



# AssuredSAN 6004 Series Setup Guide

For firmware release G222

## **Abstract**

This document describes initial hardware setup for AssuredSAN 6004 Series controller enclosures, and is intended for use by storage system administrators familiar with servers and computer networks, network administration, storage system installation and configuration, storage area network management, and relevant protocols.

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Adobe PostScript

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# About this guide

## Overview

This guide provides information about initial hardware setup for the AssuredSAN™ 6004 Series storage enclosure product listed below:

- CNC (Converged Network Controller) controller enclosure: 6844/6854
  - Qualified Fibre Channel SFP option supporting (4/8/16 Gb)
  - Qualified Internet SCSI (10GbE) SFP option
  - Qualified Internet SCSI (1 Gb) Copper RJ-45 SFP option
- HD mini-SAS (12 Gb) controller enclosure: 6544/6554

AssuredSAN 6004 Series provides high-capacity storage enclosures supporting 48 2.5" small form factor (SFF) disks in a 2U chassis and 56 3.5" large form factor (LFF) disks in a 4U chassis. The chassis form factor supports controller enclosures and expansion enclosures. Storage enclosures are equipped with dual I/O modules (IOMs); and they are equipped with either two AC power supply modules or two DC power supply modules. The 6004 Series controller enclosures can optionally be cabled to supported drive enclosures for adding storage.

See the Dot Hill web site for more information about specific storage product models and uses:  
<https://www.dothill.com>.

AssuredSAN 6004 Series enclosures support both traditional linear storage and virtual storage, which uses paged-storage technology. For linear storage, a group of disks with an assigned RAID level is called a *vdisk* or *linear disk group*. For virtual storage, a group of disks with an assigned RAID level is called a *virtual disk group*. This guide uses the term *vdisk* when specifically referring to linear storage, and uses the term *disk group* otherwise.

## AssuredSAN 6004 Series enclosure user interfaces

The 6004 Series enclosures support two versions of the web-based application for configuring, monitoring, and managing the storage system. Both web-based application GUI versions (v3 and v2), and the command-line interface are briefly described:

- Storage Management Console (SMC) is the primary web interface (v3) to manage virtual storage.
- RAIDar is a secondary web interface (v2) to manage linear storage. This legacy interface provides certain functionality that is not available in the primary interface.
- The command-line interface (CLI) enables you to interact with the storage system using command syntax entered via the keyboard or scripting. You can set a CLI preference to use v3 commands to manage virtual storage or v2 commands to manage linear storage.

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**NOTE:** For more information about enclosure user interfaces, see the following:

- AssuredSAN Storage Management Guide or online help  
The guide describes SMC (v3) and RAIDar (v2) GUIs
  - AssuredSAN CLI Reference Guide
- 

## CNC ports used for host connection


AssuredSAN 6844/6854 models use Converged Network Controller (CNC) technology, allowing you to select the desired host interface protocol from the available Fibre Channel (FC) or Internet SCSI (iSCSI) host interface protocols supported by the system. You can use the Command-line Interface (CLI) to set all controller module CNC ports to use one of these host interface protocols:

- 16 Gb FC
- 8 Gb FC
- 4 Gb FC

- 10 GbE iSCSI
- 1 GbE iSCSI

Alternatively, you can use the CLI to set CNC ports to support a combination of host interface protocols. When configuring a combination of host interface protocols, host ports 0 and 1 are set to FC (either both 16 Gbit/s or both 8 Gbit/s), and host ports 2 and 3 must be set to iSCSI (either both 10GbE or both 1 Gbit/s), provided the CNC ports use the qualified SFP connectors and cables required for supporting the selected host interface protocol. See [CNC technology](#) on page 51 and [6844/6854 CNC controller module — rear panel LEDs](#) on page 110 for more information.


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 **TIP:** See the Storage Management Guide for information about configuring CNC ports with host interface protocols of the same type or a combination of types.

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 **IMPORTANT:** AssuredSAN 6844/6854 models ship with CNC ports initially configured for FC. When connecting CNC ports to iSCSI hosts, you must use the CLI (not the SMC orRAIDar) to specify which ports will use iSCSI. It is best to do this before inserting the iSCSI SFPs into the CNC ports (see [Change the CNC port mode](#) on page 71 for instructions).

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## HD mini-SAS ports used for host connection

The AssuredSAN 6544/6554 models provide four high-density mini-SAS (HD mini-SAS) ports per controller module. The HD mini-SAS host interface protocol uses the SFF-8644 external connector interface defined for SAS3.0 to support a link rate of 12 Gbit/s using the qualified connectors and cable options. See [6544/6554 SAS controller module—rear panel LEDs](#) on page 112 for more information.

## Intended audience

This guide is intended for storage system administrators.

## Prerequisites

Prerequisites for installing and using this product include knowledge of:

- Servers and computer networks
- Network administration
- Storage system installation and configuration
- Storage area network (SAN) management and direct attach storage (DAS)
- Fibre Channel (FC), Internet SCSI (iSCSI), Serial Attached SCSI (SAS), and Ethernet protocols

## Related documentation

**Table 1** Related documents

For information about	See
Enhancements, known issues, and late-breaking information not included in product documentation	Release Notes
Overview of product shipkit contents and setup tasks	Getting Started*
Regulatory compliance and safety and disposal information	AssuredSAN Product Regulatory Compliance and Safety*
Using a rackmount bracket kit to install an enclosure into a rack	AssuredSAN Rackmount Bracket Kit Installation* document pertaining to the specific enclosure model
Attaching or removing an enclosure bezel, and servicing the optional air filter	AssuredSAN Enclosure Bezel Kit Installation* document pertaining to the specific enclosure model

**Table 1** Related documents (continued)

For information about	See
Identifying and installing or replacing field-replaceable units (FRUs)	AssuredSAN 6004 Series FRU Installation and Replacement Guide
Obtaining and installing a license to use licensed features	AssuredSAN Obtaining and Installing a License
Using the v3 and v2 web interfaces to configure and manage the product	AssuredSAN Storage Management Guide
Using the command-line interface (CLI) to configure and manage the product	AssuredSAN CLI Reference Guide
Event codes and recommended actions	AssuredSAN Event Descriptions Reference Guide

\* Printed document included in product shipkit.

For additional information, see Dot Hill's Customer Resource Center web site: <https://crc.dothill.com>.

## Document conventions and symbols

**Table 2** Document conventions

Convention	Element
Blue text	Cross-reference links and e-mail addresses
Blue, underlined text	Web site addresses
<b>Bold</b> text	<ul style="list-style-type: none"> <li>Key names</li> <li>Text typed into a GUI element, such as into a box</li> <li>GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes</li> </ul>
<i>Italic</i> text	Text emphasis
Monospace text	<ul style="list-style-type: none"> <li>File and directory names</li> <li>System output</li> <li>Code</li> <li>Text typed at the command-line</li> </ul>
<i>Monospace, italic</i> text	<ul style="list-style-type: none"> <li>Code variables</li> <li>Command-line variables</li> </ul>
<b>Monospace, bold</b> text	Emphasis of file and directory names, system output, code, and text typed at the command-line


---

 **CAUTION:** Indicates that failure to follow directions could result in damage to equipment or data.

---



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 **IMPORTANT:** Provides clarifying information or specific instructions.

---



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**NOTE:** Provides additional information.

---



---

 **TIP:** Provides helpful hints and shortcuts.

---

# 1 Components

## Front panel components

AssuredSAN 6004 Series supports storage enclosures in dual-purpose fashion. For each form factor, the chassis can be configured as either a controller enclosure or an expansion enclosure:

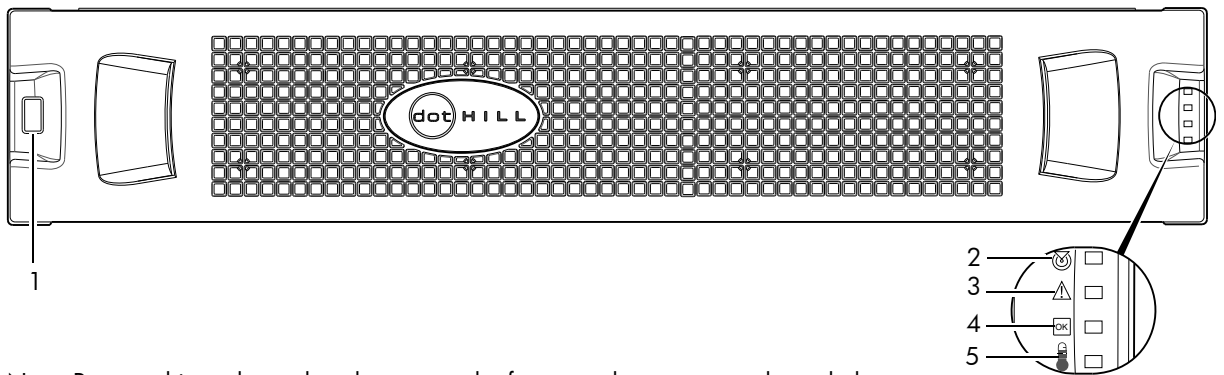
- 2U48 high-capacity chassis—supports 48 2.5" small form factor (SFF) disks (up to 16 disks per drawer) (see [48-drive enclosure front panel components](#) on page 13)
- 4U56 high-capacity chassis—supports 56 3.5" large form factor (LFF) disks (up to 28 disks per drawer) (see [56-drive enclosure front panel components](#) on page 16)

Supported expansion enclosures are used for adding storage (see [Table 4](#) on page 37 and [Table 5](#) on page 38). Enclosures (except for the 2U48—which supports AC PSUs only) are equipped with either two redundant AC or two DC redundant power supply modules (see [Controller enclosure — rear panel layout](#) on page 19).

## 48-drive enclosure front panel components

### 2U48 enclosure bezel installed

When the enclosure is in operation, the bezel should be installed on the front panel as shown in [Figure 1](#). The enclosure bezel is equipped with an EMI (Electromagnetic Interference) shield to provide protection from the product.



Note: Remove this enclosure bezel to access the front panel components shown below.

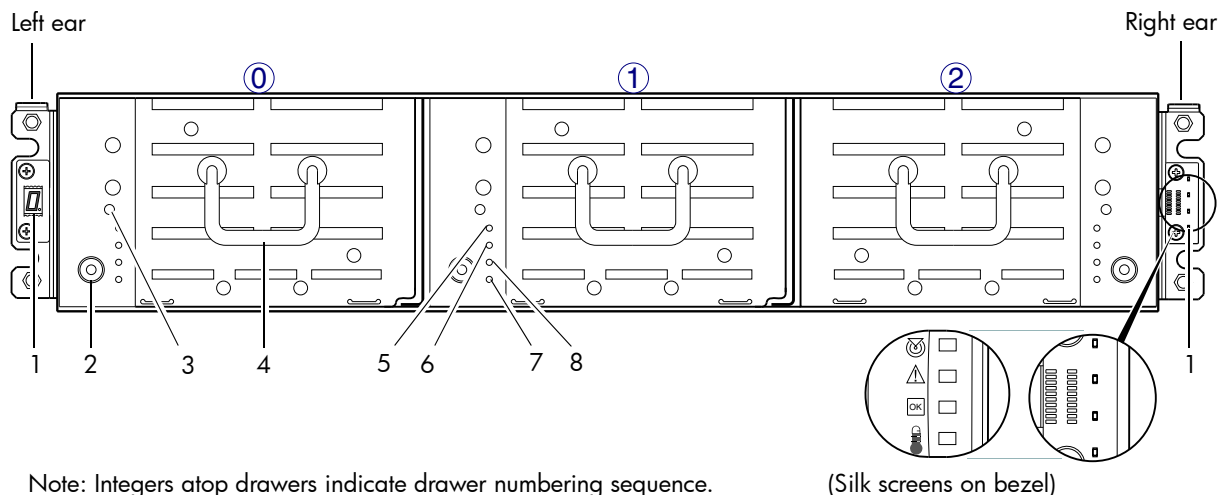
- |  |   |
|--|---|
| 1 Enclosure ID LED                             | 4 Enclosure status LED: FRU OK            |
| 2 Enclosure status LED: Unit Locator           | 5 Enclosure status LED: Temperature Fault |
| 3 Enclosure status LED: Fault/Service Required |   |

**Figure 1** 2U48 enclosure: front panel with bezel installed

**TIP:** See [Enclosure bezel attachment and removal](#) on page 96 and [Figure 75](#) on page 97 (2U48).

## 2U48 enclosure bezel removed

To access the drawers, you must remove the enclosure bezel (shown removed in [Figure 2](#)).



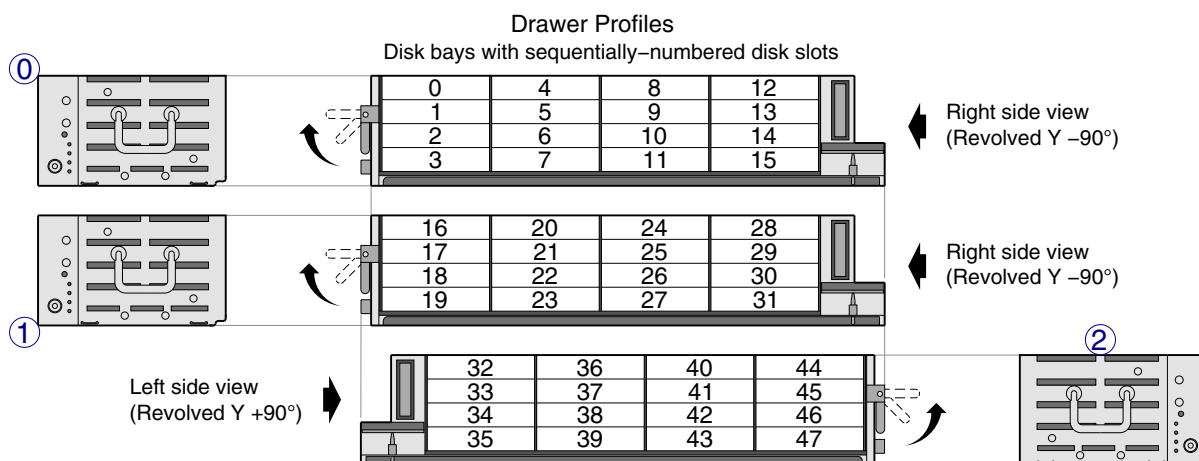
Note: Integers atop drawers indicate drawer numbering sequence.

- |  |   |
|--|---|
| 1 Enclosure ear LEDs (see <a href="#">Figure 1</a> on page 13) | 5 Drawer status LED: FRU OK                 |
| 2 Thumbscrew for securing or accessing drawer                  | 6 Drawer status LED: Fault/Service Required |
| 3 Disabled button (used by engineering only)                   | 7 Drawer status LED: OK to Remove           |
| 4 Drawer handle (shown in stowed position)                     | 8 Drawer status LED: Unit Locator           |

**Figure 2** 2U48 enclosure: front panel with bezel removed

## 2U48 enclosure drawers

You can open the enclosure drawers to access the disks. Drawers 0 and 1 provide access to disk bays from the right side of the drawer; whereas drawer 2 provides access to disk bays from the left side of the drawer. These respective side views—or profiles—are shown below.



**Figure 3** 2U48 enclosure: drawer front and side views with disk slot numbering

Your 2U48 enclosure is shipped with the drawers installed, but they are not populated with disks. Depending on your product configuration, disk bay blanks—also known as Air Management Solution (AMS) inserts—might be installed. Locate the box containing your sledged disks and AMS inserts (if applicable) in preparation for populating the drive slots.

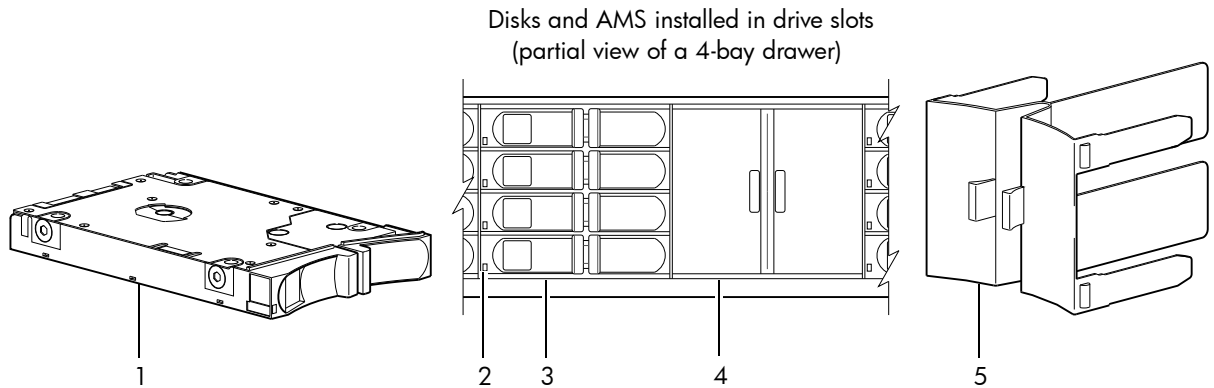
- See [Table 3](#) on page 26 for sequential tasks required for successful enclosure installation.
- See [Populating drawers in 2U48 enclosures](#) on page 27 for instructions on installing disks and AMS inserts.

---

**IMPORTANT:** Disk drive slot numbering is also provided on the label that is laminated to the sheet metal housing (top face) on each drawer. Refer to the drawer label when installing disks into the drawer.

---

Figure 4 below provides a sample partial configuration of disk bays within a drawer. The bay on the left is populated with four disks, whereas the adjacent bay on the right contains an AMS insert to manage air flow within the enclosure to maintain optimal operating temperature.



1 2.5" sledged disk module assembly pictorial<sup>1,2</sup>

2 Disk drive status LED (see [Disk drive LED \(2U48\)](#) on page 102)

3 2.5" disk drive module (installed in 3 of 4 disk bays)

4 Air Management Solution (AMS) insert (installed)<sup>3</sup>

5 AMS insert pictorial<sup>3</sup>

<sup>1</sup>The disk is oriented in the sled such that its PCBA faces upward on the top side of the disk drive module as shown.

<sup>2</sup>Electromagnetic interference protection is provided by the EMI shield within the enclosure bezel.

<sup>3</sup>The AMS insert spans an entire disk bay (4 slots). A single disk slot AMS is also available.

**Figure 4** 2U48 enclosure: sample drawer population

---

**IMPORTANT:** Empty bays will cause overheating. To avoid overheating, install an AMS insert in disk bays that do not contain quantity four disk drive modules.

- Legacy models use the disk bay AMS insert shown above (spans four disk slots).
  - New models use the single disk slot AMS insert (See [Figure 24](#) on page 29).
- 

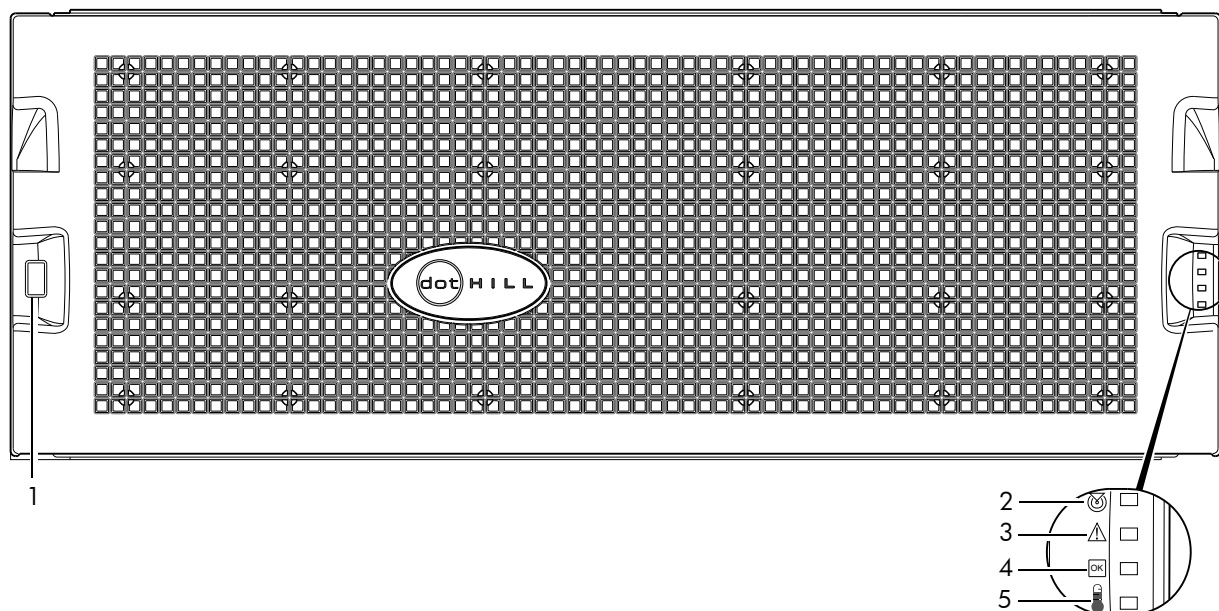
**NOTE:** Front and rear panel LEDs for 6004 Series enclosures are described in [LED descriptions](#).

---

## 56-drive enclosure front panel components

### 4U56 enclosure bezel installed

When the enclosure is in operation, the bezel should be installed on the front panel as shown in [Figure 5](#). The enclosure bezel is equipped with an EMI (Electromagnetic Interference) shield to provide protection from the product. It also provides a serviceable air filter option for NEBS Level 3 compliance.



Note: Remove this enclosure bezel to access the front panel components shown below.

- |  |   |
|--|---|
| 1 Enclosure ID LED                             | 4 Enclosure status LED: FRU OK            |
| 2 Enclosure status LED: Unit Locator           | 5 Enclosure status LED: Temperature Fault |
| 3 Enclosure status LED: Fault/Service Required |   |

**Figure 5** 4U56 enclosure: front panel with bezel installed

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**TIP:** See [Enclosure bezel attachment and removal](#) on page 96 and [Figure 77](#) on page 98 (4U56).

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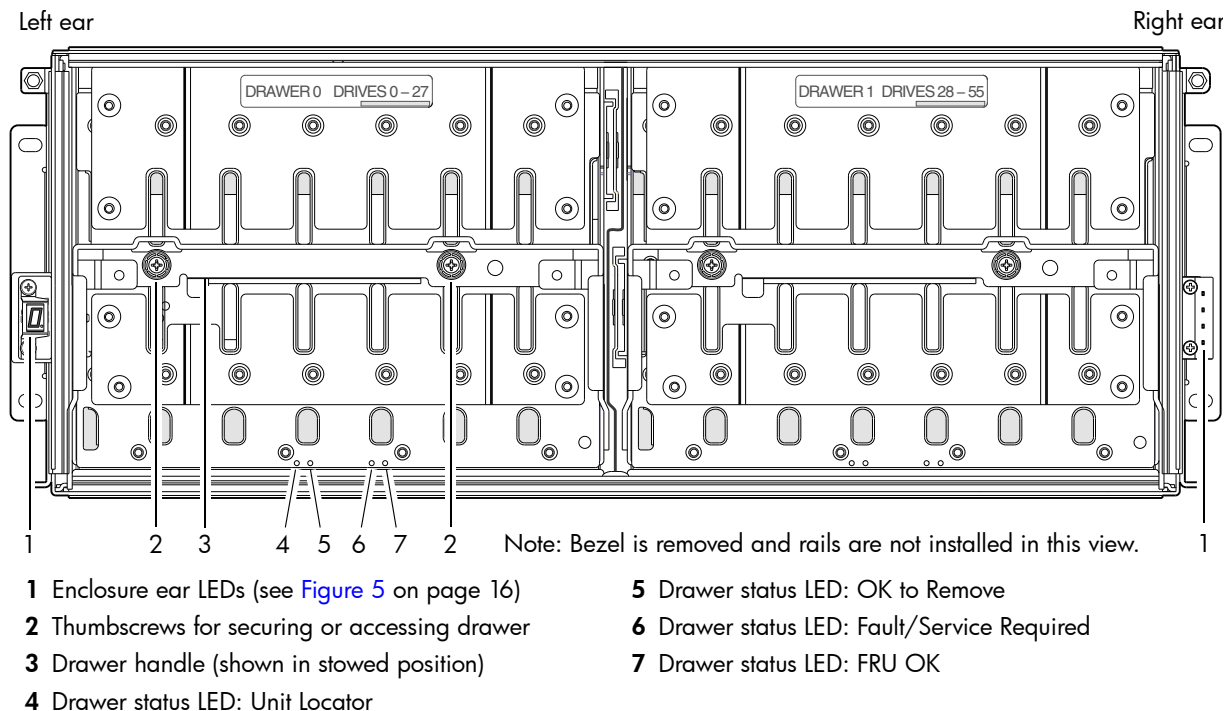
**NOTE:** Front and rear panel LEDs for 6004 Series enclosures are described in [LED descriptions](#).

---



## 4U56 enclosure bezel removed

To access the drawers, you must remove the enclosure bezel (shown removed in [Figure 6](#)).

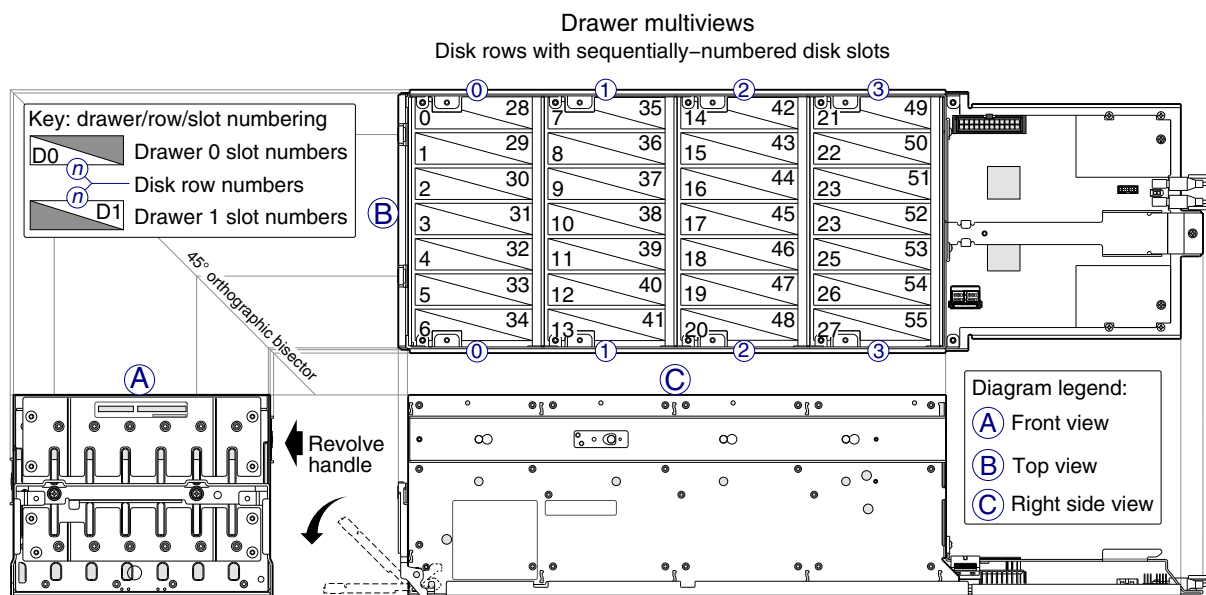


**Figure 6** 4U56 enclosure: front panel with bezel removed

[Figure 6](#) shows the drawer handle in stow (closed and locked) position.

## 4U56 enclosure drawers

You can open the enclosure drawers to access the disks. Drawers 0 and 1 provide access to disks that are oriented vertically—such that the back face of the disk faces down—and is inserted into the drawer disk slots from above. A single drawer diagram is used to describe the numbering scheme.



**Figure 7** 4U56 enclosure: drawer front and side views with disk slot numbering

Your 4U56 enclosure is shipped with the drawers installed, but they are not populated with disks. Although Air Management Solution (AMS) inserts are used with 2U48 enclosures, they are not used by the 4U56 enclosures. Locate the box containing your sledged disks.

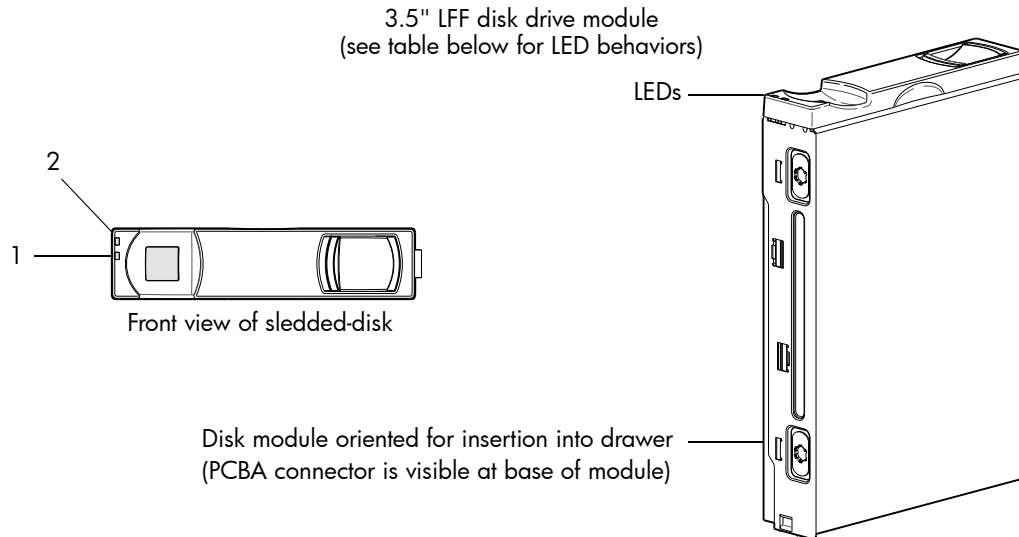
- See [Table 3](#) on page 26 for sequential tasks required for successful enclosure installation.
- See [Populating drawers in 4U56 enclosures](#) on page 31 for instructions on installing disk modules.

---

**IMPORTANT:** Disk drive slot numbering is also provided on the label that is applied to the sheet metal housing (side face) on each drawer. Refer to the drawer label when installing disks into the drawer.

---

Figure 8 below provides two different view orientations of the disk drive module used in 4U56 enclosures.



Electromagnetic interference protection is provided by the EMI shield in the enclosure bezel.

- |   |   |
|---|---|
| <p><b>1</b> 3.5" sledged disk module assembly (front view)</p> <p><b>2</b> Disk drive LEDs (see <a href="#">Disk drive LEDs (4U56)</a> on page 106)</p> | <p><b>3</b> 3.5" disk module aligned for insertion into drawer (AMS inserts are not used in blank disk slots)</p> |
|---|---|

**Figure 8** 4U56 disk drive module

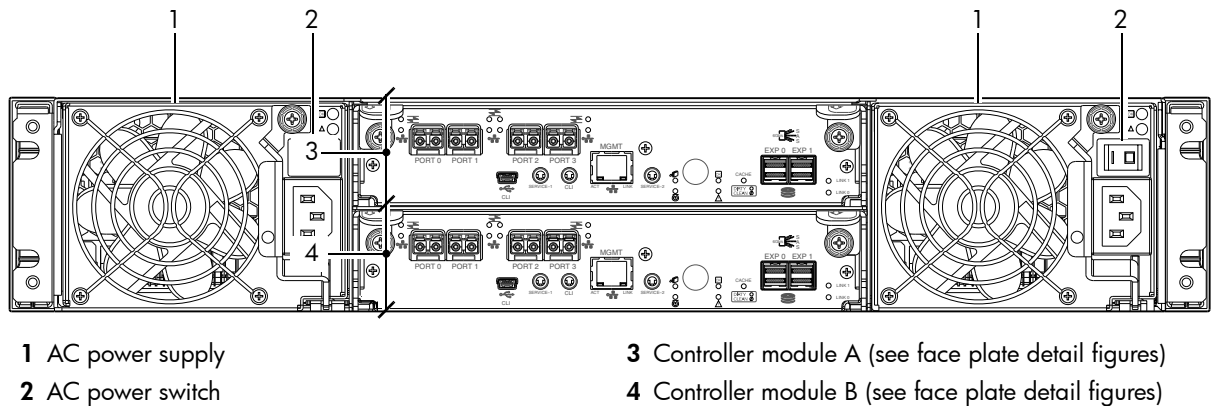
## Disk drives used in 6004 Series enclosures

6004 Series enclosures support LFF/SFF Midline SAS, LFF/SFF Enterprise SAS, and SFF SSD disks. They also support LFF/SFF Midline SAS and LFF/SFF Enterprise self-encrypting disks that work with the Full Disk Encryption (FDE) feature. For information about creating disk groups and adding spares using different disk drive types, see the Storage Management Guide or online help. Also see [FDE considerations](#) on page 35.

# Controller enclosure — rear panel layout

## 2U48 controller enclosures

The diagram and table below display and identify important component items that comprise the rear panel layout of a 2U48 controller enclosure. The 6844 is shown as a representative example of 2U48 controller enclosure models included in the product series.



**Figure 9** 6004 Series controller enclosure: rear panel (2U)

A controller enclosure accommodates two AC power supply FRUs within the two power supply slots (see two instances of callout No.1 above). The controller enclosure accommodates two controller module FRUs of the same type within the I/O module IOM) slots (see callouts No.3 and No.4 above).

---

**IMPORTANT:** The 6004 Series enclosures support dual-controller environments only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

---

The diagrams with tables that immediately follow provide descriptions for the controller modules and power supply modules that can be installed into the rear panel of a 6004 Series controller enclosure. Showing controller modules and power supply modules separately from the enclosure enables improved clarity in identifying the component items called out in the diagrams and described in the tables.

Descriptions are also provided for optional drive enclosures supported by 6004 Series controller enclosures for expanding storage capacity.

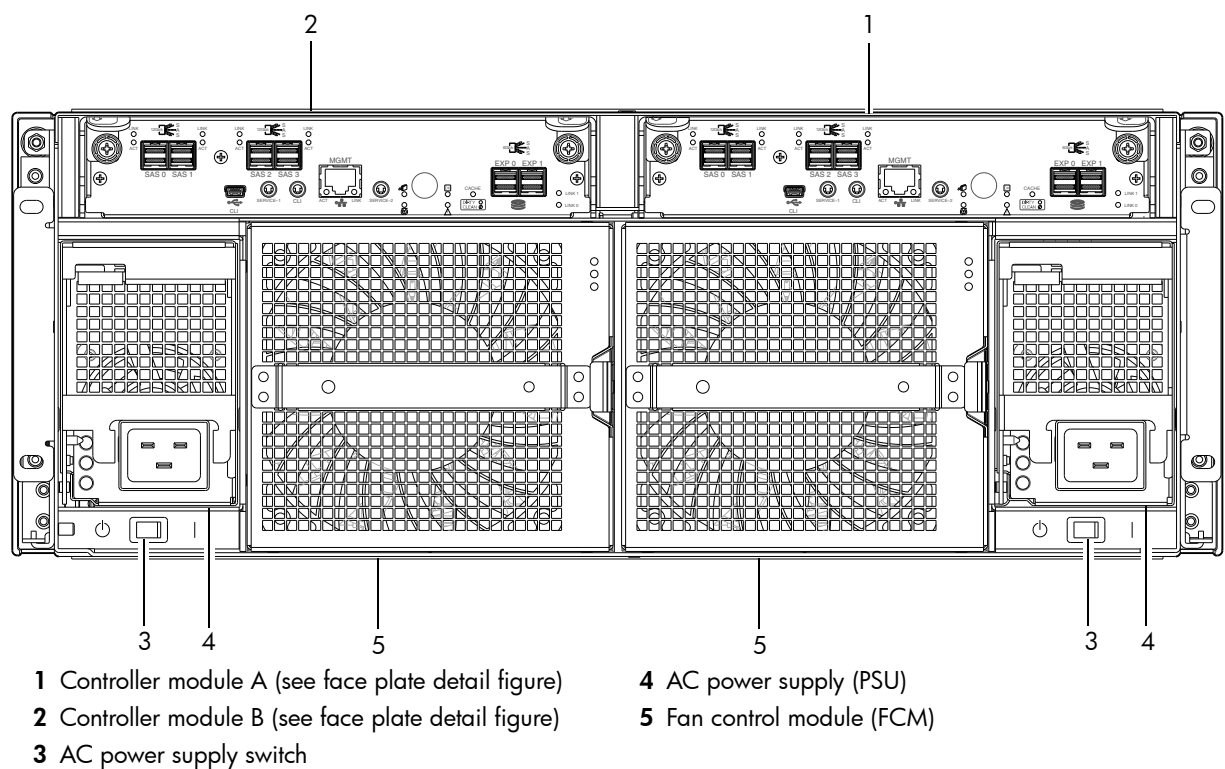
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**NOTE:** 6004 Series enclosures support hot-plug replacement of redundant controller modules, fans, power supplies, and expansion modules. Hot-add replacement of drive enclosures is also supported.

---

# 4U56 controller enclosure

The diagram and table below display and identify important component items that comprise the rear panel layout of a 4U56 controller enclosure.



**Figure 10** 6004 Series controller enclosure: rear panel (4U)

The controller enclosure accommodates two controller module FRUs of the same type within the I/O module (IOM) slots (see callouts No.1 and No.2 above). The controller enclosure accommodates two AC power supply FRUs of the same type within the two power supply slots (see two instances of callout No.4 above). Beneath each power supply is a power supply switch (see two instances of callout No.3 above). The controller enclosure accommodates two fan control modules (see two instances of callout No.5 above).

**IMPORTANT:** The 6004 Series enclosures support dual-controller environments only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

Figure 10 shows a 4U56 controller enclosure equipped with AC power supplies. Alternatively, the enclosure can be equipped with redundant DC power supplies (see Figure 50 on page 49).

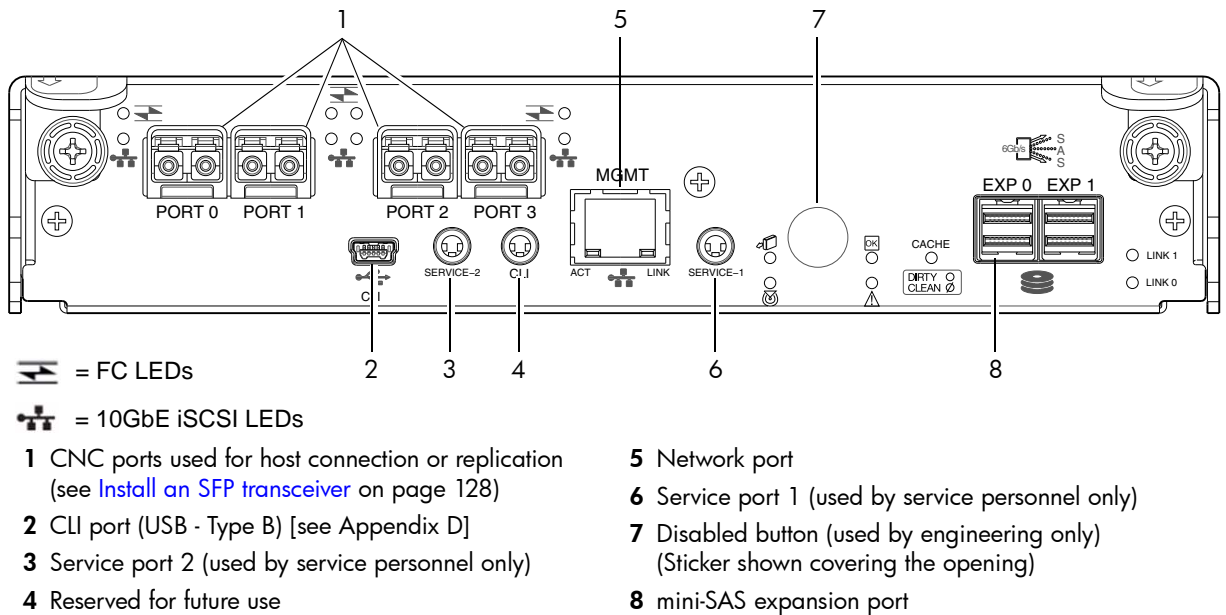
The diagrams with tables that immediately follow provide descriptions for the controller modules, power supply modules, and fan control modules that can be installed into the rear panel of a 6004 Series controller enclosure. Showing them separately from the enclosure enables improved clarity in identifying the component items called out in the diagrams and described in the tables.

Descriptions are also provided for optional drive enclosures supported by 6004 Series controller enclosures for expanding storage capacity.

**NOTE:** 6004 Series enclosures support hot-plug replacement of redundant controller modules, fans, power supplies, and expansion modules. Hot-add replacement of drive enclosures is also supported.

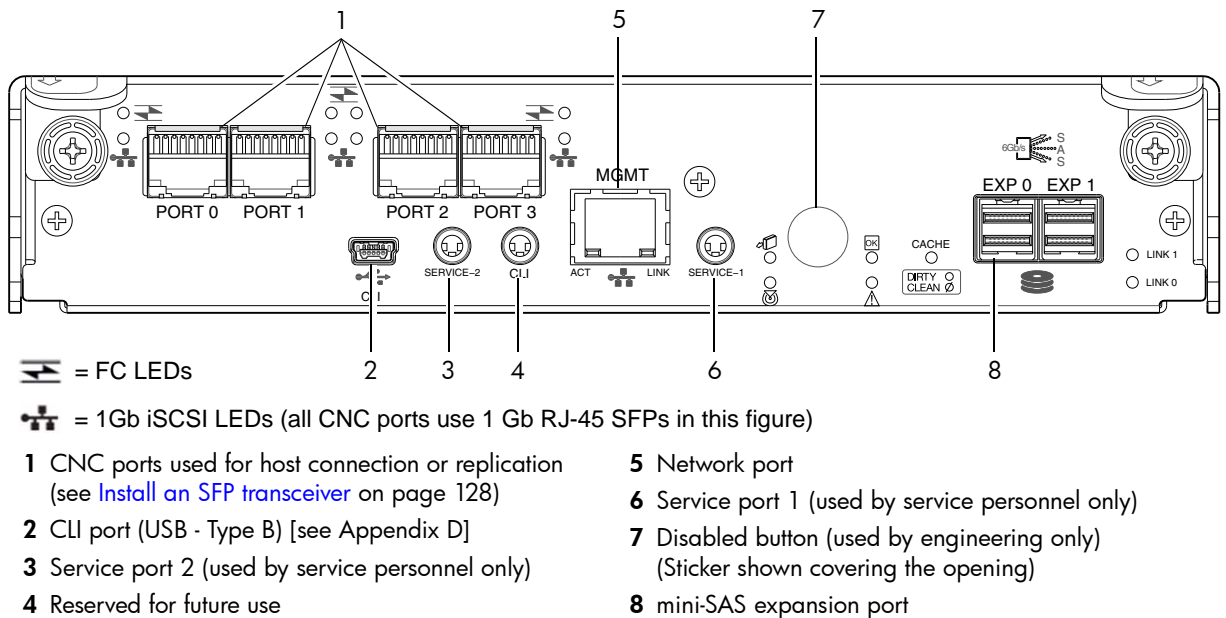
## 6844/6854 CNC controller module — rear panel components

Figure 11 shows CNC ports configured with SFPs supporting either 4/8/16 Gb FC or 10GbE iSCSI. The SFPs look identical. Refer to the CNC LEDs that apply to the specific configuration of your CNC ports.



**Figure 11** 6844/6854 controller module face plate (FC or 10GbE iSCSI)

Figure 12 shows CNC ports configured with 1 Gb RJ-45 SFPs.

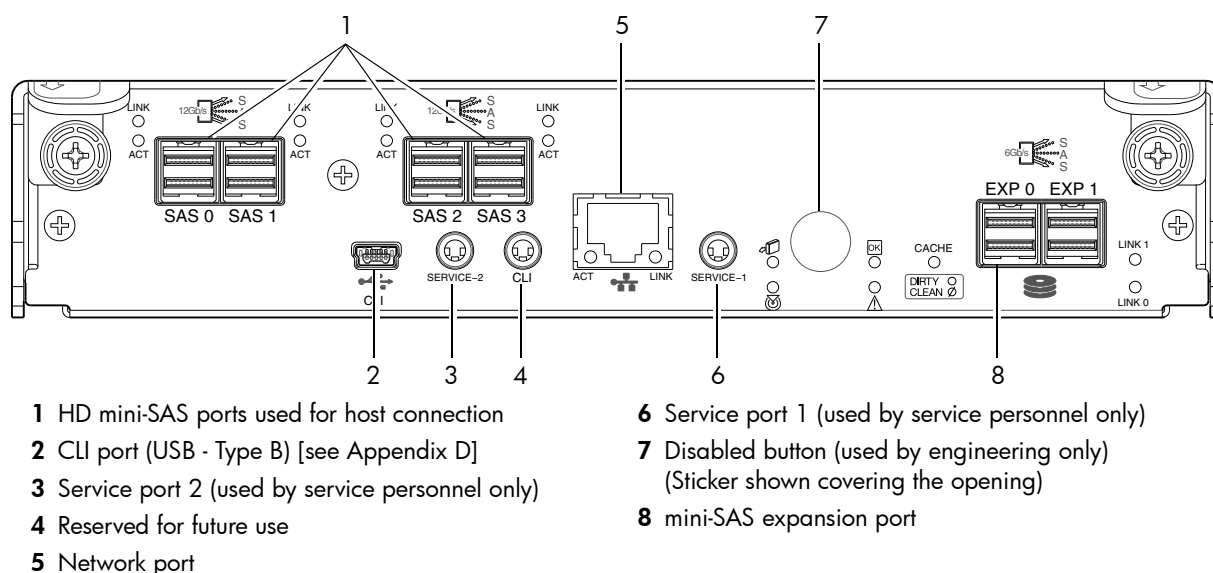


**Figure 12** 6844/6854 controller module face plate (1 Gb RJ-45)

**NOTE:** See [CNC ports used for host connection](#) on page 10 for more information about CNC technology. For CNC port configuration, see the “Configuring host ports” topic within the Storage Management Guide or online help.

## 6544/6554 SAS controller module — rear panel components

Figure 13 shows host ports configured with 12 Gbit/s HD mini-SAS (SFF-8644) connectors.



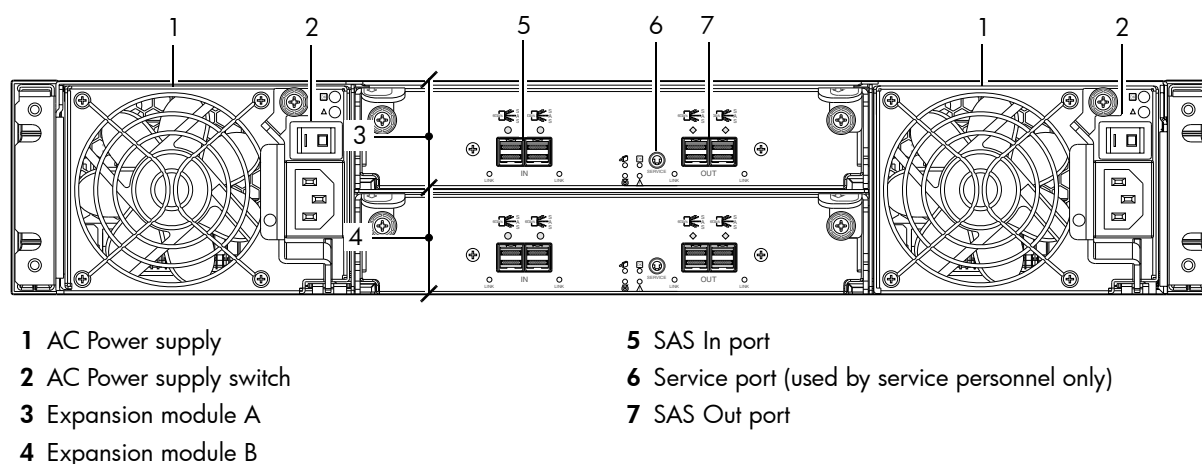
**Figure 13** 6544/6554 controller module face plate (HD mini-SAS)

## Supported drive enclosures

AssuredSAN controller enclosures support compatible Dot Hill drive enclosures—using 2U and 4U form factors—for adding storage.

