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Exos[®] AP 2U12-B, 2U24-B, 5U84-B Hardware Installation and Maintenance Guide

Abstract

This guide describes initial hardware setup for Exos AP 2U12-B, 2U24-B, and 5U84-B storage enclosures. It also describes removal and installation of customer-replaceable components. The guide is intended for use by storage system administrators familiar with servers and computer networks, network administration, storage system administration and configurations, storage area network management, and relevant protocols.

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Contents

1 Introduction	10
Knowledge prerequisites	10
Product documentation and support	10
Intended audience	10
2 System overview	11
Storage enclosure components	11
Storage enclosure chassis	12
2U enclosure components	12
5U enclosure components	14
AP controller module components	17
Optional components	18
Optional slots and cards	18
3 Initial install preparations	20
Installation checklist	20
Complete installation prerequisites	21
4 Installation of 2U enclosures	23
Unpack and prepare the 2U enclosure	23
Install the 2U rackmount rail kit	24
Mount the 2U enclosure into the rack cabinet	27
Populate the 2U enclosure	30
Test enclosure connections	30
Route 2U enclosure power cords and data cables	30
Route 2U enclosure and expansion data cables	31
Route 2U enclosure power cords	33
5 Installation of 5U enclosures	35
Unpack and prepare the 5U enclosure	35
Install the 5U rackmount rail kit	36
Mount the 5U enclosure into the rack cabinet	39
Access a drawer	42
Populate the 5U enclosure	42
Test enclosure connections	44
Route 5U enclosure power cords and data cables	44
Route 5U enclosure and expansion data cables	44
Route 5U enclosure power cords	47
6 Operation of 2U enclosures	48
Apply power to the 2U enclosure	48

Remove power from the 2U enclosure	49
Set the unit identification number	49
Interpret system LEDs	50
Interpret 2U12 and 2U24 operator's panel LEDs	50
Interpret controller module LEDs	52
Interpret SAS 12Gb expansion module LEDs	54
7 Operation of 5U enclosures	55
Apply power to the 5U enclosure	55
Remove power from the 5U enclosure	56
Set the unit identification number	57
Interpret system LEDs	57
Interpret 5U enclosure operator's panel LEDs	58
Interpret drawer LED panels	59
Interpret controller module LEDs	60
Interpret SAS 12Gb expansion module LEDs	62
8 System installation and configuration	63
System console access options	63
Synchronize service passwords	64
Obtain and set BMC IP addresses	65
Use the BMC web-based management interface (BMC WMI)	66
Use console redirection	67
Use a Serial over LAN session	67
Command-line interface usage	68
Configure the management host for serial communication	69
Select installation media boot method	71
BIOS	72
Invoke the BIOS setup utility	72
Specify the boot device order	74
Install an operating system	74
SAS zone modes	76
Set SAS zone mode 1	78
Set SAS zone mode 2	81
Set SAS zone mode 3	83
9 Hardware installation and basic configuration issues	87
Address initial start-up issues	87
Interpret storage and expansion enclosure fault LEDs	88
2U12 and 2U24 enclosure fault LEDs	88
5U84 enclosure fault LEDs	92
Identify 2U enclosure fault conditions	97
Identify 5U enclosure fault conditions	98

Isolate hardware and connectivity faults	99
Isolate system application faults	100
Take corrective action for 2U enclosures	100
Take corrective action for 5U enclosures	102
10 In-service field maintenance for 2U enclosures	106
Replace a 2U enclosure drive module in its carrier	107
Replace a 2U enclosure controller module	109
Replace a 2U power cooling module	111
11 In-service field maintenance for 5U enclosures	114
Replace a 5U enclosure drive module in its carrier	115
Replace a 5U enclosure controller module	119
Replace a 5U fan cooling module	121
Replace a 5U power supply unit	123
A Technical specifications	126
B Standards and regulations	128
International standards	128
WEEE recycling	128
C BIOS POST codes	129
Index	131

Figures

Figure 1	2U12 and 2U24 front panel area	13
Figure 2	2U12 and 2U24 rear panel area	14
Figure 3	5U84 front panel area	15
Figure 4	5U84 rear panel area	16
Figure 5	Profile and top views of fully populated 5U84 drawers	17
Figure 6	Controller module ports, shown with OCP and PCIe optional cards	18
Figure 7	2U12 and 2U24 storage enclosure packaging	23
Figure 8	2U enclosure outer rail components	25
Figure 9	Attachment of front mount bracket to front rack cabinet posts	26
Figure 10	Adjustment of rail length to fit rack cabinet	26
Figure 11	Attachment of rear mount bracket to rear rack cabinet posts	27
Figure 12	Alignment between 2U chassis and rails (removed rear components for clarity)	28
Figure 13	Installation of 2U rear screw to secure chassis to rail	29
Figure 14	Installation of 2U operator's panel screw and cover	29
Figure 15	Sample reverse cabling method among 2U controller modules (CMs) and expansion modules	32
Figure 16	Sample invalid loop (in red) among 2U controller modules (CMs) and expansion modules	33
Figure 17	2U power cord routing to independent power distribution units	34
Figure 18	2U power cord surrounded by secure tie	34
Figure 19	Default belt straps already around the 5U storage enclosure	35
Figure 20	5U left and right rail components	37
Figure 21	Insertion of 5U front mount bracket screw	38
Figure 22	Insertion of 5U rear mount bracket screws	38
Figure 23	Alignment between 5U chassis and rails, minus rear components for clarity	40
Figure 24	Secure chassis operator's panel to rack posts	41
Figure 25	5U rear chassis connection to outer rails, detail, minus rear components for clarity	41
Figure 26	Carrier latch features	42
Figure 27	Release latch open and unlocked	43
Figure 28	Release latch properly locked	43
Figure 29	Safety lock to release left drawer slide rail (lower drawer used for relational clarity)	43
Figure 30	Sample reverse cabling method among 5U controller modules (CMs) and expansion modules	46
Figure 31	Sample invalid loop (in red) among 5U controller modules (CMs) and expansion modules	46
Figure 32	5U power cord routing to independent power distribution units	47
Figure 33	Route power cords to redundant PDUs	49
Figure 34	2U12 and 2U24 operator's panel LEDs with logical fault option	51
Figure 35	2U12 and 2U24 operator's panel LEDs with UID option	52
Figure 36	Controller module LEDs, shown with OCP and PCIe optional cards	53
Figure 37	SAS 12Gb expansion module LEDs	54
Figure 38	Route 5U power cords to redundant PDUs	56

Figure 39	5U84 operator's panel LEDs	59
Figure 40	5U84 drawer LED panel	60
Figure 41	Controller module LEDs, shown with OCP and PCIe optional cards	61
Figure 42	SAS 12Gb expansion module LEDs	62
Figure 43	Default BMC WMI dashboard	67
Figure 44	AP controller module ports and buttons, assuming non-inverted orientation	69
Figure 45	Main menu for ASU version of BIOS setup utility	73
Figure 46	Main menu for ARU version of BIOS setup utility	74
Figure 47	Sample AMI boot device selection screen	75
Figure 48	Sample AMI boot device selection screen of USB flash drive	76
Figure 49	Sample phydump with comments for 2U12 storage enclosure	78
Figure 50	Sample storage enclosure cabling for SAS zone mode 1, using local storage enclosure resources	80
Figure 51	Sample zone mode 1 data for 2U12 storage enclosure	81
Figure 52	Sample storage and expansion enclosure cabling for SAS zone mode 2	82
Figure 53	Sample zone mode 2 data for 2U12 storage enclosure	83
Figure 54	Sample storage enclosure cabling for SAS zone mode 3	85
Figure 55	Sample zone mode 3 data for 2U12 storage enclosure	86
Figure 56	2U12 and 2U24 operator's panel fault LEDs with logical fault option	88
Figure 57	2U12 and 2U24 operator's panel fault LEDs with UID option	89
Figure 58	2U12 and 2U24 fault LEDs on carrier bezel	89
Figure 59	Controller module fault LEDs, shown with OCP and PCIe optional cards	90
Figure 60	SAS 12Gb expansion module fault LEDs	91
Figure 61	Power cooling module fault LEDs	92
Figure 62	5U84 operator's panel fault LEDs	93
Figure 63	5U84 drawer fault LEDs on drawer LED panel	94
Figure 64	Drive fault LED on carrier bezel	94
Figure 65	Controller module fault LEDs, shown with OCP and PCIe optional cards	95
Figure 66	SAS 12GB expansion module fault LEDs	96
Figure 67	Fan cooling module fault LEDs	96
Figure 68	Power supply unit fault LEDs	97
Figure 69	2U12 and 2U24 fault LEDs on carrier bezel	107
Figure 70	Removal of 2U12 and 2U24 drive in carrier	108
Figure 71	Open 2U12 and 2U24 carrier handle	109
Figure 72	Controller module LEDs to examine for fault conditions	110
Figure 73	Controller module removal, upper	110
Figure 74	Controller module	111
Figure 75	Power cooling module fault LEDs	112
Figure 76	Power cooling module removal	113
Figure 77	Power cooling module	113
Figure 78	Drive fault LED on carrier bezel	115

Figure 79	Operator's panel	116
Figure 80	Drawer panel	116
Figure 81	Drawer release and access	116
Figure 82	Carrier latch features	117
Figure 83	Removal of drive in its carrier	117
Figure 84	Replacement of drive in its carrier	118
Figure 85	Release latch open and unlocked	118
Figure 86	Release latch properly locked	118
Figure 87	Safety lock to release left drawer slide rail of lower drawer	119
Figure 88	Controller module LEDs to examine for fault conditions	120
Figure 89	Controller module removal, left	120
Figure 90	Replacement controller module	121
Figure 91	Fan cooling module fault LEDs	122
Figure 92	Fan cooling module removal	123
Figure 93	Fan cooling module	123
Figure 94	Power supply unit fault LEDs	124
Figure 95	Power supply unit removal	125
Figure 96	Power supply unit	125
Figure 97	Sample 0x9A hex code for AP controller module	129

Tables

Table 1	Storage enclosure variations	11
Table 2	Installation checklist tasks	20
Table 3	Fault LED prioritization	50
Table 4	Fault LED prioritization	57
Table 5	Methods of access to controller module	63
Table 6	Interface options	64
Table 7	Power-on factory default password credentials	64
Table 8	NCSI MAC address using an OCP card	65
Table 9	Methods to obtain and set BMC IP addresses	65
Table 10	BMC WMI menu options	67
Table 11	Supported terminal emulator applications	70
Table 12	Sample Linux Minicom serial port parameter settings	70
Table 13	Terminal emulator port connection settings	71
Table 14	Installation media options	72
Table 15	Zone mode types	77
Table 16	Zone mode 1 host port settings matrix	79
Table 17	Zone mode 2 host port settings matrix	81
Table 18	Zone mode 3 host port settings matrix	83
Table 19	2U enclosure non-fault conditions	98
Table 20	5U enclosure non-fault conditions	99
Table 21	2U enclosure corrective action for fault conditions	101
Table 22	5U enclosure corrective action for fault conditions	102
Table 23	2U enclosure time limits for FRU replacement	106
Table 24	5U enclosure time limits for FRU replacement	114
Table 25	Storage enclosure dimensions	126
Table 26	Storage enclosure FRU weights	126
Table 27	Environmental specifications	126
Table 28	Power specifications	127
Table 29	Standard and approvals	128
Table 30	Warm and cold boot BIOS POST codes	129

1 Introduction

Seagate Exos storage enclosures combine strong performance with high reliability, flexibility, and manageability. Powerful and compact, the AP-BV-1 series expandable storage solution supports business with high-capacity and high-availability options.

The system is designed for high availability (HA), with no single point of failure for data or power. Controller modules (CMs) are Storage Bridge Bay (SBB) v2.1 compatible for interconnects, power budgets and rails, form factors, and footprints.

All Seagate storage enclosures contain one or more CMs, which each contain a complete server with CPU, memory, storage controller, and optional HBA cards for input and output. Customize the on-board server by installing a 64-bit operating system (OS), based on the latest generation of AMD processor architectures. Then, load and leverage storage applications to support functions such as data encryption, data duplication, data transformation, and data manipulation.

⚠ WARNING! Heed all warnings and cautions on labeling and throughout this guide to reduce risk of personal injury or damage to equipment. You must adhere to all safety requirements in this document. Some relate to the entire system, some to the rack, some to the storage enclosure, and others to the FRUs within it.


Knowledge prerequisites

Make sure you have the appropriate knowledge base prior to product installation or service.

- Server system administration
- Storage system configuration
- Storage area network (SAN) management
- Serial Attached SCSI (SAS) protocol
- Internet SCSI (iSCSI) protocol
- Ethernet protocol
- Redfish Management protocol

Product documentation and support

To obtain the following documents, videos, and other product information, visit www.seagate.com/support.

Content description	Document	Seagate QR codes
Enhancements, known issues, and updates	Release Notes	 Documentation, Support
Overview of product shipkit contents and setup support	Getting Started*	
Installation of the rail kit and enclosure into a rack	Rackmount Guide*	
Initial installation of hardware and component replacement	Hardware Installation and Maintenance Guide	
Regulatory compliance, safety, and disposal information	Compliance, Safety, and Disposal Guide	
*Printed document included in the shipkit		

Intended audience

This guide is for software integration providers, storage installation professionals, and system administration personnel.

2 System overview

The Seagate Exos AP storage enclosure consists of a sheet metal chassis that contains an integrated midplane and module runner system. You can mount the storage enclosure into a standard 19-inch rack cabinet, occupying either two (2U) or five (5U) EIA rack space units. All plug-in modules are hot-swappable, but you must adhere to all safety precautions and time limitations.

Table 1 Storage enclosure variations

Type	Typical set of plug-in modules	Maximum expansions
2U12 storage enclosure	2U chassis and rackmount railkit	Up to 9
	12 3.5-inch large form factor (LFF) drive modules in carriers (DDICs)	
	Two controller modules (CMs)	
	Two power cooling modules (PCMs)	
2U24 storage enclosure	2U chassis and rackmount railkit	Up to 9
	24 2.5-inch small form factor (SFF) DDICs	
	Two controller modules (CMs)	
	Two power cooling modules (PCMs)	
5U84 storage enclosure	5U chassis and rackmount railkit: Contains two drawers, each with 42 drive modules	Up to 3
	84 3.5-inch or 2.5-inch drive modules with adapters in carriers	
	Two controller modules (CMs)	
	Five fan cooling modules (FCMs)	
	Two power supply units (PSUs)	
	Four sideplane printed circuit boards (PCBs), two per drawer <i>Authorized service personnel only</i>	

You can use the 2U or 5U chassis as a controller storage enclosure when configured with AP controller modules, or as an expansion enclosure when configured with expansion modules.

CAUTION Make sure you are not connected to power at any time during installation procedures.

CAUTION Only operate the storage enclosure in a dust-free environment to meet temperature control and airflow requirements.

For optimum function, use the high availability (HA) model that requires dual paths for data and power to increase fault tolerance and minimize single points of failure. This manual assumes HA model system integration using a minimum of one fully populated storage enclosure.

