
	storage controller (SAS link service action LED)	SAS cable failure	Replace the SAS cable.
		SAS host bus adapter failure	Check the SAS host bus adapter in the host and replace the adapter if necessary.
		SAS port failure	Replace the controller. See “Replacing components” on page 89 for more information.
	Front bezel (system error LED)	General machine fault	A fault LED is lit somewhere on the storage subsystem (check for amber LEDs on components).
		General machine fault (continued)	<p>Open the Subsystem Management window and click <b>Recovery Guru</b> to see problems in the DCS3700 configuration.</p> <p>Some errors cause the system error LED to be lit but not cause any individual component fault LEDs to be lit. (Drive PFA exceeded or nominal temperature exceeded errors are examples.) Follow the corrective actions in the Recovery Guru window.</p>



Amber LED is lit (continued)	storage controller fault LED (service action LED may also be lit)	Unsupported controller	Controller configurations do not match. Check that host daughter card and cache memory are the same in both controllers.
	Front panel	Fibre Channel connection	Check that the CRUs are properly installed. If no amber LEDs are lit, suspect failure of the SFP module. Verify the failure using the Storage Manager Client.  If all Fibre Channel connections failed, suspect failure of the Fibre Channel host daughter card.
		SAS connection	Check the SAS connection to verify that the CRUs are properly installed.  If the SAS port LED is off, suspect failure of the SAS host daughter card.
		iSCSI connection	Check the iSCSI connection to verify that the CRUs are properly installed.  If the iSCSI port LED is off, check the Ethernet cable or verify the link speed.  If all the iSCSI port LEDs are off, suspect failure of the iSCSI host daughter card.
		One of the drive drawers is not fully closed	Use Storage Manager software to identify the drive drawer that was not closed and close that drawer. Pull the drawer out about 1 inch; then push it back in until it clicks in place.  Check all drive drawers in the enclosure to ensure they are fully closed.
	Battery fault	Battery unit failure	Verify the failure using the Storage Manager Client and replace the failed battery.
Amber LED is lit and green LED is off	ESM	Board failure	Replace the failed ESM. See “Replacing components” on page 89 for more information.
	Power supply  (Amber fault LED is lit and both power LEDs are not lit)	The power switch is turned off or there is an ac or dc power source failure.	Replace the failed power supply or turn on all power-supply switches. If this is a dc power supply, check the disconnect device to make sure that it is working and is in the on position.

Amber and green LEDs are lit	Power supply  (Amber fault LED is lit and both power LEDs are not lit, AC power or DC IN LED is lit and DC power or DC out LED is not lit)	Power supply failure	Replace the failed power supply. See “Replacing components” on page 89 for more information.
	Fan assembly	Fan failure	Replace the fan assembly.
	Drive	Drive not certified	Verify the drive and part number to make sure the drive is supported by the DCS3700. See <a href="http://www.ibm.com/systems/storage/disk">http://www.ibm.com/systems/storage/disk</a>
		Drive failure	Use Storage Manager to identify the failed drive; then replace the failed drive.
All amber and green LEDs are slowly flashing	All drives (activity and fault LEDs are not lit)	Check for and solve one of the following situations: <ul style="list-style-type: none"> <li>• storage enclosures are not correctly connected to the DCS3700.</li> <li>• DCS3700 does not have the correct firmware version.</li> </ul>	
All green LEDs are off	All components	Subsystem power is off	Make sure that all storage subsystem power cables are connected and that the power-supply switches are on. If applicable, make sure that the main circuit breakers for the rack are turned on.
		Power failure	Check the main circuit breaker and ac receptacle (ac models). Check the -48 V dc power source and disconnect device (dc models).
		Power-supply failure	Replace the power supply.
		Operating environment is too hot	Cool down the environment.
		Midplane failure	Contact your IBM technical support representative.
Amber LED is flashing	Drives (fault LED is lit)	Drive identification is in process	No corrective action is needed.
	Front panel	One or multiple components has intermittent problems	Use the Storage Manager Recovery Guru menu function and the Major Event Log to troubleshoot the problem.

One or more green LEDs are off	Power supplies	Power cable is disconnected or switches are turned off	Make sure that the power cables are connected (ac or dc) and that the disconnect device (dc only) and the power-supply switches are turned on.
	Several components	Hardware failure	Replace the affected components. If this does not correct the problem, replace the controllers. Contact your IBM technical-support representative.
		The DCS3700 was not powered-on, or all SAS cable connections between the storage enclosures and the DCS3700 storage subsystem failed.	Perform one of the following actions: <ul style="list-style-type: none"> <li>• Power-on the storage subsystem.</li> <li>• Make sure that the SAS cable connections between the storage enclosures and the DCS3700 storage subsystem are made.</li> </ul>
	Front panel	Power supply problem	Make sure that the power cables are connected and that the power supplies are turned on.
		Hardware failure	If any other LEDs are lit, replace the midplane. Contact your IBM technical-support representative.
	All drives	Midplane failure	Replace the DCS3700. Contact your IBM technical-support representative.
		The DCS3700 expansion enclosure is connected to unsupported storage subsystem	Verify that the expansion enclosure is connected to a supported storage subsystem. See <a href="http://www.ibm.com/systems/storage/disk">http://www.ibm.com/systems/storage/disk</a>
One or more green LEDs are off (continued)	All drives (continued)	The DCS3700 storage system is connected to unsupported expansion enclosure	Verify that the storage system is connected to a supported expansion enclosure. See <a href="http://www.ibm.com/systems/storage/disk">http://www.ibm.com/systems/storage/disk</a>
		Bad disk drawer	Use Storage Manager software to verify the drive drawer failure and replace the drawer.
		The disk drawer cable chains are not installed correctly	This condition might occur after the disk drawer is replaced and the disk drawer cable chains are not fully inserted in the disk drawer or the midplane sockets. Use the instructions in “Replacing a drive drawer” to reseal the left and right disk drawer cable chains.
		Drives are not fully inserted in the drive drawers	Verify that the drives are seated correctly in the drive drawers. Remove and reinsert the drives if required.
		On activity to the drives	No action is required.
		Damaged or loose SAS cables	Check the SAS cables and connections.
		ESM failure. Use the Storage Manager software to check the drive status, if necessary, replace the ESM.	Use the Storage Manager software to check the drive status, if necessary, replace the ESM.

Green LED is flashing slowly (once every 2 seconds)	Drives	The DCS3700 was not powered-on, or all SAS connections between the storage enclosures and the DCS3700 storage subsystem have failed.	Perform one of the following actions: <ul style="list-style-type: none"> <li>• Power-on the storage subsystem.</li> <li>• Make sure that the SAS connections between the storage enclosures and the DCS3700 storage subsystem are made.</li> <li>• Make sure that all the storage enclosures in the same channel pair have the same enclosure speed setting.</li> </ul>
Intermittent or sporadic power loss to the storage subsystem	Some or all components	Defective power source or incorrectly connected power cable	Check the ac or dc power source. Reseat all installed power cables and power supplies. If applicable, check the power components (power supplies or uninterruptible power supply). Replace defective power cables.
		Power supply failure	Check the fault LED on the power supply. If the LED is lit, replace the failed component.
		Faulty disconnect device	Check and install a new 30A rated disconnect device.
		Midplane failure	Replace the DCS3700. Contact your IBM technical-support representative.
Unable to access drives	Drives	Incorrect storage subsystem ID settings	Make sure that the SAS cables are undamaged and correctly connected. Check the storage subsystem ID settings.
		controller failure	Replace one or both controllers. Contact an IBM technical-support representative.
		Drive failure	Replace the failed drive or drives.
		SAS cable	1. Make sure that the SAS cables are undamaged and correctly connected. 2. Replace the SAS cables.
		ESM failure	Contact your IBM technical support representative.
Random errors	Subsystem	Midplane failure	Replace the DCS3700. Contact your IBM technical-support representative.

Drive is not visible in the Storage Manager software	Several components	Drive failure	Replace the failed drive or drives.
		SAS cable failed	Replace the SAS cable.
		controller failure	Replace controller. See “Replacing components” on page 89 for more information.
		Midplane failure	Replace the DCS3700. Contact your IBM technical-support representative.
		A drive has an interface problem with the ESM or controller.	Replace the drive. See “Replacing components” on page 89 for more information.
		Incorrect firmware version	Make sure that the DCS3700 has the correct firmware version.
		In a dual-controller storage subsystem, one controller has failed, and in the drive channel that originates from the other (functioning) controller, an ESM has failed.	Replace the failed controller and ESM. See “Replacing components” on page 89 for more information.
Storage enclosure is not detected	Storage subsystem	Storage enclosure is not supported	Verify that the storage enclosure is supported by the DCS3700 storage subsystem.
		SAS cable failed	Replace the SAS cable.