## J6X48 drive enclosure rear panel components

6004 Series controller enclosures support SFF J6X48 48-disk drive enclosures in the 2U form factor for expansion of storage capacity. These drive enclosures use mini-SAS (SFF-8088) connectors to facilitate backend SAS expansion. Each J6X48 PSU is configured with a power switch.

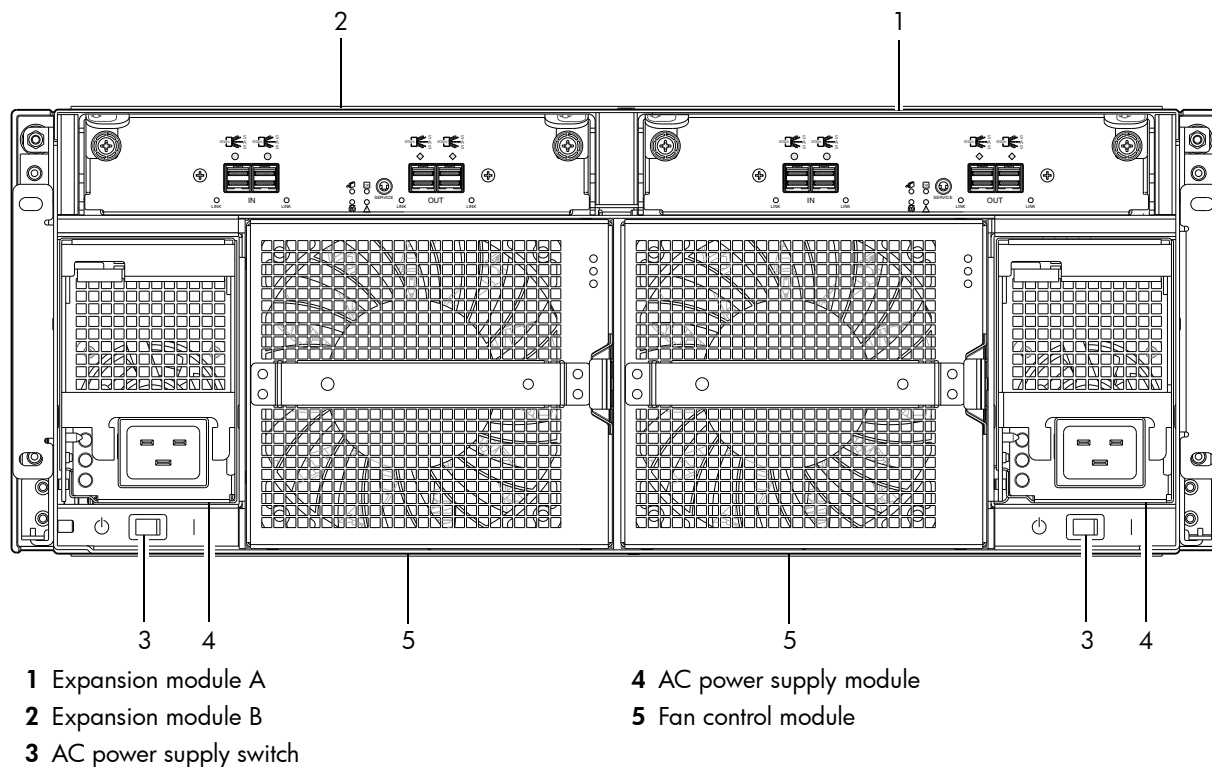


**Figure 14** Drive enclosure rear panel view (2U form factor)

The J6X48 expansion enclosure uses the same 2.5" SFF disk drive modules used by the 2U48 controller enclosures (see Figure 4 on page 15 for a visual representation of disk drive modules and AMS inserts used by the J6X48). See [Cable requirements for storage enclosures](#) on page 38 for cabling information.

## J6X56 drive enclosure rear panel components

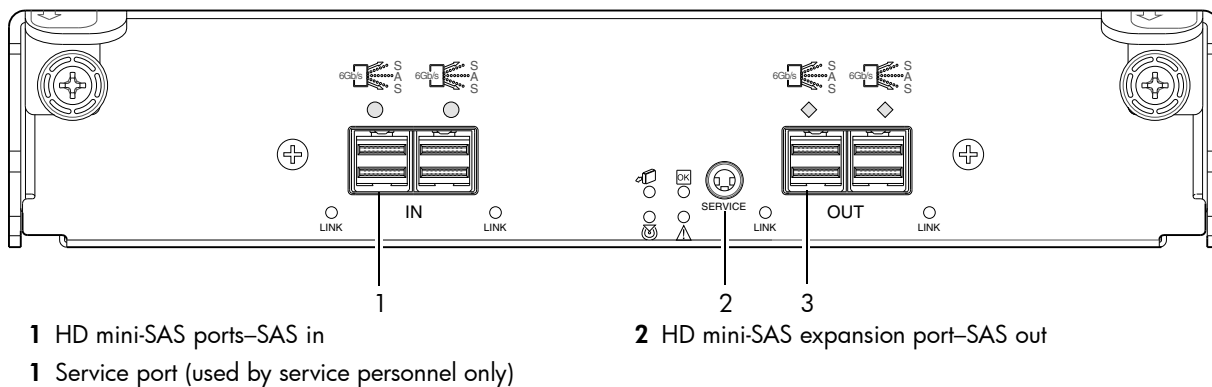
6004 Series controller enclosures support LFF 56-disk drive enclosures (J6X56) for expansion of storage capacity. These drive enclosures use HD mini-SAS (SFF-8644) connectors to facilitate backend SAS expansion. See [Cable requirements for storage enclosures](#) on page 38 for cabling information. The example below features AC power supplies (DC not shown).



**Figure 15** Drive enclosure rear panel view (4U form factor)

## J6X56 expansion module — rear panel components

[Figure 16](#) shows host ports configured with 12 Gbit/s J6X56 HD mini-SAS (SFF-8644) connectors.



**Figure 16** 6554 controller module face plate (J6X56 HD mini-SAS)

# Component installation and replacement

Installation and replacement of 6004 Series FRUs (field-replaceable units) is addressed in the FRU Installation and Replacement Guide within the “Procedures” chapter.

FRU procedures facilitate replacement of a damaged chassis or chassis component:

- Replacing a controller or expansion module
- Replacing a disk drive module
- Replacing a power supply unit
- Replacing a fan control module (4U56)
- Replacing ear components
- Replacing a Fibre Channel transceiver
- Replacing a 10GbE SFP+ transceiver
- Replacing a 1 Gb SFP transceiver
- Replacing a controller enclosure chassis


See Dot Hill’s Customer Resource Center web site for additional information: <https://crc.dothill.com>.

## Cache

To enable faster data access from disk storage, the following types of caching are performed:

- Write-back or write-through caching. The controller writes user data into the cache memory in the controller module rather than directly to the disks. Later, when the storage system is either idle or aging—and continuing to receive new I/O data—the controller writes the data to the disks.
- Read-ahead caching. The controller detects sequential data access, reads ahead into the next sequence of data—based upon settings—and stores the data in the read-ahead cache. Then, if the next read access is for cached data, the controller immediately loads the data into the system memory, avoiding the latency of a disk access.

---

 **TIP:** See the Storage Management Guide for more information about cache options and settings.


---

## CompactFlash

During a power loss or controller failure, data stored in cache is saved off to non-volatile memory (CompactFlash). The data is restored to cache, and then written to disk after the issue is corrected. To protect against writing incomplete data to disk, the image stored on the CompactFlash is verified before committing to disk.


The CompactFlash card is located at the midplane-facing end of the controller module as shown in [Figure 17](#) on page 25. Do not remove the card; it is used for cache recovery only.

---

 **IMPORTANT:** In dual-controller configurations featuring one healthy partner controller, there is no need to transport failed controller cache to a replacement controller because the cache is duplicated between the controllers (subject to volume write optimization setting).

---

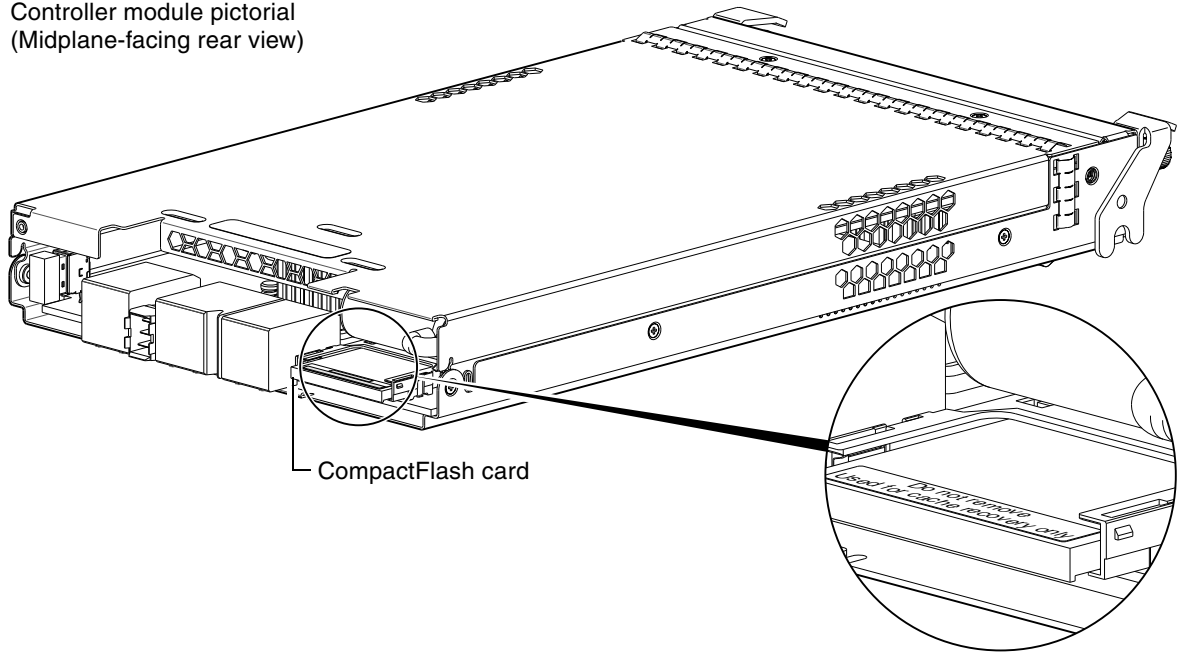
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 **IMPORTANT:** The 6004 Series enclosures support dual-controller environments only. Do not transport the CompactFlash since data corruption might occur. Single-controller support is provided only when a controller fails over to its partner controller.

---



Controller module pictorial  
(Midplane-facing rear view)



**Figure 17** CompactFlash card

---

△ **CAUTION:** The CompactFlash memory card should only be removed for transportable purposes. To preserve the existing data stored in the CompactFlash, you must transport the CompactFlash from the failed controller to the replacement controller using a procedure outlined in the FRU Installation and Replacement Guide with the procedure for replacing a controller module. Failure to use this procedure will result in the loss of data stored in the cache module. The CompactFlash must stay with the same enclosure. If the CompactFlash is used/installed in a different enclosure, data loss/data corruption will occur.

---


## Supercapacitor pack

To protect controller module cache in case of power failure, each controller enclosure model is equipped with supercapacitor technology, in conjunction with CompactFlash memory, built into each controller module to provide extended cache memory backup time. The supercapacitor pack provides energy for backing up unwritten data in the write cache to the CompactFlash, in the event of a power failure. Unwritten data in CompactFlash memory is automatically committed to disk media when power is restored. In the event of power failure, while cache is maintained by the supercapacitor pack, the Cache Status LED flashes at a rate of 1/10 second on and 9/10 second off.

## 2 Installing the enclosures

### Installation checklist

The following table outlines the steps required to install the enclosures, and initially configure and provision the storage system. To ensure successful installation, perform the tasks in the order presented.

 **IMPORTANT:** For 4U56 enclosures, retain original packaging materials for use with returns. For chassis returns, the master container must ship on a pallet (non-compliance could void warranty).

**Table 3** Installation checklist

Step	Task	Where to find procedure
1.	Install the controller enclosure and optional drive enclosures in the rack.	See the rack-mount bracket kit installation instructions pertaining to your enclosure.
2.	Install the disk drive modules into the drawers.	See <a href="#">Populating Drawers</a> on page 27. (The enclosure bezel must be removed for this task.)
3.	Attach the enclosure bezel. <sup>1</sup>	Refer to the bezel attachment instructions for your enclosure.
4.	Connect controller enclosure and optional drive enclosures.	See <a href="#">Connecting the controller enclosure and drive enclosures</a> on page 36.
5.	Connect power cords.	See <a href="#">Powering on/powering off</a> on page 46.
6.	Test enclosure connectivity.	See <a href="#">Testing enclosure connections</a> on page 46.
7.	Install required host software.	See <a href="#">Host system requirements</a> on page 51.
8.	Connect hosts. <sup>2</sup>	See <a href="#">Connecting the enclosure to hosts</a> on page 51.
9.	Connect remote management hosts. <sup>2</sup>	See <a href="#">Connecting a management host on the network</a> , page 61.
10.	Obtain IP values and set network port IP properties on the controller enclosure.	See <a href="#">Obtaining IP values</a> on page 68. For USB CLI port and cable use, see Appendix D.
11.	Use the CLI to set the host interface protocol.	See <a href="#">CNC technology</a> on page 51. The 6844/6854 models allow you to set the host interface protocol for your qualified SFP option. Use the <code>set host-port-mode</code> command as described in the CLI Reference Guide or online help.
12.	Perform initial configuration tasks <sup>3</sup> : <ul style="list-style-type: none"><li>• Sign-in to the web-browser interface(v3 or v2) to access the application GUI.</li><li>• Verify firmware revisions and update if necessary.</li><li>• Initially configure and provision the system using the SMC (v3) or RAIDar(v2).</li></ul>	Topics below correspond to bullets at left:  See “Getting Started” in the web-posted Storage Management Guide.  See <a href="#">Updating firmware</a> . Also see the same topic in the Storage Management Guide.  See “Configuring the System” and “Provisioning the System” topics in the Storage Management Guide or online help.

<sup>1</sup> See the FRU Installation and Replacement Guide for illustrations and narrative describing attachment of enclosure bezels to chassis. See also [Enclosure bezel attachment and removal](#) on page 96. The 4U56 chassis includes hard copy shipkit instructions describing enclosure bezel attachment and removal.

<sup>2</sup> For more about hosts, see the “About hosts” topic in the Storage Management Guide.

<sup>3</sup> The SMC and RAIDar are introduced in [Accessing the SMC or RAIDar](#) on page 73. See the Storage Management Guide or online help for additional information.

# Populating Drawers

## Populating drawers in 2U48 enclosures

Although the 2U48 chassis provides pre-assembled and pre-installed drawers, disk drive modules must be installed into the drawers. In addition to locating your disk modules—and any Air Management Solution (AMS) inserts, you should become familiar with the following concepts before populating the drawers:

- Full Disk Encryption (FDE) firmware feature (see [FDE considerations](#) on page 35).
- Preventing electrostatic discharge (see [Electrostatic discharge](#) appendix).

---

 **IMPORTANT:** Please review the bullet topics above before populating the drawers.

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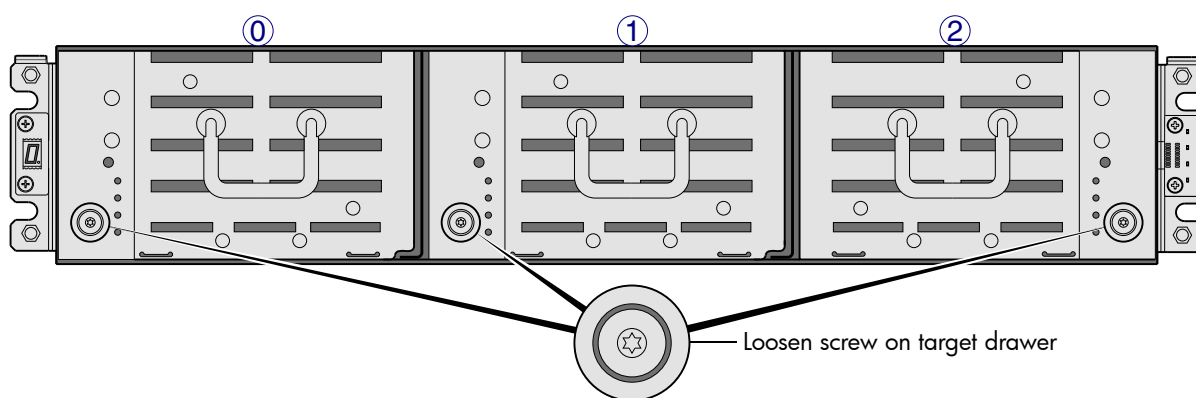
## Opening and closing a 2U16 drawer

You can open a drawer for visual inspection of disk bays. Before accessing the drawer via its handle, you must first remove the enclosure bezel (see [Enclosure bezel removal](#) on page 97). Given that the enclosure bezel is required to provide EMI protection, you should re-attach the bezel to the enclosure after examining the drawer (see [Enclosure bezel attachment](#) on page 97).

1. Using a Torx T15 or straight blade screwdriver, loosen the drawer stop screw on the front face of the drawer.

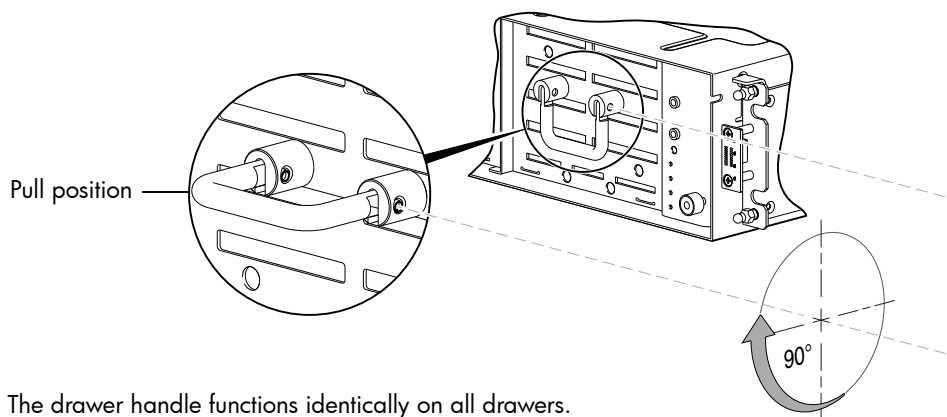
Once the screw is loosened, turn the outer thumbwheel counter-clockwise to unlock the drawer. Take care not to remove the screw.

Enclosure front panel with bezel removed showing left (0), middle, (1) and right (2) drawers



**Figure 18** Opening a 2U16 drawer: loosen the drawer stop screw

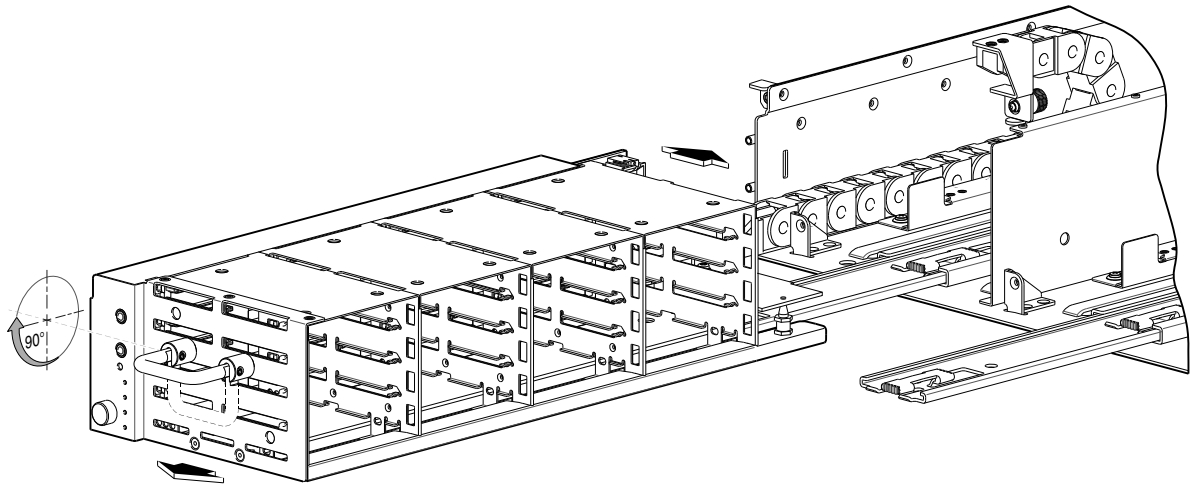
2. Revolve the drawer handle upwards by 90° to enable pulling the drawer outward for viewing disks.



The drawer handle functions identically on all drawers.

**Figure 19** Opening a 2U16 drawer: revolve the handle

3. Face the front of the drawer—and using the handle—pull the drawer outward along the drawer slide until it meets the drawer stop.

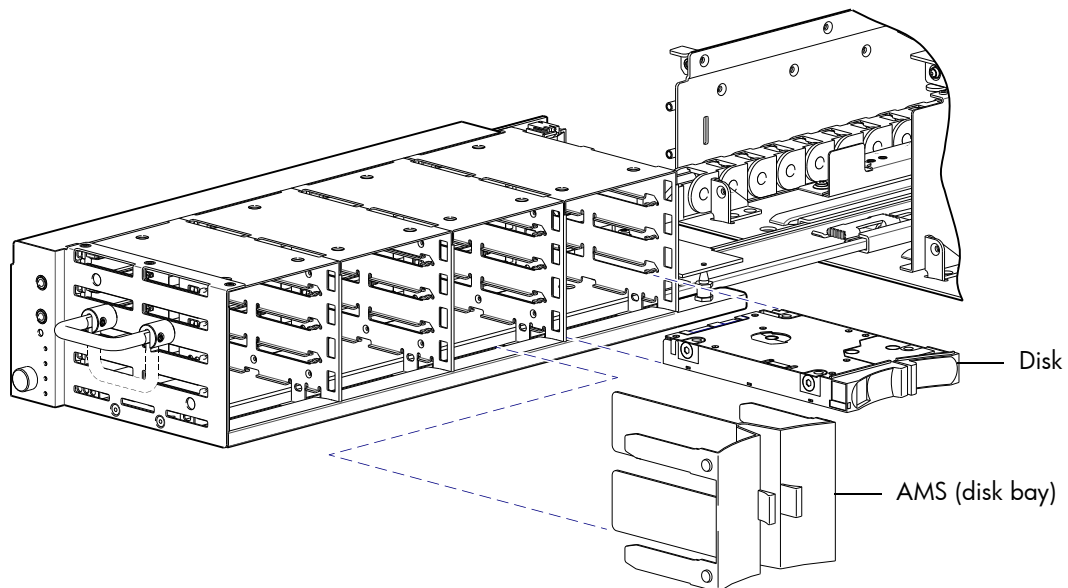


**Figure 20** Opening and closing a 2U16 drawer: pull or push drawer along slide

To close the drawer, simply slide the drawer into the enclosure along the drawer slide until it properly seats in the drawer bay. Take care to ensure there are no loose cable wires protruding beyond the limits of the igus chainflex cable. After closing the drawer, revolve the handle downwards such that it is flush with the drawer front panel—in its stowed position—and re-attach the bezel to the front of the enclosure.

### Aligning an AMS or disk module for installation into a 2U16 drawer

Once you have opened the drawer, you can access the disk bays. The enclosure uses an SFF sledded disk positioned to lay on its side—with the disk PCBA facing up—for insertion into the disk slot within the drawer. Each disk is mated to a connector on the drawer PCBA. In the absence of quantity-four disks, the enclosure uses an AMS insert within disk bays to manage air flow within the enclosure, to help maintain optimal operating temperature. A new AMS is also available for single disk slots.



**Figure 21** Align AMS or disk module for installation into the 2U16 drawer

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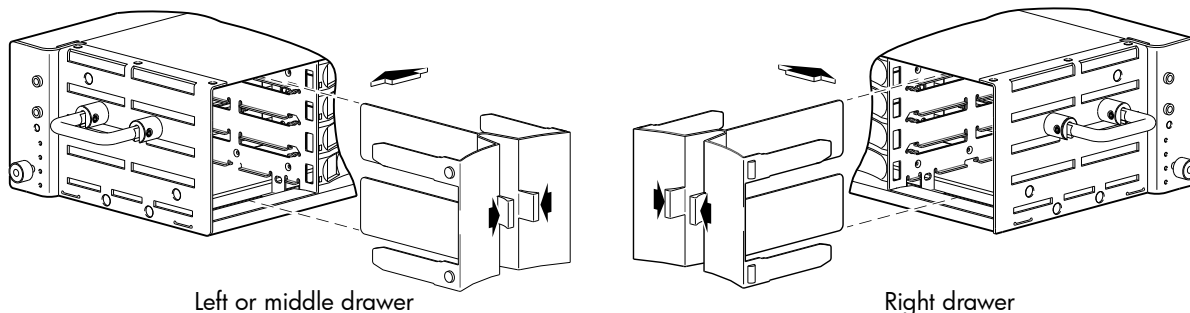
**IMPORTANT:** Each disk bay must be populated with either a full complement of four disk drive modules, a disk bay AMS insert (shown above), or a combination of disks and single disk slot AMS inserts (see [Figure 24](#) on page 29). Empty disk slots are disallowed.

---

## Installing an AMS into a 2U16 drawer

Refer to [Figure 22](#) when orienting the AMS for insertion into the target drawer. If you are installing into the left drawer or middle drawer, refer to the illustration on the left when performing this step-procedure. If you are installing into the right drawer, refer to the illustration on the right when performing this step-procedure.

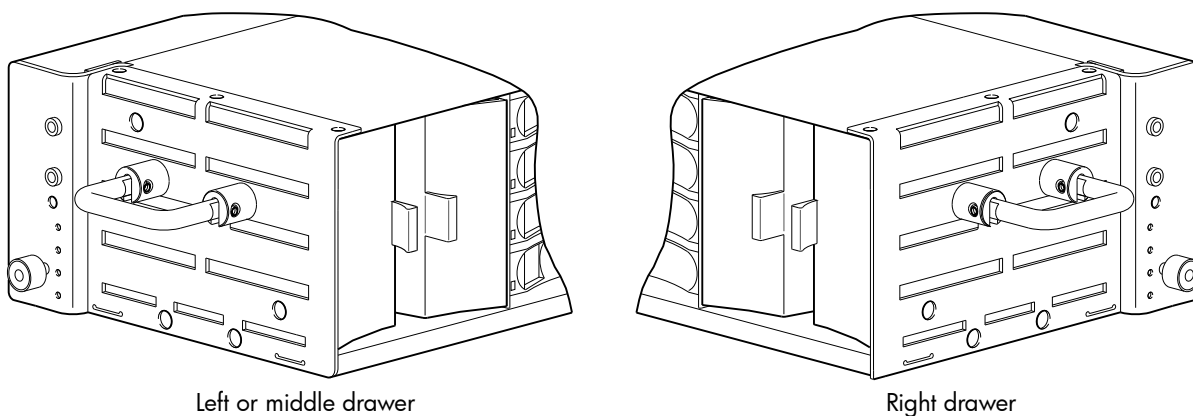
Align AMS for insertion into disk bay



**Figure 22** Orient the AMS for installation (2U48)

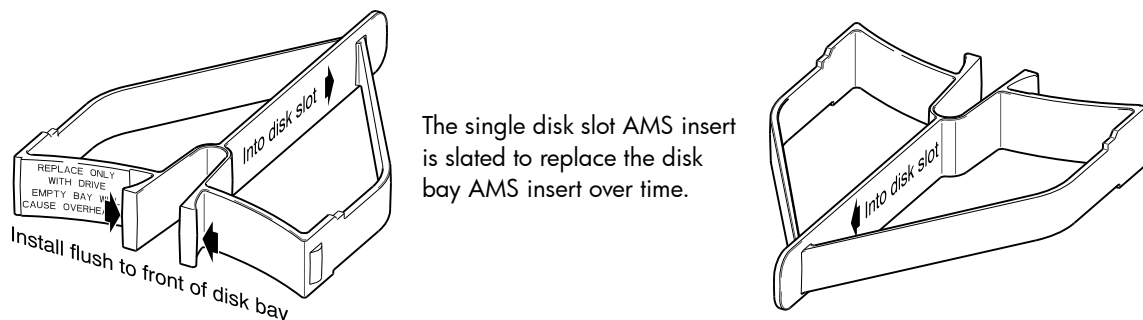
1. Squeeze the latch release flanges together—so that the locking-nib will clear the sheet metal bay wall—and insert the AMS into the target disk bay.
2. Verify that the AMS is firmly seated in place.

The installed disk drive module should now appear as shown in the sectioned cutaway views of the respective drawers in [Figure 23](#).




**Figure 23** Secure the AMS into the disk bay (2U48)

If using the new single disk slot AMS insert shown in [Figure 24](#), the insertion steps are essentially the same as those described for [Figure 22](#) and [Figure 23](#) above; however, they pertain to a single disk slot rather than a disk bay (four vertically-contiguous disk slots).



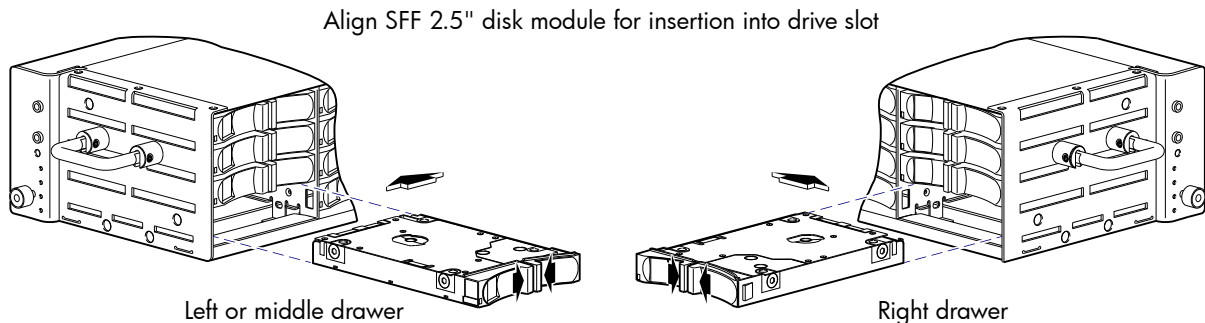
**Figure 24** AMS insert for a single disk slot (2U48)

## Installing a disk module into a 2U16 drawer

 **IMPORTANT:** Please review [FDE considerations](#) on page 35 before populating the 6004 Series enclosure drawers.

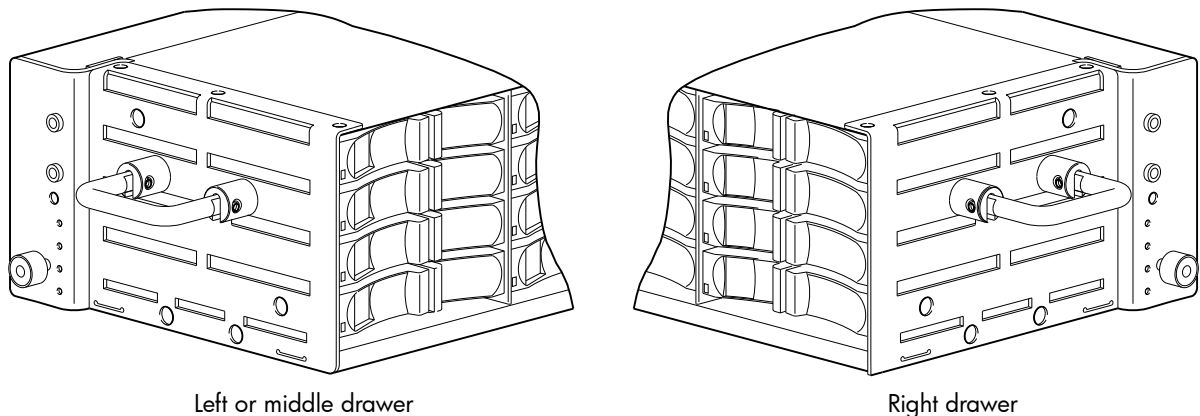
Refer to [Figure 25](#) when orienting the disk drive module for insertion into the target drawer. If you are installing a disk drive module in the left drawer or middle drawer, refer to the illustration on the left when performing the step-procedure. If you are installing a disk drive module in the right drawer, refer to the illustration on the right when performing this step-procedure.

Also see the admonition—following this procedure—concerning the installation of disk drive modules into an operating enclosure (not powered-off).




**Figure 25** Orient the disk for installation (2U48)

1. While supporting the bottom of the disk module with one hand (disk PCBA should be facing up and latch release flanges should be facing out)—align the disk for insertion into the target disk slot.
2. Using your other hand, squeeze the latch release flanges together—so that the locking-nib will clear the sheet metal bay wall—and insert the disk drive module into the target slot.



**Figure 26** Secure the disk module into the drive slot (2U48)

3. Gently push the disk drive module into the slot until it latches in place.  
The installed disk drive module should now appear as shown in the sectioned cutaway views of the respective drawers in [Figure 26](#).

 **IMPORTANT:** Disk drive module replacement guidelines

When replacing disks in an operating enclosure, only one disk drive module can be replaced at a time (see “Replacing a disk drive module” within the FRU Installation and Replacement Guide).

## Populating drawers in 4U56 enclosures

Although the 4U56 chassis provides pre-assembled and pre-installed drawers, disk drive modules must be installed into the drawers. In addition to locating your disk modules, you should become familiar with the following concepts before populating the drawers:

- Full Disk Encryption (FDE) firmware feature (see [FDE considerations](#) on page 35).
- Preventing electrostatic discharge (see [Electrostatic discharge](#) appendix).

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 **IMPORTANT:** Please review the bullet topics above before populating the drawers.

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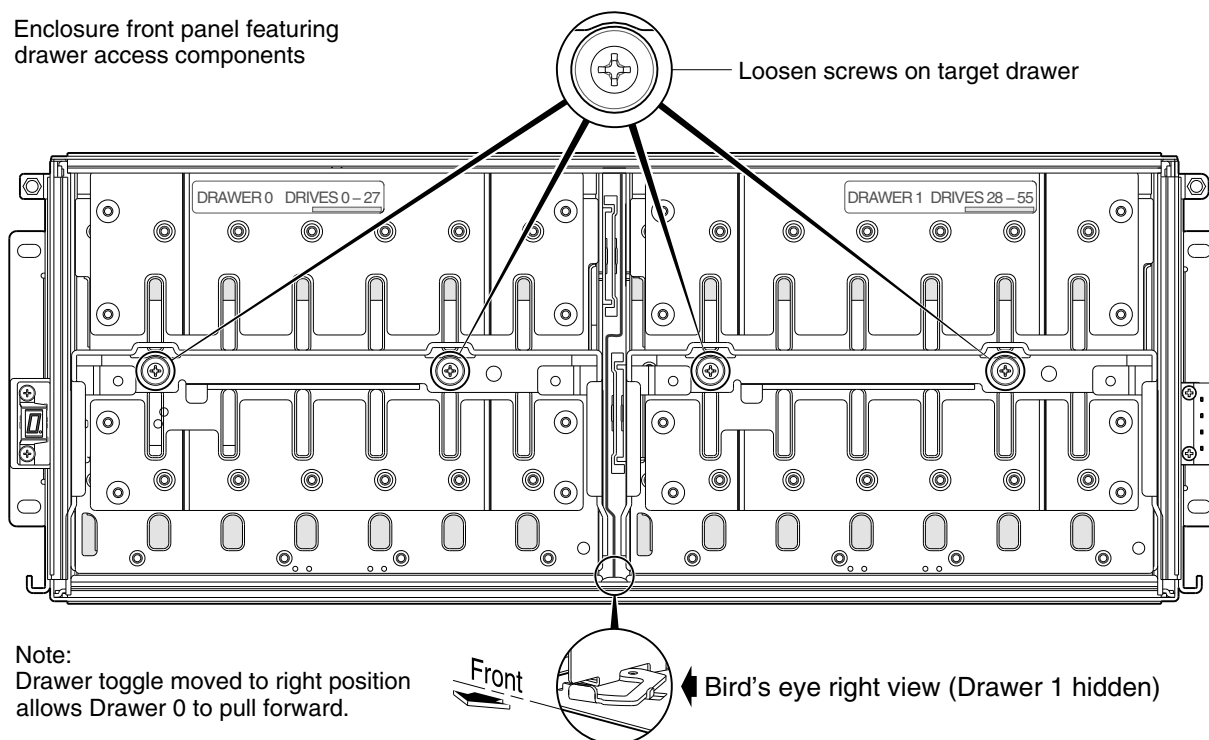
### Opening and closing a 4U28 drawer

You can open a drawer for visual inspection of disk bays. Before accessing the drawer via its handle, you must first remove the enclosure bezel (see [Enclosure bezel removal](#) on page 97). Given that the enclosure bezel is required to provide EMI protection, you should re-attach the bezel to the enclosure after examining the drawer (See [Enclosure bezel attachment](#) on page 97).

1. Using a No.2 phillips screwdriver, loosen the two screws securing the handle to the front face of the drawer.

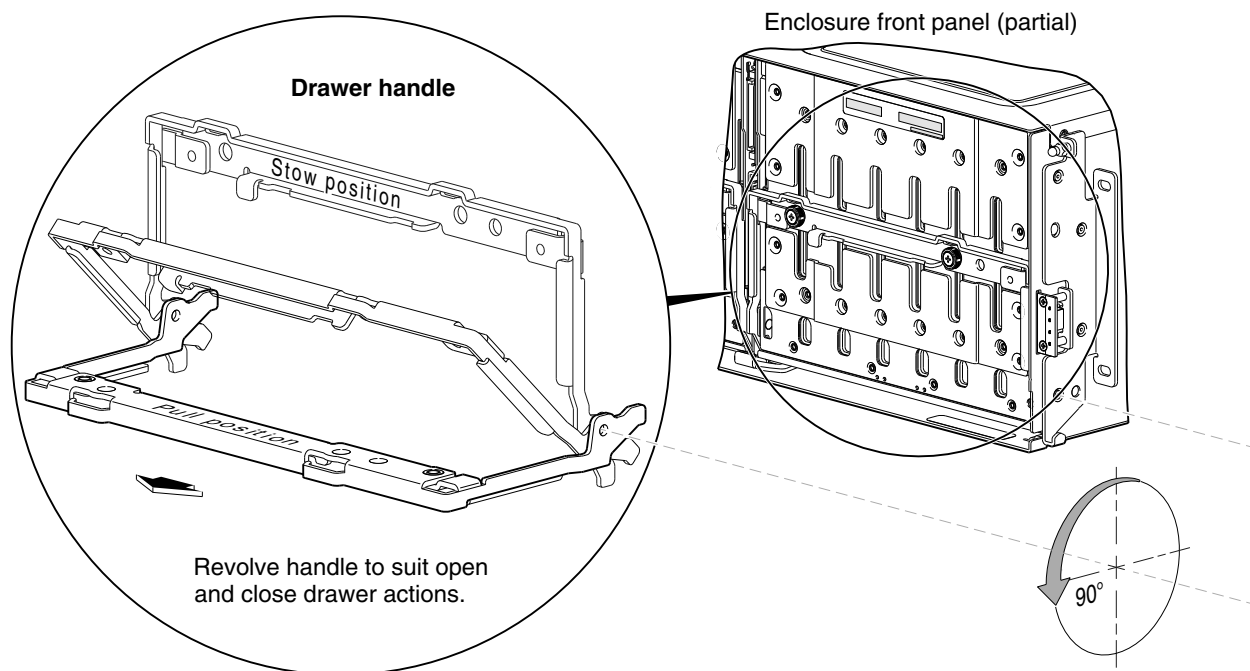
Once the two screws on the target drawer are loosened, turn the thumbwheel counter-clockwise to disengage the handle from its upright stowed position.

Enclosure front panel featuring  
drawer access components



**Figure 27** Opening a 4U28 drawer: loosen screws and move the drawer toggle

2. Move the drawer toggle to enable the target drawer to travel along the slide.  
Move the toggle to the right to open Drawer 0 (left drawer); or move the toggle to the left to open Drawer 1 (right drawer).
3. Revolve the drawer handle downwards by 90° to enable pulling the drawer outward for viewing disk slots.



**Figure 28** Opening a 4U28 drawer: revolve the handle

The detail at left in [Figure 28](#) shows the drawer handle in pull and stow (closed and locked) position.

4. Face the front of the drawer—and using the handle—pull the drawer outward along the drawer slide until it meets the drawer stop (see [Figure 29](#) on page 33).

To close the drawer, simply slide the drawer into the enclosure along the drawer slide until it properly seats in the drawer bay. Take care to ensure that no loose cable wires protrude beyond the limits of the igus chainflex cable. After closing the drawer, rotate the handle upwards such that it is flush with the drawer front panel. Tighten the two thumbwheel screws on each drawer handle. Re-attach the enclosure bezel to the front of the enclosure (see [Enclosure bezel attachment](#) on page 97).

### Aligning a disk module for installation into a 4U56 drawer

Once you have opened the drawer, you can access the disk bays. The enclosure uses a sledged disk positioned to stand on end, for insertion into the drawer. Each sledged disk or SSD is mated to its connector on the drawer PCBA.

---

**IMPORTANT:** Please refer to the disk slot numbering diagram on the center exterior wall of the target drawer.

---

For Drawer 0 (left drawer), the pictorial is on the right exterior drawer wall. For Drawer 1 (right drawer) the pictorial is on the left exterior drawer wall. Disk row and slot numbering is also provided in [Figure 7](#) on page 17.

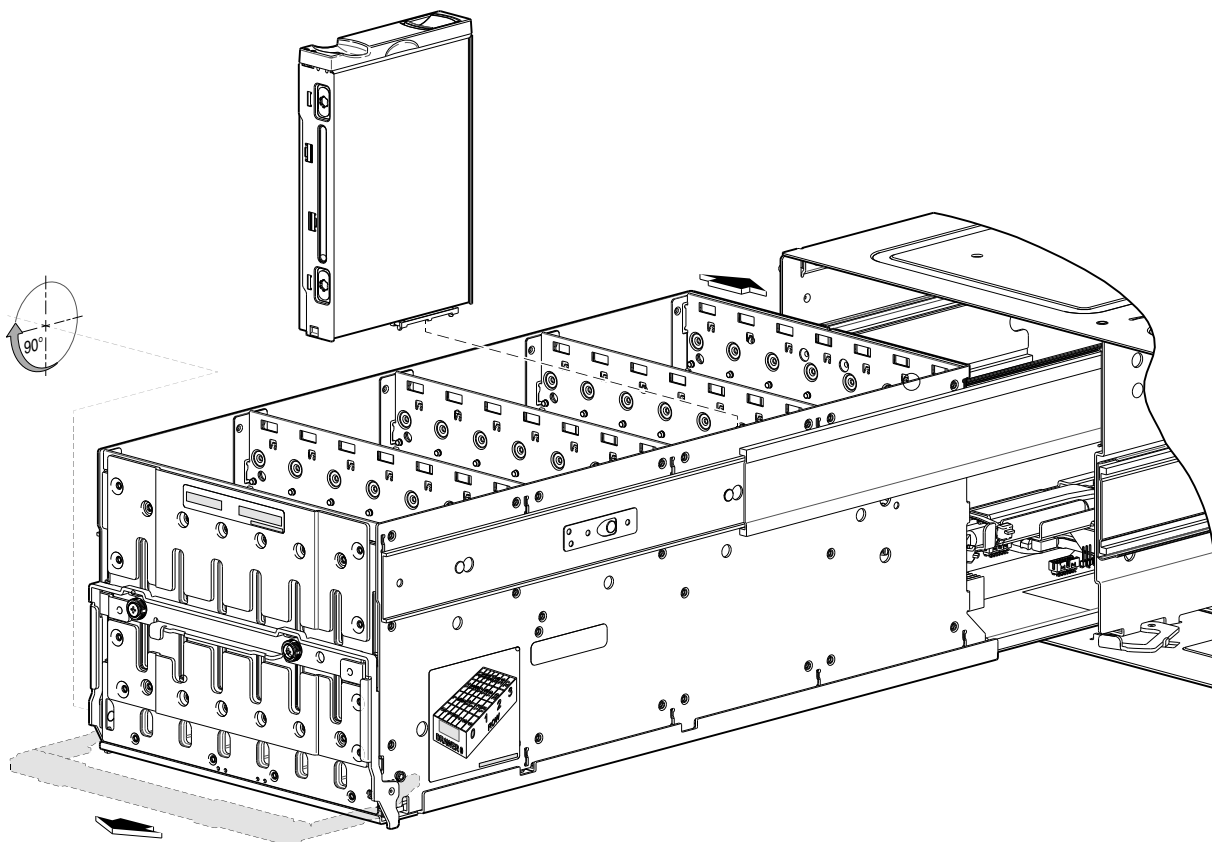
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**NOTE:** Blank disk drive slots are allowed. Unlike other Dot Hill Systems enclosures (2U48), the 4U56 enclosure does *not* employ an Air Management Solution (AMS) for use in empty disk drive slots.

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During setup of your storage system, you will need to install disk modules into the drawers. You may also need to remove a disk module, or move it to a different slot. Both procedures are provided herein.





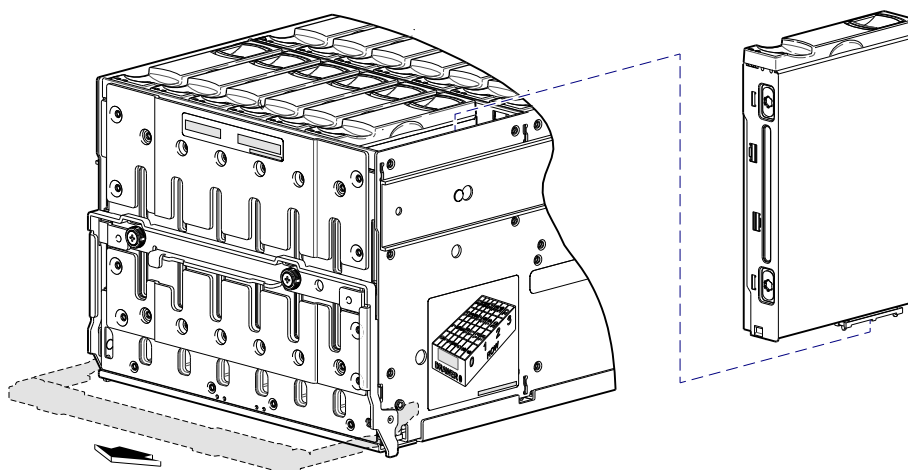
**Figure 29** Align the disk module for installation into the open a 4U28 drawer

## Installing a disk module into a 4U28 drawer

**IMPORTANT:** Please review [FDE considerations](#) on page 35 before populating the enclosure drawers.

Refer to [Figure 29](#) when orienting the disk drive module for insertion into the target drawer. The disk installation procedure applies to the left drawer (Drawer 0) and the right drawer (Drawer 1). Disk row and slot numbering for each drawer is provided on the sticker applied to the exterior wall of each drawer.

