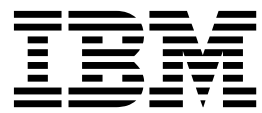


IBM System Storage DCS3860 with Gen2 Controllers

*Installation, User's, 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 ix and “Notices” on page 161 sections.

This edition applies to the IBM System Storage DCS3860 with Gen2 Controllers Storage System with controller firmware version 8.2, and to all subsequent releases and modifications until otherwise indicated in new editions.

This is the second edition.

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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® DCS3860 with Gen2 Controllers storage system. 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">1. Turn everything OFF.2. First, attach all cables to devices.3. Attach signal cables to connectors.4. Attach power cords to outlet.5. Turn device ON.	<ol style="list-style-type: none">1. Turn everything OFF.2. First, remove power cords from outlet.3. Remove signal cables from connectors.4. Remove all cables from devices.

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, do not:

- Remove the covers of the laser product as it might expose the product to hazardous laser radiation. There are no serviceable parts inside the device.
- Perform procedures, or use controls or adjustments, other than those specified in this guide, as it might cause radiation exposure.



DANGER




Some laser products contain an embedded Class 3A or Class 3B laser diode. When laser radiation is open, do not stare into the beam or view with optical instruments.

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



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

CAUTION:

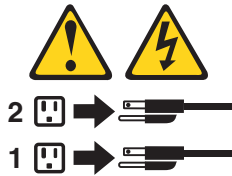
Use safe practices when lifting.

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 mm² 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.**

About this document

This document provides instructions for installing and customizing the IBM System Storage DCS3860 with Gen2 Controllers storage system and the EXP3800/DCS3700 expansion enclosures. It also provides maintenance procedures and troubleshooting information.

Who should read this document

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

How this document is organized

Chapter 1, "Introduction," on page 1 describes the IBM System Storage DCS3860 with Gen2 Controllers storage system and the EXP3800/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 DCS3860 with Gen2 Controllers," on page 25 contains information on how to install the DCS3860 with Gen2 Controllers.

Chapter 3, "Cabling the DCS3860 with Gen2 Controllers," on page 43 contains information on how to cable the DCS3860 with Gen2 Controllers.

Chapter 4, "Operating the DCS3860 with Gen2 Controllers and EXP3800/DCS3700 expansion enclosure," on page 55 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 77 contains step-by-step instructions to install or remove customer replaceable units (CRUs), such as hard disk drives, power supplies, fan assemblies, environmental service modules (ESMs), drive drawers, and SFP modules.

Chapter 6, "Hardware maintenance," on page 123 describes problems and symptoms that are specific to your storage expansion enclosure. It also provides a parts list for the DCS3860 with Gen2 Controllers.

Chapter 7, "Records," on page 141 provides a table that you can use to record and update important information about your DCS3860 with Gen2 Controllers, including serial number and device records. Whenever you add options to your DCS3860 with Gen2 Controllers, be sure to update the information in this table.

Chapter 8, "Rack mounting template," on page 145 provides the rack mounting templates for installation of the DCS3860 with Gen2 Controllers. If you want to tear out the templates from the document for use during installation, use these copies of the templates.

Chapter 9, “Specifications for non-IBM rack installation,” on page 149 provides safety requirements and rack specifications for installing DCS3860 with Gen2 Controllers storage systems and DCS3860 with Gen2 Controllers storage expansion enclosures into non-IBM racks.

Chapter 10, “Power cords,” on page 157 lists power cord information for the DCS3860 with Gen2 Controllers.

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 systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

Using the documentation

Information about your 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

IBM 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 IBM DS Storage Manager software, consult the README file. 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 available on the web, at the following address:

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

To access the documentation related to your storage system, 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 website:

publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp

Essential websites for DCS3860 with Gen2 Controllers support information

The most up-to-date information about DCS3860 with Gen2 Controllers storage systems and IBM DS Storage Manager, including documentation and the most recent software, firmware, and NVSRAM downloads, is available on the IBM support portal. To access these:

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 the 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 website:

www.ibm.com/services/sl/products

For more information about the IBM Support Line and other IBM services, check the following websites:

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

Hardware service and support

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

www.ibm.com/planetwide

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

Fire suppression systems

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

Chapter 1. Introduction

This section describes the operating specifications, features, and components of the IBM System Storage DCS3860 with Gen2 Controllers storage system and EXP3800/DCS3700 expansion units.

Note: For Ethernet Interfaces: DCS3860 with Gen2 Controllers storage system is not intended to be connected directly or indirectly by any means whatsoever to interfaces of public telecommunication networks.

This chapter also includes an inventory checklist and important information about best practices guidelines and product updates for your DCS3860 with Gen2 Controllers.

Overview

The DCS3860 with Gen2 Controllers storage system is designed to meet the storage needs of highly scalable, data streaming applications in high-performance computing environments. The DCS3860 is a high-performance system that is designed to meet midrange storage requirements. This high-availability, modular, and scalable storage system provides SAN-attached 6 Gbps Serial Attached SCSI (SAS) connectivity, support for RAID levels 0, 1, 3, 5, 6, and 10, data access and data protection, and other advanced functions.

Note: RAID 6 uses a P+Q design implementation. When RAID level 1 is implemented and there are more than two drives, RAID level 10 is automatically implemented.

The DCS3860 with Gen2 Controllers storage system supports attachment of the EXP3800/DCS3700 expansion enclosures. The DCS3860 with Gen2 Controllers 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 system, see “DCS3860 Features” on page 2.

For more details about the DCS3700 expansion enclosure, see *IBM System Storage DCS3700 with Gen2 Controllers - Installation, User's, and Maintenance Guide*.

The DCS3860 with Gen2 Controllers 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. As a standard, the DCS3860 with Gen2 Controllers storage system RAID controllers have two 6 Gbps x4 SAS expansion ports on the base controller. Each controller has an additional slot in which you can install a Host Interface Card (HIC). For details on the supported HIC, see “DCS3860 Features” on page 2.

The IBM DS Storage Manager client is also available for the DCS3860 with Gen2 Controllers storage system. This storage management software is designed to help centralize storage management, simplify partitioning of the DCS3860 with Gen2 Controllers series storage into as many as 512 partitions, and strategically allocate storage capacity to maximize storage space.

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.

Operating system support

For host operating system support, refer to the IBM DCS3860 with Gen2 Controllers product at the IBM System Storage Interoperation Center (SSIC):

www.ibm.com/systems/support/storage/config/ssic/index.jsp

DCS3860 Features

For a list of the operating specifications, such as weight, height, and heat output, see "Specifications" on page 17.

Table 1. DCS3860 with Gen2 Controllers features

General: <ul style="list-style-type: none">• Modular components<ul style="list-style-type: none">– RAID storage controller modules– Environmental services modules (ESMs)– Power supplies– Fan assembly– High-capacity disk drives	Storage system: <ul style="list-style-type: none">• RAID controllers:<ul style="list-style-type: none">– Expansion: Two 26 pin, mini-SAS connector per controller– Dual 1 Gbps Ethernet management ports– Seven segment display• Power supply:<ul style="list-style-type: none">– 2 hot-swap 1755-watt (200 - 240 V ac) standard– Redundant power• Premium Feature Options:<ul style="list-style-type: none">– Performance Read Cache– Disaster Recovery Option– Copy Services Option– Super Key Option	Storage expansion enclosure: <ul style="list-style-type: none">• ESM:<ul style="list-style-type: none">– Host interface: Two 26-pin, mini-SAS connectors per controller– Expansion: One 26 pin, mini-SAS connector per controller– Single 100 Mbps Ethernet debug port– Seven segment display• Power supply:<ul style="list-style-type: none">– 2 hot-swap 1755-watt (200 - 240 V ac) standard– Redundant power
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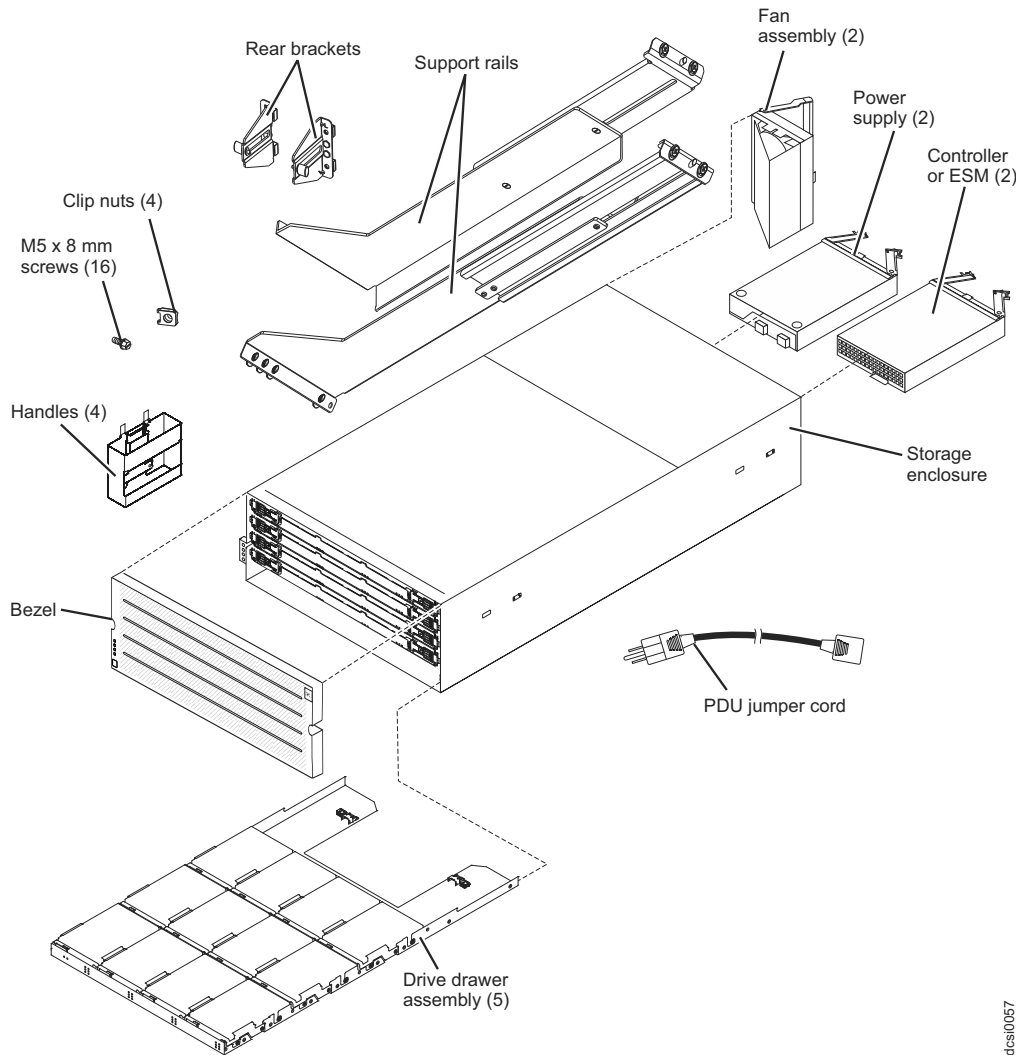
Table 1. DCS3860 with Gen2 Controllers features (continued)

<ul style="list-style-type: none"> • Technology <ul style="list-style-type: none"> – Support for RAID 0, 1, 3, 5, 6, and 10 disk arrays – Support for up to 360 SAS or NL-SAS disk drives when using five additional expansion enclosures. – Support for up to 120 Solid-State Drives – Controller cache size of 12 GB per controller for a total of 24 GB per storage system – Storage capacity up to 2.16 PB – Each controller supports 3 host interface adapter. Support for: <ul style="list-style-type: none"> - Eight 12 GB SAS - 10 Gbps iSCSi - 16 Gbps FC host interface ports (four per controller) – Redundant controllers or ESMs, power supply, and fan assemblies – Hot-swap technology for controllers and power supply 		
<ul style="list-style-type: none"> • User interface <ul style="list-style-type: none"> – Built-in power, activity, and fault LEDs, identification labeling on components, rear LEDs, and connectors – Easy-to-replace drives, power supplies, fan assemblies, controllers, and ESMs 		

Inventory checklist

The following illustration and inventory list display 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.

Note: The illustration might differ slightly from your hardware.



After you unpack the DCS3860 with Gen2 Controllers, ensure that you have the following items:

- 4U-high storage enclosure (1)
 - A box containing Disk Drive Modules (if you have ordered: the box may be shipped in this carton or separately)
 - Drive drawer assemblies (5)
 - Fan assemblies (2)
 - Power supplies (2)
 - ESMs (2) (for 1813 80E)
 - Controllers (2) (for 1813-86C)
- Handles (4), 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)

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

- Washers (8)
- Clip nuts (4)

Important: The DCS3860 with Gen2 Controllers does not ship with region-specific ac power cords. You must obtain the IBM-approved power cords for your region. For more information, see Chapter 10, “Power cords,” on page 157.

Receiving product updates and support notifications

Download the latest versions of these packages at the time of initial installation and when product updates become available.

- DS Storage Manager host software
- DCS3860 with Gen2 Controllers storage system controller firmware and NVSRAM
- EXP3800/DCS3700 expansion unit ESM firmware
- Drive firmware

Important

Subscribe to support notifications for product updates and update the system with the latest firmware.

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

Best practices guidelines

IBM recommends guidelines or best practices for optimal operation of your system.

- Ensure that your system is in an optimal state before you shut it down. Never turn off the power if any Service Action Required LED is lit. Ensure that you 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 right and left power supplies of the DCS3860 with Gen2 Controllers storage system into two independent external power circuits through the distribution units that are inside a rack cabinet or directly into external receptacles. The DCS3860 with Gen2 Controllers storage system and all its attached expansion enclosures can then have power in the event that only one power circuit is available. Also, during an unattended restoration of power, the storage devices in the configuration can power on simultaneously.

Note: Do not overload the circuits that power your storage system and storage expansion enclosures. Use additional pairs of power distribution units (PDUs) if necessary. Refer to Table 10 on page 20 for information about storage expansion enclosure power requirements. Contact your IBM service representative for additional information.

- Before a planned system shutdown or after 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 system profile.
 2. Save the storage system configuration.

3. Save the Collect All Support Data (CASD).

Ensure that you save the files in a location other than in the logical drives, which were created for the storage system.

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

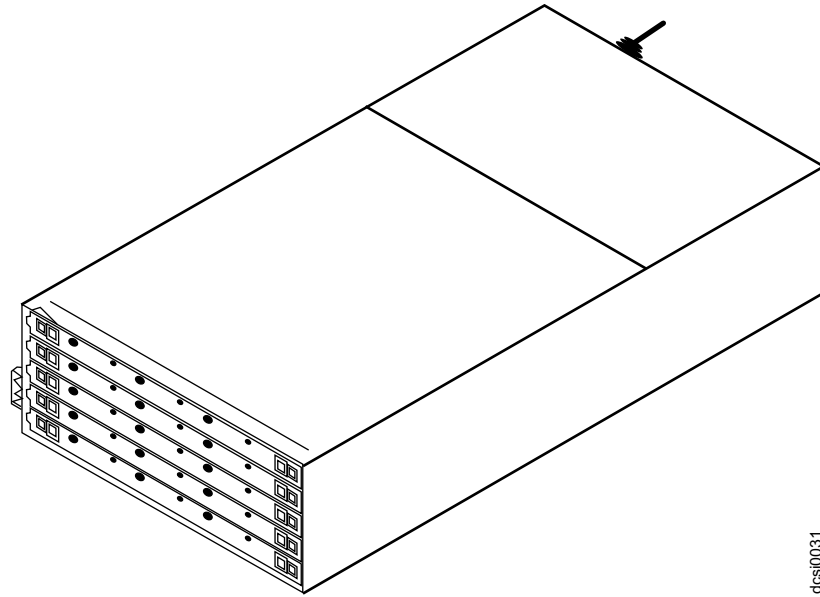
- During any maintenance or attended power on procedure, carefully follow the power on sequence listed in “Restoring power after an unexpected shutdown” on page 73. Ensure that each component of the system is powered on in the correct order, so that the controller can optimally access all the storage systems.
- The storage system supports simultaneous power on to the system components. However, you must always follow the power on sequence listed in “Restoring power after an unexpected shutdown” on page 73.
- A storage system in an optimal state should recover automatically from an unexpected shutdown and an unattended restoration of power to system components. After power is restored, call IBM support if any of the following conditions occur:
 - The storage system logical drives and systems do not display in the DS Storage Manager graphical user interface (GUI).
 - The storage system logical drives and systems are not online.
 - The storage system logical drives and systems are degraded.

DCS3860 with Gen2 Controllers components

The DCS3860 with Gen2 Controllers storage system directs and manages the I/O activity between a host and the drives in a RAID array. The EXP3800/DCS3700 expansion units provides additional storage capacity to the storage system.

Figure 1 on page 7 shows the DCS3860 with Gen2 Controllers unit without the front bezel in place.

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



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Figure 1. Isometric view of the DCS3860 with Gen2 Controllers

The DCS3860 with Gen2 Controllers 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 1813-96C)
- Two environmental service modules (ESMs) (for the 1813-80E)
- Two power supplies
- Two fan assemblies

You can use the hot-swap features of the DCS3860 with Gen2 Controllers to remove and replace DDMs, power supplies, fan assemblies, ESMs, and RAID controllers without turning off the enclosure. You can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

The EXP3800/DCS3700 expansion unit is designed for use with the DCS3860 storage system. The DCS3860 storage system can support up to five EXP3800/DCS3700 expansion enclosures for a total of 360 disk drive modules (DDM).

Drive drawers

The DCS3860 with Gen2 Controllers storage system and EXP3800/DCS3700 expansion enclosure have five removable drive drawers that are accessible from the front of the enclosure. Each drive drawer can contain up to 12 disk drives (see Figure 3 on page 8). With the drive drawers fully populated, the DCS3860 with Gen2 Controllers can support up to 60 DDMs. (see Figure 2 on page 8).

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

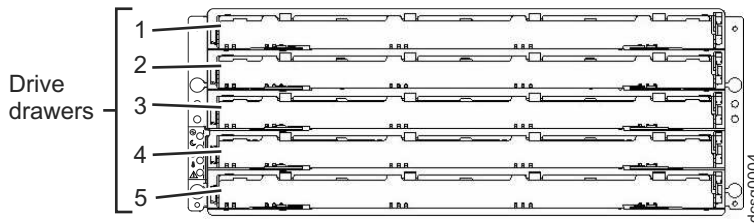


Figure 2. DCS3860 with Gen2 Controllers hot-swap drive drawers

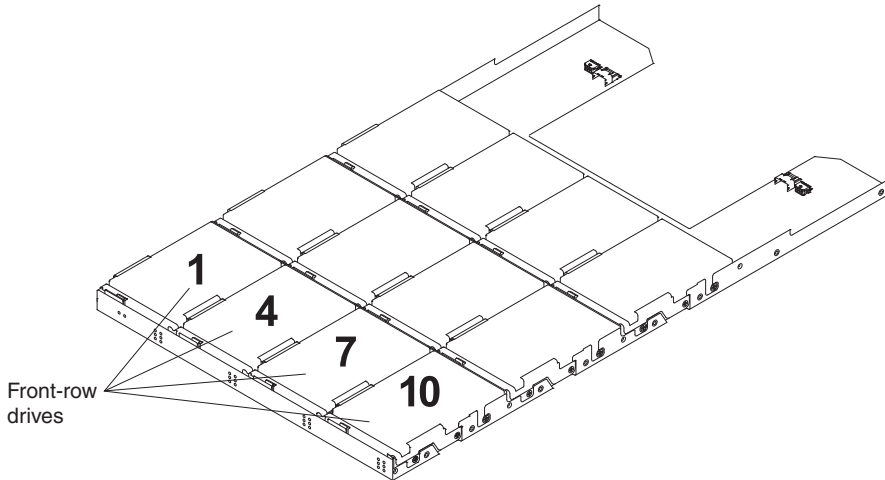


Figure 3. DCS3860 with Gen2 Controllers drive drawer

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 ensure that there is sufficient airflow to the drives (see Figure 3). To verify these slots, consult the overlay on the front of each of the five drive drawers. Ensure that the four drives in each row are next to each other. The long edge of each drive must touch the drive next to it. 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.

Disk Drive Modules (DDMs)

The DCS3860 with Gen2 Controllers supports up to 60 DDMs in five drive drawers that are accessible from the front of the storage expansion enclosure. The disk drawer system board supports 6 Gbps SAS (Serial Attached SCSI) and Near-Line SAS interface.

There are no serviceable parts in a DDM FRU. If the DDM FRU fails, it must be replaced. When replacing a DDM FRU, ensure that you 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 can cause undesired events.
2. Never hot-swap a drive FRU when its 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.

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 DCS3860 with Gen2 Controllers storage system (1813-96C) has two redundant controllers, which can be hot-swapped. The controllers contain the storage system 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 DCS3860 with Gen2 Controllers.

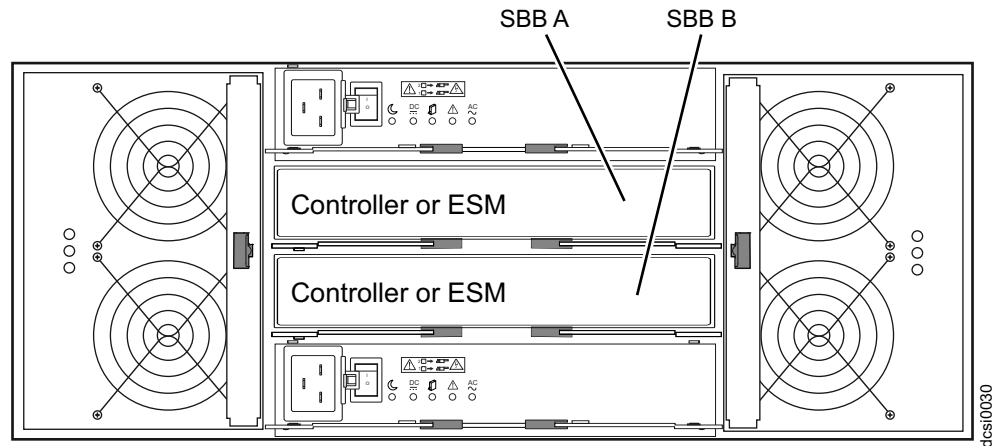


Figure 4. Location of the DCS3860 with Gen2 Controllers controllers

Note: To preserve optimal airflow, do not remove a failed controller FRU from the DCS3860 with Gen2 Controllers chassis until you are ready to replace it with a new FRU.

Information about the condition of the controllers is conveyed by indicator LEDs on the controller. See “Controller LEDs” on page 62 for more information about the LEDs found on the RAID controller.

Controller cable connections

The SAS ports, Ethernet ports, and the optional HIC on a DCS3860 with Gen2 Controllers system are depicted with a diagram. Each controller contains the following connections:

- Two 6 Gbps x4 SAS expansion ports to connect EXP3800/DCS3700 expansion enclosures
- Two RJ-45 Ethernet ports for system management

- Support for one optional host interface card (HIC)

Attention: The DCS3860 with Gen2 Controllers 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.

Expansion ports

Each controller has two 6 Gbps x4 SAS expansion ports to connect expansion enclosures to the storage system. The four SAS expansion ports (two 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 system. The second port is reserved for service personnel or acts as a backup port if the primary port fails.

1. Connect the management station to the management port of the system.
2. Start IBM DS Storage Manager from your management station. The Enterprise Management and Confirm Initial Automatic Discovery window opens.
3. Complete one of the following tasks:
 - If the DHCP server is set up, select **Automatic Discovery** from the Enterprise Management Window to discover the storage system. After the initial automatic discovery is complete, the Enterprise Management window displays all hosts and storage system that are attached to the local subnetwork.

Note: Ensure that the management station is under the same DHCP service. To discover storage system that are outside of the local subnetwork, click **Edit > Add Storage Subsystem** and manually enter the IP address of the storage system controller management ports or the IP address of a remote host.

- If the DHCP server is not set up, set the IP addresses of the storage system controller management ports to the same subnet of default IP addresses for the controllers.

The default IP address for each controller is 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 both Ethernet ports is 255.255.255.0
4. Click **Rename the Storage Subsystem**. Use the serial number of the storage system as the first part of the system name. The host name has a maximum of 30 characters.
 5. Click **Locate the Storage Subsystem**. A blue LED flashes on the front of the selected storage system. Label the storage system with its associated name.
 6. Highlight the storage system and click **Tools > Manage Storage Subsystem** to open the Subsystem Management window and the Task Assistant.

7. If the storage system is not in Optimal state, click the **Recover from Failure** icon in the Task Assistant. Follow the steps in the Recovery Guru. When the system is Optimal, close the Task Assistant.
8. In the Subsystem Management window, click **Storage Subsystem > View > Profile**. Click the **Controller Firmware**, **NVSRAM**, **ESM Firmware**, **Drive Product ID**, and **Firmware Versions** tabs, and write each number in the following table for future use.

Controller firmware:
NVSRAM:
ESM firmware:
Drive product ID:
Firmware versions:

9. Save the profile for future use and close the profile window.

Note: Save a copy of the storage system profile and the Collect All Support Data bundle when you make configuration changes to the storage system.

Serial port

The serial port 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

The data cache memory is a buffer used to temporarily store hard disk drive data during data read and write operations. Each RAID controller has data cache memory. The Cache Active LED on the controller turns on when the cache contains data that is not written to the hard disk drives. The Cache Active LED is off when there is no data stored in cache. The DCS3860 with Gen2 Controllers storage system is available with 24 GB (12 GB per controller) of cache memory.

Cache battery backup module

Each controller contains 12 GB 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 if the power fails.

Figure 5 on page 12 shows the locations of the cache battery and memory cache DIMM in the controller.

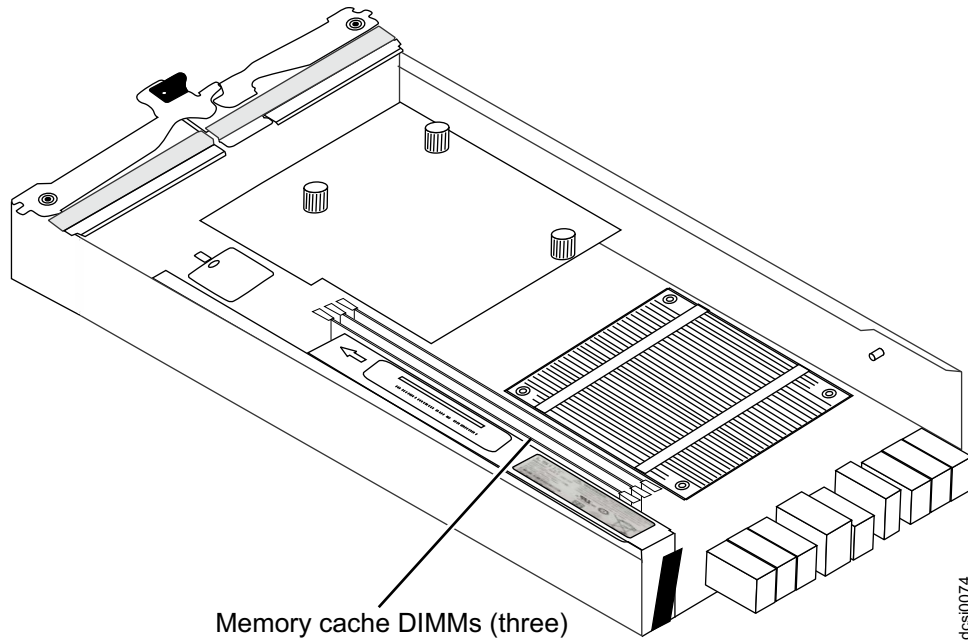


Figure 5. Cache battery and memory cache DIMM locations

The battery chargers in the power supplies perform a battery-learn test when the storage system 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 62 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 IBM DS Storage Manager.

Environmental Service Modules (ESMs)

The ESMs are at the back of the EXP3800/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.

Note: To preserve the optimal airflow, do not remove a failed ESM FRU from the DCS3860 with Gen2 Controllers chassis until you are ready to replace it with a new FRU.

The ESMs contain the storage expansion enclosure control logic, interface ports, and LEDs. Each ESM has two 6 Gbps x4 SAS IN ports and a single 6 Gbps 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 6 on page 13 shows the location of the SAS IN and OUT ports on the ESMs.

The DCS3860 with Gen2 Controllers ESMs support automatic ESM firmware synchronization. With this function, a new ESM with a different version of ESM firmware can automatically synchronize with the firmware version of the existing ESM in the enclosure. To enable automatic ESM firmware synchronization, ensure that:

1. The IBM DS Storage Manager Event Monitor is installed and running.

- The storage system is defined in the Enterprise Management window of the IBM DS Storage Manager client (SMclient).

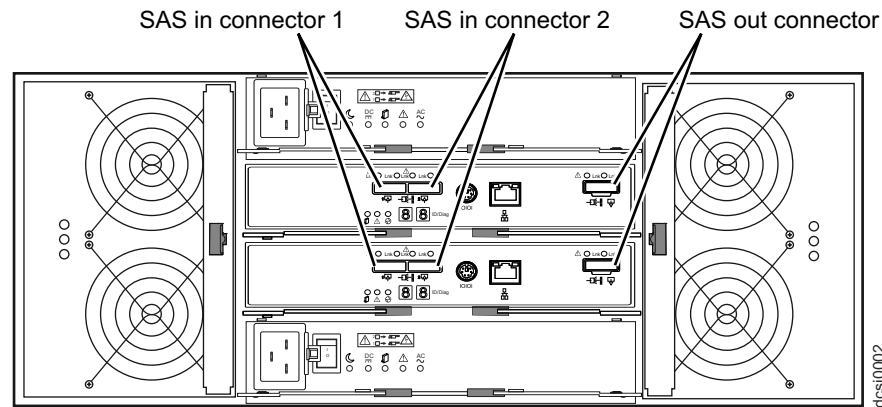


Figure 6. ESM SAS port locations

Enclosure ID

Each controller and ESM contain two 7-segment numeric LED displays. These LEDs provide enclosure identification and diagnostic data. The two digits that comprise the enclosure ID are referred to as x10 and x11 digits. The enclosure ID provides a unique identifier for each enclosure in the storage system.

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

Figure 7 shows the seven-segment numeric display on the storage expansion enclosure.

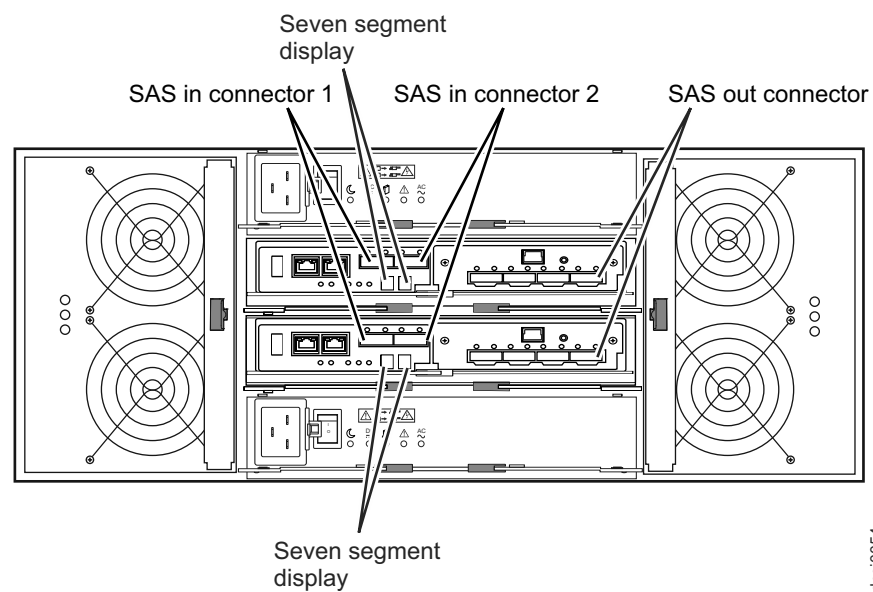


Figure 7. Location of seven-segment numeric display on ESM

For more information regarding the enclosure ID, see “Enclosure ID Settings” on page 45 or “Seven-segment numeric display LEDs” on page 68.

Power supplies

The storage expansion enclosure has two removable power supplies that 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 DCS3860 with Gen2 Controllers chassis until you are ready to replace it with a new FRU.

Figure 8 shows the power supply controls, LEDs, and connectors.