Blue LED is lit (no Amber LED is lit)	Front panel	The enclosure is being located by the Storage Manager software.	Stop locating the enclosure from the Storage Manager software.
	Drive	Drives are part of an array that is in "exported – Ready to import" state. Once the array is exported, the drives in the array are spun down in preparation for being removed from the enclosure.	Use the Storage Manager software to import the array or remove the drives from the storage subsystem.
		Drives are incompatible. Incompatible drives are spun down when they are inserted into the drive slots. The associated drive Service Action LED might also be lit.	Use the Storage Manager software to verify the incompatible drives and remove the drives from the storage subsystem.
	Controller, ESM, Disk Drawer, or Power Supply	Component Blue Service Action Allowed LED was turned on by the "Prepare for Removal" menu function in the Storage Manager Subsystem Management window.	<p>Turn off the SAA LED by using the appropriate script command in the script window.</p> <ul style="list-style-type: none"> <li>The script command to turn off a drive drawer SAA LED is: set enclosure [enclosureID] drawer [drawerID] serviceAllowedIndicator=off;</li> <li>The script command to turn off a Controller, ESM or Power Supply SAA LED is: set enclosure [enclosureID] (powerFan [(top   bottom)]   esm [(top   bottom)]   controller [(top   bottom)]) serviceAllowedIndicator=off;</li> </ul>
Blue LED is lit with associate Amber LED lit	Disk drive, Controller, ESM, Drive Drawer, Power Supply, Fan Assembly	Failed component	Use the Recovery Guru in the Storage Manager Subsystem Management window to identify the failure and replace the failed component.
Link fault amber LED lit	ESM	SAS communication failure	<ol style="list-style-type: none"> <li>1. Reconnect the SAS cable</li> <li>2. Replace the SAS cable</li> <li>3. If the LED is still lit, replace either the ESM or the controller. Also, consider replacing the device at the other end of the SAS cable.</li> </ol>

## Parts listing

Figure 88 on page 137 and the following table provide a parts listing for the DCS3700.

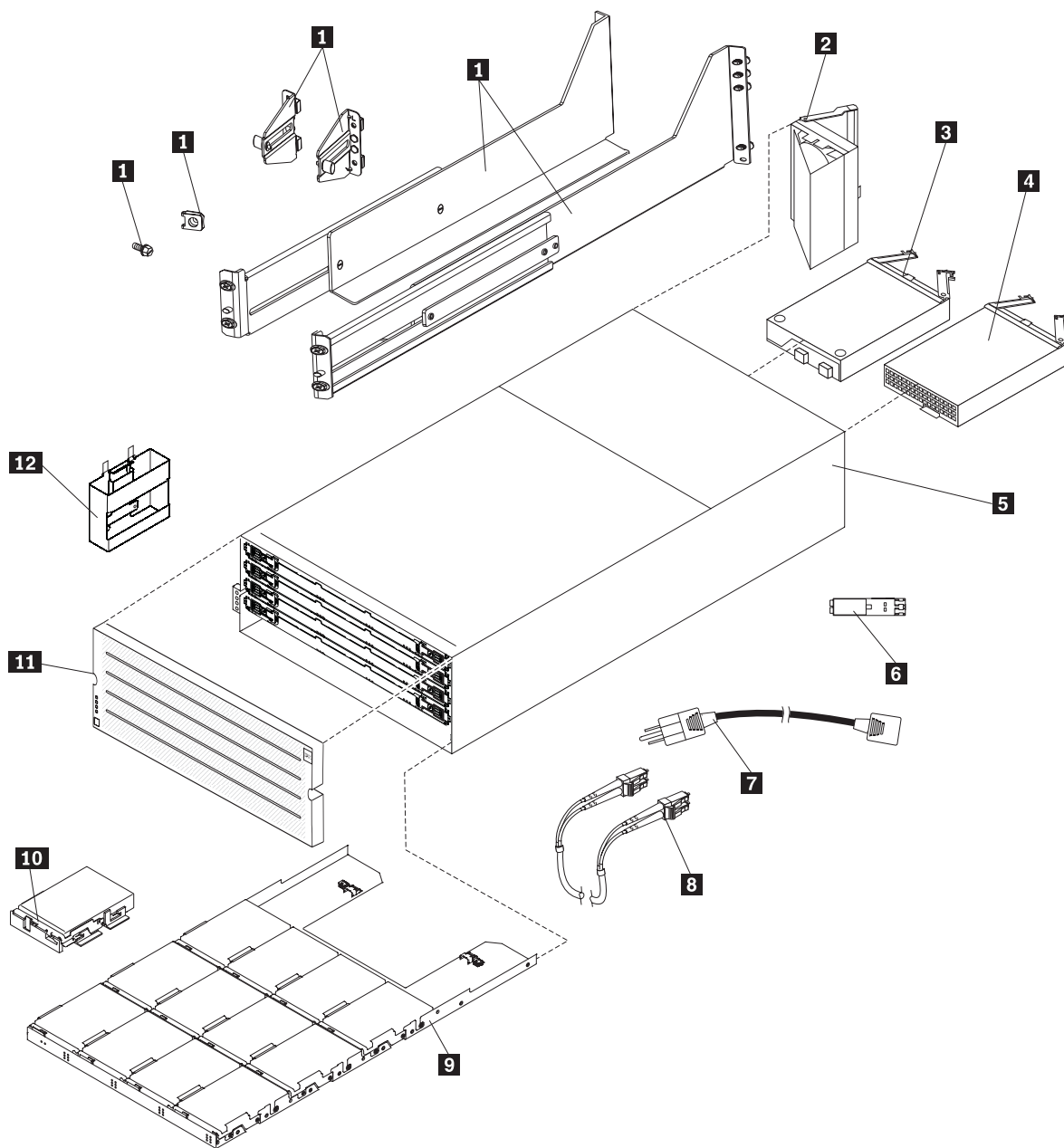


Figure 88. DCS3700 storage subsystem enclosure parts list

Table 22. Parts listing (DCS3700 storage system and expansion enclosure)

Index	DCS3700 (MT 1818-80E, 80C)	FRU P/N
1	Rail kit	59Y5414
2	Fan assembly	90Y8598
3	Power supply, 1755w, AC	90Y8593
4	Controller with 2GB Cache DIMM, no host interface adapter, no backup battery module, no flash memory	90Y8596
4	Controller with 4GB Cache DIMM, no host interface adapter, no backup battery module, no flash memory	90Y8693
4	ESM	90Y8595

Table 22. Parts listing (DCS3700 storage system and expansion enclosure) (continued)

Index	DCS3700 (MT 1818-80E, 80C)	FRU P/N
5	Chassis assembly, includes midplane and disk drive drawers	90Y8591
6	8GB SFP module, short wave	49Y4123
7	PDU jumper cable	
8	Cable, Fibre Channel, 1M	39M5699
8	Cable, Fibre Channel, 5M	39M5700
8	Cable, Fibre Channel, 25M	39M5701
9	Drive drawer assembly, includes right and left cable chains	90Y8594
10	2TB, 6Gbps NL-SAS, 7200 RPM disk drive module	90Y8597
11	Bezel	90Y8592
12	Handle	59Y5526
	HDD carrier	69Y2773
	Cable, SAS, 1M	39R6530
	Cable, SAS, 3M	39R6532
	Flash memory, cache backup, 8GB	90Y8691
	Memory DIMM, Cache, 2GB	69Y2843
	Memory DIMM, Cache, 4GB	90Y8690
	Host interface adapter, 6Gbps SAS 2-port	69Y2840
	Host interface adapter, 8Gbps FC 4-port	69Y2841
	Backup battery module	69Y2926
	Service cable	39M5942



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## Appendix A. Records

Whenever you add options to your storage expansion enclosure, 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 your IBM technical support representative.

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### Identification numbers

Record and retain the following information.

Product name:	IBM System Storage DCS3700 Storage System
Machine type:	1818
Model number:	80C
Serial number:	

Product name:	IBM System Storage DCS3700 Expansion Enclosure
Machine type:	1818
Model number:	80E
Serial number:	

The serial number is located on the agency label affixed to the top of the enclosure and also on the bottom right at the front of the enclosure.

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## Storage subsystem and controller information record

Table 23 provides a data sheet for recording storage subsystem names, management types, Ethernet hardware addresses, and IP addresses. Make a copy of this table and complete the information for your storage subsystems and controllers. Use the information to set up the BOOTP table for the network server and the host or Domain Name System (DNS) table. The information is also helpful if you add storage subsystems after initial installation. Refer to your DS Storage Manager documentation for detailed instructions about how to obtain the information. For a sample information record, see Table 24 on page 141.

*Table 23. Storage subsystem and controller information record*

Storage subsystem name	Management method	Controllers-Ethernet and IP addresses, and host name		Host-IP address and host name

## Sample information record

Table 24 shows a sample information record. This network contains storage subsystems that are managed by using both the direct-management and host-agent-management method.