1. With the disk module standing on end—and the LEDs oriented to the left—insert the disk module into the vertically-aligned disk slot, and seat it into the connector on the drawer PCBA.



**Figure 30** Install a disk into a drawer slot (4U56)

2. Verify that you have inserted the disk module into the slot as far as it will go, to ensure that the module is firmly seated in the drawer PCBA and latched in place.

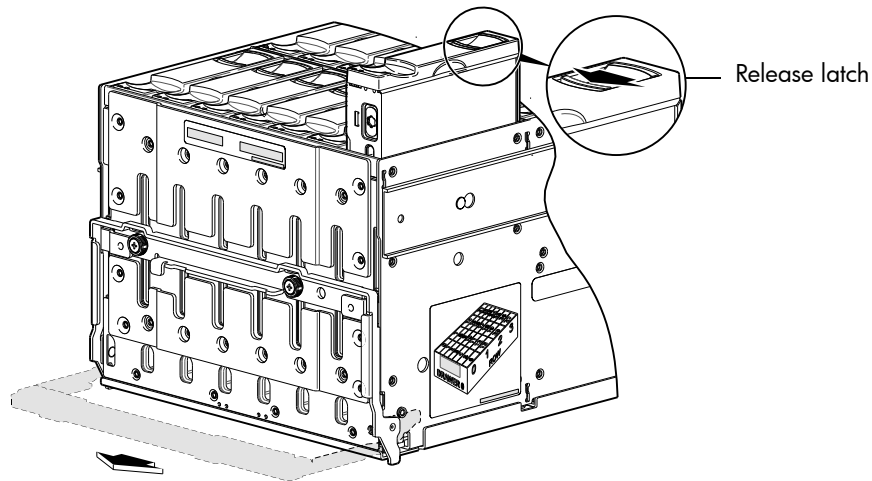
**IMPORTANT:** If you are completely filling a drawer with disk modules, populate from back row to front row, while installing disks into the slots. Provide adequate support for the weight of the extended drawer as you install the disks.

If you are installing disk modules to partially fill a drawer, you must install a minimum of 14 disk modules, and they must be placed in contiguous slots closest to the front of the drawer.

## Removing a disk module from a 4U28 drawer

1. Using your index finger, slide the release latch—located in the right pocket on the face of the disk drive module—to the left to disengage the disk drive module (see detail inset view in [Figure 31](#)).

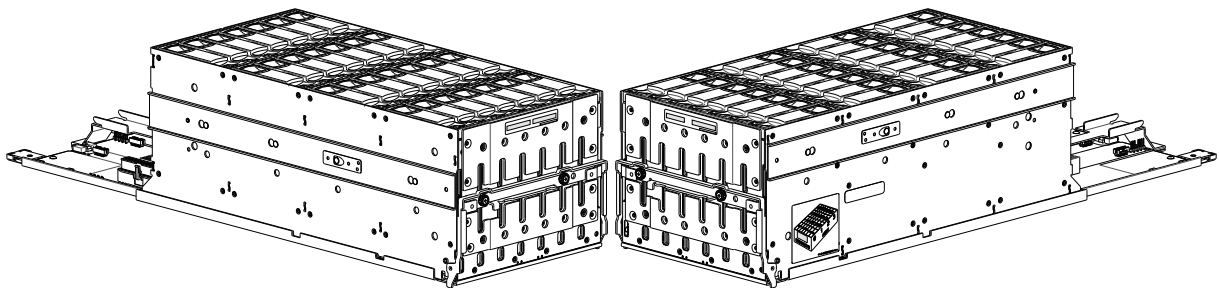
Moving the latch to the left will provide a clicking sound and cause the spring to move its position inside the drawer cage, partially ejecting the disk from its installed position within the disk drive slot.



**Figure 31** Remove a disk from a drawer slot (4U56)

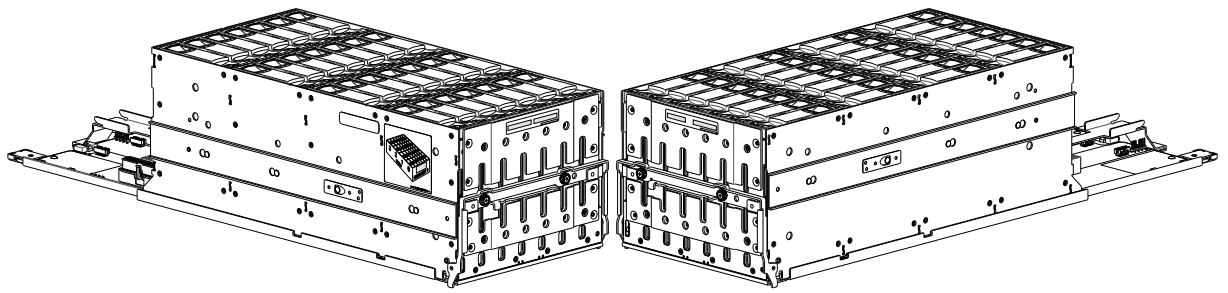
2. Wait 20 seconds for the internal disk to stop spinning.
3. Once the disk drive module partially ejects from the slot, grasp the module firmly, and carefully pull it straight out of the drawer slot. Take care not to drop the module.

Examples of fully-populated drawers are shown below as isolated sub-assembly pictorials.



**Figure 32** Drawer 0 with full complement of disks (4U56)

The complementary views of the left drawer ([Figure 32](#)) and right drawer ([Figure 33](#) on page 35) viewed from front bird's-eye orientation show key characteristics of the drawers, including a) staggered elevation of slide rails, b) locations of applied drawer row/slot-numbering reference diagrams, and c) orientation of installed disk modules.



**Figure 33** Drawer 1 with full complement of disks (4U56)

## FDE considerations

The Full Disk Encryption feature available via the management interfaces requires use of self-encrypting drives (SED) which are also referred to as FDE-capable disk drive modules. When installing FDE-capable disk drive modules, follow the same procedures for installing disks that do not support FDE. The exception occurs when you move FDE-capable disk drive modules for one or more vdisks or disk groups to a different system, which requires additional steps.

The procedures for using the FDE feature, such as securing the system, viewing disk FDE status, and clearing and importing keys are performed using the web-based (v3 or v2) application or CLI commands (see the Storage Management Guide or CLI Reference Guide for more information).

---

**NOTE:** When moving FDE-capable disk drive modules for a disk group, stop I/O to any disk groups before removing the disk drive modules. Follow the “Removing a disk drive module” and “Installing a disk drive module” procedures within the FRU Installation and Replacement Guide. Import the keys for the disks so that the disk content becomes available.

---

While replacing or installing FDE-capable disk drive modules, consider the following:

- If you are installing FDE-capable disk drive modules that do not have keys into a secure system, the system will automatically secure the disks after installation. Your system will associate its existing key with the disks, and you can transparently use the newly-secured disks.
- If the FDE-capable disk drive modules originate from another secure system, and contain that system’s key, the new disks will have the Secure, Locked status. The data will be unavailable until you enter the passphrase for the other system to import its key. Your system will then recognize the metadata of the disk groups and incorporate it. The disks will have the status of Secure, Unlocked and their contents will be available:
  - To view the FDE status of disks, use the SMC or RAIDar, or the `show fde-state` CLI command.
  - To import a key and incorporate the foreign disks, use the SMC or RAIDar, or the `set fde-import-key` CLI command.

---

**NOTE:** If the FDE-capable disks contain multiple keys, you will need to perform the key importing process for each key to make the content associated with each key become available.

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- If you do not want to retain the disks’ data, you can repurpose the disks. Repurposing disks deletes all disk data, including lock keys, and associates the current system’s lock key with the disks. To repurpose disks, use the SMC or RAIDar, or the `set disk` CLI command.
- You need not secure your system to use FDE-capable disks. If you install all FDE-capable disks into a system that is not secure, they will function exactly like disks that do not support FDE. As such, the data they contain will not be encrypted. If you decide later that you want to secure the system, all of the disks must be FDE-capable.
- If you install a disk module that does not support FDE into a secure system, the disk will have the Unusable status and will be unavailable for use.

- If you are re-installing your FDE-capable disk drive modules as part of the process to replace the chassis-and-midplane FRU, you must insert the original disks and re-enter their FDE passphrase (see the FRU Installation and Replacement Guide for more information).

## Network Equipment-Building System (NEBS) Level 3 compliance

### Generic Requirements (GRs)

Meets the NEBS requirement of GR-1089-CORE Issue 6, port types 2, 7 & 8.  
Meets the NEBS requirements of GR-63-CORE Issue 4, for the product's intended use.  
Meets the NEBS filter requirements.

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 **IMPORTANT:** [Table 5](#) on page 38 shows NEBS-compliance for individual storage enclosures.

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### Exceptions to GRs

Exceptions to the overall NEBS GR-63-CORE Issue 4 requirements include:

- Heat Dissipation: Environmental Criteria Section 4.1.6, Objective O4-29 and Operational Requirement R4-31. This product exceeds the values shown in Table 4-5 for Forced-Air Fan Shelf equipment.
- The equipment does not meet the objective O4-103 for Surface Reflectance, Section 4.1.7, as it has a black bezel that mounts to the front.

Exceptions to the overall NEBS GR-1089-CORE Issue 6 requirements include:

- None reported

### Product documentation requirements

NEBS product documentation requirements applying to AssuredSAN 6004 Series controller and drive enclosures are listed beneath "NEBS (Level 3)" in the Index — under either GR-1089-CORE Issue 6 or GR-63-CORE Issue 4 — together with adjacent page locations. NEBS topics are *integrated* within the overall content of this Setup Guide. The requirement designators in the Index have been codified for use within index marker tags according to the following example:

NEBS generic requirement number "R2-7 [7]" appears as "R2-7.7" within the Index.

Each codified string (e.g., R2-7.7) is followed by a hyphen and brief description of the requirement. Within the Index, click on the [blue page number](#) link to navigate to the corresponding NEBS topic.

## Connecting the controller enclosure and drive enclosures

AssuredSAN 6004 Series controller enclosures—available in 48-drive (2.5") and 56-drive (3.5") chassis. The high-density 2U enclosure support up to four enclosures, or a maximum of 192 disk drives. The high-density 4U enclosure supports up to eight enclosures, or a maximum of 248 disk drives for 56-drive enclosures. The maximum number of storage enclosures cited include the controller enclosure.

The 6004 Series enclosures support both *straight-through* and *reverse* SAS cabling. Reverse cabling allows any drive enclosure to fail—or be removed—while maintaining access to other enclosures. Fault tolerance and performance requirements determine whether to optimize the configuration for high availability or high performance when cabling. AssuredSAN 6004 Series controller modules support both 3-Gbps and 6-Gbps internal disk drive speeds together with 3 Gbps and 6 Gbps expander link speeds.

---

△ **CAUTION:** Some 6-Gbps disks might not consistently support a 6-Gbps transfer rate. If this happens, the system automatically adjusts transfers to those disks to 3 Gbps, increasing reliability and reducing error messages with little impact on system performance. This rate adjustment persists until the controller is restarted or power-cycled.

---

AssuredSAN controller enclosures support compatible Dot Hill drive enclosures for adding storage. Supported enclosure form factors include high-capacity models in 2U (2U48) and 4U (4U56) format. A summary overview of drive enclosures supported by controller enclosures is provided herein.

**NOTE:** See [Table 4](#) for a comparative tabular view of AssuredSAN drive enclosures supported by AssuredSAN controller enclosures.

**Table 4** Summary of drive enclosures supported by controller enclosures

RAID	Model	6004	
	Form	2U48	4U56
Expansion	2U48	J6X48	J6X48
	4U56	J6X56	J6X56
Chassis	4U56: Chassis (4-rack units high) with 56 LFF (3.5") sledged disk drive modules. 2U48: Chassis (2-rack units high) with 48 SFF (2.5") sledged disk drive modules.		
Models	J6X56: 4U56 chassis configured as a 6 Gb drive (expansion) enclosure for adding storage. J6X48: 2U48 chassis configured as a 6 Gb drive (expansion) enclosure for adding storage.		

<sup>1</sup> See <https://www.dothill.com> for most current information concerning support of drive enclosures for storage expansion.

<sup>2</sup> See the website (above) or the Setup Guide for your product model for enclosure maximum configuration limits.

<sup>3</sup> Using high-capacity drive enclosures reduces the maximum number of enclosures supported, without materially affecting the maximum number of disks allowed.

Cabling diagrams in this section show fault-tolerant cabling patterns. Controller and expansion modules are identified by <enclosure-ID><controller-ID>. When connecting multiple drive enclosures, use reverse cabling to ensure the highest level of fault tolerance, enabling controllers to access remaining drive enclosures if a drive enclosure fails.

For example, the illustration in [Figure 42](#) on page 43 shows reverse cabling, wherein controller 0A (i.e., enclosure-ID = 0; controller-ID = Able) is connected to expansion module 1A, with a chain of connections cascading down (blue). Controller 0B is connected to the lower expansion module (B) of the last drive enclosure in the chain, with connections moving in the opposite direction (green). Several cabling examples are provided on the following pages.

## Connecting the 6004 Series controller to the 2U48 drive enclosure

The high capacity J6X48 48-drive enclosure, supporting 6 Gb internal disk drive and expander link speeds, can be attached to an 6004 Series controller enclosure using supported mini-SAS to mini-SAS cables of 0.5 m (1.64') to 2 m (6.56') length (see [Figure 34](#) on page 39).

## Connecting the 6004 Series controller to the 4U56 drive enclosure

The high capacity J6X56 56-drive enclosure, supporting 6 Gb internal disk drive and expander link speeds, can be attached to a 6004 Series controller enclosure using supported mini-SAS to mini-SAS cables of 1 m (3.28') to 2 m (6.56') length (see [Figure 34](#) on page 39).

## Connecting the 6004 Series controller to mixed model drive enclosures

The 6004 Series controllers support cabling of 6 Gb SAS link-rate SFF and LFF expansion modules—in mixed model fashion—as shown in [Figure 34](#) on page 39.

## Cable requirements for storage enclosures

The 6004 Series enclosures support 6 Gbps or 3 Gbps expansion port data rates. Use only AssuredSAN or OEM-qualified cables, and observe the following guidelines (see [Table 5](#) on page 38):

- When installing SAS cables to expansion modules, use only supported mini-SAS x4 cables with SFF-8644 connectors.
- Qualified mini-SAS to mini-SAS 0.5 m (1.64') cables are used to connect cascaded enclosures in the rack. The "HD mini-SAS to HD mini-SAS" cable designator connotes SFF-8644 to SFF-8644 connectors.
- The maximum expansion cable length allowed in any configuration is 2 m (6.56').
- Cables required, if not included, must be separately purchased.
- When adding more than two drive enclosures, you may need to purchase additional 1 m or 2 m cables, depending upon number of enclosures and cabling method used:
  - Spanning 3, 4, or 5 drive enclosures requires 1 m (3.28') cables.
  - Spanning 6 or 7 drive enclosures requires 2 m (6.56') cables.
- You may need to order additional or longer cables when reverse-cabling a fault-tolerant configuration (see [Figure 38](#) on page 41).
- Use only AssuredSAN or OEM-qualified cables for host connection:
  - Qualified Fibre Channel SFP and cable options
  - Qualified 10GbE iSCSI SFP and cable options
  - Qualified 1 Gb RJ-45 SFP and cable options
  - Qualified HD mini-SAS standard cable options supporting SFF-8644 and SFF-8088 host connection (also see [HD mini-SAS host connection](#) on page 54):

A qualified SFF-8644 to SFF-8644 cable option is used for connecting to a 12 Gbit/s enabled host; whereas a qualified SFF-8644 to SFF-8088 cable option is used for connecting to a 6 Gbit/s enabled host.


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**NOTE:** The 4U56 enclosure does not use the 0.5 m (1.64') length supported for 2U enclosures.

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 **TIP:** Requirements for cabling 6004 Series controller enclosures and supported drive enclosures are summarized in [Table 5](#).

---

[Table 5](#) summarizes key characteristics of controller enclosures and compatible drive (expansion) enclosures relative to cabling concerns.

**Table 5** Summary of cabling connections for AssuredSAN 6004 Series storage enclosures

Model	Form	Host connect	NEBS	SFF 48-disk chassis	LFF 56-disk chassis
6844 <sup>1,2</sup>	2U48	Qualified CNC option: FC (8/16 Gb) SFP 10GbE iSCSI SFP 1 Gb iSCSI SFP	Note 4	mini-SAS to mini-SAS	mini-SAS to mini-SAS
6854 <sup>1,2</sup>	4U56		Note 4	mini-SAS to mini-SAS	mini-SAS to mini-SAS
6544 <sup>1,3</sup>	2U48	HD mini-SAS connector: standard cables	Note 4	mini-SAS to mini-SAS	mini-SAS to mini-SAS
6554 <sup>1,3</sup>	4U56		Note 4	mini-SAS to mini-SAS	mini-SAS to mini-SAS
J6X48	2U48		Note 4	mini-SAS to mini-SAS	mini-SAS to mini-SAS
J6X56	4U56		Note 4	mini-SAS to mini-SAS	mini-SAS to mini-SAS

**Table 5** Summary of cabling connections for AssuredSAN 6004 Series storage enclosures (continued)

Model	Form	Host connect	NEBS	SFF 48-disk chassis	LFF 56-disk chassis
Enclosure chassis designators:					
4U56: Enclosure measuring four rack units high, providing 56 LFF (3.5") sledged disk drive modules.					
2U48: Enclosure measuring two rack units high, providing 48 SFF (2.5") sledged disk drive modules.					
See <a href="#">Physical requirements</a> on page 120 for more information about AssuredSAN storage enclosures.					

<sup>1</sup>These compatible product models feature 6 Gbit/s internal disk and SAS expander link speeds.

<sup>2</sup>See [CNC technology](#) on page 51 for information about locating and installing qualified SFP options into CNC ports.

<sup>3</sup>See [12 Gb HD mini-SAS](#) on page 53 for information about host connection using SFF-8644 high-density mini-SAS connectors.

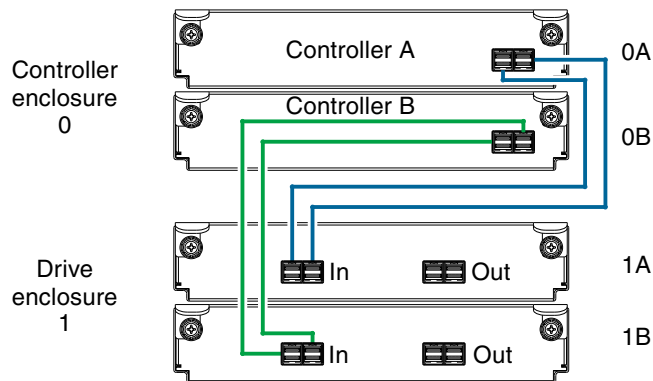
<sup>4</sup>The 6004 Series 4U56 enclosures are designed for NEBS compliance; however, the 6004 Series 2U48 enclosures are *not*.

## Summary of drive enclosure cabling illustrations

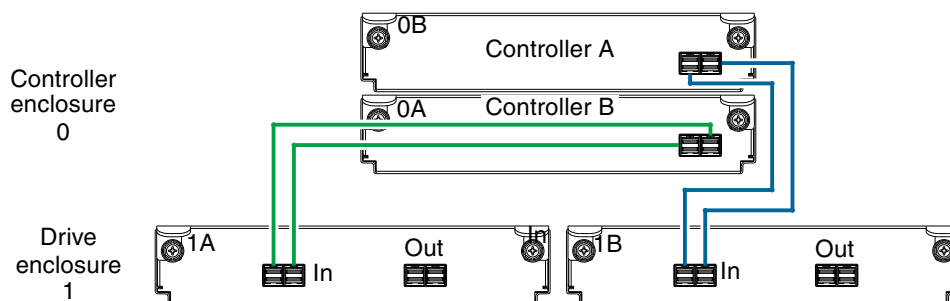
The following illustrations show both *reverse* and *straight-through* cabling examples featuring 6004 Series controller enclosures and compatible J6X48 (2U48) and J6X56 (4U56).

**NOTE:** For clarity, the schematic diagrams show only relevant details such as face plate outlines and expansion ports. For detailed illustrations, see [Controller enclosure — rear panel layout](#) on page 19. Also see the controller module face plate illustrations that follow the rear panel layout.

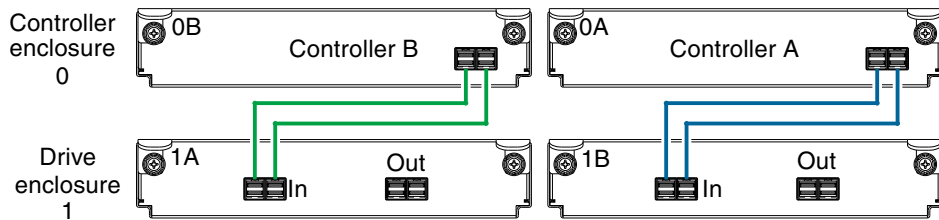
### 6004 Series controller enclosures cabled to a supported drive enclosure



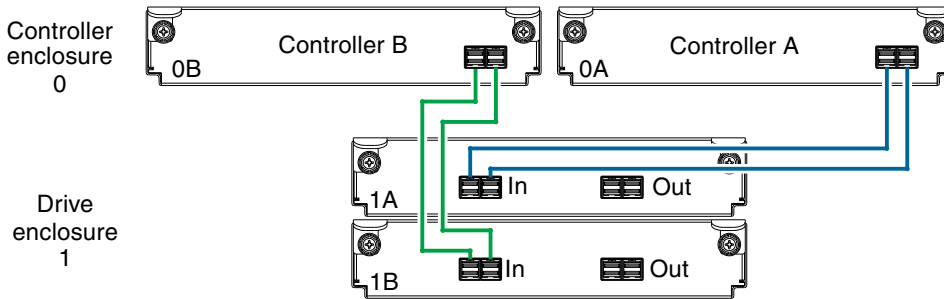
**Figure 34** Cabling connections between a 2U controller enclosure and one 2U drive enclosure



**Figure 35** Cabling connections between a 2U controller enclosure and one 4U drive enclosure



**Figure 36** Cabling connections between a 4U controller enclosure and a 4U drive enclosure



**Figure 37** Cabling connections between a 4U controller enclosure and a 2U drive enclosure

The preceding illustrations (Figure 34 through Figure 37) show examples of 2U and 4U controller enclosures cabled to either a 2U or 4U drive enclosure. Each set of examples feature enclosures equipped with dual IOMs.

See the “Replacing a controller or expansion module” topic within the FRU Installation and Replacement Guide for additional information.

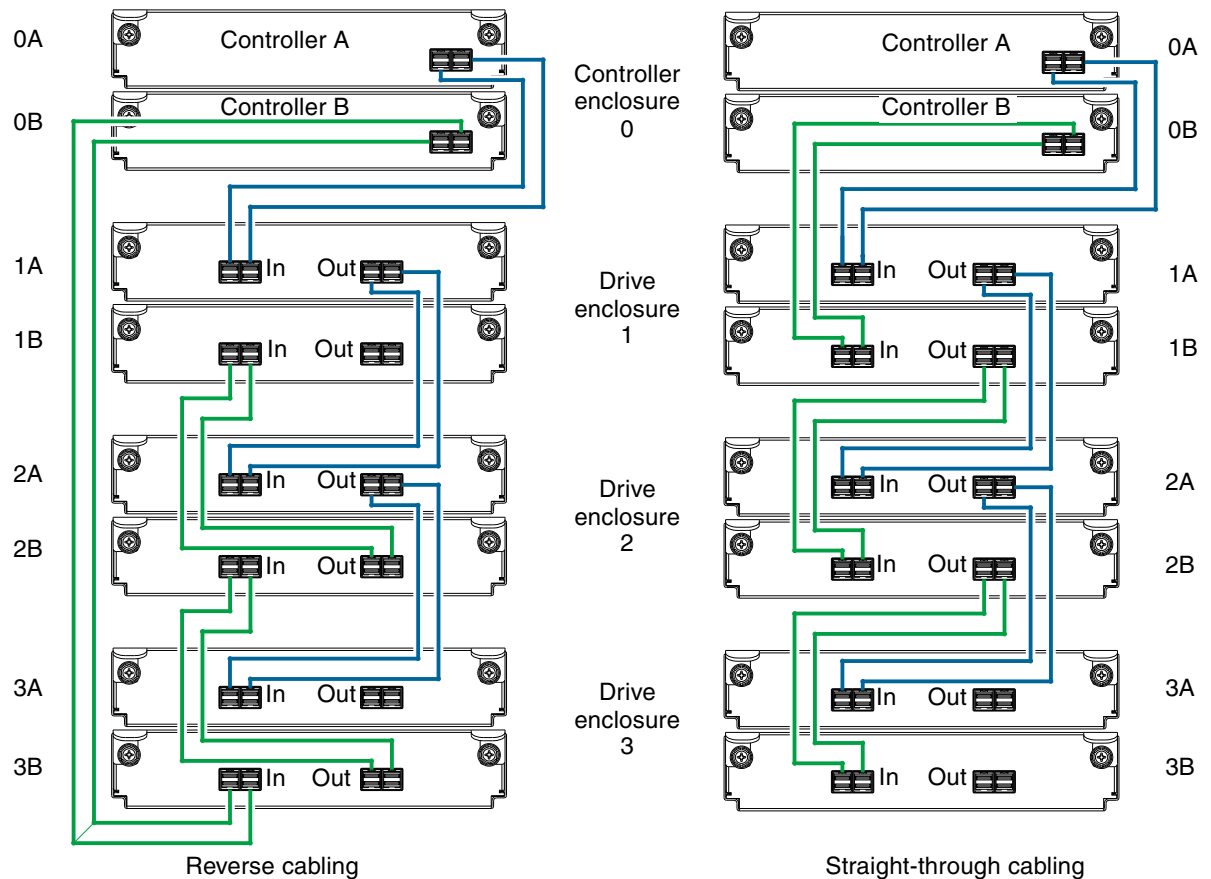
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**NOTE:** Figure 38–Figure 41 feature 2U controller enclosures cabled to supported drive enclosures; whereas Figure 42–Figure 46 feature 4U controller enclosures cabled to supported drive enclosures.

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## 6004 Series 2U controller enclosures cabled to supported drive enclosures



**Figure 38** Fault-tolerant cabling between a dual-IOM 2U enclosure and three 2U drive enclosures

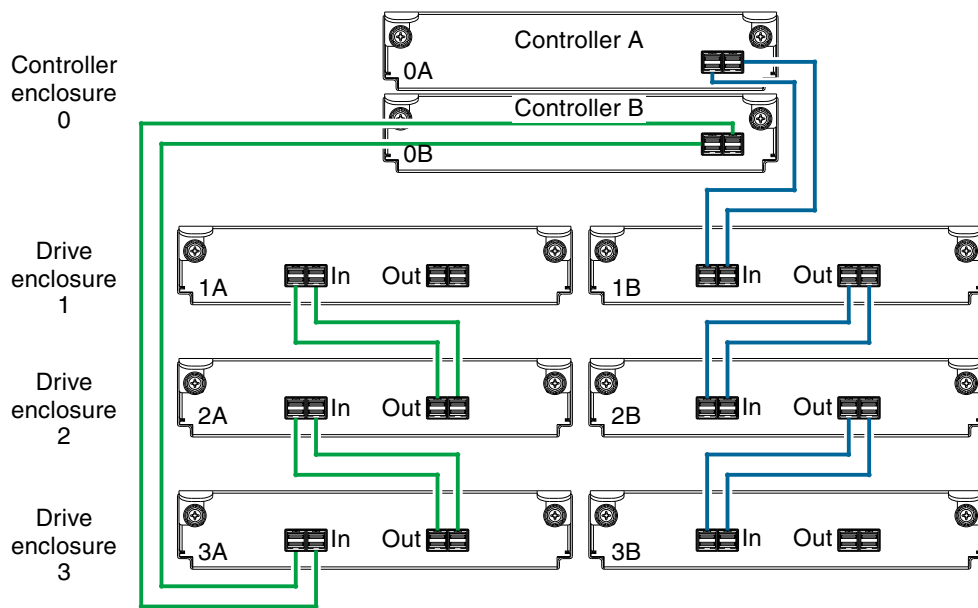
The diagram at left (above) shows reverse cabling of a 6004 Series dual-controller 2U enclosure and J6X48 drive enclosures configured with dual-expansion modules. Controller module 0A is connected to expansion module 1A, with a chain of connections cascading down (blue). Controller module 0B is connected to the lower expansion module (3B), of the last expansion enclosure, with connections moving in the opposite direction (green). Reverse cabling allows any expansion enclosure to fail—or be removed—while maintaining access to other enclosures.

The diagram at right (above) shows the same storage components connected using straight-through cabling. Using this method, if an expansion enclosure fails, the enclosures that follow the failed enclosure in the chain are no longer accessible until the failed enclosure is repaired or replaced.

Refer to these diagrams when cabling multiple compatible 2U drive enclosures together with the 6004 Series controller enclosure.

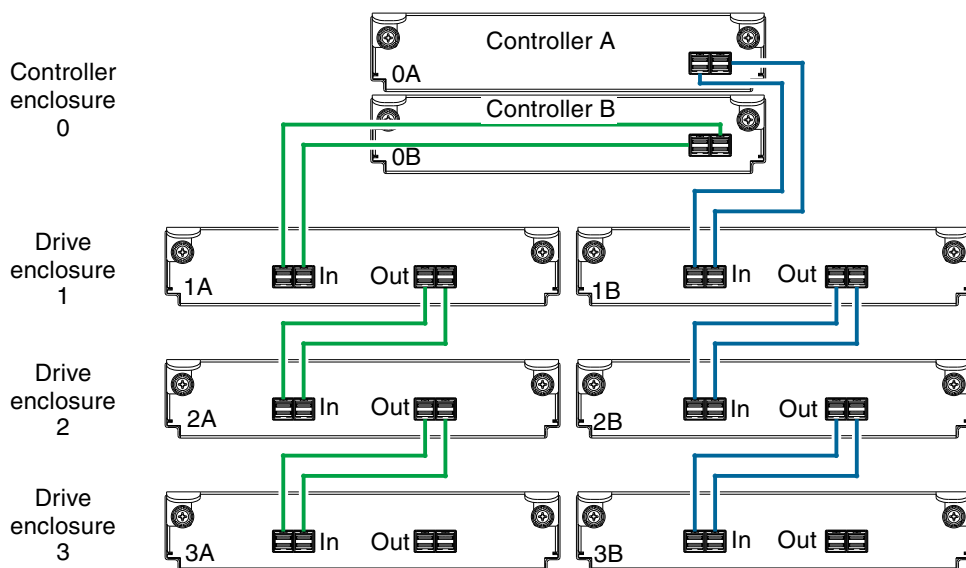
**IMPORTANT:** Guidelines for stacking enclosures in the rack are provided in the rackmount bracket kit installation sheet provided with your product.

**TIP:** Per common convention, in diagrams the controller enclosure is shown atop the stack of connected enclosures. In reality, for [Figure 44–Figure 46](#), you can invert the order of the stack for optimal weight and placement stability within the rack. The schematic representation of the cabling remains unchanged. See the rackmount bracket kit installation instructions for your product(s) for more detail.



**Figure 39** Reverse cabling between a dual-controller 2U enclosure and three 4U drive enclosures.

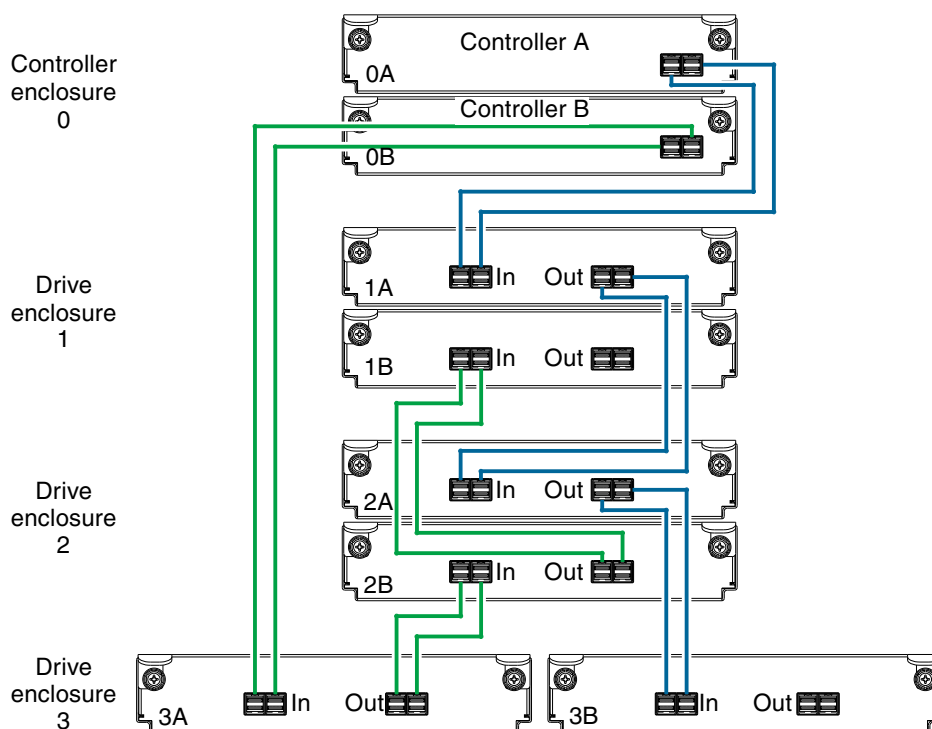
The diagram at above shows reverse cabling of an 6004 Series dual-controller enclosure and 2U drive enclosures configured with dual-expansion modules. Controller module 0A is connected to expansion module 1A, with a chain of connections cascading down (blue). Controller module 0B is connected to the lower expansion module (3A), of the last expansion enclosure, with connections moving in the opposite direction (green). Reverse cabling allows any expansion enclosure to fail—or be removed—while maintaining access to other enclosures.



**Figure 40** Straight-through cabling between a dual-controller 2U enclosure and three 4U drive enclosures

The diagram at right shows the same storage components connected using straight-through cabling. Using this method, if an expansion enclosure fails, the enclosures that follow the failed enclosure in the chain are no longer accessible until the failed enclosure is repaired or replaced.

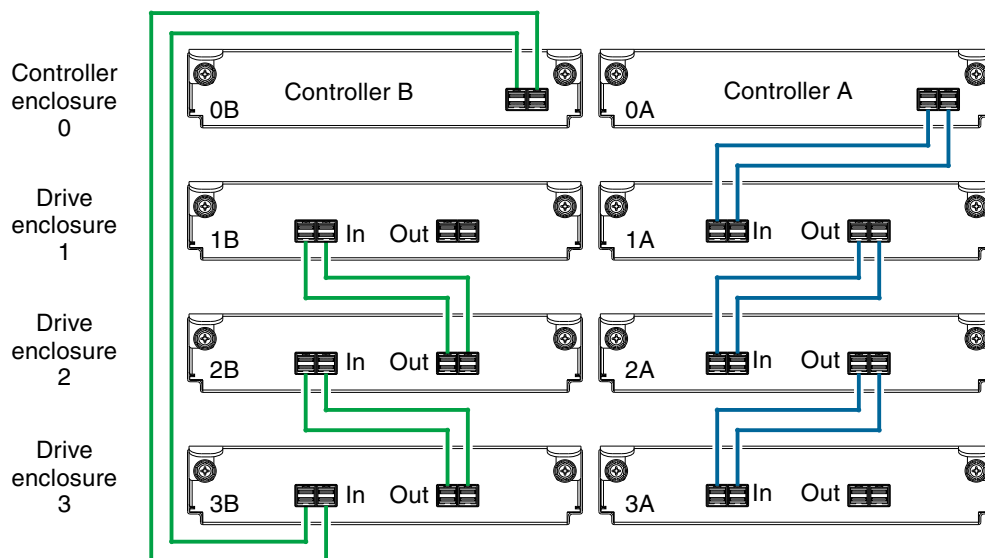
Figure 39 shows reverse-cabling and Figure 40 shows straight-through cabling. Cabling logic is explained in the narrative supporting Figure 39.



**Figure 41** Reverse cabling between a dual-controller 2U enclosure and mixed drive enclosures

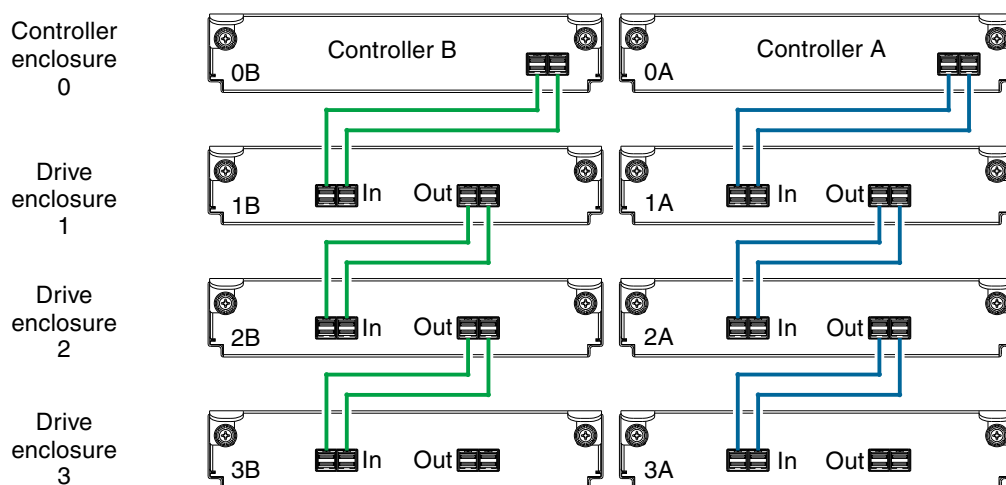
The diagram above shows dual-controller enclosures cabled to drive enclosures featuring dual-expansion modules. In the example shown above, a 4U drive enclosure is included with 2U drive enclosures within the RAID-array cascade.

6004 Series 4U controller enclosures cabled to supported drive enclosures



**Figure 42** Reverse-cabling between a dual-controller 4U enclosure and three 4U drive enclosures

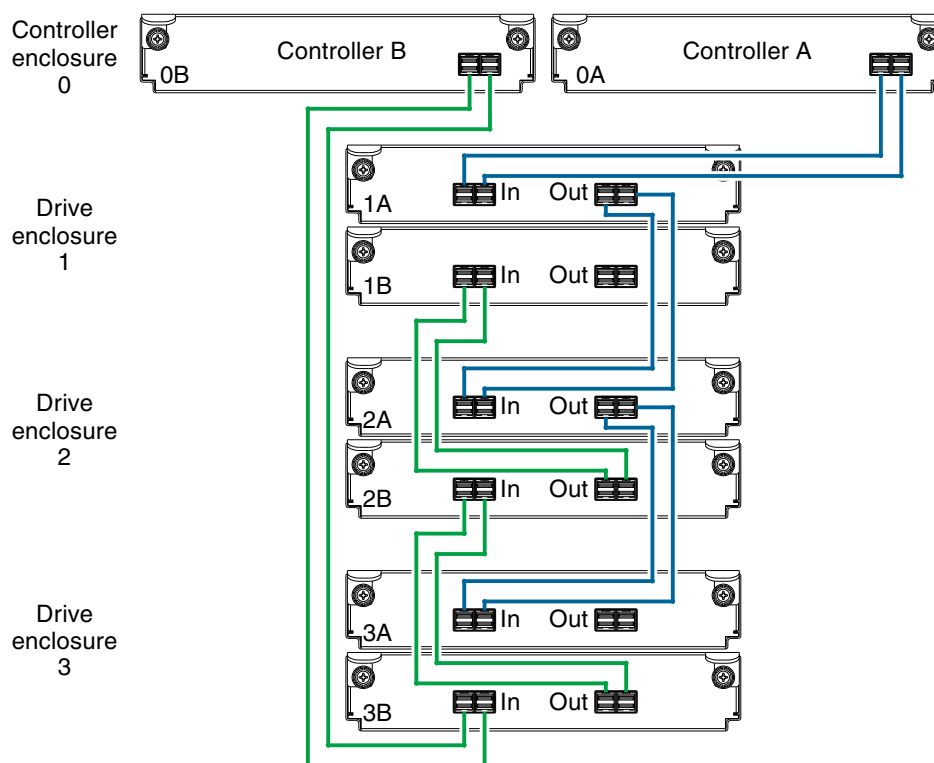
Figure 42 shows reverse-cabling of a 6004 Series dual-controller enclosure and J6X56 drive enclosures configured with dual-expansion modules. Controller module 0A is connected to expansion module 1A, with a chain of connections cascading down (blue). Controller module 0B is connected to the lower expansion module (3B), of the last expansion enclosure, with connections moving in the opposite direction (green). Reverse cabling allows any expansion enclosure to fail—or be removed—while maintaining access to other enclosures.



**Figure 43** Straight-through cabling between a dual-controller 4U enclosure and three 4U drive enclosures

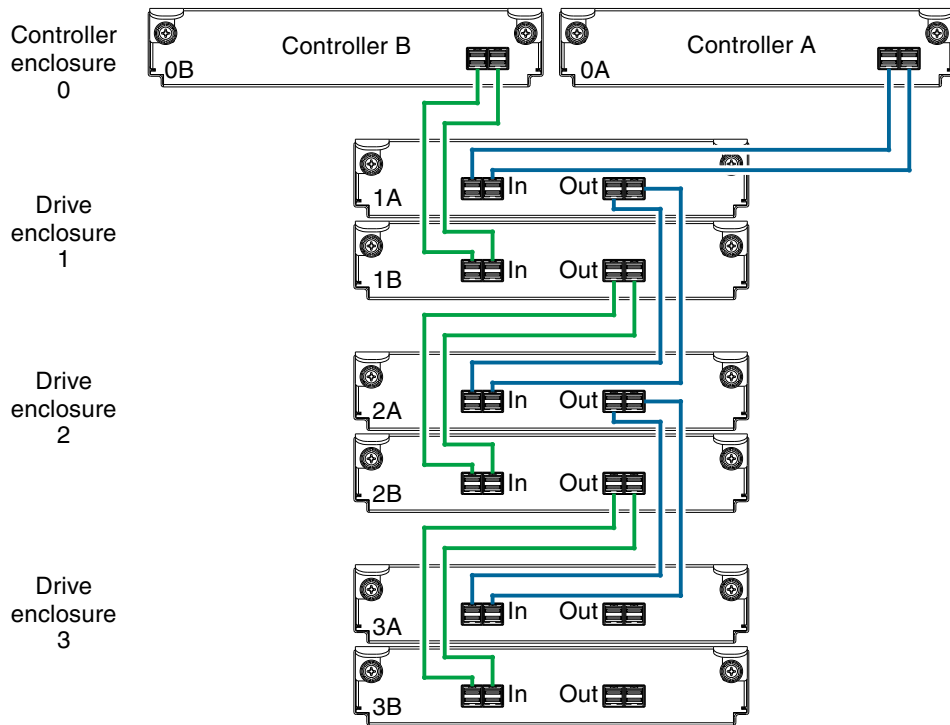
Figure 43 on page 44 shows the same storage components used in Figure 42, but they are connected using straight-through cabling. Using this method, if an expansion enclosure fails, the enclosures that follow the failed enclosure in the chain are no longer accessible until the failed enclosure is repaired or replaced.

Refer to these diagrams when cabling multiple compatible drive enclosures together with the 6004 Series controller enclosure. The cabling diagrams reflect maximum configuration.



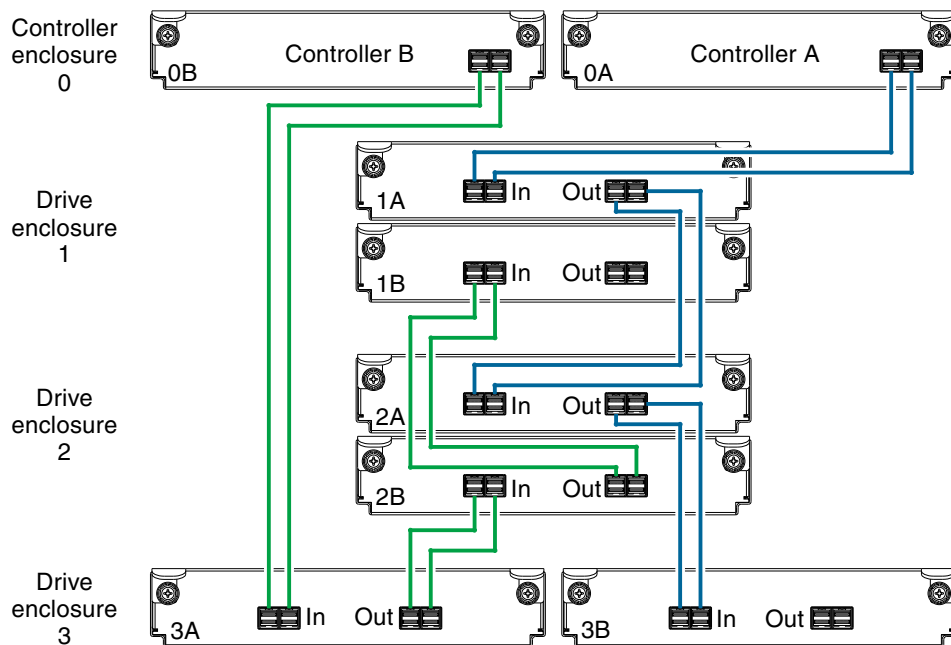
**Figure 44** Reverse-cabling between a dual-controller 4U enclosure and three 2U drive enclosures

Figure 44 shows reverse cabling of a 6004 Series dual-controller enclosure and 2U drive enclosures configured with dual-expansion modules. Controller module 0A is connected to expansion module 1A, with a chain of connections cascading down (blue). Controller module 0B is connected to the lower expansion module (3B), of the last expansion enclosure, with connections moving in the opposite direction (green). Reverse cabling allows any expansion enclosure to fail—or be removed—while maintaining access to other enclosures.



**Figure 45** Straight-through cabling between a dual-controller 4U enclosure and three 2U drive enclosure

Figure 45 on page 45 shows the same storage components used in Figure 44, but they are connected using straight-through cabling. Using this method, if an expansion enclosure fails, the enclosures that follow the failed enclosure in the chain are no longer accessible until the failed enclosure is repaired or replaced.



**Figure 46** Reverse-cabling between a dual-controller 4U enclosure and mixed-model drive enclosures

Figure 46 shows reverse cabling of a 6004 Series dual-controller enclosure and supported mixed-model (2U and 4U) drive enclosures configured with dual-expansion modules. In this example, the 2U enclosures follow the 4U enclosures. Given that all of the supported drive enclosure models use 6 Gb SAS link-rate and SAS 2.0 expanders, they can be ordered in desired sequence within the array, following the controller enclosure.