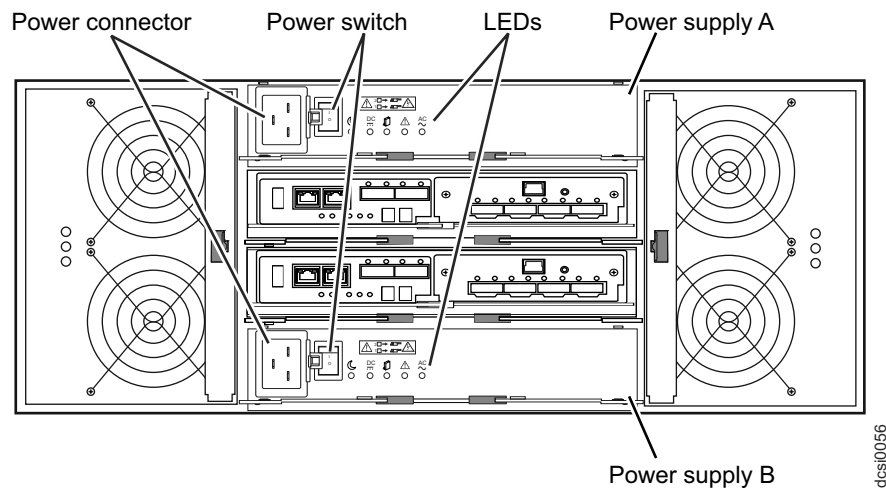


Figure 8. Power supply components

Fan assemblies

The storage expansion enclosure has two removable fan assemblies. Each fan assembly contains two fans. The fan assemblies draw 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 operates at maximum speed under the following conditions:

- During the first few minutes after power is applied to the DCS3860 with Gen2 Controllers enclosure
- When one of the disk drawers is pulled out or not in the closed/latched position
- When one of the fan assemblies fails or is removed from the enclosure

Note: To preserve 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 9 on page 15 shows the location of the fan assemblies. See “Fan assembly LEDs” on page 64 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 directions. If the fan assembly cannot be fully inserted in

the fan assembly bay, rotate it 180 degrees and reinsert it. There are notches on the top and bottom of the fan assembly bay. Ensure that the slits on the top and bottom of the fan assembly align with these two notches before the fan assembly is fully inserted in the fan bay.

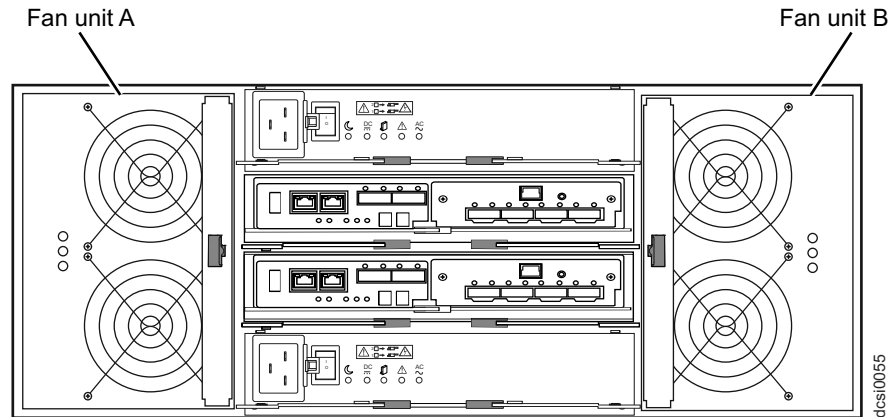


Figure 9. Fan assembly components

Figure 10 shows fan assembly airflow through the storage expansion enclosure.

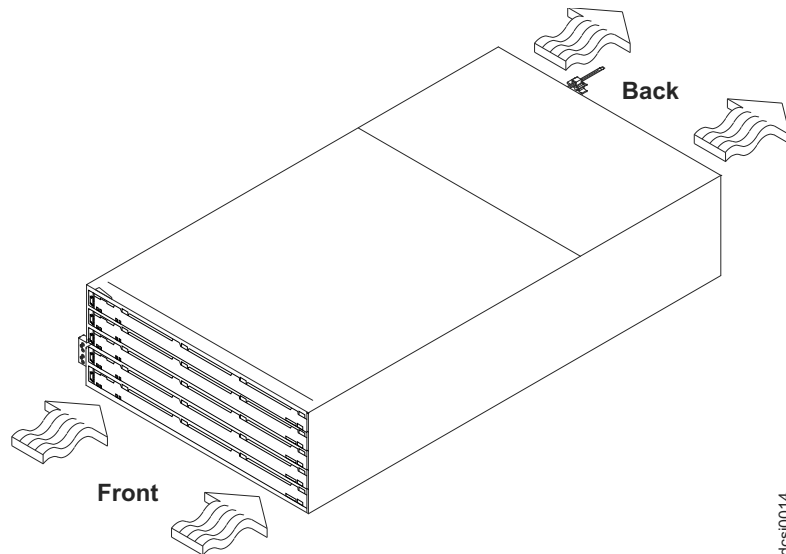


Figure 10. Storage expansion enclosure airflow

Software and hardware compatibility and upgrades

The support portal has the latest publications, firmware, and host software.

The latest DCS3860 with Gen2 Controllers controller firmware and NVSRAM, expansion enclosure ESM firmware, and the drive firmware must be installed to ensure optimal functionality, manageability, and reliability. You can find the latest publications, firmware, and host software at www.ibm.com/support/entry/portal.

Software and firmware support code upgrades

Table 2 shows the minimum supported software and firmware versions. To enable support for the DCS3860 with Gen2 Controllers, ensure that the software and firmware of the system are of the latest versions.

Table 2. Minimum DCS3860 with Gen2 Controllers software and firmware versions

Software/firmware	Version
DS Storage Manager software	11.20.xx.xx
DCS3860 with Gen2 Controllers controller firmware and NVSRAM	08.20.xx.xx
ESM firmware	039C
Drive firmware	See the latest software and firmware at the IBM System Storage Support website: www.ibm.com/support/entry/portal .

For T10 PI, you must use drives that support this feature.

To find the latest Storage Manager software, controller firmware, NVSRAM, ESM firmware, and drive firmware, check IBM System Storage Support website: www.ibm.com/support/entry/portal.

For instructions to install the IBM DS Storage Manager, see the *IBM System Storage DS® Storage Manager Version 11.0 Installation and Host Support Guide*.

If you need further assistance, contact your IBM reseller or IBM representative to find out which controller firmware is to be used for DCS3860 with Gen2 Controllers attachment.

For more information about the DCS3860 with Gen2 Controllers parts replacement procedure and problem troubleshooting, see “Solving problems” on page 123.

Determining firmware versions

There are two different methods to determine the DCS3860 with Gen2 Controllers storage system and EXP3800/DCS3700 expansion enclosure firmware versions. Each method uses the IBM DS Storage Manager that manages the DCS3860 with Gen2 Controllers storage system with the attached storage expansion enclosure.

Method One:

1. In the Subsystem Management window, click the **Summary** tab.
2. In the Monitor section, click **View Storage Subsystem Profile**. The **Storage Subsystem Profile** window opens. Scroll through the data to locate the following information:

Note: The Storage Subsystem Profile window shows information for the entire system. Therefore, you might have to scroll through a large amount of information to locate the firmware version numbers.

DCS3860 with Gen2 Controllers storage system

- NVSRAM version
- Firmware version

Drives

- Drive firmware version

EXP3800/DCS3700 expansion unit

- ESM card firmware version

Method Two:

To obtain the controller firmware version:

Go to the Subsystem Management window. In the left pane of the **Physical View** tab, click the Controller icon. The properties of the controller are displayed in the right pane of the **Physical View** tab.

You must perform this step for every controller.

To obtain the drive firmware version:

Go to the Subsystem Management window. In the left pane of the **Physical View** tab, click the Drive icon. The properties of the drive are displayed in the right pane of the **Physical View** tab.

You must perform this step for every drive.

To obtain the ESM and drive enclosure component firmware versions:

1. Go to the Subsystem Management window. In the left pane of the **Physical View** tab, click the Drive Enclosure Component icon. The Drive Enclosure Component Information window opens.
2. In the left pane, click the ESM icon. The ESM information is displayed 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 check whether your planned installation site meets these requirements, or prepare the site so that it meets 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 be strong enough to support the weight of the storage system and associated equipment; have sufficient space to install, operate, and service the storage system; and have sufficient ventilation.

Dimensions

The DCS3860 with Gen2 Controllers conforms to the 19-inch rack standard. Table 3 lists the dimensions of the DCS3860 with Gen2 Controllers with all its components.

Table 3. DCS3860 with Gen2 Controllers storage expansion enclosure dimensions (with disk drives).

Height	Width	Depth ¹
6.93 in. (17.6 cm)	19 in. (48.3 cm)	34.1 in. (86.6 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 DCS3860 with Gen2 Controllers in different configurations. Table 5 lists the weight of each component.

Table 4. DCS3860 with Gen2 Controllers weights.

Unit	Weight		
	Maximum ¹	Empty ²	Shipping ³
DCS3860 with Gen2 Controllers storage system	103.16 kg (227.4 lb)	58.56 kg (129.1 lb)	111.06 kg (244.8 lb)
EXP3800 expansion unit	101.0 kg (222.6 lb)	56.3 kg (124.2 lb)	

¹ Chassis with all FRUs and 60 drives.

² Chassis without drives but with midplane and all FRUs.

³ Includes the DCS3860 with Gen2 Controllers, support rails, power cords, publications, 20 drives, shipping material, and the pallet.

Table 5. DCS3860 with Gen2 Controllers component weights

Unit	Weight
EXP3800 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)
3.5 inch disk expansion enclosure	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 and SAS HIC	3.06 kg (6.75 lb)

Shipping dimensions

The DCS3860 with Gen2 Controllers is shipped on a pallet. Table 6 and Table 7 list shipping carton dimensions.

Table 6. DCS3860 with Gen2 Controllers shipping carton dimensions when shipped with drives.

Width	Depth	Height ¹
24 in. (61 cm)	39.75 in. (101 cm)	29.5 in. (74.9 cm)

Table 7. DCS3860 with Gen2 Controllers shipping carton dimensions when shipped without drives.

Width	Depth	Height ¹
24 in. (61 cm)	39.75 in. (101 cm)	19 in. (48.2 cm)

Table 7. DCS3860 with Gen2 Controllers shipping carton dimensions when shipped without drives (continued).

Width	Depth	Height ¹
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¹ The height shown includes the height of the pallet.

Environmental requirements and specifications

This section contains information about the environmental requirements and specifications for the storage expansion enclosure. It includes temperature and humidity, altitude, airflow and heat dissipation, shock and vibration requirements, and acoustic noise levels.

Temperature and humidity

Table 8 lists the acceptable temperature and humidity ranges for the DCS3860 with Gen2 Controllers 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, expose the unit to greater risk of failure from external causes.

Table 8. 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 9 lists the acceptable altitudes for operating, storing, and shipping the DCS3860 with Gen2 Controllers.

Table 9. DCS3860 with Gen2 Controllers 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 11 shows the intended airflow for the DCS3860 with Gen2 Controllers. Allow at least 30 inches in front of the storage system and at least 24 inches behind the storage system for service clearance, ventilation, and heat dissipation.

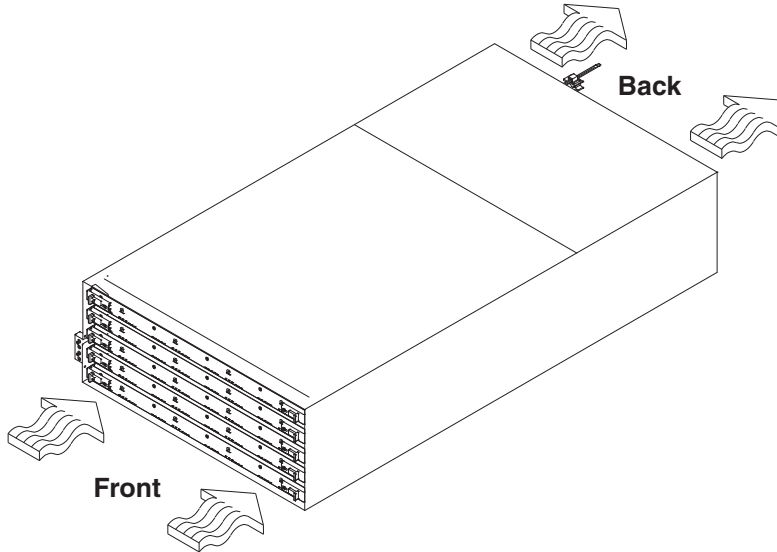


Figure 11. DCS3860 with Gen2 Controllers airflow

Table 10 lists the KVA, watts, and Btu calculations. These values assume that the power supplies have an 88 percent efficiency and a power factor of 0.99. These tabulated power and heat dissipation values are typical for the storage system. Maximum configuration units are typically operated at higher data rates, have larger random access memory (RAM) capacities, or have different host interface boards.

Table 10. DCS3860 with Gen2 Controllers power and heat dissipation

Parameter	KVA	Watts (ac)	Btu per hour
DCS3860 with Gen2 Controllers storage system	1.177	1108.6	3791
EXP3800/DCS3700 expansion unit	.895	802	2736

Shock and vibration requirements

Operational Shock: The DCS3860 with Gen2 Controllers can withstand the following shock. Subjecting the equipment to a single shock pulse with the following characteristics simulates this level of shock:

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

Operational Vibration (Random): While in its normal operating position, the DCS3860 with Gen2 Controllers continues operating when subjected to a random vibration test using the criteria shown in Table 11 on page 21. This test uses the indicated spectral power density for 30 minutes in each of the three axes.

Table 11. Random vibration power spectral density

Hz	5	17	150	200	500
g^2/Hz	9.0×10^{-5}	3.0×10^{-4}	3.0×10^{-4}	9.0×10^{-5}	9.0×10^{-5}

Acoustic noise

Table 12 lists the maximum sound levels emitted by the storage system.

Table 12. DCS3860 with Gen2 Controllers sound levels

Measurement	Level
Sound power (normal operation)	7.0 bels
Sound power (normal operation with 4 TB drives)	7.2 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. See “Noise” on page 164 to know more about measures needed to ensure hearing protection of the operating personnel.

Electrical requirements

This section provides information regarding site power and wiring, storage system AC power requirements, and power cord routing instructions. Consider the following factors 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 power fails, the unit automatically performs a power on recovery sequence without operator intervention after power is restored.

Attention: The DCS3860 with Gen2 Controllers does not support 90-136V AC sources. It supports 200-240 V AC sources only. Ensure that the AC input is appropriate for the DCS3860 with Gen2 Controllers before turning on the power switches.

Table 13. DCS3860 with Gen2 Controllers AC power requirements.

AC Power Requirements	Range
Nominal Voltage	180 - 264 V AC
Frequency (Hertz)	50 - 60 Hz
Idle Current	7.55 A ^{a,b}
Maximum Operating Current	7.79 A ^a
Maximum Surge Current	7.82 A ^a

^a. Typical voltage: 220 V AC, 50 Hz

Table 13. DCS3860 with Gen2 Controllers AC power requirements (continued).

AC Power Requirements	Range
^b . While the system is idle, it still performs background data scrubbing on all the drives. However, during regular I/O the system benefits from cache, which uses less power.	

Note: The DCS3860 with Gen2 Controllers power supplies have C20 power inlets.

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 13 on page 21. The power supplies meet standard voltage requirements for both domestic (inside USA) and international (outside USA) operations. They use standard industrial wiring with line-to-neutral or line-to-line power connections.

The agency voltage and current ratings for the DCS3860 with Gen2 Controllers storage expansion enclosure are 200 V

AC - 240 V AC and 7.79 A - 7.64 A.

Power recovery after a 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 DCS3860 with Gen2 Controllers ships with either two IEC C19 to C14 jumper cords or two IEC C19 to C20 jumper cords. The C19 plug connects to the DCS3860 with Gen2 Controllers power supply and the other end is 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 Chapter 10, "Power cords," on page 157 for more information.

Heat output, airflow, and cooling

The system has a hot aisle and cold aisle requirement for disk system reliability. See "Airflow and heat dissipation" on page 20 for heat output, airflow, and cooling specifications.

Note: In general, disk system 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 12 on page 23.
- 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 must

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.

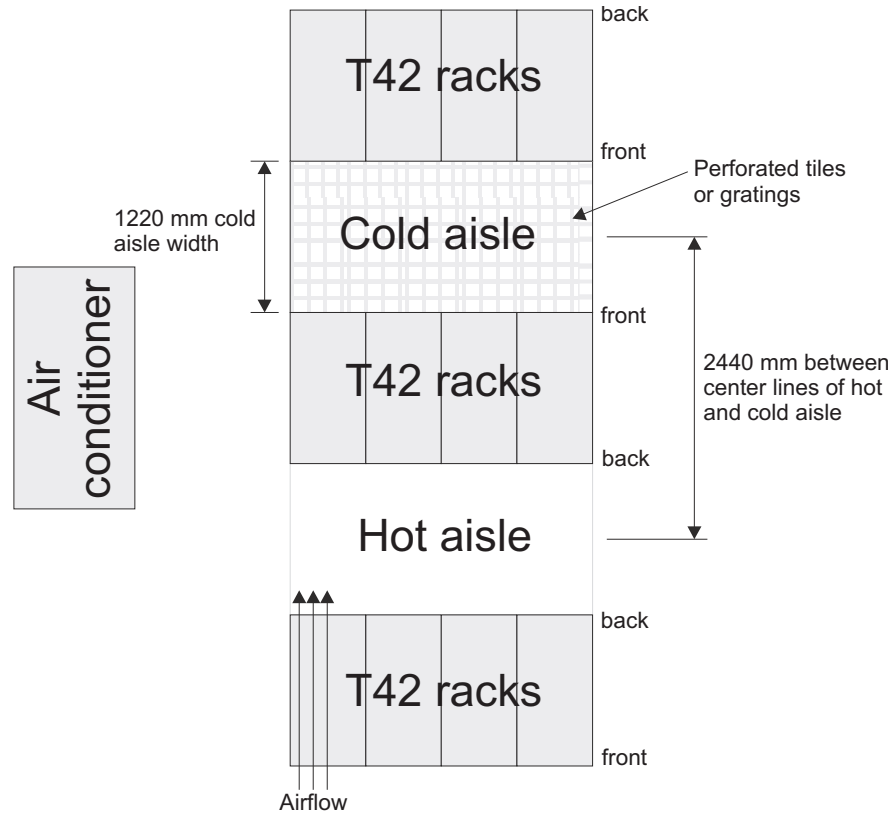


Figure 12. Example of cold aisle/hot aisle rack configuration

Chapter 2. Installing the DCS3860 with Gen2 Controllers

This section provides 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

Attention: Refer to “Safety” on page ix for general safety instructions and Chapter 9, “Specifications for non-IBM rack installation,” on page 149 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 three people to push the enclosure out of the custom-designed package. You can also use a lift tool.
2. A fully populated DCS3860 with Gen2 Controllers 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.

Installation sequence

1. Prepare the installation site and the rack cabinet.
2. Unpack the DCS3860 with Gen2 Controllers 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, you require three people to push the enclosure out of its custom-designed package. You can also use a lift tool and push the enclosure onto the lift tool.
 - b. Before you move or relocate a rack that contains DCS3860 storage enclosures, see “Relocating the DCS3860 with Gen2 Controllers” on page 53 for additional information.
3. Install the support rails in the rack. See “Installing the support rails” on page 30.
4. Install the DCS3860 with Gen2 Controllers storage enclosure in the rack. See “Installing the DCS3860 with Gen2 Controllers into the rack cabinet using a lift tool” on page 36 if you have ordered a lift tool. See “Installing the DCS3860 with Gen2 Controllers into the rack cabinet without using a lift tool” on page 37 if you do not have a lift tool.
5. Install disk drives in the DCS3860 with Gen2 Controllers storage enclosure. See “Installing the DDMs” on page 39.
6. If there are other DCS3860 with Gen2 Controllers storage enclosures to be installed in the same rack, repeat step 3 to step 5 for the other DCS3860 with Gen2 Controllers units.

7. Install the power supply cables to the DCS3860 with Gen2 Controllers. Ensure that the DCS3860 with Gen2 Controllers power supplies are connected to 240 V AC sources only. See “Cabling the power supply” on page 53.
8. Cable the DCS3860 with Gen2 Controllers Storage system to any storage expansion enclosures. See Chapter 3, “Cabling the DCS3860 with Gen2 Controllers,” on page 43.
9. Install the IBM DS Storage Manager host software to manage the DCS3860 with Gen2 Controllers Storage system. See “Software and hardware compatibility and upgrades” on page 15 for the appropriate version. For instructions to install the DS Storage Manager software, see the *IBM System Storage DS Storage Manager Version 11.2 Installation and Host Support Guide* for the applicable operating system.
10. Turn on the DCS3860 with Gen2 Controllers (if you have not done so already). See “Powering on the DCS3860 with Gen2 Controllers” on page 56.
11. Upgrade the controller firmware. See “Finding Storage Manager software, controller firmware, and README files” on page xvi for more information.

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.

- Limit your movement, so that it does not 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 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it in its static-protective package. Do not place the device on your system unit cover or on a metal table.
- Take additional care when handling devices during cold weather because heating reduces indoor humidity and increases static electricity.

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, failover requirements, operating systems to be used, and total storage capacity requirements.

1. Prepare the site according to the 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, you require three people to push the enclosure out of its custom-designed package. You can also use a lift tool and place the enclosure onto the lift tool. Alternatively, you can reduce the weight of the storage enclosure and then push the enclosure out of the package, as follows:
 - Remove two power supplies and ensure that the hard disk drive drawers are empty; then, two people can lift the storage enclosure.
 - Ensure 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 people can lift the storage enclosure.See “Weight” on page 18 to know the weight of each component.
- b. Before you move or relocate a rack that contains DCS3860 storage enclosures, see “Relocating the DCS3860 with Gen2 Controllers” on page 53 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 you proceed with installation.
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: You must install the support rails in the rack cabinet before you install the storage enclosure. Hence, do not remove the storage enclosure from the shipping box until the support rails are installed.

1. Remove the following items from the shipping box. Do not remove the DCS3860 with Gen2 Controllers from the shipping box at this time.
 - Six full or empty boxes of DDMs (if you have ordered DDMs, and also ordered DDMs to be included in the shipping box. You can also order the DDMs to be shipped separately.)

Note: The DDMs are packaged 10 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 will be 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 ensure that you have received all the necessary parts. See the “Inventory list” for the parts that are included with the storage enclosure.

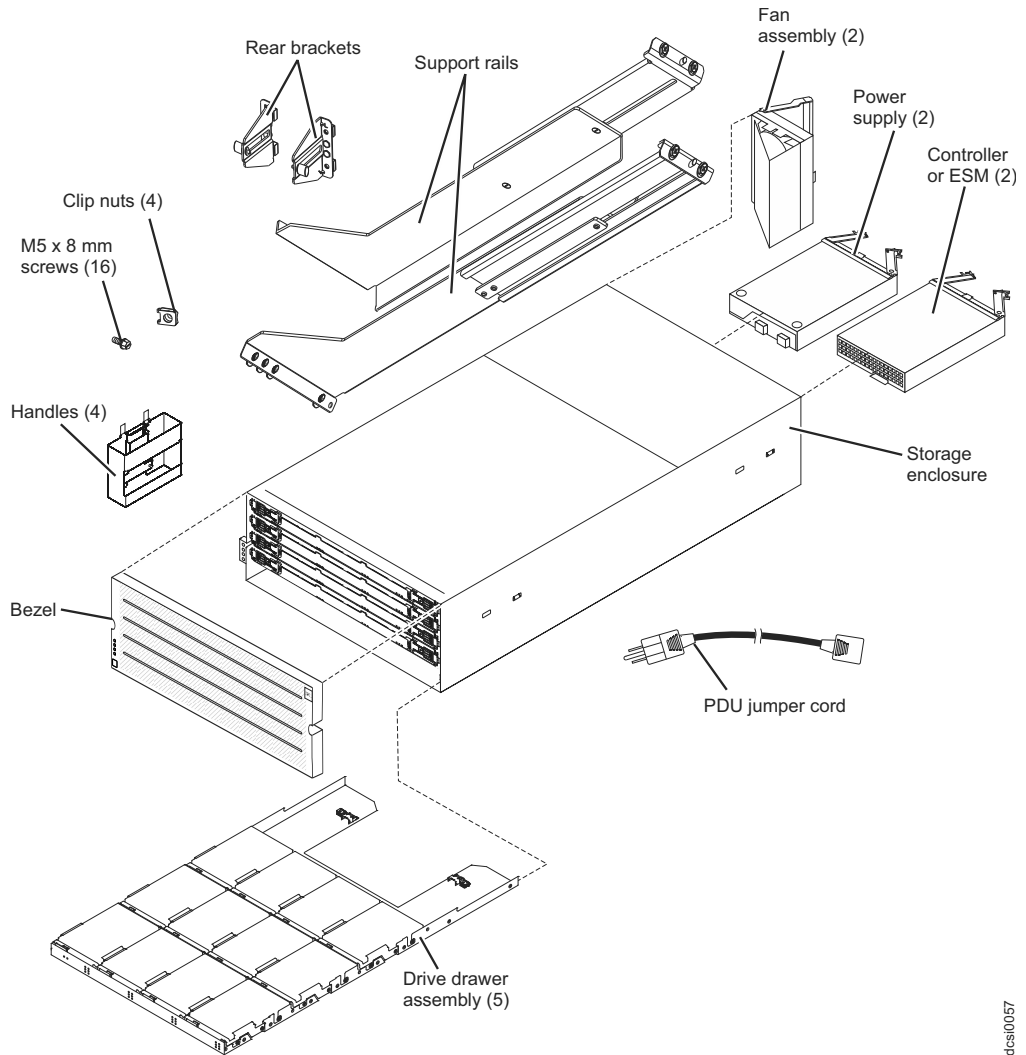
Inventory list

If any items are missing or damaged, contact your place of purchase.

Note:

1. The illustration might differ slightly from your hardware.

2. Depending on your DCS3860 with Gen2 Controllers order, your shipping box might contain additional materials that are not shown in the following illustration.



After you unpack the DCS3860 with Gen2 Controllers, 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 1813-86C
 - ESMs (2), if you ordered 1813-80E
- Handles (4), packaged in a smaller box inside the shipping box
- DDMs (20 or more, depending on your DCS3860 with Gen2 Controllers order), packaged in a smaller box inside the shipping box, if you have ordered the DDMs to be shipped with the storage system.
- Bezel (1)
- Rack-mounting hardware kit (1), packaged in a smaller box inside the shipping box, including:
 - Rails (2), right and left assembly

dcsi0057

- 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 DCS3860 with Gen2 Controllers does not ship with region-specific ac power cords. You must obtain the IBM-approved power cords for your region. For more information, see Chapter 10, “Power cords,” on page 157.

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

These might include:

- A portable mechanized lift (optional)
- A number 2 Phillips screwdriver
- An M5 hex nut driver
- A medium flat-blade screwdriver
- anti-static protection (such as a grounding wrist strap)
- The rack power jumper cords that are shipped with the storage enclosure
- Rack-mounting hardware that ships with the storage enclosure

Preparing the site

For information about interface cables and connections, see Chapter 3, “Cabling the DCS3860 with Gen2 Controllers,” on page 43.

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

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

Weight: The weight of the storage enclosure 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 weighs up to 228.4 lb (103.6 kg). For more information, see “Weight” on page 18.

Other Factors: Before you prepare the rack:

- 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.

Preparing the rack

- When DCS3860 with Gen2 Controllers 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 DCS3860 with Gen2 Controllers. The DCS3860 with Gen2 Controllers does not fit in the 2101-200 rack if the ruggedized rack feature is installed.
- Do not install the DCS3860 with Gen2 Controllers above EIA Unit position 32 in any rack. Installing the DCS3860 with Gen2 Controllers 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 Chapter 9, “Specifications for non-IBM rack installation,” on page 149.
- 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 Chapter 8, “Rack mounting template,” on page 145. If you want to tear out the templates from this document for easier use, use the copies in Chapter 8, “Rack mounting template,” on page 145 rather than the copies provided in this section.

Use the following templates (Figure 13 on page 31 and Figure 14 on page 32) to identify the proper locations for inserting M5 screws when mounting the support rails and DCS3860 with Gen2 Controllers to a rack. The locations for the M5 screws are highlighted in the templates.

The DCS3860 with Gen2 Controllers 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 the rack might be round, square, or threaded.

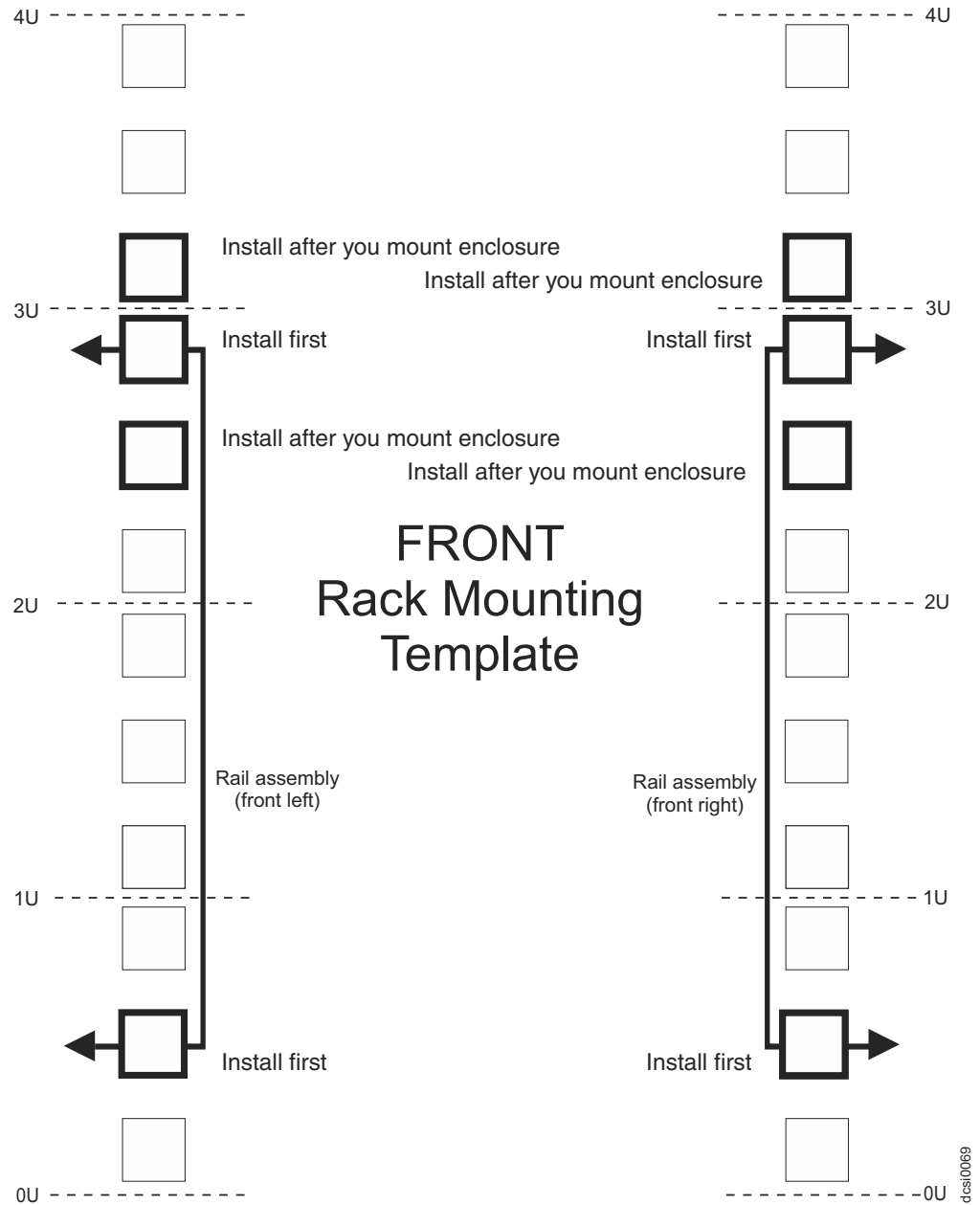


Figure 13. Front rack mounting template

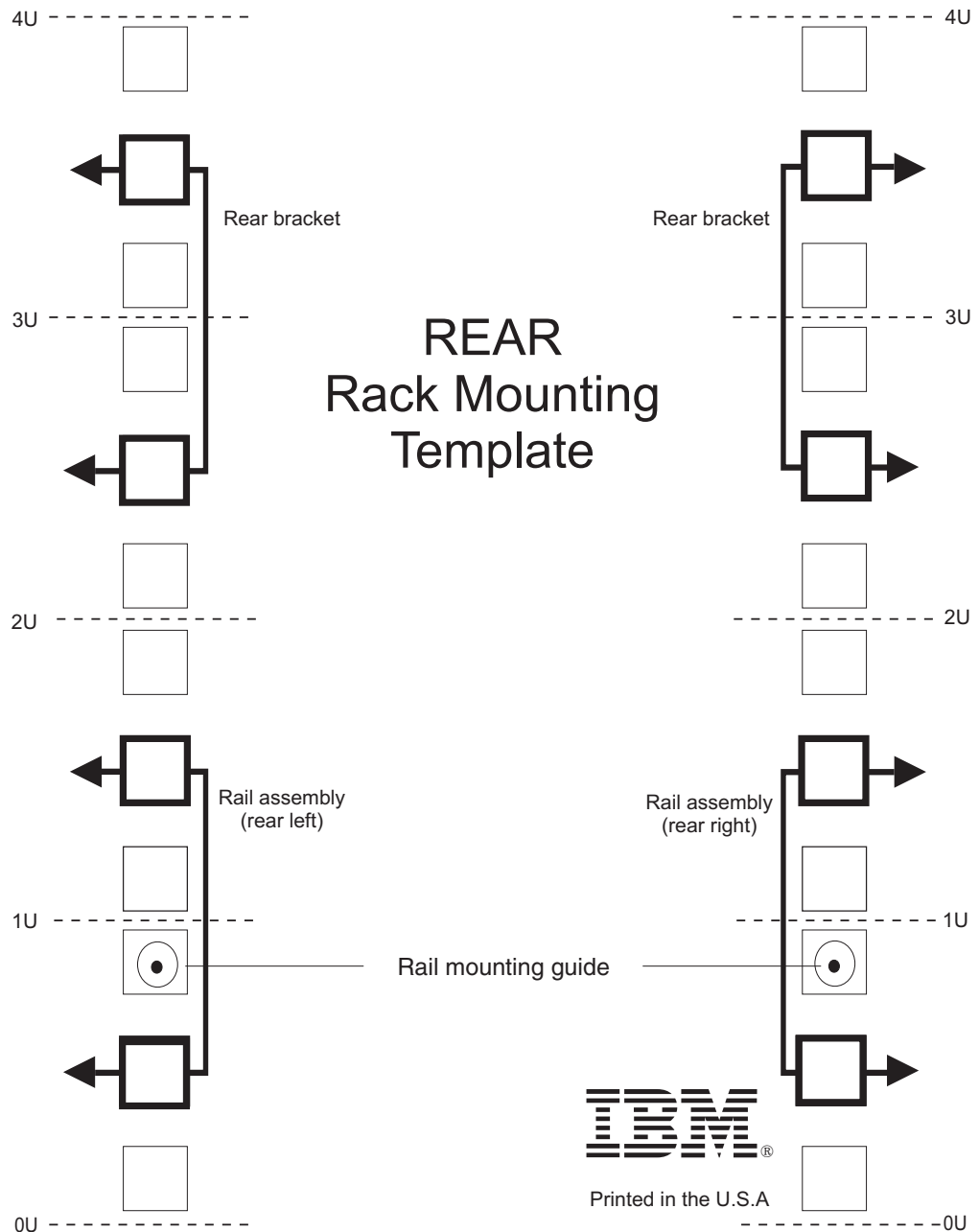


Figure 14. Rear rack mounting template

Before installing the DCS3860 with Gen2 Controllers in a rack, you must install the rails and rack-mounting hardware that is shipped with your storage enclosure. The DCS3860 with Gen2 Controllers 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, ranges between 76 cm (30 in.) and 81.28 cm (32 in.). This rack conforms to the EIA standard. Where you place the support rails in the rack depends on where you intend to place the storage enclosure.