*Table 24. Sample information record*

Storage subsystem name	Management method	Controllers-Ethernet and IP addresses, and host name		Host-IP address and host name
		Controller A	Controller B	
Finance	Direct	Hardware Ethernet address = 00a0b8020420	Hardware Ethernet address = 00a0b80000d8	
		IP address = 192.168.128.101	IP address = 192.168.128.102	
		Host = Denver_a	Host = Denver_b	
Engineering	Host-agent			IP address = 192.168.2.22
				Host = Atlanta

---

## Installed device records

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

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

*Table 25. Hard disk drive record*

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

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## Appendix B. Rack mounting template

This appendix provides duplicate copies of the rack mounting templates. If you want to tear out the templates from this document for easier use, use these copies rather than those provided in “Installing the support rails” on page 30.

Use the following templates (Figure 89 on page 144 and Figure 90 on page 145) to identify the proper locations for inserting M5 screws when mounting the support rails and DCS3700 to a rack. The locations for the M5 screws are highlighted in the templates.

The DCS3700 is 4 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 mounting holes that are shown in the following templates are square. The holes in your rack might be round or square.

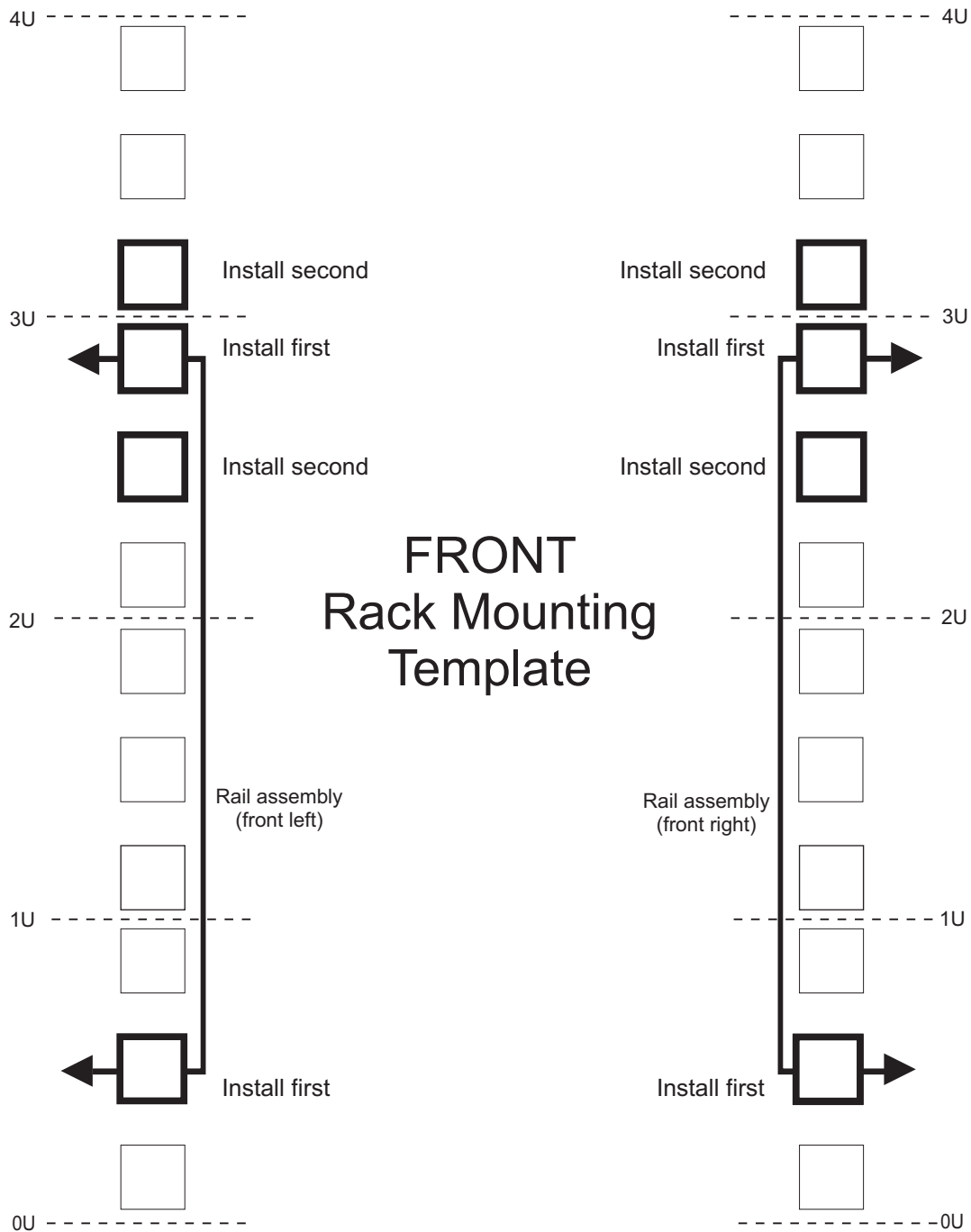


Figure 89. Front rack mounting template

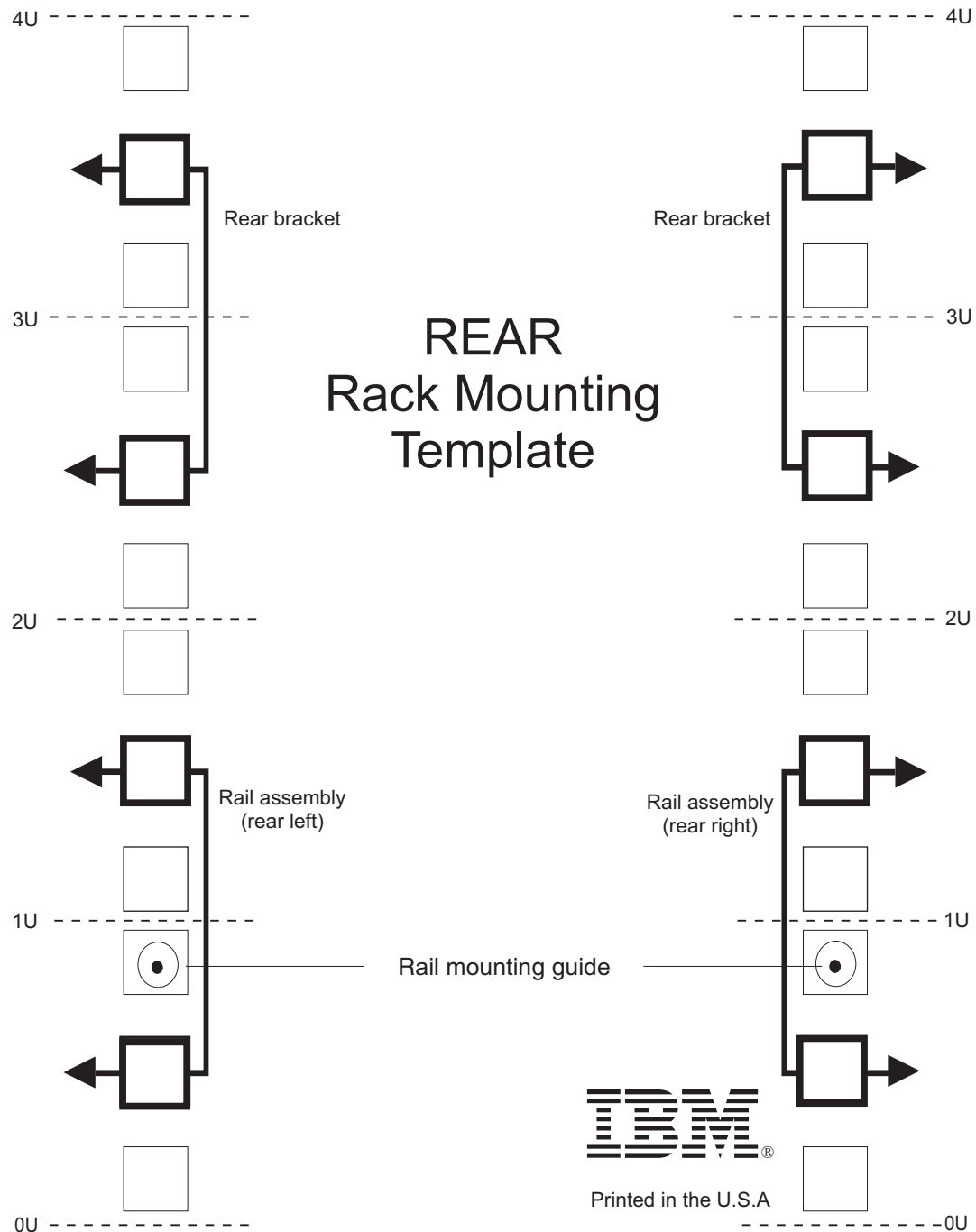


Figure 90. Rear rack mounting template





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## Appendix C. Specifications for non-IBM rack installation

The following instructions provide safety requirements and rack specifications for installing the DCS3700 storage system and DCS3700 storage expansion enclosures into non-IBM racks.