Controller module 0A is connected to expansion module 1A, with a chain of connections cascading down (blue). Controller module 0B is connected to the lower expansion module (3B), of the last expansion enclosure, with connections moving in the opposite direction (green). Reverse cabling allows any expansion enclosure to fail—or be removed—while maintaining access to other enclosures.

## Testing enclosure connections

Power cycling procedures vary according to the type of power supply unit (PSU) provided with the enclosure. Some enclosure models are equipped with PSUs that do not have power switches; whereas 6004 Series enclosures use a PSU model that is equipped with a power switch.

AssuredSAN 4U chassis use a different PSU model for AC and a different PSU model for DC. The 2U48 enclosures presently do not use DC power supplies. The AC PSU with power switch—used by the 2U48 and 4U56 chassis—is described within the following section, [Powering on/powering off](#), which also describes power cycling procedures relative to PSUs installed within enclosures.

Once the power-on sequence succeeds, the storage system is ready to be connected to hosts as described in [Connecting the enclosure to hosts](#) on page 51.

## Powering on/powering off

Before powering on the enclosure for the *first* time:

- Install all disk drives in the enclosure so the controller can identify and configure them at power-up.

---

**NOTE:** For high-capacity 2U48 or 4U56 enclosures, you must remove the enclosure bezel and open the target drawer to access disk slots or view LEDs for disks:

- Remove/attach bezel ([Enclosure bezel attachment and removal](#) on page 96).
  - Open/close drawer in 2U48 chassis ([Opening and closing a 2U16 drawer](#) on page 27).
  - Open/close drawer in 4U56 chassis ([Opening and closing a 4U28 drawer](#) on page 31).
- 

- Connect the cables and power cords to the enclosure as described herein.
- Generally, when powering up, make sure to power up the enclosures and associated data host in the following order:

- Drive enclosures *first*

This ensures that the disks in the drive enclosure have enough time to completely spin up before being scanned by the controller modules within the controller enclosure.


While enclosures power up, their LEDs blink. After the LEDs stop blinking—if no LEDs on the drawer panels and no LEDs on the front and back of the enclosure are amber—the power-on sequence is complete, and no faults have been detected. See [LED descriptions](#) on page 96 for descriptions of LED behavior. Navigate to the desired 2U or 4U enclosure for product-specific LED behavior.

- Controller enclosure *next*

Depending upon the number and type of disks in the system, it may take several minutes for the system to become ready.

- Data host *last* (if powered down for maintenance purposes).

---

 **TIP:** Generally, when powering off, you will reverse the order of steps used for powering on.

---

## Power supplies

This section provides an overview of power supplies—2U and 4U form factors—used in 6004 Series enclosures.

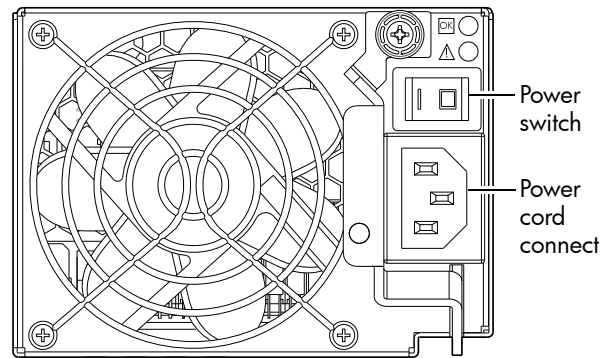
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 **CAUTION:** Remove power cords from both power supplies before servicing the system.

---

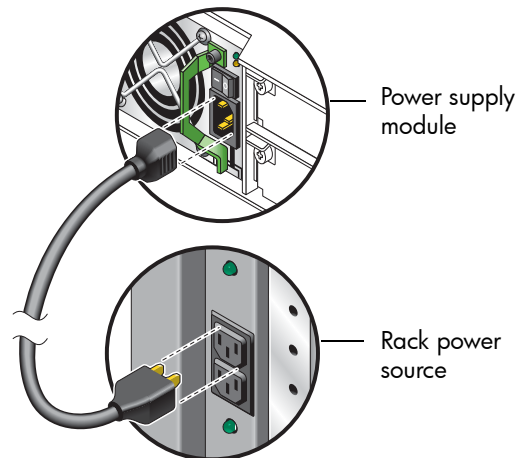
## AC PSU (2U)

Each AC power supply is equipped with a power switch. The illustration below shows the face of an AC power supply module as it appears when viewing the rear panel of the enclosure.



**Figure 47** AC PSU (2U)

Connect power cord to AC power supply



**Figure 48** AC power cord connect (2U)

Obtain two suitable AC power cords: one for each AC power supply that will connect to a separate power source. See [Figure 48](#) and the illustration in [Figure 47](#) when performing the following steps:

1. Verify that the enclosure's power switches are in the **Off** position.
2. Identify the power cord connector on the PSU, and locate the target power source.
3. Using the AC power cords provided, plug one end of the cord into the power cord connector on the PSU. Plug the other end of the power cord into the rack power source.
4. Verify connection of primary power cords from the rack to separate external power sources.  
See [Power cycle \(2U48\)](#).

### Power cycle (2U48)

Once the system is successfully cabled, use the following procedures to power on and power off.

#### To power on the system:

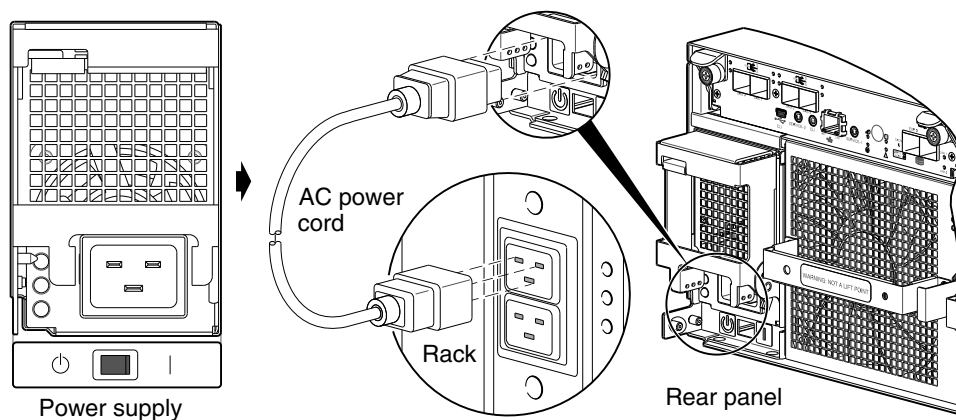
1. Power up drive enclosure(s). Allow several seconds for disks to spin up.  
Press the power switches at the back of each drive enclosure to the **On** position.
2. Power up the controller enclosure next.  
Press the power switches at the back of the controller enclosure to the **On** position.

### To power off the system:

1. Stop all I/O from hosts to the system (see [Stopping I/O](#) on page 77).
2. Shut down both controllers using *either* method described below:
  - Use the SMC or RAIDar to shut down both controllers, as described in the online help and Storage Management Guide.  
Proceed to [step 3](#).
  - Use the CLI to shut down both controllers, as described in the CLI Reference Guide.
3. Press the power switches at the back of the controller enclosure to the **Off** position.
4. Press the power switches at the back of each drive enclosure to the **Off** position.

## AC PSU (4U)

The 6004 Series enclosures use two redundant AC PSUs, each of which is controlled by a power switch mounted on the chassis (beneath the PSU). The illustration below shows the face of an AC power supply module as it appears when viewing the rear panel of the 4U enclosure. Connection of the power cable to the rack power source is also shown.



**Figure 49** AC PSU with power switch (4U)

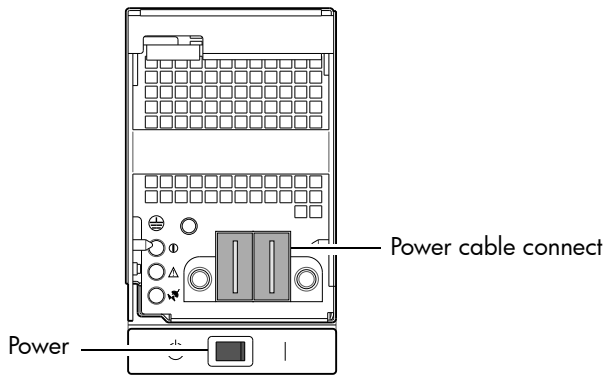
Obtain two suitable power cords: one for each AC power supply that will connect to a separate power source. See [Figure 49](#) when performing the following steps:

1. Verify that the enclosure's power switches are in the **Standby** position.
2. Identify the power cord connector on the PSU, and locate the target power source.
3. Using the AC power cords provided, plug one end of the cord into the power cord connector on the PSU. Plug the other end of the power cord into the rack power source.
4. Verify connection of primary power cables from the rack to separate external power sources.

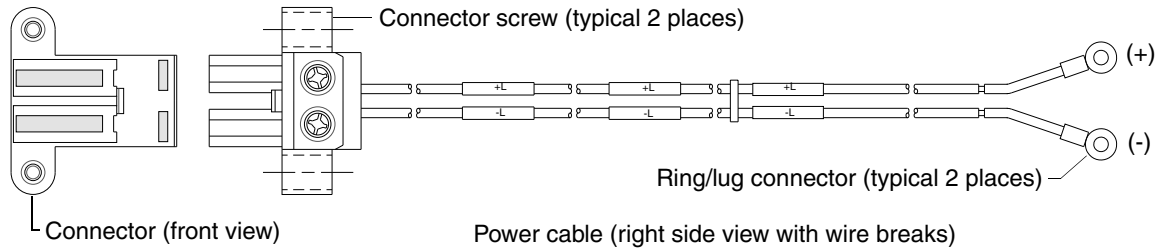
## DC PSU (4U)

As an alternative to using AC PSUs, the 6004 Series enclosure can use two redundant DC PSUs controlled by the power switch mounted on the chassis.





**Figure 50** DC PSU with power switch (4U)



**Figure 51** DC power cable featuring 2-circuit header and lug connectors (4U)

See [Figure 50](#) and [Figure 51](#) when performing the following steps:

1. Locate the appropriate DC power cables.
2. Verify that the enclosure's power switches are in the **Standby** position.
3. Connect the DC power to each DC power supply using the 2-circuit header connector.
4. Tighten the screws at the base of the connector—left and right sides—applying a torque between 1.7 N-m (15 in-lb) and 2.3 N-m (20 in-lb), to securely attach the cable to the DC power supply module.
5. To complete the DC connection, secure the other end of each cable wire component of the DC power cable to the target DC power source.

Check the two individual DC cable wire labels before connecting each cable wire lug to its power source. One wire is labeled *positive* (+L) and the other is labeled *negative* (-L), as shown in [Figure 51](#) above. The 4U56 enclosure is grounded independently of this DC cable. The chassis ground wire is connected from a stud on its mounting rail to the rack in which it is mounted.

---

△ **CAUTION:** Connecting to a DC power source outside the designated -48VDC nominal range (-36VDC to -72 VDC) may damage the enclosure.

---

### Power cycle (4U56)

Once the system is successfully cabled, use the following procedures to power on and power off.

#### To power on the system:

1. Power up drive enclosure(s) by doing one of the following:
  - Press the power switches at the back of each drive enclosure to the **On** position.
  - Connect the power cable from the power source to the connector on the PSU (switchless PSUs).  
Allow 2.5 minutes for disks to spin up.
2. Power up the 4U56 controller enclosure next.  
Press the power switches at the back of the controller enclosure to the **On** position.

#### To power off the system:

1. Stop all I/O from hosts to the system (see [Stopping I/O](#) on page 77).

2. Shut down both controllers using *either* method described below:
  - Use the SMC or RAIDar to shut down both controllers, as described in the online help and Storage Management Guide.  
Proceed to [step 3](#).
  - Use the CLI to shut down both controllers, as described in the CLI Reference Guide.
3. Press the power switches at the back of the 4U controller enclosure to the **Standby** position.
4. Power down drive enclosure(s) by doing one of the following:
  - Press the power switches at the back of each drive enclosure to the **Off** position; or
  - Disconnect the power cable from the power source to the connector on the PSU (switchless PSUs).

---

## 3 Connecting hosts

### Host system requirements

Hosts connected to an AssuredSAN 6004 Series controller enclosure must meet the following requirements:

- Depending on your system configuration, host operating systems may require that multipathing is supported.  
If fault tolerance is required, then multipathing software may be required. Host-based multipath software should be used in any configuration where two logical paths between the host and any storage volume may exist at the same time. This would include most configurations where there are multiple connections to the host or multiple connections between a switch and the storage.
- Use native Microsoft MPIO DSM support with Windows Server 2008 and Windows Server 2013. Use either the Server Manager or the command-line interface (*mpclaim* CLI tool) to perform the installation.

See the following web sites for information about using native Microsoft MPIO DSM:

<https://support.microsoft.com>

<https://technet.microsoft.com> (search the site for “multipath I/O overview”)

### Cabling considerations

Common cabling configurations address hosts, controller enclosures, drive enclosures, and switches. Host interface ports on 6004 Series controller enclosures can connect to respective hosts via direct-attach or switch-attach. Cabling systems to enable use of the optional AssuredRemote™ feature—to replicate volumes—is yet another important cabling consideration. See [Connecting two storage systems to replicate volumes](#) on page 61. The 6844/6854 models can be licensed to support replication; whereas the 6544/6554 models do not support the feature.

---

 **TIP:** [Table 5](#) on page 38 aligns product model numbers with 2U and 4U chassis form factors.

---

### Connecting the enclosure to hosts

A *host* identifies an external port to which the storage system is attached. The external port may be a port in an I/O adapter (such as an FC HBA) in a server. Cable connections vary depending on configuration. This section describes host interface protocols supported by 6004 Series controller enclosures, while showing a few common cabling configurations.


---

**NOTE:** 6004 Series controllers use Unified LUN Presentation (ULP): a controller feature enabling a host to access mapped volumes through any controller host port.

---

ULP can show all LUNs through all host ports on both controllers, and the interconnect information is managed by the controller firmware. ULP appears to the host as an active-active storage system, allowing the host to select any available path to access the LUN, regardless of disk group ownership.

---

 **TIP:** See “Using the Configuration Wizard” in the Storage Management Guide to initially configure the system or change system configuration settings (such as Configuring host ports).

---

### CNC technology

AssuredSAN 6844/6854 models use Converged Network Controller technology, allowing you to select the desired host interface protocol(s) from the available FC or iSCSI host interface protocols supported by


the system. The small form-factor pluggable (SFP transceiver or SFP) connectors used in CNC ports are further described in the subsections below. Also see [CNC ports used for host connection](#) on page 10 for more information concerning use of CNC ports.

---

**NOTE:** Controller modules are *not* shipped with pre-installed SFPs. Within your product kit, you will need to locate the qualified SFP options, and install them into the CNC ports. See [Install an SFP transceiver](#) on page 128.

---

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 **IMPORTANT:** Use the `set host-port-mode` CLI command to set the host interface protocol for CNC ports using qualified SFP options. AssuredSAN 6844/6854 models ship with CNC ports configured for FC. When connecting CNC ports to iSCSI hosts, you must use the CLI (not the SMC or RAIDar) to specify which ports will use iSCSI. It is best to do this before inserting the iSCSI SFPs into the CNC ports (see [Change the CNC port mode](#) on page 71 for instructions).

---

---

**NOTE:** AssuredSAN 6844/6854 models support the optionally-licensed AssuredRemote replication feature. Whereas linear storage supports FC and iSCSI host interface ports for replication, virtual supports iSCSI host interface ports for replication. Both linear and virtual storage support all qualified CNC options for host connection.

---

## Fibre Channel protocol

AssuredSAN 6844/6854 controller enclosures support two controller modules using the Fibre Channel interface protocol for host connection. Each controller module provides four host ports designed for use with an FC SFP supporting data rates up to 16 Gbit/s. When configured with FC SFPs, 6844/6854 controller enclosures can also be cabled to support the optionally-licensed AssuredRemote replication feature via the FC ports (linear storage only).


The controller supports Fibre Channel Arbitrated Loop (public or private) or point-to-point topologies. Loop protocol can be used in a physical loop or in a direct connection between two devices. Point-to-point protocol is used to connect to a fabric switch. Point-to-point protocol can also be used for direct connection, and it is the only option supporting direct connection at 16 Gbit/s. See the `set host-parameters` command within the CLI Reference Guide for command syntax and details about parameter settings relative to supported link speeds.

Fibre Channel ports are used in either of two capacities:

- To connect two storage systems through a Fibre Channel switch for use of AssuredRemote replication (linear storage only).
- For attachment to FC hosts directly, or through a switch used for the FC traffic.

The first usage option requires valid licensing for the AssuredRemote replication feature, whereas the second option requires that the host computer supports FC and optionally, multipath I/O.

---

 **TIP:** Use the SMC or RAIDar Configuration Wizard to set FC port speed. Within the Storage Management Guide, see “Configuring host ports.” Use the `set host-parameters` CLI command to set FC port options, and use the `show ports` CLI command to view information about host ports.

---

## 10GbE iSCSI protocol


AssuredSAN 6844/6854 controller enclosures support two controller modules using the Internet SCSI interface protocol for host connection. Each controller module provides four host ports designed for use with a 10GbE iSCSI SFP supporting data rates up to 10 Gbit/s, using either one-way or mutual CHAP (Challenge-Handshake Authentication Protocol).

---

 **TIP:** See the topics about Configuring CHAP, and CHAP and replication in the Storage Management Guide.

---

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 **TIP:** Use the SMC or RAIDar Configuration Wizard to set iSCSI port options. Within the Storage Management Guide, see “Configuring host ports.” Use the `set host-parameters` CLI command to set iSCSI port options, and use the `show ports` CLI command to view information about host ports.

---

The 10GbE iSCSI ports are used in either of two capacities:

- To connect two storage systems through a switch for use of AssuredRemote replication.
- For attachment to 10GbE iSCSI hosts directly, or through a switch used for the 10GbE iSCSI traffic.

The first usage option requires valid licensing for the AssuredRemote replication feature, whereas the second option requires that the host computer supports Ethernet, iSCSI, and optionally, multipath I/O.

## 1 Gb iSCSI protocol


AssuredSAN 6844/6854 controller enclosures support two controller modules using the Internet SCSI interface protocol for host port connection. Each controller module provides four iSCSI host ports configured with an RJ-45 SFP supporting data rates up to 1 Gbit/s, using either one-way or mutual CHAP.

---

 **TIP:** See the topics about Configuring CHAP, and CHAP and replication in the Storage Management Guide.

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---

 **TIP:** Use the SMC or RAIDar Configuration Wizard to set iSCSI port options. Within the Storage Management Guide, see “Configuring host ports.” Use the `set host-parameters` CLI command to set iSCSI port options, and use the `show ports` CLI command to view information about host ports.

---

The 1 Gb iSCSI ports are used in either of two capacities:

- To connect two storage systems through a switch for use of AssuredRemote replication.
- For attachment to 1 Gb iSCSI hosts directly, or through a switch used for the 1 Gb iSCSI traffic.

The first usage option requires valid licensing for the AssuredRemote replication feature, whereas the second option requires that the host computer supports Ethernet, iSCSI, and optionally, multipath I/O.

## HD mini-SAS technology

AssuredSAN 6544/6554 models use high-density mini-SAS (Serial Attached SCSI) interface protocol for host connection.

### 12 Gb HD mini-SAS

Each controller module provides four SFF-8644 HD mini-SAS host ports supporting data rates up to 12 Gbit/s. HD mini-SAS host ports connect to hosts or switches; they are not used for replication. Use a qualified SFF-8644 to SFF-8644 cable option when connecting to a 12 Gbit/s host. Use a qualified SFF-8644 to SFF-8088 option when connecting to a supported 6 Gbit/s host.

## Connecting direct attach configurations

AssuredSAN 6004 Series controller enclosures support up to eight direct-connect server connections, four per controller module. Connect appropriate cables from the server’s HBAs to the controller module’s host ports as described below, and shown in the following illustrations.

---

**NOTE:** The 4U56 enclosure does not use the 0.5 m (1.64') length supported for 2U enclosures.

---

## Fibre Channel host connection

To connect 6844/6854 controller modules supporting (4/8/16 Gb) FC host interface ports to a server HBA or switch—using the controller’s CNC ports—select a qualified FC SFP option.

Qualified options support cable lengths of 1 m (3.28'), 2 m (6.56'), 5 m (16.40'), 15 m (49.21'), 30 m (98.43'), and 50 m (164.04') for OM4 multimode optical cables and OM3 multimode FC cables, respectively. A 0.5 m (1.64') cable length is also supported for OM3. In addition to providing host connection, these cables are used for connecting a local storage system to a remote storage system via a switch, to facilitate use of the optional AssuredRemote replication feature (linear storage only).

## 10GbE iSCSI host connection

To connect 6844/6854 controller modules supporting 10GbE iSCSI host interface ports to a server HBA or switch—using the controller’s CNC ports—select a qualified 10GbE SFP option.

Qualified options support cable lengths of 1 m (3.28'), 3 m (9.84'), 5 m (16.40'), and 7 m (22.97') for copper cables; and cable lengths of 0.65 m (2.13'), 1 m (3.28'), 1.2 m (3.94'), 3 m (9.84'), 5 m (16.40'), and 7 m (22.97') for direct attach copper (DAC) cables. In addition to providing host connection, these cables are used for connecting a local storage system to a remote storage system via a switch, to facilitate use of the optional AssuredRemote replication feature.

## 1 Gb iSCSI host connection

To connect 6844/6854 controller modules supporting 1 Gb iSCSI host interface ports to a server HBA or switch—using the controller’s CNC ports—select a qualified 1 Gb RJ-45 copper SFP option supporting (CAT5-E minimum) Ethernet cables of the same lengths specified for 10GbE iSCSI above. In addition to providing host connection, these cables are used for connecting a local storage system to a remote storage system via a switch, to facilitate use of the optional AssuredRemote replication feature.

## HD mini-SAS host connection

To connect 6544/6554 controller modules supporting HD mini-SAS host interface ports to a server HBA or switch —using the controller’s SFF-8644 dual HD mini-SAS host ports—select a qualified HD mini-SAS cable option. A qualified SFF-8644 to SFF-8644 cable option is used for connecting to a 12 Gbit/s enabled host; whereas a qualified SFF-8644 to SFF-8088 cable option is used for connecting to a 6 Gbit/s host. Qualified SFF-8644 to SFF-8644 options support cable lengths of 0.5 m (1.64'), 1 m (3.28'), 2 m (6.56'), and 4 m (13.12'). Qualified SFF-8644 to SFF-8088 options support cable lengths of 1 m (3.28'), 2 m (6.56'), 3 m (9.84'), and 4 m (13.12').

---

**NOTE:** Supported qualified cable options for host connection are subject to change.

---

---

**NOTE:** Keys to reading cabling diagrams for host connection:

- The diagrams that follow use a single representation for each CNC cabling example. This is due to the fact that the CNC port locations and labeling are identical for each of the three possible interchangeable SFPs supported by the system.
  - Within each cabling connection category, the HD mini-SAS model is shown beneath the CNC model.
- 

## Dual-controller configurations

A dual-controller configuration improves application availability because in the event of a controller failure, the affected controller fails over to the partner controller with little interruption to data flow. A failed controller can be replaced without the need to shut down the storage system.

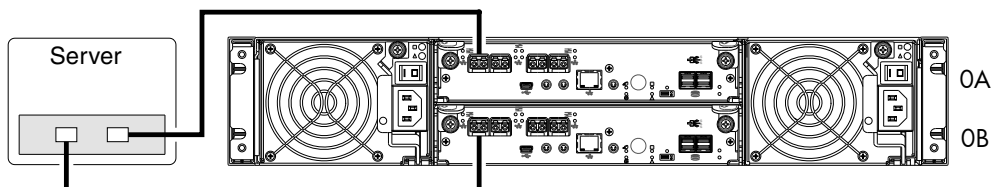
In a dual-controller system, hosts use LUN-identifying information from both controllers to determine that up to four paths are available to a given storage volume. Assuming MPIO software is installed, a host can use any available data path to access a volume owned by either controller. The path providing the best performance is through host ports on the volume’s owning controller. Both controllers share one set of 1,024 LUNs (0-1,023) for use in mapping volumes to hosts (see “ULP” in the Storage Management Guide).

**IMPORTANT:** 6004 Series controller enclosures support dual-controller configuration only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

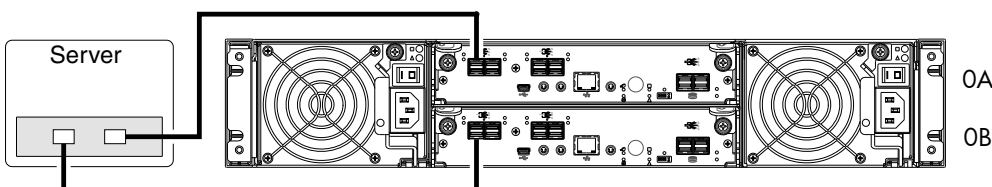
The illustrations below show dual-controller configurations for 6004 Series controller enclosures equipped with either CNC ports or 12 Gb HD mini-SAS host ports (shown beneath the CNC model).

One server/one HBA/dual path

6844

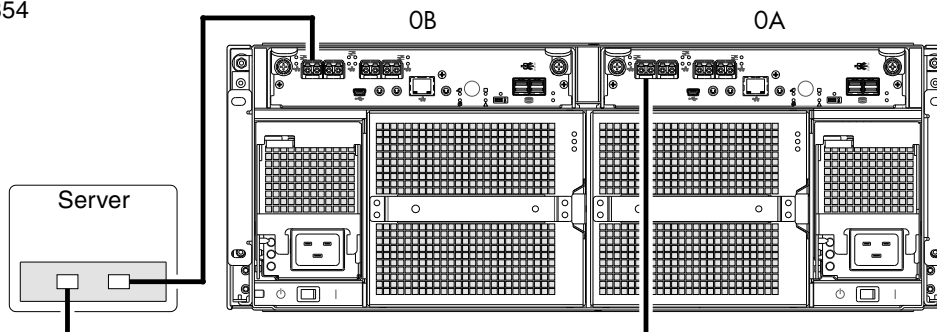


6544



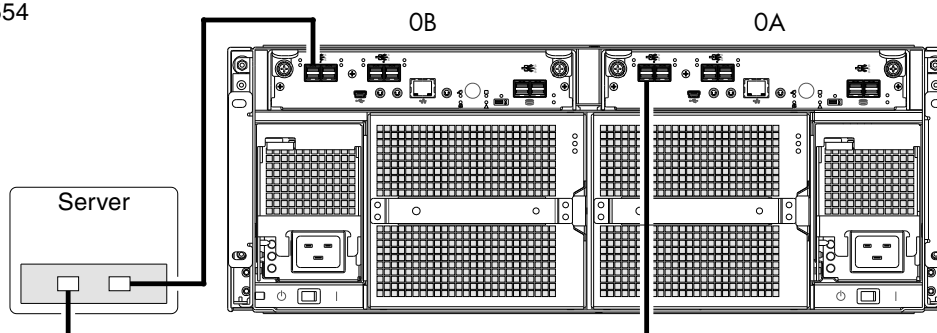
**Figure 52** Connecting hosts: direct attach—one server/one HBA/dual path (2U)

6854



**Figure 53** Connecting hosts: direct attach—one server/one HBA/dual path (4U CNC)

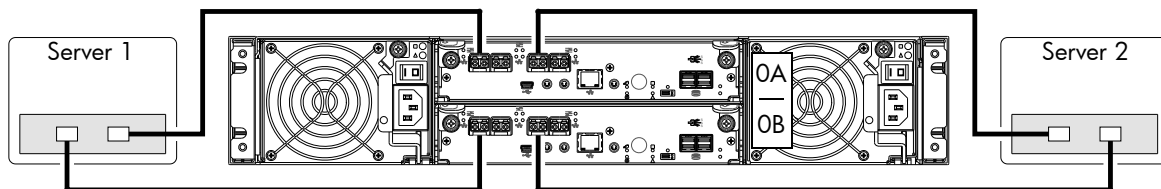
6554



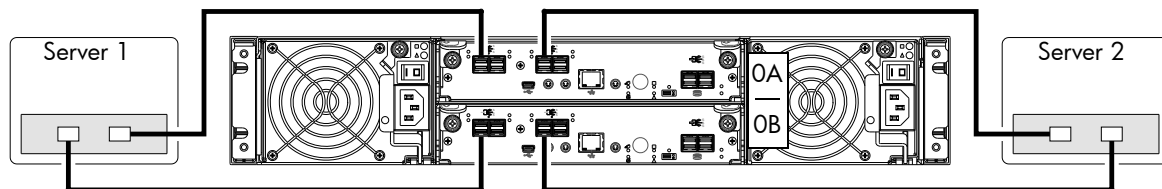
**Figure 54** Connecting hosts: direct attach—one server/one HBA/dual path (4U HD mini-SAS)

Two servers/one HBA per server/dual path

6844

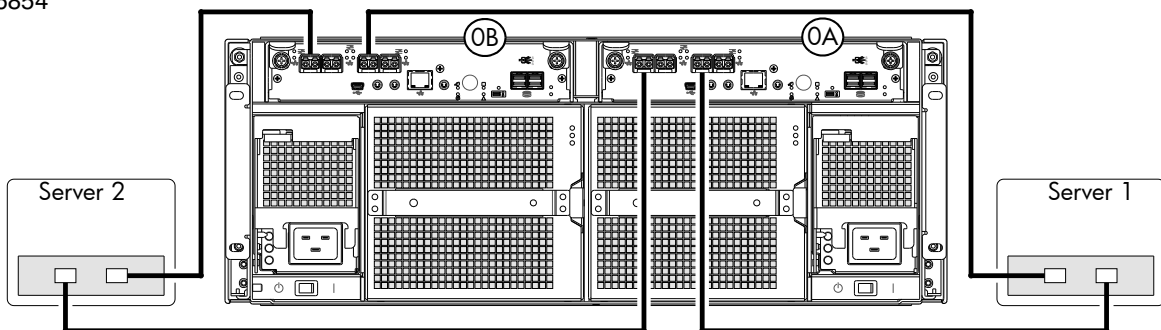


6544



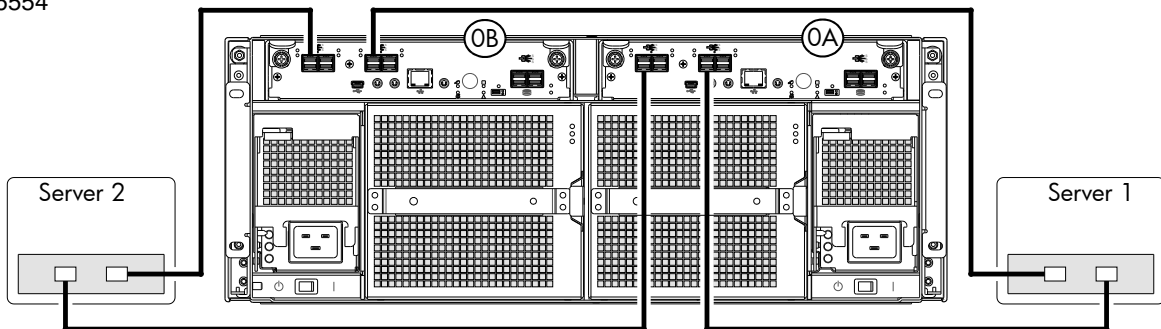
**Figure 55** Connecting hosts: direct attach—two servers/one HBA per server/dual path (2U)

6854



**Figure 56** Connecting hosts: direct attach—two servers/one HBA per server/dual path (4U CNC)

6554

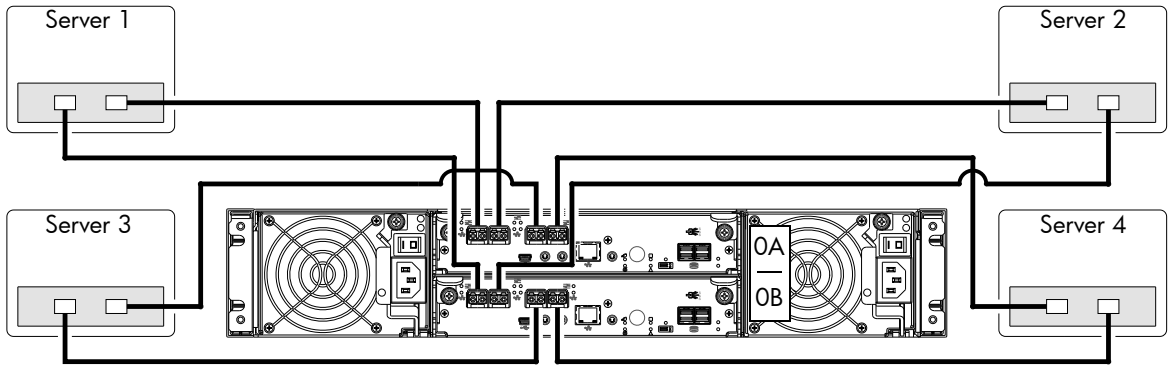


**Figure 57** Connecting hosts: direct attach—two servers/one HBA per server/dual path (4U HD mini-SAS)

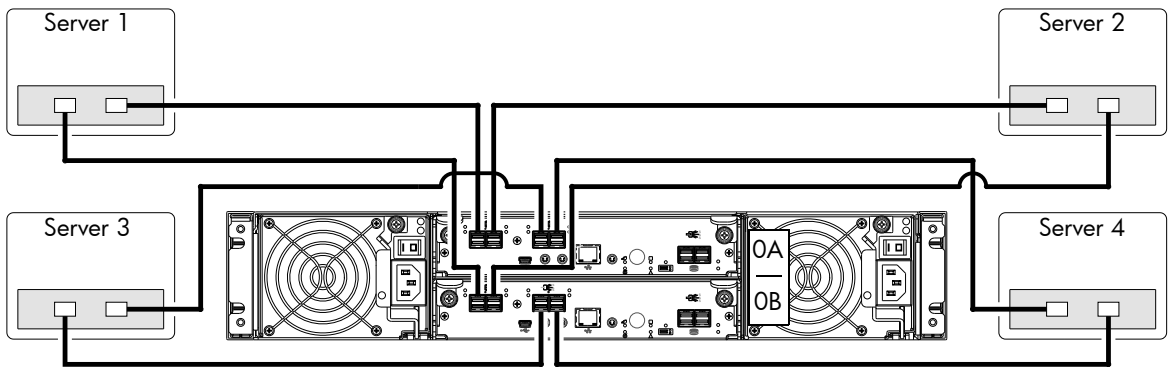


Four servers/one HBA per server/dual path

6844

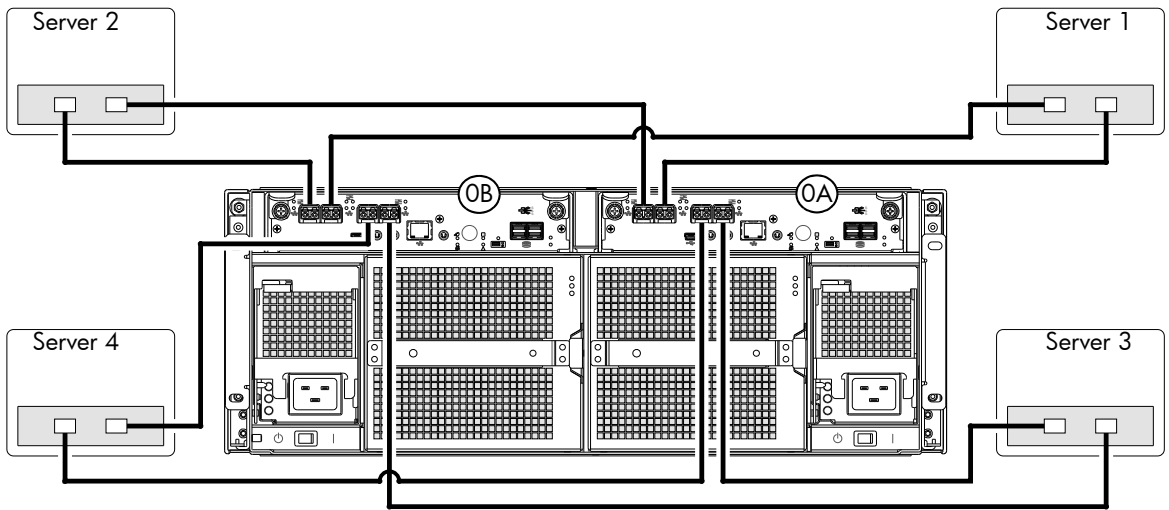


6544



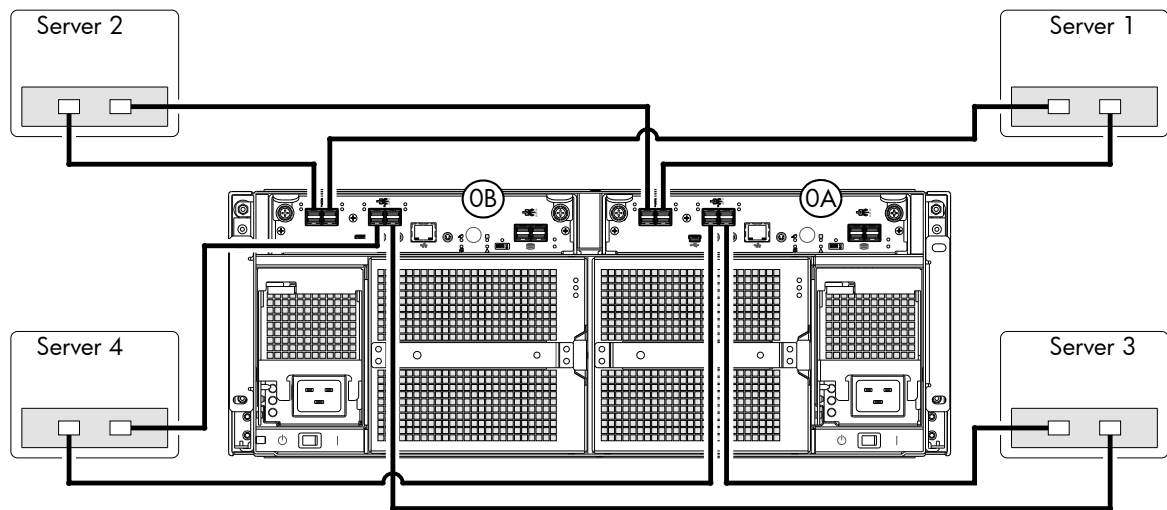
**Figure 58** Connecting hosts: direct attach—four servers/one HBA per server/dual path (2U)

6854



**Figure 59** Connecting hosts: direct attach—four servers/one HBA per server/dual path (4U CNC)

6554



**Figure 60** Connecting hosts: direct attach—four servers/one HBA per server/dual path (4U HD mini-SAS)

## Connecting switch attach configurations

A switch attach solution—or SAN—places a switch between the servers and the controller enclosures within the storage system.

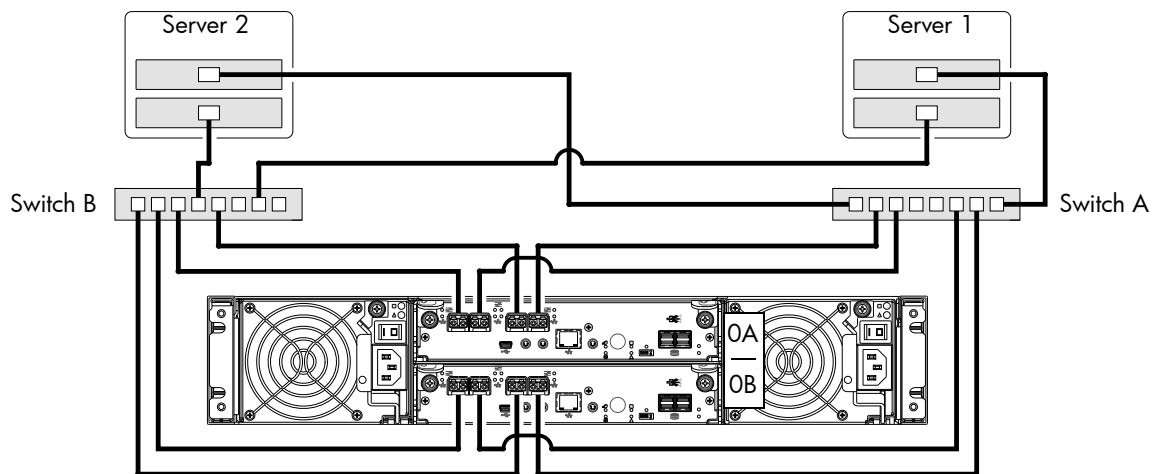
Using switches, a SAN shares a storage system among multiple servers, reducing the number of storage systems required for a particular environment. Using switches increases the number of servers that can be connected to the storage system. A 6004 Series controller enclosure supports 64 hosts.

The diagrams that follow show the SAN by using labeled switches and by using a cloud symbol to denote a SAN fabric.

### Dual-controller configuration

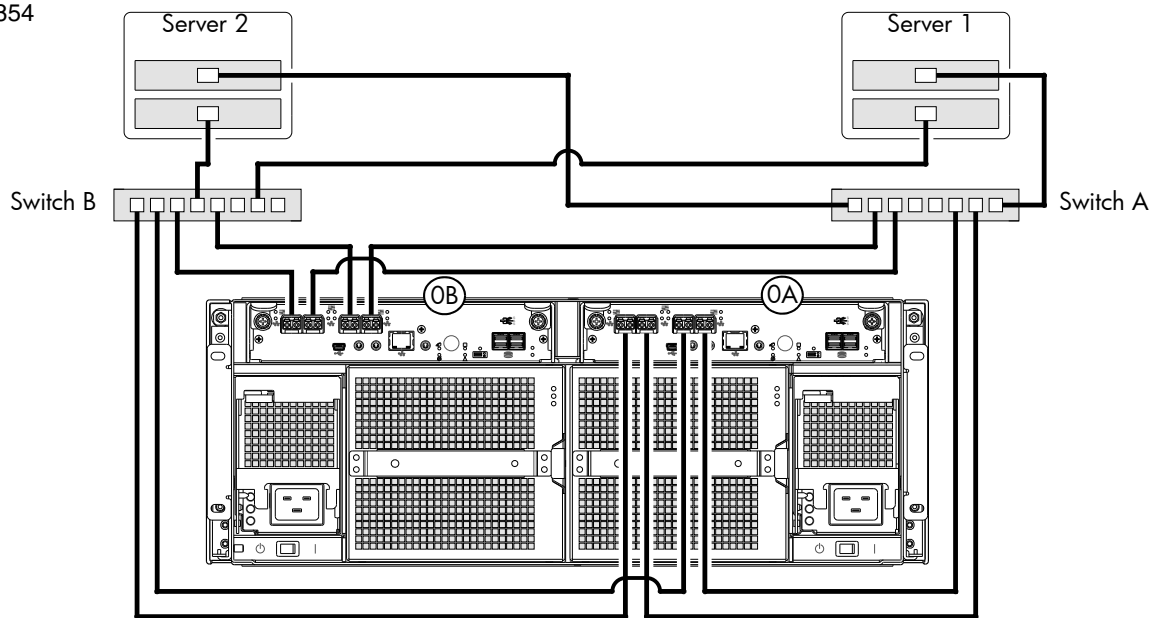
Two servers/two switches

6844



**Figure 61** Connecting hosts: switch attach—two servers/two switches (2U CNC)

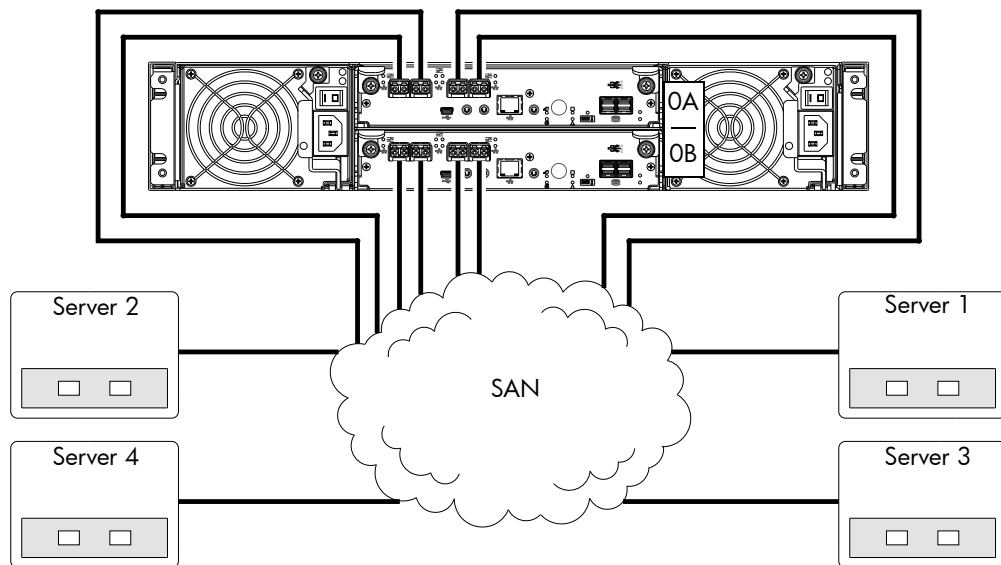
6854



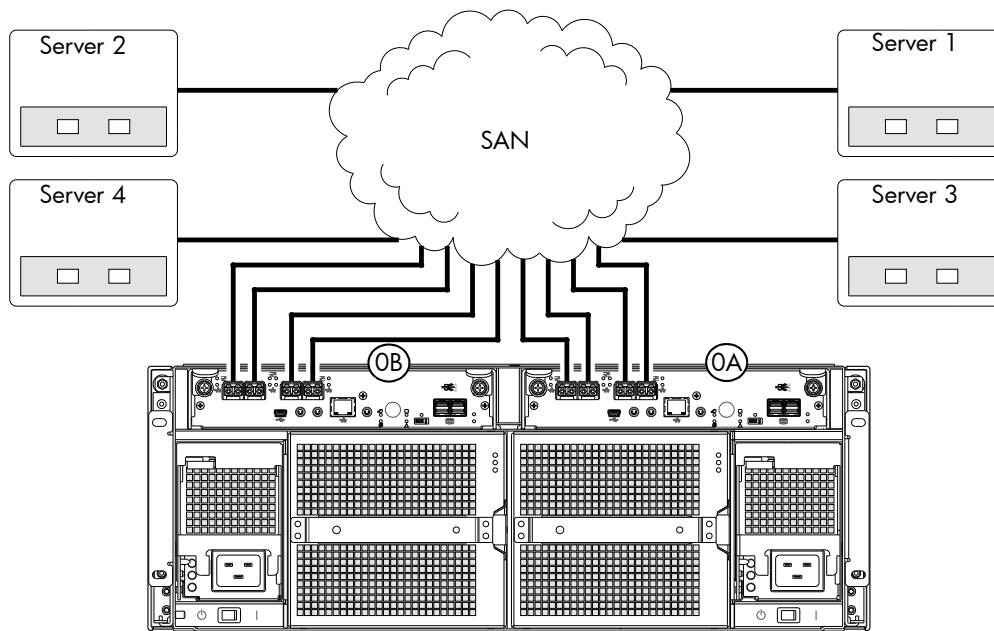
**Figure 62** Connecting hosts: switch attach—two servers/two switches (4U CNC)

Four servers/multiple switches/SAN fabric

6854



**Figure 63** Connecting hosts: switch attach—four servers/multiple switches/SAN fabric (2U CNC)



**Figure 64** Connecting hosts: switch attach—four servers/multiple switches/SAN fabric (4U CNC)

#### 6004 Series controller enclosure iSCSI considerations

When installing an 6004 Series iSCSI controller enclosure, use at least three ports per server—two for the storage LAN, and one or more for the public LAN(s)—to ensure that the storage network is isolated from the other networks. The storage LAN is the network connecting the servers—via switch attach—to the controller enclosure (see [Figure 61](#) on page 58 and [Figure 63](#)).