Storage enclosure components

All Seagate Exos storage enclosures have 2 main access points:

1. **Front panel area** — Contains the operator's (ops) panel and access to drive modules in their carriers (DDICs)
 - a. **2U enclosures** — Direct access to DDICs
 - b. **5U enclosures** — Access to DDICs by opening the related drawer
2. **Rear panel area** — Contains controllers and methods for cooling and powering the storage enclosure

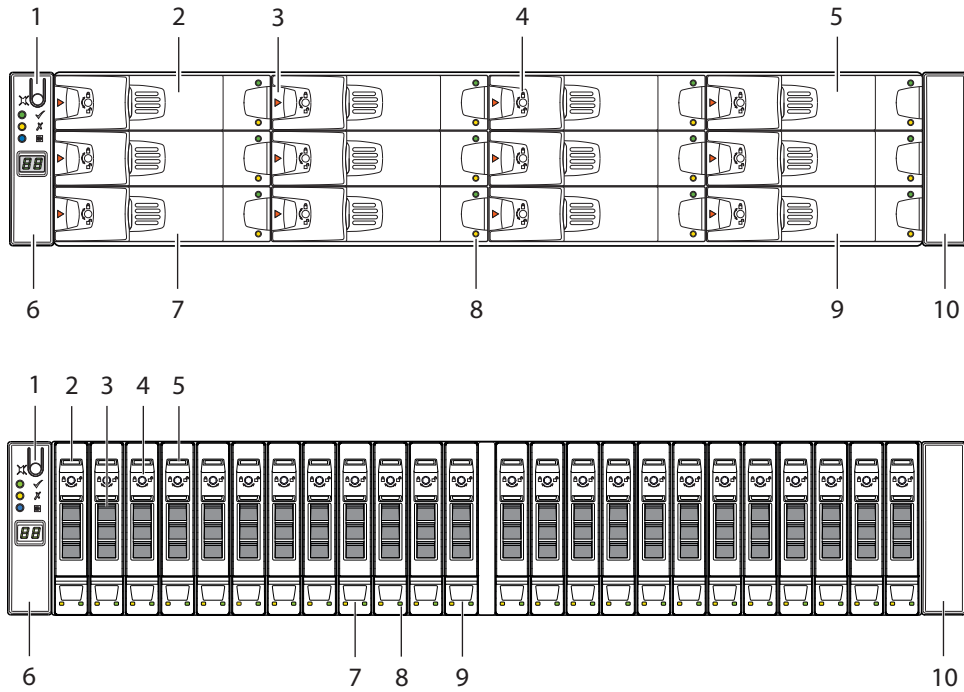
Storage enclosure chassis

Chassis sheet metal is bonded and riveted together and free from non-conductive coatings. Each chassis is designed specifically for mounting in a rack cabinet.

2U enclosure components

The front panel area hosts an operator's panel and the drive modules.

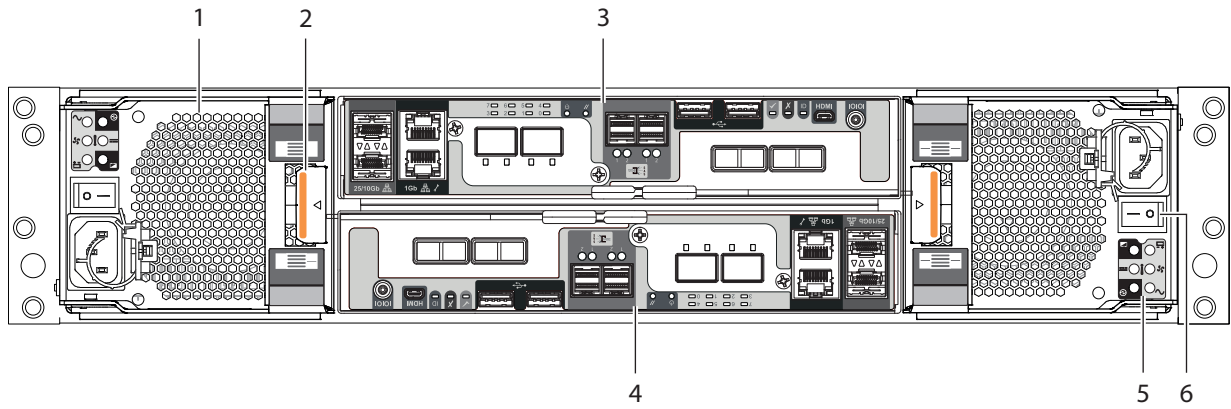
- **2U12**— Contains 3.5-inch large form factor (LFF) drives installed in keyed carriers, inserted into horizontal slots, and logically numbered in rows from 0 to 11 from left to right, from top to bottom
- **2U24**— Contains 2.5-inch small form factor (SFF) drives installed in keyed carriers, inserted into vertical slots, and logically numbered from 0 to 23 from left to right



Item	Description	Function
1	Input button	Selects and sets UID when combined with system Locate command
2	Drive 0	Responds to commands for drive logically numbered "0"
3	Release latch, drive module	Allows drive module insertion onto and removal from the midplane and slot
4	Anti-tamper lock, drive module	Prevents drive module removal when locked
5	Drive 3	Responds to commands for drive logically numbered "3"
6	Operator's (ops) panel on left rack ear flange	Connects to midplane, provides users with storage enclosure information and status
7	Drive 8	Responds to commands for drive logically numbered "8"
8	Status LEDs, drive module	Provides users with drive module status
9	Drive 11	Responds to commands for drive logically numbered "11"
10	Right rack ear cover	Acts as cosmetic cover over rack flange

Figure 1 2U12 and 2U24 front panel area

The rear panel area hosts modules designed for power, thermal cooling, and host connectivity.



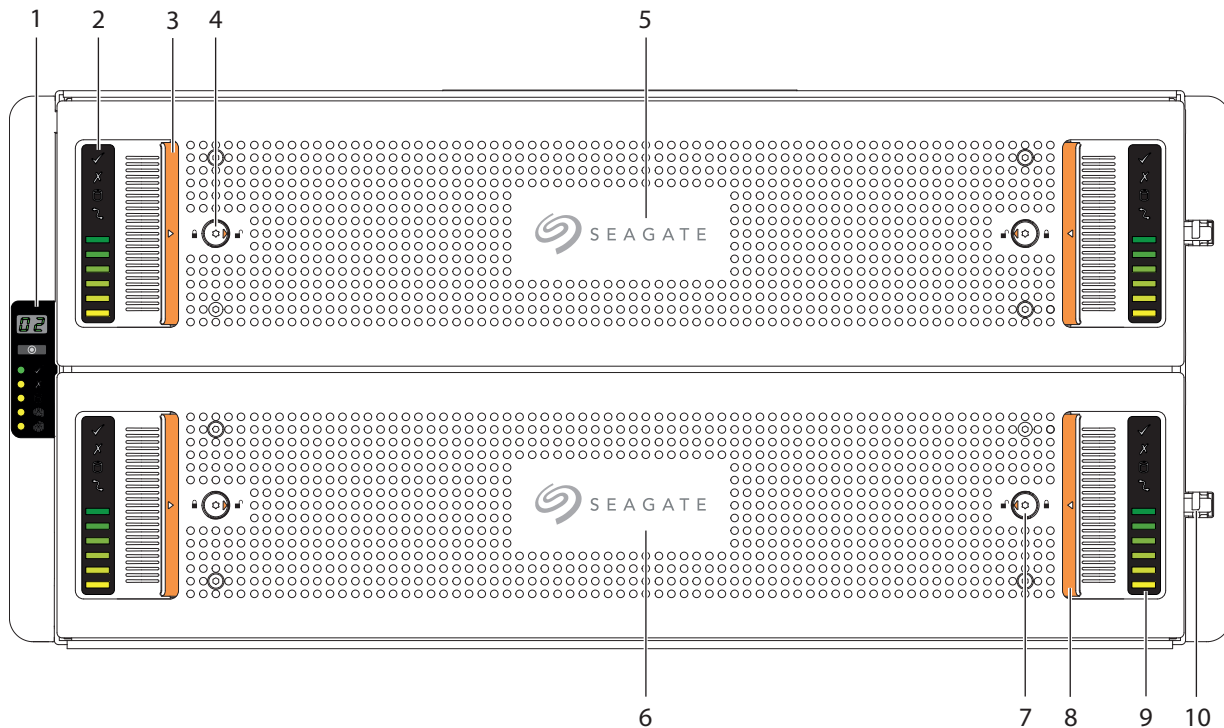
Item	Description	Function
1	Power cooling module (PCM)	Provides redundant regulation of power, temperature, and airflow
2	PCM release latch	Latches or unlatches PCM from midplane
3	Controller module (CM)	Provides data redundancy, acts as the nerve center of the storage enclosure
4	Inverted CM	
5	Inverted PCM status LEDs	Provides users with PCM status
6	Inverted PCM power switch	Switches power on or off

Figure 2 2U12 and 2U24 rear panel area

5U enclosure components

The 5U84 chassis retains two sliding drawers, so has drawer panels that augment the operator's (ops) panel on the left rack ear flange. Each drawer has its own set of dedicated connectors behind the midplane that allow continuous operation, even if the drawer is extended to the fully open service position or closed with the drawer latch engaged.

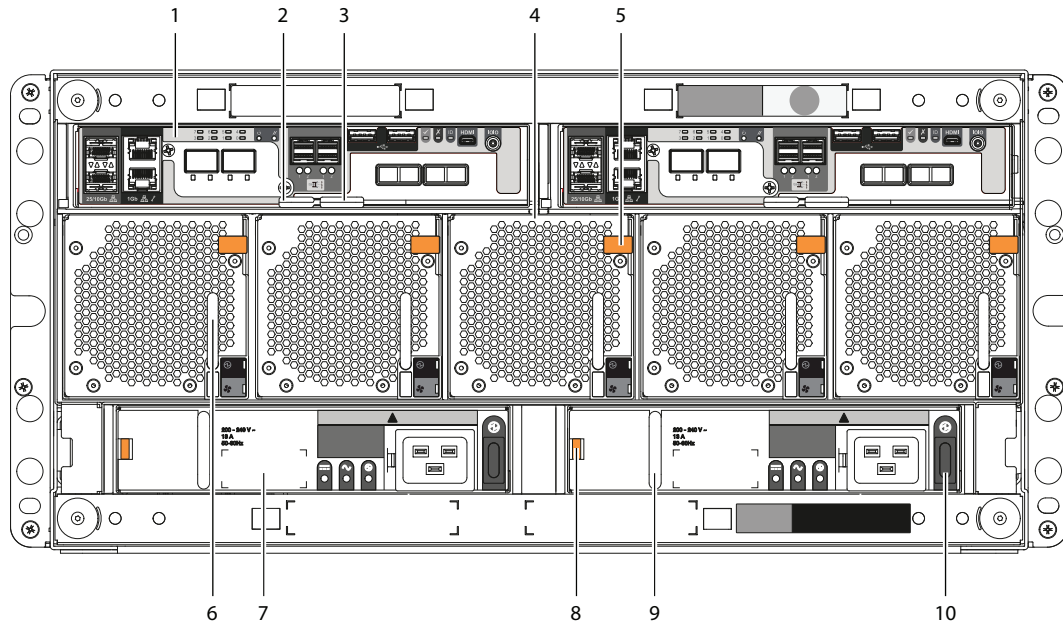
The front panel area is the primary physical user interface. Closely watch the ops and drawer panels for status.



Item	Description	Function
1	Operator's (ops) panel	Connects to midplane, provides users with storage enclosure information and status
2	Drawer left sideplane indicators	Registers activity for the related drive in its carrier (DDIC) and controller for the drawer's left sideplane
3	Left pull handle in recessed pocket	Provides user access to DDICs contained in drawer
4	Drawer left side anti-tamper lock	Prevents drawer access when locked
5	Top drawer: Drawer 1	Contains DDIC slots logically numbered from 0 to 41
6	Bottom drawer: Drawer 2	Contains DDIC slots logically numbered from 42 to 83
7	Drawer right side anti-tamper lock	Prevents drawer access when locked
8	Right pull handle in recessed pocket	Provides user access to DDICs within the drawer
9	Drawer right sideplane indicators	Registers activity for the related DDIC and controller for the drawer's right sideplane
10	Drawer latch	Latches the drawer closed when properly engaged

Figure 3 5U84 front panel area

The rear panel area provides you access to modules designed for power, thermal cooling, and host connectivity.

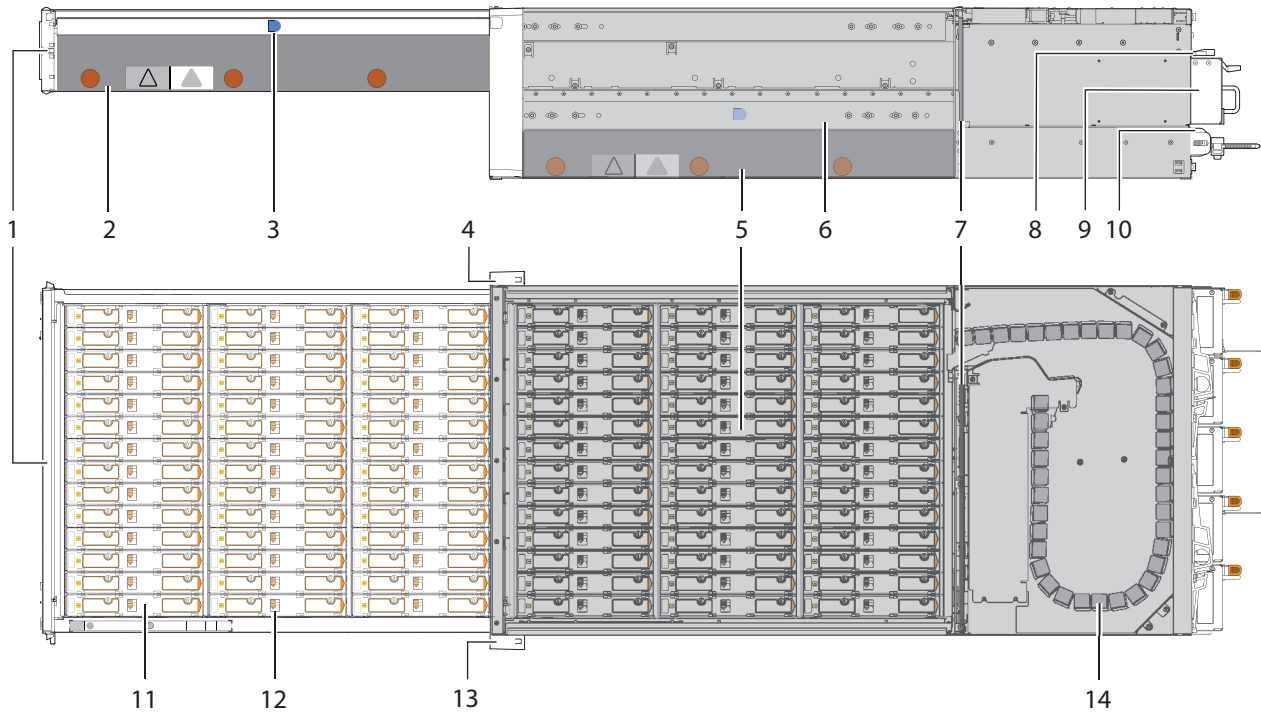


Item	Description	Function
1	AP controller module (CM)	Provides data redundancy and is the nerve center of the storage enclosure
2	CM release latch	Provides full contact with midplane or releases AP controller for inspection and service
3	CM release latch and handle	
4	Fan cooling module (FCM)	Provides redundant regulation of temperature and airflow
5	FCM release latch	Provides full contact with midplane or releases FCM for inspection and service
6	FCM pull handle	
7	Power supply unit (PSU)	Provides redundant regulation of power
8	PSU release latch	Provides full contact with midplane or releases PSU for inspection and service
9	PSU pull handle	
10	PSU power switch	Powers on or off the storage enclosure

Figure 4 5U84 rear panel area

Two sliding drawers hold DDICs and their related sideplanes.

- **Two drawers** each can contain 42 DDICs. Drawer slides lock the drawer in the fully open service position, so require release latch activation to close the drawer.
- **DDICs** slide into 42 slots in each drawer. The upper drawer, Drawer 1, contains slots logically numbered from 0 to 41 in rows moving from top to bottom, then from left to right. The lower drawer, Drawer 2, contains slots logically numbered from 42 to 83, following the same pattern.