**Note:** The information in this section applies to 19-inch racks. It is your responsibility, working with your rack manufacturer, to ensure that the non-IBM rack chosen meets the safety requirements and specifications listed in this section.

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### General safety requirements for IBM products installed in a non-IBM rack or cabinet

The general safety requirements for IBM products installed in non-IBM racks are:

1. Any product or component that plugs into either an IBM power distribution unit or mains power (via a power cord), or uses any voltage over 42 V ac or 60 V dc (considered to be hazardous voltage) must be Safety Certified by a Nationally Recognized Test Laboratory (NRTL) for the country in which it will be installed.

Some of the items that require safety certification may include: the rack or cabinet (if it contains electrical components integral to the rack or cabinet), fan trays, power distribution unit, uninterruptible power supplies, multi-outlet strips, or any other products installed in the rack or cabinet that connect to hazardous voltage.

Examples of OSHA-approved NRTLs for the U.S.:

- UL
- ETL
- CSA (with CSA NRTL or CSA US mark)

Examples of approved NRTLs for Canada:

- a. UL (ULc mark)
- b. ETL (ETLc mark)
- c. CSA

The European Union requires a CE mark and a Manufacturer's Declaration of Conformity (DOC).

Certified products should have the NRTL logos or marks somewhere on the product or product label. However, proof of certification must be made available to IBM upon request. Proof consists of such items as copies of the NRTL license or certificate, a CB Certificate, a Letter of Authorization to apply the NRTL mark, the first few pages of the NRTL certification report, Listing in an NRTL publication, or a copy of the UL Yellow Card. Proof should contain the manufacturer's name, product type and model, standard to which it was certified, the NRTL name or logo, the NRTL file number or license number, and a list of any Conditions of Acceptance or Deviations. A Manufacturer's Declaration is not proof of certification by an NRTL.

2. The rack or cabinet must meet all electrical and mechanical safety legal requirements for the country in which it is installed.

The rack or cabinet must be free of exposed hazards (such as voltages over 60 V dc or 42 V ac, energy over 240 VA, sharp edges, mechanical pinch points, or hot surfaces).

3. There must be an accessible and unambiguous disconnect device for each product in the rack, including any power distribution unit.

A disconnect device may consist of either the plug on the power cord (if the power cord is no longer than 1.8 m (6 ft.)), the appliance inlet receptacle (if the power cord is of a detachable type), or a power on/off switch, or an Emergency Power Off switch on the rack, provided all power is removed from the rack or product by the disconnect device.

If the rack/or cabinet has electrical components (such as fan trays or lights), the rack must have an accessible and unambiguous disconnect device.

4. The rack or cabinet, power distribution unit and multi-outlet strips, and products installed in the rack or cabinet must all be properly grounded to the customer facility ground.

There must be no more than 0.1 Ohms between the ground pin of the power distribution unit or rack plug and any touchable metal or conductive surface on the rack and on the products installed in the rack. Grounding method must comply with applicable country's electric code (such as NEC or CEC). Ground continuity can be verified by your IBM service personnel, after the installation is completed, and should be verified prior to the first service activity.

5. The voltage rating of the power distribution unit and multi-outlet strips must be compatible with the products plugged into them.

The power distribution unit or multi-outlet strips current and power ratings are rated at 80 percent of the building supply circuit (as required by the National Electrical Code and the Canadian Electrical Code). The total load connected to the power distribution unit must be less than the rating of the power distribution unit. For example, a power distribution unit with a 30 A connection will be rated for a total load of 24 A (30 A x 80 percent). Therefore, the sum of all equipment connected to the power distribution unit in this example must be lower than the 24 A rating.

If an uninterruptible power supply is installed, it must meet all the above electrical safety requirements as described for a power distribution unit (including certification by an NRTL).

6. The rack or cabinet, power distribution unit, uninterruptible power supply, multi-outlet strips and all products in the rack or cabinet must be installed according to the manufacturer's instructions, and in accordance with all national, state or province, and local codes and laws.

The rack or cabinet, power distribution unit, uninterruptible power supply, multi-outlet strips and all products in the rack or cabinet must be used as intended by the manufacturer (per manufacturer's product documentation and marketing literature).

7. All documentation for use and installation of the rack or cabinet, power distribution unit, uninterruptible power supply, and all products in the rack or cabinet, including safety information, must be available on-site.
8. If there is more than one source of power in the rack cabinet, there must be clearly visible safety labels for "Multiple Power Source" (in the languages required for the country in which the product is installed).
9. If the rack or cabinet or any products installed in the cabinet had safety or weight labels applied by the manufacturer, they must be intact and translated into the languages required for the country in which the product is installed.
10. The rack or cabinet configuration must comply with all IBM requirements for "safe to service" (contact your IBM Installation Planning Representative for assistance in determining if the environment is safe).

There must be no unique maintenance procedures or tools required for service.

11. Elevated service installations, where the product(s) to be serviced are installed between 1.5 m and 3.7 m (5 ft. and 12 ft.) above the floor, require the availability of an OSHA- and CSA-approved nonconductive step ladder. If a ladder is required for service, the customer must supply the OSHA- and CSA- approved nonconductive step ladder (unless other arrangements have been made with the local IBM Service Branch Office). Products installed over 2.9 m (9 ft.) above the floor requires a Special Bid to be completed before they can be serviced by IBM service personnel.

For products not intended for rack-mounting to be serviced by IBM, the products and parts that will be replaced as part of that service must not weigh over 11.4 kg (25 lb). (Contact your Installation Planning Representative if in doubt).

12. There must not be any special education or training required for safe servicing of any of the product(s) installed in the racks. (Contact your Installation Planning Representative if in doubt).

## Rack specifications

When installing a DCS3700 storage system or DCS3700 storage expansion enclosure into a non-IBM rack, follow the specifications below.

1. The rack or cabinet must meet the EIA Standard EIA-310-D for 19-inch racks published August 24, 1992. The EIA-310-D standard specifies internal dimensions, for example, the width of the rack opening (width of the chassis), the width of the module mounting flanges, the mounting hole spacing, and the depth of the mounting flanges. The EIA-310-D standard does not control the overall external width of the rack. There are no restrictions on the location of side walls and corner posts relative to the internal mounting space.

The front rack opening must be 451 mm wide + 0.75 mm (17.75 in. + 0.03 in.), and the rail-mounting holes must be 465 mm + 0.8 mm (18.3 in. + 0.03 in.) apart on center (horizontal width between vertical columns of holes on the two front-mounting flanges and on the two rear-mounting flanges).