#### IP address scheme for the controller pair — two iSCSI ports per controller

The 6844/6854 can use port 2 of each controller as one failover pair, and port 3 of each controller as a second failover pair for iSCSI traffic. Port 2 of each controller must be in the same subnet, and port 3 of each controller must be in second subnet. See [Controller enclosure — rear panel layout](#) on page 19 for iSCSI port numbering.

For example (with a netmask of 255.255.255.0):

- Controller A port 2: 10.10.10.100
- Controller A port 3: 10.11.10.120
- Controller B port 2: 10.10.10.110
- Controller B port 3: 10.11.10.130

The 6844/6854 can use port 0 of each controller as one failover pair, and port 1 of each controller as a second failover pair. Port 0 of each controller must be in the same subnet, and port 1 of each controller must be in second subnet. See [Controller enclosure — rear panel layout](#) on page 19 for iSCSI port numbering.

For example (with a netmask of 255.255.255.0):

- Controller A port 0: 10.10.10.100
- Controller A port 1: 10.11.10.120
- Controller B port 0: 10.10.10.110
- Controller B port 1: 10.11.10.130

#### IP address scheme for the controller pair — four iSCSI ports per controller

When all CNC ports are configured for iSCSI, the scheme is similar to the one described for two-ports above. See [Controller enclosure — rear panel layout](#) on page 19 for iSCSI port numbering.

For example (with a netmask of 255.255.255.0):

- Controller A port 0: 10.10.10.100
- Controller A port 1: 10.11.10.120
- Controller A port 2: 10.10.10.110
- Controller A port 3: 10.11.10.130
- Controller B port 0: 10.10.10.140
- Controller B port 1: 10.11.10.150
- Controller B port 2: 10.10.10.160
- Controller B port 3: 10.11.10.170

In addition to setting the port-specific options described above, you can view the settings using the GUI.

- If using the SMC, in the **System** topic, select **Action > Set Up Host Ports**.  
The Host Ports Settings panel opens, allowing you to access host connection settings.
- If using RAIDar, in the Configuration View panel, right-click the system and select **Configuration > System Settings > Host Interfaces**.  
The Configure Host Interface panel opens, allowing you to access host connection settings.

## Connecting a management host on the network

The management host directly manages storage systems out-of-band over an Ethernet network.

1. Connect an RJ-45 Ethernet cable to the network port on each controller.
2. Connect the other end of each Ethernet cable to a network that your management host can access (preferably on the same subnet).

---

**NOTE:** Connections to this device must be made with shielded cables—grounded at both ends—with metallic RFI/EMI connector hoods, in order to maintain compliance with NEBS and FCC Rules and Regulations. See the Product Regulatory Compliance and Safety (included in your product’s ship kit).

---


Alternatively, you can access the document online. See Dot Hill’s customer resource center (CRC) web site for additional information: <https://crc.dothill.com>.

## Connecting two storage systems to replicate volumes

AssuredRemote™ replication is a licensed feature for disaster recovery, providing access to either of the following software product versions:

- SMC (v3) supports replication for virtual storage environments.
- RAIDar (v2) supports replication for linear storage environments.

---

 **IMPORTANT:** These two replication models are mutually exclusive to one another. Choose the method that applies to your storage system. For more information, see replication topics in the Storage Management Guide.

---

The replication feature performs asynchronous replication of block-level data from a volume in a primary system to a volume in a secondary system by creating an internal snapshot of the primary volume, and copying the snapshot data to the secondary system via FC (linear storage only) or iSCSI links.

The two associated standard volumes form a replication set, and only the primary volume (source of data) can be mapped for access by a server. Both systems must be licensed to use the replication feature, and must be connected through switches to the same fabric or network (i.e., no direct attach). The server accessing the replication set need only be connected to the primary system. If the primary system goes offline, a connected server can access the replicated data from the secondary system.


Replication configuration possibilities are many, and can be cabled—in switch attach fashion—to support the CNC-based systems on the same network, or on physically-split networks (SAS systems do not support

replication). As you consider the physical connections of your system—specifically connections for replication—keep several important points in mind:

- Ensure that controllers have connectivity between systems, whether local or remote.
- Whereas linear storage supports FC and iSCSI host interface ports for replication, virtual storage supports iSCSI host interface ports for replication. Both linear and virtual storage support all qualified CNC options for host connection.
- If using the RAIDar (v2) user interface, be sure of the desired link type before creating the linear replication set, because you cannot change the replication link type after creating the replication set.
- Assign specific ports for replication whenever possible. By specifically assigning ports available for replication, you free the controller from scanning and assigning the ports at the time replication is performed.
- Ensure that all ports assigned for replication are able to communicate appropriately with the replication system (see the CLI Reference Guide for more information).
  - For linear replication, use the `verify remote-link` command.
  - For virtual replication, use the `query peer-connection` command.
- Allow two ports to perform replication. This permits the system to balance the load across those ports as I/O demands rise and fall. On dual-controller enclosures, if some of the volumes replicated are owned by controller A and others are owned by controller B, then allow at least one port for replication on each controller module—and possibly more than one port per controller module—depending on replication traffic load.
- For the sake of system security, do not unnecessarily expose the controller module network port to an external network connection.

Conceptual cabling examples are provided addressing cabling on the same network and cabling relative to physically-split networks. The cabling examples provided apply to linear replication and virtual replication.

---

 **IMPORTANT:** Controller module firmware must be compatible on all systems used for replication. For license information, see the Storage Management Guide.

---

## Cabling for replication

This section shows example replication configurations for CNC-based controller enclosures. The following illustrations provide conceptual examples of cabling supporting linear replication and virtual replication. Blue cables show I/O traffic and green cables show replication traffic.

---

**NOTE:** Simplified versions of controller enclosures are used in cabling illustrations to show either FC or iSCSI host interface protocol, given that only the external connectors used in the host interface ports differ.

- Cabling for replication diagrams pertain to linear replication and virtual replication.
    - Linear replication supports FC and iSCSI host interface protocols.
    - Virtual replication supports iSCSI host interface protocol.
  - The 2U enclosure rear panel view represents 6844 models
  - The 4U enclosure rear panel view represents 6854 models.
- 

Once the CNC systems are physically cabled, see the Storage Management Guide or online help for information about configuring, provisioning, and using the optional replication feature. Refer to the replication feature topic pertaining to your environment (linear replication or virtual replication).

## CNC ports and replication

CNC controller modules can use qualified SFP options of the same type, or they can use a combination of qualified SFP options supporting different host interface protocols. If you use a combination of different protocols, then CNC ports 0 and 1 must be set to FC (either both 16 Gbit/s or both 8 Gbit/s), and CNC ports 2 and 3 must be set to iSCSI (either both 10GbE or both 1 Gbit/s).

In linear storage environments [RAIDar (v2)], each CNC port can perform I/O or replication. In combination environments, one interface—for example FC—might be used for I/O, and the other interface type—10GbE or 1 Gb iSCSI—might be used for replication. In virtual storage environments [SMC (v3)], each CNC port can perform I/O, but replication traffic is supported by iSCSI host interface ports (either both 10GbE or both 1 Gbit/s).

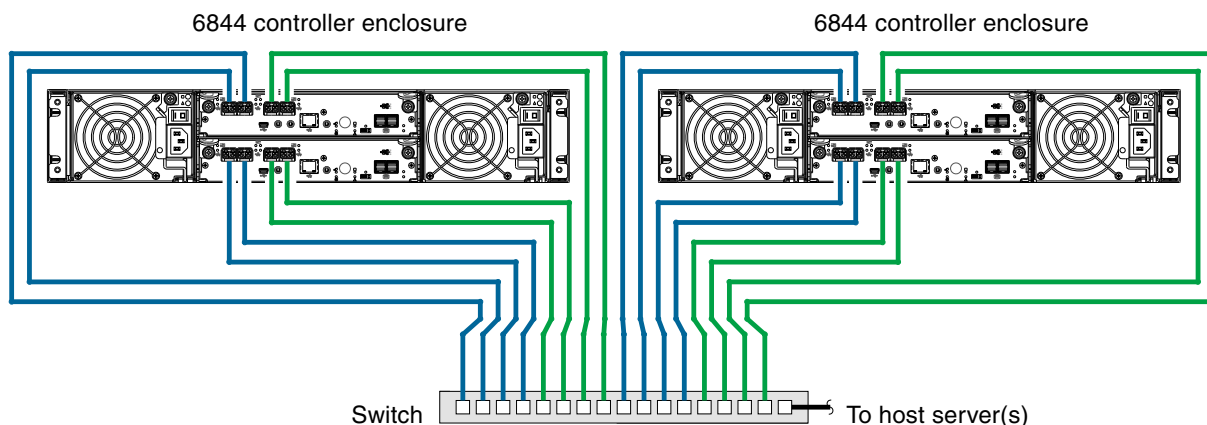
## Dual-controller configuration

Each of the following diagrams show the rear panel of two 6844 controller enclosures equipped with dual-controller modules.

**IMPORTANT:** Whereas linear storage supports FC and iSCSI host interface protocols for replication, virtual storage supports iSCSI host interface protocol for replication. Both linear and virtual storage support all qualified CNC options for host connection.

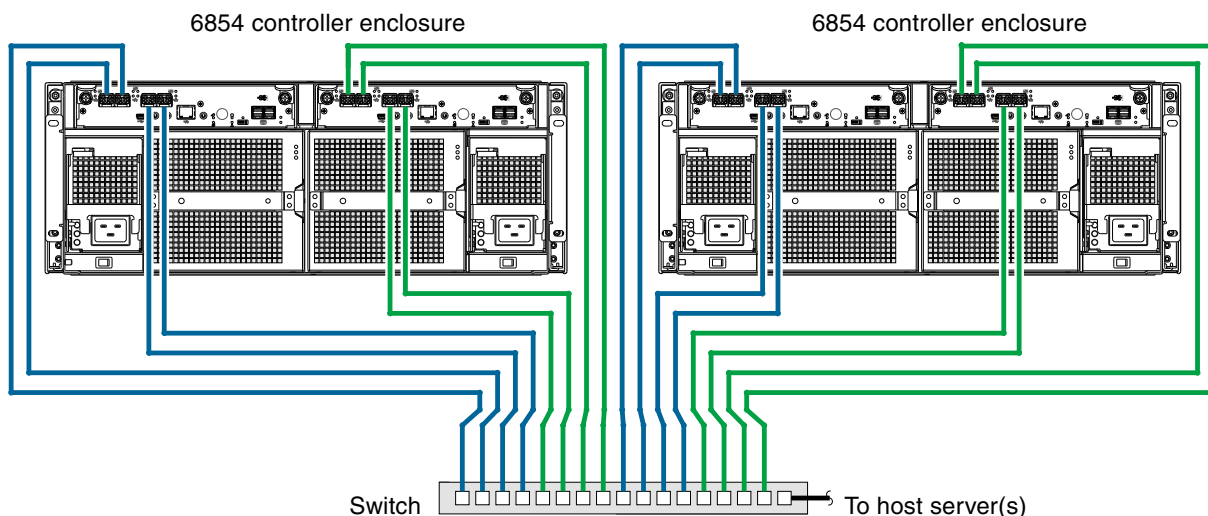
### Multiple servers/single network

Figure 65 shows the rear panel of two 6844 controller enclosures with both I/O and replication occurring on the same physical network.



**Figure 65** Connecting two storage systems for replication: multiple servers/one switch/one location

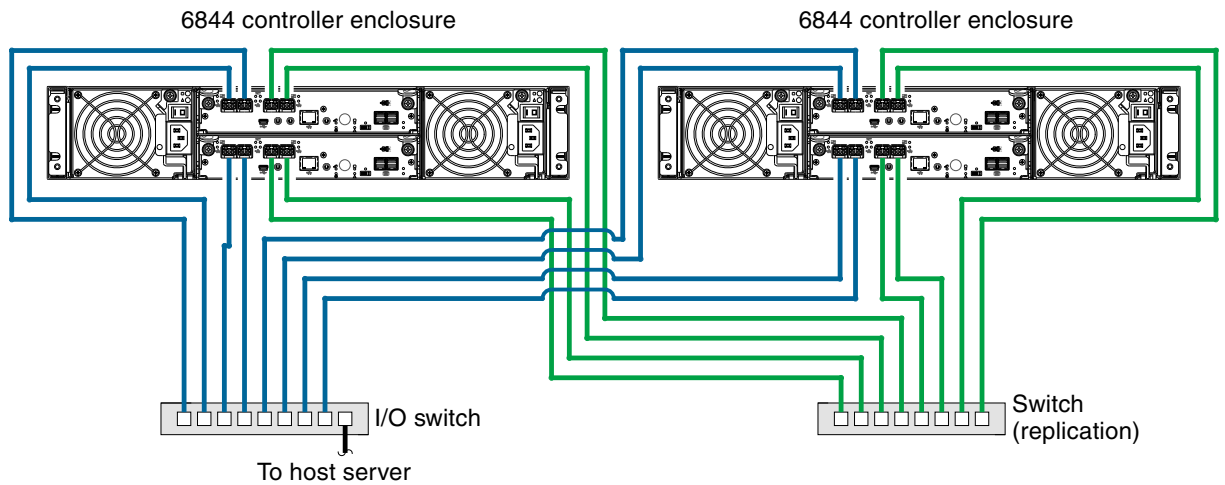
Figure 66 shows the rear panel of two 6854 controller enclosures with both I/O and replication occurring on the same physical network.



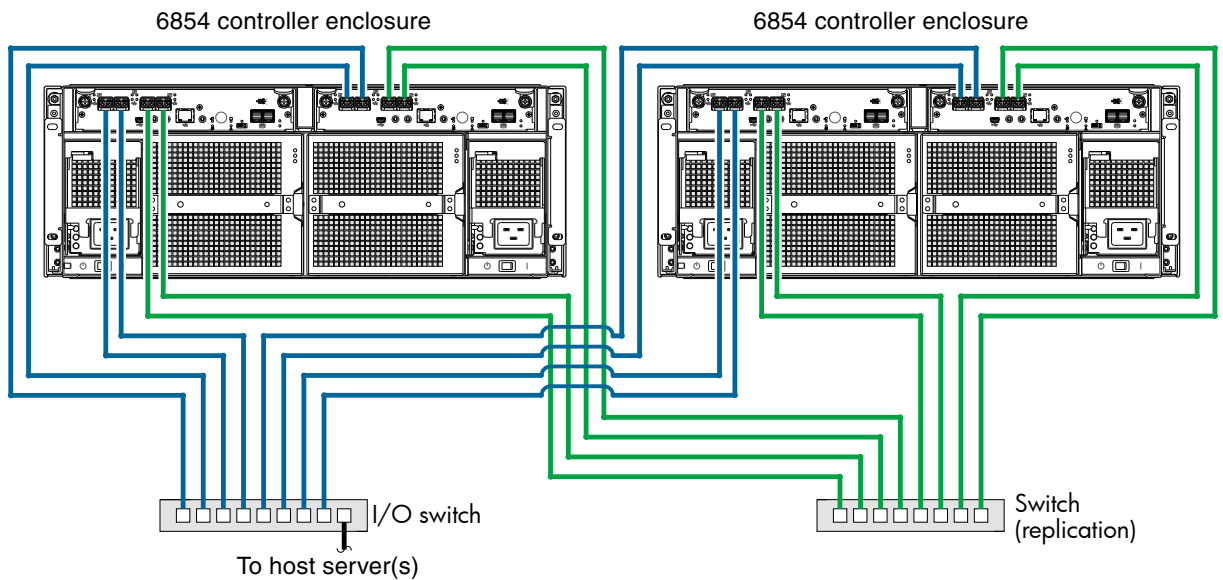
**Figure 66** Connecting two storage systems for replication: multiple servers/one switch/one location

Figure 67 and Figure 68 on page 65 show CNC host interface connections and CNC-based replication, with I/O and replication occurring on different networks. For optimal protection, use two switches. Connect two ports from each controller module to the first switch to facilitate I/O traffic, and connect two ports from each controller module to the second switch to facilitate replication. Using two switches in tandem avoids the potential single point of failure inherent to using a single switch; however, if one switch fails, either I/O or replication will fail, depending on which of the switches fails.





**Figure 67** Connecting two storage systems for replication: multiple servers/switches/one location

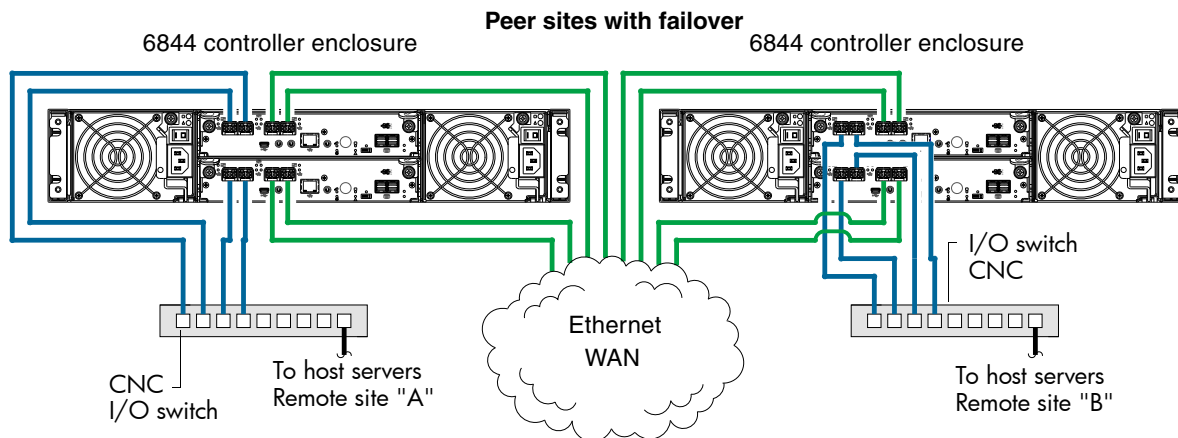


**Figure 68** Connecting two storage systems for replication: multiple servers/switches/one location

Virtual Local Area Network (VLAN) and zoning can be employed to provide separate networks for iSCSI and FC, respectively. Whether using a single switch or multiple switches for a particular interface, you can create a VLAN or zone for I/O and a VLAN or zone for replication to isolate I/O traffic from replication traffic. Since each switch would include both VLANs or zones, the configuration would function as multiple networks.

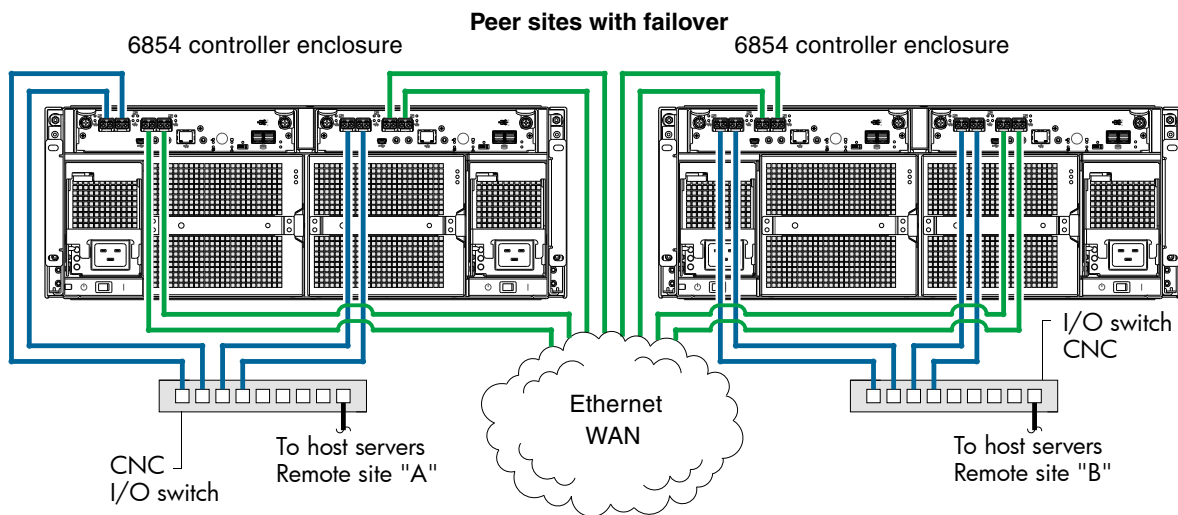
Multiple servers/different networks/multiple switches

Figure 69 shows the rear panel of two 6844 controller enclosures with I/O and replication occurring on different networks.



**Figure 69** Connecting two storage systems for replication: multiple servers/switches/two locations

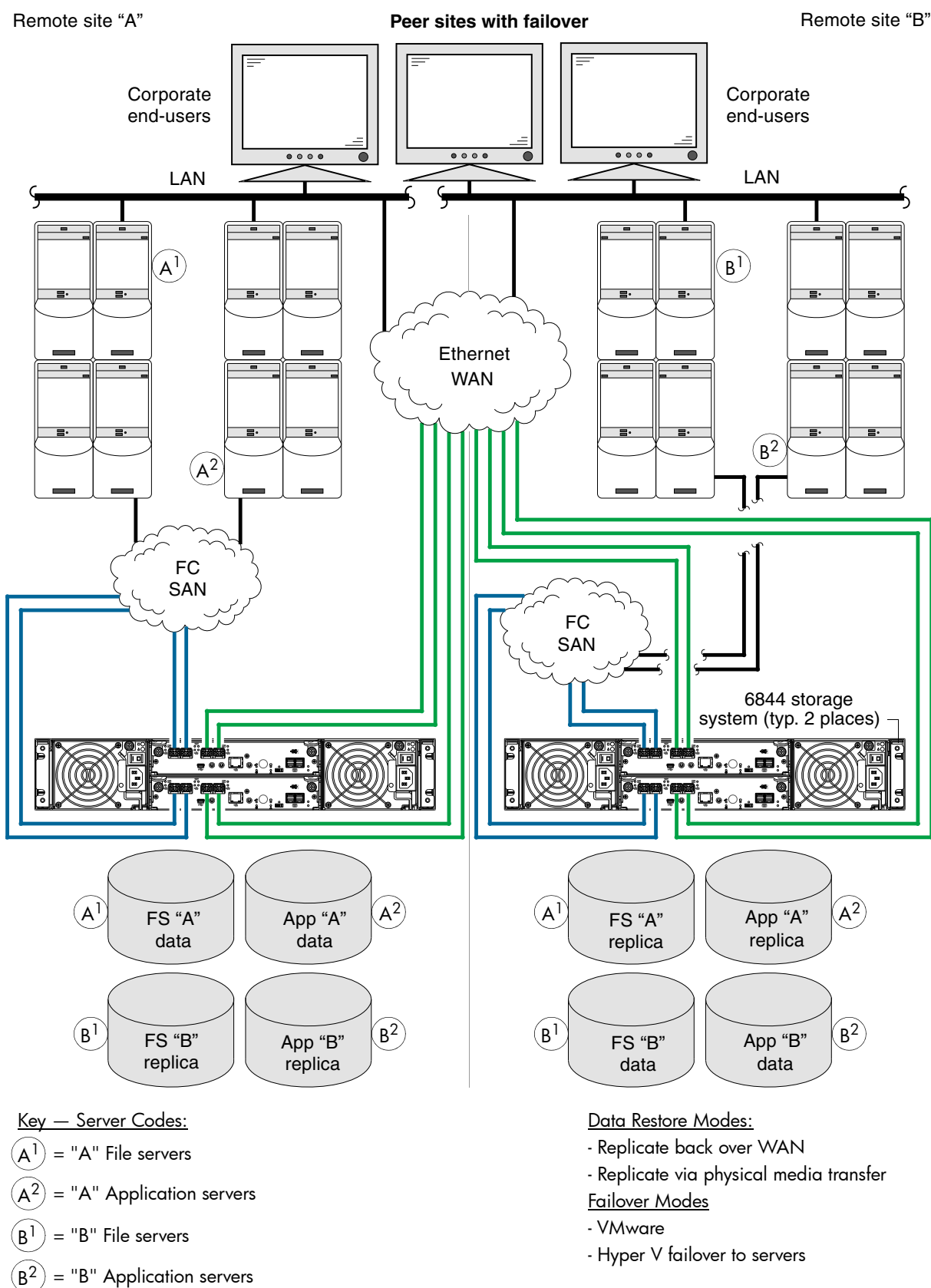
Figure 70 shows the rear panel of two 6854 controller enclosures with I/O and replication occurring on different networks.



**Figure 70** Connecting two storage systems for replication: multiple servers/switches/two locations

The diagram entitled "Connecting two storage systems for replication: multiple servers/SAN fabric/two locations" (Figure 71 on page 67) shows the rear-panel of two 6844 controller enclosures with both I/O and replication occurring on different networks.

This diagram represents two branch offices cabled to enable disaster recovery and backup. In case of failure at either the local site or the remote site, you can fail over the application to the available site.



**Figure 71** Connecting two storage systems for replication: multiple servers/SAN fabric/two locations

Although not shown in the preceding cabling examples, you can cable replication-enabled 6844 systems and compatible 6004 Series systems—via switch attach—for performing replication tasks.

## Updating firmware

After installing the hardware and powering on the storage system components for the first time, verify that the controller modules, expansion modules, and disk drives are using the current firmware release.

- If using the SMC (v3), in the **System** topic, select **Action > Update Firmware**.

The Update Firmware panel opens. The Update Controller Module tab shows versions of firmware components currently installed in each controller.

---

**NOTE:** The SMC does *not* provide a check-box for enabling or disabling Partner Firmware Update for the partner controller. To enable or disable the setting, use the `set advanced-settings` command, and set the `partner-firmware-upgrade` parameter. See the CLI Reference Guide for more information about command parameter syntax.


---

- If using RAIDar (v2), right-click the system in the Configuration View panel, and select **Tools > Update Firmware**.

The Update Firmware panel displays the currently installed firmware versions, and allows you to update them.

Optionally, you can update firmware using FTP (File Transfer Protocol) as described in the Storage Management Guide.

---

 **IMPORTANT:** See the “Updating firmware” topic in the Storage Management Guide before performing a firmware update.

---

## Obtaining IP values

You can configure addressing parameters for each controller module’s network port. You can set static IP values or use DHCP.

---

 **TIP:** See the “Configuring network ports” topic in the Storage Management Guide.

---

## Setting network port IP addresses using DHCP

In DHCP mode, network port IP address, subnet mask, and gateway values are obtained from a DHCP server if one is available. If a DHCP server is unavailable, current addressing is unchanged. You must have some means of determining what addresses have been assigned, such as the list of bindings on the DHCP server.

Because DHCP is disabled by default in 6004 Series systems, you must either use the CLI to change controller IP address settings, or use the Configuration Wizard as described in the Storage Management Guide or online help.

## Setting network port IP addresses using the CLI port and cable

If you did not use DHCP to set network port IP values, set them manually (default method) as described below. If you are using the USB CLI port and cable, you will need to enable the port for communication (also see [Using the CLI port and cable—known issues on Windows](#) on page 127).

Network ports on controller module A and controller module B are configured with the following default values:

- **Network port IP address:** 10.0.0.2 (controller A), 10.0.0.3 (controller B)
- **IP subnet mask:** 255.255.255.0
- **Gateway IP address:** 10.0.0.1

If the default IP addresses are not compatible with your network, you must set an IP address for each network port using the CLI embedded in each controller module. The CLI enables you to access the system using the USB (Universal Serial Bus) communication interface and terminal emulation software.

---

**NOTE:** If you are using the mini USB CLI port and cable, see Appendix D - [USB device connection](#):

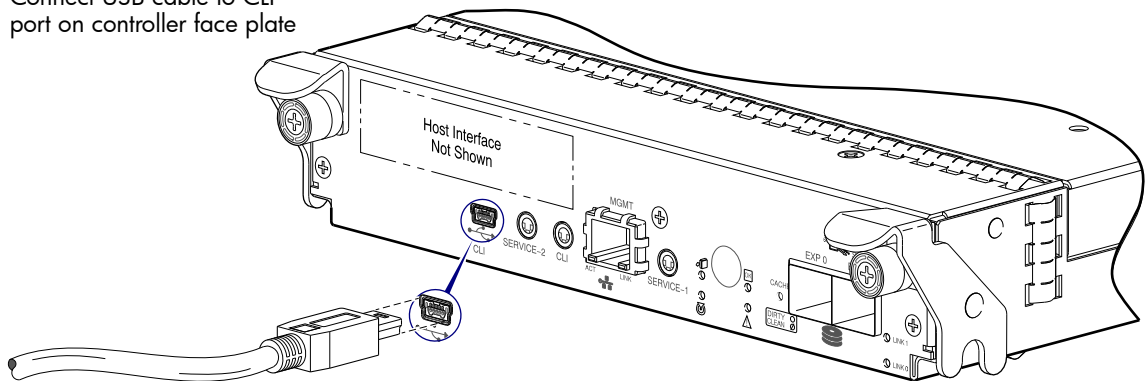
- Windows customers should download and install the device driver as described in [Obtaining the software download](#) on page 126.
  - Linux customers should prepare the USB port as described in [Setting parameters for the device driver](#) on page 127.
- 

Use the CLI commands described in the steps below to set the IP address for the network port on each controller module.

Once new IP addresses are set, you can change them as needed using the SMC or RAIDar. Be sure to change the IP address via the SMC or RAIDar before changing the network configuration. See [Accessing the SMC or RAIDar](#) on page 73 for more information concerning the web-based storage management application.

1. From your network administrator, obtain an IP address, subnet mask, and gateway address for controller A and another for controller B.  
Record these IP addresses so you can specify them whenever you manage the controllers using the SMC, RAIDar, or the CLI.
2. Use the provided USB cable to connect controller A to a USB port on a host computer. The USB mini 5 male connector plugs into the CLI port as shown in [Figure 72](#) on page 69 (generic 6004 Series controller module shown).

Connect USB cable to CLI  
port on controller face plate



**Figure 72** Connecting a USB cable to the CLI port

3. Enable the CLI port for subsequent communication:
  - Linux customers should enter the command syntax provided in [Setting parameters for the device driver](#) on page 127.
  - Windows customers should locate the downloaded device driver described [Obtaining the software download](#) on page 126, and follow the instructions provided for proper installation.
4. Start and configure a terminal emulator, such as HyperTerminal or VT-100, using the display settings in [Table 6](#) and the connection settings in [Table 7](#) (also, see the note following this procedure).

**Table 6** Terminal emulator display settings

Parameter	Value
Terminal emulation mode	VT-100 or ANSI (for color support)
Font	Terminal
Translations	None
Columns	80

**Table 7** Terminal emulator connection settings

Parameter	Value
Connector	COM3 (for example) <sup>1,2</sup>
Baud rate	115,200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

<sup>1</sup>Your server or laptop configuration determines which COM port is used for Disk Array USB Port.

<sup>2</sup>Verify the appropriate COM port for use with the CLI.

5. In the terminal emulator, connect to controller A.

6. Press Enter to display the CLI prompt (#).

The CLI displays the system version, MC version, and login prompt:

a. At the login prompt, enter the default user `manage`.

b. Enter the default password `!manage`.

If the default user or password—or both—have been changed for security reasons, enter the secure login credentials instead of the defaults shown above.

---

**NOTE:** The following CLI commands enable you to set the management mode to v3 or v2:

- Use `set protocols` to change the default management mode.
- Use `set cli-parameters` to change the current management mode for the CLI session.

The system defaults to v3 for new customers and v2 for existing users (see the CLI Reference Guide for more information).

---

7. At the prompt, enter the following command to set the values you obtained in [step 1](#) for each Network port, first for controller A, and then for controller B:

```
set network-parameters ip address netmask netmask gateway gateway controller a|b
```

where:

- *address* is the IP address of the controller
- *netmask* is the subnet mask
- *gateway* is the IP address of the subnet router
- *a|b* specifies the controller whose network parameters you are setting

For example:

```
# set network-parameters ip 192.168.0.10 netmask 255.255.255.0 gateway 192.168.0.1 controller a
```

```
# set network-parameters ip 192.168.0.11 netmask 255.255.255.0 gateway 192.168.0.1 controller b
```

8. Enter the following command to verify the new IP addresses:

```
show network-parameters
```

Network parameters, including the IP address, subnet mask, and gateway address are displayed for each controller.

9. Use the `ping` command to verify connectivity to the gateway address.

For example:

```
# ping 192.168.0.1
```

```
Info: Pinging 192.168.0.1 with 4 packets.
```

```
Success: Command completed successfully. - The remote computer responded with 4 packets. (2011-12-19 10:20:37)
```

10. In the host computer's command window, type the following command to verify connectivity, first for controller A and then for controller B:

```
ping controller-IP-address
```


**If you cannot access your system for at least three minutes after changing the IP address**, you might need to restart the Management Controller(s) using the serial CLI.

When you restart a Management Controller, communication with it is temporarily lost until it successfully restarts.

Enter the following command to restart the Management Controller in both controllers:

```
restart mc both
```

---

 **IMPORTANT:** When configuring an iSCSI system or a system using a combination of FC and iSCSI SFPs, do *not* restart the Management Controller or exit the terminal emulator session until configuring the CNC ports as described in [Change the CNC port mode](#) on page 71.

---

11. When you are done using the CLI, exit the emulator.

12. Retain the IP addresses (recorded in step 1) for accessing and managing the controllers using the SMC, RAIDar, or the CLI.

---

**NOTE:** Using HyperTerminal with the CLI on a **Microsoft Windows** host:

On a host computer connected to a controller module's mini-USB CLI port, incorrect command syntax in a HyperTerminal session can cause the CLI to hang. To avoid this problem, use correct syntax, use a different terminal emulator, or connect to the CLI using telnet rather than the mini-USB cable.

Be sure to close the HyperTerminal session before shutting down the controller or restarting its Management Controller. Otherwise, the host's CPU cycles may rise unacceptably.

---

If communication with the CLI is disrupted when using an out-of-band cable connection, communication can sometimes be restored by disconnecting and reattaching the mini-USB CLI cable as described in [step 2](#) and [Figure 72](#) on page 69.

## Change the CNC port mode

This subsection applies to 6844/6854 models only. While the USB cable is still connected and the terminal emulator session remains active, perform the following steps to change the CNC port mode from the default setting (FC), to either iSCSI or FC-and-iSCSI used in combination.

When using FC SFPs and iSCSI SFPs in combination, host ports 0 and 1 are set to FC (either both 16 Gbits/s or both 8 Gbit/s), and host ports 2 and 3 must be set to iSCSI (either both 10GbE or both 1 Gbit/s).

### Set CNC port mode to iSCSI

To set the CNC port mode for use with iSCSI SFPs, run the following command at the command prompt:

```
set host-port-mode iSCSI
```

The command notifies you that it will change host port configuration, stop I/O, and restart both controllers. When asked if you want to continue, enter **y** to change the host port mode to use iSCSI SFPs.

Once the `set host-port-mode` command completes, it will notify you that the specified system host port mode was set, and that the command completed successfully.

Continue with [step 11](#) of [Setting network port IP addresses using the CLI port and cable](#) on page 68.

## Set CNC port mode to FC and iSCSI

To set the CNC port mode for use with FC SFPs and iSCSI SFPs in combination, run the following command at the command prompt:

```
set host-port-mode FC-and-iSCSI
```

The command notifies you that it will change host port configuration, stop I/O, and restart both controllers. When asked if you want to continue, enter **y** to change the host port mode to use FC and iSCSI SFPs.

Once the `set host-port-mode` command completes, it will notify you that the specified system host port mode was set, and that the command completed successfully.

Continue with [step 11](#) of [Setting network port IP addresses using the CLI port and cable](#) on page 68.

## Configure the system

---

### NOTE:

- After using either of the CLI command sequences shown above, you may see events stating that the SFPs installed are not compatible with the protocol set for the host ports. The new host port mode setting will be synchronized with the qualified SFP option once the controller modules restart.
  - See Appendix E—[SFP option for CNC ports](#) for instructions about locating and installing your qualified SFP transceivers within the CNC ports.
- 

After changing the CNC port mode, you can invoke the SMC or RAIDar, and use the Configuration Wizard to initially configure the system, or change system configuration settings as described in the Storage Management Guide and [Basic operation](#).



---


## 4 Basic operation

Verify that you have successfully completed the sequential “Installation Checklist” instructions in [Table 3](#) on page 26. Once you have successfully completed steps 1 through 8 therein, you can access the management interfaces using your web-browser, to complete the system setup.

### Accessing the SMC or RAIDar

Upon completing the hardware installation, you can access the controller module’s web-based management interface [either the SMC (v3) or RAIDar (v2)] to configure, monitor, and manage the storage system. Invoke your web browser, and enter the IP address of the controller module’s network port in the address field (obtained during completion of “Installation Checklist” step 9), then press Enter. To sign-in to the SMC or RAIDar, use the default user name **manage** and password **!manage**. If the default user or password—or both—have been changed for security reasons, enter the secure login credentials instead of the defaults shown above. *This brief Sign In discussion assumes proper web browser setup.*


---

 **IMPORTANT:** For detailed information on accessing and using either the SMC or RAIDar, see the “Getting Started” section in the web-posted Storage Management Guide.

---

In addition to summarizing the processes to configure and provision a new system for the first time—using the wizards—the Getting Started section provides instructions for signing in to the SMC or RAIDar, introduces key system concepts, addresses browser setup, and provides tips for using the main window and the help window.

---

 **TIP:** After signing-in to either the SMC or RAIDar, you can use online help as an alternative to consulting the Storage Management Guide.

---

### Configuring and provisioning the storage system

Once you have familiarized yourself with either the SMC or RAIDar, use the interface to configure and provision the storage system. If you are licensed to use the optional AssuredRemote feature, you may also need to set up the storage systems for replication. Refer to the following topics within the Storage Management Guide or online help:


- Getting started
- Configuring the system
- Provisioning the system
- Using AssuredRemote to replicate volumes

---

**NOTE:** See the “Installing a license” topic within the Storage Management Guide for instructions about creating a temporary license, or installing a permanent license.

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 **IMPORTANT:** If the system is used in a VMware environment, set the system’s Missing LUN Response option to use its Illegal Request setting. To do so, see either the configuration topic “Changing the missing LUN response” in the Storage Management Guide or the command topic “set-advanced-settings” in the CLI Reference Guide.

---

## 5 Troubleshooting

These procedures are intended to be used only during initial configuration, for the purpose of verifying that hardware setup is successful. They are not intended to be used as troubleshooting procedures for configured systems using production data and I/O.

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**NOTE:** For further troubleshooting help, after initial setup and when user data is present, contact Dot Hill support as specified at <https://crc.dothill.com>.

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### USB CLI port connection

AssuredSAN 6004 Series controllers feature a CLI port employing a mini-USB Type B form factor. If you encounter problems communicating with the port after cabling your computer to the USB device, you may need to either download a device driver (Windows), or set appropriate parameters via an operating system command (Linux). See Appendix D for more information.

### Fault isolation methodology

AssuredSAN 6004 Series storage systems provide many ways to isolate faults. This section presents the basic methodology used to locate faults within a storage system, and to identify the pertinent FRUs (Field Replaceable Units) affected.

As noted in [Basic operation](#) on page 73, use the SMC or RAIDar to configure and provision the system upon completing the hardware installation. As part of this process, configure and enable event notification so the system will notify you when a problem occurs that is at or above the configured severity (see “Using the Configuration Wizard > Configuring event notification” within the Storage Management Guide). With event notification configured and enabled, you can follow the recommended actions in the notification message to resolve the problem, as further discussed in the options presented below.

### Basic steps

The basic fault isolation steps are listed below:

- Gather fault information, including using system LEDs  
(see [Gather fault information](#) on page 75)
- Determine where in the system the fault is occurring  
(see [Determine where the fault is occurring](#) on page 75)
- Review event logs  
(see [Review the event logs](#) on page 76)
- If required, isolate the fault to a data path component or configuration  
(see [Isolate the fault](#) on page 76)

Cabling systems to enable use of the licensed AssuredRemote feature—to replicate volumes—is another important fault isolation consideration pertaining to initial system installation. See [Isolating replication faults](#) on page 85 for more information about troubleshooting during initial setup.

### Options available for performing basic steps

When performing fault isolation and troubleshooting steps, select the option or options that best suit your site environment. Use of any option (four options are described below) is not mutually-exclusive to the use of another option. You can use the SMC or RAIDar to check the health icons/values for the system and its components to ensure that everything is okay, or to drill down to a problem component. If you discover a problem, either the SMC or RAIDar and the CLI provide recommended-action text online. Options for performing basic steps are listed according to frequency of use:

- Use the SMC or RAIDar

- Use the CLI
- Monitor event notification
- View the enclosure LEDs

## Use the SMC or RAIDar

The SMC and RAIDar uses health icons to show OK, Degraded, Fault, or Unknown status for the system and its components. The SMC and RAIDar enables you to monitor the health of the system and its components. If any component has a problem, the system health will be Degraded, Fault, or Unknown. Use the web application's GUI to drill down to find each component that has a problem, and follow actions in the component Health Recommendations field to resolve the problem.

## Use the CLI

As an alternative to using the SMC or RAIDar, you can run the `show system` command in the CLI to view the health of the system and its components. If any component has a problem, the system health will be Degraded, Fault, or Unknown, and those components will be listed as Unhealthy Components. Follow the recommended actions in the component Health Recommendations field to resolve the problem.

## Monitor event notification

With event notification configured and enabled, you can view event logs to monitor the health of the system and its components. If a message tells you to check whether an event has been logged, or to view information about an event in the log, you can do so using the SMC, RAIDar, or the CLI. Using either the SMC or RAIDar, you would view the event log and then click on the event message to see detail about that event. Using the CLI, you would run the `show events detail` command (with additional parameters to filter the output) to see the detail for an event.

## View the enclosure LEDs

You can view the LEDs on the hardware (while referring to [LED descriptions](#) for your enclosure model) to identify component status. If a problem prevents access to the SMC, RAIDar or the CLI, this is the only option available. However, monitoring/management is often done at a management console using storage management interfaces, rather than relying on line-of-sight to LEDs of racked hardware components.

## Performing basic steps

You can use any of the available options described above in performing the basic steps comprising the fault isolation methodology.

## Gather fault information

When a fault occurs, it is important to gather as much information as possible. Doing so will help you determine the correct action needed to remedy the fault.

Begin by reviewing the reported fault:

- *Is the fault related to an internal data path or an external data path?*
- *Is the fault related to a hardware component such as a disk drive module, controller module, or power supply unit?*

By isolating the fault to *one* of the components within the storage system, you will be able to determine the necessary corrective action more quickly.

## Determine where the fault is occurring

Once you have an understanding of the reported fault, review the enclosure LEDs. The enclosure LEDs are designed to immediately alert users of any system faults, and might be what alerted the user to a fault in the first place.

When a fault occurs, the Fault ID status LED on an enclosure's right ear illuminates (see the diagram pertaining to your product's front panel components on [page 13](#) (2U48) or [page 16](#) (4U56)). Check the LEDs on the back of the enclosure to narrow the fault to a FRU, connection, or both. The LEDs also help you identify the location of a FRU reporting a fault.

Use the SMC or RAIDar to verify any faults found while viewing the LEDs. The SMC and RAIDar is also a good tool to use in determining where the fault is occurring if the LEDs cannot be viewed due to the location of the system. This web-application provides you with a visual representation of the system and where the fault is occurring. The SMC and RAIDar can also provide more detailed information about FRUs, data, and faults.

## Review the event logs

The event logs record all system events. Each event has a numeric code that identifies the type of event that occurred, and has one of the following severities:

- Critical. A failure occurred that may cause a controller to shut down. Correct the problem *immediately*.
- Error. A failure occurred that may affect data integrity or system stability. Correct the problem as soon as possible.
- Warning. A problem occurred that may affect system stability, but not data integrity. Evaluate the problem and correct it if necessary.
- Informational. A configuration or state change occurred, or a problem occurred that the system corrected. No immediate action is required.

See the Event Descriptions Reference Guide for information about specific events. See Dot Hill's Customer Resource Center web site for additional information: <https://crc.dothill.com>.

The event logs record all system events. It is very important to review the logs, not only to identify the fault, but also to search for events that might have caused the fault to occur. For example, a host could lose connectivity to a virtual disk or disk group if a user changes channel settings without taking the storage resources assigned to it into consideration. In addition, the type of fault can help you isolate the problem to either hardware or software.

## Isolate the fault

Occasionally, it might become necessary to isolate a fault. This is particularly true with data paths, due to the number of components comprising the data path. For example, if a host-side data error occurs, it could be caused by any of the components in the data path: controller module, cable, or data host.

## If the enclosure does not initialize

It may take up to two minutes for all enclosures to initialize. If an enclosure does not initialize:

- Perform a rescan
- Power cycle the system
- Make sure the power cord is properly connected, and check the power source to which it is connected
- Check the event log for errors

## Correcting enclosure IDs

When installing a system with drive enclosures attached, the enclosure IDs might not agree with the physical cabling order. This is because the controller might have been previously attached to enclosures in a different configuration, and it attempts to preserve the previous enclosure IDs, if possible. To correct this condition, make sure that both controllers are up, and perform a rescan using the SMC, RAIDar, or the CLI. This will reorder the enclosures, but can take up to two minutes for the enclosure IDs to be corrected.

To perform a rescan using the CLI, type the following command:

```
rescan
```

To rescan using the SMC (v3):

1. Verify that both controllers are operating normally.
2. Do one of the following:
  - Point to the **System** tab and select **Rescan Disk Channels**.
  - In the **System** topic, select **Action** > **Rescan Disk Channels**.
3. Click **Rescan**.

To rescan using RAIDar (v2):

1. Verify that controllers are operating normally
2. In the Configuration View panel, right-click the system and select **Tools > Rescan Disk Channels**
3. Click **Rescan**

---


**NOTE:** The reordering enclosure IDs action only applies to Dual Controller mode. If only one controller is available, due to either Single Controller configuration or controller failure, a manual rescan will not reorder the drive enclosure IDs.

---

## Stopping I/O

When troubleshooting disk drive and connectivity faults, stop I/O to the affected disk groups from all hosts and remote systems as a data protection precaution. As an additional data protection precaution, it is helpful to conduct regularly scheduled backups of your data.

---

 **IMPORTANT:** Stopping I/O to a disk group is a host-side task, and falls outside the scope of this document.

---

When on-site, you can verify that there is no I/O activity by briefly monitoring the system LEDs; however, when accessing the storage system remotely, this is not possible. Remotely, you can use the `show disk-group-statistics` command to determine if input and output has stopped. Perform these steps:

1. Using the CLI, run the `show disk-group-statistics` command.  
The `Reads` and `Writes` outputs show the number of these operations that have occurred since the statistic was last reset, or since the controller was restarted. Record the numbers displayed.
2. Run the `show disk-group-statistics` command a second time.  
This provides you a specific window of time (the interval between requesting the statistics) to determine if data is being written to or read from the disk group. Record the numbers displayed.
3. To determine if any reads or writes occur during this interval, subtract the set of numbers you recorded in [step 1](#) from the numbers you recorded in [step 2](#).
  - If the resulting difference is zero, then I/O has stopped.
  - If the resulting difference is not zero, a host is still reading from or writing to this disk group. Continue to stop I/O from hosts, and repeat [step 1](#) and [step 2](#) until the difference in [step 3](#) is zero.