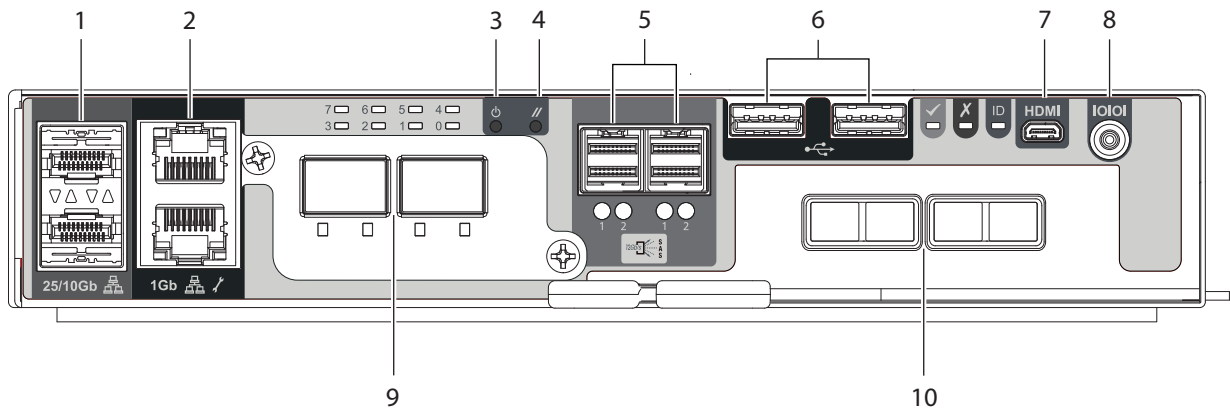
Item	Description	Function
1	Drawer front with keyed anti-tamper lock and 2 drawer latches	Prevents or provides access to DDICs, contains dual drawer panel LEDs for drive activity and fault status
2	Right sideplane	Registers DDIC activity and fault conditions for the primary host path
3	Top drawer: Drawer 1	Contains slots logically numbered from 0 to 41
4	Operator's (ops) panel on left rack ear flange	Connects to midplane, provides users with storage enclosure information and status
5	Bottom drawer: Drawer 2	Contains slots logically numbered from 42 to 83
6	Drawer slide	Supports full extension to service position and access to DDICs
7	Midplane	Connects modules to system controls (<i>Authorized service personnel only</i>)
8	AP controller module (CM)	Provides data redundancy and acts as the nerve center of the storage enclosure
9	Fan cooling module (FCM)	Provides redundant regulation of temperature and airflow
10	Power supply unit (PSU)	Provides redundant regulation of power
11	Drive module in its carrier (DDIC)	Provides redundant data storage
12	Locking mechanism	Secures full connection of DDIC
13	Right rack ear cover	Cosmetic
14	Cable management system	Protects cabling associated with the related drawer

Figure 5 Profile and top views of fully populated 5U84 drawers

AP controller module components

The controller modules (CMs) manage the flow of data to and from the storage enclosure. Each CM provides a very specialized, solutions-specific interaction that depends on your system configuration and software implementation, including SAS zoning, failover and failback procedures, and multi-path procedures.

The CM has a number of ports and any related LEDs. See ["Interpret controller module LEDs" on page 60](#).



Item	Description	Function
1	SFP28 25Gb Ethernet ports	10Gb or 25Gb Ethernet data and system management link
2	1Gb Ethernet ports	1Gb Ethernet data and system management link
3	Power button, inset	Manual power cycle of CM
4	Reset button, inset	Manual soft reset of CM
5	SAS expansion ports	Serial attached SCSI data link
6	USB ports	Universal serial bus for firmware uploads, keyboard, or mouse connections
7	Micro-HDMI port	High-definition multimedia input port for computer monitor connection
8	Diagnostic port	Serial port for low-level access and diagnosis
9	Optional OCP 2.0 ports (2)	Open Core Protocol-compliant Ethernet data link for higher bandwidth
10	Optional PCIe ports (4)	Peripheral Component Interconnect Express high-speed serial data link

Figure 6 Controller module ports, shown with OCP and PCIe optional cards

Optional components

Occasionally, you may configure the storage enclosure to operate without all of its components. The most common reason is to perform in-field maintenance. Temperature and airflow requirements for 2U enclosures mandate you immediately use blanks to replace modules you remove and adhere to all specified time limitations for replacement.

- **Carrier blank**— For 2U enclosures not fully populated, occupies any empty drive slot to secure proper airflow
- **Controller blank**— For 2U enclosures configured with a single controller, occupies the empty controller slot to secure proper airflow

Optional slots and cards

The AP-BV-1 family of controller modules (CMs) features a single optional PCI Express (PCIe) slot and an optional Open Compute Project (OCP) 2.0 mezzanine slot, sized specifically for use in the Seagate AP storage enclosures.

- **PCIe slot**—The PCIe slot supports a connection over fibre channel, fibre channel over Ethernet (FCoE), iSCSI, or other methods. In an enclosure with redundant controller modules (CMs), CMs share information by means of a PCIe link. Each card can function as a host bus adapter (HBA), a network interface card (NIC), or a converged network adapter (CNA) to expand network capabilities. A riser card connects it to the controller's system board.

- **OCP slot**—The OCP mezzanine connector supports a host connection with an installed PCIe Gen4/Gen3 or OCP Mezzanine card 2.0.

Seagate qualifies PCIe and OCP 2.0 mezzanine cards on a case-by-case basis, since thermal, power, and form factor considerations and requirements may impact installation and operation. Contact Seagate to discuss supported HBAs, CPUs, DIMM capacities, and DIMM speeds.

3 Initial install preparations

Each storage enclosure installation requires the same amount of preparation to successfully mount it into your industry-standard rack cabinet of up to 1.2m in depth.

⚠ WARNING! Heed all warnings and cautions on labeling and throughout this guide to reduce risk of personal injury or damage to equipment. You must adhere to all safety requirements in this document. Some relate to the entire system, some to the rack, some to the storage enclosure, and others to the FRUs within it.

⚠ CAUTION Use only power cords supplied in the installation kit or those that meet product specifications.

⚠ IMPORTANT Only a qualified service technician should perform the installation.

Installation checklist

Use this checklist, performing each task only in the sequence presented after successful completion of the prior step.

Table 2 Installation checklist tasks

Step	Task	Reference
1	Complete all installation prerequisites	Identified below
2	Unpack the storage enclosure	"Unpack and prepare the 2U enclosure" on page 23, "Unpack and prepare the 5U enclosure" on page 35
3	Prepare the site for installation of the storage enclosure into the rack cabinet	"Unpack and prepare the 2U enclosure" on page 23, "Unpack and prepare the 5U enclosure" on page 35
4	For rackmount installation, temporarily move to a static-protected area any drive modules not installed in the storage enclosure	
5	Install the rackmount kit in the rack cabinet	"Install the 2U rackmount rail kit" on page 24, "Install the 5U rackmount rail kit" on page 36
6	Mount the storage enclosure into the rack cabinet	"Mount the 2U enclosure into the rack cabinet" on page 27, "Mount the 5U enclosure into the rack cabinet" on page 39
7	Install DDICs in the storage enclosure	"Populate the 2U enclosure" on page 30, "Populate the 5U enclosure" on page 42
8	Connect all power cords and data cables	"Route 2U enclosure power cords and data cables" on page 30, "Route 5U enclosure power cords and data cables" on page 44
9	Route storage enclosure cables to a compatible host	"Route 2U enclosure and expansion data cables" on page 31, "Route 5U enclosure and expansion data cables" on page 44
10	Test the enclosure to verify full functionality	"Test enclosure connections" on page 44
11	Install required host software	"Install an operating system" on page 74

You must adhere to all safety requirements prior to and during installation of a storage enclosure.

⚠ WARNING! Do not attempt to install the 5U storage enclosure into the rack cabinet with drive modules preloaded in the slots. Serious injury and damage could result. Unload any drive modules in storage enclosure slots to a static-protected area. Do not further lighten the storage enclosure by removing other components.

To adhere to installation safety precautions:

- **Site preparation**

1. Use the installation checklist.
2. Clear the site for installation and secure a static-protected area.

- **Before storage enclosure installation**

1. Unpack the storage enclosure in a clear area, using appropriate safety precautions.
2. Temporarily set aside all drives in carriers (DDICs) into a static-protected area, regardless of how your storage enclosure or drives ship.
3. Follow all instructions for installing the provided rackmount rails into the rack cabinet.
4. Review all related warnings before mounting the storage enclosure into the rack.

- **Storage enclosure installation**

1. Move the storage enclosure onto a suitable mechanical lift.
 - a. For the 2U storage enclosures, have two people move the storage enclosure to a lift.
 - b. For the 5U storage enclosures, have three people use the provided belt straps to move the storage enclosure to a lift.
2. Use a mechanical lift for positioning the storage enclosure and mounting it into the rack cabinet. Do not use a vacuum lift. To maintain personal and equipment safety, do not use any other method to support the weight of the storage enclosure during installation or maintenance.
3. Maintain adequate storage enclosure clearances, both front and back.

- **Before FRU installation**

1. Prior to handling the DDICs, make sure you are static-compliant.
2. Confirm you can easily reach the slots and you can visually inspect the installation of each DDIC in the enclosure, while safely maintaining your balance.

- **DDIC installation**

1. Only after you securely mount the storage enclosure in the rack can you retrieve the DDICs from their static-protected area.
2. Install all DDICs into the proper module slots.

- **Prior to testing the enclosure**

1. Examine cables and make sure connections are completely secure on both ends.
2. Adhere to all electrical safety guidelines.

Complete installation prerequisites

The rackmount rails are designed to bear the maximum weight of the storage enclosure when it is properly mounted in a standard rack cabinet. You can install multiple storage enclosures in a single rack cabinet.

 **CAUTION** You must use only the supplied rail kit and related mounting hardware.

To complete installation prerequisites:

1. Prepare the host system for the installation by obtaining access to the following items:
 - a. A host computer with the correct firmware, BIOS, and drivers
 - b. A functioning host bus adapter installed in the host computer, or a switch connected to a host computer
 - c. Tested, good cables for host connection that meet storage enclosure requirements
 - d. The provided power cords, which meet power specifications
2. Familiarize yourself with system configuration requirements and the storage enclosure components.
3. Obtain the following:
 - a. An anti-static wrist or ankle strap for handling static-sensitive components
 - b. A static-protected environment for temporary storage of the storage enclosure and the FRUs
 - c. A Torx screwdriver, 6-in length, with T10 and T20 bits
 - d. A flat-bladed screwdriver, 6-in length
 - e. A Philips screwdriver, 6-in length
 - f. A mechanical lift with sufficient clearance and capable of safely lifting the storage enclosure without drive modules
4. Ensure the rack cabinet is suitable for use with the storage enclosure.
 - a. A rack cabinet capable of holding 2U or 5U form factors that meets all UL and IEC safety requirements, leveled in all planes with respect to each other
 - b. Adequate clearance in front of the rack cabinet to install the provided rail kit
 - c. A maximum depth of 884mm (34.81 inches) from back of front post to maximum extremity, excluding cabling and door closure considerations
 - d. A rack cabinet that causes a maximum back air pressure of 5 pascals (0.5mm water gauge)
 - e. A rack cabinet constructed to meet the installed weight capacity for the total number of storage enclosures in the rack cabinet, based on the related maximum weight per storage enclosure

2U12	2U24	5U84
A maximum of 32kg (71 lb)	A maximum of 30kg (60 lb)	A maximum of 130kg (287 lb)
 - f. A maximum operating ambient temperature of 35° C (95° F)
5. Secure sufficient staff to assist with the installation. Minimum staff:
 - a. One qualified service technician for the complete installation procedure
 - b. One spotter to assist with the lift and to assist with the installation from the rear of the rack cabinet
 - c. A total of two people (2U) or three people (5U) to unpack the storage enclosure and move it onto the mechanical lift

4 Installation of 2U enclosures

Sequentially follow the installation checklist to install your 2U storage enclosure.

Unpack and prepare the 2U enclosure

CAUTION Do not operate a storage enclosure outside the manufacturer's intended use.

- Storage enclosures are suitable for connection to intra-building or non-exposed wiring or cabling only.
 - Storage enclosures are suitable for installation in locations where the National Electrical Code (NEC) applies but are not suitable for Outside Plant (OSP) installations.
 - Customer facilities must provide for voltages with not more than ± 5 percent fluctuation. Customer facilities must also provide suitable surge protection.
-

To unpack and prepare the 2U enclosure:

1. Prepare the site for the storage enclosure installation. This includes meeting all product specifications and providing a clean, clear, static-protected environment prior to unpacking the storage enclosure.
2. Complete the following actions to complete inspection of the 2U enclosure:
 - a. Examine packaging for damage. This includes cuts, water damage, or evidence of mishandling during shipment.
 - b. If there is damage, photograph and document it, but do not proceed. Retain original packaging for returns.
 - c. Cut open the package lid to remove all protective foam above the storage enclosure and access the chassis.
3. Slide the plastic bag aside to allow access to the chassis.

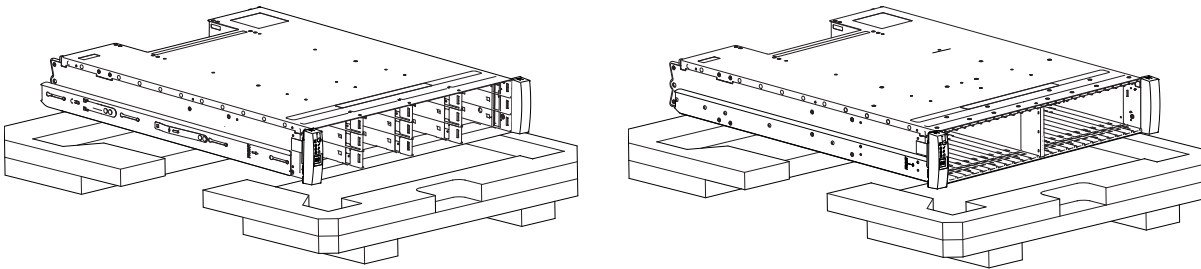


Figure 7 2U12 and 2U24 storage enclosure packaging

4. Locate two people to assist in moving the storage enclosure onto the mechanical lift, using an appropriate safe lifting technique to perform the following actions:
 - a. Position a person on each side of the storage enclosure, grasping the chassis sides, not the front or rear panel.

IMPORTANT Almost all the weight of the storage enclosure is to the rear, so prepare to lift more from the side of the chassis to the rear than the chassis side to the front.

- b. Simultaneously lift the storage enclosure, using appropriate safe lifting technique while moving it to a static-protected location, and then to the mechanical lift for mounting to the rack cabinet.

5. Complete the following actions to prepare the 2U chassis for installation:
 - a. If drives are present in the chassis, grasp the latch of the first drive in its carrier (DDIC) between thumb and forefinger and squeeze together to release the latch, then pivot outward to release the DDIC from the midplane.
 - b. Temporarily remove and store each DDIC in a static-protected environment.
 - c. Facing the chassis front, grasp the right rack flange cover, work the cover free, and set it aside in a safe location.
 - d. Grasp the left rack flange cover, gently work the cover free, and set it aside in a safe location.

Install the 2U rackmount rail kit

The storage enclosure requires rackmount hardware for installation into a standard 1.2m rack and occupies 2 EIA units of rack space (8.89 cm or 3.50 inches) per unit. The rail kit contains a left and right rail designed to handle the 2U storage enclosure and provide for installation of multiple enclosures without loss of rack space. Product function and user safety hinge on proper installation. This task assumes square mounting holes but pertains to other rack types.


You must take all appropriate rack cabinet safety precautions before mounting a storage enclosure into a rack.

CAUTION Observe all the following directives:

- Always place the rack cabinet on a flat, leveled surface. Do not install a storage enclosure into a rack cabinet until you verify the rack cabinet is level.
- Follow prescribed leveling procedures from the rack cabinet manufacturer.
- Never install or remove from the rack cabinet more than one storage enclosure at a time. This helps prevent the rack cabinet from tipping or falling.
- Verify the rack cabinet meets all safety requirements when configured with storage enclosures.
- Verify connections comply with all electrical requirements.
- Verify the system complies with all temperature and exhaust requirements.