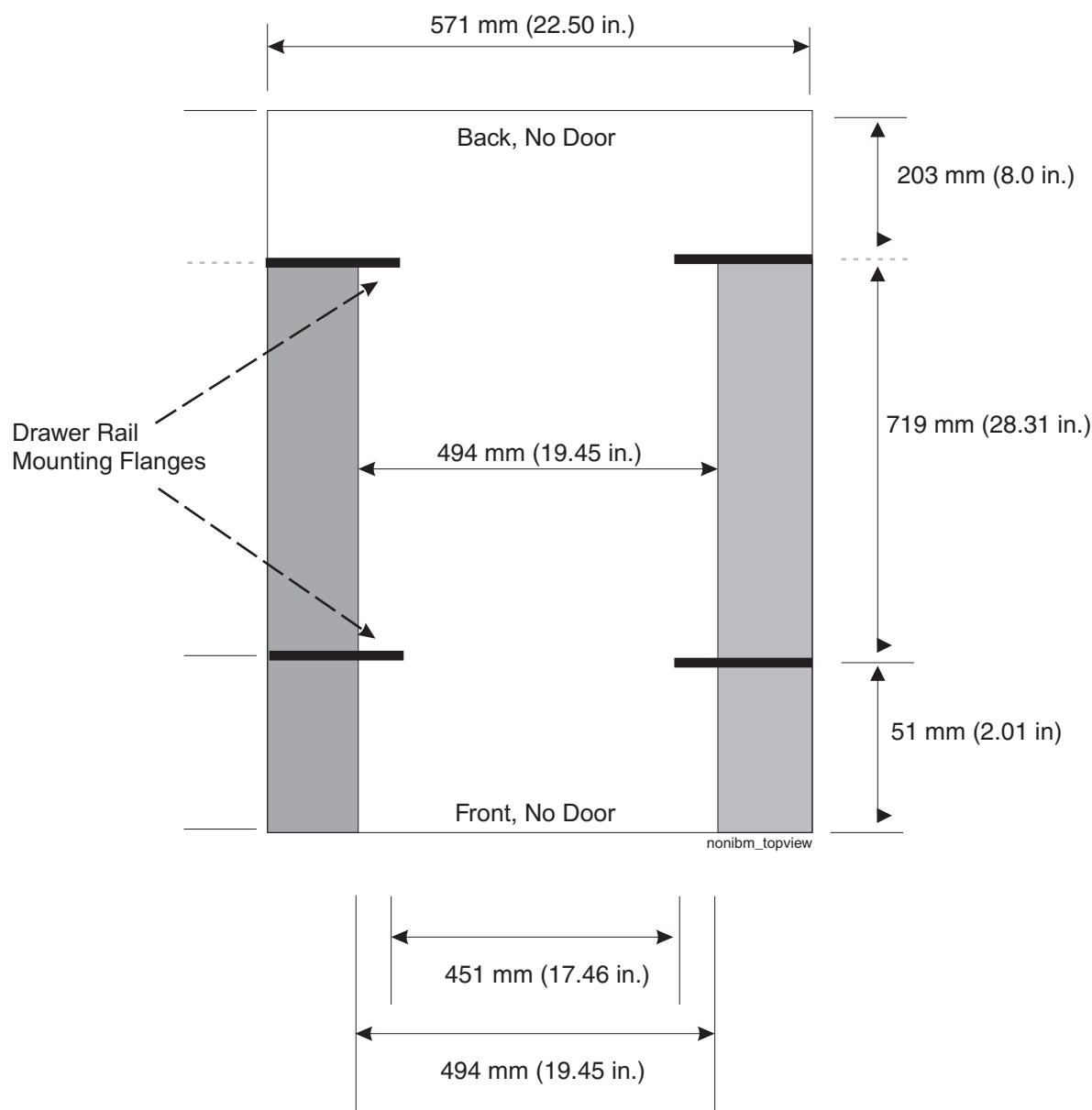


Figure 91. Top View of non-IBM Rack Specifications Dimensions

Top view of non-IBM rack specifications dimensions

The vertical distance between mounting holes must consist of sets of three holes spaced (from bottom to top) 15.9 mm (0.625 in.), 15.9 mm (0.625 in.), and 12.67 mm (0.5 in.) on center (making each three hole set of vertical hole spacing 44.45 mm (1.75 in.) apart on center). The front and rear mounting flanges in the rack or cabinet must be 719 mm (28.3 in.) apart and the internal width bounded by the mounting flanges at least 494 mm (19.45 in.), for the IBM Storage System or eServer™ rails to fit in your rack or cabinet (see Figure 91 on page 149).

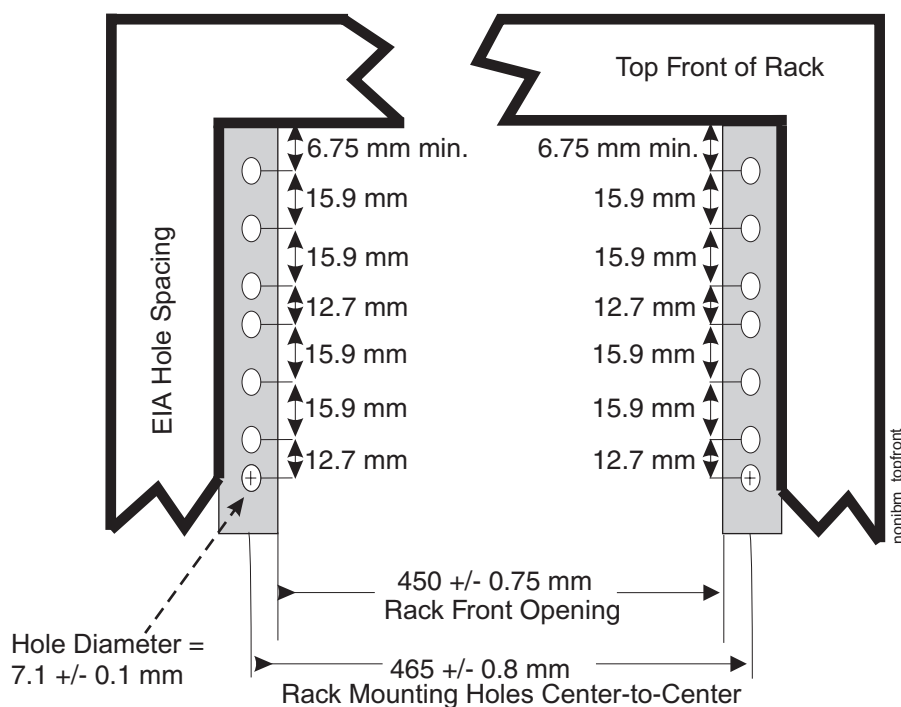


Figure 92. Rack specifications dimensions, top front view

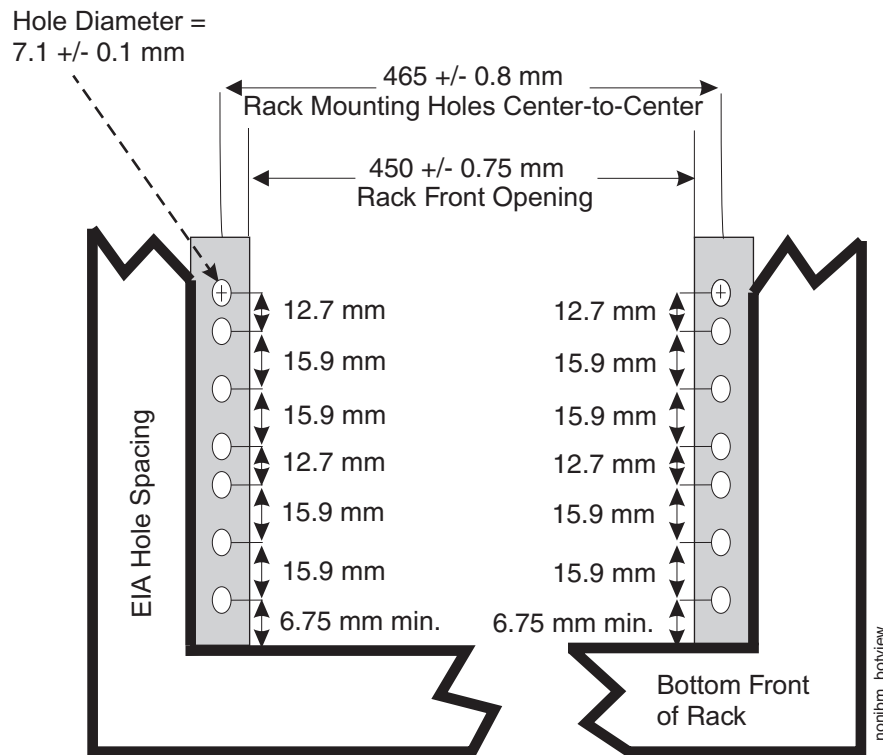


Figure 93. Rack specifications dimensions, bottom front view

2. When installing a DCS3700 storage expansion enclosure into a non-IBM rack, contact your Installation Planning Representative to ensure a safe installation into your environment for rack mounting loads and floor loading. Weight for one DCS3700 fully loaded is 102.27 kg (255 lbs). The load per EIA unit that a standard EIA rack enclosure must be able to support is 25.49 kg (56.2 lbs) per unit.
3. AC or dc power drawers need to be support based on equipment purchased for the rack or cabinet. It is strongly recommended that you use a power distribution unit that meets the same specifications as each unit already installed in the rack. Each power distribution unit needs a dedicated power line. Rack or cabinet power distribution device(s) must meet the drawer power requirements, as well as that of any additional products that will be connected to the same power distribution device.  
The rack or cabinet power receptacle (power distribution unit, uninterruptible power supply, or multi-outlet strip) must have a compatible plug type for your drawer or device. The customer is responsible for ensuring the power distribution unit is compatible with the rack or cabinet and assumes responsibility for any and all agency certifications required.
4. The rack or cabinet must be compatible with drawer mounting rails, including a secure and snug fit of the rail-mounting pins and screws into the rack or cabinet rail mounting holes. You must use the IBM mounting rails that are shipped with the IBM product to install it in the rack. The mounting rails that ship with IBM products have been designed and tested to safely support the product during operation and service activities as well as to safely support the weight of your drawer or device. The rails must facilitate service access by allowing the drawer to be safely extended, if necessary, forwards, backwards, or both.

**Note:** If the rack or cabinet has square holes on the mounting flanges, additional hardware may be required.

5. The rack or cabinet must have stabilization feet or brackets installed both in the front and rear of the rack, or have another means of preventing the rack/cabinet from tipping while the drawer or device is pulled into its extreme front or rear service positions.

Examples of some acceptable alternatives: The rack or cabinet may be securely bolted to the floor, ceiling or walls, or to adjacent racks or cabinets in a long and heavy row of racks or cabinets.