---

**NOTE:** See the CLI Reference Guide for additional information.

---

## Diagnostic steps

This section describes possible reasons and actions to take when an LED indicates a fault condition during initial system setup. See Appendix A – [LED descriptions](#) for descriptions of all LED statuses.

---

**NOTE:** Once event notification is configured and enabled using the SMC or RAIDar, you can view event logs to monitor the health of the system and its components using the GUI.

---

In addition to monitoring LEDs via line-of-sight observation of the racked hardware components when performing diagnostic steps, you can also monitor the health of the system and its components using the management interfaces previously discussed. Bear this in mind when reviewing the **Actions** column in the following diagnostics tables, and when reviewing the step procedures provided later in this chapter.

Is the enclosure front panel Fault/Service Required LED amber?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	A fault condition exists/occurred. If installing an I/O module FRU, the module has gone online and likely failed its self-test.	<ul style="list-style-type: none"> <li>Check the LEDs on the back of the controller to narrow the fault to a FRU, connection, or both.</li> <li>Check the event log for specific information regarding the fault; follow any Recommended Actions.</li> <li>If installing an IOM FRU, try removing and reinstalling the new IOM, and check the event log for errors.</li> <li>If the above actions do not resolve the fault, isolate the fault, and contact an authorized service provider for assistance. Replacement may be necessary.</li> </ul>

**Table 8** Diagnostics LED status: Front panel "Fault/Service Required"

Is the controller back panel FRU OK LED off?

Answer	Possible reasons	Actions
No (blinking)	System functioning properly. System is booting.	No action required. Wait for system to boot.
Yes	The controller module is not powered on. The controller module has failed.	<ul style="list-style-type: none"> <li>Check that the controller module is fully inserted and latched in place, and that the enclosure is powered on.</li> <li>Check the event log for specific information regarding the failure.</li> </ul>

**Table 9** Diagnostics LED status: Rear panel "FRU OK"

Is the controller back panel Fault/Service Required LED amber?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes (blinking)	One of the following errors occurred: <ul style="list-style-type: none"> <li>Hardware-controlled power-up error</li> <li>Cache flush error</li> <li>Cache self-refresh error</li> </ul>	<ul style="list-style-type: none"> <li>Restart this controller from the other controller using the SMC, RAIDar or the CLI.</li> <li>If the above action does not resolve the fault, remove the controller module and reinsert it.</li> <li>If the above action does not resolve the fault, contact an authorized service provider for assistance. It may be necessary to replace the controller module.</li> </ul>

**Table 10** Diagnostics LED status: Rear panel "Fault/Service Required"

## Is the drawer panel Fault/Service Required LED amber?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes (solid)	A drawer-level fault is detected or a service action is required.	<ul style="list-style-type: none"><li>Check the event log for specific information regarding the fault; follow any Recommended Actions.</li><li>If the above action does not resolve the fault, contact an authorized service provider for assistance.</li></ul>
Yes (blink)	Hardware-controlled power-up error	<ul style="list-style-type: none"><li>Check the event log for specific information regarding the fault; follow any Recommended Actions.</li><li>If the above action does not resolve the fault, contact an authorized service provider for assistance.</li></ul>

**Table 11** Diagnostics LED status: Drawer panel “Fault/Service Required”

**NOTE:** Consider the following when troubleshooting drawer LEDs:

- See [Enclosure bezel attachment and removal](#) on page 96 and [2U48 enclosure drawers](#) on page 14
- See [Enclosure bezel attachment and removal](#) on page 96 and [4U56 enclosure drawers](#) on page 17.

## Are both disk drive module LEDs off?

Answer	Possible reasons	Actions
Yes	<ul style="list-style-type: none"><li>There is no power.</li><li>The disk drive is offline.</li><li>The disk is not configured.</li></ul>	Check that the disk drive module is fully inserted and latched in place, and that both the enclosure and the drawer are powered on.

**Table 12** Diagnostics LED status: Drawer slot “Disk Power/Activity” and “Disk Fault Status”

**NOTE:** See [2U48 enclosure drawers](#) on page 14 or [4U56 enclosure drawers](#) on page 17.

## Is the 2U48 disk drive module LED blinking blue (4Hz blink rate)?

Answer	Possible reasons	Actions
Yes	<ul style="list-style-type: none"><li>The disk has failed or experienced a fault.</li><li>The disk is a leftover.</li><li>The disk group that the disk is associated with is down or critical.</li></ul>	<ul style="list-style-type: none"><li>Check the event log for specific information regarding the fault; follow any Recommended Actions.</li><li>Isolate the fault.</li><li>Contact an authorized service provider for assistance.</li></ul>

**Table 13** Diagnostics LED status: Disk drive fault status (2U48 modules)

**NOTE:** Consider the following when accessing disks: see [FDE considerations](#) on page 26.

## Is the 4U56 disk drive module Fault LED amber?

Answer	Possible reasons	Actions
Yes, and the online/activity LED is <b>off</b> .	The disk drive is offline. An event message may have been received for this device.	<ul style="list-style-type: none"> <li>Check the event log for specific information regarding the fault.</li> <li>Isolate the fault.</li> <li>Contact an authorized service provider for assistance.</li> </ul>
Yes, and the online/activity LED is <b>blinking</b> .	The disk drive is active, but an event message may have been received for this device.	<ul style="list-style-type: none"> <li>Check the event log for specific information regarding the fault.</li> <li>Isolate the fault.</li> <li>Contact an authorized service provider for assistance.</li> </ul>

**Table 14** Diagnostics LED status: Disk drive fault status (4U56 modules)

## Is a connected host port Host Link Status LED off?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required (see Link LED note: <a href="#">page 112</a> ).
Yes	The link is down.	<ul style="list-style-type: none"> <li>Check cable connections and reseal if necessary.</li> <li>Inspect cable for damage.</li> <li>Swap cables to determine if fault is caused by a defective cable. Replace cable if necessary.</li> <li>Verify that the switch, if any, is operating properly. If possible, test with another port.</li> <li>Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.</li> <li>In the SMC or RAIDar, review event logs for indicators of a specific fault in a host data path component.</li> <li>Contact an authorized service provider for assistance.</li> <li>See <a href="#">Isolating a host-side connection fault</a> on page 82.</li> </ul>

**Table 15** Diagnostics LED status: Rear panel “Host Link Status”

## Is a connected port Expansion Port Status LED off?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The link is down.	<ul style="list-style-type: none"> <li>Check cable connections and reseal if necessary.</li> <li>Inspect cable for damage. Replace cable if necessary.</li> <li>Swap cables to determine if fault is caused by a defective cable. Replace cable if necessary.</li> <li>In the SMC or RAIDar, review the event logs for indicators of a specific fault in a host data path component.</li> <li>Contact an authorized service provider for assistance.</li> <li>See <a href="#">Isolating a controller module expansion port connection fault</a> on page 84.</li> </ul>

**Table 16** Diagnostics LED status: Rear panel “Expansion Port Status”



Is a connected port's Network Port link status LED off?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The link is down.	Use standard networking troubleshooting procedures to isolate faults on the network.

**Table 17** Diagnostics LED status: Rear panel "Network Port Link Status"

Is the fan control module Fault/Service Required LED amber?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The power supply unit or a fan is operating at an unacceptable voltage/RPM level, or has failed.	<p>When isolating faults in the power supply, remember that the fans in both modules receive power through a common bus on the midplane, so if a power supply unit fails, the fans continue to operate normally.</p> <ul style="list-style-type: none"> <li>• Verify that the FCM FRU is firmly locked into position.</li> <li>• Verify that the power cable is connected to a power source.</li> <li>• Verify that the power cable is connected to the enclosure's power supply unit.</li> </ul>

**Table 18** Diagnostics LED status: Rear panel fan control module "Fault/Service Required" (4U56)

Is the power supply Input Power Source LED off?

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The power supply is not receiving adequate power.	<ul style="list-style-type: none"> <li>• Verify that the power cord is properly connected, and check the power source to which it connects.</li> <li>• Check that the power supply FRU is firmly locked into position.</li> <li>• Check the event log for specific information regarding the fault.</li> <li>• If the above action does not resolve the fault, isolate the fault, and contact an authorized service provider for assistance.</li> </ul>

**Table 19** Diagnostics LED status: Rear panel power supply "Input Power Source"

Is the Voltage/Fan Fault/Service Required LED amber?


Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The power supply unit or a fan is operating at an unacceptable voltage/RPM level, or has failed.	<p>When isolating faults in the power supply, remember that the fans in both modules receive power through a common bus on the midplane, so if a power supply unit fails, the fans continue to operate normally.</p> <ul style="list-style-type: none"> <li>• Verify that the power supply FRU is firmly locked into position.</li> <li>• Verify that the power cable is connected to a power source.</li> <li>• Verify that the power cable is connected to the enclosure's power supply unit.</li> </ul>

**Table 20** Diagnostics LED status: Rear panel power supply "Voltage/Fan Fault/Service Required"

## Controller failure in a single-controller configuration

This subsection addresses a potential situation that might occur if a partner controller fails following failure of its peer controller.

---

 **IMPORTANT:** Transportable cache only applies to single-controller configurations. In dual-controller configurations, there is no need to transport a failed controller's cache to a replacement controller because the cache is duplicated between the partner controllers (subject to volume write optimization settings).

---

Cache memory is flushed to CompactFlash in the case of a controller failure or power loss. During the write to CompactFlash process, only the components needed to write the cache to the CompactFlash are powered by the supercapacitor. This process typically takes 60 seconds per 1 Gbyte of cache. After the cache is copied to CompactFlash, the remaining power left in the supercapacitor is used to refresh the cache memory. While the cache is being maintained by the supercapacitor, the Cache Status LED flashes at a rate of 1/10 second on and 9/10 second off.

If the controller has failed or does not start, is the Cache Status LED on/blinking?

Answer	Actions
No, the Cache LED status is off, and the controller does not boot.	If valid data is thought to be in Flash, see <a href="#">Transporting cache</a> ; otherwise, replace the controller module.
No, the Cache Status LED is off, and the controller boots.	The system has flushed data to disks. If the problem persists, replace the controller module.
Yes, at a strobe 1:10 rate - 1 Hz, and the controller does not boot.	See <a href="#">Transporting cache</a> .
Yes, at a strobe 1:10 rate - 1 Hz, and the controller boots.	The system is flushing data to CompactFlash. If the problem persists, replace the controller module.
Yes, at a blink 1:1 rate - 1 Hz, and the controller does not boot.	See <a href="#">Transporting cache</a> .
Yes, at a blink 1:1 rate - 1 Hz, and the controller boots.	The system is in self-refresh mode. If the problem persists, replace the controller module.

**Table 21** Diagnostics LED status: Rear panel "Cache Status"

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**NOTE:** See also [Cache Status LED details](#) on page 113.

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## Transporting cache

To preserve the existing data stored in the CompactFlash, you must transport the CompactFlash from the failed controller to a replacement controller. To transport cache, you must return the controller module to a maintenance depot for servicing by qualified personnel.

---


 **CAUTION:** Transporting of cache must be performed by a qualified service technician.

---

## Isolating a host-side connection fault

During normal operation, when a controller module host port is connected to a data host, the port's host link status/link activity LED is green. If there is I/O activity, the host activity LED blinks green. If data hosts are having trouble accessing the storage system, and you cannot locate a specific fault or cannot access the event logs, use the following procedure. This procedure requires scheduled downtime.

---

 **IMPORTANT:** Do not perform more than one step at a time. Changing more than one variable at a time can complicate the troubleshooting process.

---

## Host-side connection troubleshooting featuring CNC ports

The procedure below applies to AssuredSAN 6004 Series controller enclosures employing small form factor pluggable (SFP) transceiver connectors in 4/8/16 Gb FC, 10GbE iSCSI, or 1 Gb iSCSI host interface ports. In the following procedure, “SFP and host cable” is used to refer to any of the qualified SFP options supporting CNC ports used for I/O or replication.

---

**NOTE:** When experiencing difficulty diagnosing performance problems, consider swapping out one SFP at a time to see if performance improves.

---

1. Halt all I/O to the storage system (see [Stopping I/O](#) on page 77).
2. Check the host link status/link activity LED.  
If there is activity, halt all applications that access the storage system.
3. Check the Cache Status LED to verify that the controller cached data is flushed to the disk drives.
  - Solid – Cache contains data yet to be written to the disk.
  - Blinking – Cache data is being written to CompactFlash.
  - Flashing at 1/10 second on and 9/10 second off – Cache is being refreshed by the supercapacitor.
  - Off – Cache is clean (no unwritten data).
4. Remove the SFP and host cable and inspect for damage.
5. Reseat the SFP and host cable.  
Is the host link status/link activity LED on?
  - Yes – Monitor the status to ensure that there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
  - No – Proceed to the next step.
6. Move the SFP and host cable to a port with a known good link status.  
This step isolates the problem to the external data path (SFP, host cable, and host-side devices) or to the controller module port.  
Is the host link status/link activity LED on?
  - Yes – You now know that the SFP, host cable, and host-side devices are functioning properly. Return the cable to the original port. If the link status LED remains off, you have isolated the fault to the controller module’s port. Replace the controller module.
  - No – Proceed to the next step.
7. Swap the SFP with the known good one.  
Is the host link status/link activity LED on?
  - Yes – You have isolated the fault to the SFP. Replace the SFP.
  - No – Proceed to the next step.
8. Re-insert the original SFP and swap the cable with a known good one.  
Is the host link status/link activity LED on?
  - Yes – You have isolated the fault to the cable. Replace the cable.
  - No – Proceed to the next step.
9. Verify that the switch, if any, is operating properly. If possible, test with another port.
10. Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.
11. Replace the HBA with a known good HBA, or move the host side cable and SFP to a known good HBA.  
Is the host link status/link activity LED on?

- Yes – You have isolated the fault to the HBA. Replace the HBA.
- No – It is likely that the controller module needs to be replaced.

**12. Move the cable and SFP back to its original port.**

Is the host link status/link activity LED on?

- No – The controller module port has failed. Replace the controller module.
- Yes – Monitor the connection for a period of time. It may be an intermittent problem, which can occur with damaged SFPs, cables, and HBAs.

## Host-side connection troubleshooting featuring SAS host ports

The procedure below applies to 6544/6554 controller enclosures employing 12 Gb SFF-8644 connectors in the HD mini-SAS host ports used for I/O. These models do not support AssuredRemote replication.

**1. Halt all I/O to the storage system (see [Stopping I/O](#) on page 77).**

**2. Check the host activity LED.**

If there is activity, halt all applications that access the storage system.

**3. Check the Cache Status LED to verify that the controller cached data is flushed to the disk drives.**

- Solid – Cache contains data yet to be written to the disk.
- Blinking – Cache data is being written to CompactFlash.
- Flashing at 1/10 second on and 9/10 second off – Cache is being refreshed by the supercapacitor.
- Off – Cache is clean (no unwritten data).

**4. Reseat the host cable and inspect for damage.**

Is the host link status LED on?

- Yes – Monitor the status to ensure that there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
- No – Proceed to the next step.

**5. Move the host cable to a port with a known good link status.**

This step isolates the problem to the external data path (host cable and host-side devices) or to the controller module port.

Is the host link status LED on?

- Yes – You now know that the host cable and host-side devices are functioning properly. Return the cable to the original port. If the link status LED remains off, you have isolated the fault to the controller module port. Replace the controller module.
- No – Proceed to the next step.

**6. Verify that the switch, if any, is operating properly. If possible, test with another port.**

**7. Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.**

**8. Replace the HBA with a known good HBA, or move the host side cable to a known good HBA.**

Is the host link status LED on?

- Yes – You have isolated the fault to the HBA. Replace the HBA.
- No – It is likely that the controller module needs to be replaced.

**9. Move the host cable back to its original port.**

Is the host link status LED on?

- No – The controller module port has failed. Replace the controller module.
- Yes – Monitor the connection for a period of time. It may be an intermittent problem, which can occur with damaged cables and HBAs.

## Isolating a controller module expansion port connection fault

During normal operation, when a controller module's expansion port is connected to a drive enclosure, the expansion port status LED is green. If the connected port's expansion port LED is off, the link is down. Use the following procedure to isolate the fault.

This procedure requires scheduled downtime.

---

**NOTE:** Do not perform more than one step at a time. Changing more than one variable at a time can complicate the troubleshooting process.

---

1. Halt all I/O to the storage system (see [Stopping I/O](#) on page 77).
2. Check the host activity LED.  
If there is activity, halt all applications that access the storage system.
3. Check the Cache Status LED to verify that the controller cached data is flushed to the disk drives.
  - Solid – Cache contains data yet to be written to the disk.
  - Blinking – Cache data is being written to CompactFlash.
  - Flashing at 1/10 second on and 9/10 second off – Cache is being refreshed by the supercapacitor.
  - Off – Cache is clean (no unwritten data).
4. Reseat the expansion cable, and inspect it for damage.  
Is the expansion port status LED on?
  - Yes – Monitor the status to ensure there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
  - No – Proceed to the next step.
5. Move the expansion cable to a port on the controller enclosure with a known good link status.  
This step isolates the problem to the expansion cable or to the controller module's expansion port.  
Is the expansion port status LED on?
  - Yes – You now know that the expansion cable is good. Return the cable to the original port. If the expansion port status LED remains off, you have isolated the fault to the controller module's expansion port. Replace the controller module.
  - No – Proceed to the next step.
6. Move the expansion cable back to the original port on the controller enclosure.
7. Move the expansion cable on the drive enclosure to a known good expansion port on the drive enclosure.  
Is the expansion port status LED on?
  - Yes – You have isolated the problem to the drive enclosure's port. Replace the expansion module.
  - No – Proceed to the next step.
8. Replace the cable with a known good cable, ensuring the cable is attached to the original ports used by the previous cable.  
Is the host link status LED on?
  - Yes – Replace the original cable. The fault has been isolated.
  - No – It is likely that the controller module must be replaced.


## Isolating replication faults

### Cabling for replication

The replication feature is a licensed option for disaster recovery, providing access to either of the following software product versions:

- SMC (v3) supports replication for virtual storage environments.
- RAIDar (v2) supports replication for linear storage environments.

---

 **IMPORTANT:** These two replication models are mutually exclusive to one another. Choose the method that applies to your storage system. For more information, see replication topics in the Storage Management Guide.

---

## Replication setup and verification

After storage systems are cabled for replication, you can use the SMC (v3) or RAIDar (v2) to prepare to use the replication feature. Alternatively, you can use telnet to access the IP address of the controller module and access the replication feature using the CLI.

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**NOTE:** You can use the CLI to perform replication in linear or virtual storage environments.

- Set Management mode to v2 for linear replication (use Manage role).
  - Set Management mode to v3 for virtual replication (use Manage role).
- 


Basic information for enabling the 6004 Series controller enclosures for replication supplements the troubleshooting procedures that follow.

- Familiarize yourself with replication by reviewing the “Getting started”, “Working in the Replications topic”, and “Using AssuredRemote to replicate volumes” chapters in the Storage Management Guide.
  - For virtual replication, in order to replicate an existing volume to a pool on the peer in the primary system or secondary system, follow these steps:
    - Find the port address.  
Using the CLI, run the `query peer-connection` command.
    - Create a peer connection.  
To create a peer connection, use the CLI command `create peer-connection` or in the SMC **Replications** topic, select **Action > Create Peer Connection**.
    - Create a virtual replication set.  
To create a replication set, use the CLI command `create replication-set` or in the SMC **Replications** topic, select **Action > Create Replication Set**.
    - Replicate.  
To initiate replication, use the CLI command `replicate` or in the SMC **Replications** topic, select **Action > Initiate Replication**.
  - For linear replication, in order to replicate an existing volume to another disk group in the primary or secondary system, follow these steps:
    - Use RAIDar’s **Wizards > Replication Setup Wizard** to prepare to replicate an existing volume to another disk group in the primary system or secondary system.  
Follow the wizard to select the primary volume, replication mode, and secondary volume, and to confirm your replication settings. The wizard verifies the communication links between the primary and secondary systems. Once setup is successfully completed, you can initiate replication from RAIDar or the CLI.
  - For descriptions and replication-related events, see the Event Descriptions Reference Guide.
- 

**NOTE:** These steps are a general outline of the replication setup. Refer to the following manuals for more information about replication setup:

- See the Storage Management Guide for procedures to setup and manage replications.
  - See the CLI Reference Guide for replication commands and syntax.
  - See the Event Descriptions Reference Guide for replication event reporting.
- 

---

 **IMPORTANT:** Controller module firmware must be compatible on all systems used for replication. For license information, see the Storage Management Guide.

---

## Diagnostic steps for replication setup

The tables in the following subsections show menu navigation using the SMC (v3), and using RAIDar (v2). The shorthand v3 and v2 prefixes are used to distinguish between the SMC and RAIDar, respectively.

### Virtual replication using the SMC

Can you successfully use the replication feature?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	The replication feature is not licensed on each controller enclosure used for replication.	<p>Verify licensing of the optional feature per system:</p> <ul style="list-style-type: none"><li>In the <b>Home</b> topic in the SMC, select <b>Action &gt; Install License</b>. The License Settings panel opens and displays information about each licensed feature.</li><li>If the Replication feature is not enabled, obtain and install a valid license for this feature. See the Storage Management Guide for license information.</li></ul> <hr/> <p><b>NOTE:</b> Virtual replication is only supported by 6004 Series iSCSI controller enclosures.</p> <hr/>
No	Compatible firmware revision supporting the replication feature is not running on each system used for replication.	<p>Perform the following actions on each system used for virtual replication:</p> <ul style="list-style-type: none"><li>In the <b>System</b> topic, select <b>Action &gt; Update Firmware</b>. The Update Firmware panel opens. The Update Controller Modules tab shows firmware versions installed in each controller.</li><li>If necessary, update the controller module firmware to ensure compatibility with the other systems.</li><li>For more information on compatible firmware, see the topic about updating firmware in the Storage Management Guide.</li></ul>
No	Invalid cabling connection. (If multiple controller enclosures are used, check the cabling for each system.)	<p>Verify controller enclosure cabling:</p> <ul style="list-style-type: none"><li>Verify use of proper cables.</li><li>Verify proper cabling paths for host connections.</li><li>Verify cabling paths between replication ports and switches are visible to one another.</li><li>Verify that cable connections are securely fastened.</li><li>Inspect cables for damage and replace if necessary.</li></ul>

**Table 22** Diagnostics for replication setup: Using the replication feature (v3)

Can you view information about remote links?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Communication link is down	<ul style="list-style-type: none"> <li>• Verify controller enclosure cabling (see <a href="#">Table 22</a>).</li> <li>• Review event logs for indicators of a specific fault in a host or replication data path component. In the footer, click the events panel and select <b>Show Event List</b>. This will open the <b>Event Log Viewer</b> panel.</li> <li>• Verify valid IP address of the network port on the remote system.</li> <li>• Click in the <b>Volumes</b> topic, then click on a volume name in the volumes list. Click the <b>Replication Sets</b> tab to display replications and associated metadata.</li> <li>• Alternatively, click in the <b>Replications</b> topic to display replications and associated metadata.</li> </ul>

**Table 23** Diagnostics for replication setup: Viewing information about remote links (v3)

Can you create a replication set?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	On controller enclosures with iSCSI host interface ports, replication set creation fails due to use of CHAP.	If using CHAP (Challenge-Handshake Authentication Protocol), see the topics about configuring CHAP and working in replications within the Storage Management Guide.
No	Unable to create the secondary volume (the destination volume in the virtual disk group to which you will replicate data from the primary volume)? <sup>1</sup>	<ul style="list-style-type: none"> <li>• Review event logs (in the footer, click the events panel and select <b>Show Event List</b>) for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>• Verify valid specification of the secondary volume according to either of the following criteria: <ul style="list-style-type: none"> <li>• A conflicting volume does not already exist</li> <li>• Creation of the new volume on the disk group</li> </ul> </li> </ul>
No	Communication link is down.	<ul style="list-style-type: none"> <li>• See actions described in <a href="#">Can you view information about remote links?</a> on page 88.</li> </ul>
<sup>1</sup> After ensuring valid licensing, valid cabling connections, and network availability, create the replication set using the <b>Replications</b> topic, select <b>Action &gt; Create Replication Set</b> .		

**Table 24** Diagnostics for replication setup: Creating a replication set (v3)

Can you replicate a volume?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	The replication feature is not licensed on each controller enclosure used for replication.	See actions described in <a href="#">Can you successfully use the replication feature?</a> on page 87.

**Table 25** Diagnostics for replication setup: Replicating a volume (v3)



Answer	Possible reasons	Actions
No	Nonexistent replication set.	<ul style="list-style-type: none"> <li>Determine existence of primary or secondary volumes.</li> <li>If a replication set has not been successfully created, use the <b>Replications</b> topic, select <b>Action &gt; Create Replication Set</b> to create one.</li> <li>Review event logs (in the footer, click the events panel and select <b>Show Event List</b>) for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> </ul>
No	Network error occurred during in-progress replication.	<ul style="list-style-type: none"> <li>Review event logs for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>Click in the <b>Volumes</b> topic, then click on a volume name in the volumes list. Click the <b>Replication Sets</b> tab to display replications and associated metadata.</li> <li>Replications that enter the suspended state can be resumed manually.</li> </ul>
No	Communication link is down.	See actions described in <a href="#">Can you view information about remote links?</a> on page 88.

**Table 25** Diagnostics for replication setup: Replicating a volume (v3) (continued)

Has a replication run successfully?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Last Successful Run shows N/A	<ul style="list-style-type: none"> <li>In the <b>Volumes</b> topic, click on the volume that is a member of the replication set. <ul style="list-style-type: none"> <li>Select the Replication Sets table.</li> <li>Check the Last Successful Run information.</li> </ul> </li> <li>If a replication has not run successfully, use the SMC to replicate as described in the “Working in the Replications topic” in the Storage Management Guide.</li> </ul>
No	Communication link is down.	See actions described in <a href="#">Can you view information about remote links?</a> on page 88.

**Table 26** Diagnostics for replication setup: Checking for a successful replication (v3)

## Linear replication using RAIDar

Can you successfully use the replication feature?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	The replication feature is not licensed on each controller enclosure used for replication.	<p>Verify licensing of the optional feature per system:</p> <ul style="list-style-type: none"> <li>In the Configuration View panel in RAIDar, right-click on the system, and select <b>View &gt; Overview</b>. Within the System Overview table, select the <b>Licensed Features</b> component to display the status of licensed features.</li> <li>If the Replication feature is not enabled, obtain and install a valid license for AssuredRemote.</li> </ul> <hr/> <p><b>NOTE:</b> Linear replication is not supported by 6004 Series SAS controller enclosures.</p>
No	Compatible firmware revision supporting replication is not running on each system used for replication.	<p>Perform the following actions on each system used for replication:</p> <ul style="list-style-type: none"> <li>In the Configuration View panel in RAIDar, right-click the system, and select <b>Tools &gt; Update Firmware</b>. The Update Firmware panel displays currently installed firmware versions.</li> <li>If necessary, update the controller module firmware to ensure compatibility with the other systems.</li> </ul>
No	Invalid cabling connection. (If multiple controller enclosures are used, check the cabling for each system.)	<p>Verify controller enclosure cabling:</p> <ul style="list-style-type: none"> <li>Verify use of proper cables.</li> <li>Verify proper cabling paths for host connections.</li> <li>Verify cabling paths between replication ports and switches on the same fabric or network.</li> <li>Verify that cable connections are securely fastened.</li> <li>Inspect cables for damage and replace if necessary.</li> </ul>

**Table 27** Diagnostics for replication setup: Using the replication feature (v2)

Can you view information about remote links?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Invalid login credentials	<ul style="list-style-type: none"> <li>Verify user name with Manage role on remote system.</li> <li>Verify user's password on remote system.</li> </ul>
No	Communication link is down	<ul style="list-style-type: none"> <li>Verify controller enclosure cabling (see <a href="#">Table 27</a>).</li> <li>Review event logs (in the Configuration View panel, right-click the system, and select <b>View &gt; Event Log</b>) for indicators of a specific fault in a host or replication data path component.</li> <li>Verify valid IP address of the network port on the remote system.</li> <li>In the Configuration View panel, right-click the remote system, and select <b>Tools &gt; Check Remote System Link</b>. Click <b>Check Links</b>.</li> </ul>

**Table 28** Diagnostics for replication setup: Viewing information about remote links (v2)

Can you create a replication set?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Selected link type or port-to-link connections are incorrect.	<ul style="list-style-type: none"> <li>Remote Replication mode: In the Configuration View panel, right-click the remote system, and select <b>Tools &gt; Check Remote System Link</b>. Click <b>Check Links</b> to verify correct link type and remote host port-to-link connections.</li> <li>Local Replication mode: In the Configuration View panel, right-click the local system, and select <b>Tools &gt; Check Local System Link</b>. Click <b>Check Links</b> to verify correct link type and local host port-to-link connections.</li> </ul>
No	On controller enclosures with iSCSI host interface ports, replication set creation fails due to use of CHAP.	If using CHAP (Challenge-Handshake Authentication Protocol), configure it as described in the Storage Management Guide topics "Using the Replication Setup Wizard" or "Replicating a volume."
No	Unable to select the replication mode (Local or Remote)? <sup>1</sup>	<ul style="list-style-type: none"> <li>Review event logs (in the Configuration View panel, right-click the system, and select <b>View &gt; Event Log</b>) for indicators of a specific fault in a host or replication data path component. Follow any Recommended Actions.</li> <li>Local Replication mode replicates to a secondary volume residing in the local storage system. <ul style="list-style-type: none"> <li>Verify valid links. On dual-controller systems, verify that A ports can access B ports on the partner controller, and vice versa.</li> <li>Verify existence of either a replication-prepared volume of the same size as the master volume, or a disk group with sufficient unused capacity.</li> </ul> </li> <li>Remote Replication mode replicates to a secondary volume residing in an independent storage system: <ul style="list-style-type: none"> <li>Verify selection of a valid remote disk group.</li> <li>Verify selection of valid remote volume on disk group.</li> <li>Verify valid IP address of remote system network port.</li> <li>Verify user name with Manage role on remote system.</li> <li>Verify user password on remote system.</li> </ul> </li> </ul> <p><b>NOTE:</b> If the remote system has not been added, it cannot be selected.</p>
No	Unable to select the secondary volume (the destination volume on the disk group to which you will replicate data from the primary volume)? <sup>1</sup>	<ul style="list-style-type: none"> <li>Review event logs for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>Verify valid specification of the secondary volume according to either of the following criteria: <ul style="list-style-type: none"> <li>Creation of the new volume on the disk group</li> <li>Selection of replication-prepared volume</li> </ul> </li> </ul>
No	Communication link is down.	See actions described in <a href="#">Can you view information about remote links?</a> on page 90.
<sup>1</sup> After ensuring valid licensing, valid cabling connections, and network availability, create the replication set using the <b>Wizards &gt; Replication Setup Wizard</b> .		

**Table 29** Diagnostics for replication setup: Creating a replication set (v2)

Can you replicate a volume?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	AssuredRemote is not licensed on each controller enclosure used for replication.	See actions described in <a href="#">Can you successfully use the replication feature?</a> on page 90.
No	Nonexistent replication set.	<ul style="list-style-type: none"> <li>• Determine existence of primary or secondary volumes.</li> <li>• If a replication set has not been successfully created, use the Replication Setup Wizard to create one.</li> <li>• Review event logs (in the Configuration View panel, right-click the system, and select <b>View &gt; Event Log</b>) for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> </ul>
No	Network error occurred during in-progress replication.	<ul style="list-style-type: none"> <li>• Review event logs for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>• In the Configuration View panel, right-click the secondary volume, and select <b>View &gt; Overview</b> to display the Replication Volume Overview table: <ul style="list-style-type: none"> <li>• Check for replication interruption (suspended) status.</li> <li>• Check for inconsistent status.</li> <li>• Check for offline status.</li> </ul> </li> <li>• Replications that enter the suspended state must be resumed manually.</li> </ul>
No	Communication link is down.	See actions described in <a href="#">Can you view information about remote links?</a> on page 90.

**Table 30** Diagnostics for replication setup: Replicating a volume (v2)

Can you view a replication image?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Nonexistent replication image.	<ul style="list-style-type: none"><li>In the Configuration View panel, expand disk groups and subordinate volumes to reveal the existence of a replication image or images.</li><li>If a replication image has not been successfully created, use RAIDar to create one as described in the “Using AssuredRemote to replicate volumes” topic within the Storage Management Guide.</li></ul>
No	Communication link is down.	See actions described in <a href="#">Can you view information about remote links?</a> on page 90.

**Table 31** Diagnostics for replication setup: Viewing a replication image (v2)

Can you view remote systems?

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Communication link is down.	See actions described in <a href="#">Can you view information about remote links?</a> on page 90.

**Table 32** Diagnostics for replication setup: Viewing a remote system (v2)

## Resolving voltage and temperature warnings

1. Check that all of the fans are working by making sure the Voltage/Fan Fault/Service Required LED on each power supply module is off, or by using the SMC or RAIDar to check enclosure health status.
  - v3: In the lower corner of the footer, overall health status of the enclosure is indicated by a health status icon. For more information, point to the **System** tab and select **View System** to see the System panel. You can select **Front**, **Rear**, and **Table** views on the System panel. If you hover over a component, its associated metadata and health status displays onscreen.
  - v2: In the Configuration View panel, right click the enclosure and click **View > Overview** to view the health status of the enclosure and its components. The Enclosure Overview page enables you to see information about each enclosure and its physical components in front, rear, and tabular views—using graphical or tabular presentation—allowing you to view the health status of the enclosure and its components.

See [Options available for performing basic steps](#) on page 74 for a description of health status icons and alternatives for monitoring enclosure health.

2. Make sure that all modules are fully seated in their slots and that their latches are locked.
3. Make sure that no slots are left open for more than two minutes.

If you need to replace a module, leave the old module in place until you have the replacement or use a blank module to fill the slot. Leaving a slot open negatively affects the airflow and can cause the enclosure to overheat.
4. Try replacing each power supply one at a time.
5. Replace the controller modules one at a time.
6. Replace SFPs one at a time.

## Sensor locations

The storage system monitors conditions at different points within each enclosure to alert you to problems. Power, cooling fan, temperature, and voltage sensors are located at key points in the enclosure. In each controller module and expansion module, the enclosure management processor (EMP) monitors the status of these sensors to perform SCSI enclosure services (SES) functions.

The following sections describe each element and its sensors.

## Power supply sensors

Each enclosure has two fully redundant power supplies with load-sharing capabilities. The power supply sensors described in the following table monitor the voltage, current, temperature, and fans in each power supply. If the power supply sensors report a voltage that is under or over the threshold, check the input voltage.

**Table 33** Power supply sensor descriptions

Description	Event/Fault ID LED condition
Power supply 1	Voltage, current, temperature, or fan fault
Power supply 2	Voltage, current, temperature, or fan fault

## Cooling fan sensors

Each power supply uses two fans. The normal range for fan speed is 4,000 to 6,000 RPM. When a fan speed drops below 4,000 RPM, the EMP considers it a failure and posts an alarm in the storage system event log. The following table lists the description, location, and alarm condition for each fan. If the fan speed remains under the 4,000 RPM threshold, the internal enclosure temperature may continue to rise. Replace the power supply reporting the fault.

**Table 34** Cooling fan sensor descriptions

Description	Location	Event/Fault ID LED condition
Fan 1	Power supply 1	< 4,000 RPM
Fan 2	Power supply 1	< 4,000 RPM
Fan 3	Power supply 2	< 4,000 RPM
Fan 4	Power supply 2	< 4,000 RPM

During a shutdown, the cooling fans do not shut off. This allows the enclosure to continue cooling.

## Temperature sensors

Extreme high and low temperatures can cause significant damage if they go unnoticed. Each controller module has six temperature sensors. Of these, if the CPU or FPGA (Field-programmable Gate Array) temperature reaches a shutdown value, the controller module is automatically shut down. Each power supply has one temperature sensor.

When a temperature fault is reported, it must be remedied as quickly as possible to avoid system damage. This can be done by warming or cooling the installation location.

**Table 35** Controller module temperature sensor descriptions

Description	Normal operating range	Warning operating range	Critical operating range	Shutdown values
CPU temperature	3°C–88°C	0°C–3°C, 88°C–90°C	> 90°C	0°C 100°C
FPGA temperature	3°C–97°C	0°C–3°C, 97°C–100°C	None	0°C 105°C
Onboard temperature 1	0°C–70°C	None	None	None
Onboard temperature 2	0°C–70°C	None	None	None
Onboard temperature 3 (Capacitor temperature)	0°C–70°C	None	None	None
CM temperature	5°C–50°C	≤ 5°C, ≥ 50°C	≤ 0°C, ≥ 55°C	None

When a power supply sensor goes out of range, the Fault/ID LED illuminates amber and an event is logged to the event log.

**Table 36** Power supply temperature sensor descriptions

Description	Normal operating range
Power supply 1 temperature	–10°C–80°C
Power supply 2 temperature	–10°C–80°C

## Power supply module voltage sensors

Power supply voltage sensors ensure that an enclosure's power supply voltage is within normal ranges. There are three voltage sensors per power supply.

**Table 37** Voltage sensor descriptions

Sensor	Event/Fault LED condition
Power supply 1 voltage, 12V	< 11.00V > 13.00V
Power supply 1 voltage, 5V	< 4.00V > 6.00V
Power supply 1 voltage, 3.3V	< 3.00V > 3.80V

## A LED descriptions

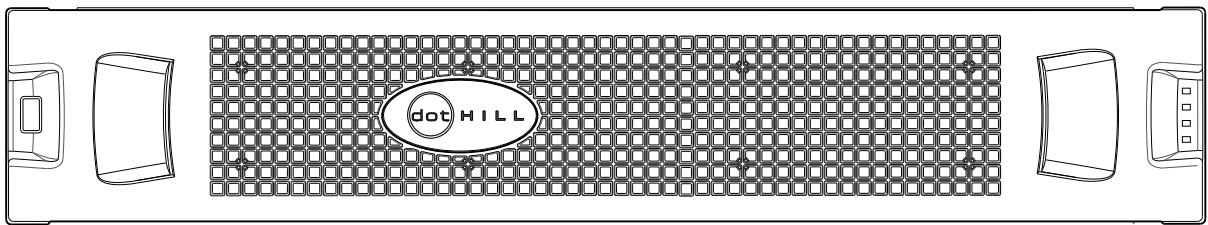
### Front panel LEDs

AssuredSAN 6004 Series supports storage enclosures in dual-purpose fashion. Each of the supported chassis form factors can be configured as a controller enclosure or expansion enclosure (see [Front panel components](#) on page 13 for descriptions of supported chassis).

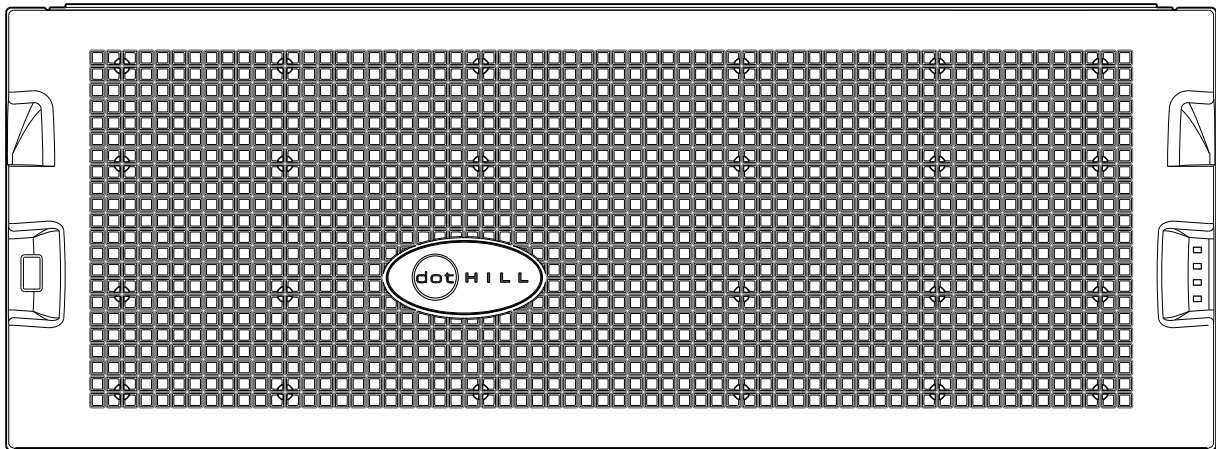
Supported expansion enclosures are used for adding storage. The J6X48 48-drive enclosure is the SFF drive enclosures used for storage expansion. The J6X56 56-drive enclosure is the LFF drive enclosures used for storage expansion. See [Table 4](#) on page 37 for a matrix showing controller enclosures and compatible drive enclosures. Storage enclosures support dual I/O modules (IOMs), and they are equipped with two redundant power supply modules. 4U56 enclosures are equipped with two fan control modules. See [Controller enclosure — rear panel layout](#) on page 19.

### Enclosure bezels

Each AssuredSAN 6004 Series enclosure is equipped with a removable bezel designed to cover the front panel during enclosure operation. The bezel provides two debossed pockets. It is equipped with an EMI (Electromagnetic Interference) shield to provide protection from the product.



**Figure 73** Front panel enclosure bezel: 48-drive enclosure (2U48)



**Figure 74** Front panel enclosure bezel: 56-drive enclosure (4U56)

### Enclosure bezel attachment and removal

When you initially attach or remove the front panel enclosure bezel for the first time, refer to the appropriate pictorials for your enclosure(s) from the list below, and follow the instructions provided.

- Front view of 48-drive enclosure (2U48): [Figure 73](#)
- Front view of 56-drive enclosure (4U56): [Figure 74](#)
- Bezel alignment for 48-drive enclosure (2U48): [Figure 75](#) on page 97
- Bezel alignment for 56-drive enclosure (4U56): [Figure 77](#) on page 98



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**NOTE:** Step procedures for attaching and removing enclosure bezels are also provided in the FRU Installation and Replacement Guide.

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## Enclosure bezel attachment

2U—Orient the enclosure bezel to align its back side with the front face of the enclosure as shown in [Figure 75](#) on page 97. Face the front of the enclosure, and while supporting the base of the bezel, position it such that the mounting sleeves within the integrated ear caps align with the ball studs, and then gently push-fit the bezel onto the ball studs to securely attach the bezel to the front of the enclosure.

4U—Orient the enclosure bezel to align its back side with the front face of the enclosure as shown in [Figure 77](#) on page 98. Tilt the bezel forward, and guide the two angle-bracket slots on the backside of the bezel onto the two upturned flanges located on sidemount brackets near the front of the enclosure (on the exterior left and right chassis walls). Then, gently push the sleeves onto the ball studs as shown in the details in [Figure 77](#).

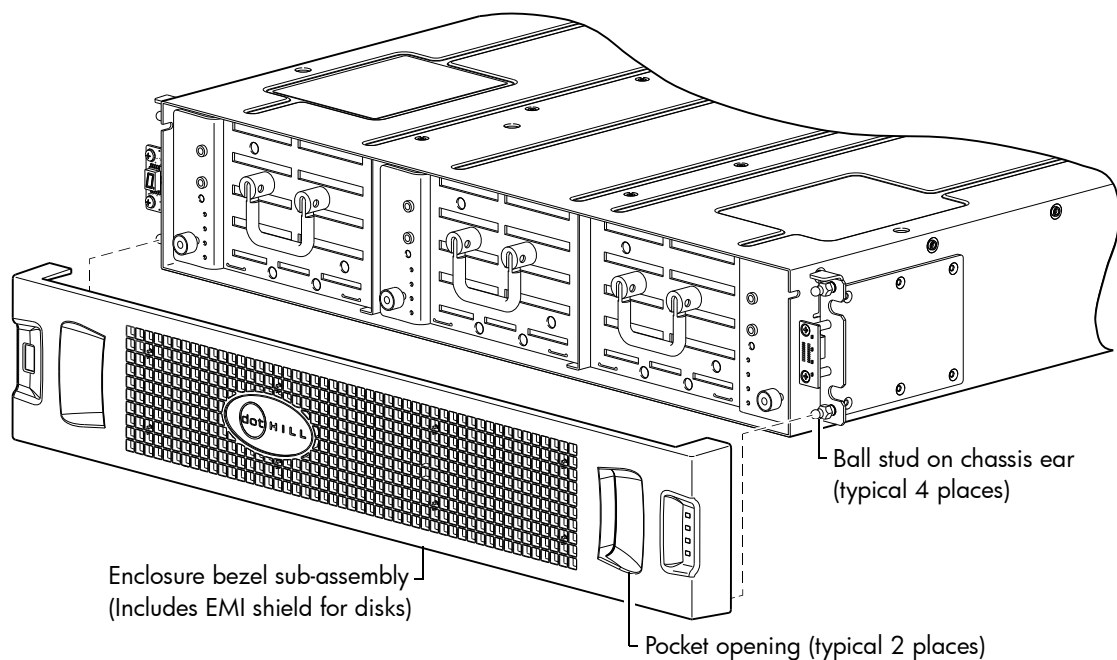
## Enclosure bezel removal

2U—While facing the front of the enclosure, insert the index finger of each hand into the top of the respective (left or right) pocket opening, and insert the middle finger of each hand into the bottom of the respective opening, with thumbs on the bottom of the bezel face. Gently pull the top of the bezel while applying slight inward pressure below, to release the bezel from the ball studs.

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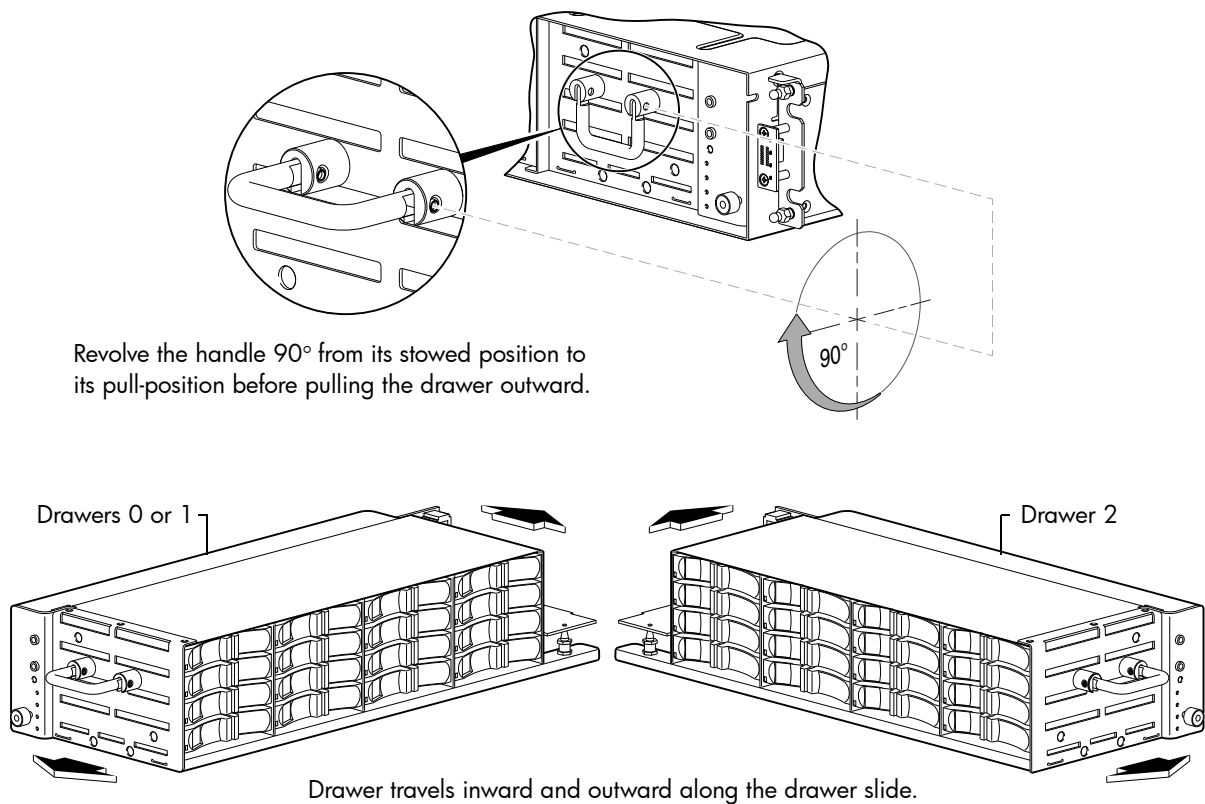
**NOTE:** Bezel alignment for the 2U48 enclosure is shown in [Figure 75](#) below.