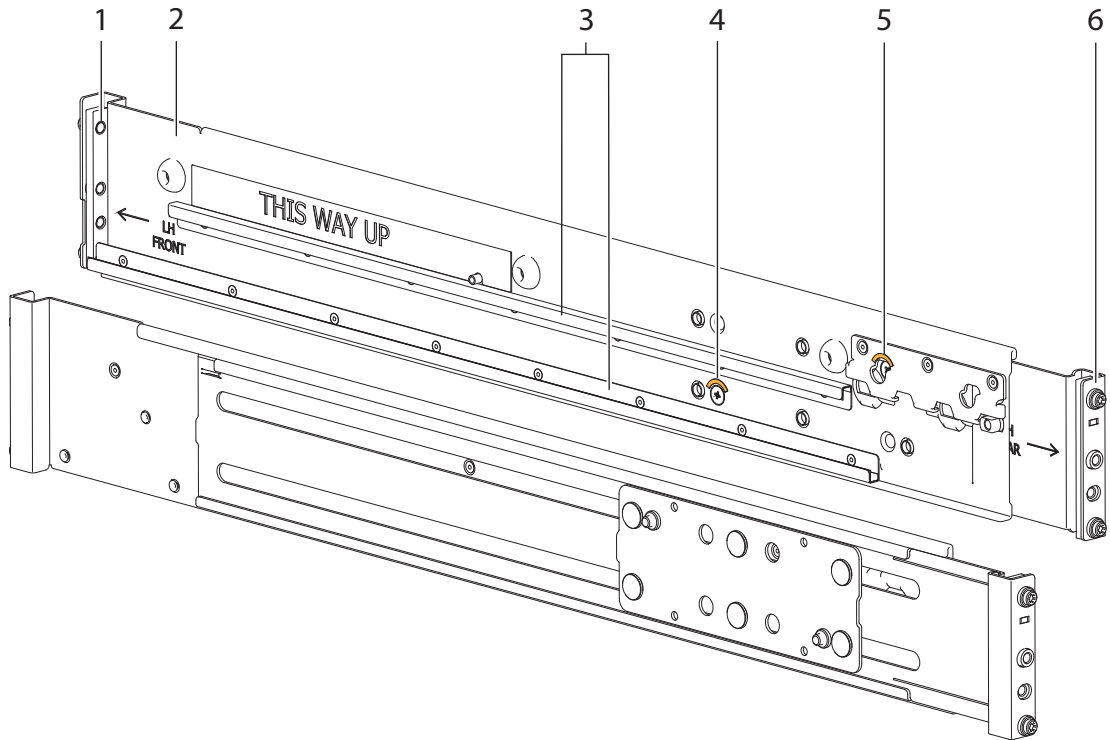
To adhere to safety precautions when mounting a storage enclosure into a rack cabinet:

1. Read and observe all warning and caution labels on the storage enclosure.
2. Verify the rack cabinet is on a flat, leveled surface because any incline or unevenness stresses the rack cabinet and storage enclosure. A storage enclosure in an uneven rack cabinet resists smooth rail movement and may distort the chassis.
3. Verify the rack cabinet design supports the total weight of storage enclosures and has stabilizing features to prevent the rack cabinet from tipping or being pushed over during installation or normal use.
4. Do not lift the storage enclosure without a mechanical lift. No single person should lift a storage enclosure without help.
5. Mount storage enclosures into the rack cabinet from the bottom to the top during installation.
6. Locate lighter storage enclosures above heavier ones to maximize stability.
7. Remove storage enclosures from the top of the rack cabinet to the bottom when emptying it.

Required equipment	Qty	Identification
Outer rails, properly oriented	2	N/A
#2 Phillips-head screwdriver, 6-in length	1	N/A
(Optional) 8mm nut driver, 6-in length	1	N/A
Phillips-head screw, M5 x 15, 8mm hex flange	8	

To install the 2U rackmount rail kit:

1. Remove both outer rail assemblies from their packaging.



Item	Description	Item	Description
1	Left front mount bracket	4	Set screw, front
2	Left front outer rail	5	Set screw, rear
3	Left rail slides	6	Left rear mount bracket

Figure 8 2U enclosure outer rail components

2. Orient the outer rail with the LH FRONT embossed on it to your left, the other with the RH FRONT embossed on it to your right, and each emboss toward you, facing inward.
3. Loosen, but do not remove, the 2 set screws on each outer rail with a Philips screwdriver.
4. Facing the left side of the rack cabinet, slide the left front mount bracket pins into holes in the front rack post.
5. Bias the left rack mount bracket as far inward as possible, then verify the entirety of the lower rail tab is visible just beyond the inner edge of the front rack mount bracket.

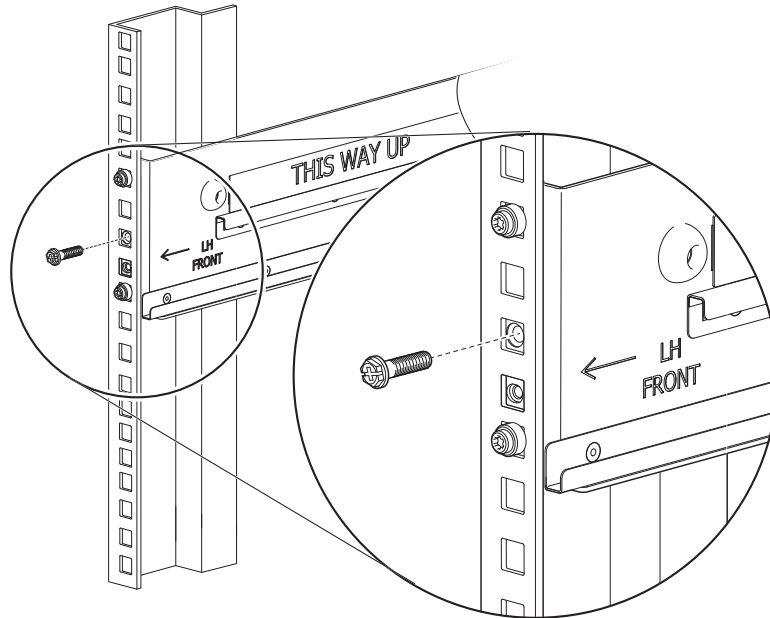


Figure 9 Attachment of front mount bracket to front rack cabinet posts

6. Hold the biased mount bracket in that position and barely tighten against the front rack post using an 8mm nut driver or a Philips screwdriver.
7. Extend the length of the rail until fully mating the rear mount bracket pins in the mirror location on the rear rack post.

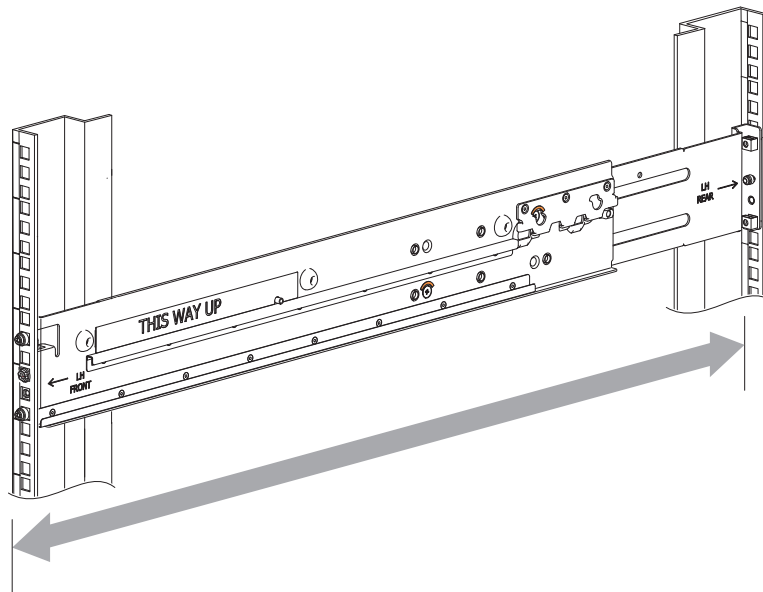


Figure 10 Adjustment of rail length to fit rack cabinet

8. Verify that the rails are level at the same height on both rack posts, and that all mount bracket location pins fully seat in identical locations in the rack posts.
9. Facing the rear of the rack cabinet, insert a Phillips-head M5 x 15 screw into the center hole of the rear mount bracket.

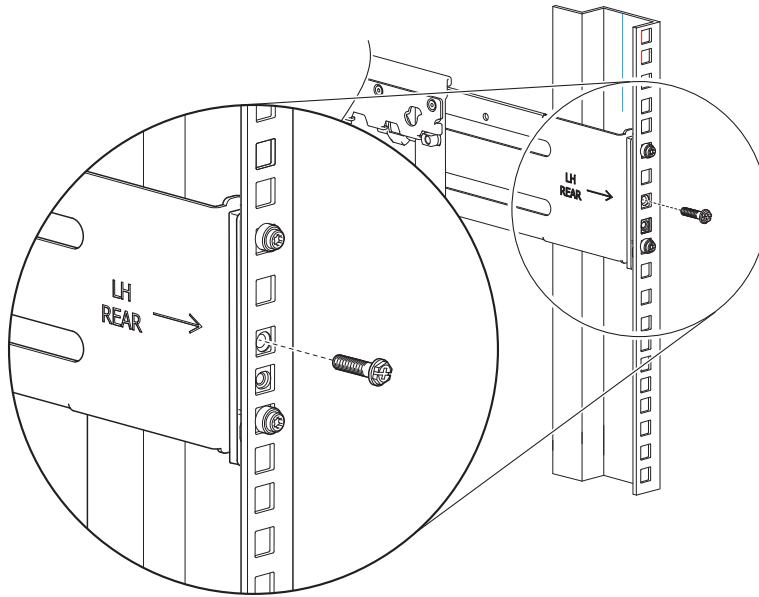


Figure 11 Attachment of rear mount bracket to rear rack cabinet posts

10. Hand tighten firmly against the rack post using an 8mm nut driver or a Phillips screwdriver.
11. Facing the front of the rack cabinet, hand tighten the Phillips-head M5 x 15 screw using an 8mm nut driver or a Phillips screwdriver so that the hex head flange is flush with the front rack post.
12. Fix the adjusted length of the left outer rail by hand tightening both rail slide set screws using a Phillips screwdriver.
13. Repeat the process for the right outer rail.



Mount the 2U enclosure into the rack cabinet

⚠ WARNING! Serious injury and mechanical failure can result if you do not adhere to rack cabinet safety precautions.

- To avoid risk of death or injury from tipping the rack, follow all rack installation guidelines, securing the rack cabinet to the floor with a concrete anchor kit.
 - To avoid catastrophic failure of the rack assembly, never exceed rack cabinet weight limits.
 - Entirely support the storage enclosure with the mechanical lift until the storage enclosure is in the storage position.
 - Follow local occupational health and safety guidelines and meet all requirements for manual material handling.
-

Mounting the storage enclosure into the rack cabinet is the most critical of installation procedures and requires your full attention. Safety and hardware longevity depend on the rail's smooth function and correct implementation of this task.

- Make sure there is sufficient clearance for a technician and the storage enclosure in front of the rack cabinet.
- Observe rack cabinet weight limits.
- Fill the rack cabinet from the bottom to the top, with the heaviest equipment at the bottom.
- Make your approach with the mechanical lift level, straight, and parallel to the rack cabinet. Any skew, warp, or tilt prevents the inner rails attached to the storage enclosure from properly engaging the outer rails in the rack cabinet.

Required equipment	Qty	Identification
Mechanical lift	1	N/A
Storage enclosure with attached inner rails	1	N/A
Rack cabinet with installed outer rails	1	N/A
#2 Phillips-head screwdriver, 6-in length	1	N/A
Panhead screw, M5 x 8, #2	2	
Phillips-head screw, M5 x 15, 8mm hex flange	2	

To mount the 2U enclosure into the rack cabinet:

1. Confirm that the outer rails are properly and securely installed in the rack cabinet.
2. Complete the following actions to position the mechanical lift and the 2U chassis:
 - a. Using proper safety precautions, position the 2U chassis on the mechanical lift perpendicular to the lift wheels.
 - b. Move the mechanical lift into position perpendicular to the rack cabinet so that the 2U chassis is parallel to the opening and is a minimum of 5 to 7 inches (12.7cm to 17.78cm) away from the rack cabinet.
 - c. Adjust the mechanical lift height to be as close as possible to the allocated 2U location.
 - d. Moving only the 2U chassis, position it so the attached inner rails align with the outer rails in the rack.

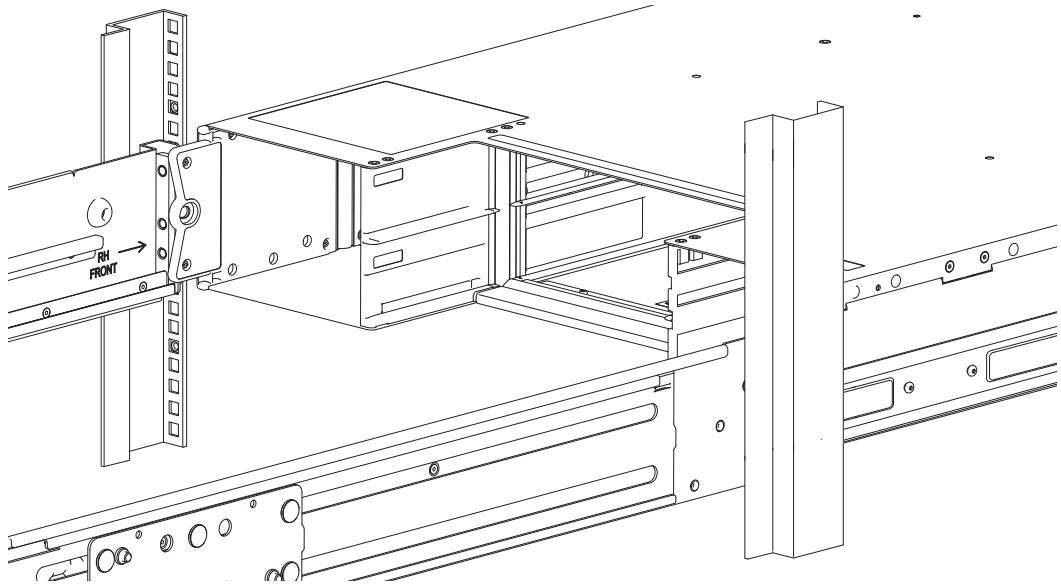


Figure 12 Alignment between 2U chassis and rails (removed rear components for clarity)

3. Complete the following actions to properly secure the 2U chassis on the outer rails:
 - a. Keep the 2U chassis stationary on the lift.
 - b. Verify that both outer rails fully engage the 2U chassis inner rails.
 - c. Guide the chassis inward with the leading edge of each inner rail inside the top and bottom lip of the outer rail.
 - d. Conduct a visual inspection of both sides to verify both inner rails are an equal distance along the outer rail and that the direction is straight in, not at an angle.

4. Complete the following actions to insert the 2U chassis into the rack cabinet:
 - a. Facing the front of the enclosure, carefully exert even pressure on both sides of the storage enclosure front, inserting the storage enclosure until the rack ear flanges are flush with the front rack posts.
 - b. Carefully lower the mechanical lift.
 - c. Thoroughly examine the rack rails for issues such as bowing, scraping, resistance, or indicators of misalignment.
5. Complete the following actions to secure the 2U chassis:
 - a. Facing the rear of the enclosure, insert and tighten a Panhead M5 x 8 screw into the tail of each outer rail and through the 2U chassis to secure the rear of the chassis.