Use the front and rear rack-mounting templates in Figure 13 on page 31 and Figure 14 to align the support rails and rear brackets with the correct rack holes. If the support rails will be installed above an existing storage system or storage enclosure, position the DCS3860 with Gen2 Controllers support rails directly above

it. If the support rails will be installed below an existing storage system or storage enclosure, allow 178 mm (7 in.) of vertical clearance for the DCS3860 with Gen2 Controllers.

Note: For proper weight distribution, install the support rails as low in the rack cabinet as possible. The rack cabinet must have a minimum depth of 100 cm (40 in.). If you are using a non-IBM rack or cabinet, review the information in Chapter 9, "Specifications for non-IBM rack installation," on page 149.

Complete the following steps to install the left and right support rails in the rack cabinet:

1. Ensure that the rack has already been installed.
2. Ensure 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.

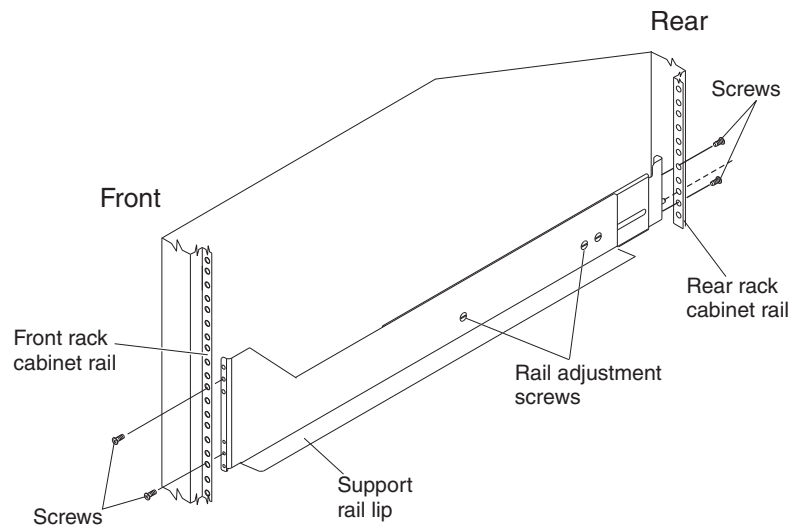
Refer to the installation and service guide, or equivalent, for the rack as required.

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

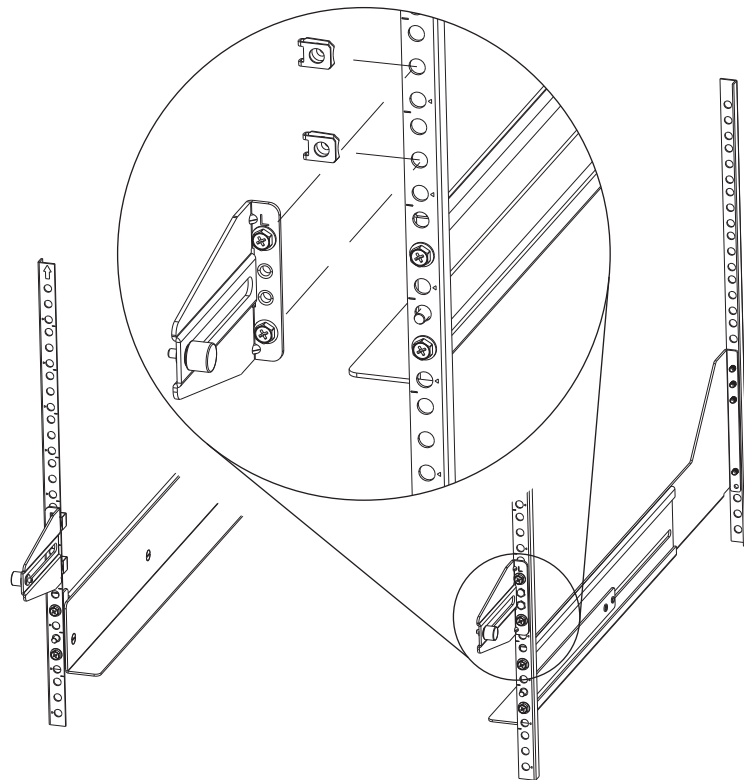
washers through the front of the cabinet and screw them into the support rail front flange. Ensure that you use a washer when you install an M5 screw through a square hole on a rack-mounting flange.

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

7. Ensure 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 to ensure 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. Ensure that you clip the nuts on the rack. Do not tighten the screws until the DCS3860 with Gen2 Controllers is installed in the rack (see 8 on page 37).



13. Continue with “Installing the DCS3860 with Gen2 Controllers into the rack cabinet using a lift tool” on page 36 or “Installing the DCS3860 with Gen2 Controllers into the rack cabinet without using a lift tool” on page 37.

Installing and removing the handles

After you install the storage enclosure in the rack cabinet and remove the handles, store the handles for future use.

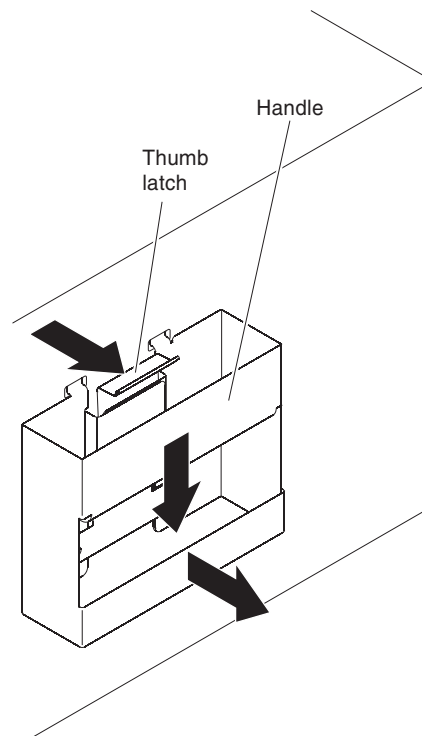
Installing the handles

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 remaining handles.

Removing the handles

Complete the following steps to remove the handles from the storage enclosure:

1. Release the latch with your thumb and pull down and away from the unit.
2. Repeat step 1 for the three remaining handles.

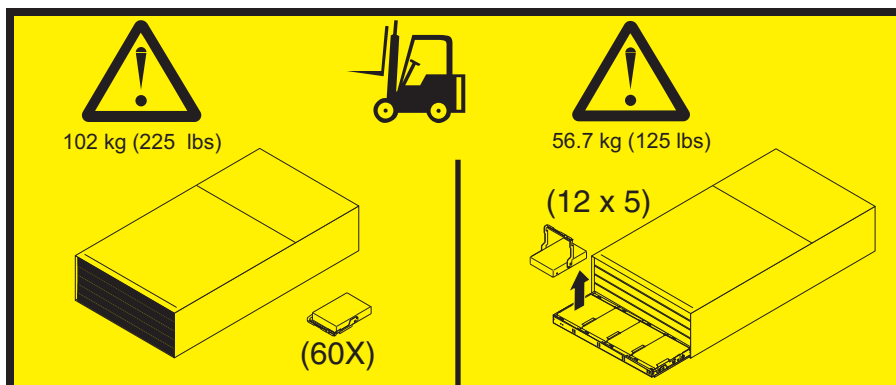


3. Store the handles for future use.

Installing the DCS3860 with Gen2 Controllers into the rack cabinet using a lift tool

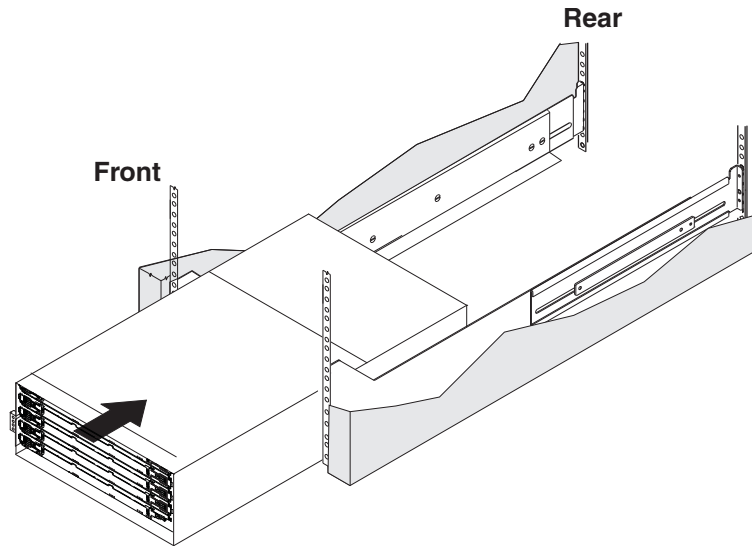
Complete the following steps to install the storage enclosure if you have acquired a lift tool:

1. Prepare the storage enclosure for installation:
 - a. Position the lift tool so that it faces 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 out of the shipping box onto the lift tool, then out 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 35 for detailed instructions.

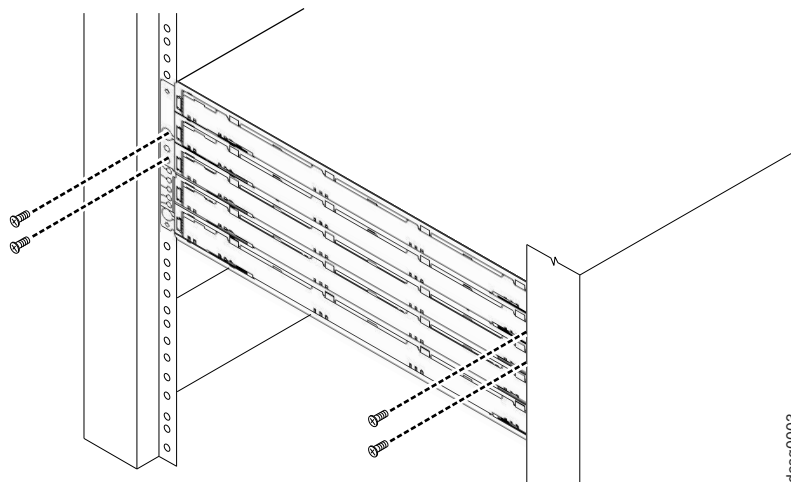


Attention:

- a. Because of the size and weight of the storage enclosure as shipped, you require a minimum of three people to push the enclosure out of its custom-designed package. For more information about the lift tool, see “Installation overview” on page 25.
 - b. Before you move or relocate a rack that contains DCS3860 with Gen2 Controllers storage enclosures, see “Relocating the DCS3860 with Gen2 Controllers” on page 53 for additional information.
2. Slide the storage enclosure out 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 enclosure.



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.

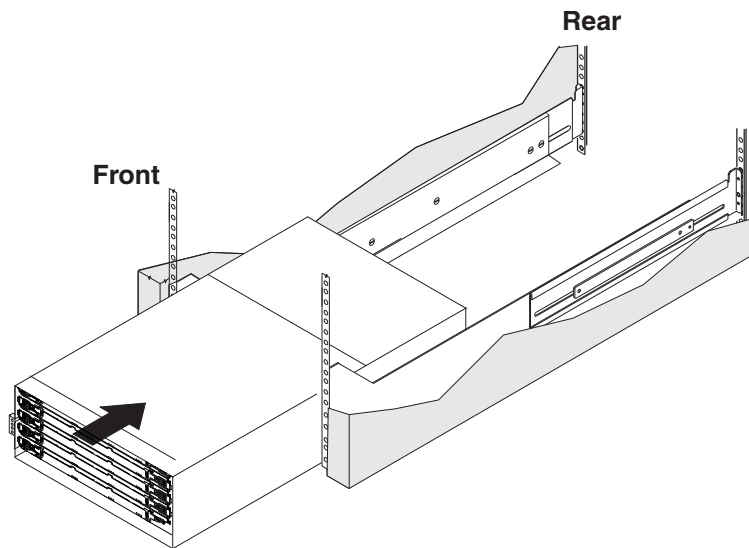
8. Tighten all of the M5 screws to secure the rear bracket to the rack cabinet.
9. Continue with "Installing the DDMs" on page 39.

Installing the DCS3860 with Gen2 Controllers into the rack cabinet without using a lift tool

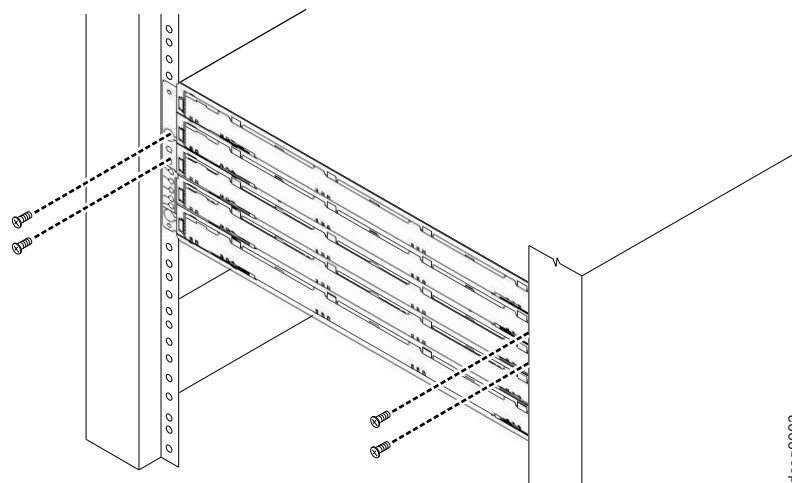
Complete the following steps to install the storage enclosure if you do not have a lift tool:

1. Prepare the storage enclosure for installation:
 - a. Remove the foam shipping material from the sides and ends of the storage enclosure.

- b. If necessary, cut away sides of the shipping box to access the storage enclosure.
 - c. Open the plastic bag and tuck it under the storage enclosure. The plastic bag reduces friction and makes it easier to move the unit out of the shipping box and then into the rack cabinet.
 - d. Install the four handles on the sides of the storage enclosure. See “Installing and removing the handles” on page 35 for detailed instructions.
2. Lift the storage enclosure off the side of the shipping box. 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 enclosure.



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 DDMs."

Installing the DDMs

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 ensure that there is sufficient airflow to the drives (see Figure 15). To verify these slots, check the overlay on the front of each of the five drive drawers. Ensure that 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.

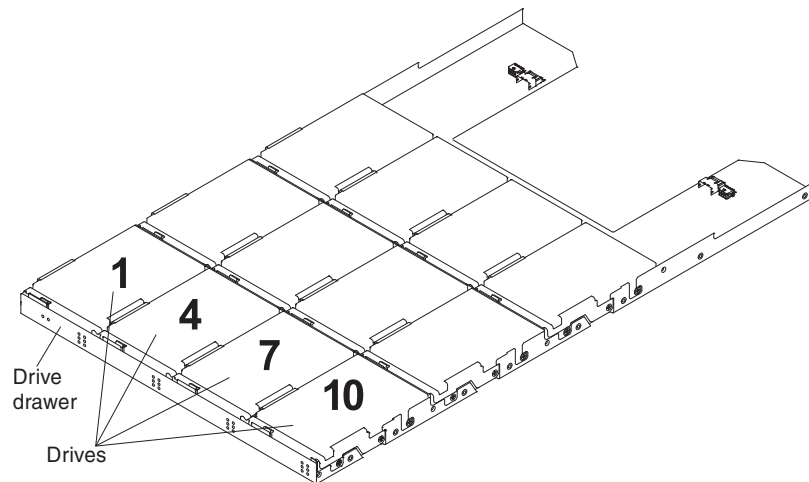
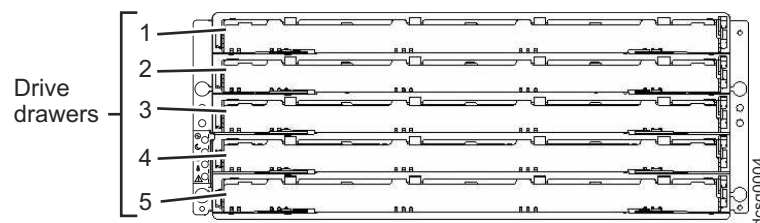


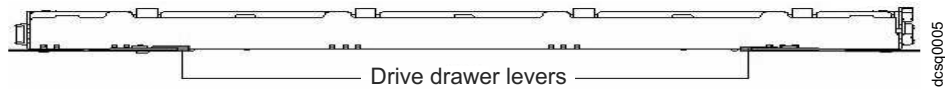
Figure 15. DCS3860 with Gen2 Controllers drive drawer with labeled disk drives

The drive drawers are preinstalled in the DCS3860 with Gen2 Controllers, but the DDMs are shipped separately from the drive drawers. Ensure that you install the storage enclosure in the rack cabinet before you install DDMs in the storage enclosure.

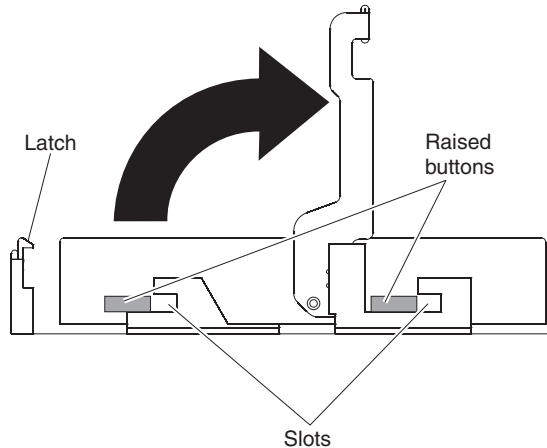


Complete the following steps to install the DDMs in the drive drawers:

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.



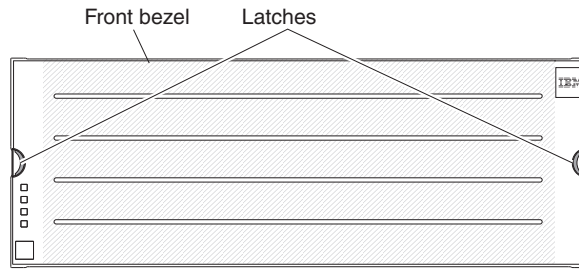
4. Align the raised buttons on the sides with the matching slots in the DDM channel on the drawer. Lower the DDM down onto the drawer, and rotate the DDM handle until the DDM snaps into place under the DDM release lever.

Note:

- a. If the DDM does not correctly fit into the drive connector on the disk drawer, push the rear of the drive as you install it.
 - b. If the storage enclosure is turned on, you must wait for 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. In this case, 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: Ensure that 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 and you will not be able to open another drawer. If you try to open another drawer, both drawers might be damaged.

7. Repeat steps 1 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 Chapter 3, “Cabling the DCS3860 with Gen2 Controllers,” on page 43.

Chapter 3. Cabling the DCS3860 with Gen2 Controllers

The section contains information and instructions for cabling the DCS3860 with Gen2 Controllers storage system. After the storage system 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 interface card)

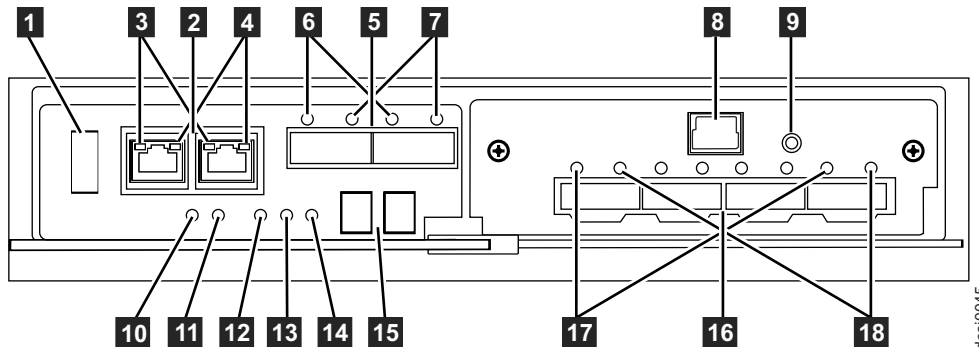


Figure 16. DCS3860 with Gen2 Controllers storage system

Table 14. Legend to the DCS3860 with Gen2 Controllers storage system diagram

Number	Description	Number	Description
1	USB port	10	Battery fault LED
2	Two Ethernet ports	11	Battery charging LED
3	Link rate	12	Service Action Allowed LED
4	Link activity	13	Controller Fault LED
5	Two 6 Gbps SAS expansion ports (port 1 on the left and port 2 on the right)	14	Cache active LED
6	Fault indicator (for the SAS expansion port)	15	Seven segment status display
7	Activity indicator (for the SAS expansion port)	16	Four 6 Gbps SAS host ports
8	Serial port	17	Fault indicator (for the SAS host port)
9	Password reset button	18	Activity indicator (for the SAS host port)

SAS Host port 1, 2, 3, and 4 on Host Interface Card

Each of the DCS3860 with Gen2 Controllers host ports is a x4 multilane, 12 Gbps universal mini-SAS port. Connect a SAS cable from your host system SAS host bus adapter to a host port on each controller.

Expansion port 1 and 2

Expansion port is a x4 multilane, 6 Gbps SAS port. Connect a SAS cable to this port and to a drive expansion enclosure.

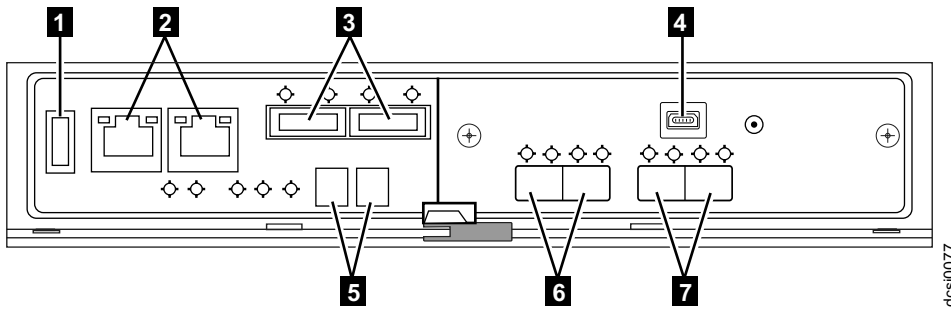


Figure 17. DCS3860 with Gen2 Controllers storage system with 4-port FC/iSCSI

Table 15. Legend to the DCS3860 with Gen2 Controllers storage system with 4-port FC/iSCSI diagram

Number	Description
1	USB port
2	Two Ethernet ports
3	Two 6 Gbps SAS expansion ports
4	Mini-USB port (Serial)
5	Seven segment status display
6	Four FC/iSCSI ports
7	Four FC/iSCSI ports

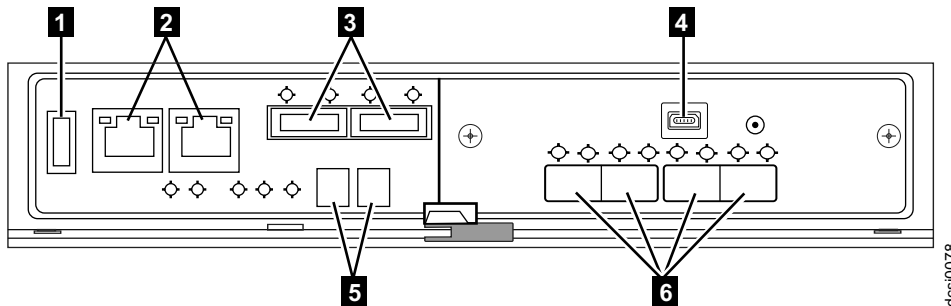


Figure 18. DCS3860 with Gen2 Controllers storage system with SAS 4-port

Table 16. Legend to the DCS3860 with Gen2 Controllers storage system with SAS 4-port diagram

Number	Description
1	USB port
2	Two Ethernet ports
3	Two 6 Gbps SAS expansion ports
4	Mini-USB port (Serial)
5	Seven segment status display
6	Four 12 Gbps SAS host ports

Enclosure ID Settings

The enclosure ID is a unique two-digit identifier for each enclosure in the storage system configuration. In a dual controller or ESM configuration, both enclosure IDs are identical under normal operating conditions. Each DCS3860 with Gen2 Controllers storage system and EXP3800/DCS3700 expansion enclosure in the storage system 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.

Working with SAS cables

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

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

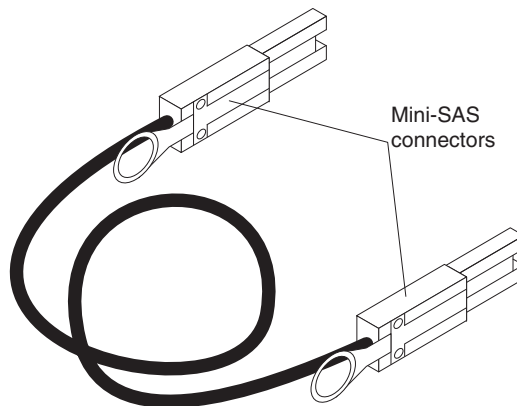


Figure 19. Mini-SAS cable

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. Ensure that the cable is well supported.

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

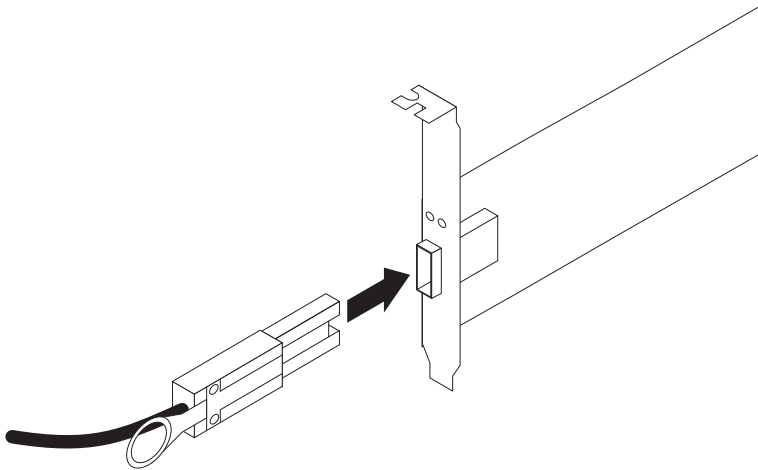


Figure 20. Connecting a mini-SAS cable

Complete the following steps to remove a mini-SAS cable:

1. Hold the blue plastic tab at the end of the mini-SAS connector and gently pull on the tab to release the locking mechanism.

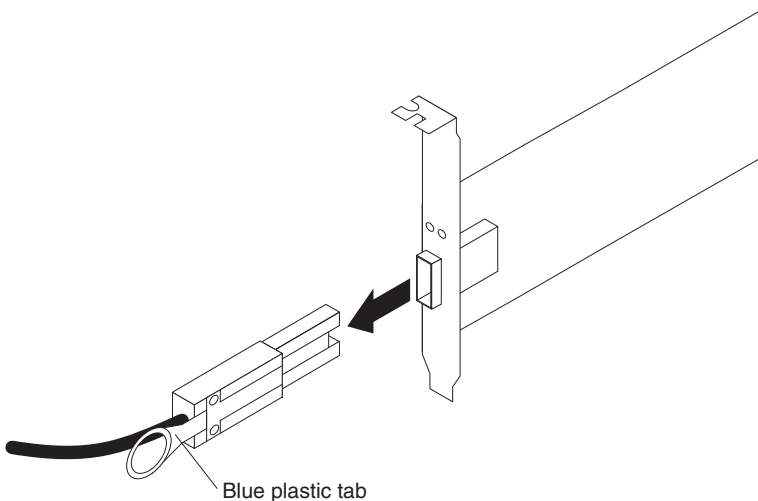


Figure 21. Removing a mini-SAS cable

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

Cabling the EXP3800/DCS3700 expansion enclosure

The EXP3800/DCS3700 expansion enclosure is a dual ESM unit, which provides additional storage capacity when attached to the DCS3860 with Gen2 Controllers storage system.

ESM connectors

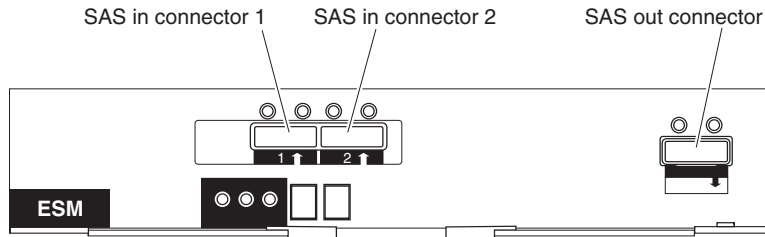


Figure 22. ESM connectors

SAS In connector 1

Connect a SAS cable to this connector and to either the drive expansion port on the DCS3860 with Gen2 Controllers controller or the SAS Out (↓) connector of another EXP3800/DCS3700 expansion enclosure.

SAS In connector 2

Connect a SAS cable to this connector and to either the drive expansion port on the DCS3860 with Gen2 Controllers controller or the SAS Out (↓) connector of another EXP3800/DCS3700 expansion enclosure.

SAS Out connector

Connect a SAS cable to this connector and to the SAS In (↑) connector of another EXP3800/DCS3700 expansion enclosure.

Connecting the EXP3800/DCS3700 expansion enclosure

The DCS3860 with Gen2 Controllers storage system supports up to five EXP3800/DCS3700 expansion enclosures with two physical expansion ports. Multiple EXP3800/DCS3700 expansion enclosures can be connected by chaining them together.

Complete the following steps to connect the first EXP3800/DCS3700 expansion enclosure to the DCS3860 with Gen2 Controllers storage system.

1. Connect one end of a SAS cable to the drive expansion port 1 on controller A and the other end to the In (↑) SAS connector 1 on the ESM located in slot A of the EXP3800/DCS3700 expansion enclosure.
2. Connect one end of a SAS cable to the drive expansion port 2 on controller A and the other end to the In (↑) SAS connector 1 on the ESM located in slot B.
3. Connect one end of a SAS cable to the drive expansion port 1 on controller B and the other end to the In (↑) SAS connector 2 on the ESM located in slot A.
4. Connect one end of a SAS cable to the drive expansion port 2 on controller B and the other end to the In (↑) SAS connector 2 on the ESM located in slot B.
5. Wait until the status of the storage system is Optimal.
6. Add drives to the storage enclosure one at a time. Add drive only after the IBM DS Storage Manager recognizes the drive you added earlier. Wait at least 30 seconds for the IBM DS Storage Manager to recognize a newly added drive.