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**Figure 75** Partial assembly showing bezel alignment with 2U48 chassis

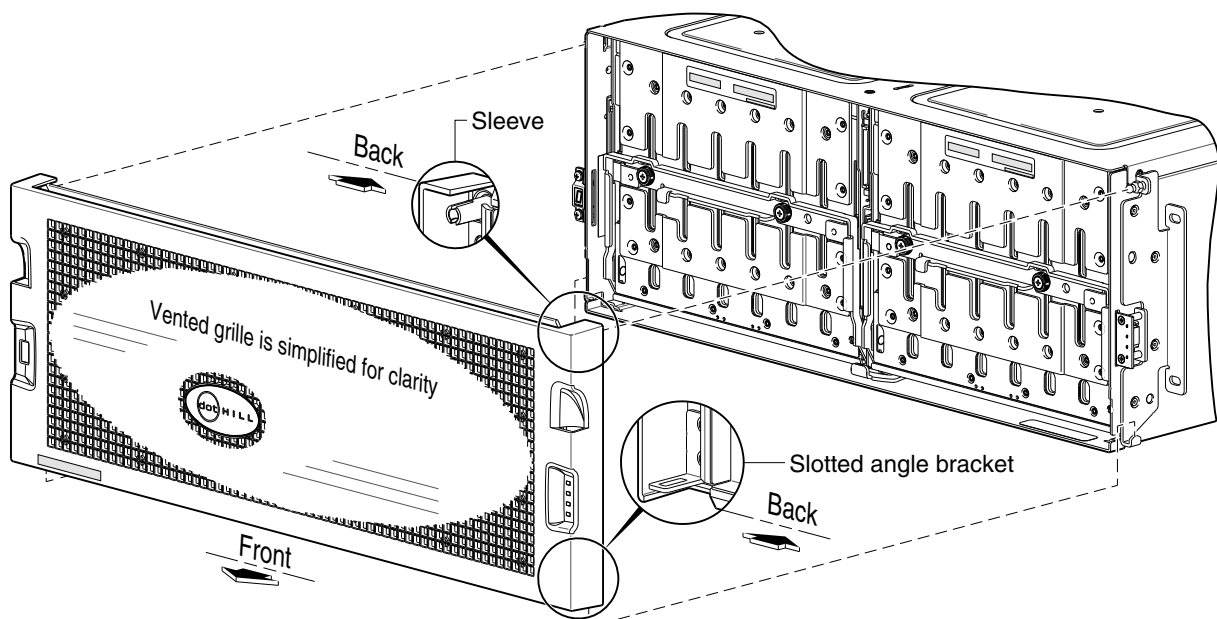
Once you have removed the bezel, you can access the drawers. To open a drawer, you should first revolve the pull-handle upwards by 90° to enable pulling the drawer outward for viewing disks. The handle can be in the stowed position when pushing the drawer back into the enclosure along the drawer slide (See [Figure 76](#) for instructions about using 2U48 drawer handles).



**Figure 76** Drawer detail showing handle rotation and drawer travel (2U48)

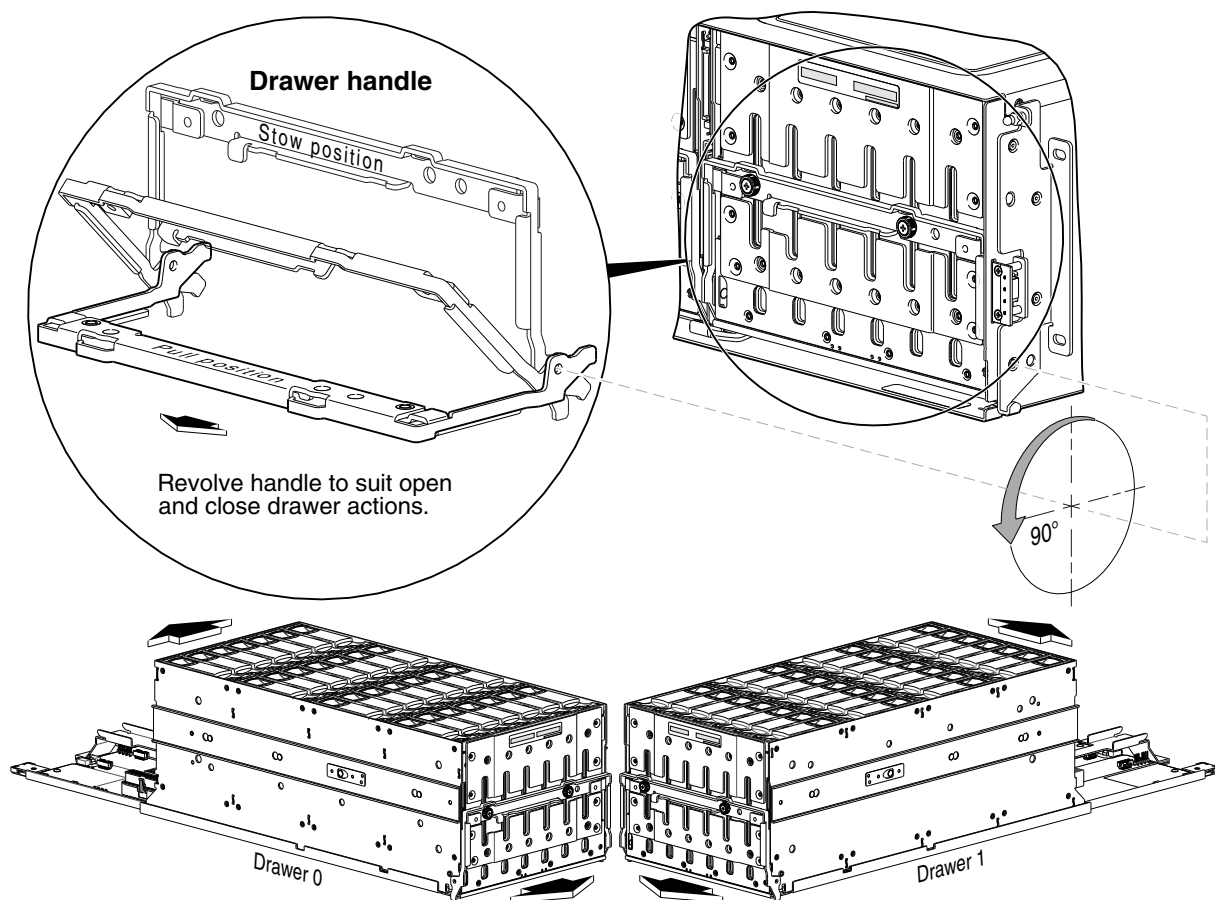
**NOTE:** Bezel alignment for the 4U56 enclosure is shown in [Figure 77](#) below.

4U—While facing the front of the enclosure, insert the index finger of each hand into the top of the respective (left or right) pocket opening. Gently pull the top of the bezel while applying slight inward pressure below to release the top sleeves from the ball studs. Lift the bezel upwards to allow the angle-bracket slots to clear the upturned mounting flanges.



**Figure 77** Partial assembly showing bezel alignment with 4U56 chassis

Once you have removed the bezel, you can access the drawers. To open a drawer, you must first revolve the pull-handle downwards by 90° to enable pulling the drawer outward for viewing disks (see [Figure 78](#) for instructions about using the 4U56 drawer handles). The handle can be in the stowed position when pushing the drawer back into the enclosure along the drawer slide.



**Figure 78** Drawer detail showing handle rotation and drawer travel (4U56)

---

**IMPORTANT:** The front panel enclosure illustrations that follow assume that you have removed the enclosure bezel to reveal the underlying components.

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## 48-drive enclosure front panel LEDs

Enclosure front panel LEDs are described in two interrelated figure/table ensembles within this subsection:

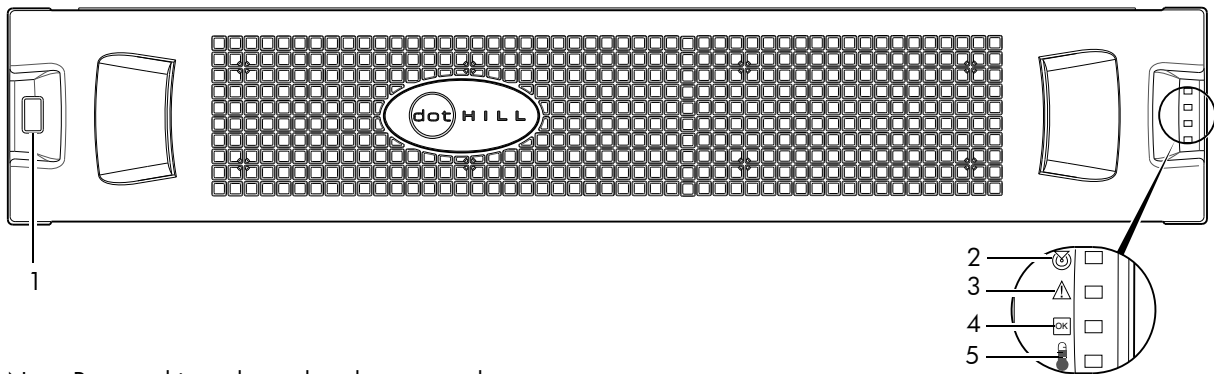
- [Figure 79](#): describes enclosure front panel LEDs (visible with the bezel installed).
- [Figure 80](#) on page 101: describes drawer panel LEDs (visible with the bezel removed).

The disk module LED is described in another related figure/table ensemble within [Disk drive LED \(2U48\)](#):

- [Figure 81](#) on page 102: describes the LED located on disk modules (visible with the bezel removed and drawer(s) opened).
- [Table 38](#) and [Table 39](#) on page 103 describe additional disk LED behavior.

### LEDs visible with enclosure bezel installed

The LEDs located on the chassis ears are described in [Figure 79](#) and are visible with the enclosure bezel installed.



Note: Remove this enclosure bezel to access drawers.

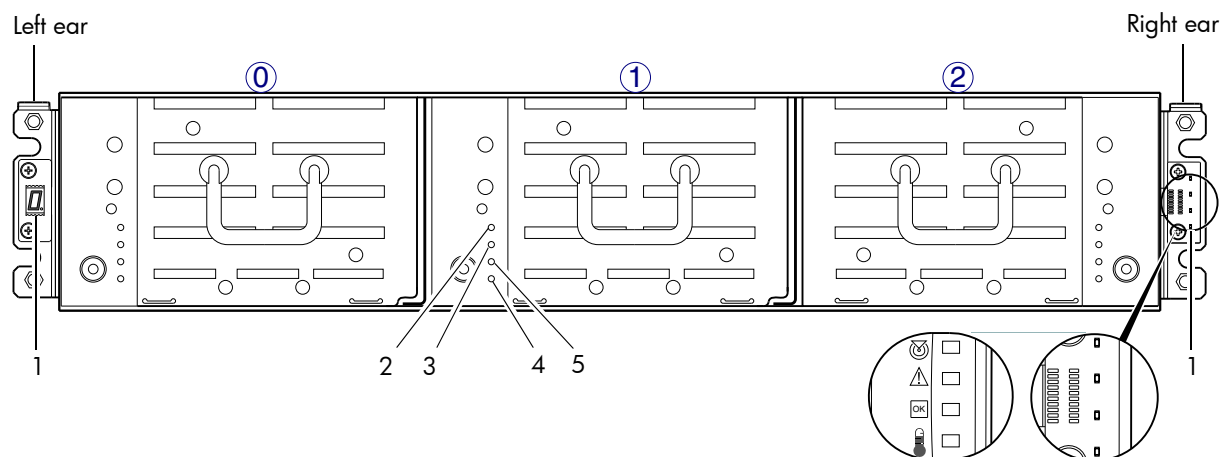
LED	Description	Definition
1	Enclosure ID	Green — On Enables you to correlate the enclosure with logical views presented by management software. Sequential enclosure ID numbering of controller enclosures begins with the integer 0. The enclosure ID for an attached drive enclosure is nonzero.
2	Unit Locator	White blink — Enclosure is identified Off — Normal operation
3	Fault/Service Required	Amber — On Enclosure-level fault condition exists. The event has been acknowledged but the problem needs attention. Off — No fault condition exists.
4	FRU OK	Green — On The enclosure is powered on with at least one power supply operating normally. Off — Both power supplies are off; the system is powered off.
5	Temperature Fault	Green — On The enclosure temperature is normal. Amber — On The enclosure temperature is above threshold.

**Figure 79** LEDs: 2U48 enclosure front panel

**NOTE:** The enclosure front panel illustrations that follow assume that you have removed the enclosure bezel to reveal underlying components.

## LEDs visible with enclosure bezel removed

The enclosure bezel is removed to reveal the underlying 2U48 enclosure front panel LEDs. The front panel LEDs—including ear LEDs and drawer panel LEDs—are described in the table below the illustration.



Note: Integers atop drawers indicate drawer numbering sequence.

(Silk screens on bezel)

LED	Description	Definition
1	Enclosure ear LEDs	Enclosure ear LEDs (see <a href="#">Figure 79</a> on page 100).
2	FRU OK	Green — On The drawer is powered on with the power supply operating normally. Green — blink The drawer is initializing. Off — The drawer is not OK.
3	Fault/Service Required	Amber — On Drawer-level fault condition exists. The event has been acknowledged but the problem needs attention. Amber — blink Hardware-controlled power-up. Off — No fault condition exists.
4	OK to Remove	Blue — On The drawer is prepared for removal. Off — The drawer is not prepared for removal.
5	Unit Locator	White blink — Enclosure is identified Off — Normal operation

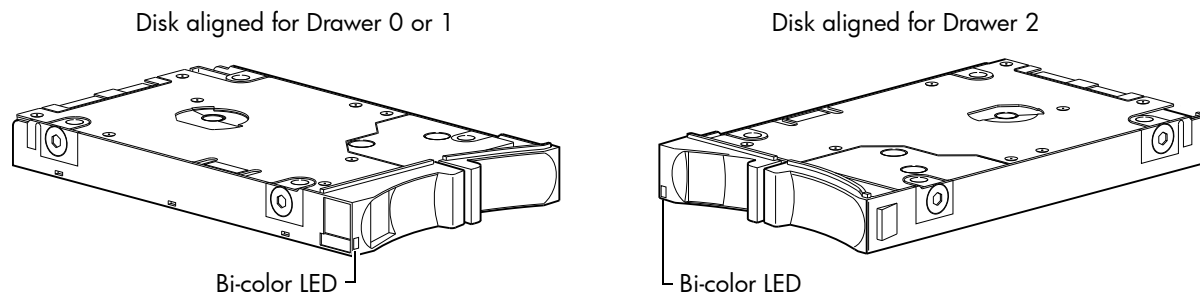
**Figure 80** LEDs: 2U48 drawer front panel

The enclosure bezel for this model provides the EMI protection. The bezel should be securely attached to the enclosure during operation (see [Enclosure bezel attachment](#) on page 97 and [Figure 75](#) on page 97).

△ **CAUTION:** To ensure adequate EMI protection from the product, the enclosure bezel should be properly installed while the enclosure is in operation.

## Disk drive LED (2U48)

You must remove the enclosure bezel to facilitate visual observation of the drawers containing disk drive modules. To view disks in a drawer, you must open the drawer (see [Opening and closing a 4U28 drawer](#) on page 31). Alternatively, you can use management interfaces to monitor disk LED behavior.



2.5" SFF disk drive module  
(see table below for LED behaviors)

LED mode description	Color	State	Definition
Removal/Identification/Fault	Blue <sup>1</sup>	On	The disk drive is prepared for removal.
		1Hz Blink	Physically identifies the disk drive module.
		4Hz Blink	The disk has failed; experienced a fault; is a leftover; or the vdisk or disk group that it is associated with is down or critical.
		Off	No fault, identify, or remove requests are active.
Power/Activity	Green	On	The disk drive module is operating normally.
		Blink	The disk drive module is initializing; active and processing I/O; performing a media scan; or the vdisk or disk group is initializing or reconstructing.
		Off	The disk drive is not powered on.

<sup>1</sup>Given that the blue behavior (state) of the LED can indicate only one state at a time, the precedence of requests from highest to lowest is as follows: Identify; Fault; OK to remove. A higher precedence indication can hide a lower precedence indication.

**Figure 81** LEDs: Disk drive modules (2U48)

For information about disk drives supported by 6004 Series enclosures see SFF disk drive modules, see [Disk drives used in 6004 Series enclosures](#) on page 18.

**IMPORTANT:** For instructions about accessing drawers and installing disk drive modules into them, see [Populating drawers in 2U48 enclosures](#) on page 27, and [AMS insert for a single disk slot \(2U48\)](#) on page 29.

For information about replacing a disk drive module in a 6004 Series controller enclosure or J6X48 drive enclosure, refer to the “Replacing disk drive module” topic in the FRU Installation and Replacement Guide. Instructions are provided for replacing SFF disk drive modules therein.

For information about creating a disk group, or a vdisk with volumes, and mapping the volumes to hosts, see the “Provisioning the system” topic within the Storage Management Guide.

**IMPORTANT:** For information about self-encrypting disk (SED) drives, see [FDE considerations](#) on page 35 and the Storage Management Guide or online help.

**NOTE:** Additional information pertaining to 2U48 disk drive LED behavior is provided in the supplementary tables on the following page.

**Table 38** LEDs: Disks in 2U48 enclosures

Disk drive module LED behavior		SFF disk drive module	
Description	State	Color	Action
Disk drive OK, FTOL	Off	None	None
	On (operating normally)	Green	On
	OK to remove	Blue	On
	Identifying self—offline/online	Blue	Blink—1Hz
Disk drive I/O	Initializing	Green	Blink
	Active and processing I/O	Green	Blink
	Performing a media scan	Green	Blink
Disk drive leftover	Disk drive is a leftover	Blue	Blink—4Hz
	Identifying a leftover	Blue	Blink—4Hz
Disk drive failed	Fault or failure	Blue	Blink—4Hz
	Fault and remove disk drive	Blue	Blink—4Hz
	Fault and identify disk drive	Blue	Blink—4Hz
	Fault, identify, and remove disk drive	Blue	Blink—4Hz

**Table 39** LEDs: Disk groups in 2U48 enclosures

Disk group LED behavior		SFF disks	
Description	State	Color	Action
FTOL	On (operating normally)	Green	On
Disk group activity	Disk group is reconstructing	Green	Blink
	Disk group is initializing	Green	Blink
Disk group degraded	Disk group is critical/down	See note 1 below	

<sup>1</sup>Individual disks will display fault LEDs

## 56-drive enclosure front panel LEDs

Enclosure front panel LEDs are described in two interrelated figure/table ensembles within this subsection:

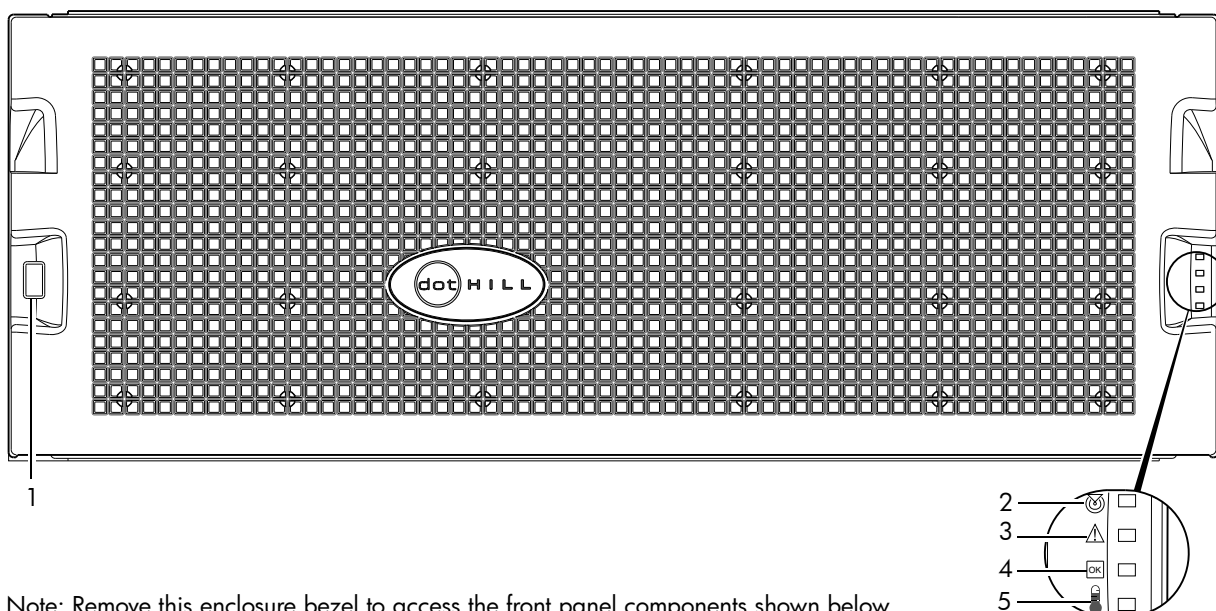
- [Figure 82](#): describes enclosure front panel LEDs (visible with the bezel installed).
- [Figure 83](#) on page 105: describes drawer panel LEDs (visible with the bezel removed).

Disk module LEDs are described in another related figure/table ensemble within [Disk drive LEDs \(4U56\)](#):

- [Figure 84](#) on page 106: describes the LEDs located on disk modules (visible with the bezel removed and drawer(s) opened).
- [Table 40](#) and [Table 41](#) on page 107 describe additional disk LED behavior.

### LEDs visible with enclosure bezel installed

The LEDs located on the chassis ears are described in [Figure 82](#) and are visible with the enclosure bezel installed.



Note: Remove this enclosure bezel to access the front panel components shown below.

LED	Description	Definition
1	Enclosure ID	Green — On Enables you to correlate the enclosure with logical views presented by management software. Sequential enclosure ID numbering of controller enclosures begins with the integer 0. The enclosure ID for an attached drive enclosure is nonzero.
2	Unit Locator	White blink — Enclosure is identified Off — Normal operation
3	Fault/Service Required	Amber — On Enclosure-level fault condition exists. The event has been acknowledged but the problem needs attention. Off — No fault condition exists.
4	FRU OK	Green — On The enclosure is powered on with at least one power supply operating normally. Off — Both power supplies are off; the system is powered off.
5	Temperature Fault	Green — On The enclosure temperature is normal. Amber — On The enclosure temperature is above threshold.

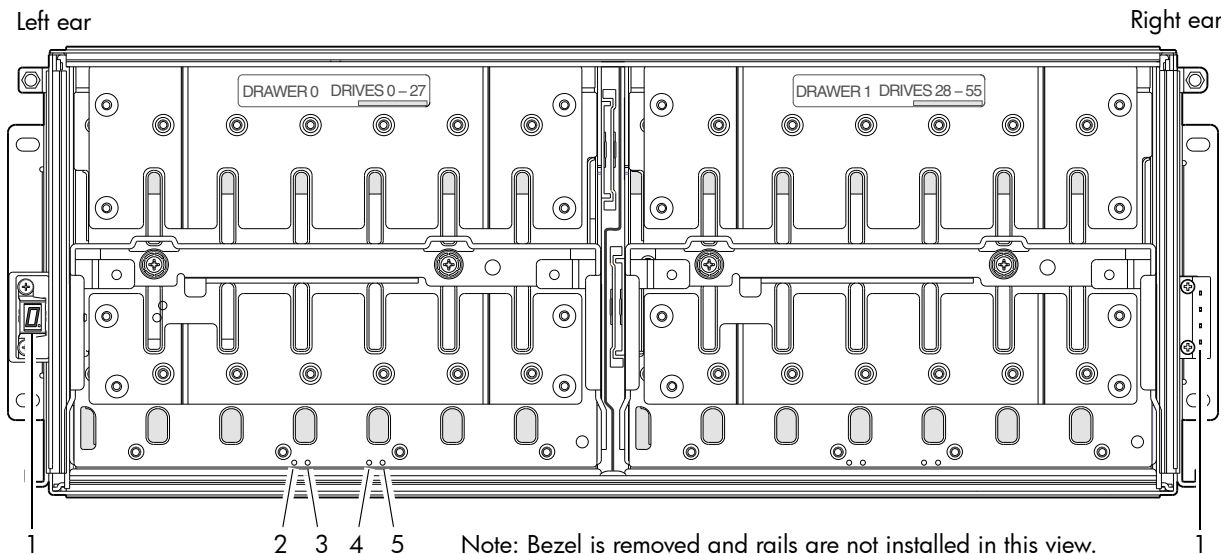
**Figure 82** LEDs: 4U56 enclosure front panel



**NOTE:** The enclosure front panel illustrations that follow assume that you have removed the enclosure bezel to reveal underlying components.

## LEDs visible with enclosure bezel removed

The enclosure bezel is removed to reveal the underlying 4U56 enclosure front panel LEDs. The front panel LEDs—including ear LEDs and drawer panel LEDs—are described in the table below the illustration.



LED	Description	Definition
1	Enclosure ear LEDs	Enclosure ear LEDs (see <a href="#">Figure 82</a> on page 104).
2	Unit Locator	White blink — Enclosure is identified Off — Normal operation
3	OK to Remove	Blue — On The drawer is prepared for removal. Off — The drawer is not prepared for removal.
4	Fault/Service Required	Amber — On Drawer-level fault condition exists. The event has been acknowledged but the problem needs attention. Amber — Blink Hardware-controlled power-up. Off — No fault condition exists.
5	FRU OK	Green — On The drawer is powered on with the power supply operating normally. Green — blink The drawer is initializing. Off — The drawer is not OK.

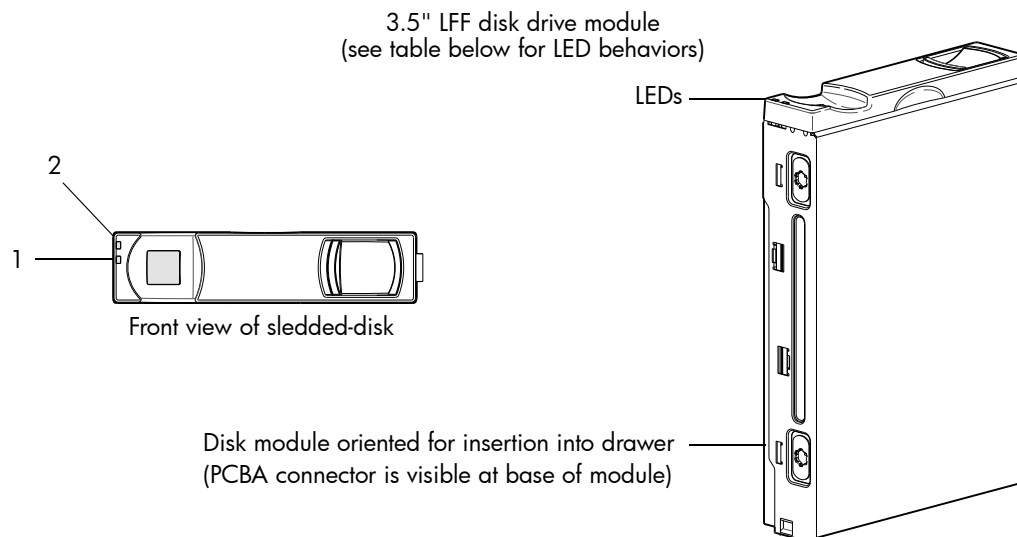
**Figure 83** LEDs: 4U56 drawer front panel

The enclosure bezel for this model provides the EMI protection for the product. The bezel should be securely attached to the enclosure during operation.

△ **CAUTION:** To ensure adequate EMI protection from the product, the enclosure bezel should be properly installed while the enclosure is in operation.

## Disk drive LEDs (4U56)

You must remove the enclosure bezel to facilitate visual observation of the drawers containing disk drive modules. To view disks in a drawer, you must open the drawer (see [Opening and closing a 4U28 drawer](#) on page 31). Alternatively, you can use management interfaces to monitor disk LED behavior.



Electromagnetic interference protection for disks is provided by the EMI shield in the enclosure bezel.


LED mode description	Color	State	Definition
1—Power/Activity	Green	On	The disk drive is operating normally.
		Blink	The disk drive module is initializing; active and processing I/O; performing a media scan; or the vdisk or disk group is initializing or reconstructing.
		Off	No identify or remove requests are active. If not illuminated and Fault is not illuminated, the disk is not powered on.
2—Fault	Amber	On	The disk has failed; experienced a fault; is a leftover; or the disk group that it is associated with is down or critical.
		Blink	Physically identifies the disk; or locates a leftover (also see Blue).
	Blue	Off	If not illuminated and Power/Activity is not illuminated, the disk is not powered on.
	Blue	Blink	Leftover disk from disk group is located (alternates blinking amber).

**Figure 84** LEDs: Disk drive modules (4U56)

For information about disks supported in 6004 Series enclosures, see [Disk drives used in 6004 Series enclosures](#) on page 18.

**IMPORTANT:** For instructions about accessing drawers and installing disk drive modules into them, see [Populating drawers in 4U56 enclosures](#) on page 31, and [Installing a disk module into a 4U28 drawer](#) on page 33.

For information about replacing a disk drive module in an 6004 Series enclosure, refer to the “Replacing a disk drive module” topic in the FRU Installation and Replacement Guide. Instructions are provided for replacing LFF disk drive modules therein. For information about creating a disk group, or a vdisk with volumes, and mapping the volumes to hosts, see the “Provisioning the system” topic within the Storage Management Guide.

 **IMPORTANT:** For information about self-encrypting disk (SED) drives, see [FDE considerations](#) on page 35 and the Storage Management or online help.

**Table 40** LEDs: Disks in LFF enclosures

Disk drive module LED behavior		LFF disks	
Description	State	Color	Action
Disk drive OK, FTOL	Off	None	None
	On (operating normally)	Green	On
	OK to remove	Green	Blink
		Blue	On
	Identifying self — offline/online	Green <sup>1</sup>	On
		Amber	Blink
Disk drive I/O	Initializing	Green	Blink
	Active and processing I/O	Green	Blink
	Performing a media scan	Green	Blink
Disk drive leftover	Disk drive is a leftover	Amber	On
	Identifying a leftover	Amber	Blink
		Blue <sup>1</sup>	On
Disk drive failed	Fault or failure	Green <sup>1</sup>	On
		Amber	On
	Fault and remove disk drive	Green	On
		Amber	On
	Fault and identify disk drive	Green	On
		Amber	On
	Fault, identify, and remove disk drive	Green	On
		Amber	Blink
		Blue	On

<sup>1</sup>This color may or may not illuminate.

**Table 41** LEDs: Disk groups in LFF enclosures

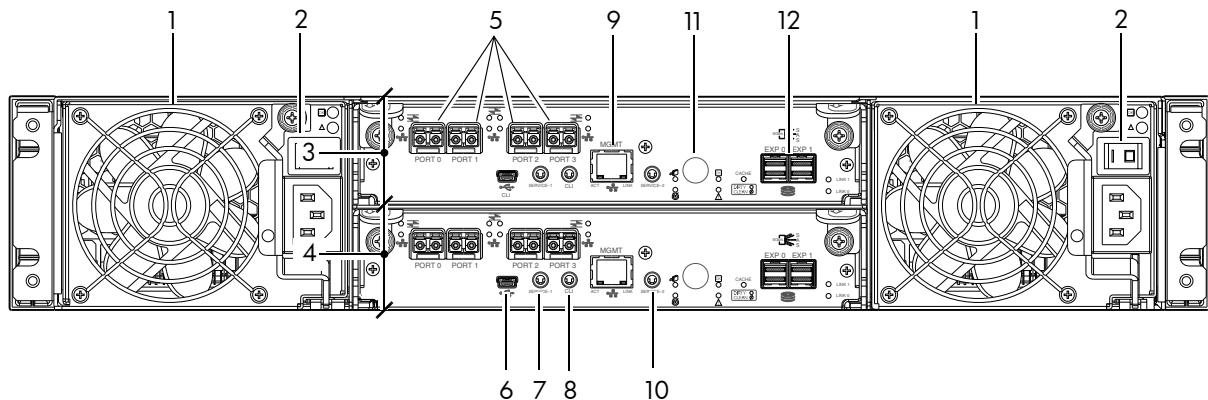
Disk group LED behavior		LFF disks	
Description	State	Color	Action
FTOL	On (operating normally)	Green	On
Disk group activity	Disk group is reconstructing	Green	Blink
	Disk group is initializing	Green	Blink
Disk group degraded	Disk group is critical/down	See note 1 below	

<sup>1</sup>Individual disks will display fault LEDs

# Controller enclosure — rear panel layout

## 2U48 controller enclosures

The diagram and table below display and identify important component items that comprise the rear panel layout of a 2U48 controller enclosure. In [Figure 85](#) below, a 6844 is shown as a representative example. Diagrams and tables on the following pages describe rear panel LED behavior.



- |  |  |
|--|--|
| 1 AC power supplies                                  | 8 Reserved for future use  |
| 2 AC power switch                                    | 9 Network port   |
| 3 Controller module A                                | 10 Service port 1 (used by service personnel only)   |
| 4 Controller module B                                | 11 Disabled button (used by engineering/test only)<br>(Stickers shown covering the openings) |
| 5 CNC ports: used for host connection or replication | 12 SAS expansion port  |
| 6 CLI port (USB - Type B)                            |  |
| 7 Service port 2 (used by service personnel only)    |  |

**Figure 85** 6004 Series controller enclosure: rear panel (2U)

A controller enclosure accommodates two AC power supply FRUs within the two power supply slots (see two instances of callout No.1 above). The controller enclosure is equipped with two controller module FRUs of the same type within the I/O module (IOM) slots (see callouts No.3 and No.4 above).

**IMPORTANT:** 6004 Series controller enclosures support dual-controller configuration only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

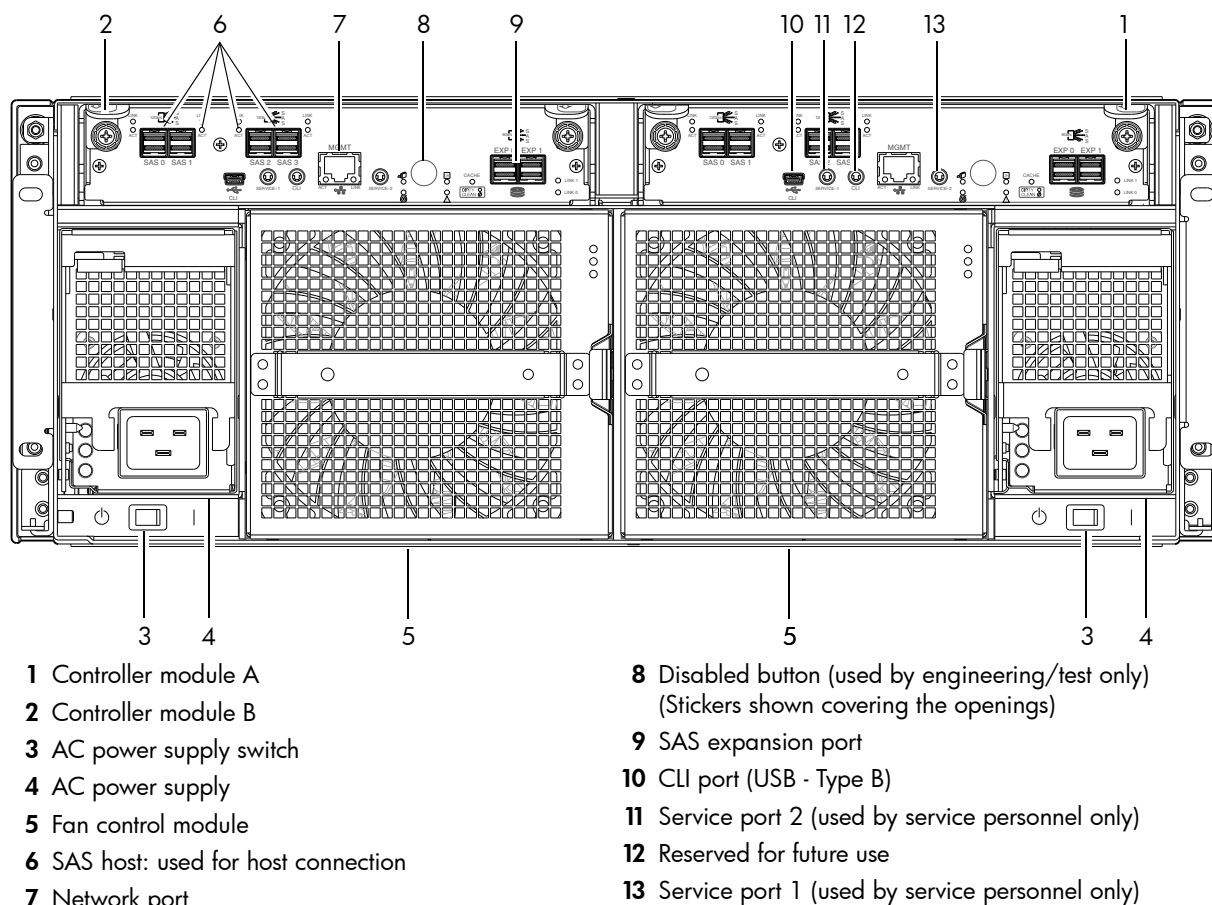
The diagrams with tables that immediately follow provide descriptions for the different controller modules and power supply modules that can be installed into the rear panel of a 6004 Series controller enclosure. Showing controller modules and power supply modules separately from the enclosure enables improved clarity in identifying the component items called out in the diagrams and described in the tables.

LED descriptions are also provided for optional drive enclosures supported by the 6004 Series controller enclosures.

For information about replacing 6004 Series controller enclosure FRUs, refer to the appropriate FRU replacement procedure in the FRU Installation and Replacement Guide.

## 4U56 controller enclosures

The diagram and table below display and identify important component items that comprise the rear panel layout of a 4U56 controller enclosure. Diagrams and tables on the following pages describe rear panel LED behavior.



**Figure 86** 6004 Series controller enclosure: rear panel (4U)

The controller enclosure accommodates two controller module FRUs of the same type within the I/O module (IOM) slots (see callouts No.1 and No.2 above). The controller enclosure accommodates two power supply FRUs of the same type within the two power supply slots (see two instances of callout No.4 above). AC PSUs are shown in the example. Beneath each power supply is a power supply switch (see two instances of callout No.3 above). The controller enclosure accommodates two fan control modules (see two instances of callout No.5 above).

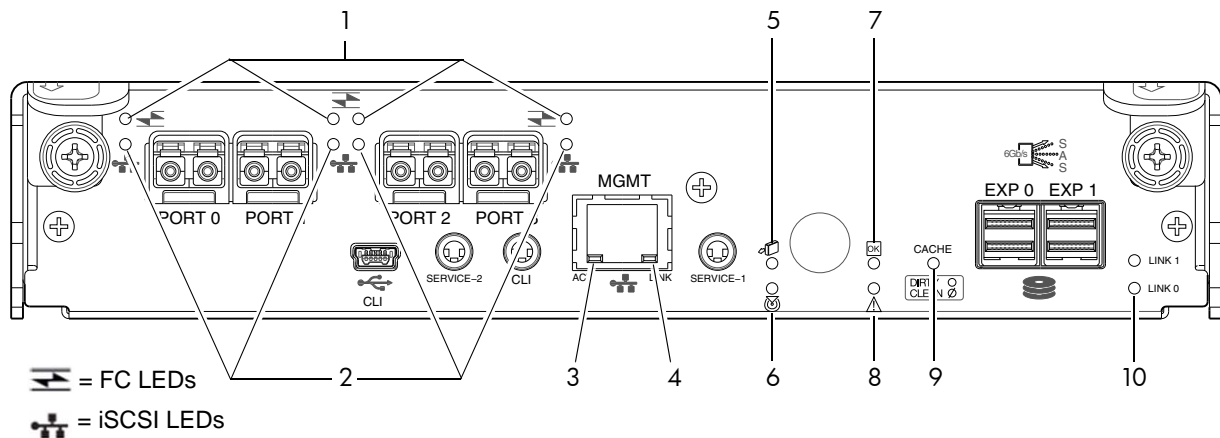
**IMPORTANT:** 6004 Series controller enclosures support dual-controller configuration only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

Figure 86 shows a 4U56 controller enclosure equipped with AC power supplies. Alternatively, the enclosure can be equipped with redundant DC power supplies (see Figure 91 on page 114).

The diagrams with tables that immediately follow provide descriptions for the controller modules, power supply modules, and fan control modules that can be installed into the rear panel of a 4U56 controller enclosure. Showing them separately from the enclosure enables improved clarity in identifying the component items called out in the diagrams and described in the tables.

Descriptions are also provided for optional drive enclosures supported by 6004 Series controller enclosures for expanding storage capacity.

## 6844/6854 CNC controller module — rear panel LEDs



LED	Description	Definition
1	Host 4/8/16 Gb FC <sup>1</sup> Link Status/ Link Activity	Off — No link detected. Green — The port is connected and the link is up. Blinking green — The link has I/O or replication activity.
2	Host 10GbE iSCSI <sup>2,3</sup> Link Status/ Link Activity	Off — No link detected. Green — The port is connected and the link is up. Blinking green — The link has I/O or replication activity.
3	Network Port Link Active Status <sup>4</sup>	Off — The Ethernet link is not established, or the link is down. Green — The Ethernet link is up (applies to all negotiated link speeds).
4	Network Port Link Speed <sup>4</sup>	Off — Link is up at 10/100base-T negotiated speeds. Amber — Link is up and negotiated at 1000base-T.
5	OK to Remove	Off — The controller module is not prepared for removal. Blue — The controller module is prepared for removal.
6	Unit Locator	Off — Normal operation. Blinking white — Physically identifies the controller module.
7	FRU OK	Off — Controller module is not OK. Blinking green — System is booting. Green — Controller module is operating normally.
8	Fault/Service Required	Amber — A fault has been detected or a service action is required. Blinking amber — Hardware-controlled power-up or a cache flush or restore error.
9	Cache Status	Green — Cache is dirty (contains unwritten data) and operation is normal. The unwritten information can be log or debug data that remains in the cache, so a Green cache status LED does not, by itself, indicate that any user data is at risk or that any action is necessary. Off — In a working controller, cache is clean (contains no unwritten data). This is an occasional condition that occurs while the system is booting. Blinking green — A CompactFlash flush or cache self-refresh is in progress, indicating cache activity. See also <a href="#">Cache Status LED details</a> on page 113.
10	Expansion Port Status	Off — The port is empty or the link is down. On — The port is connected and the link is up.

<sup>1</sup>When in FC mode, the SFPs must be a qualified 8 Gb or 16 Gb fibre optic option. A 16 Gbit/s SFP can run at 16 Gbit/s, 8 Gbit/s, 4 Gbit/s, or auto-negotiate its link speed. An 8 Gbit/s SFP can run at 8 Gbit/s, 4 Gbit/s, or auto-negotiate its link speed.

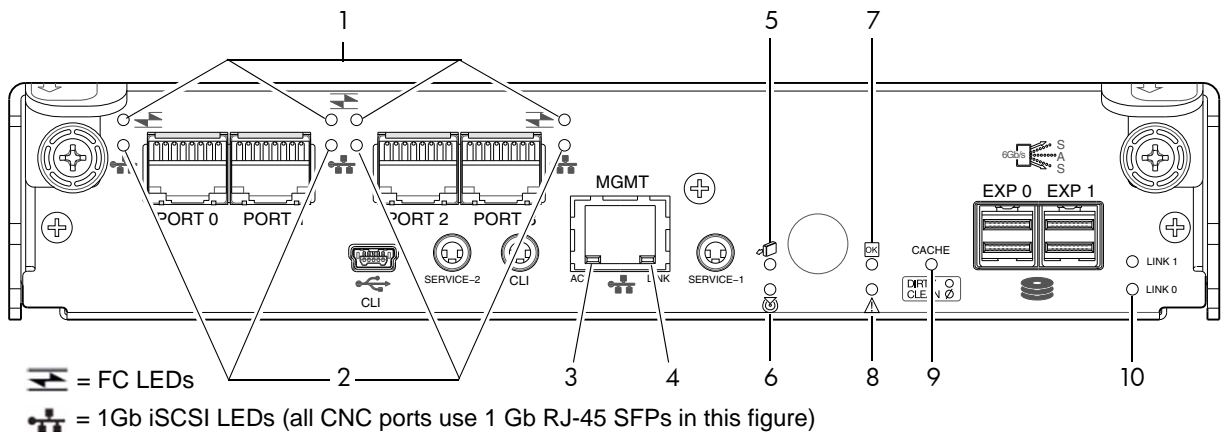
<sup>2</sup>When in 10GbE iSCSI mode, the SFPs must be a qualified 10GbE iSCSI optic option.

<sup>3</sup>When powering up and booting, iSCSI LEDs will be on/blinking momentarily, then they will switch to the mode of operation.

<sup>4</sup>When port is down, both LEDs are off.

**Figure 87** LEDs: 6844/6854 CNC controller module (FC and 10GbE SFPs)

**NOTE:** For information about supported combinations of host interface protocols using CNC ports, see [CNC ports used for host connection](#) on page 10 and the “Configuring host ports topic” in the Storage Management Guide.