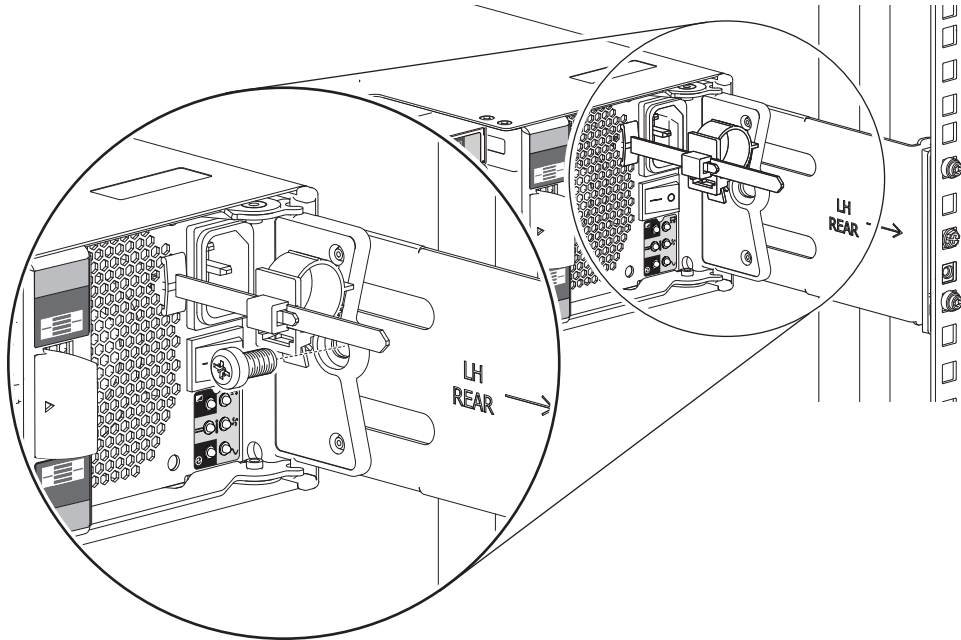


Figure 13 Installation of 2U rear screw to secure chassis to rail

- b. Facing the front of the 2U chassis, insert a Phillips-head screws with the hex head flanges into the operator's (ops) panel with an 8mm nut driver or a Philips screwdriver.

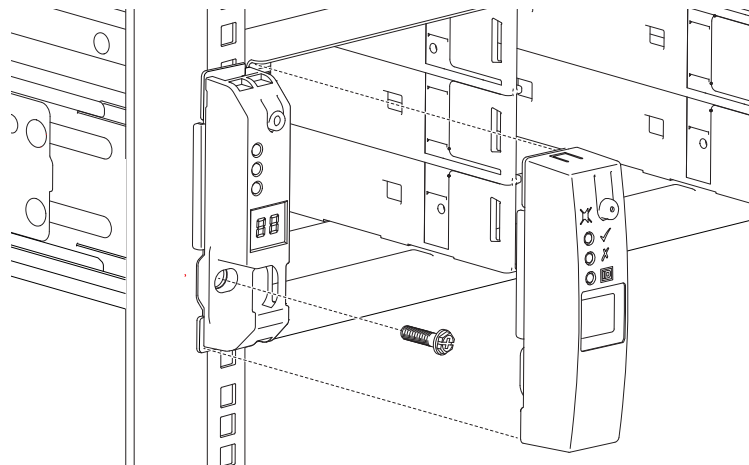


Figure 14 Installation of 2U operator's panel screw and cover


- c. Hand tighten firmly against front rack post at the center of the rack ear flange.
- d. Slide the ops panel cover over the left rack ear flange until flush with the rack post.
- e. Repeat the process for the right rack ear flange and cover.

Populate the 2U enclosure

After successfully mounting the 2U chassis into the rack cabinet, populate the storage enclosure.


To populate the 2U enclosure:

1. Examine drive carriers for damage. If you installed a new drive in the carrier, verify drive connector pins are not bent.
2. Orient a drive in its carrier (DDIC) so the release latch is to the left for the 2U12 or to the top for the 2U24.
3. Insert it into the first available left-hand slot and press inward until fully seated against the midplane and the latch locks.
4. For the 2U12 storage enclosure, take the following actions until all slots hold either a DDIC or an optional blank carrier.
 - a. Insert the next DDIC and move across the row to the next slot in the sequence, repeating until the top row is full.
 - b. Repeat until the middle row is full.
 - c. Repeat until the bottom row is full.
5. For the 2U24 storage enclosure, insert the next DDIC and move across the row to the next slot in the sequence, repeating until all slots hold either a DDIC or an optional blank carrier.

 **CAUTION** If you partially populate the storage enclosure with drives in their carriers (DDICs), you must install a minimum of one DDIC. For proper air flow, all drive slots must hold either a DDIC or an optional blank carrier. You may not leave any empty slots.

Test enclosure connections

After completion of all installation procedures, the storage enclosure is ready for connection to power. You can only connect the storage enclosure to a power source that has a safety electrical earth connection. Have a qualified electrical engineer confirm the earth connection meets the product specifications.

 **CAUTION** If you install multiple storage enclosures in a rack cabinet, the importance of the earth connection increases, since each storage enclosure increases earth leakage current.

 **IMPORTANT** Only a qualified electrical engineer who meets local and national standards should perform the inspection.

Route 2U enclosure power cords and data cables

When properly connected to autonomous power distribution units (PDUs), power cords provide uninterrupted power to the storage enclosure and data cables provide an efficient highway for data exchanges to and from the storage enclosure. You must properly route both while adhering to all grounding requirements and electrical safety precautions.

To adhere to electrical safety precautions:

1. Observe the caution labels affixed to the power cooling modules (PCMs).
2. Confirm PCM input voltage range is 100-240VAC at 50 to 60Hz, then only operate the storage enclosure in that range.
3. You must provide a suitable power source with electrical overload protection to meet technical specification requirements.

4. You must use a provided power cord that has a tested, safe electrical earth connection for storage enclosure power supply.
5. Confirm the storage enclosure connection to earth before applying power to it.
6. Do not operate a storage enclosure with less than the provided 2 PCMs, other than to provide in-service maintenance within the required time allotment.

! **IMPORTANT** Use only Cat-6 or above cables with RJ-45 connectors for Base-T connections.

! **IMPORTANT** Use only Seagate approved HD mini-SAS (SFF-8644) x4 data cables that are at least .5m (1.64 ft) in length and do not exceed 3m (9.84 ft) in length to connect to the SAS ports on each controller module.

Route 2U enclosure and expansion data cables

The 2U storage enclosure supports SAS cabling for up to 3 expansion enclosures and several methods for connectivity to a switch or the host system. Select data cables that best align with available controller module ports and your host environment. Fault tolerance and performance are key factors in determining how to best optimize your particular system and cabling configuration. This topic assumes a fault-tolerant *reverse* cabling method, since it provides a method of maintaining access to all enclosures in the chain, even if one of the enclosures fails or requires removal. If you use the high-performance *straight-through* cabling method, it is less fault tolerant. When using straight-through cabling, a failed enclosure in the chain prevents access to enclosures further down the chain until you address the fault.

You must comply with all SAS cabling requirements and confirm that they meet all related standards.

△ CAUTION Do not create invalid closed loops anywhere along the SAS port cabling configuration. A valid cabling configuration is directional and does not contain any loops between components already in that cabling configuration. An invalid closed loop introduces a circular flow into the cabling configuration that can degrade performance or cause failure.

△ CAUTION Do not connect more than one cable to the 1Gb Ethernet port at a time. Connection to both can cause a serious data event and bring the network down.

To route 2U enclosure and expansion data cables:

1. Route data and management cables from the host system to the best available controller module port for your environment: either the SFP28 25/10Gb Ethernet ports or the 1Gb Ethernet ports.
2. Take the following actions to connect Controller 0A to its related expansion modules. The example below has 3 expansion enclosures directly below the storage enclosure.

! **IMPORTANT** Best practice is to use the expansion Port A for input and Port C for output.

- a. Connect two approved data cables from the host bus adaptor (HBA) or switch to the top controller, Controller 0A.
 - b. Insert a mini-SAS data cable into the top controller, Controller 0A, then connect the other end to SAS port A in the first expansion enclosure, 1A.
 - c. Insert a mini-SAS data cable from SAS port C in the first expansion enclosure, 1A, and connect the other end to SAS port A in the second expansion enclosure, 2A.
 - d. Insert a mini-SAS data cable from SAS port C in the second expansion enclosure, 2A, and connect the other end to SAS port A in the third expansion enclosure, 3A.
3. Take the following actions to connect Controller 0B to its related expansion modules.

IMPORTANT Best practice is to use the expansion Port A for input and Port C for output.

- Connect two approved data cables from the HBA or switch to the bottom controller, Controller 0B.
- Insert a mini-SAS data cable into the bottom controller, Controller 0B, and connect the other end to SAS port A in the third expansion enclosure, 3B.
- Insert a mini-SAS data cable from SAS port C in the third expansion enclosure, 3B, and connect the other end to SAS port A in the second expansion enclosure, 2B.
- Insert a mini-SAS data cable from SAS port C in the second expansion enclosure, 2B, and connect the other end to SAS port A in the first expansion enclosure, 1B.

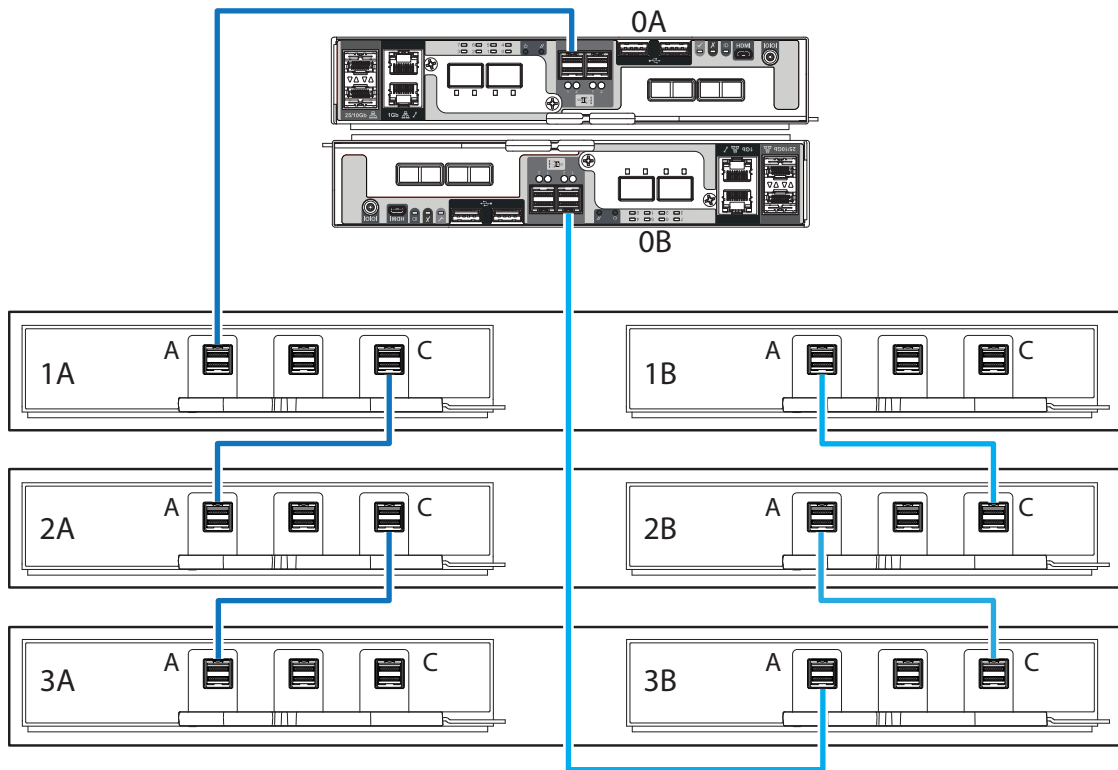


Figure 15 Sample reverse cabling method among 2U controller modules (CMs) and expansion modules

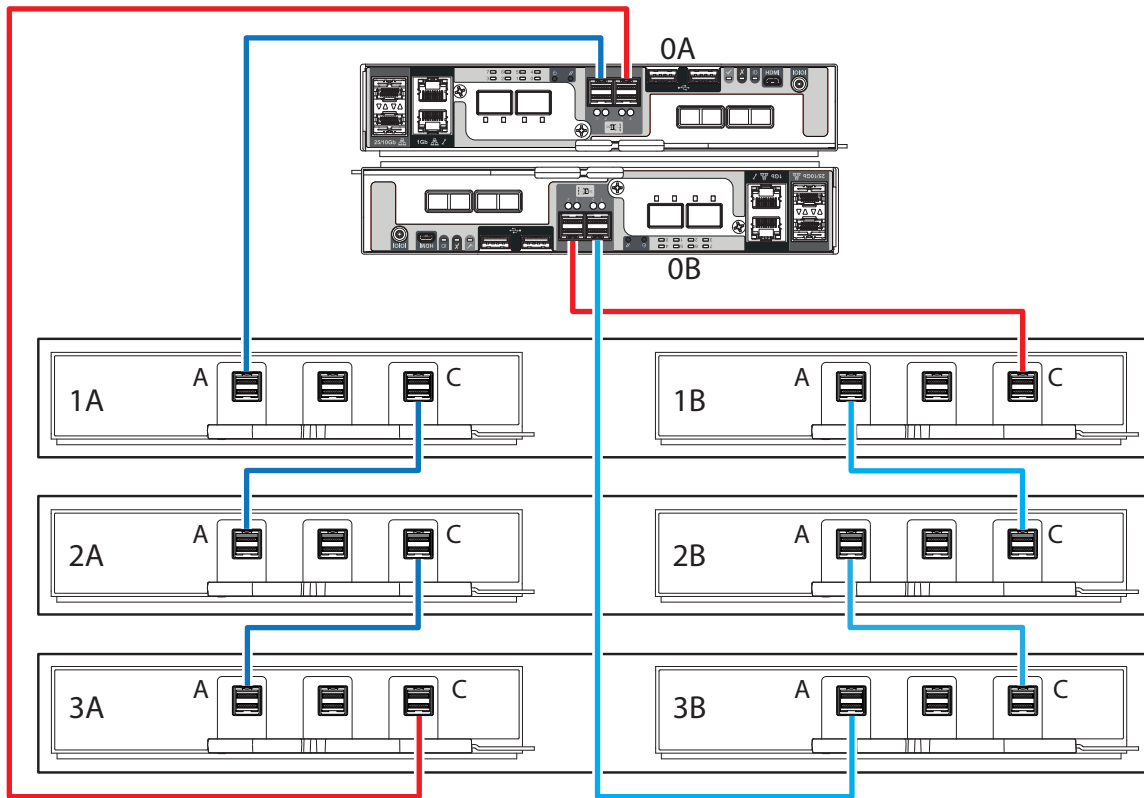


Figure 16 Sample invalid loop (in red) among 2U controller modules (CMs) and expansion modules

Route 2U enclosure power cords

This basic task connects the supplied power cords to the redundant power cooling modules (PCMs) and then to independent power distribution units (PDUs) that are connected to an uninterruptible power system. You must only connect PDUs to a power source that has a safety electrical earth connection.

CAUTION Use only power cords supplied in the installation kit or those that meet product specifications.

CAUTION Adhere to power source and power connection requirements to avoid harm to equipment.

- Only connect the power cooling module (PCM) to power sources that comply with product specifications and labels.
- Always remove all power connections before you remove a PCM from the storage or expansion enclosure.

To route 2U enclosure power cords:

1. Select both power cords from the packaging and remove the cable ties.
2. Facing the rear of the rack cabinet, connect a power cord connector to each PCM.
3. Route the left power cord below the left fan and connect the plug to an outlet on an independent PDU, allowing a minimum of slack.
4. Route the left power cord below the right fan and connect the plug to an outlet on an independent PDU, allowing a minimum of slack.