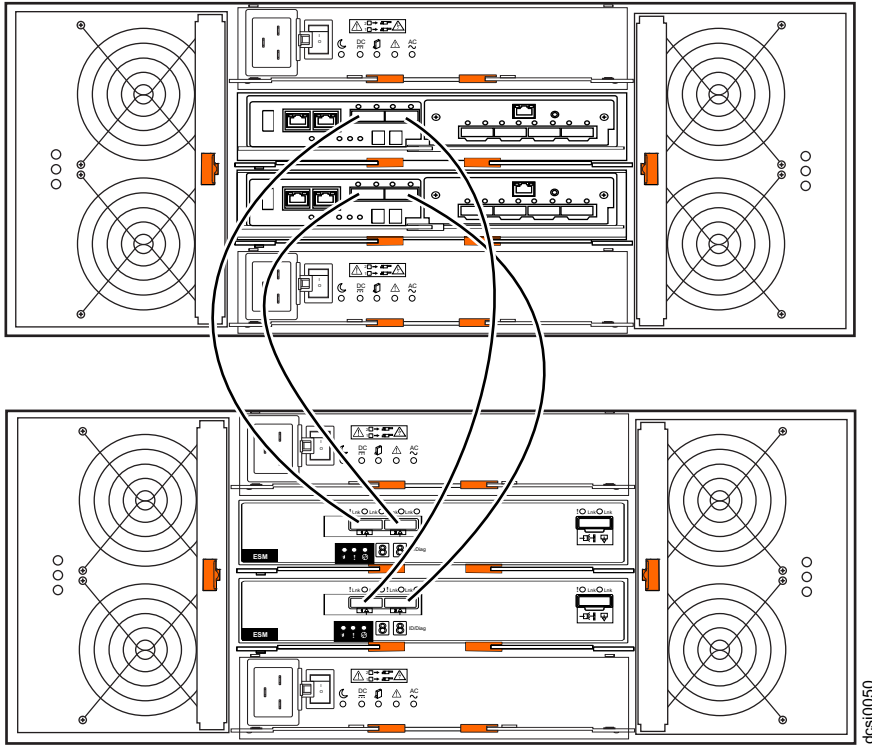


Figure 23. Connecting the first EXP3800/DCS3700 expansion enclosure

Adding a storage enclosure to a running dual-controller configuration

Note: Ensure that each storage enclosure has two ESMs before you connect it to a dual-controller DCS3860 with Gen2 Controllers storage system. The second ESM must be purchased separately. Contact your IBM marketing representative or authorized reseller for more information about purchasing a second ESM. For more information about installing a second ESM, see the Installation Guide that is shipped with the storage enclosure.

1. Ensure that the status of the DCS3860 with Gen2 Controllers storage system is Optimal.
2. Use the expansion enclosure Rack Installation Instructions document to install the new expansion enclosure in the rack.
3. Connect the power cables to the new expansion enclosure and power it on.
4. Connect one end of a SAS cable to the Out (↓) SAS connector on the ESM located in slot A of the earlier/last EXP3800/DCS3700 expansion enclosure in the configuration.
5. Connect the other end to the In (↑) SAS connector 1 on the ESM located in slot A of the EXP3800/DCS3700 expansion enclosure you want to add.
6. Remove the cable from the In (↑) SAS connector 1 on the ESM located in slot B of the earlier/last EXP3800/DCS3700 expansion enclosure and connect it to the In (↑) SAS connector 1 on the ESM located in slot B of the EXP3800/DCS3700 expansion enclosure you want to add.
7. Remove the cable from the In (↑) SAS connector 2 on the ESM located in slot B of the earlier/last EXP3800/DCS3700 expansion enclosure and connect it to the In (↑) SAS connector 2 on the ESM located in slot B of the EXP3800/DCS3700 expansion enclosure you want to add.

8. Connect one end of a SAS cable to the In (↑) SAS connector 1 on the ESM located in slot B of the earlier/last EXP3800/DCS3700 expansion enclosure and connect the other end of the SAS cable to the Out (↓) SAS connector on the ESM located in slot B of the EXP3800/DCS3700 expansion enclosure you want to add.
9. Repeat steps 2 on page 48 through 8 to add more EXP3800/DCS3700 expansion enclosures. You can add up to five expansion enclosures.

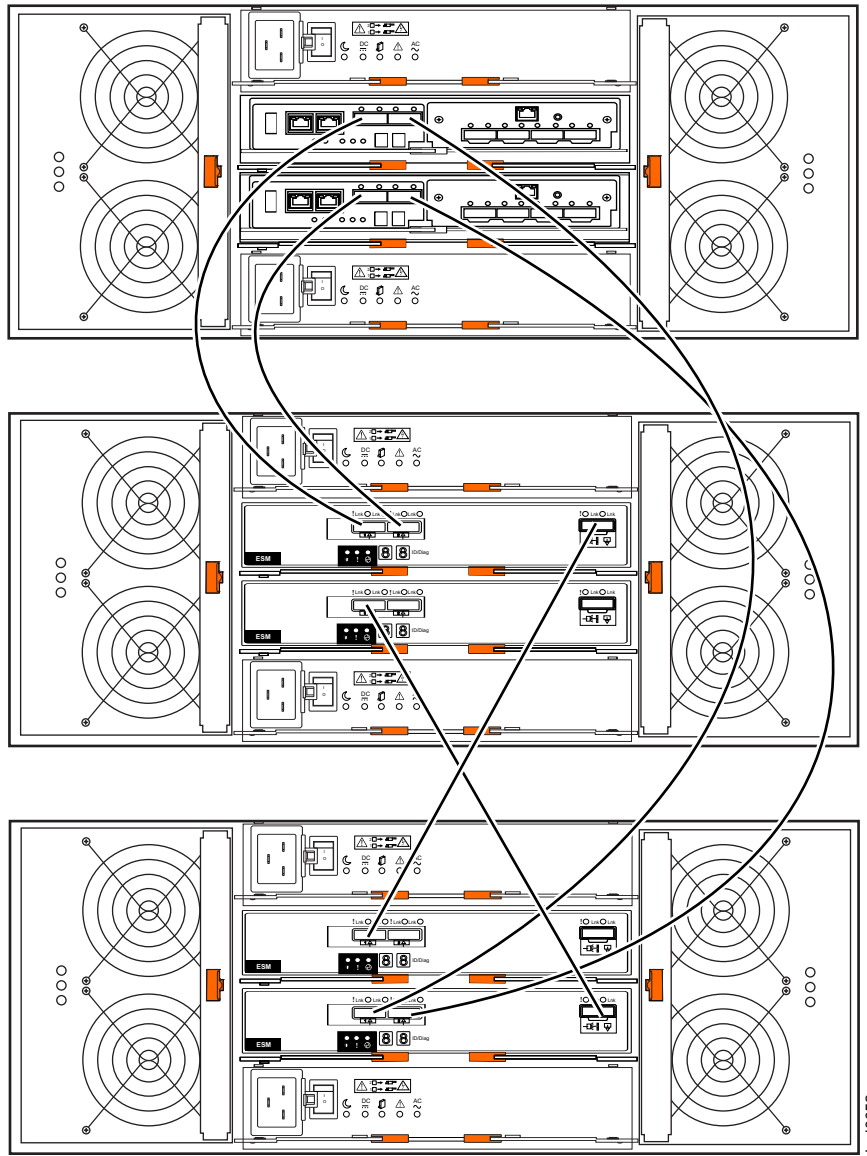


Figure 24. Adding enclosures

Redundant drive channel pair

Each storage controller on the DCS3860 with Gen2 Controllers storage system has a drive expansion channel that contains two x4 SAS ports. The storage expansion enclosures that are connected to this connector form a drive channel. The maximum number of drives that can be installed is 360. In DCS3860 with Gen2 Controllers, 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 management interface cables

Use the Ethernet management port on the rear of the DCS3860 with Gen2 Controllers system storage controllers for direct management of the storage systems (see Figure 26 on page 52).

Important:

1. To minimize security risks, do not connect the DCS3860 with Gen2 Controllers to a public LAN or public subnet. Use a local private network for the DCS3860 with Gen2 Controllers 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 DCS3860 with Gen2 Controllers storage system.

Configuring the storage system

After you install the DCS3860 with Gen2 Controllers storage system and EXP3800 expansion enclosures in a rack, you must configure the storage system. Use the information in the following sections to configure your storage system.

Storage system management methods

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

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 *IBM System Storage DS Storage Manager Version 11.0 Installation and Host Support Guide* for the operating system of the host server that you will use to manage the DCS3860 with Gen2 Controllers storage system.

Important: If the operating system of the host server that the storage system 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 system to set the correct host type first. Then, the server will be able to recognize the storage system correctly for host-agent (in-band) management.

Host-agent (in-band) management method: To use this method, the host-agent software should be installed on the host server. This software enables the IBM DS Storage Manager to manage the storage system by using the same connections between the host server and the storage system. 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.

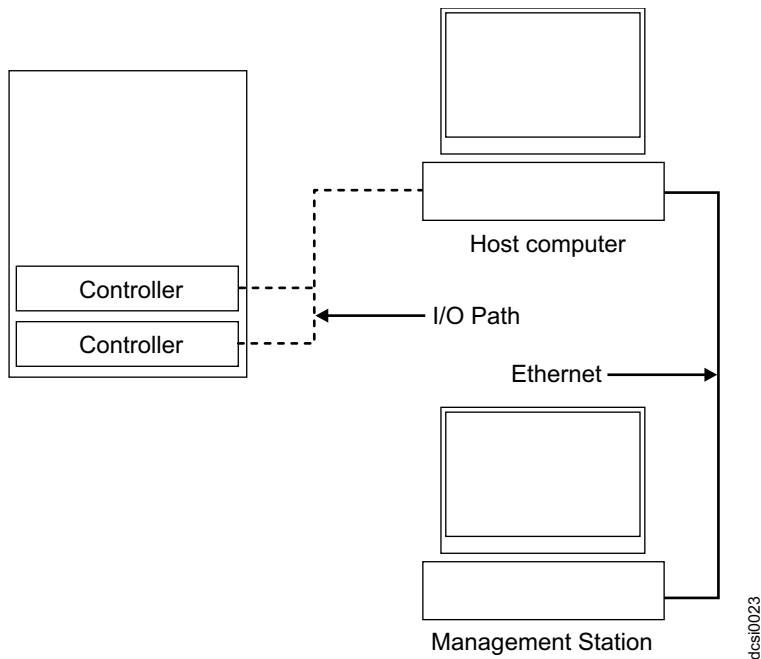


Figure 25. Host-agent (in-band) management

Direct (out-of-band) management method: Ethernet connections are used from a management station to each controller in the storage system. 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 system). You will connect the cables to each storage system controller later when you install the storage system. Figure 26 on page 52 shows the direct (out-of-band) management method.

Note: Do not connect the DCS3860 with Gen2 Controllers storage system Ethernet ports to a public network or public subnet. To minimize security risks, create a private network between the DCS3860 with Gen2 Controllers storage system and the management station.

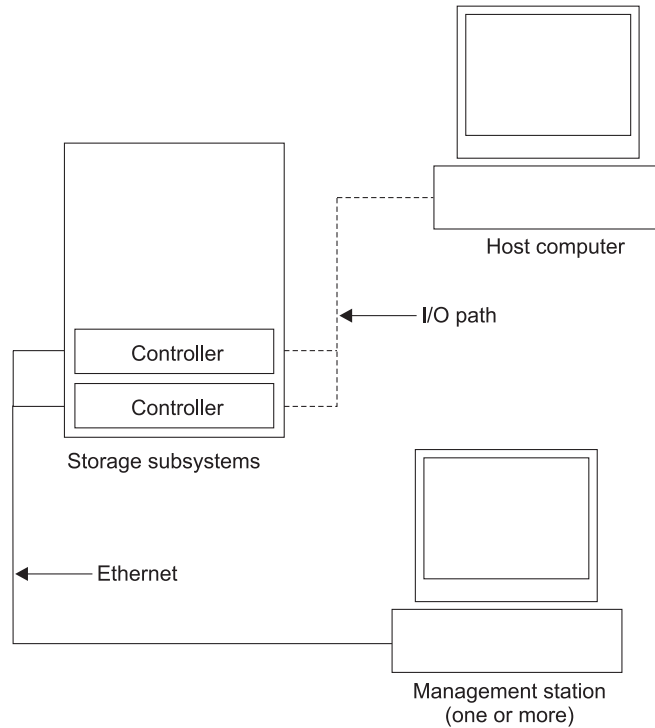


Figure 26. Direct (out-of-band) management method

Installing the storage system configuration

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

Note:

1. See the documentation that is shipped 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 file that comes with the DCS3860 with Gen2 Controllers controller firmware.

For a SAS attached host, attach a SAS cable to each HBA. Continue with “Connecting SAS hosts to the DCS3860 with Gen2 Controllers” to connect the other end of each cable to a controller.

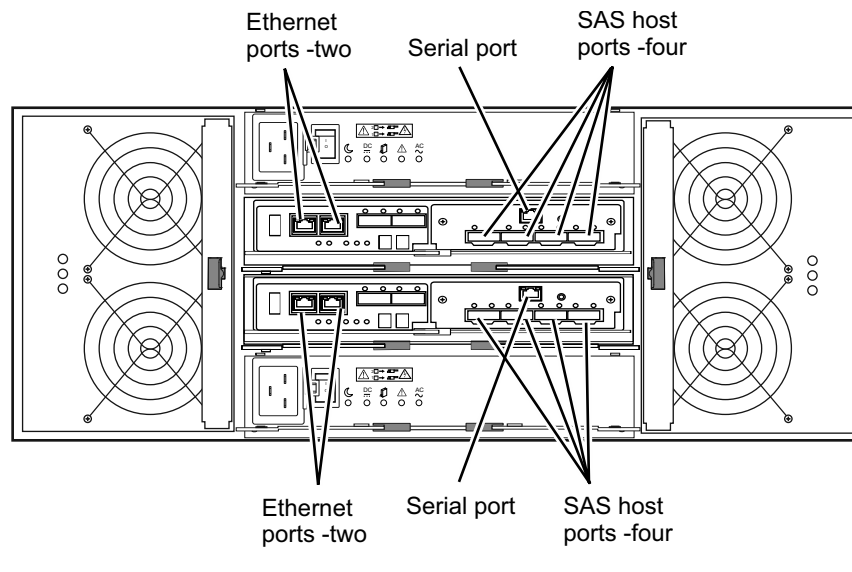
Connecting SAS hosts to the DCS3860 with Gen2 Controllers

The DCS3860 with Gen2 Controllers can support up to 1024 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 DCS3860 with Gen2 Controllers storage system, use redundant host connections.

Note: The DCS3860 with Gen2 Controllers 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.

Complete the following steps to connect a SAS host bus adapter (HBA) to the storage system:

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 DCS3860 with Gen2 Controllers storage system.

The DCS3860 with Gen2 Controllers can support up to two redundant host connections to a base DCS3860 with Gen2 Controllers storage system. With the optional host interface card installed in each controller, up to four redundant host connections are supported.

Cabling the power supply

The DCS3860 with Gen2 Controllers requires 200-240V AC power. Ensure that it is connected only to the correct AC supply voltage. If there are multiple DCS3860 with Gen2 Controllers units to be connected, ensure that the AC source and the rack Power Distribution Unit current ratings are sufficient to support the DCS3860 with Gen2 Controllers operating and surge current requirements.

Complete the following steps to connect the power supply cable.

1. Using the strap that is provided with 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 DCS3860 with Gen2 Controllers” on page 56 for the initial startup of the storage expansion enclosure.

Relocating the DCS3860 with Gen2 Controllers

Before you move a DCS3860 with Gen2 Controllers with populated hard drive drawers, you must obtain a rack relocation kit. Follow the instructions provided with the relocation kit to avoid potential damage to the DCS3860 with Gen2 Controllers:

- You can unmount the system from the rack and move the system alone. Use the DS/DCS dense drive enclosure relocation kit.
- You can also move the rack with the system mounted in it. Use the rack relocation kit.
- You must remove the drives from the DCS3860 with Gen2 Controllers and place them in the boxes that come with the relocating kit.
- You must label the drives using the labels that are shipped with the relocating kit.

Chapter 4. Operating the DCS3860 with Gen2 Controllers and EXP3800/DCS3700 expansion enclosure

This section describes operating procedures for the DCS3860 with Gen2 Controllers and the EXP3800/DCS3700 expansion enclosures. To ensure optimal operation of your DCS3860 with Gen2 Controllers and the EXP3800/DCS3700 expansion enclosure, see “Best practices guidelines” on page 5.

Performing the DCS3860 with Gen2 Controllers Health Check process

This section describes the health check process which helps 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.

Conduct the following health checks after the initial configuration of the storage system and after all configuration sessions.

1. Monitor the Recovery Guru in the IBM DS Storage Manager for any obvious storage system errors or problem conditions.
2. Gather and save the following storage system 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. In the Subsystem Management window, click **Monitor > Health > Collect Support Data Manually**.

You should also collect event logs for the host servers that have mapped logical drives from the storage system.

Attention: Save these event-log files to a server disk that will remain accessible in the event of a DCS3860 with Gen2 Controllers storage configuration failure. Do not save these event log files only to a LUN in the DCS3860 with Gen2 Controllers storage system.

3. Use the Storage system Profile or DCS3860 with Gen2 Controllers 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 system profile before you perform any controller or ESM firmware upgrades. Save the storage system profile and all .cfg files to a server disk that will remain accessible in the event of a DCS3860 with Gen2 Controllers storage configuration failure.

4. Use the Storage system Profile or DCS3860 with Gen2 Controllers Profile to ensure that the following functions are enabled:

- For the DCS3860 with Gen2 Controllers, enable Media Scan both at the controller level and at the LUN level.
- For the DCS3860 with Gen2 Controllers, enable the read/write cache. In addition, use the Storage system 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

You must regularly inspect hardware components to ensure optimal performance of the storage system. For best results:

- Maintain an up-to-date storage system profile for the storage configuration. Save the profile to a server disk that will remain accessible in case of a DCS3860 with Gen2 Controllers storage configuration failure. Do not save the profile only to a LUN in the storage system.
- Develop a change-management plan. The plan should include schedules for updating system firmware and server host software.

Note: Some updates might require storage system downtime.

- Use only IBM-approved cables. If any of the cables are not IBM-approved, note this down in the configuration document.
- 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).
- Ensure that all controllers and ESMs are correctly seated.
- Ensure that all drives are correctly seated.
- Ensure that cables are managed correctly.
- Ensure proper air flow and temperature for all components in the storage configuration.

In addition to these inspection and maintenance responsibilities, conduct training for staff that support storage configurations. Although it 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 DCS3860 with Gen2 Controllers

This section contains instructions for turning on the storage system under normal situations. “Turning off the storage system” on page 70 contains instructions for turning off the storage system under normal and emergency situations. When you turn on and turn off the storage system, ensure that you follow the startup sequence that is described in this section. If you are turning on the storage system after an emergency shutdown or power outage, see “Restoring power after an unexpected shutdown” on page 73.

While performing this procedure, you must remember that:

- The entire storage system 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:

- Repeatedly turning the power off and on without waiting for the drives to spin down can damage the drives. Always wait for at least 90 seconds after you turn off the power before you turn it on again.
 - If you are connecting a power cord to a storage system enclosure, turn off the power switches first. If the main circuit breaker is turned off, ensure that both power switches are off on each storage enclosure in the rack before you turn on the main circuit breakers.
 - Turn on the power to the supporting devices (for example, Ethernet switches and management stations) before powering on the storage system enclosures.
1. Check whether the main circuit breakers are turned on. If yes, then turn off *both* power switches on each enclosure that you intend to connect to power. If not, then turn off *both* power switches on *all* enclosures in the storage system.
 2. Ensure 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 controller enclosures so that the controllers recognize all drives in the configuration during the startup process.

Depending on the number of enclosures in the configuration, the storage system 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 system might flash intermittently.

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

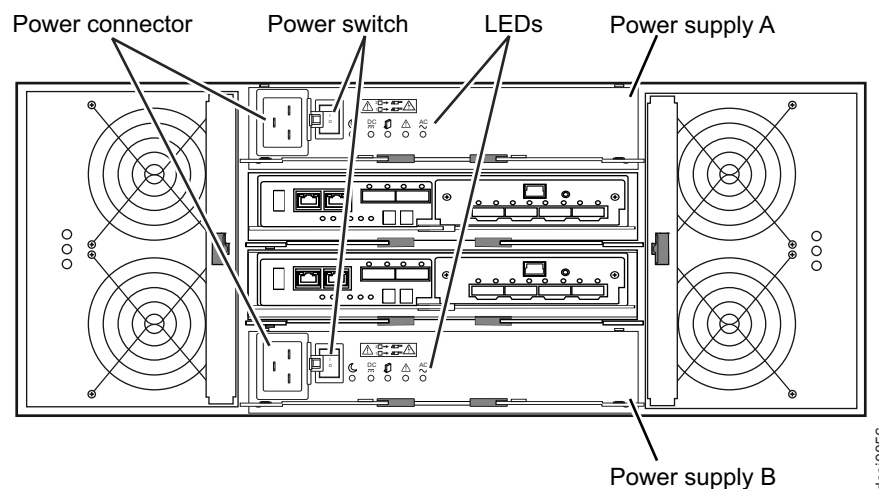


Figure 27. Power-supply switches and connectors for DCS3860 dc models

5. Determine the status of all the components in the storage system configuration by completing the following steps:
 - a. Check all LEDs on each component in the EXP3800/DCS3700 expansion enclosures. Ensure that all the LEDs show normal status. For more information about LED status for expansion enclosures, see “Checking the LEDs” on page 61.
 - b. Check all LEDs on each component in the DCS3860 with Gen2 Controllers storage system. Ensure that all the LEDs show normal status. For information about LED status, see “Checking the LEDs” on page 61 or “Solving problems” on page 123.
 - c. Open the Storage Manager Subsystem Management window, and display the status of the storage system.
6. If the LEDs indicate normal operation and the Storage Manager GUI status is 'Optimal' on all the configuration components, then you have powered on the DCS3860 with Gen2 Controllers.
7. If the LEDs do not indicate normal operation or the Storage Manager GUI status is not 'Optimal' on all the configuration components, then 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 system to locate the specific failed component. For troubleshooting procedures, see “Solving problems” on page 123.
 - 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 IBM DS Storage Manager

For instructions to install the DS Storage Manager software, see the *IBM System Storage DS Storage Manager Version 11.2 Installation and Host Support Guide* for the applicable operating system. Use this 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

Save the storage system profile 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). For instructions to save the storage system profile, see the *IBM System Storage DS*

Storage Manager Version 11.2 Installation and Host Support Guide for the applicable operating system. Save the profile in a location other than the logical drives that are created for the storage system.

Ensure that you read the readme file that is included with the DCS3860 with Gen2 Controllers storage system firmware package for any special requirements or restrictions that apply to that firmware version.

Note: Ensure that you install the Storage Manager event monitoring service to enable continuous monitoring of the status of the storage system. For more information about the importance of this information, see “Monitoring status through software.”

Monitoring status through software

Run the software constantly, and check it frequently.

Note: You can monitor only storage systems that are within the management domain of the Storage Manager. 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 systems.)

For more information, see the Enterprise Management online help.

Important: For instructions to install the DS Storage Manager software, see the *IBM System Storage DS Storage Manager Version 11.2 Installation and Host Support Guide* for the applicable operating system.

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-system 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.

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 and cause loss of data access.

Firmware updates

You must maintain the ESM firmware, controller firmware, drive firmware, and the NVSRAM firmware up-to-date and know the prerequisites, update instructions, download-sequence information, and host I/O restrictions.

Attention: Save the storage system 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 DCS3860 with Gen2 Controllers storage configuration failure. Do not save these files only to a LUN in the storage system.

Go to <http://www.ibm.com/servers/storage/support/disk/> to get the latest updates.

Ensure that you read 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 system arrays and logical drives. Subscribe to My Support for automatic notifications of firmware or Storage Manager software updates or any important information about the DCS3860 with Gen2 Controllers storage systems (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 system

Run the IBM DS Storage Manager continuously, and frequently check the configuration status.

IBM DS Storage Manager is the best way to monitor the storage system, diagnose a problem, and recover from a hardware failure. Complete the following steps to check the status of and identify a problem with the storage system. If a problem has occurred, use the Storage Manager software and the LEDs on the storage system to help locate a failed component.

1. Open the Subsystem Management window.
2. Click the **Summary** tab, and view the status of the storage system.

3. If any storage system has a 'Needs Attention' status, 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 4.

Attention: If the fault requires you to power-off an enclosure in your storage system, you might have to cycle the power on the DCS3860 with Gen2 Controllers storage system and all remaining expansion enclosures that are part of the storage system. Contact your IBM technical-support representative before you power-off any other component of the storage system.

4. If no storage system has a 'Needs Attention' status, then all components are optimal. 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.
5. Check if the amber LED is lit. If yes, locate and troubleshoot the failed components. See "Checking the LEDs." If not, then you have completed this procedure. If you are still experiencing a problem with the storage system, create, save, and print a storage system 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 system 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 DCS3860 with Gen2 Controllers 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 DCS3860 with Gen2 Controllers.

Check all the LEDs on the front and rear of the storage system when you turn on the power. During power-on, the LEDs flash intermittently as the storage system and components complete the power-on process. In addition to checking for faults, you can use the LEDs on the front of the storage system 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 DCS3860 with Gen2 Controllers. The front LEDs and controls for the DCS3860 with Gen2 Controllers storage system or expansion unit is shown in Figure 28.

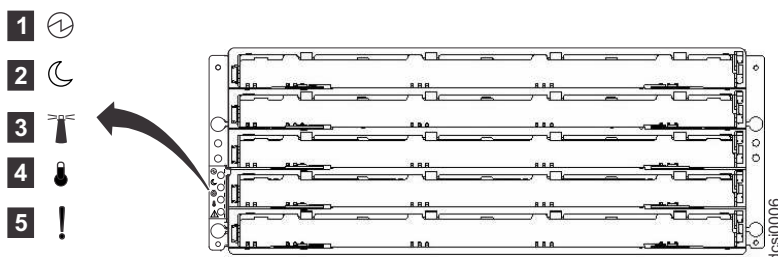


Figure 28. DCS3860 with Gen2 Controllers front LEDs and controls

Figure 29. DCS3860 storage system and EXP3800/DCS3700 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 system.
- 4 Overtemperature LED (amber)**
When this amber LED is lit, it indicates that the storage system 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 system.

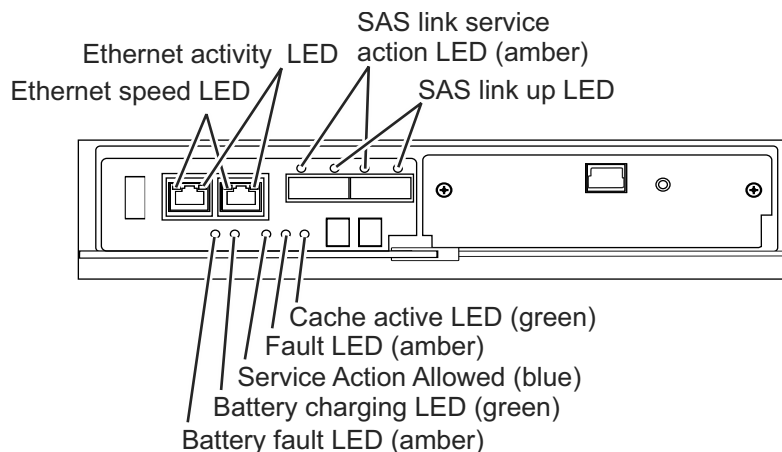


Figure 30. Controller LEDs

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 flashing, 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.

Service Action Allowed LED (blue)

When this LED is lit, it indicates that it is safe to remove the controller from the DCS3860 with Gen2 Controllers; 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 flashing, 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.

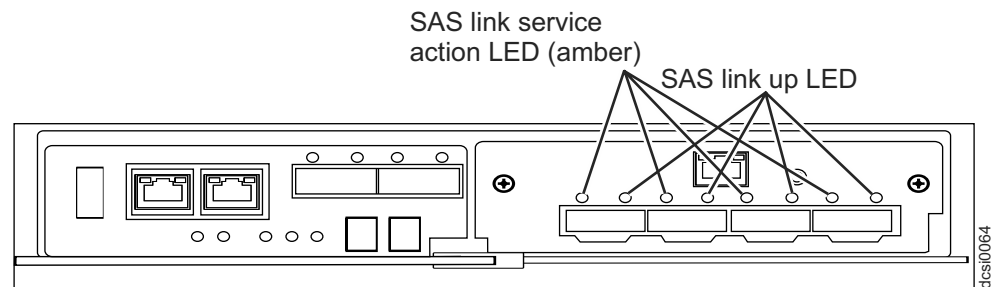


Figure 31. SAS host port adapter LEDs

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 32 on page 64 shows the LEDs on the ESM.

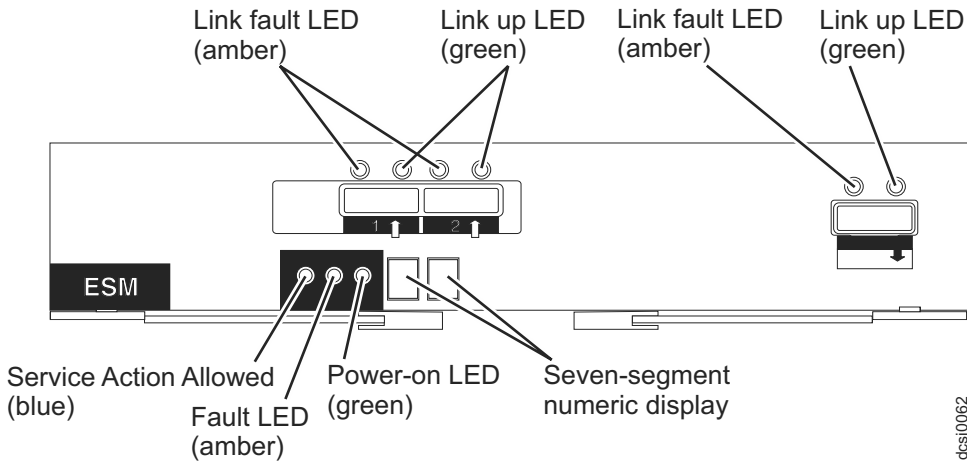


Figure 32. ESM LEDs

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.

Service Action Allowed (blue)

This LED is supported only when the EXP3800/DCS3700 is attached to a DCS3860 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.

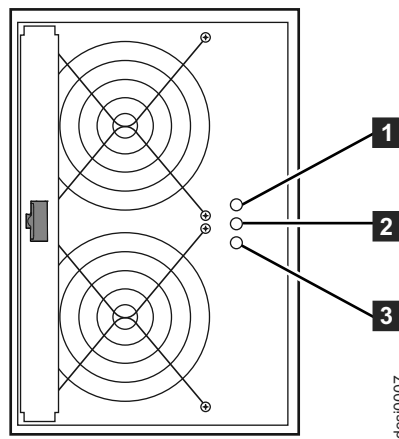





Figure 33. Fan assembly LEDs

Table 17. 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 DCS3860 with Gen2 Controllers ac power supplies.

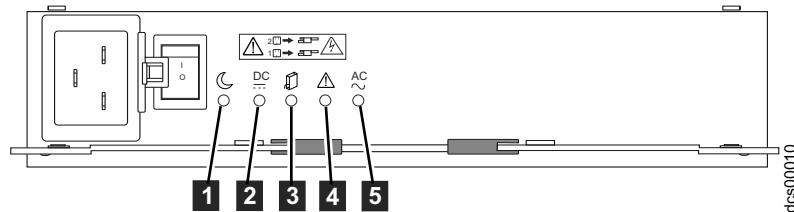


Figure 34. AC power-supply LEDs

1 Standby power LED (green)

Future use only.

2 DC power LED (green)

When this green LED is lit, it indicates that the DCS3860 with Gen2 Controllers 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 system is receiving ac power.




Drive drawer LEDs

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



Figure 35. Drive drawer LEDs

Table 18. 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)  Note: 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 Flashing (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” on page 65 for more information.

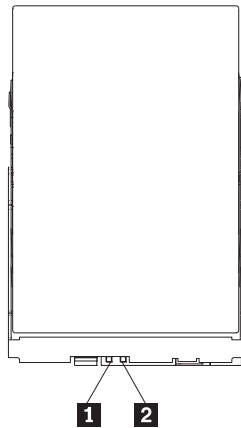


Figure 36. Disk drive LEDs

Table 19. 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 20. 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	flashing	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 37 shows the numeric display LEDs and the heartbeat and diagnostic LEDs.