6. There must be adequate front and rear service clearances (in and around the rack or cabinet).

The rack or cabinet must have sufficient horizontal width clearance in the front and rear to allow the drawer to be fully slid into the front and, if applicable, the rear service access positions (typically this requires 914.4 mm (36 in.) clearance in both the front and rear).

If present, front and rear doors must be able to open far enough to provide unrestrained access for service or be easily removable. If doors must be removed for service, it is the customer's responsibility to remove them prior to service.
7. The rack or cabinet must provide adequate clearance around the rack drawer.

There must be adequate clearance around the drawer bezel so that it can be opened and closed, according to the product specifications.

Front or rear doors must also maintain a minimum of 51 mm (2 in.) front, 203 mm (8 in.) rear, door to mounting flange clearance, and 494 mm (19.4 in.) front, 571 mm (22.5 in.) rear, side-to-side clearance for drawer bezels and cables (see Figure 91 on page 149).
8. The rack or cabinet must provide adequate front-to-back ventilation.

For optimum ventilation, it is recommended the rack or cabinet not have a front door. If the rack or cabinet has doors, the doors must be fully perforated so that there is proper front-to-back airflow to maintain the required drawer ambient inlet temperature as specified in the server specifications. The perforations should yield at least 34 percent minimum open area per square inch.

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## 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).

**Attention:** The DCS3700 does not support 90-136V AC sources. It supports 200-240V AC sources only. Ensure that the AC input is appropriate for the DCS3700 before turning the power switches to the on position.

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.

*Table 26. IBM power cords*

IBM power cord part number	Feature code	Description	Used in these countries or regions
39M5262	9870	2.5m, 15A/250V, C19 to NEMA 6-15P	Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Caicos Islands, Canada, Cayman Islands, Costa Rica, Colombia, 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 of America, Venezuela
39M5274	9871	2.5m, 15A/250V, C19 to NEMA L6-15P	Canada, Colombia, Mexico, United States

Table 26. IBM power cords (continued)

IBM power cord part number	Feature code	Description	Used in these countries or regions
39M5282	9872	2.5m, 16A/250V, C19 to IEC 60884-1	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 Republic, Dahomey, Djibouti, Egypt, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, French Guyana, French Polynesia, Germany, Greece, Guadeloupe, Guinea, Guinea Bissau, Hungary, Iceland, Indonesia, Iran, Kazakhstan, Kyrgyzstan, Laos (People's 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, Syrian Arab Republic, Tajikistan, Tahiti, Togo, Tunisia, Turkey, Turkmenistan, Ukraine, Upper Volta, Uzbekistan, Vanuatu, Vietnam, Wallis and Futuna, Yugoslavia (Federal Republic of), Zaire
39M5290	9873	2.5m, 16A/250V, C19 to SANS 1661 / SABS 164	Bangladesh, Lesotho, Maceo, Maldives, Namibia, Nepal, Pakistan, Samoa, South Africa, Sri Lanka, Swaziland, Uganda
39M5294	9874	2.5m, 13A/250V, C19 to BS 1363/A	Abu Dhabi, Bahrain, Botswana, Brunei Darussalam, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Dominica, Gambia, Ghana, Grenada, Iraq, Ireland, Jordan, Kenya, Kuwait, Liberia, Malawi, Malaysia, Malta, Myanmar (Burma), Nigeria, Oman, Polynesia, Qatar, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Seychelles, Sierra Leone, Singapore, Sudan, Tanzania (United Republic of), Trinidad and Tobago, United Arab Emirates (Dubai), United Kingdom, Yemen, Zambia, Zimbabwe
39M5298	9875	2.5m, 16A/250V, C19 to CEI 23-16	Chile, Italy, Libyan Arab Jamahiriya
39M5310	9876	2.5m, 16A/250V, C19 to SI 32	Israel
39M5322	9877	2.5m, 16A/250V, C19 to IEC 309 Type 2P+G IP67	Denmark, Liechtenstein, Switzerland
39M5330	9878	2.5m, 15A/250V, C19 to AS/NZS 3112	Australia, Fiji, Kiribati, Nauru, New Zealand, Papua New Guinea
39M5334	9879	2.5m, 15A/250V, C19 to JIS C8303, C8306	Japan
39M5342	9880	2.5m, 20A/250V, C19 to IRAM 2073	Argentina, Paraguay, Uruguay
39M5346	9881	2.5m, 15A/250V, C19 to KSC 8305	Korea (Democratic People's Republic of), Korea (Republic of)
39M5535	9884	2.5m, 16A/250V, C19 to IEC 60083/75	Brazil



Table 26. IBM power cords (continued)

IBM power cord part number	Feature code	Description	Used in these countries or regions
39M5366	9885	2.5m, 20A/250V, C19 to CNS 10917-3	Taiwan



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## Appendix E. Component weights

Because of the size and weight of the DCS3700 storage enclosure, a lift tool and two trained service technicians are required to install the enclosure in a rack or remove the enclosure from a rack. If a lift tool is not available, you must reduce the weight of the storage enclosure before you lift it, as follows:

- Remove two power supplies and make sure that the hard disk drive drawers are empty; then, three trained service technicians can lift the storage enclosure.
- Make sure that the hard disk drive drawers are empty. Remove two power supplies, two fan assemblies, two controllers or environmental services modules, and a minimum of three of the five unpopulated hard disk drive drawers; then, two trained service technicians can lift the storage enclosure.

The total weight of the storage expansion enclosure depends on the number of components installed. Table 27 lists the unit weights for the storage expansion enclosure and expansion enclosure components.

**Note:** Two trained service technicians can lift up to 70 lb, and three trained service technicians can lift up to 121.2 lb.

*Table 27. DCS3700 component weights*

Unit or Component	Weight
<b>DCS3700 Storage system</b>	
Drive-ready weight: 5 drive drawers, 2 controllers, 2 power supplies, 2 fan assemblies, no disk drive modules	126.8 lb (57.5 kg)
Maximum system weight: 5 drive drawers, 2 controllers, 2 power supplies, 2 fan assemblies, 60 disk drive modules assemblies, and bezel	225 lb (102.1 kg)
<b>DCS3700 Expansion unit</b>	
Drive-ready weight: 5 drive drawers, 2 controllers, 2 power supplies, 2 fan assemblies, no disk drive modules	124.2 lb (56.3 kg)
Maximum system weight: 5 drive drawers, 2 controllers, 2 power supplies, 2 fan assemblies, 60 disk drive modules	222.6 lb (101.0 kg)
<b>Enclosure components</b>	
Chassis with midplane only	43 lb (19.5 kg)
Rails (left and right)	8.2 lb (3.7 kg)
3.5" disk drive module	1.6 lb (0.7 kg)
Controller with cache battery backup, no HIC	4.5 lb (2.0 kg)
8Gbps Fibre Channel host interface card	.18 lb (.08 kg)
Gbps SAS6 host interface card	.15 lb (.07 kg)
ESM	3.4 lb (1.5 kg)
Fan assembly	2.4 lb (1.1 kg)
Power supply	5.5 lb (2.5 kg)
Drive drawer assembly including right and left cable chains	11.5 lb (5.2 kg)



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## Important notes

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

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1024 bytes, MB stands for 1 048 576 bytes, and GB stands for 1 073 741 824 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 can vary depending on operating environments.

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**Attention:** Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the storage expansion enclosure that is described in this document. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the storage expansion enclosure to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If IBM determines that the levels of particulates or gases in your environment have caused damage to the storage expansion enclosure, IBM may condition provision of repair or replacement of storage expansion enclosure or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

*Table 28. Limits for particulates and gases*

Contaminant	Limits
Particulate	<ul style="list-style-type: none"><li>• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2<sup>1</sup>.</li><li>• Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282.</li><li>• The deliquescent relative humidity of the particulate contamination must be more than 60%<sup>2</sup>.</li><li>• The room must be free of conductive contamination such as zinc whiskers.</li></ul>
Gaseous	<ul style="list-style-type: none"><li>• Copper: Class G1 as per ANSI/ISA 71.04-1985<sup>3</sup></li><li>• Silver: Corrosion rate of less than 300 Å in 30 days</li></ul>

<sup>1</sup> ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

<sup>2</sup> The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.

<sup>3</sup> ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

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

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

**See also**  
Refers you to a related term.

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

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

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

**adapter.** A printed circuit assembly that transmits user data input/output (I/O) between the internal bus of the host system and the external fibre-channel (FC) link and vice versa. Also called an I/O adapter, host adapter, or FC adapter.

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

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

**AGP.** See *accelerated graphics port*.

**AL\_PA.** See *arbitrated loop physical address*.

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

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

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

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

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

**ATA.** See *AT-attached*.

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

**auto-volume transfer/auto-disk transfer (AVT/ADT).** A function that provides automatic failover in case of controller failure on a storage subsystem.