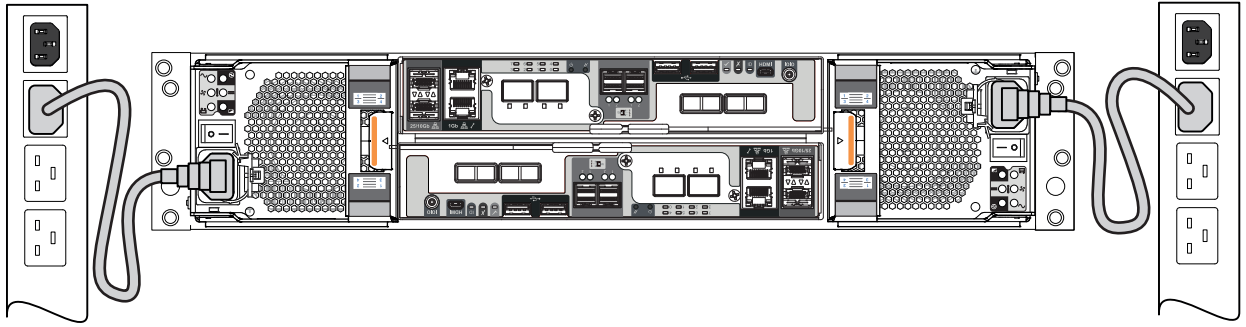


Figure 17 2U power cord routing to independent power distribution units

5. Secure each power cord, using the built-in secure ties on the PCM.

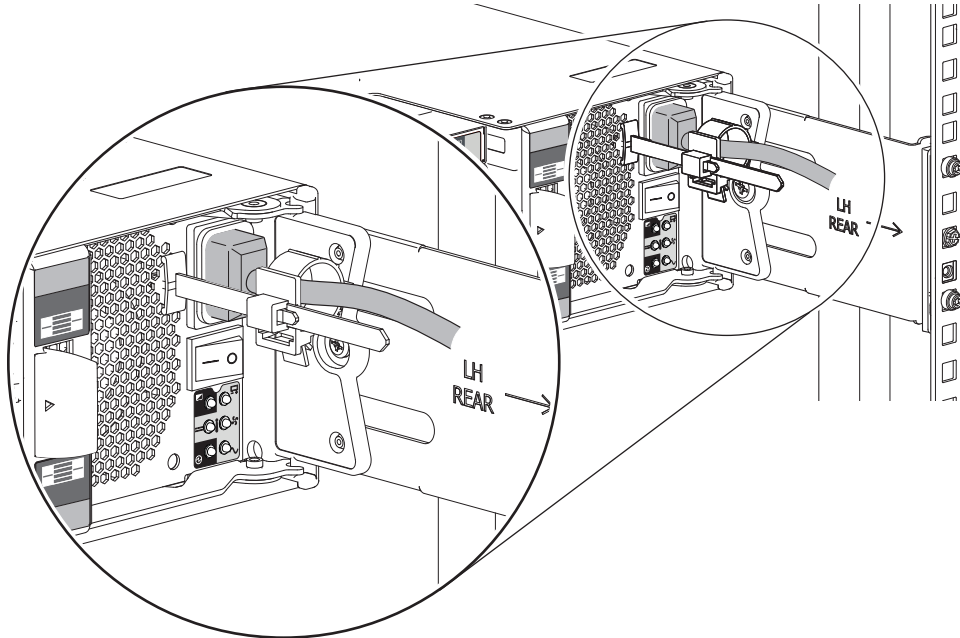


Figure 18 2U power cord surrounded by secure tie

6. Proceed with routing data cables in the next tasks, leaving the power on sequence until after you complete all other cabling tasks and are fully ready to test your connections.

5 Installation of 5U enclosures

Sequentially follow the installation checklist to install your 5U storage enclosure.

Unpack and prepare the 5U enclosure

CAUTION Do not operate a storage enclosure outside the manufacturer's intended use.

- Storage enclosures are suitable for connection to intra-building or non-exposed wiring or cabling only.
- Storage enclosures are suitable for installation in locations where the National Electrical Code (NEC) applies but are not suitable for Outside Plant (OSP) installations.
- Customer facilities must provide for voltages with not more than ± 5 percent fluctuation. Customer facilities must also provide suitable surge protection.

To unpack and prepare the 5U enclosure:

1. Prepare the site for the storage enclosure installation. This includes meeting all product specifications and providing a clean, clear, static-protected environment prior to unpacking the storage enclosure.
2. Complete the following actions to complete inspection of the 5U enclosure:
 - a. Examine packaging for damage. This includes cuts, water damage, or evidence of mishandling during shipment.
 - b. If there is damage, photograph and document it, but do not proceed. Retain all original packaging for returns.
 - c. Remove pallet strapping and all protective foam above the storage enclosure to access it.
3. Slide the plastic bag aside to allow access to the chassis.

WARNING! The box is deep, and the chassis is very heavy. Do not attempt to lift by yourself.

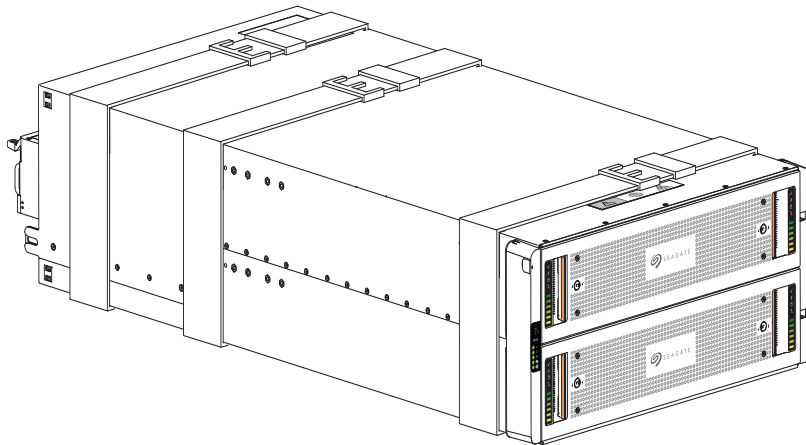



Figure 19 Default belt straps already around the 5U storage enclosure

4. Locate three people to assist in moving the storage enclosure onto the mechanical lift, using an appropriate safe lifting technique to perform the following actions:
 - a. Position one person at the front to grip the front belt strap securely by both loops, not by any portion of the front or rear panel areas.
 - b. Position one person at each rear corner to grip both rear belt straps by the loops on that side.
 - c. Simultaneously lift the storage enclosure, using appropriate safe lifting technique while moving it to a static-protected location, and then to the mechanical lift for mounting to the rack cabinet.
5. Facing the front of the chassis, grasp the right rack flange cover, gently work the cover free, and set it aside in a safe location.
6. Grasp the left rack flange cover, gently work the cover free, and set it aside in a safe location.

Install the 5U rackmount rail kit

The storage enclosure requires rackmount hardware for installation into a standard 1.0m or 1.2m rack and occupies 5 EIA units of rack space (22.22 cm or 8.75 inches) per unit. The rail kit contains a left and right rail designed and tested to handle the 5U storage enclosure and provide for installation of multiple enclosures without loss of rack space. Product function and user safety hinge on their proper installation. The following task assumes your rack posts have square mounting holes.


You must take all appropriate rack cabinet safety precautions before mounting a storage enclosure into a rack.

 **CAUTION** Observe all the following directives:

- Always place the rack cabinet on a flat, leveled surface. Do not install a storage enclosure into a rack cabinet until you verify the rack cabinet is level.
- Follow prescribed leveling procedures from the rack cabinet manufacturer.
- Never install or remove from the rack cabinet more than one storage enclosure at a time. This helps prevent the rack cabinet from tipping or falling.
- Verify the rack cabinet meets all safety requirements when configured with storage enclosures.
- Verify connections comply with all electrical requirements.
- Verify the system complies with all temperature and exhaust requirements.

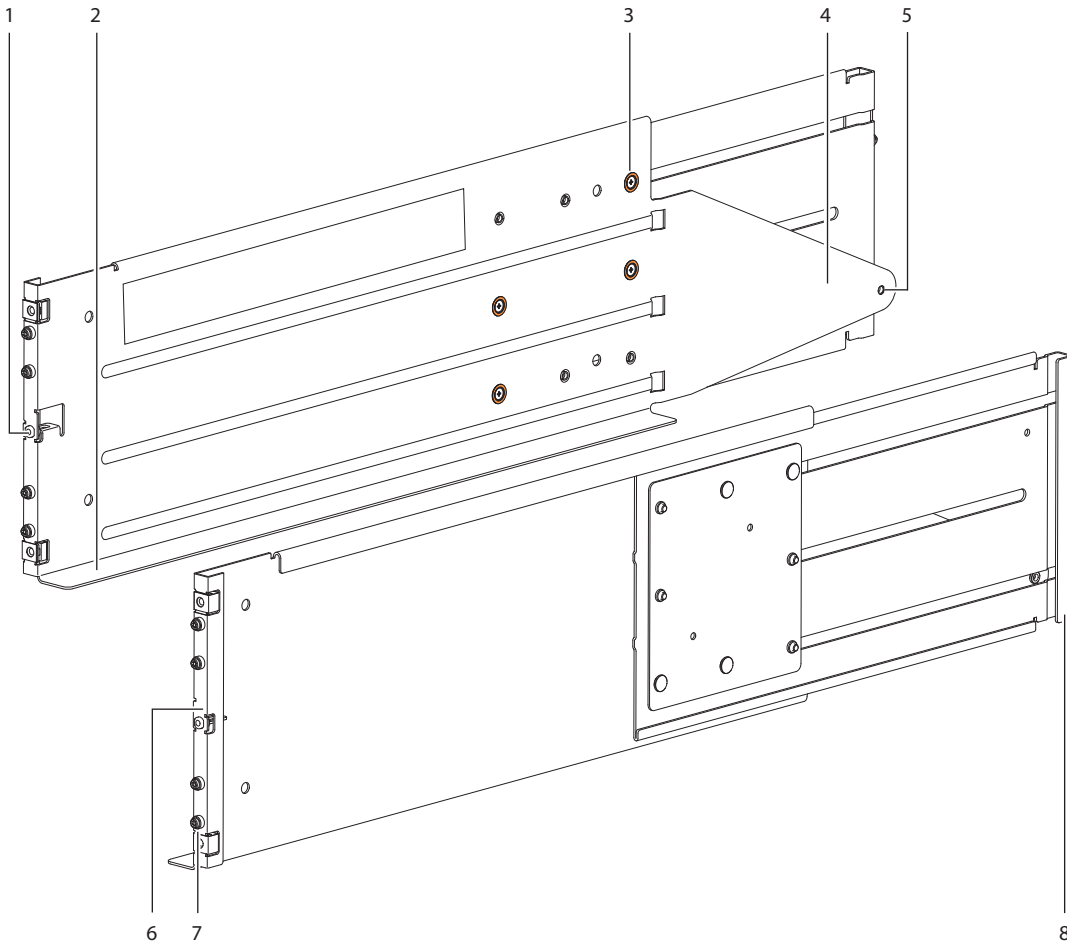
To adhere to safety precautions when mounting a storage enclosure into a rack cabinet:

1. Read and observe all warning and caution labels on the storage enclosure.
2. Verify the rack cabinet is on a flat, leveled surface because any incline or unevenness stresses the rack cabinet and the storage enclosure. A storage enclosure in an uneven rack cabinet resists smooth movement on the rails and possibly distorts the storage enclosure.
3. Verify the rack cabinet design supports the total weight of storage enclosures and has stabilizing features to prevent the rack cabinet from tipping or being pushed over during installation or normal use.
4. Do not lift the storage enclosure without a mechanical lift. No single person should ever lift a storage enclosure without assistance.
5. Mount storage enclosures into the rack cabinet from the bottom to the top during installation.
6. Locate lighter storage enclosures above heavier ones to maximize stability.
7. Remove storage enclosures from the top of the rack cabinet to the bottom when emptying it.

Required equipment	Qty	Identification
Outer rails, properly oriented	2	N/A
#2 Phillips-head screwdriver, 6-in length	1	N/A
(Optional) 8mm nut driver, 6-in length	1	N/A
Phillips-head screw, M5 x 15, 8mm hex flange	8	

To install the 5U rackmount rail kit:

1. Remove both rail assemblies from their packaging.
2. Orient the rail with the LH FRONT embossed on it to your left, the other with the RH FRONT embossed on it to your right, and each emboss toward you, facing inward.



Item	Description	Item	Description	Item	Description	Item	Description
1	Left front mount bracket	3	Rail slide set screw	5	Rear mount	7	Rack pin
2	Left rail shelf	4	Left rear tail	6	Right front mount bracket	8	Right rear mount bracket

Figure 20 5U left and right rail components

3. Loosen, but do not remove, all 4 rail slide set screws on each rail with a Philips screwdriver.

4. Select the left rail, then face the left side of the rack cabinet and slide the front mount bracket pins into the desired slots in the front rack post.
5. Insert a Phillips-head M5 x 15 screw through the rack post into the center of the front rack mount bracket and barely tighten against the front rack post, using an 8mm nut driver or a Philips screwdriver.

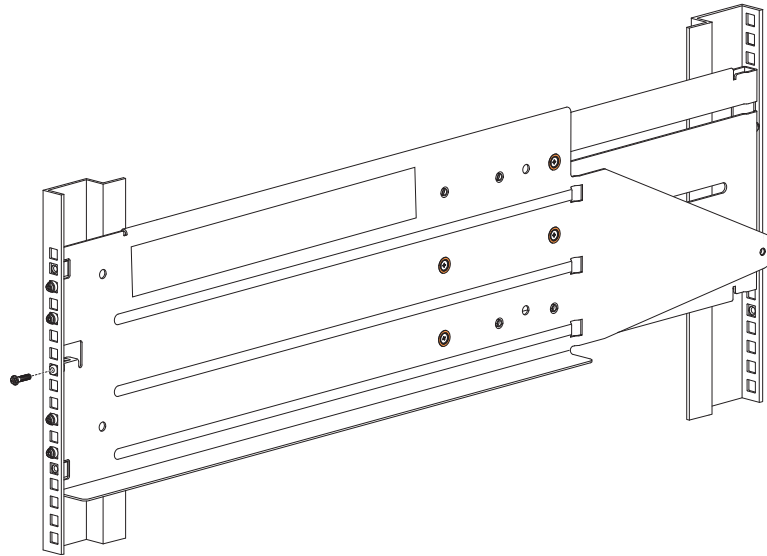


Figure 21 Insertion of 5U front mount bracket screw

6. Extend the length of the rail until the rear mount bracket pins in the mirror location on the rear rack post.
7. Verify that the rails are level at the same height on both rack posts, and that all location pins fully seat in the rack posts.
8. Facing the rear of the rack cabinet, insert 2 Phillips-head M5 x 15 screws into the top and bottom holes of the rear mount bracket.