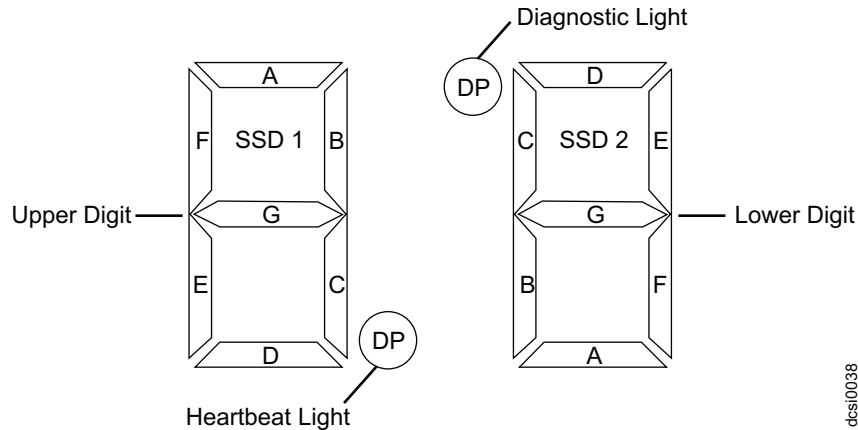


Figure 37. Numeric display LEDs

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. If the diagnostic LED is illuminated and the heartbeat LED is turned off, it indicates that diagnostic information is displayed on the numeric display. When the controller completes the boot process and is operating normally, the diagnostic LED turns off, the heartbeat LED flashes, and the numeric display changes to show the enclosure identification (enclosure ID) for that individual enclosure.

If an error occurs during the boot process and the Needs Attention LED is on, the numeric display shows diagnostic information as sequence of 2-digit diagnostic code. The number of time each 2-digit code is displayed during a sequence is fixed and under hardware control. Each sequence minimally consists of a two-digit category code, followed by a two-digit detail code that is specific to the category. Longer sequences can be displayed if more than one event is to be reported. This nominally consists of a series of category-detail sequences with a delimiter between each category-detail sequence. The entire display goes blank at the end of the sequence (all segments off, the diagnostic light off), and then the sequence repeats.

For more information about the diagnostic codes and their possible causes, see the "Seven-segment display sequence codes and their causes" section of this document.

Cache memory and cache battery

Cache memory size stores read and write operations in the DCS3860 with Gen2 Controllers system. Each storage controller in the DCS3860 with Gen2 Controllers storage system contains 12 GB of cache memory to store read and write operations. In a dual controller configuration, both controllers in the DCS3860 with Gen2 Controllers 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 DCS3860 with Gen2 Controllers 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, 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 device has failed.

See “Controller LEDs” on page 62 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 DCS3860 with Gen2 Controllers storage system if they are identified as failing by the Subsystem Management window, or when the battery fault LEDs are lit. See “Controller LEDs” on page 62 for the location of the battery fault LED.

Replace only the battery unit that is indicated as failed by the LEDs or in the Subsystem Management window. In a dual controller configuration, you do not have 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 system 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 system, 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 system power is first turned on, when a new battery is installed to replace a failed battery, or when the system power is turned on after months of inactivity.

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

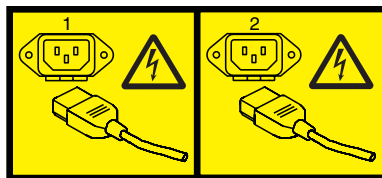
Turning off the storage system

The DCS3860 with Gen2 Controllers 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 73 .

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 DCS3860 with Gen2 Controllers . All LEDs should be green on the front of the storage system. If they are not, use the Storage Manager software to diagnose the problem so that the DCS3860 with Gen2 Controllers will power-on correctly later.

(L003)



or



Attention:: Turning off and turning on power without waiting for the storage system 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

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

1. Turn off power to the host before the storage system. If the host must stay powered-on to support a network, see the operating-system documentation for information about disconnecting the storage system logical drives from the host before the storage system 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 system.

To turn off power to one or more components of the storage system 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 73.

Figure 8 on page 14 shows the locations of the power switches on a storage system.

Before you proceed, use the Storage Manager software to determine the status of the storage system components and special instructions. You might have to complete other procedures before you turn off the power.

1. Stop all I/O activity to each storage system.
2. Determine the status of all storage systems components in the configuration by completing the following steps:
 - a. Check all LEDs on each component in the expansion enclosures. Ensure that all the LEDs show normal status.
 - b. Check all LEDs on each component in the storage system. Ensure 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. If the LEDs do not indicate normal operation or the status on all configuration components is not 'Optimal', diagnose and correct the fault:
 - a. Run the Recovery Guru by clicking Recovery Guru in the toolbar of the Subsystem Management window.
 - b. If you need 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 ensure 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.
4. If the LEDs indicate normal operation and the status on all configuration components is 'Optimal', check the cache active LED, and ensure 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.
5. Check the LEDs of the disk drive drawer to ensure that all drive activity LEDs are off.
If one or more LEDs are flashing, it indicates that data is being written to or from the drives. Wait for all activity LEDs to stop flashing.
6. Turn off the ac power switch on the rear of the DCS3860 with Gen2 Controllers storage system in the storage system.

Note: Until the power switch on each power supply is turned off, power remains turned on for both controllers.
7. Turn off both power switches on the rear of each storage expansion enclosure in the configuration.
8. After you perform the necessary maintenance procedures, turn on the power, using the procedure in “Powering on the DCS3860 with Gen2 Controllers” on page 56.

Performing an emergency shutdown

Emergency situations might include fire, flood, extreme weather conditions, or other hazardous circumstances. If a power outage or emergency situation occurs, 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 system loses power unexpectedly, it might be due to a hardware failure in the power system or in the midplane.

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

1. If you have time, stop all I/O activity to the storage system by shutting down the host or disconnecting the storage system logical drives through the host.
2. Check the LEDs. Note down 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 DCS3860 with Gen2 Controllers storage system first and followed by the EXP3800 expansion enclosures. Then, disconnect the power cables from the storage system.

Restoring power after an unexpected shutdown

Complete the following steps to restore power to the storage system after an unplanned shutdown:

DANGER

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

1. After the emergency situation is over or power is restored, check the storage system for damage.
2. If there is evidence of damage to any of the storage system components, cables, or equipment that is attached to the storage system, 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.
Attention: To avoid potential data loss, ensure 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 DCS3860 with Gen2 Controllers” on page 56 for details about the correct power-on sequence.
3. After you check the storage system for damage, ensure that the power switches are off; then connect the DCS3860 with Gen2 Controllers power cables, if required.
4. Check the system documentation of the hardware devices that you want to turn on and determine the correct startup sequence.
5. Turn on both of the power-supply switches on EXP3800/DCS3700 expansion enclosures and make sure that no ESM or power-supply fault LEDs are lit before you power on the DCS3860 with Gen2 Controllers storage system.

In addition, consider the following items:

- The storage system 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 system 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 system logical drives and arrays do not display in the Storage Manager graphical user interface.
 - The storage system logical drives and arrays do not come online.
 - The storage system logical drives and arrays seem to be degraded.

6. Turn on both of the power-supply switches on the DCS3860 with Gen2 Controllers storage system. See “Solving problems” on page 123.

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 system 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 61 shows the location of the LEDs on the DCS3860 with Gen2 Controllers.

If the storage system temperature exceeds 45°C (113°F), the IBM DS Storage Manager 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 system shuts down, and the storage management software displays a Not Responding status in the Subsystem Management window.

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

Complete the following steps to resume normal operation after a power-supply shutdown:

1. Confirm whether you used the procedure in “Troubleshooting the storage system” on page 60 to ensure that the power supplies have shut down because of an overheating problem.
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 72.
4. Wait for the air in and around the storage system to cool.
After the temperature inside the power supplies drops to below 65°C (149°F), the storage system 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. If the power supplies restarted automatically, go to step 8.
 6. If the power supplies did not restart automatically, turn off both power switches on the DCS3860 with Gen2 Controllers storage system (see Figure 8 on page 14 and then power-off all connected EXP3800/DCS3700 expansion enclosures. Wait for a minute and then turn on power to all connected EXP3800/DCS3700 expansion enclosures.
While the expansion enclosure powers on, the LEDs on the front and the rear of the enclosure flash intermittently. Depending on the 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 DCS3860 with Gen2 Controllers 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 system.
 - Click the **Summary** tab and review the status of the configuration.
The status is either Optimal or Needs Attention.
 9. If any module (controller, power supply, ESM) does not display a green status LED, or if the status for any module component is not 'Optimal', diagnose and correct the fault.
 - a. To run the Recovery Guru, click Recovery Guru in the toolbar in the Subsystem Management window.
 - b. If you need to replace a failed component, locate and troubleshoot that component. See “Checking the LEDs” on page 61.
 - c. When the procedure is completed, select **Recheck** in the Recovery Guru. This runs the Recovery Guru again to ensure that the problem is corrected.
 - d. If the problem remains, contact your IBM technical-support representative.
 10. Replace the bezel on the storage enclosure, if applicable.

Chapter 5. Replacing components

Replacing components

This section contains information about replacing components or installing optional devices in the DCS3860 with Gen2 Controllers storage system and EXP3800/DCS3700 expansion units.

Before you replace any component, ensure that you wear an anti-static wrist strap.

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. This LED helps 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, it might result in data unavailability. If an amber LED is lit and the associated Service Action Allowed LED is *not* lit, you must run 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 for at least two minutes after you replace a component for the storage system 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.

Before you begin, ensure that you wear an anti-static wrist strap.

CAUTION:

To prevent damage from overheating, replace a failed controller assembly FRU within 5 minutes of removal. If replacing it will take longer than 5 minutes, then ensure that the temporary filler that is shipped with the controller assembly FRU is installed in the SBB slot until you complete the replacement.

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

Before you begin:

- Read the "Safety" and "Best practices guidelines" sections of this document.
- Ensure that you wear an anti-static wrist strap.

Attention: Never remove a controller unless the Service Action Allowed LED is lit. Doing so can result in loss of data.

Complete the following steps to remove a controller from the storage system:

CAUTION:

To prevent damage from overheating, replace a failed controller 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.

1. If the controller has failed, do not continue with this procedure. Instead, go to "Replacing a controller" on page 80.

Attention: Handle and install cables correctly to avoid degraded performance or loss of communication with devices. See Chapter 3 "Cabling the DCS3860" in this document for more information.

2. Disconnect all interface cables from the controller. Ensure that you label each cable so that you can reconnect it correctly.
3. Remove the controller from the chassis.

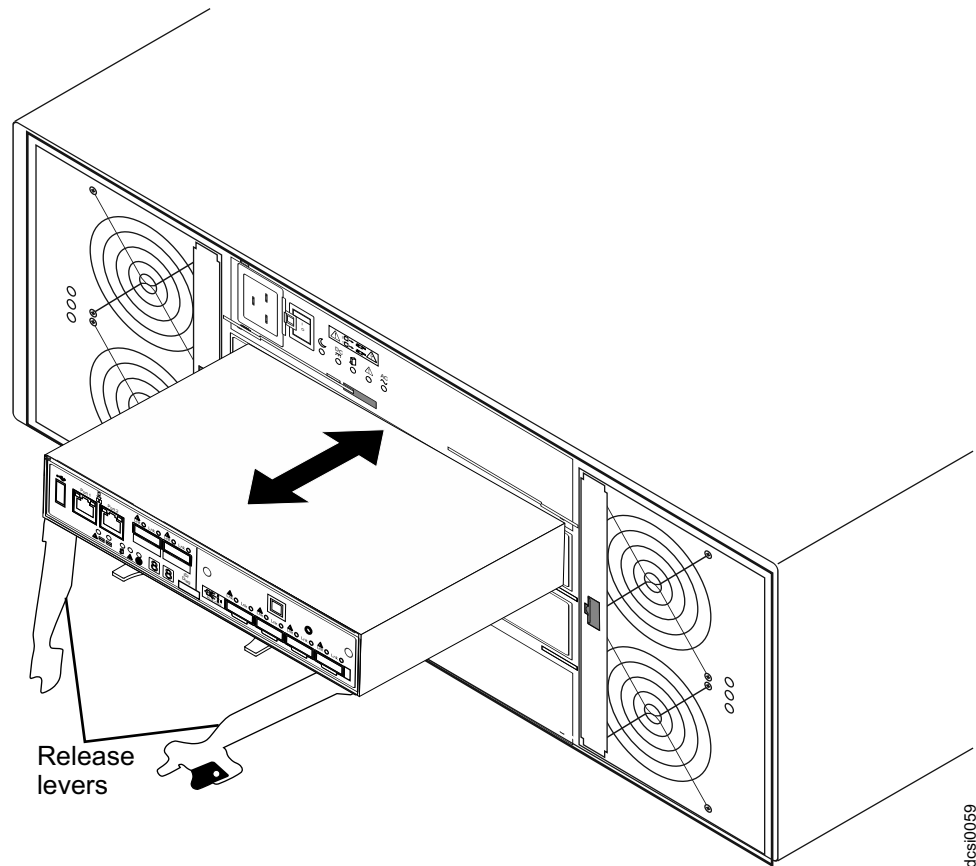


Figure 38. Removing a controller

- a. Hold the release lever with orange attachment and open it. Both the release levers open. The controller moves out of the bay approximately 1 cm (0.4 inch).
- b. Hold both the release levers and pull the controller out of the enclosure.
- c. Place the controller on a level surface.

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

Removing and installing a cover

Before you begin:

- Read the "Safety" and "Best practices guidelines" sections of this document.
- Ensure that you wear an anti-static wrist strap.

Complete the following steps to remove a cover from a controller:

1. Press the two release buttons and slide the cover toward the rear of the controller.

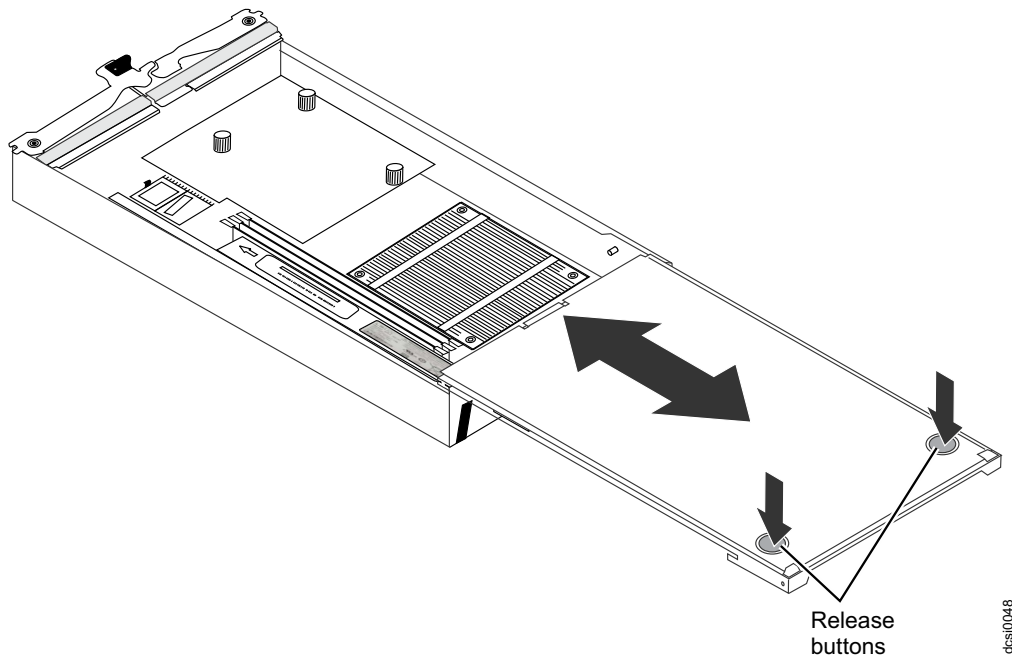


Figure 39. Removing the cover

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

To install a cover on a controller, align the cover on the controller and slide it toward the front of the controller.

Replacing a controller

Before you replace a controller in a DCS3860 with Gen2 Controllers storage system:

- Ensure that both power supplies are connected and powered-on and no amber LEDs are lit. Ensure 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.
- If you are replacing a failed controller with a replacement controller from IBM Service, 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 to the replacement controller. Transfer the battery exactly as described in this procedure. If you do not remove and insert the battery in the correct sequence, you could damage the controller.
- Read the "Safety" and "Best practices guidelines" sections of this document.
- Check the WWIDs or the MAC addresses of the host ports after replacing the controller or the host port interface adapter, or both. If you need to change any WWID or MAC address, update the servers or switches in the configuration.
- Ensure that you wear an anti-static wrist strap.

Note: While replacing the controller in a DCS3860 with Gen2 Controllers storage system, you may require an additional controller air diverter.

To replace a controller in a DCS3860 with Gen2 Controllers storage system:

CAUTION:

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

1. Use the Storage Manager software to print a storage system profile.
2. 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 Service Action Allowed 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. If the Service Action Allowed LED is not lit, another component might require attention before you 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 system 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 A; controller B is installed in slot B), and then paste 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. Ensure 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 DCS3860 with Gen2 Controllers" 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

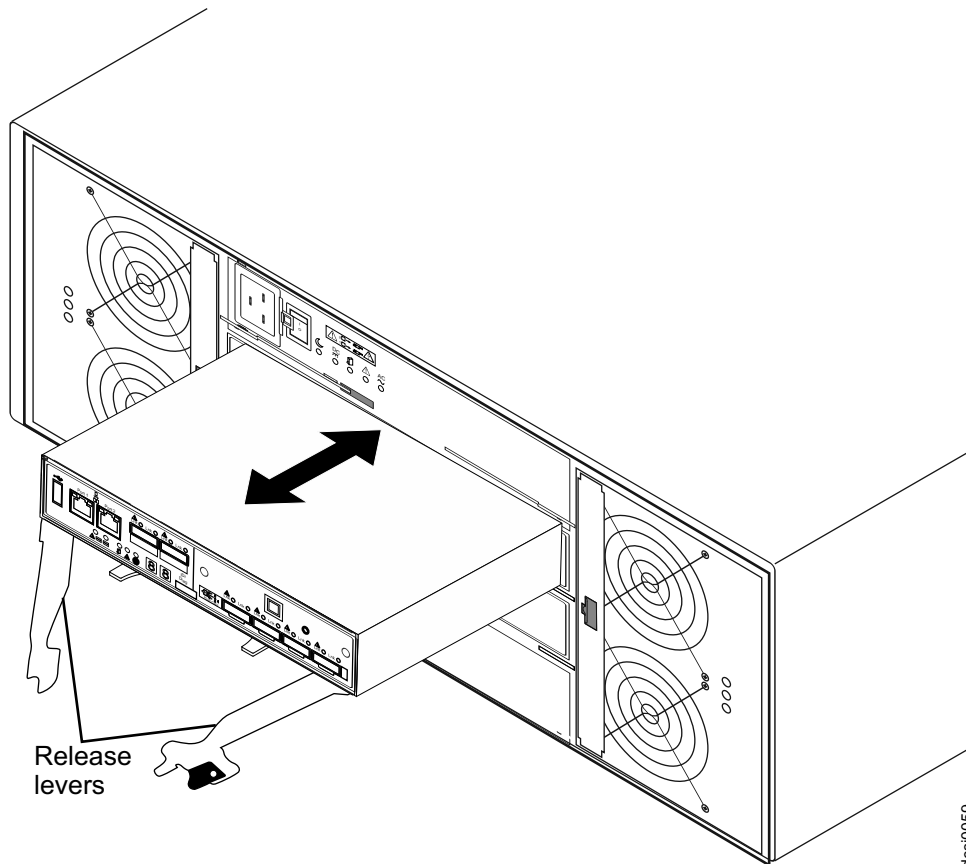


Figure 40. Removing and replacing a controller

- a. Hold the release lever with orange attachment and open it. Both the release levers open. The controller moves out of the bay approximately 1 cm (0.4 inch).
- b. Hold both the release levers and pull the controller out of the enclosure.
- c. Place the controller on a level surface.

Attention: The DCS3860 with Gen2 Controllers 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 79).
10. Remove the host interface card and set it aside (see "Replacing a host interface adapter" on page 85).
11. Remove the battery from the failed controller (see "Replacing a memory cache battery" on page 103).

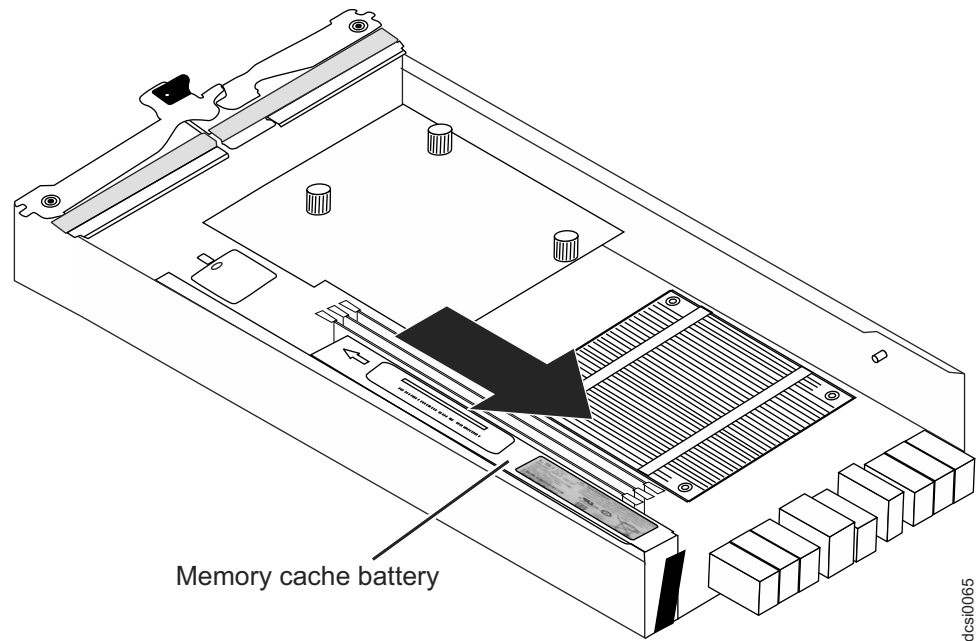


Figure 41. Removing the battery unit from the controller

12. Install the battery from step 11 on page 82 into the new controller (see “Replacing a memory cache battery” on page 103).
13. Install the host interface card you removed in step 10 on page 82 (see “Replacing a host interface adapter” on page 85).
14. Install the cover (see “Removing and installing a cover” on page 79)

Attention: Remove the temporary filler before you install the replacement controller.
15. Install the new controller.
 - a. Ensure 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 lever without the orange attachment to the closed position. Then, push the release lever with the orange attachment. Ensure that both the release levers are in the closed position.
16. Connect the cables that you disconnected in step 7 on page 81.
17. Wait up to 5 minutes for the Storage Manager software to recognize the new controller.
18. Complete any remaining Recovery Guru procedures for controller replacement.
19. Check the LEDs on the new controller to ensure that the controller is fully operational.
20. Use the Subsystem Management window to check the status of all components in the storage system.
 - If the new controller is online and the Subsystem Management window indicates normal operation, go to step 24 on page 84.
 - 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 21 on page 84.

21. 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**.
22. Check the state of the LEDs on the newly inserted controller. For more information, see the "Controller LEDs" section of this document. You can also use the Subsystem Management window to identify any new faults.
23. If any storage system has a fault (Needs Attention) status, click **Recovery Guru** in the Subsystem Management window toolbar, and complete the recovery procedure. If the problem remains, contact your IBM technical-support representative.
24. If the storage systems have no fault, use the Storage Manager software to print a new storage system profile.
25. Check the WWIDs or the MAC addresses of the host ports after replacing the controller or the host port interface adapter, or both. If you need to change any WWID or MAC address, update the servers or switches in the configuration.

Note: You might have to reboot your system to remove the LUNs information that is associated with the WWID of the controller that you removed.

Removing and disposing of the system-board lithium battery

Before you begin, ensure that you wear an anti-static wrist strap.

When you disassemble the storage system 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.

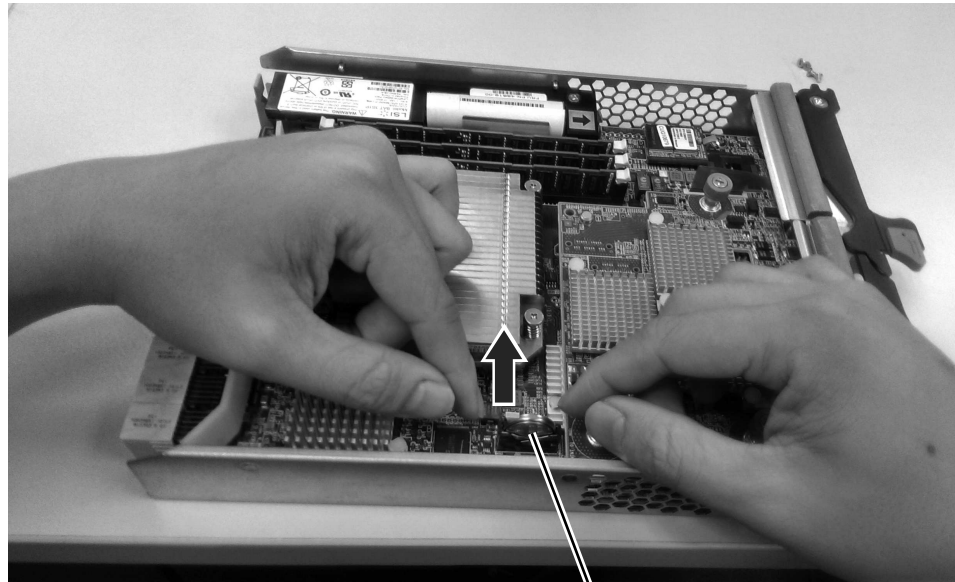
Do not:

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

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

Complete the following steps to remove the batteries for disposal:

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



Lithium battery

dcsi0067

Figure 42. Location of the Lithium battery

2. Gently pull the metal plate outward with one hand, and lift the lithium battery from the socket.
3. Insert the new lithium battery.
4. Release the metal plate.
5. Repeat Steps 1 on page 84 through 4 to locate and remove the lithium battery in Controller B; then, continue with Step 6.
6. Dispose off 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.

Replacing a host interface adapter

Before you begin, read “Safety” on page ix and ensure that you wear an anti-static wrist strap.

Attention: If the host interface adapter is to be removed from both controllers or is being replaced with a new host interface adapter, then you will need to power off the system. See “Turning off the storage system” on page 70. You do not need to power off the system to replace a failed host interface adapter.

Complete the following steps to replace a host interface adapter that is installed in a controller that is still installed in the storage system. Otherwise, go to step 4 on page 86.

1. Label and disconnect the cables that are connected to the controller.
2. To open the two controller release levers, pull the lever orange tab outward. The controller moves out of the bay approximately 0.6 cm (0.25 inch).

3. Pull the controller out of the bay and place the controller on a level surface.
4. Remove the cover.
5. Remove the cover plate from the controller. To do so, remove the four screws from the cover plate. Three screws are located on the front panel and the fourth screw is located on the side as indicated in Figure 43. After you remove the fourth screw, gently pull the cover panel till it is released.

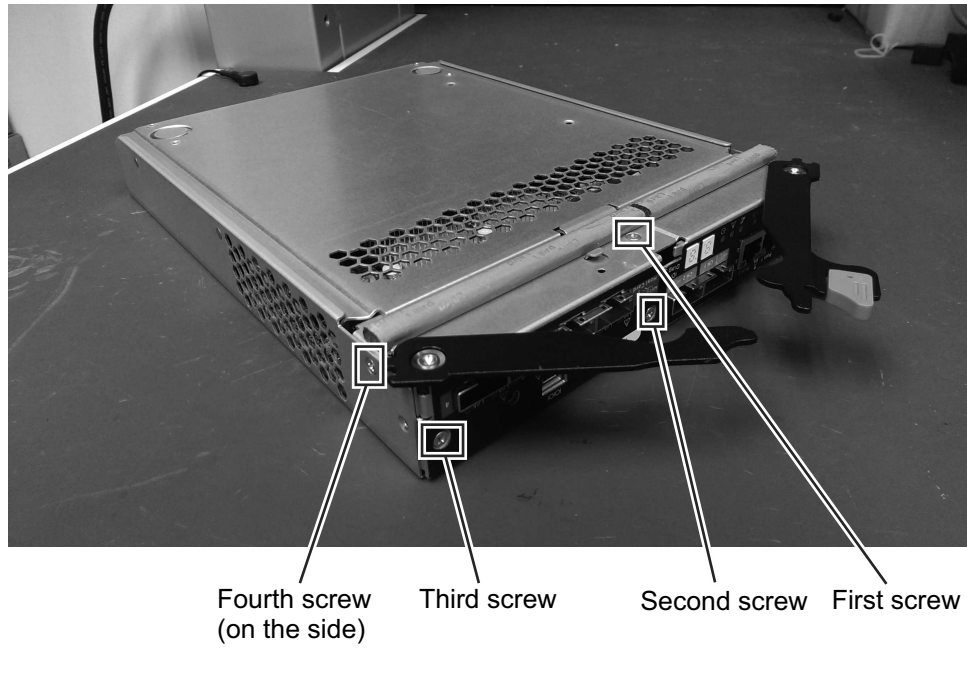


Figure 43. Four screws on the cover plate

6. Loosen the three captive fasteners on the host interface card and gently pull the card up, off the controller.

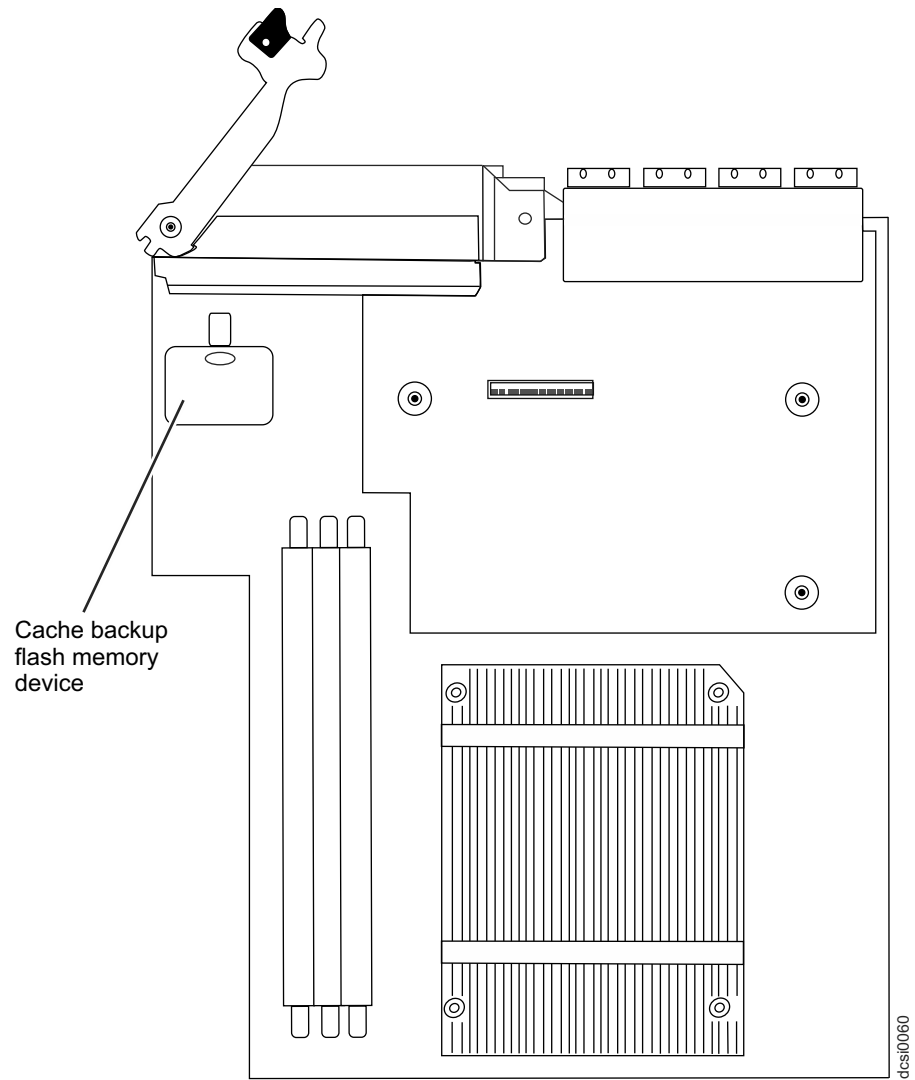


Figure 44. Removing the HIC connector

7. Align the new host interface card.

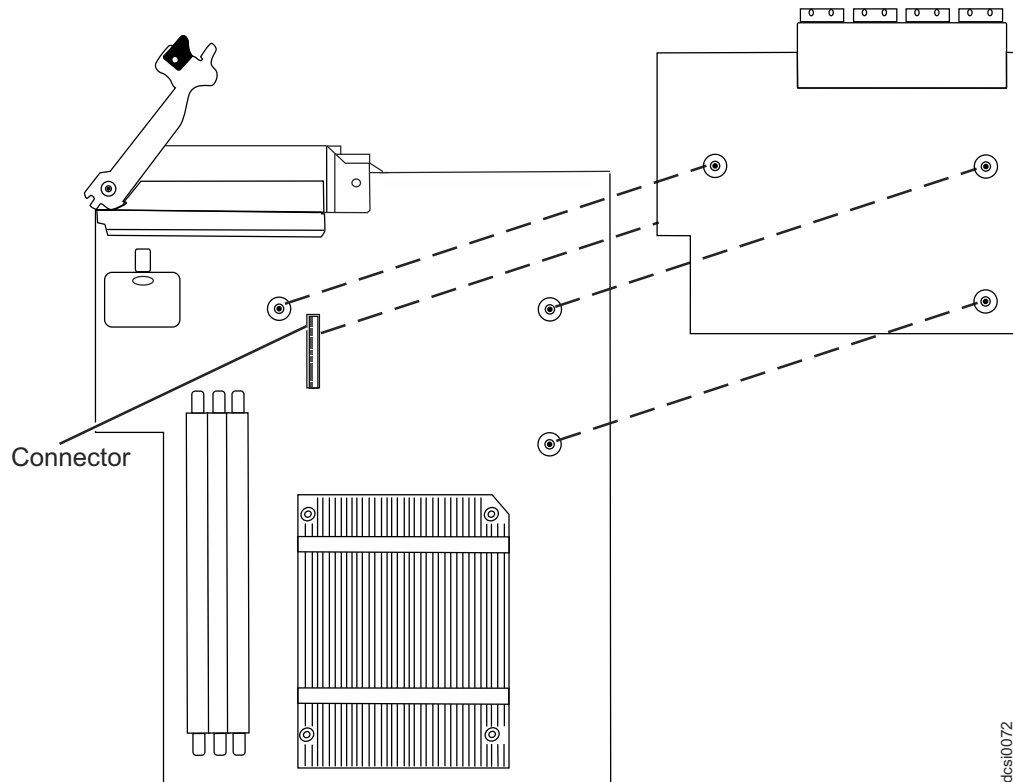


Figure 45. Aligning the HIC connector

8. Press the card in the controller and tighten the three captive fasteners.
9. Install and secure the cover plate with four screws and then install the cover.
10. Insert the controller into the chassis.
 - a. Ensure 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 lever without the orange attachment to the closed position. Then, push the release lever with the orange attachment. Ensure that both the release levers are in the closed position.