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

**AWT.** See *Abstract Windowing Toolkit*.

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

**BIOS.** See *basic input/output system*.

**BOOTP.** See *bootstrap protocol*.

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

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

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

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

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

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

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

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

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

**CRC.** See *cyclic redundancy check*.

**CRT.** See *cathode ray tube*.

**CRU.** See *customer replaceable unit*.

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

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

**dac.** See *disk array controller*.

**dar.** See *disk array router*.

**DASD.** See *direct access storage device*.

**data striping.** See *striping*.

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

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

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

**DHCP.** See *Dynamic Host Configuration Protocol*.

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

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

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

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

**DMA.** See *direct memory access*.

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

**drive channels.** The DS4200, DS4700, DS4800, and DS5000 subsystems use dual-port drive channels that, from the physical point of view, are connected in the same way as two drive loops. However, from the point of view of the number of drives and enclosures, they are treated as a single drive loop instead of two different drive loops. A group of storage expansion enclosures are connected to the DS4000/DS5000 storage subsystems using a drive channel from each controller. This pair of drive channels is referred to as a redundant drive channel pair.

**drive loops.** A drive loop consists of one channel from each controller combined to form one pair of redundant drive channels or a redundant drive loop. Each drive



loop is associated with two ports. Drive loops are more commonly referred to as drive channels. See *drive channels*.

**DRAM.** See *dynamic random access memory*.

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

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

**ECC.** See *error correction coding*.

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

**EISA.** See *Extended Industry Standard Architecture*.

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

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

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

**E\_port.** See *expansion port*.

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

**ESD.** See *electrostatic discharge*.

**ESM canister.** See *environmental service module canister*.

**automatic ESM firmware synchronization.** When you install a new ESM into an existing storage expansion enclosure in a DS4000 storage subsystem that supports automatic ESM firmware synchronization, the firmware in the new ESM is automatically synchronized with the firmware in the existing ESM.

**EXP.** See *storage expansion enclosure*.

**expansion port (E\_port).** A port that connects the switches for two fabrics.

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

**fabric.** A fibre channel entity which interconnects and facilitates logins of N\_ports attached to it. The fabric is responsible for routing frames between source and destination N\_ports using address information in the frame header. A fabric can be as simple as a point-to-point channel between two N\_ports, or as complex as a frame-routing switch that provides multiple and redundant internal pathways within the fabric between F\_ports.

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

**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 DS5000 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.

**heterogeneous host environment.** A host system in which multiple host servers, which use different operating systems with their own unique disk storage subsystem settings, connect to the same DS5000 storage subsystem at the same time. See also *host*.

**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 DS5000 Storage Manager software. To give a host computer access to a partition, its associated host ports must be defined.

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

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

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

**IC.** See *integrated circuit*.

**IDE.** See *integrated drive electronics*.

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

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

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

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

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



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

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

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

**IP.** See *Internet Protocol*.

**IPL.** See *initial program load*.

**IRQ.** See *interrupt request*.

**ISA.** See *Industry Standard Architecture*.

**Java Runtime Environment (JRE).** A subset of the Java Development Kit (JDK) for end users and developers who want to redistribute the Java Runtime Environment (JRE). The JRE consists of the Java virtual machine, the Java Core Classes, and supporting files.

**JRE.** See *Java Runtime Environment*.

**label.** A discovered or user entered property value that is displayed underneath each device in the Physical and Data Path maps.

**LAN.** See *local area network*.

**LBA.** See *logical block address*.

**local area network (LAN).** A computer network located on a user's premises within a limited geographic area.

**logical block address (LBA).** The address of a logical block. Logical block addresses are typically used in hosts' I/O commands. The SCSI disk command protocol, for example, uses logical block addresses.

**logical partition (LPAR).** (1) A subset of a single system that contains resources (processors, memory, and input/output devices). A logical partition operates as an independent system. If hardware requirements are met, multiple logical partitions can exist within a system. (2) A fixed-size portion of a logical volume. A logical partition is the same size as the physical partitions in its volume group. Unless the logical volume of which it is a part is mirrored, each logical partition corresponds to, and its contents are stored on, a single physical partition. (3) One to three physical partitions (copies). The number of logical partitions within a logical volume is variable.

**logical unit number (LUN).** An identifier used on a small computer system interface (SCSI) bus to distinguish among up to eight devices (logical units) with the same SCSI ID.

**loop address.** The unique ID of a node in fibre-channel loop topology sometimes referred to as a loop ID.

**loop group.** A collection of storage area network (SAN) devices that are interconnected serially in a single loop circuit.

**loop port.** A node port (N\_port) or fabric port (F\_port) that supports arbitrated loop functions associated with an arbitrated loop topology.

**LPAR.** See *logical partition*.

**LUN.** See *logical unit number*.

**MAC.** See *medium access control*.

**management information base (MIB).** The information that is on an agent. It is an abstraction of configuration and status information.

**man pages.** In UNIX-based operating systems, online documentation for operating system commands, subroutines, system calls, file formats, special files, stand-alone utilities, and miscellaneous facilities. Invoked by the **man** command.

**MCA.** See *micro channel architecture*.

**media scan.** A media scan is a background process that runs on all logical drives in the storage subsystem for which it has been enabled, providing error detection on the drive media. The media scan process scans all logical drive data to verify that it can be accessed, and optionally scans the logical drive redundancy information.

**medium access control (MAC).** In local area networks (LANs), the sublayer of the data link control layer that supports medium-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer. The MAC sublayer includes the method of determining when a device has access to the transmission medium.

**Metro Mirroring.** This term is used to refer to a remote logical drive mirror pair which is set up with synchronous write mode. See also *remote mirroring*, *Global Mirroring*.

**MIB.** See *management information base*.

**micro channel architecture (MCA).** Hardware that is used for PS/2 Model 50 computers and above to provide better growth potential and performance characteristics when compared with the original personal computer design.

**Microsoft Cluster Server (MSCS).** MSCS, a feature of Windows NT Server (Enterprise Edition), supports the connection of two servers into a cluster for higher availability and easier manageability. MSCS can automatically detect and recover from server or application failures. It can also be used to balance server workload and provide for planned maintenance.

**mini hub.** An interface card or port device that receives short-wave fiber channel GBICs or SFPs. These devices enable redundant fibre channel connections from the host computers, either directly or through a fibre channel switch or managed hub, over optical fiber cables to the DS4000 Storage Server controllers. Each DS4000 controller is responsible for two mini hubs. Each mini hub has two ports. Four host ports (two on each controller) provide a cluster solution without use of a switch. Two host-side mini hubs are shipped as standard. See also *host port*, *gigabit interface converter (GBIC)*, *small form-factor pluggable (SFP)*.

**mirroring.** A fault-tolerance technique in which information on a hard disk is duplicated on additional hard disks. See also *remote mirroring*.

**model.** The model identification that is assigned to a device by its manufacturer.

**MSCS.** See *Microsoft Cluster Server*.

**network management station (NMS).** In the Simple Network Management Protocol (SNMP), a station that runs management application programs that monitor and control network elements.

**NMI.** See *non-maskable interrupt*.

**NMS.** See *network management station*.

**non-maskable interrupt (NMI).** A hardware interrupt that another service request cannot overrule (mask). An NMI bypasses and takes priority over interrupt requests generated by software, the keyboard, and other such devices and is issued to the microprocessor only in disastrous circumstances, such as severe memory errors or impending power failures.

**node.** A physical device that allows for the transmission of data within a network.

**node port (N\_port).** A fibre-channel defined hardware entity that performs data communications over the fibre-channel link. It is identifiable by a unique worldwide name. It can act as an originator or a responder.

**nonvolatile storage (NVS).** A storage device whose contents are not lost when power is cut off.

**N\_port.** See *node port*.

**NVS.** See *nonvolatile storage*.

**NVSRAM.** Nonvolatile storage random access memory. See *nonvolatile storage*.

**Object Data Manager (ODM).** An AIX proprietary storage mechanism for ASCII stanza files that are edited as part of configuring a drive into the kernel.

**ODM.** See *Object Data Manager*.

**out-of-band.** Transmission of management protocols outside of the fibre-channel network, typically over Ethernet.

**partitioning.** See *storage partition*.

**parity check.** (1) A test to determine whether the number of ones (or zeros) in an array of binary digits is odd or even. (2) A mathematical operation on the numerical representation of the information communicated between two pieces. For example, if parity is odd, any character represented by an even number has a bit added to it, making it odd, and an information receiver checks that each unit of information has an odd value.