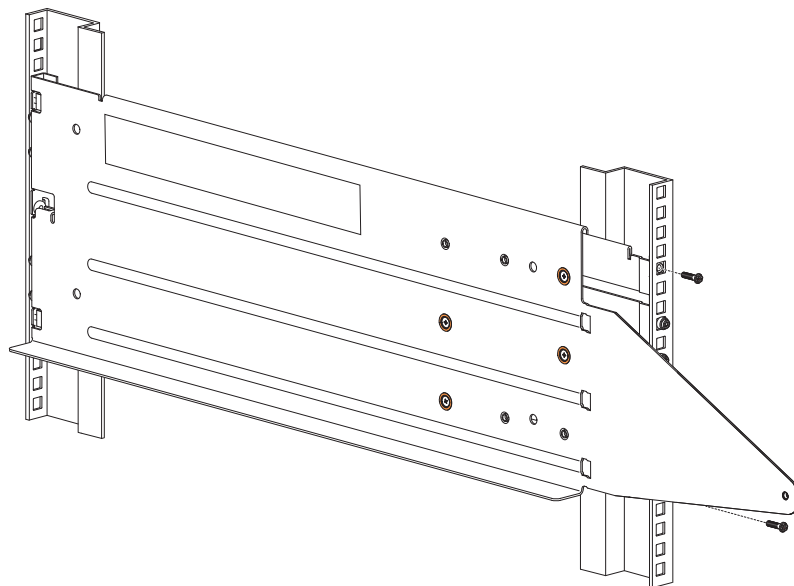


Figure 22 Insertion of 5U rear mount bracket screws

9. Hand tighten firmly against the rack post using an 8mm nut driver or a Philips screwdriver.

10. Facing the front of the rack cabinet, hand tighten both of the Phillips-head M5 x 15 screws using an 8mm nut driver or a Phillips screwdriver so that the hex head flanges are flush with the front rack post.
11. Fix the adjusted length of the left rail by hand tightening all 4 rail slide set screws using a Phillips screwdriver.
12. Repeat the process for the right rail.


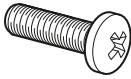


Mount the 5U enclosure into the rack cabinet

⚠ WARNING! Serious injury and mechanical failure can result if you do not adhere to rack cabinet safety precautions.

- To avoid risk of death or injury from tipping the rack, follow all rack installation guidelines, securing the rack cabinet to the floor with a concrete anchor kit.
- To avoid catastrophic failure of the rack assembly, never exceed rack cabinet weight limits.
- Entirely support the storage enclosure with the mechanical lift until the storage enclosure is in the storage position.
- Follow local occupational health and safety guidelines and meet all requirements for manual material handling.

Mounting the storage enclosure into the rack cabinet is the most critical of the installation procedures and requires your full attention. Safety and hardware longevity depend on rails' smooth function and correct implementation of this task.

- Make sure there is sufficient clearance for a technician and the storage enclosure when a drawer is fully extended.
- Observe rack cabinet weight limits.
- Fill the rack cabinet from the bottom to the top, with the heaviest equipment at the bottom.
- Make your approach with the mechanical lift level, straight, and parallel to the rack cabinet. Any skew, warp, or tilt prevents the storage enclosure from properly resting on the rackmount shelf in the rack cabinet.

Required equipment	Qty	Identification
Mechanical lift	1	N/A
Storage enclosure with attached inner rails	1	N/A
Rack cabinet with installed outer rails	1	N/A
#2 Phillips-head screwdriver, 6-in length	1	N/A
(Optional) 8mm nut driver, 6-in length	1	N/A
Panhead screw, M5 x 8, #2	4	
Panhead screw, 10-32 X 3/4"	6	
Lock washer, M5, Type B	6	
Washer, M5, 10 x 1.6mm	6	

To mount the 5U enclosure into the rack cabinet:

1. Confirm that the outer rails are properly and securely installed in the rack cabinet.
2. Confirm that the storage enclosure does not contain any drives, so the chassis has empty drawers.

3. Complete the following actions to position the mechanical lift and the 5U chassis:
 - a. Using proper safety precautions, position the 5U chassis on the mechanical lift perpendicular to the lift wheels.
 - b. Move the mechanical lift into position perpendicular to the rack cabinet so that the storage enclosure is parallel to the opening and is a minimum of 5 to 7 inches (12.7cm to 17.78cm) away from the rack cabinet.
 - c. Adjust the mechanical lift height to be as close as possible to the allocated 5U location.
 - d. Moving only the 5U chassis, position it so the chassis aligns with the outer rails in the rack.

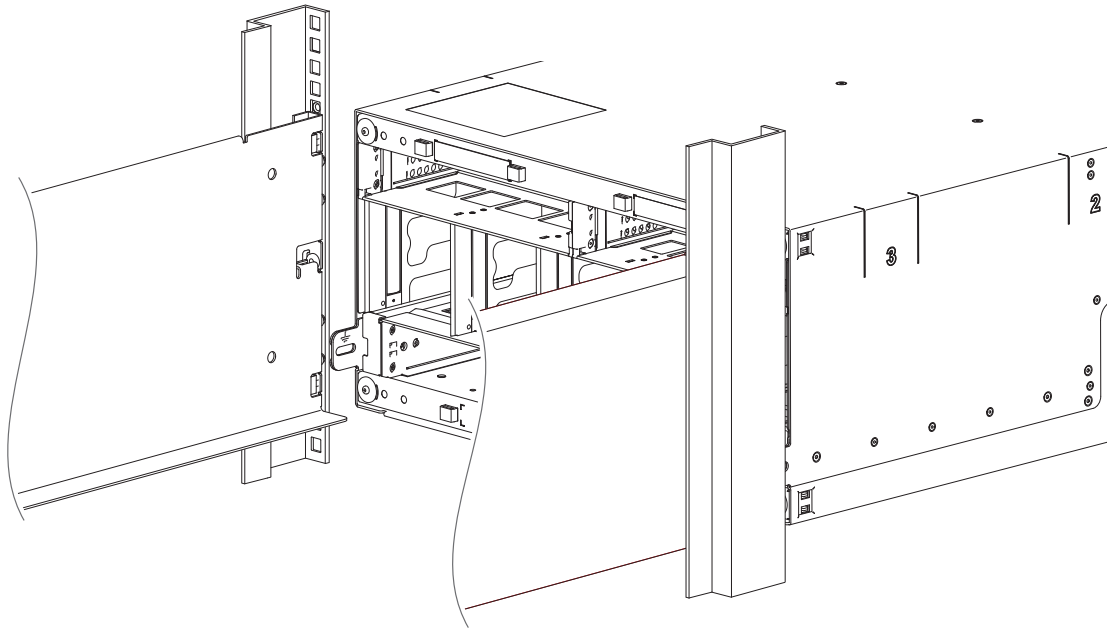


Figure 23 Alignment between 5U chassis and rails, minus rear components for clarity

4. Complete the following actions to properly secure the 5U chassis on its rails:
 - a. Keep the 5U chassis stationary on the mechanical lift.
 - b. Conduct a visual inspection of both sides to verify the bottom of the storage enclosure chassis rests squarely on the front of the bottom shelf of the outer rail and that the direction is straight in, not at an angle.
5. Complete the following actions to insert the 5U chassis into the rack cabinet:
 - a. Facing the front of the enclosure, carefully exert even pressure on both sides of the storage enclosure front, inserting the storage enclosure until the rack ear flanges are flush with the front rack posts.
 - b. Carefully lower the mechanical lift.
 - c. Thoroughly examine the rack rails for issues such as bowing, scraping, resistance, or indicators of misalignment.
6. Complete the following actions to secure the 5U chassis:
 - a. Thread a lock washer and then a washer onto each of 2 Panhead 10-32 screws.
 - b. Facing the front of the enclosure, insert a Panhead 10-32 screw with washers into the top and bottom holes in the operator's (ops) panel, then hand tighten firmly against front rack post with a Phillips screwdriver.

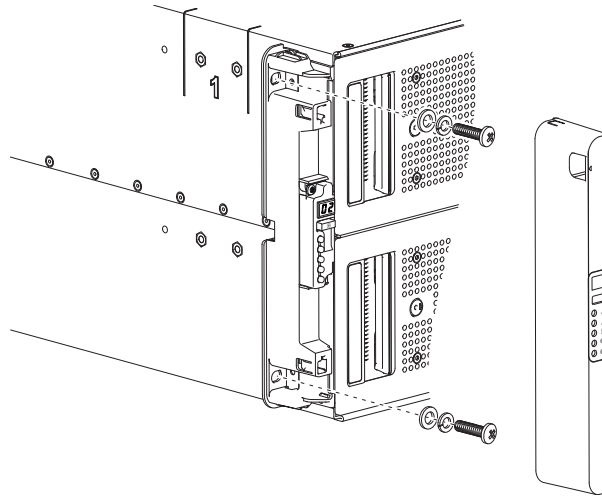


Figure 24 Secure chassis operator's panel to rack posts

- c. Slide the ops panel cover over the left rack ear flange until flush with the rack post.
- d. Repeat the process for securing the right rack ear flange and replacing the right rack ear cover.
- e. Facing the rear of the enclosure, insert and tighten an Panhead M5 x 8 screw through the chassis and into the tail of each outer rail with a Phillips screwdriver to secure the rear of the chassis.

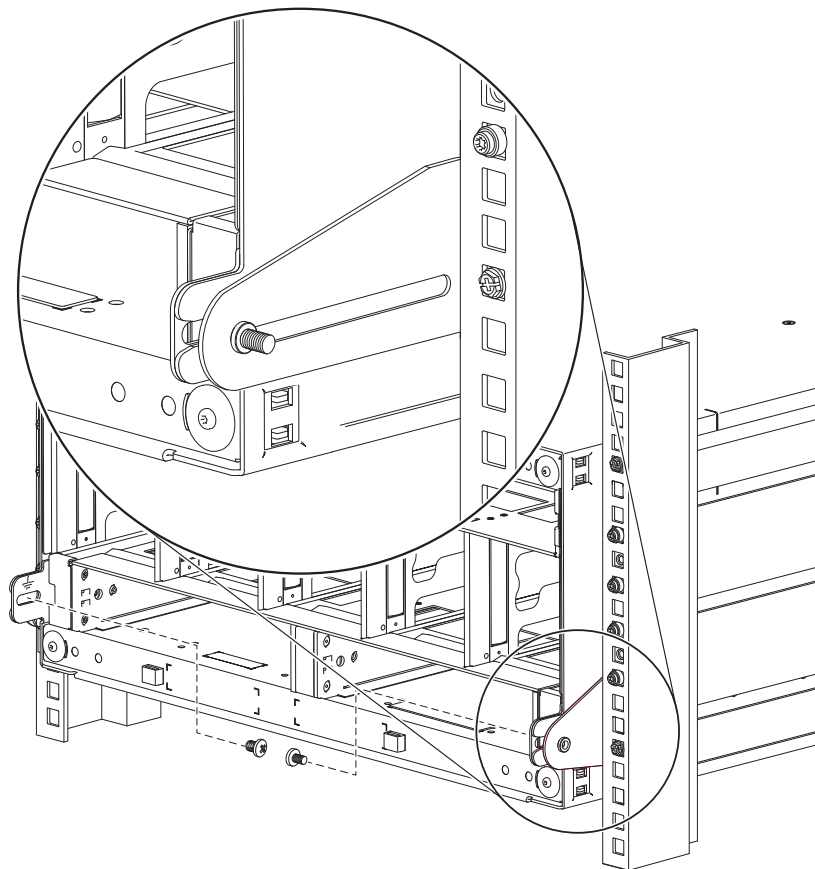


Figure 25 5U rear chassis connection to outer rails, detail, minus rear components for clarity

Access a drawer

Each tamper-resistant drawer contains 42 slots for drives in carriers (DDICs). The drawer supports its DDIC contents and own weight when partially or fully open. A safety latching mechanism prevents access to more than one drawer at a time.

You can use a T20 Torx driver to lock each drawer pull handle by turning each lock clockwise.

CAUTION Only open a drawer for no more than 10 minutes, or you will compromise airflow and cooling. DDICs are hot-swappable.

Populate the 5U enclosure

After successfully mounting the 5U chassis into the rack cabinet, populate the storage enclosure.

CAUTION If you partially populate the storage enclosure with drives in their carriers (DDICs), you must comply with several additional requirements.

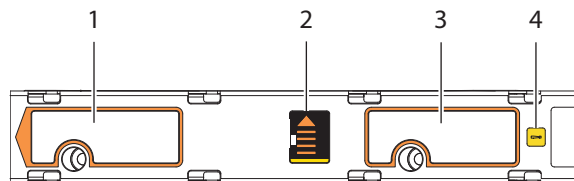
- You must install a minimum of 14 DDICs. Populate in rows, 14 DDICs at a time, from front to back of the drawer, and alternate between drawers.
 - a. Fill the front row in Drawer 1, then front row in Drawer 2.
 - b. Fill the middle row in Drawer 1, then the middle row in Drawer 2.
 - c. Fill the back row in Drawer 1, then the back row in Drawer 2.

The total number of populated drawer rows cannot differ by more than 1 row.

- Populate rows with DDICs that have the same form factor and same rotational speed.
- Do not mix drive types within the same drawer.

To populate the 5U enclosure:

1. Complete the following actions to open the upper drawer:
 - a. Facing the front of the storage enclosure, press and hold both drawer pull handles while pulling outward.
 - b. Stop as the drawer rails engage the safety lock latches to access to three rows of drives in their carriers (DDICs).
2. Complete the following actions to fully populate the upper drawer:
 - a. Select a DDIC and orient it, so the LED is towards the drawer front and the release latch arrow towards the rear.



Item	Description	Item	Description
1	Top portion of carrier latch	3	Bottom portion of carrier latch
2	Release latch, release latch arrow, open state	4	Fault condition LED

Figure 26 Carrier latch features

- b. Align the carrier with the first empty drawer slot to the front far left, then lower it fully into the slot.

- c. Push the DDIC down until the top is flush with the top of the slot.
- d. While holding it against the bottom of the slot, slide the top latch toward the rear of the drawer until it locks into place and the DDIC release latch locks.



Figure 27 Release latch open and unlocked



Figure 28 Release latch properly locked

- e. Select the next DDIC, orient it so the LED is towards the drawer front, and insert into the next slot in the same manner.
- f. Repeat, moving to the next slot in the sequence, until you complete the row.
- g. Populate the next two rows in sequence.
- h. Verify that all drives are at the same level and all DDIC release latches are properly locked.

CAUTION Do not proceed to close the drawer unless all DDICs are in a fully locked position or DDIC height can inhibit or completely prevent drawer access once you close it.

3. Complete the following actions to close a drawer:
 - a. Press and hold the safety lock latches with the blue touchpoint at the front of both extended drawer slide rails.

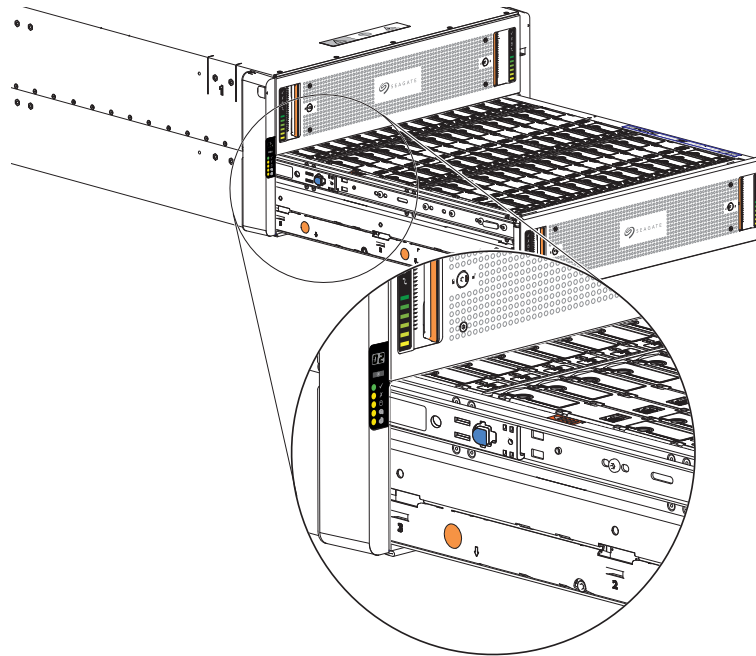


Figure 29 Safety lock to release left drawer slide rail (lower drawer used for relational clarity)

- b. Pressing simultaneously inward, begin sliding the drawer back into place until the safety lock clears the opening.
 - c. Placing the heels of both palms against the face of the drawer near the anti-tamper locks, exert even inward pressure until the drawer is almost flush with the rack ear flanges.
 - d. Simultaneously press inward and hold both drawer pull handles as you push Drawer 1 closed until it fully latches.
4. Open the lower drawer and repeat the above DDIC installation process.