Note: If a different HIC is installed or if the HIC is removed, then perform this step on the other controller too.

11. Reconnect the cables that you disconnected.
12. If necessary, turn on the storage system (see “Powering on the DCS3860 with Gen2 Controllers” on page 56).
13. Check the WWIDs or the MAC addresses of the host ports after replacing the controller or the host port interface adapter, or both. If you need to change any WWID or MAC address, update the servers or switches in the configuration.

Working with hot-swap DDMs

This section contains information about 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 ix and in “Handling static-sensitive devices” on page 26.
- Ensure that the current system configuration is working properly.
- Back up all important data before you make changes to data storage devices.
- Ensure that you wear an anti-static wrist strap.

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 DCS3860 with Gen2 Controllers, 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 at least 20 drives, with four drives in the front row of each of the five drive drawers (slots 1, 4, 7, and 10).
 - Using non-supported drives in the storage expansion enclosures can cause the storage expansion enclosures to fail.
 - After you remove a DDM FRU, wait for 90 seconds before replacing or reseating it to allow it to properly spin down.
- **Drive LEDs:** Each DDM FRU enclosure 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 21 for the drive LED states and descriptions.
- DDM FRUs are not interchangeable between the DCS3860 with Gen2 Controllers and the EXP5060 storage expansion enclosure.

Table 21. Drive LED activity

LED	LED state	Descriptions
Activity LED	Flashing green	A flashing green LED indicates Fibre Channel activity to the drive.
Activity LED	Steady green	The green LED indicates that the drive is properly installed and is spun up by the DCS3860 with Gen2 Controllers controller.
Service Action Required LED	Flashing amber	A flashing amber LED indicates that a drive has been identified by the software.
Service Action Required LED	Steady amber	The amber LED indicates a drive failure. The drive can also be put in a failed state if the drive is not certified for the DCS3860 with Gen2 Controllers storage system. Use the DS Storage Manager 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 system.
Activity and Service Action Required LEDs	All unlit	Check for and resolve the following situation: <ul style="list-style-type: none"> • DCS3860 with Gen2 Controllers is turned off.
Activity LED	Off	Check for and resolve one of the following situations: <ul style="list-style-type: none"> • Drives are part of an exported array. Once the array is exported, the drives in the array are spun down so that they can be removed from the enclosure. • Drives are failed by the storage system controllers. • Failed drive drawer.

Table 21. Drive LED activity (continued)

LED	LED state	Descriptions
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:** You can use certain hardware in DCS3860 with Gen2 Controllers to replace a failed DDM without turning off the storage expansion enclosure. You can continue to operate your system while aDDM is being removed or installed. These DDMs are known as hot-swap DDMs.

Before you begin, ensure that you wear an anti-static wrist strap.

Complete the following steps to install hot-swap DDMs in the storage expansion enclosure:

1. Read the documentation that is shipped with the DDM.
2. Check for Service Action Required LEDs described in “Drive drawer LEDs” on page 65 and “Disk drive LEDs” on page 66. If any amber LEDs are lit, see “Solving problems” on page 123.
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 106 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.

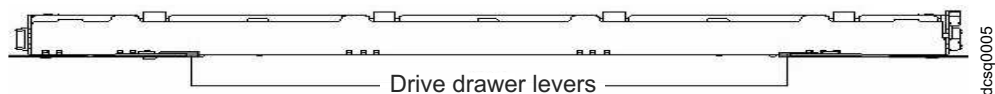


Figure 46. Opening the drive drawer

Attention: To prevent damage to the drive enclosure:

- For drive enclosures without disk drawers, do not force the drive into the drive slot at an angle. Ensure that you carefully insert each hard disk drive straight into the drive slot (horizontal or vertical).
- For drive enclosures with disk drawers, gently press on the back of the drive while pulling the lever downward to push the drive into the connector on the drive drawer board.

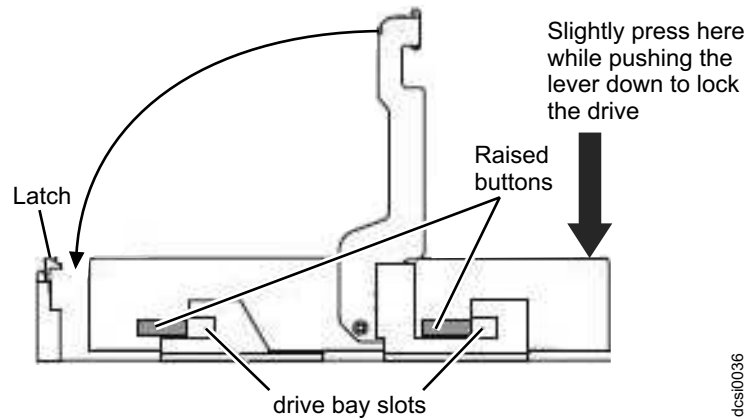


Figure 47. Inserting a hard disk drive into the connector

6. Install the DDM by completing the following steps:

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

a. Raise the drive handle to the vertical position, as shown in Figure 48.

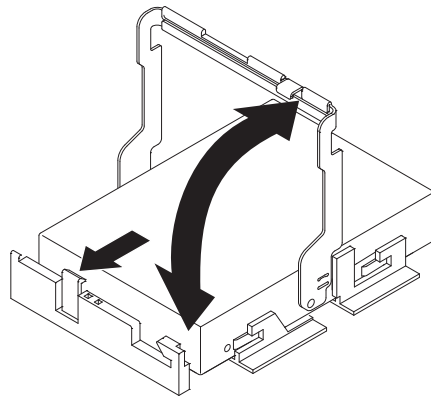


Figure 48. Raising the drive handle

b. Align the two raised buttons on each side over the matching gap in the drive channel on the drawer, as shown in Figure 49.

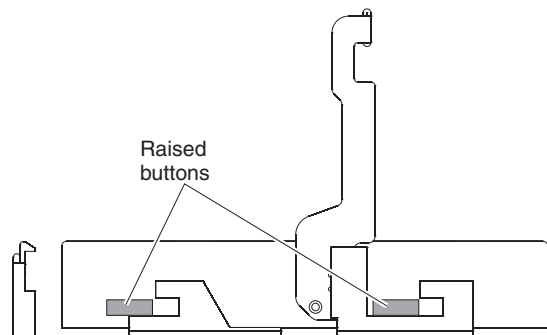


Figure 49. Aligning the drive

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 50 on page 92

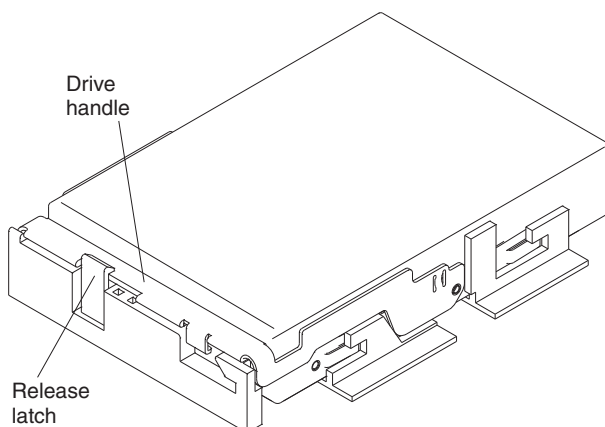


Figure 50. Locking the drive in place

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 106 for the steps to install the bezel.

Installing hot-swap hard disk drives

With the exception of the DCS3860 with Gen2 Controllers storage system initial power on, you should add DDMs while the storage expansion enclosure is turned on and running.

Attention: After you remove a DDM FRU, wait for 90 seconds before replacing or reseating it to allow it to properly spin down.

Replacing hot-swap hard disk drives

Problems with DDMs 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 contains instructions to replace a failed DDM.

Note: If you want to remove a DDM that is not in a failed or bypass state, use the IBM 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.

Before you begin, ensure that you wear an anti-static wrist strap.

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 anti-static protection.
4. Remove the bezel from the front of the storage enclosure. See “Replacing the bezel” on page 106 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 for 90 seconds to allow the drive to properly spin down and the storage system controller to properly recognize that an DDM is removed from the configuration.
 - c. Ensure 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 is installed in a drive enclosure. Do not attempt to detach the DDM from the enclosure.

- 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 IBM 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 IBM 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 IBM 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 106 for the steps to install the bezel.

Replacing multiple DDMs

This section contains guidelines for upgrading DDMs in a 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 the software should supersede anything stated in this document.

Before you begin, ensure that you wear an anti-static wrist strap.

Complete one of the following methods to upgrade DDMs:

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

You must back up the data on the affected DDMs and then turn off the DCS3860 with Gen2 Controllers storage system.

Attention: Turn off the DCS3860 with Gen2 Controllers storage system before you turn off the EXP3800/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 95.

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 system (or any storage expansion enclosures attached to the storage system) 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 97.

Using this method, you can replace the DDMs while the DCS3860 with Gen2 Controllers storage system is running, eliminating the downtime 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 system 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 follow 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.
- How many DDMs exist 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 a 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. More extensive the data changes, more work is needed to restore the data in the event of an array failure due to an additional DDM failure.

Replacing all DDMs at the same time

Use this method if you are upgrading DDMs containing RAID 0 logical drives. All data currently on the DDMs is lost when you replace them. Therefore, you must back up all data that is currently on the DDMs. Turn off the DCS3860 with Gen2 Controllers storage system, so that it is inaccessible to other users.

Before you begin, review the following information:

- “Replacing multiple DDMs” on page 94, particularly the differences between the two possible upgrade procedures
- The software documentation regarding DDM upgrades and installation
- The documentation that is shipped with the new DDMs

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

Complete the following steps to replace all the DDMs at the same time:

1. Use the IBM DS Storage Manager software to check the status of the DCS3860 with Gen2 Controllers. Correct any problems that are reported.
2. Back up data on 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 26.
3. 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.
4. Complete the following steps:
 - a. Stop all I/O activity to the storage system and attached storage expansion enclosures.
 - All of the green Drive activity LEDs on the front of the storage system are not flashing.
 - The Cache active LEDs are off. Refer to “Checking the LEDs” on page 61 for the location of the Cache active LEDs.

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

Attention: To turn off all power to the storage system, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 5 for the proper shutdown sequence.

5. Turn off 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 system. If the host must stay powered on to support an existing network, see the operating system documentation for information about disconnecting the storage system logical drives from the host before the storage system is powered off.
 - b. Turn off power to the DCS3860 with Gen2 Controllers storage system before you power off the EXP3800/DCS3700 expansion enclosure. Turn off both power supply switches on the back of the storage system.
 - c. Turn off power to other supporting devices (for example, management stations, Fibre Channel switches, or Ethernet switches).
6. Use the procedures in “Replacing hot-swap hard disk drives” on page 92 to remove the DDMs that you want to replace. Use the procedures in “Installing hot-swap hard disk drives” on page 92 to install the new DDMs into the DCS3860 with Gen2 Controllers.
7. After you install all new DDMs, follow the system documentation for the hardware devices that you intend to power on, and 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 system.
 - 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 system.
 - c. Turn on the power to the storage system; then restart or turn on the power to the host.
8. Turn on the power to each device, based on the power-on sequence in step 8. To turn on power to the DCS3860 with Gen2 Controllers 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.
9. Check the green Drive activity LEDs and the amber Drive fault LEDs above the new drive FRUs.

Ensure 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 for 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 IBM DS Storage Manager software for problem determination.

10. Use the IBM DS Storage Manager software to configure the new DDMs. See the IBM DS Storage Manager software online Help for detailed instructions.
11. Restore the data from backup to all the DDMs.

Replacing 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 95).

Note: If your storage system has hot spares assigned, you might want to unassign the hot spares while you perform this procedure. If you do unassign the hot spares, 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 for 90 seconds before replacing or reseating it to allow it to properly spin down.

Before you begin, review the following information:

- “Replacing multiple DDMs” on page 94, 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.

Complete the following steps to replace the DDMs one at a time:

1. Use the IBM DS Storage Manager software to check the status of the unit. Correct any problems that are reported.
2. 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 26.

3. 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.

4. Use the IBM 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 that you want to replace. If the array is in degraded state, use the recovery procedures to bring the array into the optimal state.

Ensure that you fail only one DDM. The software status should display a failed status for the appropriate DDM. The amber Drive fault LED (on the front bezel below the DDM) should be on.

Attention: Removing the wrong DDM can cause data loss. Ensure 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 for 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.

5. Follow the procedures in “Replacing hot-swap hard disk drives” on page 92 to remove the failed drive. Follow the procedures in “Installing hot-swap hard disk drives” on page 92 to install the new DDMs into the DCS3860 with Gen2 Controllers.

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 system 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.

6. Check the green Drive activity LED and the amber Drive fault LED above the new DDM FRUs.

Ensure 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 for 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 IBM DS Storage Manager software for problem determination.

7. Use the IBM 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.)

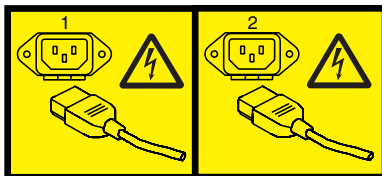
Note: The Drive activity LED will continue to flash after reconstruction is finished if there is I/O activity to that DDM. In that case, use the host software to determine if the data reconstruction is finished.

8. When reconstruction is finished on the new DDM, repeat step 4 on page 97 through step 7 for each additional DDM that you want to install.
9. Use the IBM DS Storage Manager software to configure the additional space on the new DDMs.

Replacing an ac power supply



(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 system.

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), ensure 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 system and restart it.

Attention: Do not remove the failed power supply until you have the replacement power supply. Continuous air flow cools the storage system. Any interruption in the air flow might result in overheating, so if you remove the failed power supply, install the second power supply within five minutes. .

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

Before you begin:

- Use the Storage Manager software to print a storage system profile, if required.
- Read the "Safety" section of this document.
- Ensure that you wear an anti-static wrist strap.



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:

1. Turn off everything (unless instructed otherwise).
2. Remove the power cords from the outlets.
3. Remove the signal cables from the connectors.
4. Remove all cables from the devices.

To connect:

1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

(D005a)

Complete the following steps to replace a power supply:

CAUTION:

To prevent damage to the storage system 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 system 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)



1. Ensure that you run the Recovery Guru to identify the failed component.
2. Unpack the new power supply. Save all packing material in case you have to return the failed power supply.
3. Turn off the power switch on the new unit.
4. Check the fault LED to locate the failed power supply. If a fault is detected, the amber fault LED is lit.
5. Ensure 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 77.
6. Turn off the power switch and disconnect the power cord from the failed power supply.
7. Remove the power supply from the bay.

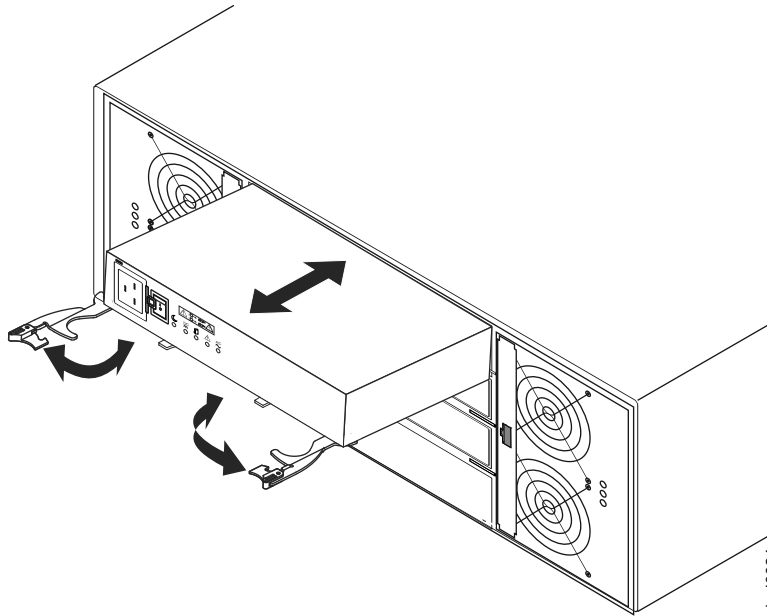


Figure 51. Replacing a power supply

- 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.
8. Place the replacement power supply on a level surface.
9. Ensure that the release levers on the power supply are in the open position.
10. Slide the power supply into the bay until it stops.
11. Push the release levers to the closed position.
12. Connect the power cord and turn on the power.
13. Check the power and fault LEDs on the new unit.
14. Check the status of the power and fault LEDs. The procedure to follow according to the LED status is as under:
 - **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 15.
 - **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 16 on page 103.
15. Perform the following substeps to solve the problem:
 - Ensure that the power switch is turned on.
 - Ensure that there is power at the ac outlet and no circuit breaker has tripped.
 - Ensure 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.

16. Complete any remaining Recovery Guru procedures.
17. If any amber LEDs are lit on any of the components of the storage system, 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.
18. If the status of each component is 'Optimal', create, save, and print a new storage system profile.

Replacing a memory cache battery

The controller in the DCS3860 with Gen2 Controllers storage system contains a rechargeable battery backup unit that provides power to back up the cache memory onto flash memory in case power supply fails. Each battery unit contains a sealed, rechargeable SMART lithium ion battery. The cache battery is the only replaceable battery in the storage system.

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 as a result of 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.

Before you begin:

- Use the IBM DS Storage Manager to print a storage system profile.
- Read the "Safety" section of this document.
- Ensure that you wear an anti-static wrist strap.

Complete the following steps to replace a battery unit:

1. Locate the controller that contains the failed battery unit.
2. Remove the controller from the chassis.

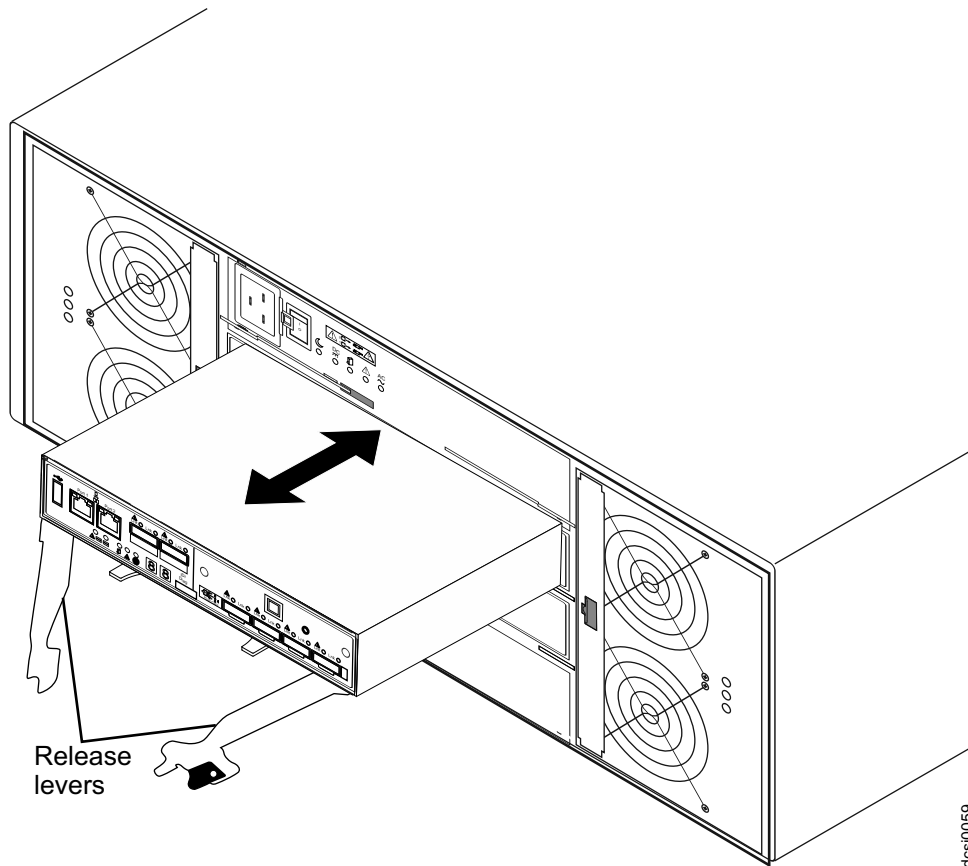


Figure 52. Removing a controller

- a. Hold the release lever with orange attachment and open it. Both the release levers open. The controller moves out of the bay approximately 1 cm (0.4 inch).
- b. Hold both the release levers and pull the controller out of the enclosure.
- c. Place the controller on a level surface.
3. Remove the cover (see "Removing and installing a cover" on page 79).
4. Place the controller on a flat surface.
5. Remove the failed battery unit from the controller.

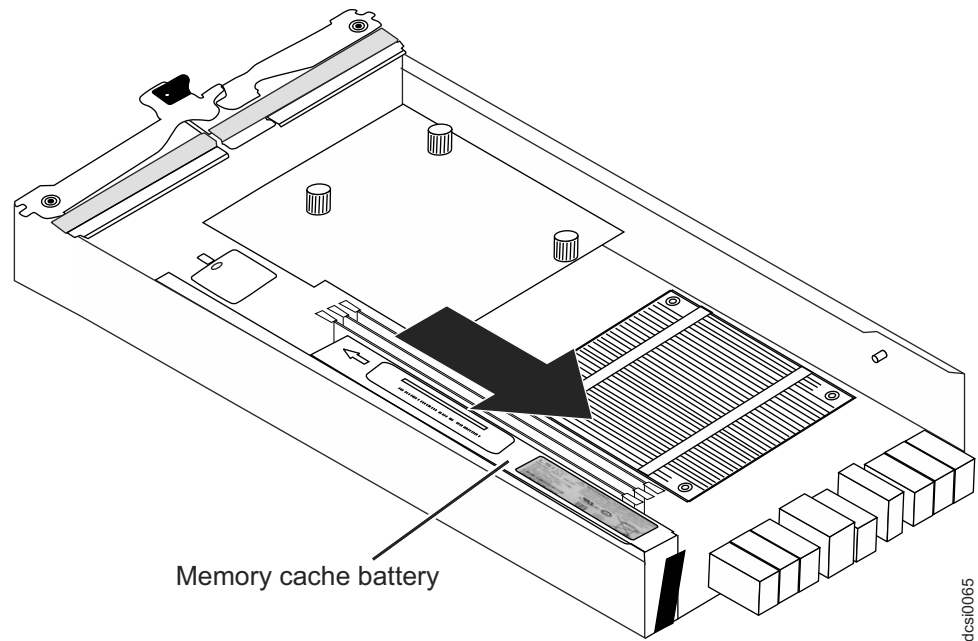


Figure 53. Removing a battery unit from the controller

- a. Push the blue release lever outward till it is in the horizontal position.
 - b. Hold the blue release lever and pull the battery unit upwards till it disengages from the connecting socket.
 - c. Slide the battery unit out of the controller in the direction that is indicated by the arrow.
 - d. Dispose off the battery as required by local ordinances or regulations. For more information, see the *IBM Systems Environmental Notices and User's Guide*.
6. 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.
 7. Insert the new battery unit into the controller chassis:
 - a. Align the connector and slide the battery unit into the controller.
 - b. Press the battery to engage it in the connecting socket.
 - c. Pull the blue release lever from the horizontal position to the vertical position.
 - d. Ensure that the battery is firmly installed on the system board.
 8. Install the cover (see "Removing and installing a cover" on page 79).
 9. Insert the controller into the chassis.
 - a. Ensure 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 lever without the orange attachment to the closed position. Then, push the release lever with the orange attachment. Ensure that both the release levers are in the closed position.

After you replace a controller cache battery, reset the battery age timer. For information about resetting the batter 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 for a specified time before you install or remove the DIMM.

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.

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 80.

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

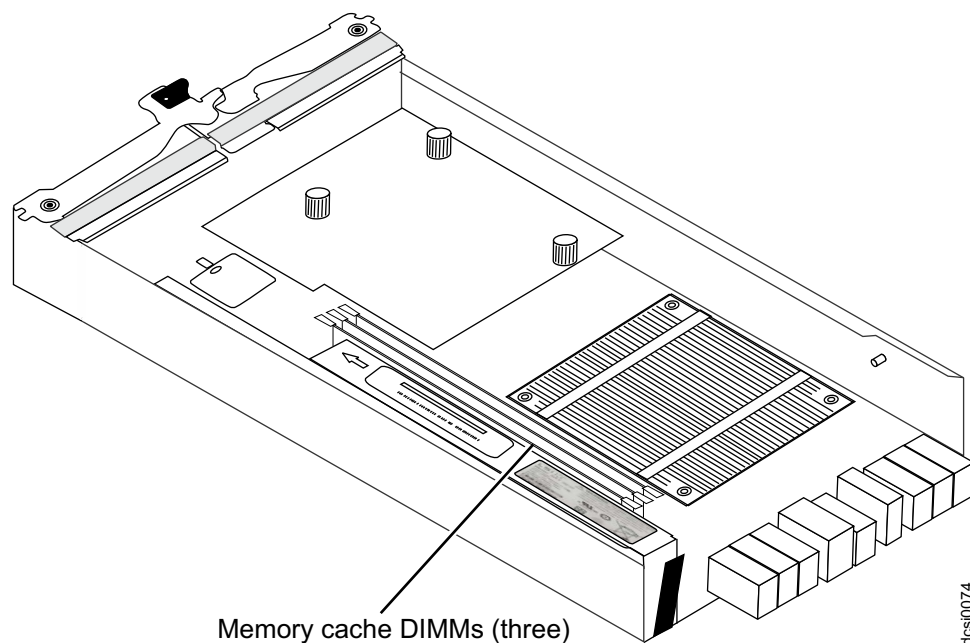


Figure 54. Memory cache DIMM location

Replacing the bezel

Before you begin, ensure that you wear an anti-static wrist strap.

Complete the following steps 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. At the front of the storage expansion enclosure, remove the bezel by pressing inward on the latches (see Figure 55 on page 107).



Figure 55. Removing the bezel

2. Pull the bezel toward you to remove it from the enclosure.
3. Place the bezel to the front of the storage expansion enclosure (see Figure 55).
4. Press the bezel inward until both latches lock the bezel in place.

Working with environmental service modules

You must be ready with these things before you work with environmental service modules (ESM).

CAUTION:

To prevent damage from overheating, replace a failed ESM 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.

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 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

Before you begin, read the safety information found in the prolog of this document.

CAUTION:

To prevent damage from overheating, replace a failed ESM 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.

Complete the following steps to replace an ESM:

1. Disconnect the SAS cables from the ESM.
2. Open the two release levers. The ESM moves out of the bay approximately 0.6 cm (0.25 inch).

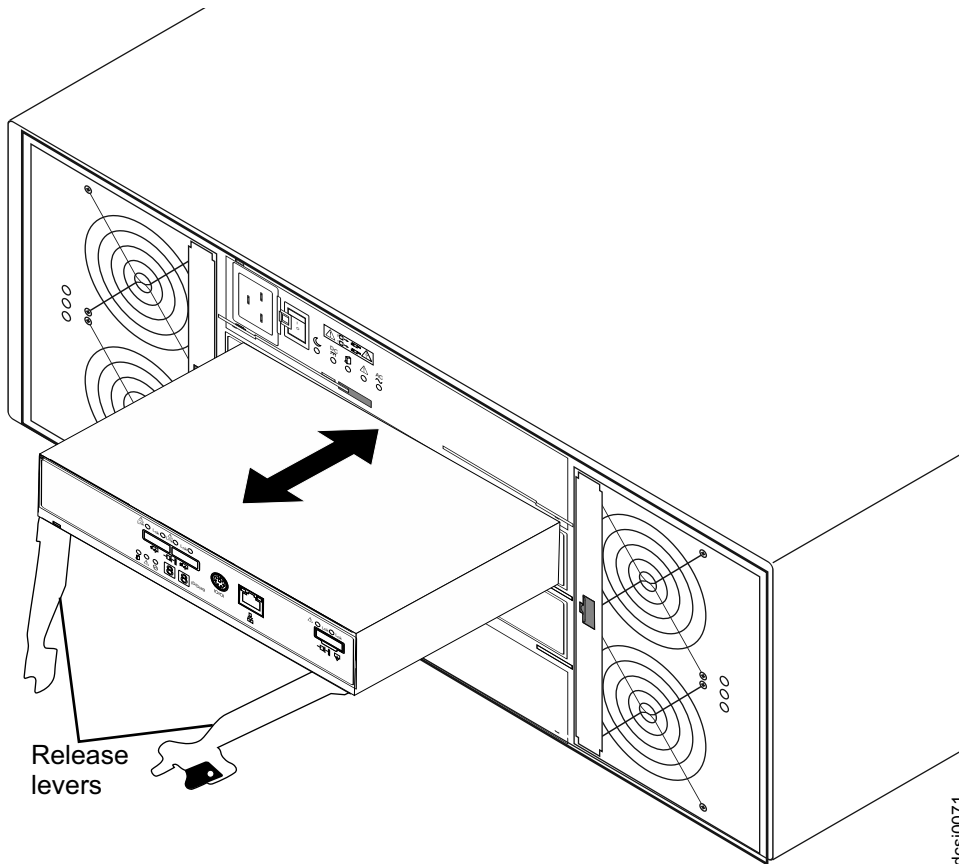


Figure 56. Removing an environmental service module

3. Slide the ESM out of the bay and set it aside.
4. Ensure that the release levers on the ESM are in the open position.
5. Slide the ESM into the bay until it stops.
6. Close the release levers.
7. Connect the SAS cables to the ESM.
8. Turn on the power.
9. 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

Before you begin, ensure that you wear an anti-static wrist strap.

Complete the following steps 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.

CAUTION:

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.

Attention: 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 57) by pressing on the locking tab holding the fan assembly handle in place; then, pull the fan assembly handle toward you.

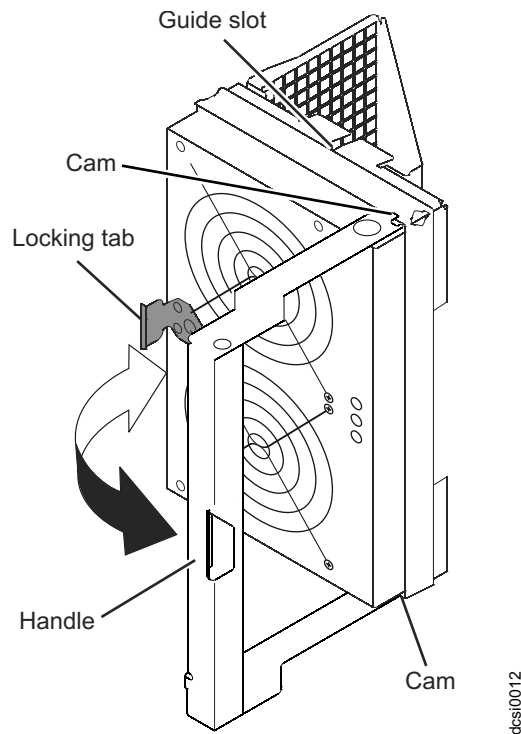


Figure 57. Removing a fan assembly

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

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 DCS3860 with Gen2 Controllers 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. Ensure 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

Before you begin, ensure that you wear an anti-static wrist strap.