LED	Description	Definition
1	Not used in example <sup>1</sup>	The FC SFP is not shown in this example (see <a href="#">Figure 87</a> on page 110).
2	Host 1 Gb iSCSI <sup>2,3</sup> Link Status/ Link Activity	Off — No link detected. Green — The port is connected and the link is up. Blinking green — The link has I/O or replication activity.
3	Network Port Link Active Status <sup>4</sup>	Off — The Ethernet link is not established, or the link is down. Green — The Ethernet link is up (applies to all negotiated link speeds).
4	Network Port Link Speed <sup>4</sup>	Off — Link is up at 10/100base-T negotiated speeds. Amber — Link is up and negotiated at 1000base-T.
5	OK to Remove	Off — The controller module is not prepared for removal. Blue — The controller module is prepared for removal.
6	Unit Locator	Off — Normal operation. Blinking white — Physically identifies the controller module.
7	FRU OK	Off — Controller module is not OK. Blinking green — System is booting. Green — Controller module is operating normally.
8	Fault/Service Required	Amber — A fault has been detected or a service action is required. Blinking amber — Hardware-controlled power-up or a cache flush or restore error.
9	Cache Status	Green — Cache is dirty (contains unwritten data) and operation is normal. The unwritten information can be log or debug data that remains in the cache, so a Green cache status LED does not, by itself, indicate that any user data is at risk or that any action is necessary. Off — In a working controller, cache is clean (contains no unwritten data). This is an occasional condition that occurs while the system is booting. Blinking green — A CompactFlash flush or cache self-refresh is in progress, indicating cache activity. See also <a href="#">Cache Status LED details</a> on page 113.
10	Expansion Port Status	Off — The port is empty or the link is down. On — The port is connected and the link is up.

<sup>1</sup>When in FC mode, the SFPs must be a qualified 8 Gb or 16 Gb fibre optic option. A 16 Gbit/s SFP can run at 16 Gbit/s, 8 Gbit/s, 4 Gbit/s, or auto-negotiate its link speed. An 8 Gbit/s SFP can run at 8 Gbit/s, 4 Gbit/s, or auto-negotiate its link speed.

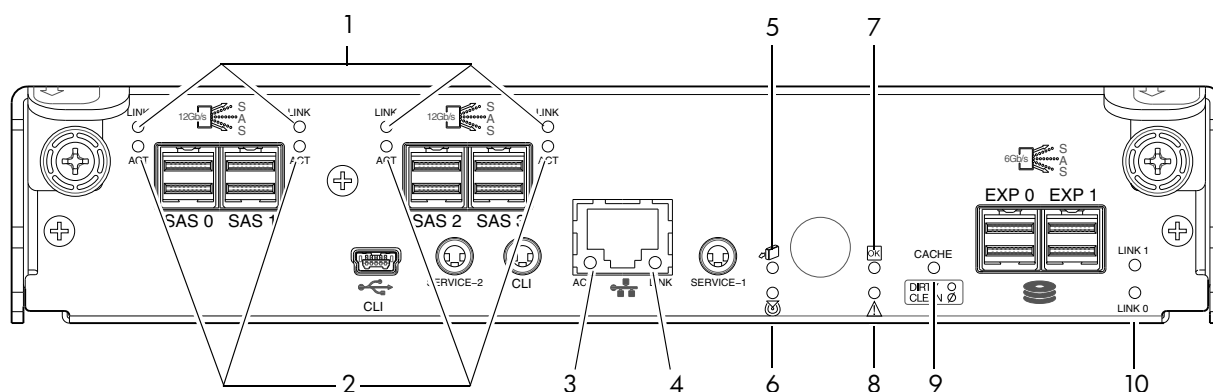
<sup>2</sup>When in 1 GbE iSCSI mode, the SFPs must be a qualified 1 GbE iSCSI optic option.

<sup>3</sup>When powering up and booting, iSCSI LEDs will be on/blinking momentarily, then they will switch to the mode of operation.

<sup>4</sup>When port is down, both LEDs are off.

**Figure 88** LEDs: 6844/6854 CNC controller module (1 Gb RJ-45 SFPs)

## 6544/6554 SAS controller module—rear panel LEDs



LED	Description	Definition
1	Host 12 Gb SAS <sup>1,3</sup> Link Status	Off — No link detected. Green — The port is connected and the link is up.
2	Host 12 Gb SAS <sup>1,3</sup> Link Activity	Off — The link is idle. Blinking green — The link has I/O activity.
3	Network Port Link Active Status <sup>4</sup>	Off — The Ethernet link is not established, or the link is down. Green — The Ethernet link is up (applies to all negotiated link speeds).
4	Network Port Link Speed <sup>4</sup>	Off — Link is up at 10/100base-T negotiated speeds. Amber — Link is up and negotiated at 1000base-T.
5	OK to Remove	Off — The controller module is not prepared for removal. Blue — The controller module is prepared for removal.
6	Unit Locator	Off — Normal operation. Blinking white — Physically identifies the controller module.
7	FRU OK	Off — Controller module is not OK. Blinking green — System is booting. Green — Controller module is operating normally.
8	Fault/Service Required	Amber — A fault has been detected or a service action is required. Blinking amber — Hardware-controlled power-up or a cache flush or restore error.
9	Cache Status	Green — Cache is dirty (contains unwritten data) and operation is normal. The unwritten information can be log or debug data that remains in the cache, so a Green cache status LED does not, by itself, indicate that any user data is at risk or that any action is necessary. Off — In a working controller, cache is clean (contains no unwritten data). This is an occasional condition that occurs while the system is booting. Blinking green — A CompactFlash flush or cache self-refresh is in progress, indicating cache activity. See also <a href="#">Cache Status LED details</a> on page 113.
10	Expansion Port Status	Off — The port is empty or the link is down. On — The port is connected and the link is up.

<sup>1</sup>Cables must be qualified HD mini-SAS host cable options.

<sup>2</sup>Use a qualified SFF-8644 to SFF-8644 cable option when connecting the 6544/6554 controller to a 12 Gb SAS HBA.

<sup>3</sup>Use a qualified SFF-8644 to SFF-8088 cable option when connecting the 6544/6554 controller to a 6 Gb SAS HBA.

<sup>4</sup>When port is down, both LEDs are off.

**Figure 89** LEDs: 6544/6554 SAS controller module (HD mini-SAS)

**NOTE:** Once a Link Status LED is lit, it remains so, even if the controller is shut down via the SMC, RAIDar, or the CLI.



When a controller is shut down or otherwise rendered inactive—its Link Status LED remains illuminated—falsely indicating that the controller can communicate with the host. Though a link exists between the host and the chip on the controller, the controller is not communicating with the chip. To reset the LED, the controller must be power-cycled (see [Powering on/powering off](#) on page 46).

## Cache Status LED details

If the LED is blinking evenly, a cache flush is in progress. When a controller module loses power and write cache is dirty (contains data that has not been written to disk), the supercapacitor pack provides backup power to flush (copy) data from write cache to CompactFlash memory. When cache flush is complete, the cache transitions into self-refresh mode.

If the LED is blinking momentarily slowly, the cache is in a self-refresh mode. In self-refresh mode, if primary power is restored before the backup power is depleted (3–30 minutes, depending on various factors), the system boots, finds data preserved in cache, and writes it to disk. This means the system can be operational within 30 seconds, and before the typical host I/O time-out of 60 seconds, at which point system failure would cause host-application failure. If primary power is restored after the backup power is depleted, the system boots and restores data to cache from CompactFlash, which can take about 90 seconds. The cache flush and self-refresh mechanism is an important data protection feature; essentially four copies of user data are preserved: one in controller cache and one in CompactFlash of each controller. The Cache Status LED illuminates solid green during the boot-up process. This behavior indicates the cache is logging all POSTs, which will be flushed to the CompactFlash the next time the controller shuts down.

---

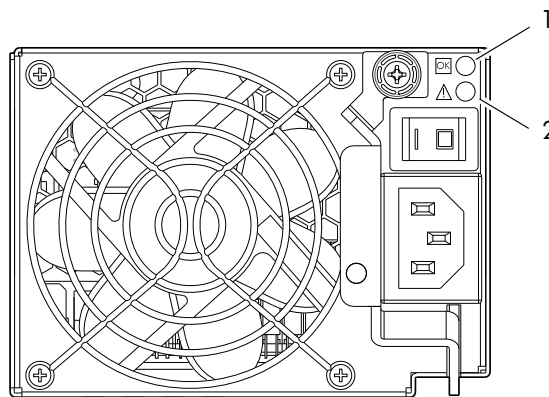
△ **CAUTION:** If the Cache Status LED illuminates solid green—and you wish to shut-down the controller—do so from the user interface, so unwritten data can be flushed to CompactFlash.

---

## Power supply LEDs for supported PSUs

Power redundancy is achieved through two independent load-sharing power supplies. In the event of a power supply failure, or the failure of the power source, the storage system can operate continuously on a single power supply. Greater redundancy can be achieved by connecting the power supplies to separate circuits. AC and DC power supplies are equipped with a power switch. Power supplies are used by controller and drive enclosures.

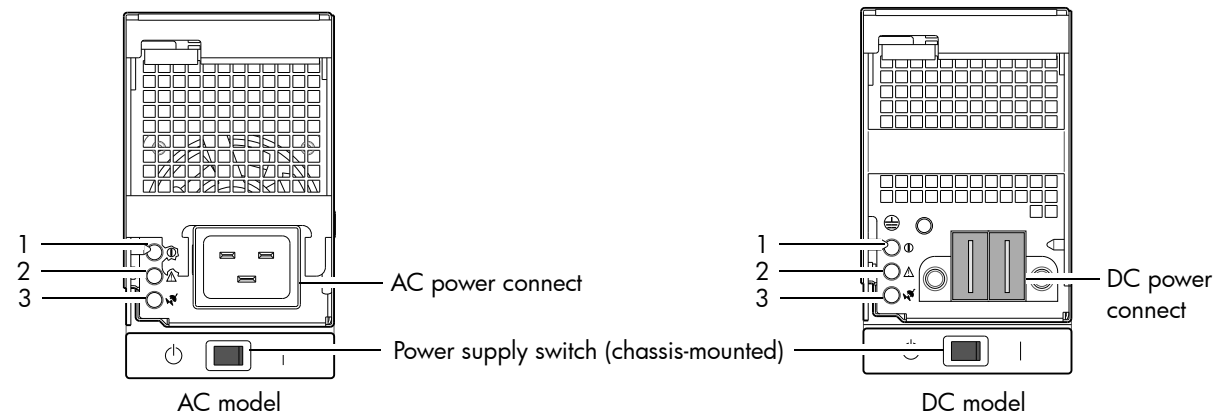
2U48 AC power supplies have a power switch. Power supplies are used by controller and drive enclosures.



LED No./Description	Color	State	Definition
1 — Input Source Power Good	Green	On	Power is on and input voltage is normal.
		Off	Power is off, or input voltage is below the minimum threshold.
2 — Voltage/Fan Fault/Service Required	Amber	On	Output voltage is out of range, or a fan is operating below the minimum required RPM.
		Off	Output voltage is normal.

**Figure 90** LEDs: Power supply units — rear panel (2U48)

The AC PSU illustration within [Figure 91](#) on page 114 employs a partial or broken section on the plastic protection guard in order to show the underlying LED icons next to the PSU LEDs.

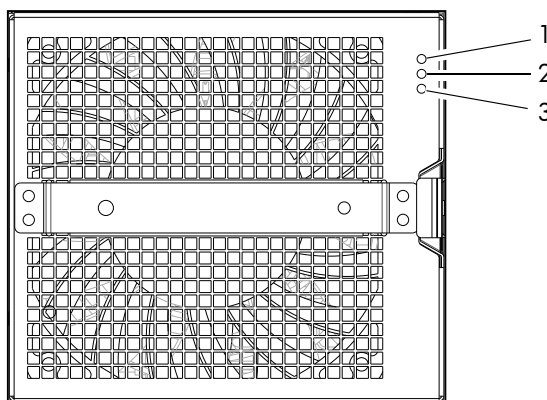


LED No./Description	Color	State	Definition
1 — AC Input Source	Green	On	Power is on and input voltage is normal.
		Off	No AC input to PSU.
2 — Voltage/Fan Fault/Service Required	Amber	On Blinking	Output voltage is out of range, or a fan is operating below the minimum required RPM.
		Off	Fault not detected.
3 — DC Power	Green	On	Main output power on.
		Off	Power is off; main output is off; or a fault is detected.

**Figure 91** LEDs: Power supply units — rear panel (4U56)

### Fan control module LEDs

Unlike the 2U48 models, the 4U56 provides a fan control module (FCM) FRU.



LED No./Description	Color	State	Definition
1 — FRU OK	Green	On	Power is on with at least one fan operating normally.
		Off	Both fans are off; the system is powered off.
2 — Fault/Service Required	Amber	On	Fault detected; event has been acknowledged but the problem needs attention.
		Off	No fault condition exists.
3 — Unit locator	White	On	FRU is identified.
		Off	Normal operation.

**Figure 92** LEDs: Fan control module — rear panel (4U56)

## Optional drive enclosures for storage expansion

AssuredSAN 6004 Series controller enclosures support a variety of AssuredSAN drive enclosures that can optionally be procured for adding storage. The following subsections describe drive enclosure LEDs.

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**NOTE:** See [Table 4](#) on page 37 for a comparative tabular view of AssuredSAN 6004 Series drive enclosures supported by AssuredSAN 6004 Series controller enclosures.

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Representative cabling examples showing controller enclosure and drive enclosure cascades are provided in [LED descriptions](#).

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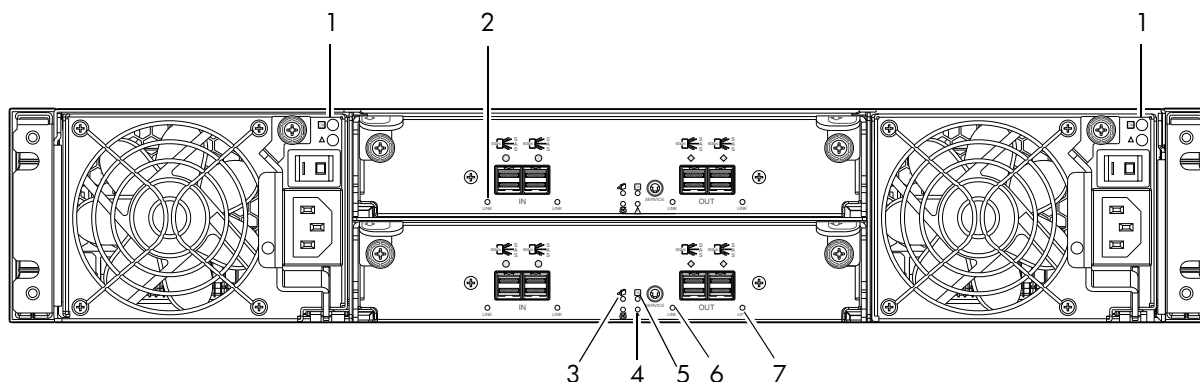
**NOTE:** See [Connecting the controller enclosure and drive enclosures](#) on page 36 for drive enclosure cabling.

---

## J6X48 drive enclosure rear panel LEDs

The rear panel layout of a 2U (J6X48) drive enclosure is shown below. Using mini-SAS (SFF-8088) external connectors, this drive enclosure supports a 6-Gbps data rate for backend SAS expansion.

The J6X48 drive enclosure features a power switch on each of its redundant AC power supplies as shown below and labeled in [Figure 85](#) on page 108. See [Powering on/powering off](#) on page 46 for more information.

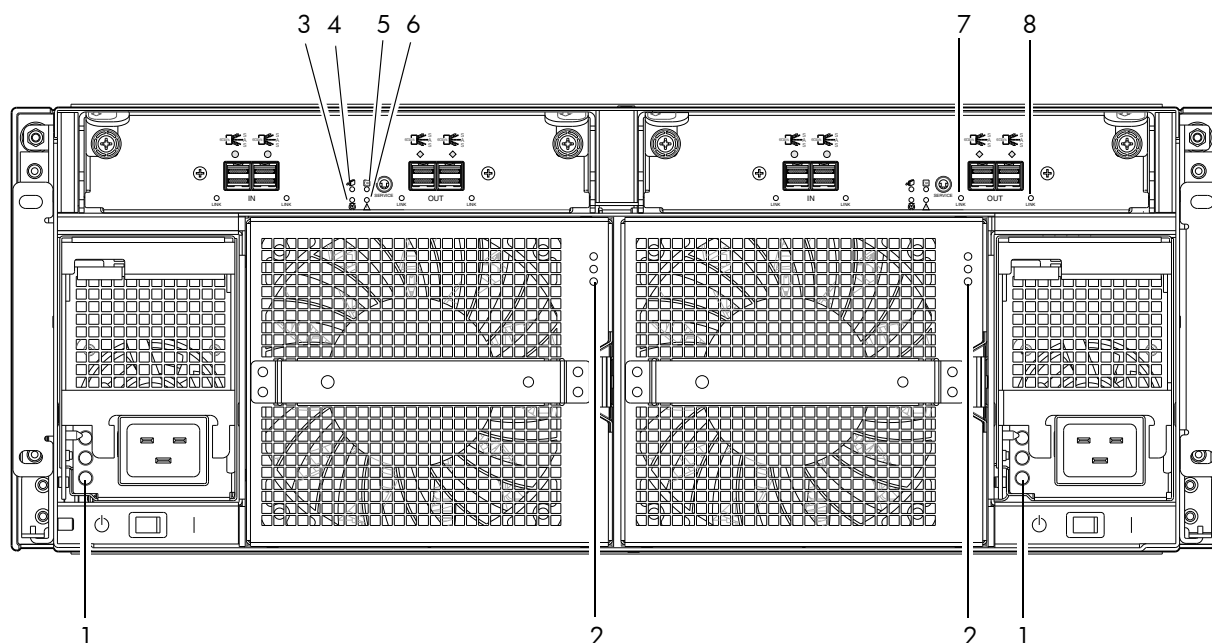


LED No./Description	Color	State	Definition
1 — Power Supply	—	—	See <a href="#">Power supply LEDs for supported PSUs</a> on page 113.
2 — Unit Locator	White	Off Blink	Normal operation. Physically identifies the expansion module.
3 — OK to Remove	Blue	Off	Not implemented.
4 — Fault/Service Required	Amber	On Blink	A fault is detected or a service action is required. Hardware-controlled power-up.
5 — FRU OK	Green	On Off Blink	Expansion module is operating normally. Expansion module is not OK. System is booting.
6 — SAS In Port Status	Green	On Off	Port is connected and the link is up. Port is empty or link is down.
7 — SAS Out Port Status	Green	On Off	Port is connected and the link is up. Port is empty or link is down.

**Figure 93** LEDs: J6X48 drive enclosure — rear panel

## J6X56 drive enclosure rear panel LEDs

6004 Series controller enclosures support LFF 56-disk drive enclosures for expansion of storage capacity. These drive enclosures use HD mini-SAS (SFF-8644) connectors to facilitate backend SAS expansion.



LED No./Description	Color	State	Definition
1 — Power Supply	—	—	See <a href="#">Power supply LEDs for supported PSUs</a> on page 113.
2 — Fan Control Module	—	—	See <a href="#">Fan control module LEDs</a> on page 114.
3 — Unit Locator	White	Off Blink	Normal operation. Physically identifies the expansion module.
4 — OK to Remove	Blue	Off	Not implemented.
5 — FRU OK	Green	On Off Blink	Expansion module is operating normally. Expansion module is not OK. System is booting.
6 — Fault/Service Required	Amber	On Blink	A fault is detected or a service action is required. Hardware-controlled power-up.
7 — SAS In Port Status	Green	On Off	Port is connected and the link is up. Port is empty or link is down.
8 — SAS Out Port Status	Green	On Off	Port is connected and the link is up. Port is empty or link is down.

**Figure 94** LEDs: J6X56 drive enclosure — rear panel

## B Specifications and requirements

### Safety requirements

Install the system in accordance with the local safety codes and regulations at the facility site. Follow all cautions and instructions marked on the equipment.

 **IMPORTANT:** Also see the hard copy Product Regulatory Compliance and Safety document (included in your product ship kit).

Alternatively, you can access the document online. See Dot Hill's customer resource center (CRC) web site for additional information: <https://crc.dothill.com>.

### Site requirements and guidelines

The following sections provide requirements and guidelines that you must address when preparing your site for the installation.

When selecting an installation site for the system, choose a location not subject to excessive heat, direct sunlight, dust, or chemical exposure. These conditions greatly reduce the system's longevity and might void your warranty.

### Site wiring and AC power requirements

The following are required for all installations using AC power supplies:

**Table 42** Power requirements - AC Input

Measurement	Ratings for 2U48	Ratings for 4U56
Input power requirements	100-240 VAC, 50/60 Hz	208-240 VAC, 50/60 Hz
Maximum input power	640 W maximum continuous	958 W maximum continuous
Heat dissipation	2,245 BTUs/hour	3,271 BTUs/hour

- All AC mains and supply conductors to power distribution boxes for the rack-mounted system must be enclosed in a metal conduit or raceway when specified by local, national, or other applicable government codes and regulations.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- To ensure redundancy, provide two separate power sources for the enclosures. These power sources must be independent of each other, and each must be controlled by a separate circuit breaker at the power distribution point.
- The system requires voltages within minimum fluctuation. The customer-supplied facilities' voltage must maintain a voltage with not more than  $\pm 5$  percent fluctuation. The customer facilities must also provide suitable surge protection.
- Site wiring must include an earth ground connection to the AC power source. The supply conductors and power distribution boxes (or equivalent metal enclosure) must be grounded at both ends.
- Power circuits and associated circuit breakers must provide sufficient power and overload protection. To prevent possible damage to the AC power distribution boxes and other components in the rack, use an external, independent power source that is isolated from large switching loads (such as air conditioning motors, elevator motors, and factory loads).

## Site wiring and DC power requirements (4U56)

The following are required for all installations using DC power supplies:

**Table 43** Power requirements - DC Input

Measurement	Rating
Input power requirements	-40 to -72 VDC, -48/-60 V nominal
Maximum input power	1,027 W maximum continuous
Heat dissipation	3,507 BTUs/hour

The 6004 Series system is suitable for installation as part of the Common Bonding Network (CBN). The system's Battery Return (BR) Input Terminals are considered to be an Isolated DC Return (DC-I).

The following criteria are required for all installations:

- All DC mains and supply conductors to power distribution boxes for the rack-mounted system must comply with local, national, or other applicable government codes and regulations.
- Ensure that the voltage of your power source matches the voltage inscribed on the equipment's electrical label.
- To ensure redundancy, provide two separate power sources for the enclosures. These power sources must be independent of each other, and each must be controlled by a separate circuit breaker at the power distribution point.
- The system requires voltages within minimum fluctuation. The customer-supplied facilities' voltage must maintain a voltage within the range specified on the equipment's electrical rating label. The customer facilities must also provide suitable surge protection.
- Site wiring must include an earth ground connection to the DC power source. Grounding must comply with local, national, or other applicable government codes and regulations.
- Power circuits and associated circuit breakers must provide sufficient power and overload protection.

## Weight and placement guidelines

Refer to [Physical requirements](#) on page 120 for detailed size and weight specifications.

- Refer to the rackmount bracket kit installation sheet pertaining to your product for guidelines about installing enclosures into the rack.
- The weight of an enclosure depends on the number and type of modules installed.
- Use two people to lift an enclosure. You can reduce the weight by removing the power supply modules and disk modules.
- Do not place enclosures in a vertical position. Always install and operate the enclosures in a horizontal (level) orientation.
- When installing enclosures in a rack, make sure that any surfaces over which you might move the rack can support the weight. To prevent accidents when moving equipment, especially on sloped loading docks and up ramps to raised floors, ensure you have a sufficient number of helpers. Remove obstacles such as cables and other objects from the floor.
- To prevent the rack from tipping, and to minimize personnel injury in the event of a seismic occurrence, securely anchor the rack to a wall or other rigid structure that is attached to both the floor and to the ceiling of the room.

## Electrical guidelines

- These enclosures work with single-phase power systems having an earth ground connection. To reduce the risk of electric shock, do not plug an enclosure into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.
- 6004 Series enclosures support either a grounding-type (three wire) power cord for AC, or a (two-wire) power cable for DC (4U56 only). To reduce the risk of electric shock with AC systems, always plug the AC power cord into a grounded power outlet. To reduce the risk of shock with DC systems, connect the

cable connector and lugs as shown on [page 49](#), and ensure that the chassis ground wire is connected from the study on it mounting rail to the rack in which it is mounted.

- Do not use household extension cords with the enclosures. Not all power cords have the same current ratings. Household extension cords do not have overload protection and are not meant for use with computer systems.

## Ventilation requirements

Refer to [Environmental requirements](#) on page 122 or [Electrical requirements](#) on page 123 for detailed environmental requirements.

- Do not block or cover ventilation openings at the front and rear of an enclosure. Never place an enclosure near a radiator or heating vent. Failure to follow these guidelines can cause overheating and affect the reliability and warranty of your enclosure.
- Leave a minimum of 15.2 cm (6 inches) at the front and back of each enclosure to ensure adequate airflow for cooling. No cooling clearance is required on the sides, top, or bottom of enclosures.
- Leave enough space in front and in back of an enclosure to allow access to enclosure components for servicing. Removing a component requires a clearance of at least 38.1 cm (15 inches) in front of and behind the enclosure.

## Cabling requirements

- Keep power and interface cables clear of foot traffic. Route cables in locations that protect the cables from damage.
- Route interface cables away from motors and other sources of magnetic or radio frequency interference.
- Stay within the cable length limitations.
- 6004 Series controller and drive enclosures are suitable for connection to intra-building or non-exposed wiring or cabling only.
- 6004 Series controller and drive enclosures are suitable for installation in Network Telecommunication Facilities and locations where the NEC applies. 6004 Series enclosures are not suitable for Outside Plant (OSP) installations.

## Management host requirements

A local management host with at least one mini-USB connection is recommended for the initial installation and configuration of a controller enclosure. After you configure one or both of the controller modules with an IP address, you then use a remote management host on an Ethernet network to manage and monitor.

---

**NOTE:** Connections to this device must be made with shielded cables – grounded at both ends – with metallic RFI/EMI connector hoods, in order to maintain compliance with NEBS and FCC Rules and Regulations.

---

## Physical requirements

The floor space at the installation site must be strong enough to support the combined weight of the rack, controller enclosures, drive enclosures, and any additional equipment. The site also requires sufficient space for installation, operation, and servicing of the enclosures, together with sufficient ventilation to allow a free flow of air to all enclosures.

The chassis of a 6004 Series controller or drive enclosure is comprised of sheet steel that is bonded together using rivets, welding, and other forced contact methods. The metal surfaces are free from non-conductive coatings and paint.

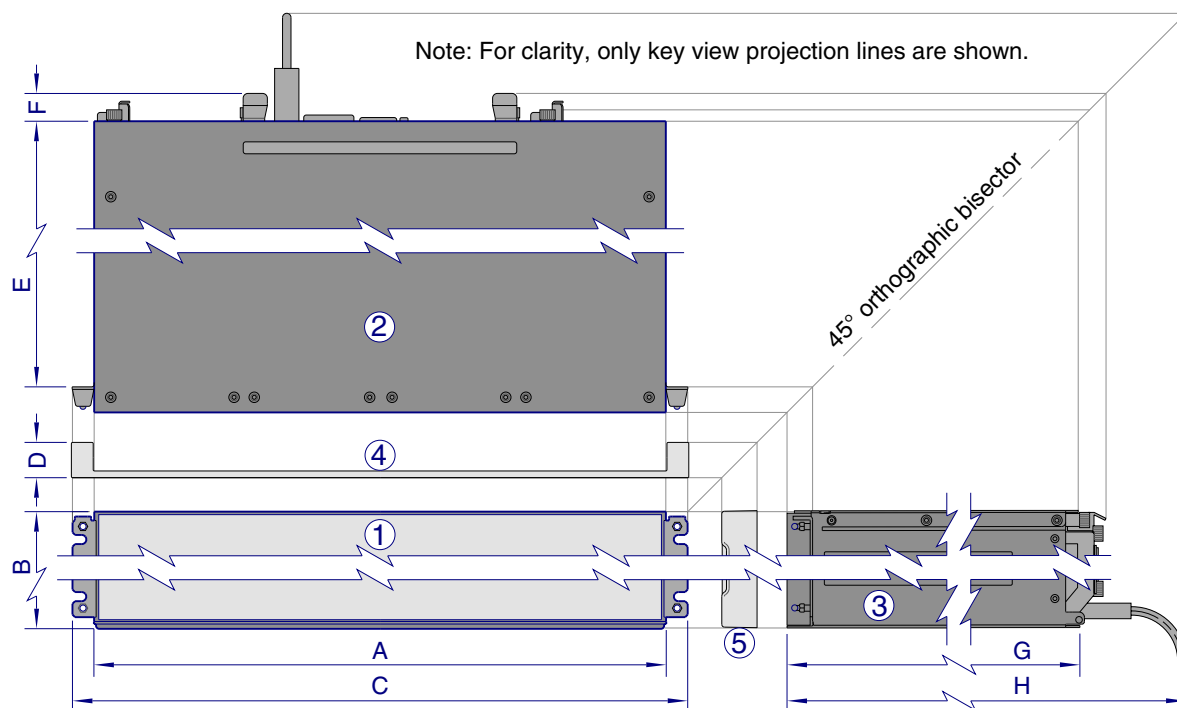
[Figure 95](#) and [Table 44](#) on page 122 show enclosure dimensions and weights. Enclosure designators are described below. Enclosure weights assume the following configuration characteristics:

- 2U48 enclosure (high-capacity with SFF disks—also see [Table 4](#) on page 37 and [Table 5](#) on page 38):
  - “2U48” denotes the 2.5" 48-drive enclosure (with controller or expansion modules)



- The 2U48 chassis includes three installed drawer slots that must be populated with disks and possibly AMS inserts if applicable, after the enclosure is installed into the rack. The table in this section assumes each drive slot contains a disk drive module.
- 4U56 enclosure (high-capacity with LFF disks—also see [Table 4](#) on page 37 and [Table 5](#) on page 38)
  - “4U56” denotes the 3.5" 56-drive enclosure (with controller or expansion modules)
  - The 4U56 chassis includes two installed drawer slots that must be populated with disks after the enclosure is installed into the rack. The table in this section assumes each drive slot contains a disk module. Unlike 2U enclosures, the 4U also includes two redundant fan control modules (FCMs) per chassis.
- Two controller modules or two expansion modules per enclosure
- Two power supply modules per enclosure

[Table 45](#) on page 122 allows you to compare the weights of drive enclosures supported by 6004 Series controller enclosures, and [Table 44](#) on page 122 allows you to compare weights of the different chassis configured as controller enclosures.



Key for generic enclosure diagram:

- ① – Front view without disks (section removed)
- ② – Enclosure top view (section removed)
- ③ – Enclosure side view (section removed)
- ④ – Enclosure bezel top view (reference only)
- ⑤ – Enclosure bezel side view (reference only)
- A–H: Critical-fit dimensions (see table)

	A		B		C		D		E		F		G		H	
Form	cm	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm	in
4U56 <sup>1</sup>	45.1	17.8	17.8	7.0	47.9	18.9	2.5	.98	78.2	30.8	3.0	1.2	83.3	32.8	90.9	35.8
2U48 <sup>2</sup>	44.7	17.6	8.9	3.5	47.9	18.9	2.5	.98	72.4	28.5	3.0	1.2	74.4	29.3	81.5	32.1

<sup>1</sup>The 4U56 enclosure uses 3.5" LFF disks. Remove the enclosure bezel and open the drawer to view disk drive module LEDs

<sup>2</sup>The 2U48 enclosure uses 2.5" SFF disks. Remove the enclosure bezel and open the drawer to view disk drive module LEDs.

**Figure 95** Rackmount enclosure dimensions

**Table 44** Rackmount controller enclosure weights

Specifications	Rackmount
High-capacity controller enclosure (2U48)	12.7 kg (28.0 lb) [chassis]
• Chassis with FRUs (no disks) <sup>1-3</sup>	23.1 kg (50.9 lb)
• Chassis with FRUs (including disks) <sup>1-4</sup>	34.0 kg (74.9 lb)
High-capacity controller enclosure (4U56)	14.9 kg (32.8 lb) [chassis]
• Chassis with FRUs (no disks) <sup>1-3</sup>	46.3 kg (102.1 lb)
• Chassis with FRUs (including disks) <sup>1-4</sup>	87.0 kg (191.7 lb)

<sup>1</sup>Weights shown are nominal, and subject to variances.

<sup>2</sup>Rail kits add between 2.8 kg (6.2 lb) and 3.4 kg (7.4 lb) to the aggregate enclosure weight.

<sup>3</sup>Weights may vary due to different power supplies, IOMs, and differing calibrations between scales.

<sup>4</sup>Weights may vary due to actual number and type of disk drives (SAS or SSD and air management modules installed).

**NOTE:** The table below provides comparative information about optional drive enclosures supported by 6004 Series controller enclosures.

**Table 45** Rackmount compatible drive enclosure weights (ordered separately)

Specifications	Rackmount
J6X48 (high-capacity 48-drive enclosure SFF 2.5" disks)	12.7 kg (28.0 lb) [chassis]
• Chassis with FRUs (no disks) <sup>1-3</sup>	20.3 kg (44.8 lb)
• Chassis with FRUs (including disks) <sup>1-4</sup>	31.2 kg (68.8 lb)
J6X56 (high-capacity 56-drive enclosure LFF 3.5" disks)	14.9 kg (32.8 lb) [chassis]
• Chassis with FRUs (no disks) <sup>1-3</sup>	45.0 kg (99.1 lb)
• Chassis with FRUs (including disks) <sup>1-4</sup>	85.6 kg (188.7 lb)

<sup>1</sup>Weights shown are nominal, and subject to variances.

<sup>2</sup>Rail kits add between 2.8 kg (6.2 lb) and 3.4 kg (7.4 lb) to the aggregate enclosure weight.

<sup>3</sup>Weights may vary due to different power supplies and differing calibrations between scales.

<sup>4</sup>Weights may vary due to actual number and type of disk drives (SAS or SSD) and air management modules installed).

## Environmental requirements

**Table 46** Operating environmental specifications

Specification	Range
Altitude	To 3,000 meters (9,843 feet) [2U48] To 1,829 meters (6,000 feet) [4U56]
Temperature <sup>1</sup>	5°C to 40°C (41°F to 104°F)
Humidity	10% to 90% RH up to 40°C (104°F) non-condensing
Shock	3.0 g, 11 ms, ½ sine pulses, X, Y, Z
Vibration	(Shaped-spectrum) 5 Hz to 500 Hz, 0.14 G <sub>rms</sub> total X, Y, Z

<sup>1</sup>Temperature is de-rated by 2°C (3.6°F) for every 1 km above sea level up to 3,000 meters.

**Table 47** Non-operating environmental specifications

Specification	Range
Altitude	To 12,000 meters (39,370 feet)
Temperature	-40°C to 70°C (-40°F to 158°F)
Humidity	Up to 93% RH @ 40°C (104°F) non-condensing
Shock	15.0 g, 11 ms, ½ sine pulses, X, Y, Z [2U48] 1" drop to hard unyielding surface per NEBS GR-63-CORE Unpackaged Equipment Shock Criteria (§4.3.2) [4U56]
Vibration	(Shaped-spectrum) 2.8 Hz to 365.4 Hz, 0.852 G <sub>rms</sub> total (horizontal) 2.8 Hz to 365.4 Hz, 1.222 G <sub>rms</sub> total (vertical)

## Electrical requirements

### Site wiring and power requirements

Each enclosure has two power supply modules for redundancy. If full redundancy is required, use a separate power source for each module.

The AC power supply unit in each power supply module is auto-ranging and is automatically configured to an input voltage range—described per chassis in [Figure 42](#) on page 118—with an input frequency of 50/60 Hz. The power supply modules meet standard voltage requirements for both U.S. and international operation. The power supply modules use standard industrial wiring with line-to-neutral or line-to-line power connections.

The high-density 4U56 enclosure supports DC power supplies as an alternative to using AC power supplies. See [Figure 43](#) on page 119 for specific information pertaining to DC power supplies.

### Power cable requirements

Each power cable connects one of the power supply modules to an independent, external power source. To ensure power redundancy, connect the two power cables to two separate circuits; for example, to one commercial circuit and one uninterruptible power source (UPS).

---

## C Electrostatic discharge

### Preventing electrostatic discharge

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-protected workstations.
- Place parts in a static-protected area before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

### Grounding methods to prevent electrostatic discharge

Several methods are used for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm ( $\pm 10$  percent) resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an authorized reseller install the part. For more information about static electricity or assistance with product installation, contact an authorized reseller.

## D USB device connection

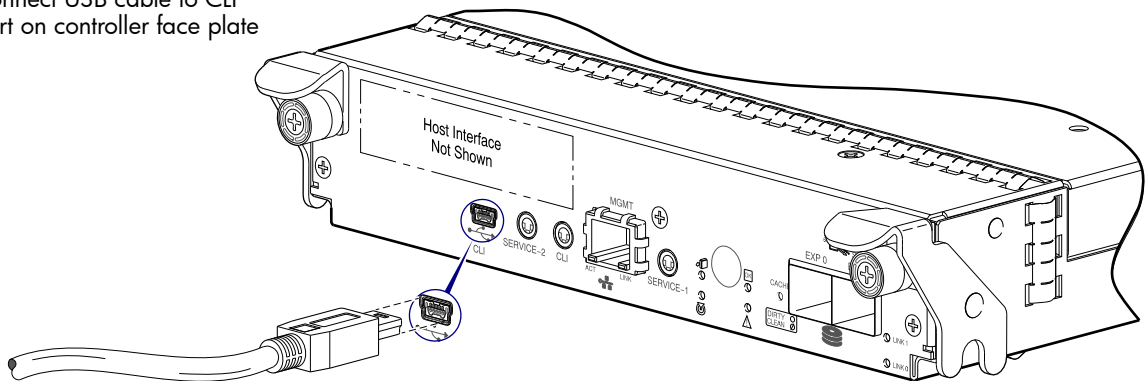
### Rear panel USB ports

AssuredSAN 6004 Series controllers contain two different USB (universal serial bus) management interfaces: a *Host* interface and a *Device* interface. Both interfaces pertain to the Management Controller (MC). The Device interface is accessed via a port on the controller module face plate. The Host interface (USB Type A)—reserved for future use—is accessible from the midplane-facing end of the controller module (see [Figure 17](#) on page 25), and its discussion is deferred.

This appendix describes the port labeled CLI (USB Type B), which enables direct connection between a management computer and the controller, using the command-line interface and appropriate cable (see [Figure 96](#)).

### USB CLI port

Connect USB cable to CLI  
port on controller face plate



**Figure 96** USB device connection — CLI port

---

**NOTE:** In [Figure 96](#), the sticker suggesting that you “install the USB driver before using the port” has been removed to show the port.

---


AssuredSAN 6004 Series controllers feature a USB CLI port used to cable directly to the controller and initially set IP addresses, or perform other configuration tasks. The USB CLI port employs a mini-USB Type B form factor, and requires a specific cable and additional support, so that a server or other computer running a Linux or Windows operating system can recognize the controller enclosure as a connected device. Without this support, the computer might not recognize that a new device is connected, or might not be able to communicate with it.

For Linux computers, no new driver files are needed, but a Linux configuration file must be created or modified (see [Linux](#) on page 127). For Windows computers a special device driver file, `gserial.inf`, must be downloaded from a web site, and installed on the computer that will be cabled directly to the controller’s CLI port (see [Microsoft Windows](#) on page 126).

### Emulated serial port

Once attached to the controller module, the management computer should detect a new USB device. Using the Emulated Serial Port interface, the 6004 Series controller presents a single serial port using a *customer vendor ID* and *product ID*. Effective presentation of the emulated serial port assumes the management computer previously had terminal emulator installed (see [Supported host applications](#)). Serial port configuration is unnecessary.

---

 **IMPORTANT:** Certain operating systems require a device driver or special mode of operation to enable proper functioning of the USB CLI port (see [Device driver/special operation mode](#)).

---

## Supported host applications

6004 Series controllers support the following applications to facilitate connection.

**Table 48** Supported terminal emulator applications

Application	Operating system
HyperTerminal and TeraTerm	Microsoft Windows (all versions)
Minicom	Linux (all versions)
	Solaris
	HP-UX

## Command-line Interface

Once the management computer detects connection to the USB-capable device, the Management Controller awaits input of characters from the host computer via the command-line. To see the command-line prompt, you must press **Enter**. The MC provides direct access to the CLI.

---

**NOTE:** Directly cabling to the CLI port is an out-of-band connection, because it communicates outside of the data paths used to transfer information from a computer or network to the controller enclosure.

---

## Device driver/special operation mode

Certain operating systems require a device driver or special mode of operation. Product and vendor identification information required for such setup is provided below.

**Table 49** USB vendor and product identification codes

USB Identification code type	Code
USB Vendor ID	0x210c
USB Product ID	0xa4a7

## Microsoft Windows

Microsoft Windows operating systems provide a USB serial port driver. However, the USB driver requires details for connecting to AssuredSAN 6004 Series controller enclosures. Dot Hill provides a device driver for use in the Windows environment. The USB device driver and installation instructions are available via a download.

### Obtaining the software download

1. Verify that the management computer has Internet access.
2. See Dot Hill's customer resource center (CRC) web site <https://crc.dothill.com>.
  - a. Select the color-filled **Download Firmware/Software** button on the home page.  
Peruse the list of downloads for an entry pertaining to "USB driver."
  - b. Select the color-filled **Download** button on the shaded "USB driver" box.  
The File Download dialog displays.
  - c. From the File Download dialog, save the zip file locally to the management computer.
  - d. Follow the instructions accompanying the device driver—within the zip file—to install the USB device driver.

## Linux

Although Linux operating systems do not require installation of a device driver, certain parameters must be provided during driver loading to enable recognition of the AssuredSAN 6004 Series controller enclosures.

### Setting parameters for the device driver

1. Enter the following command:  

```
modprobe usbserial vendor=0x210c product=0xa4a7 use_acm=1
```
2. Press Enter to execute the command.  
The Linux device driver is loaded with the parameters required to recognize the controllers.

---

**NOTE:** Optionally, this information can be incorporated into the `/etc/modules.conf` file.

---

## Using the CLI port and cable—known issues on Windows

When using the CLI port and cable for setting network port IP addresses, be aware of the following known issues on Microsoft Windows platforms.

### Problem

On Windows operating systems, the USB CLI port may encounter issues preventing the terminal emulator from reconnecting to storage after the Management Controller (MC) restarts or the USB cable is unplugged and reconnected.

### Workaround

Follow these steps when using the mini-USB cable and USB Type B CLI port to communicate out-of-band between the host and controller module for setting network port IP addresses.

To create a new connection or open an existing connection (HyperTerminal):

1. From the Windows Control Panel, select Device Manager.
2. Connect using the USB COM port and Detect Carrier Loss option.
  - a. Select **Connect To > Connect using:** > pick a COM port from the list.
  - b. Select the **Detect Carrier Loss** check box.The Device Manager page should show “Ports (COM & LPT)” with an entry entitled “Disk Array USB Port (COM $n$ )”—where  $n$  is your system’s COM port number.
3. Set network port IP addresses using the CLI (see procedure on [page 68](#)).

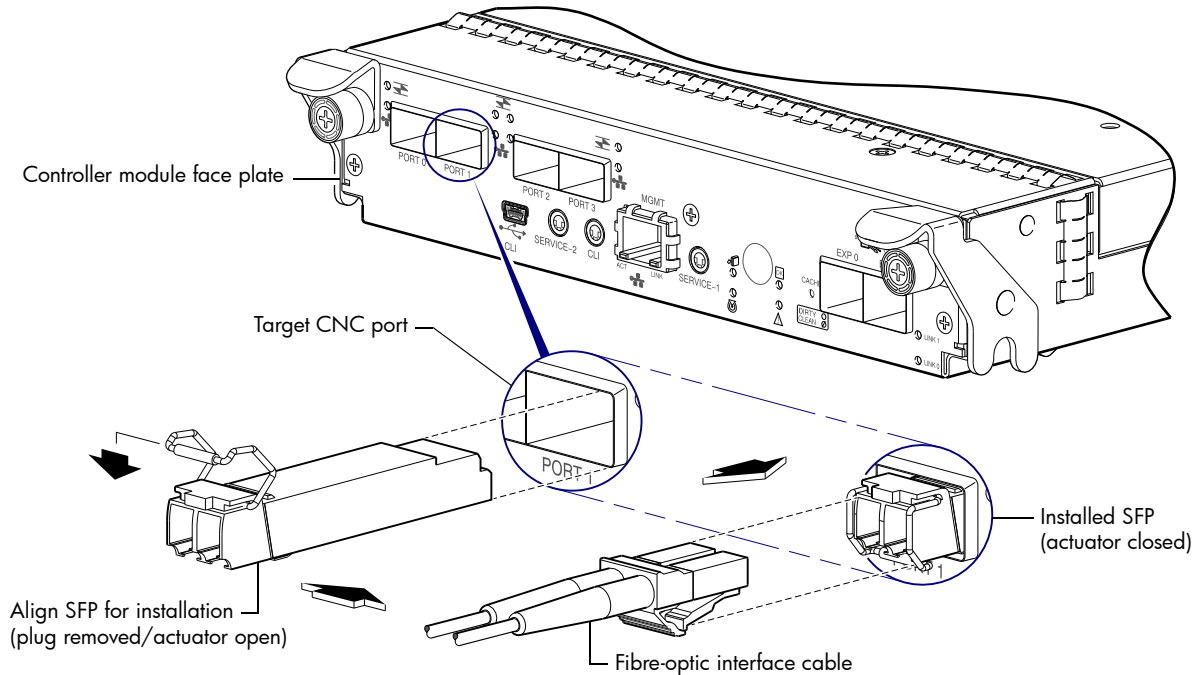
To restore a hung connection when the MC is restarted (any supported terminal emulator):

1. If the connection hangs, disconnect and quit the terminal emulator program.
  - a. Using Device Manager, locate the COM $n$  port assigned to the Disk Array Port.
  - b. Right-click on the hung **Disk Array USB Port (COM $n$ )**, and select **Disable**.
  - c. Wait for the port to disable.
2. Right-click on the previously hung—now disabled—**Disk Array USB Port (COM $n$ )**, and select **Enable**.
3. Start the terminal emulator and connect to the COM port.
4. Set network port IP addresses using the CLI (see procedure on [page 68](#)).

## E SFP option for CNC ports

### Locate the SFP transceivers

Locate the qualified SFP option for your CNC controller module within your product ship kit. The SFP transceiver (SFP) should look similar to the generic SFP shown in the figure below. Follow the guidelines provided in [Electrostatic discharge](#) when installing an SFP.



**Figure 97** Install a qualified SFP option

### Install an SFP transceiver

For each target CNC port, perform the following procedure to install an SFP. Refer to the figure above when performing the steps.

1. Orient the SFP as shown above, and align it for insertion into the target CNC port.  
The SFP should be positioned such that the actuator pivot-hinge is on top.
2. If the SFP has a plug, remove it before installing the transceiver. Retain the plug.
3. Flip the actuator open as shown in the figure (near the left detail view).  
The actuator on your SFP option may look slightly different than the one shown, and it may not open to a sweep greater than 90° (as shown in the figure).
4. Slide the SFP into the target CNC port until it locks into place.
5. Flip the actuator down, as indicated by the down-arrow next to the open actuator in the figure.  
The installed SFP should look similar to the position shown in the right detail view.
6. When ready to attach to the host, obtain and connect a qualified fibre-optic interface cable into the duplex jack at the end of the SFP connector.

---

**NOTE:** To remove an SFP module, perform the above steps in *reverse order*.

---

### Verify component operation

View the CNC port Link Status/Link Activity LED on the controller module face plate. A green LED indicates that the port is connected and the link is up (see [LED descriptions](#) for information about controller module LEDs).



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