**PCI local bus.** See *peripheral component interconnect local bus*.

**PDF.** See *portable document format*.

**performance events.** Events related to thresholds set on storage area network (SAN) performance.

**peripheral component interconnect local bus (PCI local bus).** A local bus for PCs, from Intel, that provides a high-speed data path between the CPU and up to 10 peripherals (video, disk, network, and so on). The PCI bus coexists in the PC with the Industry Standard Architecture (ISA) or Extended Industry Standard Architecture (EISA) bus. ISA and EISA boards plug into an IA or EISA slot, while high-speed PCI controllers plug into a PCI slot. See also *Industry Standard Architecture*, *Extended Industry Standard Architecture*.

**polling delay.** The time in seconds between successive discovery processes during which discovery is inactive.

**port.** A part of the system unit or remote controller to which cables for external devices (such as display stations, terminals, printers, switches, or external storage units) are attached. The port is an access point for data entry or exit. A device can contain one or more ports.

**portable document format (PDF).** A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact; can be distributed globally by e-mail, the Web, intranets, or CD-ROM; and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

**premium feature key.** A file that the storage subsystem controller uses to enable an authorized premium feature. The file contains the feature enable identifier of the storage subsystem for which the premium feature is authorized, and data about the premium feature. See also *feature enable identifier*.

**private loop.** A freestanding arbitrated loop with no fabric attachment. See also *arbitrated loop*.

**program temporary fix (PTF).** A temporary solution or bypass of a problem diagnosed by IBM in a current unaltered release of the program.

**PTF.** See *program temporary fix*.

**RAID.** See *redundant array of independent disks (RAID)*.

**RAID level.** An array's RAID level is a number that refers to the method used to achieve redundancy and fault tolerance in the array. See also *array, redundant array of independent disks (RAID)*.

**RAID set.** See *array*.

**RAM.** See *random-access memory*.

**random-access memory (RAM).** A temporary storage location in which the central processing unit (CPU) stores and executes its processes. Contrast with *DASD*.

**RDAC.** See *redundant disk array controller*.

**read-only memory (ROM).** Memory in which stored data cannot be changed by the user except under special conditions.

**recoverable virtual shared disk (RVSD).** A virtual shared disk on a server node configured to provide continuous access to data and file systems in a cluster.

**redundant array of independent disks (RAID).** A collection of disk drives (*array*) that appears as a single volume to the server, which is fault tolerant through an assigned method of data striping, mirroring, or parity checking. Each array is assigned a RAID level, which is a specific number that refers to the method used to achieve redundancy and fault tolerance. See also *array, parity check, mirroring, RAID level, striping*.

**redundant disk array controller (RDAC).** (1) In hardware, a redundant set of controllers (either active/passive or active/active). (2) In software, a layer that manages the input/output (I/O) through the active controller during normal operation and transparently reroutes I/Os to the other controller in the redundant set if a controller or I/O path fails.

**remote mirroring.** Online, real-time replication of data between storage subsystems that are maintained on separate media. The Enhanced Remote Mirror Option is a DS5000 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 DS5000 Storage Manager optional Java-based host-agent software, which can be used on Microsoft Windows, Novell NetWare, AIX, HP-UX, Solaris, and Linux on POWER host systems to manage storage subsystems through the host fibre-channel connection.

**SMclient.** The DS5000 Storage Manager client software, which is a Java-based graphical user interface (GUI) that is used to configure, manage, and troubleshoot storage servers and storage expansion enclosures in a DS5000 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 DS5000 Storage Manager utility software that is used on Microsoft Windows, AIX, HP-UX, Solaris, and Linux on POWER host systems to register and map new logical drives to the operating system. In Microsoft Windows, it also contains a utility to flush the cached data of the operating system for a particular drive before creating a FlashCopy.

**small computer system interface (SCSI).** A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

**small form-factor pluggable (SFP).** An optical transceiver that is used to convert signals between optical fiber cables and switches. An SFP is smaller than a gigabit interface converter (GBIC). See also *gigabit interface converter*.

**SNMP.** See *Simple Network Management Protocol* and *SNMPv1*.

**SNMP trap event.** (1) (2) An event notification sent by the SNMP agent that identifies conditions, such as thresholds, that exceed a predetermined value. See also *Simple Network Management Protocol*.

**SNMPv1.** The original standard for SNMP is now referred to as SNMPv1, as opposed to SNMPv2, a revision of SNMP. See also *Simple Network Management Protocol*.

**SRAM.** See *static random access memory*.

**SSA.** See *serial storage architecture*.

**static random access memory (SRAM).** Random access memory based on the logic circuit known as flip-flop. It is called static because it retains a value as long as power is supplied, unlike dynamic random access memory (DRAM), which must be regularly

refreshed. It is however, still volatile, meaning that it can lose its contents when the power is turned off.

**storage area network (SAN).** A dedicated storage network tailored to a specific environment, combining servers, storage products, networking products, software, and services. See also *fabric*.

**Storage Array Identifier (SAI or SA Identifier).** The Storage Array Identifier is the identification value used by the DS5000 Storage Manager host software (SMClient) to uniquely identify each managed storage server. The DS5000 Storage Manager SMClient program maintains Storage Array Identifier records of previously-discovered storage servers in the host resident file, which allows it to retain discovery information in a persistent fashion.

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

**storage management station.** A system that is used to manage the storage subsystem. A storage management station does not need to be attached to the storage subsystem through the fibre-channel input/output (I/O) path.

**storage partition.** Storage subsystem logical drives that are visible to a host computer or are shared among host computers that are part of a host group.

**storage partition topology.** In the DS5000 Storage Manager client, the Topology view of the Mappings window displays the default host group, the defined host group, the host computer, and host-port nodes. The host port, host computer, and host group topological elements must be defined to grant access to host computers and host groups using logical drive-to-LUN mappings.

**striping.** Splitting data to be written into equal blocks and writing blocks simultaneously to separate disk drives. Striping maximizes performance to the disks. Reading the data back is also scheduled in parallel, with a block being read concurrently from each disk then reassembled at the host.

**subnet.** An interconnected but independent segment of a network that is identified by its Internet Protocol (IP) address.

**sweep method.** A method of sending Simple Network Management Protocol (SNMP) requests for information to all the devices on a subnet by sending the request to every device in the network.

**switch.** A fibre-channel device that provides full bandwidth per port and high-speed routing of data by using link-level addressing.

**switch group.** A switch and the collection of devices connected to it that are not in other groups.



**switch zoning.** See *zoning*.

**synchronous write mode.** In remote mirroring, an option that requires the primary controller to wait for the acknowledgment of a write operation from the secondary controller before returning a write I/O request completion to the host. See also *asynchronous write mode*, *remote mirroring*, *Metro Mirroring*.

**system name.** Device name assigned by the vendor's third-party software.

**TCP.** See *Transmission Control Protocol*.

**TCP/IP.** See *Transmission Control Protocol/Internet Protocol*.

**terminate and stay resident program (TSR program).** A program that installs part of itself as an extension of DOS when it is executed.

**topology.** The physical or logical arrangement of devices on a network. The three fibre-channel topologies are fabric, arbitrated loop, and point-to-point. The default topology for the disk array is arbitrated loop.

**TL\_port.** See *translated loop port*.

**transceiver.** A device that is used to transmit and receive data. Transceiver is an abbreviation of transmitter-receiver.

**translated loop port (TL\_port).** A port that connects to a private loop and allows connectivity between the private loop devices and off loop devices (devices not connected to that particular TL\_port).

**Transmission Control Protocol (TCP).** A communication protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communication networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

**Transmission Control Protocol/Internet Protocol (TCP/IP).** A set of communication protocols that provide peer-to-peer connectivity functions for both local and wide-area networks.

**trap.** In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

**trap recipient.** Receiver of a forwarded Simple Network Management Protocol (SNMP) trap. Specifically, a trap receiver is defined by an Internet Protocol (IP) address and port to which traps are sent.

Presumably, the actual recipient is a software application running at the IP address and listening to the port.

**TSR program.** See *terminate and stay resident program*.

**uninterruptible power supply.** A source of power from a battery that is installed between a computer system and its power source. The uninterruptible power supply keeps the system running if a commercial power failure occurs, until an orderly shutdown of the system can be performed.

**user action events.** Actions that the user takes, such as changes in the storage area network (SAN), changed settings, and so on.

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

**worldwide name (WWN).** A globally unique 64-bit identifier assigned to each fibre channel port.

**WORM.** See *write-once read-many*.

**write-once read many (WORM).** Any type of storage medium to which data can be written only a single time, but can be read from any number of times. After the data is recorded, it cannot be altered.

**WWN.** See *worldwide name*.

**zoning.** (1) In fibre channel environments, the grouping of multiple ports to form a virtual, private, storage network. Ports that are members of a zone can communicate with each other, but are isolated from ports in other zones. (2) A function that allows segmentation of nodes by address, name, or physical port and is provided by fabric switches or hubs.



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Part Number: 90Y8588

Printed in USA

(1P) P/N: 90Y8588