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 92 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 anti-static 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 system. 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. If power is not applied to the storage expansion enclosure, go to step 3.
 - c. Open the script window and run the following SMcli script command:
**set enclosure [enclosureID] drawer [drawerID]
serviceAllowedIndicator=on;**

Where:

- **[enclosureID]** is the identifier of the storage expansion enclosure that contains the replaced drive drawer. Drive enclosure ID values are 0 to 99.
- **[drawerID]** is the identifier of the replaced drive drawer. Drawer ID values are 1 to 5.

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 106 for the steps to remove the bezel.
3. 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 enclosure, remove the right fan assembly. See “Replacing a fan assembly” on page 108 for the steps to remove a fan assembly. Figure 58 on page 111 indicates 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.

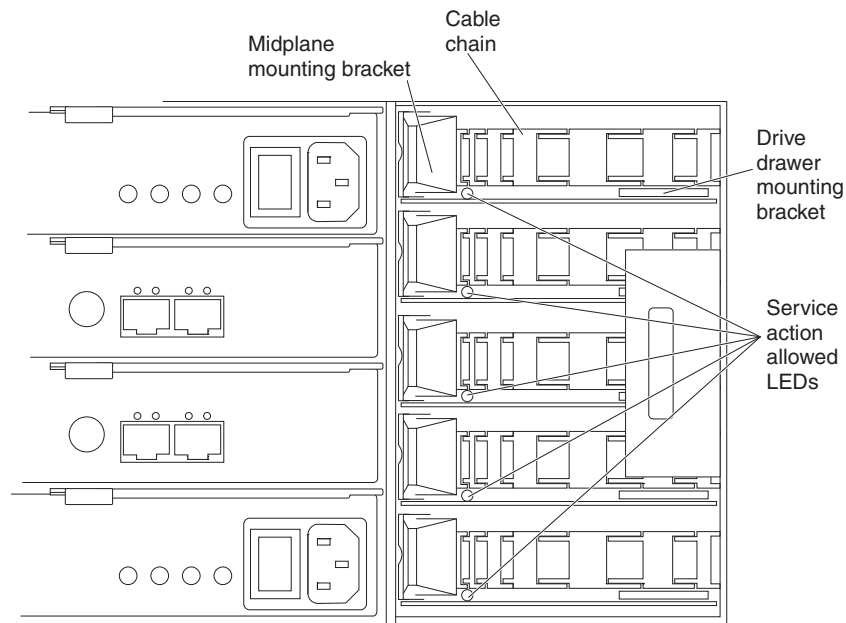


Figure 58. Rear view of the storage expansion enclosure with the right fan assembly removed

Note:

- 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 110, 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. Hold the orange handle (see Figure 59 on page 112), and pull the mounting bracket completely out of the storage expansion enclosure. If necessary, use a flashlight to see the orange handle.

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).

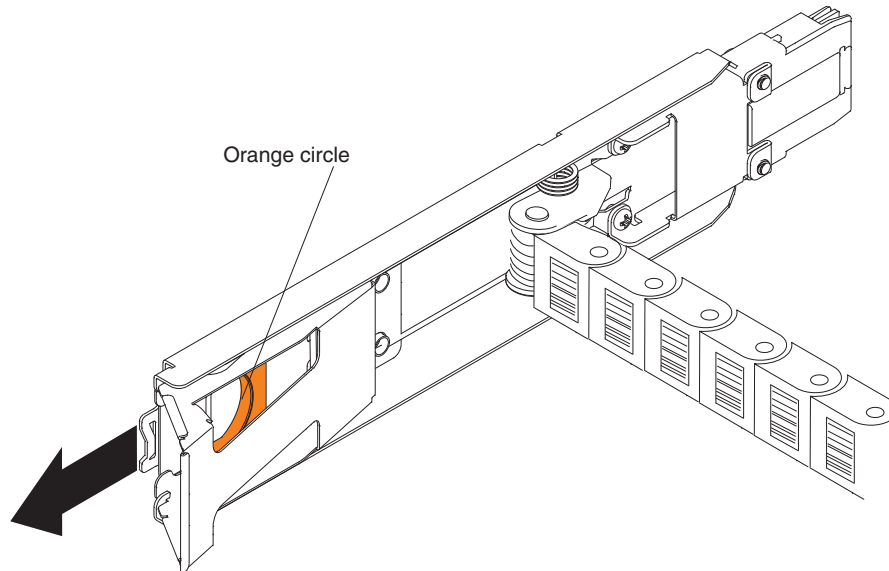


Figure 59. Vertical mounting bracket that connects to the midplane

- d. Disconnect the right cable chain mounting bracket from the drive drawer. Hold the orange handle (see Figure 60), and pull the mounting bracket completely out of the drive enclosure. Remove the right cable chain.

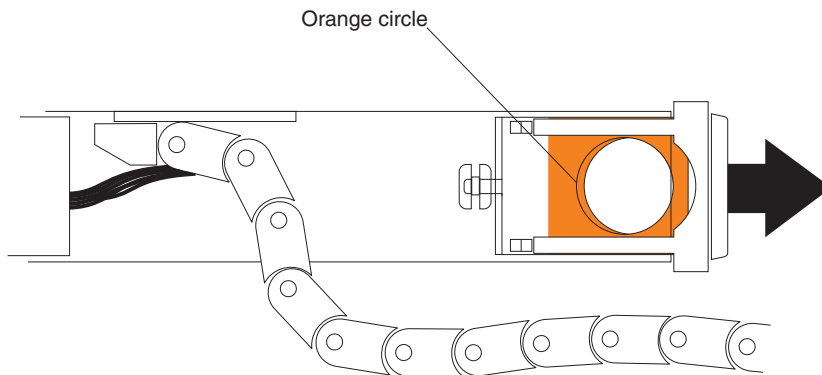


Figure 60. Horizontal mounting bracket that connects to the drive drawer

- 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 108 for the steps to install a fan assembly.
- f. Remove the left fan assembly. See “Replacing a fan assembly” on page 108 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. Hold the orange handle and pull the mounting bracket completely out of the storage expansion enclosure.

- h. Disconnect the left cable chain mounting bracket from the drive drawer. Hold the orange handle 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 108 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.

4. 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 92 for the steps to remove a DDM.
 - d. Slide the drive drawer release lever (see Figure 61) on both sides of the drive drawer toward you, and remove the drive drawer from the enclosure.

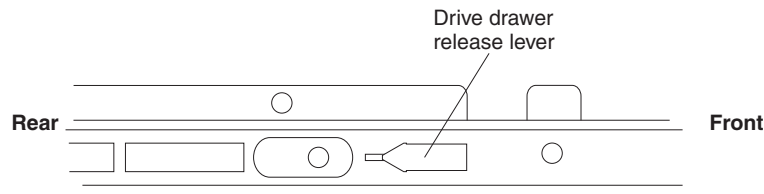


Figure 61. Drive drawer release lever on the side of the drive drawer

5. 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 62 on page 114 indicates the location of the lock-out tumbler as shown from the front of the enclosure.

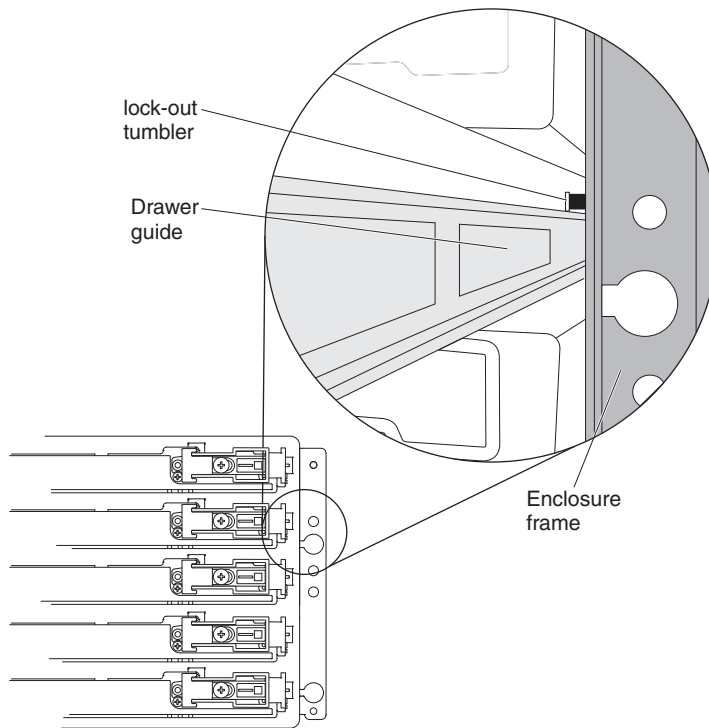


Figure 62. Lock-out tumbler located above the drawer guide

- b. Push the drive drawer all the way in until the latch fully engages.
 6. 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 108 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 disk drawer 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 108 for the steps to install a fan assembly.
 - e. Remove the right fan assembly. See “Replacing a fan assembly” on page 108 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. Use a flashlight, if necessary, so that you can see the connector on the mounting bracket connect to the midplane connector.
 - h. Connect the right cable chain mounting bracket to the midplane.
 - i. Reinstall the right fan assembly.
 7. 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 IBM DS Storage Manager Physical View before inserting the next drive. If you do not wait until the drive is recognized by the IBM 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 IBM DS Storage Manager. See “Installing hot-swap hard disk drives” on page 92 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.
8. Install the bezel on the front of the storage expansion enclosure. See “Replacing the bezel” on page 106 for the steps to install the bezel.
9. Remove the anti-static protection.
10. 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 11
11. 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 DCS3860 with Gen2 Controllers storage system, and run 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 enclosure 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.
12. Use the IBM DS Storage Manager to verify that the new drive drawer is operating correctly.

Replacing an enclosure chassis

The replacement chassis package includes a RID tag and a power supply module. You can either ship this power supply module or your existing power supply module back to IBM along with the old enclosure chassis.

Before you begin, ensure that you wear an anti-static wrist strap.

Complete the following steps to replace the enclosure chassis.

1. Schedule downtime for the storage system configuration, and:
 - a. Stop all applications in the servers, and either unmount or remove the drive letters of the mapped LUNs from the storage system.
 - b. Use the IBM DS Storage Manager to collect support data of the system. Save this information in a location other than the mapped LUNs from the storage system.

- c. Power off the DCS3860 with Gen2 Controllers enclosure with the controllers CRUs/FRU first. Then, power off the drive expansion enclosures.
2. Remove the bezel of the DCS3860 with Gen2 Controllers enclosure with the enclosure chassis you want to replace.
3. Label the drive drawers of the enclosure.
4. Label and remove the fan assembly modules.
 - a. At the rear of the storage expansion enclosure, remove the fan assembly (see Figure 63) by pressing on the locking tab holding the fan assembly handle in place; then, pull the fan assembly towards you.

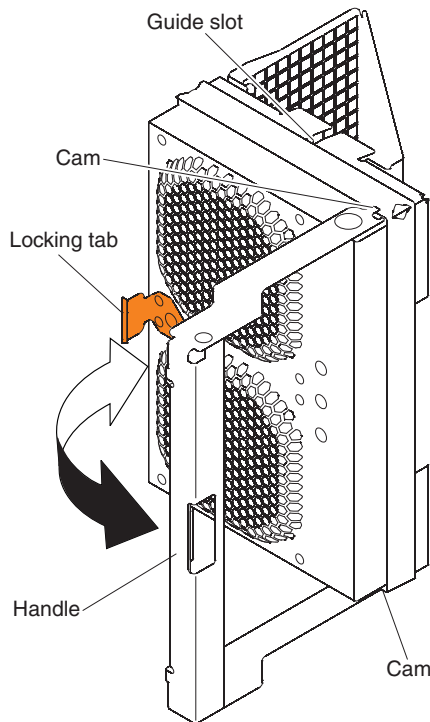


Figure 63. Removing a fan assembly

- b. Use the fan assembly handle to pull the fan assembly out of the enclosure.
5. Unplug the power cord, label the power supply modules, remove them by pulling outward the latches together, and pull the levers open to release the power supply from the enclosure. Then, slowly pull the levers to slide the power supply out of the power supply bay. The latches are the orange colored tabs on the levers.
6. Label all connections to the controller or ESM modules, disconnect all connections, and squeeze to remove the controller or ESM modules.
7. Remove the five sets of cable chains that connect the disk drawers to the midplane in the DCS3860 with Gen2 Controllers enclosure. Complete the following steps to remove each set of cable chains:

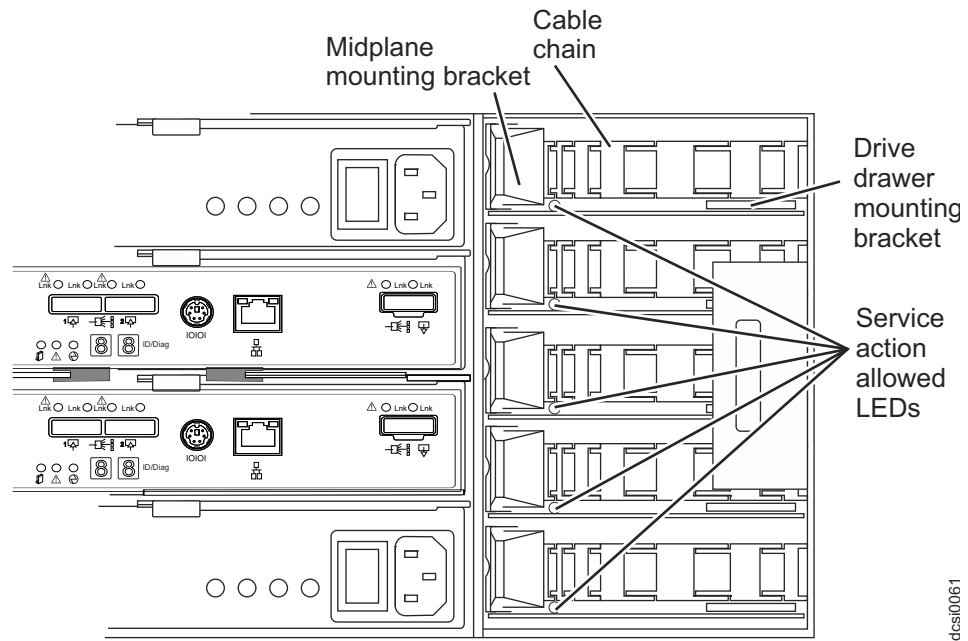


Figure 64. Rear view of the storage expansion enclosure with the right fan assembly removed

Note: Each cable chain has a vertical mounting bracket that connects to the midplane and a horizontal mounting bracket that connects to the drive drawer. Also, the left and right cable chains are not interchangeable.

- a. Disconnect the right cable chain mounting bracket from the midplane. Hold the orange handle (See Figure 65 on page 118) and pull the mounting bracket out of the storage expansion enclosure. If necessary, use a flashlight to locate the orange circle.

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

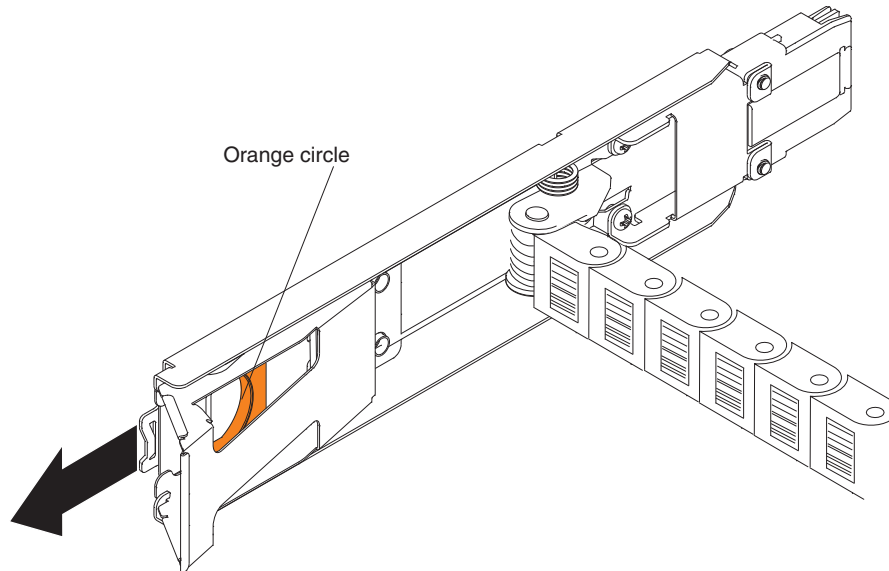


Figure 65. Vertical mounting bracket that connects to the midplane

- b. Disconnect the right cable chain mounting bracket from the drive drawer. Hold the orange handle (See Figure 66), and pull the mounting bracket out of the drive enclosure.

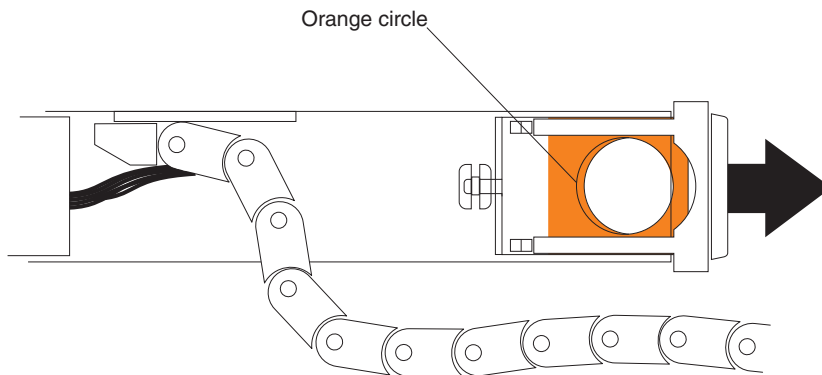


Figure 66. Horizontal mounting bracket that connects to the drive drawer

- c. Disconnect the left cable chain mounting bracket from the midplane. Hold the orange handle and pull the mounting bracket out of the storage expansion enclosure.
 - d. Disconnect the left cable chain mounting bracket from the drive drawer. Hold the orange handle and pull the mounting bracket out of the storage expansion enclosure.
8. Remove the drive drawers by completing the following steps.

CAUTION:

Hold disk drawers with both hands on each side between the second and third row of drives. Place the removed disk drawer on a flat and static-free surface. Do not stack disk drawers or hold the disk drawer such that it would to bend. The disk drawers fully loaded with 3.5" drives might be heavy for one person, so we recommend that more than one personnel should move the disk drawer. Do not use excessive force while removing the boards. You might damage the disk drawer or the disk drawer guides.

- a. Release the levers on each side of the drawer by pulling both levers towards the center. 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. Slide the drive drawer release lever (see Figure 67) on both sides of the drive drawer toward you, and remove the drive drawer from the enclosure.

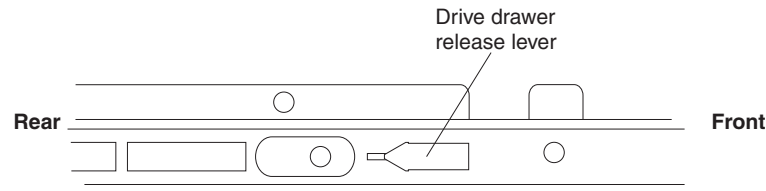


Figure 67. Drive drawer release lever on the side of the drive drawer

Important: To remove second to fifth disk drawers, you have to lift the lockout tumblers on the right side of the enclosure. The tumblers prevent more than one disk drive drawer from being pulled out simultaneously.

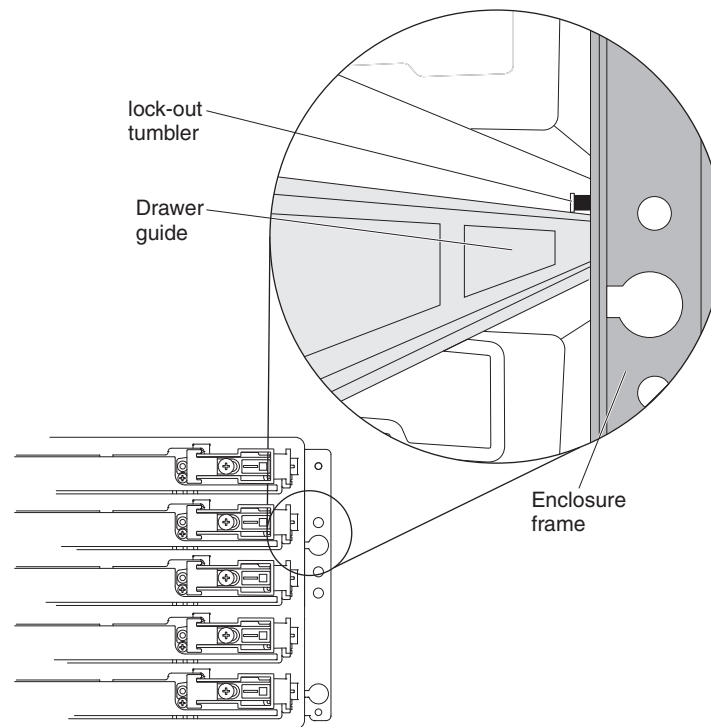
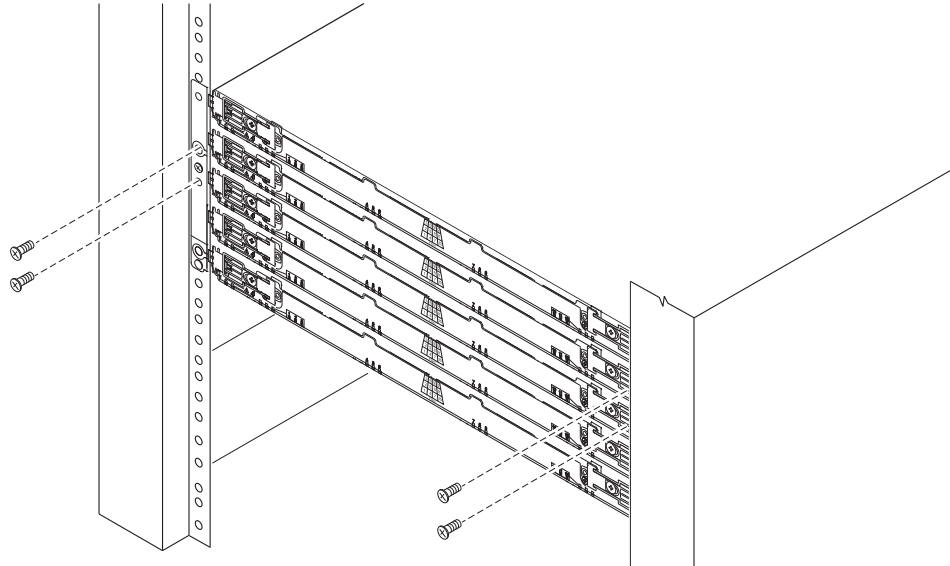


Figure 68. Lock-out tumbler located above the drawer guide

9. Loosen the thumbscrews that attach the rear brackets to the enclosure (one on each side of the enclosure).
10. On the front of the enclosure, remove the four M5 screws that attach it to the chassis (two screws on each side).



11. Remove the empty enclosure from the rack.

CAUTION:
You would need more than one personnel.
12. Insert the new enclosure into the rack.
13. Secure the new enclosure in the rack by tightening the four M5 screws in the front of the chassis and the two thumbscrews on the rear brackets.
14. Insert the disk drawers into the enclosure one by one by completing the following steps. Ensure that the correct disk drawer is inserted in the disk drawer slots. Caution: Hold the disk drawer with both hands between the second and third row of the drives on either side. Ensure that you do not bend the disk drawer board or scrape it with other objects.
 - 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 68 on page 119 indicates the location of the lock-out tumbler as shown from the front of the enclosure.
 - b. Push the drive drawer all the way in until the latch fully engages.
15. Connect the cable chains to the disk drawers and the midplane by completing the following steps.
 - a. 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 disk drawer connector.
 - b. Connect the left cable chain mounting bracket to the midplane connector.
 - c. Connect the right cable chain mounting bracket to the drive drawer.
 - d. Connect the right cable chain mounting bracket to the midplane connector.
16. Install the right and left fan modules.
17. Install the ESMs (or Controllers) modules and reconnect all of the connections.
18. Install the power supply modules and connect the power cords to the power supply modules.
19. Install the bezel.
20. Power on the drive expansion enclosures. Wait for five minutes and then turn on the controller enclosure.

21. Use the DS Storage Manager to verify that system and the new enclosure are operated optimally. Use the Recovery Guru for guidance to fix any problems. Contact IBM Support if the problem persists.
22. Fill-out the RID tag and attach it to the new enclosure.
23. Pack the old chassis and the power supply module for shipping back to IBM.

Chapter 6. Hardware maintenance

This section contains information to help you solve some of the simpler problems that you might have with your storage system. 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 system and other IBM products, see “Getting information, help, and service” on page xvi.

General checkout

Use the indicator lights, the diagnostics and test information, the symptom-to-FRU index, and the connected server HMM to diagnose problems.

Solving problems

This section contains information to help you solve some of the problems you might have with your DCS3860 with Gen2 Controllers storage system or EXP3800/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 IBM DS Storage Manager to diagnose storage system 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 IBM DS Storage Manager Recovery Guru in the Subsystem Management window. Do not depend solely on this table for a FRU replacement decision.

Troubleshooting problems in the DCS3860 with Gen2 Controllers storage system

Table 22. 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 77 for more information.
		Drive uncertified	Verify the drive and part number to ensure that it is supported by the DCS3860 with Gen2 Controllers. See http://www.ibm.com/systems/storage/disk
	storage controller (service action required LED)	controller failure	Replace the controller. See "Replacing components" on page 77 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 77 for more information.
	Front bezel (system error LED)	General machine fault	A fault LED is lit somewhere on the storage system (check for amber LEDs on components).
		General machine fault (continued)	<p>Open the Subsystem Management window and click Recovery Guru to see problems in the DCS3860 with Gen2 Controllers 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>

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
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	<p>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.</p> <p>If all Fibre Channel connections failed, suspect failure of the Fibre Channel host daughter card.</p>
		SAS connection	<p>Check the SAS connection to verify that the CRUs are properly installed.</p> <p>If the SAS port LED is off, suspect failure of the SAS host daughter card.</p>
		iSCSI connection	<p>Check the iSCSI connection to verify that the CRUs are properly installed.</p> <p>If the iSCSI port LED is off, check the Ethernet cable or verify the link speed.</p> <p>If all the iSCSI port LEDs are off, suspect failure of the iSCSI host daughter card.</p>
		One of the drive drawers is not fully closed	<p>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.</p> <p>Check all drive drawers in the enclosure to ensure they are fully closed.</p>
	Battery fault	Battery unit failure	Verify the failure using the Storage Manager Client and replace the failed battery.
ESM	Board failure	Replace the failed ESM. See "Replacing components" on page 77 for more information.	

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
Amber LED is lit and green LED is off	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 ensure 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 77 for more information.
	Fan assembly	Fan failure	Replace the fan assembly.
	Drive	Drive not certified	Verify the drive and part number to ensure the drive is supported by the DCS3860 with Gen2 Controllers. See http://www.ibm.com/systems/storage/disk
		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"> • storage enclosures are not correctly connected to the DCS3860 with Gen2 Controllers. • DCS3860 with Gen2 Controllers does not have the correct firmware version. 	

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
All green LEDs are off	All components	system power is off	Ensure that all storage system power cables are connected and that the power-supply switches are on. If applicable, ensure 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.

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
One or more green LEDs are off	Power supplies	Power cable is disconnected or switches are turned off	Ensure 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 DCS3860 with Gen2 Controllers was not powered-on, or all SAS cable connections between the storage enclosures and the DCS3860 with Gen2 Controllers storage system failed.	Perform one of the following actions: <ul style="list-style-type: none"> • Power-on the storage system. • Ensure that the SAS cable connections between the storage enclosures and the DCS3860 with Gen2 Controllers storage system are made.
	Front panel	Power supply problem	Ensure 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 DCS3860 with Gen2 Controllers. Contact your IBM technical-support representative.
The EXP3800/DCS3700 expansion enclosure is connected to unsupported storage system		Verify that the expansion enclosure is connected to a supported storage system. See http://www.ibm.com/systems/storage/disk	
Green LED is flashing slowly (once every 2 seconds)	Drives	The DCS3860 with Gen2 Controllers was not powered-on, or all SAS connections between the storage enclosures and the DCS3860 with Gen2 Controllers storage system have failed.	Perform one of the following actions: <ul style="list-style-type: none"> • Power-on the storage system. • Ensure that the SAS connections between the storage enclosures and the DCS3860 with Gen2 Controllers storage system are made. • Ensure that all the storage enclosures in the same channel pair have the same enclosure speed setting.

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
Intermittent or sporadic power loss to the storage system	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 DCS3860 with Gen2 Controllers. Contact your IBM technical-support representative.
Unable to access drives	Drives	Incorrect storage system ID settings	Ensure that the SAS cables are undamaged and correctly connected. Check the storage system 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	<ol style="list-style-type: none"> 1. Ensure that the SAS cables are undamaged and correctly connected. 2. Replace the SAS cables.
		ESM failure	Contact your IBM technical support representative.
Random errors	system	Midplane failure	Replace the DCS3860 with Gen2 Controllers. Contact your IBM technical-support representative.

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
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 77 for more information.
		Midplane failure	Replace the DCS3860 with Gen2 Controllers. 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 77 for more information.
		Incorrect firmware version	Ensure that the DCS3860 with Gen2 Controllers has the correct firmware version.
		In a dual-controller storage system, 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 77 for more information.
Storage enclosure is not detected	Storage system	Storage enclosure is not supported	Verify that the storage enclosure is supported by the DCS3860 with Gen2 Controllers storage system.
		SAS cable failed	Replace the SAS cable.

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
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 system.
		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 system.
	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 IBM DS 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"> The script command to turn off a drive drawer SAA LED is: set enclosure [enclosureID] drawer [drawerID] serviceAllowedIndicator=off; 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;
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 Subsystem Management window to identify the failure and replace the failed component.

Table 22. Troubleshooting (continued)

Problem indicator	Component	Possible cause	Possible solutions
Link fault amber LED lit	ESM	SAS communication failure	<ol style="list-style-type: none"> 1. Reconnect the SAS cable 2. Replace the SAS cable 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.

Parts listing

The replaceable components that are available for the DCS3860 with Gen2 Controllers storage system and EXP3800 storage enclosure are described in this section.

To check for an updated parts listing on the Web, complete the following steps:

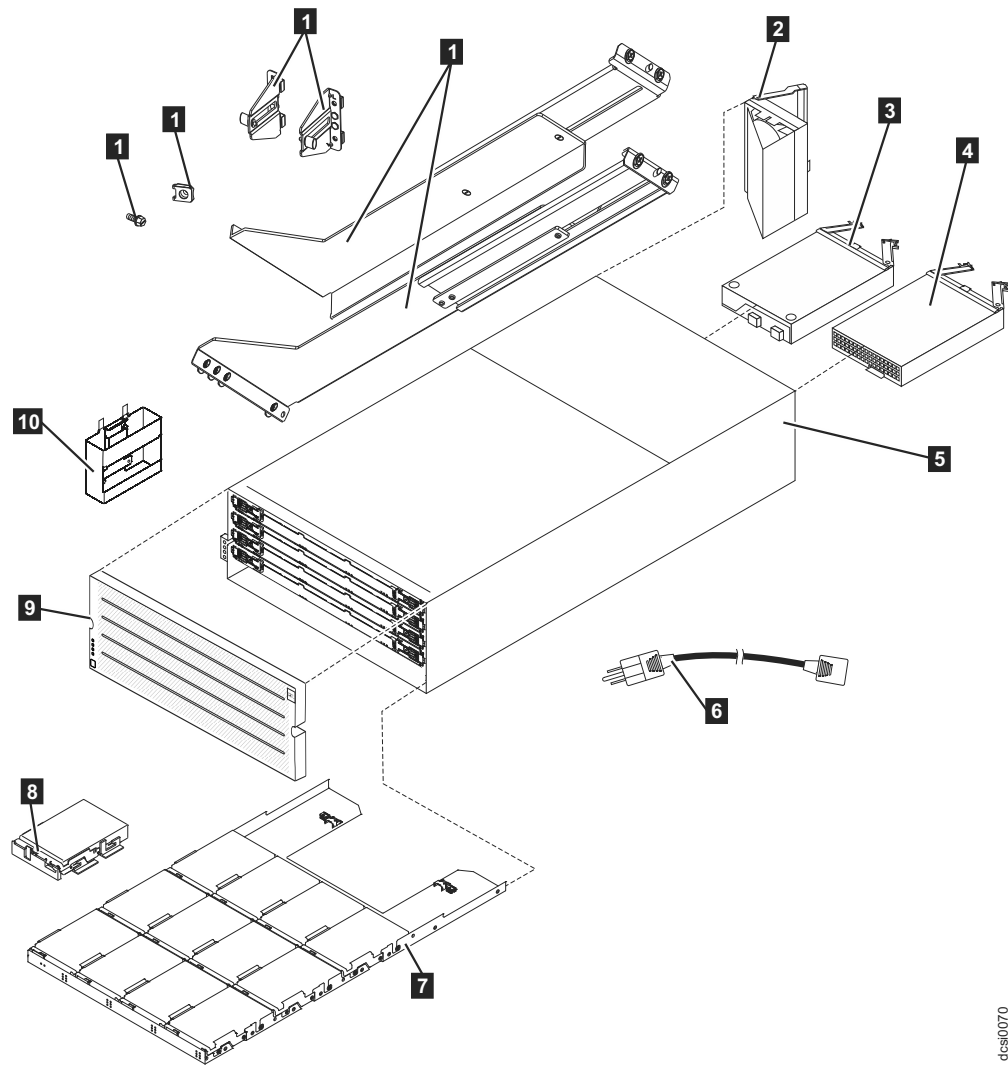
1. Go to <http://www.ibm.com/servers/storage/support/>.
2. On the "Support for System Storage and TotalStorage products" page, under **Select your product**, in the **Product family** field, select **Disk systems**.
3. In the **Product** field, select **IBM System Storage DCS3860 with Gen2 Controllers**.
4. Click **Go**.
5. For documentation updates, click the **Install/Use** tab.

Replaceable components are of three types:

- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.
- **Tier 2 customer replaceable unit:** You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.

For information about the terms of the warranty and getting service and assistance, see the *Warranty Information* document that comes with the storage system and storage enclosure.

Figure 69 on page 133 illustrates parts for the DCS3860 with Gen2 Controllers.



dcs0070

Figure 69. DCS3860 with Gen2 Controllers storage system enclosure parts list

Table 23. Parts listing (DCS3860 with Gen2 Controllers storage system and EXP3800 expansion enclosure).

Index	Description	CRU part number (Tier 1)	CRU part number (Tier 2)	FRU part number
1	Rail kit	59Y5414		
2	Fan assembly	90Y8598		
3	Power supply, 1755 W, AC	00W1526		
4	Controller for iSCSI	38L6707		
	Controller for FC/SAS	38L6706		
	4-Pt 12GB SAS Host Interface Card		38L6837	
	4-Pt 16GB FC/10Gb iSCSI Host Interface Card		38L6831	
	System Memory Cache Battery	69Y2926		
	Serial Cable Adapter	39M5942		

Table 23. Parts listing (DCS3860 with Gen2 Controllers storage system and EXP3800 expansion enclosure) (continued).

Index	Description	CRU part number (Tier 1)	CRU part number (Tier 2)	FRU part number
5	Environmental Service Module (ESM) Card Assembly	90Y8595		
6	Chassis assembly, includes midplane, fan cables, and system LED cable			00Y8790
7	1.5 Meter Mini-SAS to Mini-SAS HD Cable	00D2144		
	3 Meter Mini-SAS to Mini-SAS HD Cable	00D2148		
	1m SAS cable	00RY376		
	3m SAS cable	00RY377		
8	Drive drawer assembly, includes right and left cable chains			46W6806
9	800 GB SSD SAS	46W6981		
	1.6 TB SSD SAS	38L6785		
	4 TB, 6 Gbps 3.5" SAS, 7200 RPM disk drive module	00Y5144		
	6 TB, 6 Gbps 3.5" SAS, 7200 RPM disk drive module	38L6942		
	HDD Carrier Assembly	69Y2773		
10	Bezel	90Y8592		
11	Chassis Handle	59Y5526		

Seven-segment display sequence codes and their causes

If an error occurs during the controller or ESM boot process and the Needs Attention LED is on, the numeric display shows diagnostic information as a sequence of 2-digit diagnostic code. The following figure shows the seven-segment alphanumeric characters.

Numbers	0	1	2	3	4	5	6	7	8	9
7-Segment Font	0	1	2	3	4	5	6	7	8	9

Letters	A	b	C	d	E	F	H	L	n	O	o	P	r	S	U	u
7-Segment Font	A	b	C	d	E	F	H	L	n	0	o	P	r	S	U	u

Similar Letters and Numbers			
Upper-Case Letter "O"	0	0	Number "0"
Upper-Case Letter "S"	5	5	Number "5"
Lower-Case Letter "b"	b	6	Number "6"

Figure 70. Seven-segment alphanumeric characters

The following table lists the sequence category codes and their associated detail codes.

Startup errors and operational states are displayed in sequences. The numeric display not only helps to identify a component failure, but also provides information about the controller state in which the error occurred. The following table lists the different sequences and the corresponding errors.

Table 24. Seven-segment display sequence code definitions.

Category	Category Code	Detail Codes
(Notation is described in Notes at the end of this table)		
Startup Error	SE+	<ul style="list-style-type: none"> SE+ Power-on default df+ Power-on diagnostic fault Sx Power-on validation error
Operational Error	0E+	Lx+ Lockdown codes (See note 3)
Operational State	0S+	<ul style="list-style-type: none"> 0L+ Offline (See note 11.) bb+ Battery backup (operating on batteries) CF+ Component failure (See note 12)

Table 24. Seven-segment display sequence code definitions (continued).

Category	Category Code	Detail Codes
Component Failure	CF+	<ul style="list-style-type: none"> dx+ Processor/Cache DIMM (x = location. See note 6.) Cx+ Cache DIMM (x = location. See note 7.) Px+ Processor DIMM (x = location. See note 8.) Hx+ Host card (x = location) Fx+ Flash drive (x = location) b1+ Base controller card
Diagnostic Failure	dE+	Lx+ Lockdown code (See note 3)
Category Delimiter	dash+	Separator between category-detail code pairs (See notes 4 and 9)
End-Of-Sequence Delimiter	blank-	End-of-sequence indicator (See notes 5 and 10)
<p>Notes:</p> <ol style="list-style-type: none"> xy+ Indicates that the diagnostic LED is lit. xy- Indicates that the diagnostic LED is turned off. Lx+ Lockdown codes (See Table 26 on page 138) dash+ All segments are off except the middle segments and the diagnostic light is on. blank- All segments are off and the diagnostic light is off. dx+ Used when there is a single memory system for processor and data cache. Cx+ Used when there are separate processor and data cache memory systems. Px+ Used when there are separate processor and data cache memory systems. Category-Detail separator is used when there is more than one category-detail pair in the sequence. For examples, see Table 25 End-of-sequence indicator is automatically inserted by hardware at the end of the sequence. Example: SE+ 88+ blank- (repeat) If an enclosure ID is being displayed, this sequence is programmed to display. The controller is then held in reset. The enclosure ID is nominally displayed during normal operation. This operational state is displayed if an internal controller component failure occurs while the controller is online. An additional detail code identifies the failed component as defined for the Component Failure category. This sequence will continue to display even if the controller is later placed offline (held in reset) to service the failed component. 		

Table 25. Repeating sequences on the seven-segment display and corresponding errors

Repeating Sequence	Startup and Operational Error
Controller power-on failure:	
SE+ 88+ blank-	<ul style="list-style-type: none"> Initial phase of normal power-on controller insertion Insertion of a controller while held in reset

Table 25. Repeating sequences on the seven-segment display and corresponding errors (continued)

Repeating Sequence	Startup and Operational Error
Operational failure:	
xy- (static controller enclosure ID)	Normal operation, where xy is the ID of the enclosure
0S+ Sd+ blank-	During start-of-day (SOD) processing that is processing when the controller reaches a fully powered-up state
0S+ 0L+ blank-	Controller is placed in reset while displaying the enclosure ID
0S+ bb+ blank-	Controller is operating on batteries (cache backup)
0S+ 0H+ blank-	The processor temperature exceeds the warning level
Component failure when the controller is operational:	
0S+ CF+ HX+ blank-	The host interface card failed
0S+ CF+ Fx+ blank-	The flash drive failed
Power-on diagnostic failure:	
SE+ dF+ blank-	Failure of a component that is not a field replaceable unit is detected
SE+ dF+ dash+ CF+ dx+ blank-	Failure of a processor DIMM or a cache memory DIMM is detected
SE+ dF+ dash+ CF+ Hx+ blank	Failure of a host interface card is detected
SE+ LC+ dash+ CF+ Fx+ blank-	An incorrect number of cache backup devices are detected
Controller is suspended and no other errors to report:	
0E+ Lu+ blank-	All lockdown conditions, where Lu is the lockdown code as shown in the table of diagnostic codes
Controller is suspended because of component errors:	
0E+ L2+ dash+ CF+ CX+ blank-	Persistent processor or cache DIMM ECC errors are detected
Controller is suspended as a result of persistent cache backup configuration errors:	
0E+ LC+ blank-	During cache restore, the write-protect switch is set
0E+ LC+ dd+ blank-	The memory size is changed with invalid data in the flash drives
Controller is suspended as a result of diagnostic errors:	
dE+ L2+ dash+ CF+ Cx + blank-	A cache memory diagnostic failure is detected
dE+ L3+ dash+ CF+ b1 + blank-	A base controller diagnostic failure is detected
dE+ L3+ dash+ CF+ b2 + blank-	A base controller IOC diagnostic failure is detected

The following tables list the ESM diagnostic codes.

Table 26. 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
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 27. ESM numeric display diagnostic codes.

Value	Description
--	ESM Boot Diagnostic is running
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

Table 27. ESM numeric display diagnostic codes (continued).

Value	Description
J0	Incompatible module

Determining basic information of drive FRUs

IBM might ship drive FRUs of higher capacity than that of the drive FRUs they replace. These new drives are programmed in manufacturing to give the same capacity as the drive FRUs being replaced.

The new drive FRUs have different model IDs than the ones printed on the drive manufacturer label. You can determine the model ID and other information of these drives by referring to one of the following windows of the IBM DS Storage Manager software:

- Properties pane in the Hardware tab of the Subsystem Management window
- Storage System Profile window

You can also use the IBM hologram label to determine the drive capacity and the drive FRU part number. A sample IBM hologram label is shown in the following figure.



Figure 71. An IBM hologram label example

Table 30. Sample information record

Storage system 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.

Chapter 8. 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 72 on page 146 and Figure 73 on page 147) to identify the proper locations for inserting M5 screws when mounting the support rails and DCS3860 with Gen2 Controllers to a rack. The locations for the M5 screws are highlighted in the templates.

The DCS3860 with Gen2 Controllers 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.

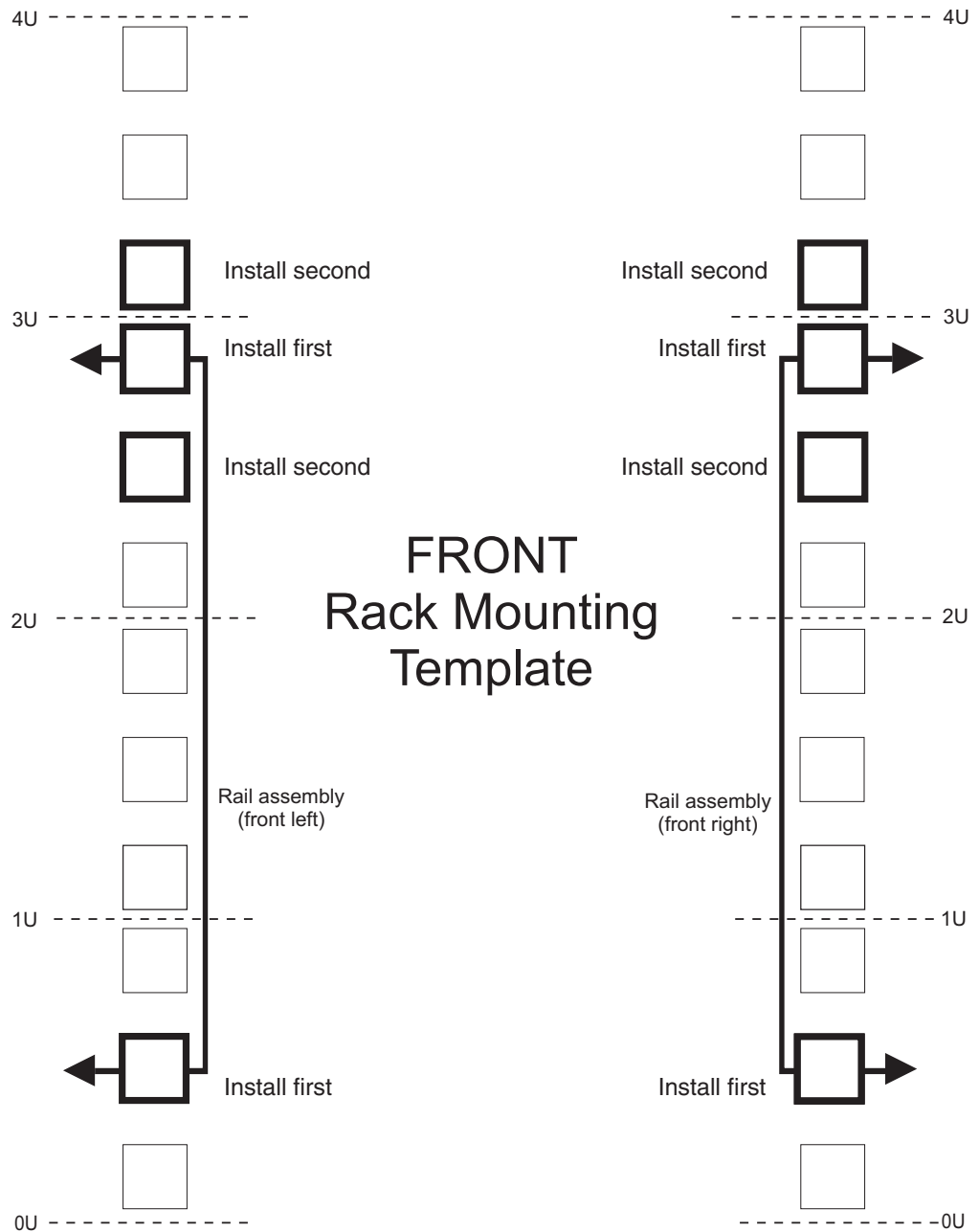


Figure 72. Front rack mounting template

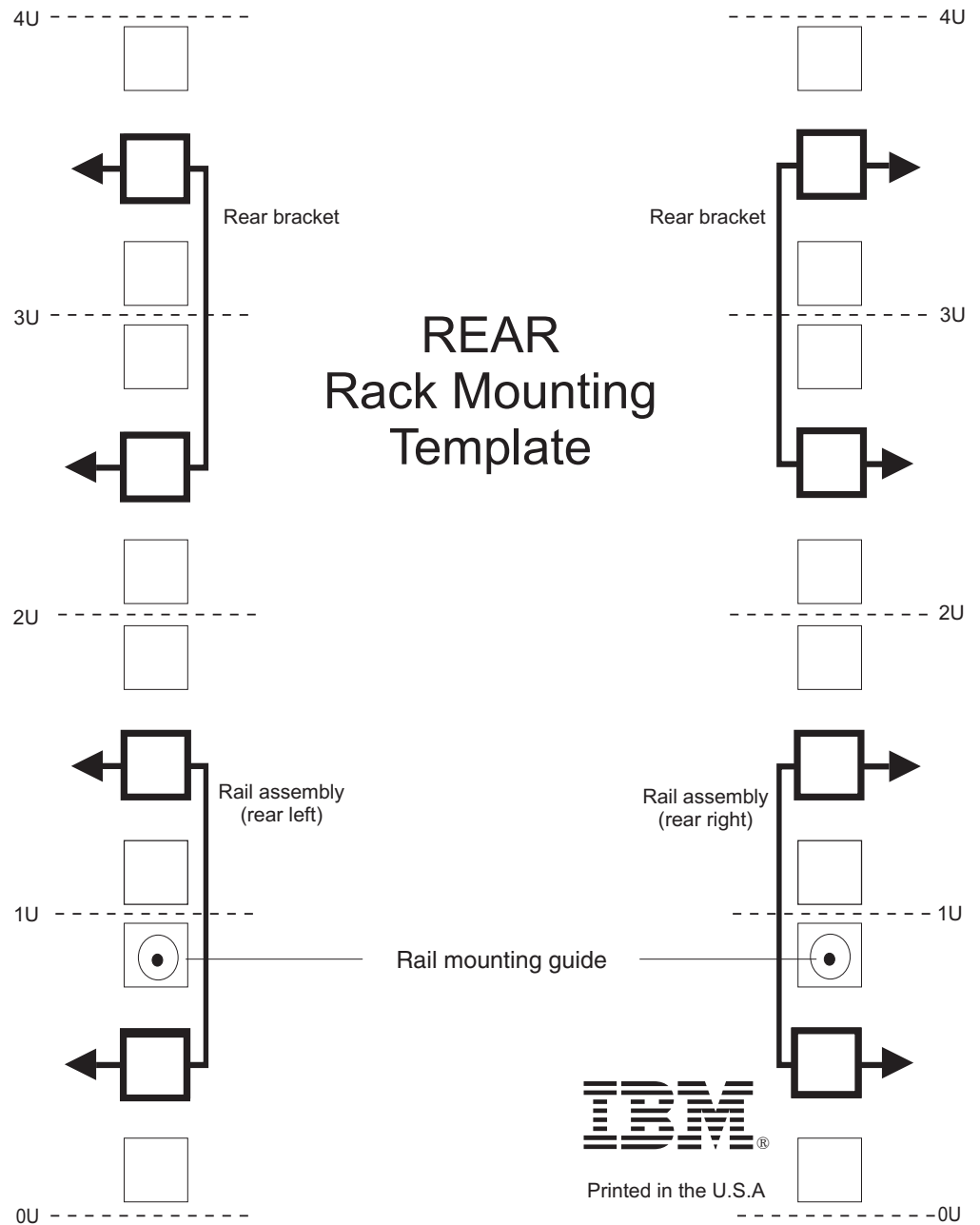


Figure 73. Rear rack mounting template

Chapter 9. Specifications for non-IBM rack installation

The following instructions provide safety requirements and rack specifications for installing the DCS3860 with Gen2 Controllers storage system and EXP3800/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.

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 DCS3860 with Gen2 Controllers storage system or EXP3800/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).

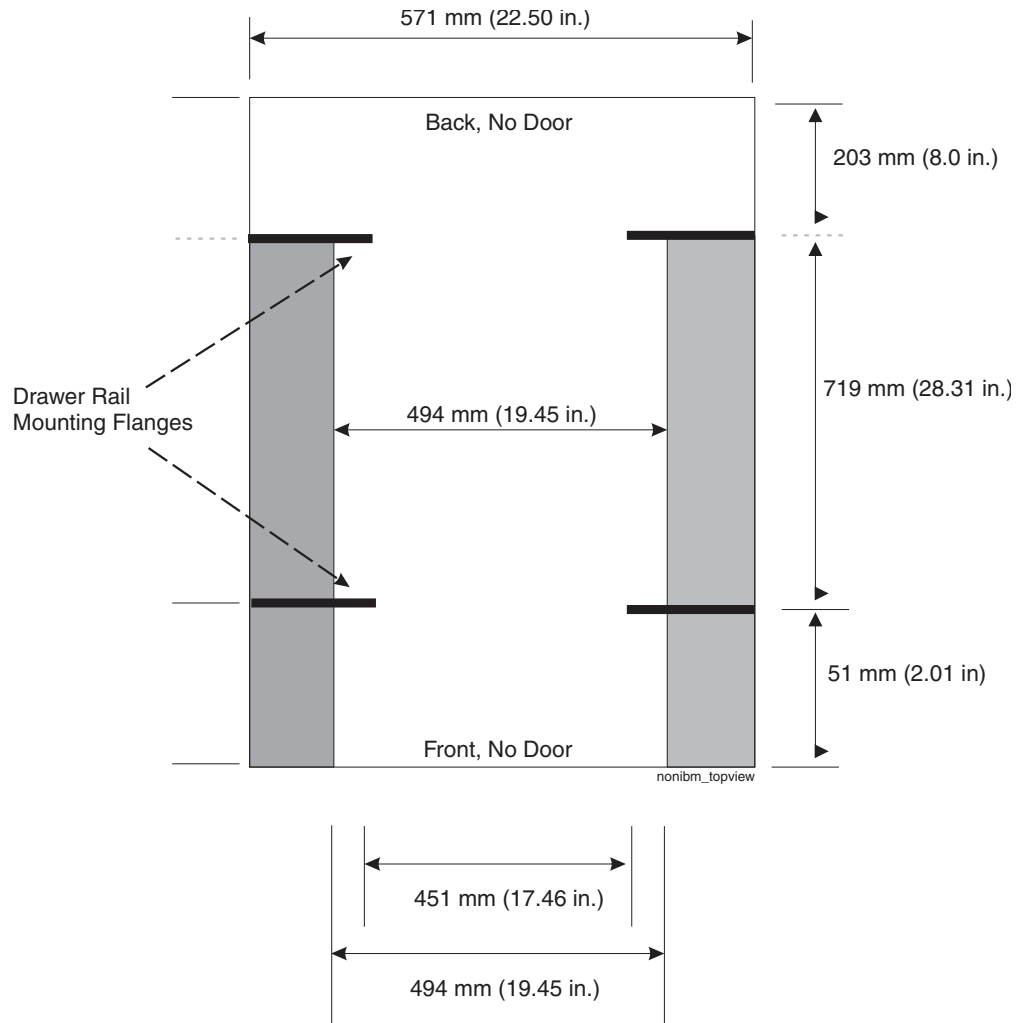


Figure 74. Top View of non-IBM Rack Specifications Dimensions

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 74).

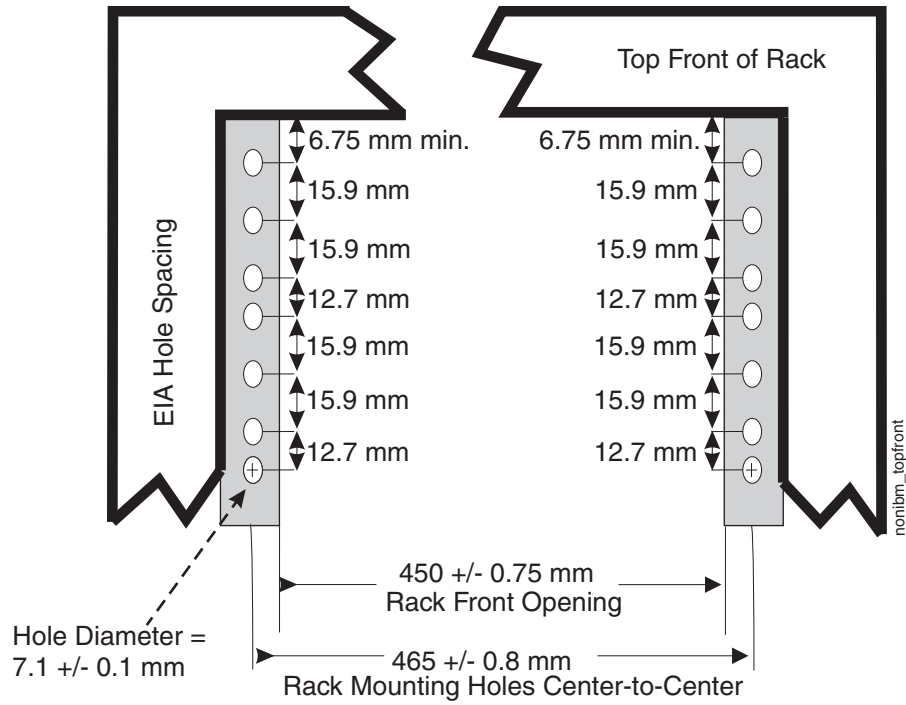


Figure 75. Rack specifications dimensions, top front view

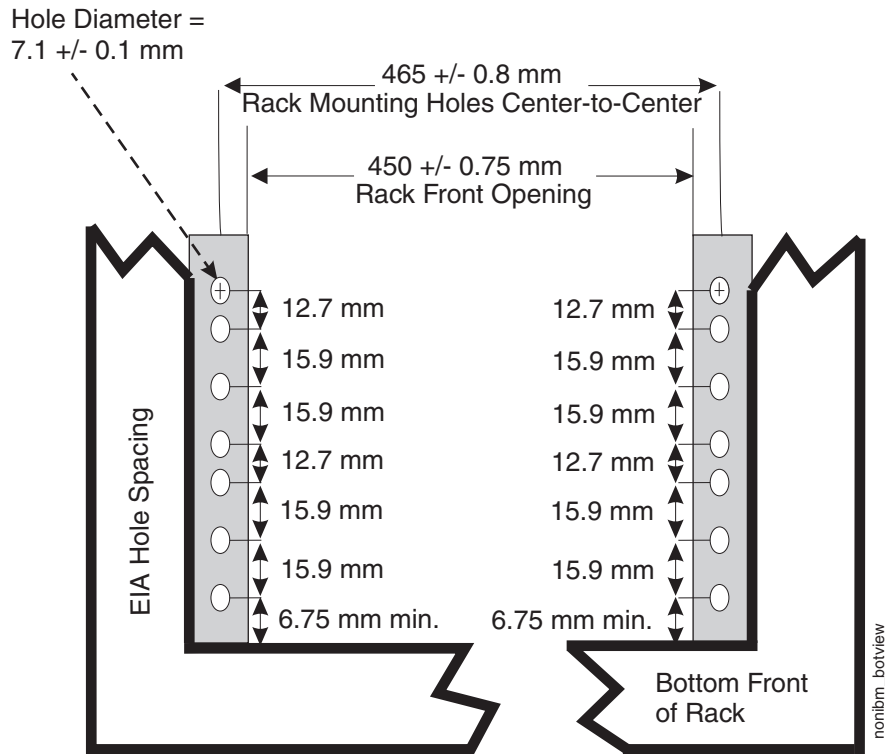


Figure 76. Rack specifications dimensions, bottom front view

2. When installing the EXP3800/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 DCS3860 with Gen2 Controllers 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 supported 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 74 on page 152).

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.

Chapter 10. 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 DCS3860 with Gen2 Controllers does not support 90-136V AC sources. It supports 200-240V AC sources only. Ensure that the AC input is appropriate for the DCS3860 with Gen2 Controllers 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 31. IBM power cords

IBM power cord part number	Description	Used in these countries or regions
39M5262	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	2.5m, 15A/250V, C19 to NEMA L6-15P	Canada, Colombia, Mexico, United States
39M5547		India
39M5354		China

Table 31. IBM power cords (continued)

IBM power cord part number	Description	Used in these countries or regions
39M5282	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	2.5m, 16A/250V, C19 to SANS 1661 / SABS 164	Bangladesh, Lesotho, Macau (China S.A.R.), Maldives, Namibia, Nepal, Pakistan, Samoa, South Africa, Sri Lanka, Swaziland, Uganda
39M5294	2.5m, 13A/250V, C19 to BS 1363/A	Abu Dhabi, Bahrain, Botswana, Brunei Darussalam, Channel Islands, Hong Kong (China 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	2.5m, 16A/250V, C19 to CEI 23-16	Chile, Italy, Libyan Arab Jamahiriya
39M5310	2.5m, 16A/250V, C19 to SI 32	Israel
39M5322	2.5m, 16A/250V, C19 to IEC 309 Type 2P+G IP67	Denmark, Liechtenstein, Switzerland
39M5330	2.5m, 15A/250V, C19 to AS/NZS 3112	Australia, Fiji, Kiribati, Nauru, New Zealand, Papua New Guinea
39M5334	2.5m, 15A/250V, C19 to JIS C8303, C8306	Japan
39M5342	2.5m, 20A/250V, C19 to IRAM 2073	Argentina, Paraguay, Uruguay

Table 31. IBM power cords (continued)

IBM power cord part number	Description	Used in these countries or regions
39M5346	2.5m, 15A/250V, C19 to KSC 8305	Korea (Democratic People's Republic of), Korea (Republic of)
39M5535	2.5m, 16A/250V, C19 to IEC 60083/75	Brazil
39M5366	2.5m, 20A/250V, C19 to CNS 10917-3	Taiwan
39M5544	DCS C19-C14 Power cords	Universal
39M5389	DCS C19-C20 Power cords	Universal

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

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.

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

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Particulate contamination

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 32. Limits for particulates and gases

Contaminant	Limits
Particulate	<ul style="list-style-type: none"> The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2¹. 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. The deliquescent relative humidity of the particulate contamination must be more than 60%². The room must be free of conductive contamination such as zinc whiskers.
Gaseous	<ul style="list-style-type: none"> Copper: Class G1 as per ANSI/ISA 71.04-1985³ Silver: Corrosion rate of less than 300 Å in 30 days

¹ 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.

² 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.

³ 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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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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

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Germany Electromagnetic Compatibility Directive

Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

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jeita1

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jeita2

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rusemi

Glossary

This glossary defines the special terms, abbreviations, and acronyms used in this publication and other related publications. If you do not find the term you are looking for, see the IBM Glossary of Computing Terms located at the following Web site:

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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 systems by using existing system memory.

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

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*.

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 system.

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 systems 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 systems 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 systems 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 system 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 system, 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 DCS3860 with Gen2 Controllers 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 Global Copy without the write consistency group option. This is also referred to as 'Enhanced Global 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 *Global Mirroring*, *remote mirroring*, *Metro Mirroring*.

Global Mirroring

Refers to a remote logical drive mirror pair that is set up using Global Copy with the write consistency group option. This is also referred to as "Enhanced Global 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 *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 system settings, connect to the same DCS3860 with Gen2 Controllers storage system at the same time. See also *host*.

host A system that is directly attached to the storage system 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 system. 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 DCS3860 with Gen2 Controllers 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)

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.

A fixed-size portion of a logical volume. A logical partition is the same size as the physical partitions in its array. 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.

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 system 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 Metro Mirror. 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

A test to determine whether the number of ones (or zeros) in an array of binary digits is odd or even.

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 system controller uses to enable an authorized premium feature. The file contains the feature enable identifier of the storage system 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 systems that are maintained on separate media. The Enhanced Remote Mirror Option is a DCS3860 with Gen2 Controllers 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 DCS3860 with Gen2 Controllers 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 systems through the host fibre-channel connection.

SMclient

The DCS3860 with Gen2 Controllers 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 DCS3860 with Gen2 Controllers storage system. SMclient can be used on a host system or on a storage management station.

SMruntime

A Java compiler for the SMclient.

SMutil

The DCS3860 with Gen2 Controllers 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

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 DCS3860 with Gen2 Controllers Storage Manager host software (SMclient) to uniquely identify each managed storage server. The DCS3860 with Gen2 Controllers 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 system. A storage management station does not need to be attached to the storage system through the fibre-channel input/output (I/O) path.
- storage partition**
Storage system 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 DCS3860 with Gen2 Controllers 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*.
- system name**
Device name assigned by the vendor's third-party software.
- TCP** See *Transmission Control Protocol*.
- TCP/IP**
See *Transmission Control Protocol/Internet Protocol*.
- terminate and stay resident program (TSR program)**
A program that installs part of itself as an extension of DOS when it is executed.
- topology**
The physical or logical arrangement of devices on a network. The three fibre-channel topologies are fabric, arbitrated loop, and point-to-point. The default topology for the disk array is arbitrated loop.
- TL_port**
See *translated loop port*.
- transceiver**
A device that is used to transmit and receive data. Transceiver is an abbreviation of transmitter-receiver.
- translated loop port (TL_port)**
A port that connects to a private loop and allows connectivity between the private loop devices and off loop devices (devices not connected to that particular TL_port).
- Transmission Control Protocol (TCP)**
A communication protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packed-switched communication networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.
- Transmission Control Protocol/Internet Protocol (TCP/IP)**
A set of communication protocols that

provide peer-to-peer connectivity functions for both local and wide-area networks.

trap In the Simple Network Management Protocol (SNMP), a message sent by a managed node (agent function) to a management station to report an exception condition.

trap recipient

Receiver of a forwarded Simple Network Management Protocol (SNMP) trap. Specifically, a trap receiver is defined by an Internet Protocol (IP) address and port to which traps are sent. Presumably, the actual recipient is a software application running at the IP address and listening to the port.

TSR program

See *terminate and stay resident program*.

uninterruptible power supply

A source of power from a battery that is installed between a computer system and its power source. The uninterruptible power supply keeps the system running if a commercial power failure occurs, until an orderly shutdown of the system can be performed.

user action events

Actions that the user takes, such as changes in the storage area network (SAN), changed settings, and so on.

worldwide port name (WWPN)

A unique identifier for a switch on local and global networks.

worldwide name (WWN)

A globally unique 64-bit identifier assigned to each fibre channel port.

WORM

See *write-once read-many*.

write-once read many (WORM)

Any type of storage medium to which data can be written only a single time, but can be read from any number of times. After the data is recorded, it cannot be altered.

WWN See *worldwide name*.

zoning

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.

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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