5. Following the same drawer closure process, completely close the drawer until it fully latches.

Test enclosure connections

After completion of all installation procedures, the storage enclosure is ready for connection to power. You can only connect the storage enclosure to a power source that has a safety electrical earth connection. Have a qualified electrical engineer confirm the earth connection meets the product specifications.

⚠ CAUTION If you install multiple storage enclosures in a rack cabinet, the importance of the earth connection increases, since each storage enclosure increases earth leakage current.

ⓘ IMPORTANT Only a qualified electrical engineer who meets local and national standards should perform the inspection.

Route 5U enclosure power cords and data cables

When properly connected to autonomous power distribution units (PDUs), power cords provide uninterrupted power to the storage enclosure. Data cables provide an efficient highway for data exchanges to and from the storage enclosure. You must properly route both while adhering to all grounding requirements and electrical safety precautions.

To adhere to electrical safety precautions:

1. Observe the caution labels affixed to the power supply units (PSUs).
2. Confirm PCM input voltage range is 100-240VAC at 50 to 60Hz, then only operate the storage enclosure in that range.
3. You must provide a suitable power source with electrical overload protection to meet technical specification requirements.
4. You must use a provided power cord that has a tested, safe electrical earth connection for storage enclosure power supply.
5. Confirm the storage enclosure connection to earth before applying power to it.
6. Do not operate a storage enclosure with less than the provided 2 PSUs and 5 fan control modules (FCMs, other than to provide in-service maintenance within the required time allotment.

ⓘ IMPORTANT Use only Seagate approved HD mini-SAS (SFF-8644) x4 data cables that are at least .5m (1.64 ft) in length and do not exceed 3m (9.84 ft) in length to connect to the SAS ports on each controller module.

Route 5U enclosure and expansion data cables

The 5U storage enclosure supports SAS cabling for up to 9 expansion enclosures and several methods for connectivity to a switch or the host system. Select data cables that best align with available controller module ports and your host environment.

Fault tolerance and performance are key factors in determining how to best optimize your system and cabling configuration. This topic assumes a fault-tolerant *reverse* cabling method, since it provides a method of maintaining access to all enclosures in the chain, even if one of the enclosures fails or requires removal. If you use a *straight-through* cabling method, optimized for high performance, it is less fault tolerant. When using straight-through cabling, a failed enclosure in the chain prevents access to enclosures further down the chain until you address the fault.

You must comply with all SAS cabling requirements and confirm that they meet all related standards.

⚠ CAUTION Do not create invalid closed loops anywhere along the SAS port cabling configuration. A valid cabling configuration is directional and does not contain any loops between components already in that cabling configuration. An invalid closed loop introduces a circular flow into the cabling configuration that can degrade performance or cause failure.

CAUTION Do not connect more than one cable to the 1Gb Ethernet port at a time. Connection to both can cause a serious data event and bring the network down.

To route 5U enclosure and expansion data cables:

1. Route data and management cables from the host system to the best available controller module port for your environment: either the SFP28 25/10Gb Ethernet ports or the 1Gb Ethernet ports.
2. Take the following actions to connect Controller OA to its related expansion modules. The example below has 3 expansion enclosures directly below the storage enclosure.

IMPORTANT Best practice is to use the expansion Port A for input and Port C for output.

- a. Connect two approved data cables from the host bus adaptor (HBA) or switch to the top controller, Controller OA.
 - b. Insert a mini-SAS data cable into the left controller, Controller OA, then connect the other end to SAS port A in the first expansion enclosure, 1A.
 - c. Insert a mini-SAS data cable from SAS port C in the first expansion enclosure, 1A, and connect the other end to SAS port A in the second expansion enclosure, 2A.
 - d. Insert a mini-SAS data cable from SAS port C in the second expansion enclosure, 2A, and connect the other end to SAS port A in the third expansion enclosure, 3A.
3. Take the following actions to connect Controller OB to its related expansion modules.

IMPORTANT Best practice is to use the expansion Port A for input and Port C for output.

- a. Connect two approved data cables from the HBA or switch to the bottom controller, Controller OB.
- b. Insert a mini-SAS data cable into the right controller, Controller OB, and connect the other end to SAS port A in the third expansion enclosure, 3B.
- c. Insert a mini-SAS data cable from SAS port C in the third expansion enclosure, 3B, and connect the other end to SAS port A in the second expansion enclosure, 2B.
- d. Insert a mini-SAS data cable from SAS port C in the second expansion enclosure, 2B, and connect the other end to SAS port A in the first expansion enclosure, 1B.

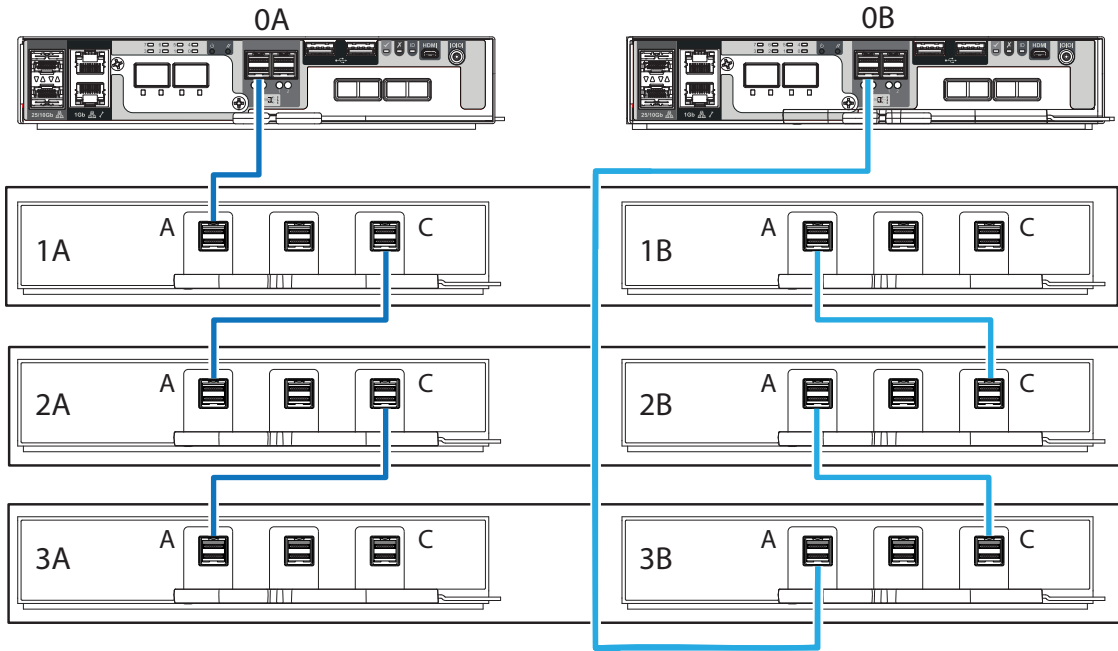


Figure 30 Sample reverse cabling method among 5U controller modules (CMs) and expansion modules

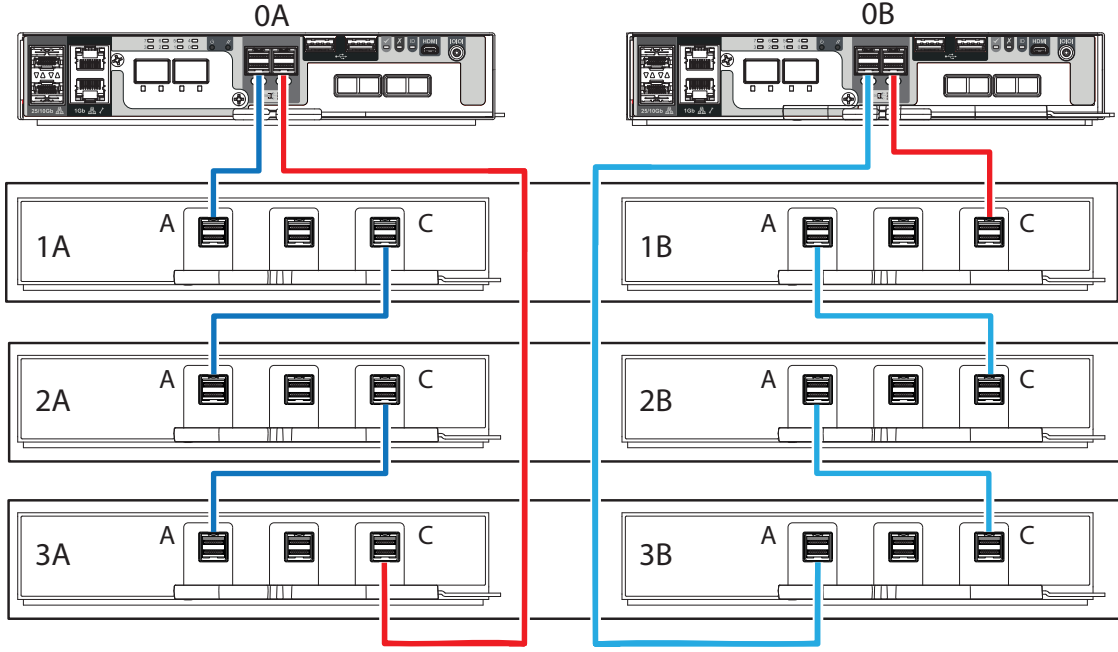


Figure 31 Sample invalid loop (in red) among 5U controller modules (CMs) and expansion modules

Route 5U enclosure power cords

This task provides direction to connect supplied power cords to the redundant power supply units (PSUs) connected to an uninterruptible power system. Only connect PDUs to a power source with a safety electrical earth connection.

CAUTION Use only power cords supplied in the installation kit or those that meet product specifications.

CAUTION Adhere to power source and power connection requirements to avoid harm to equipment.

- Only connect the power supply unit (PSU) to power sources that comply with product specifications and labels.
 - Always remove all power connections before you remove a PSU from the storage or expansion enclosure.
-

To route 5U enclosure power cords :

1. Select both power cords from the packaging and remove the cable ties.
2. Facing the rear of the rack cabinet, connect a power cord connector to each PSU.
3. Route the left power cord below the left outermost fan and connect the plug to an outlet on an independent power distribution unit (PDU), allowing a minimum of slack.
4. Route the right power cord below the right outermost fan and connect the plug to an outlet on an independent PDU, allowing a minimum of slack.

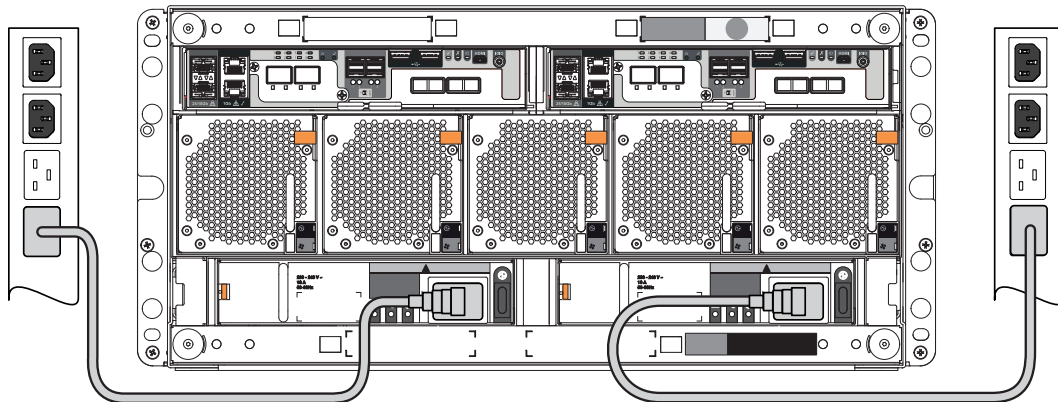



Figure 32 5U power cord routing to independent power distribution units

5. Secure each power cord, using the built-in secure ties on the PSU.
6. Proceed with routing data cables in the next tasks, leaving the power on sequence until after you complete all other cabling tasks and are fully ready to test your connections.

6 Operation of 2U enclosures

 **CAUTION** Only operate the storage enclosure in a dust-free environment to meet temperature control and airflow requirements.

Before you power on the storage enclosure, you must take the following actions:


1. Review the installation checklist, confirming the successful completion of the entire sequence.
2. Verify that all drive modules in their carriers (DDICs) are in the correct slots and that you properly engaged them by pressing firmly until each one locked into place on its midplane.
3. Confirm you have met ambient temperature requirements identified in the Environmental Reqs section.
4. Confirm that airflow paths at the front and rear of the enclosure chassis are clear and remain clear.
5. Proceed to the power on task.
6. Load the system OS and appropriate applications to the controller module (CM).
7. Access the software management interface to complete your system setup.

Apply power to the 2U enclosure

The storage enclosure relies on main power provided through separate, independent power distribution. If you lose main power for any reason, the storage enclosure automatically restarts after power restoration.


 **CAUTION** Adhere to the following electrical safety guidelines:

- During installation, never connect a power cord to a power supply unit (PSU) or power cooling module (PCM) before installing it in the appropriate storage enclosure slot.
 - Only connect the power cord to power that complies with the product specifications within the specified range, per the hazardous voltage warning label on the PSU or PCM.
 - During service, always remove the PSU or PCM from power before removing the PCM.
-

 **IMPORTANT** Only after you successfully complete the installation checklist can you complete system setup and begin operation of the storage enclosure.

To apply power to the 2U enclosure:

1. If you removed power to repair the storage enclosure, begin by facing the rear of the rack cabinet and connect the plug for each of the power to an independent power distribution unit (PDU). The second power cooling module (PCM) provides the first PCM with redundant power.

 **IMPORTANT** The storage enclosure design requires two redundant power cooling modules (PCMs). You must plug each power cord into an independent power distribution unit (PDU) that connects to an uninterruptible power system.

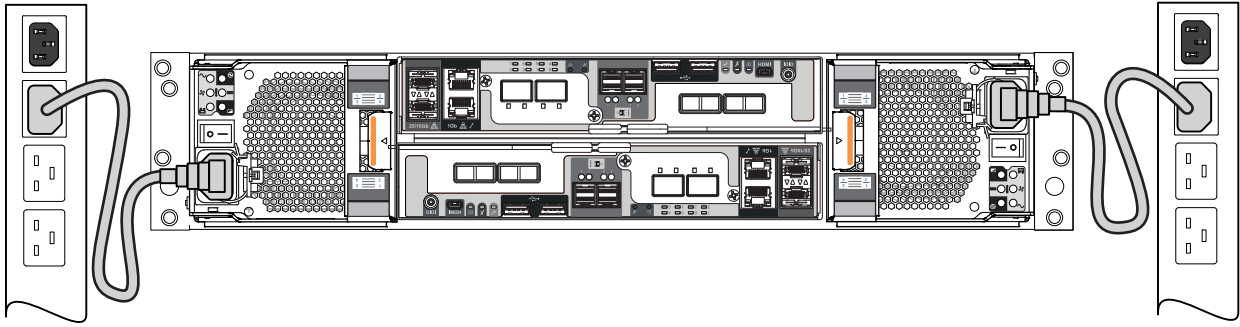


Figure 33 Route power cords to redundant PDUs

2. Press the power switch to the ON position for each PCM.
3. Facing the front, observe the LEDs on the front panel area and confirm the *Power On* LED is in a steady green state. If it is flashing amber, proceed to "[Hardware installation and basic configuration issues](#)" on page 87.

Remove power from the 2U enclosure

The storage enclosure relies on main power provided through separate, independent power distribution. If you lose main power for any reason, the storage enclosure automatically restarts after power restoration.

You must quiesce all data exchange before removing power to the storage enclosure.

To remove power from the 2U enclosure:

CAUTION Never remove power from a redundant power cooling module (PCM) when the other PCM has a fault condition, indicated by an amber LED.

1. After you complete the proper shut down of the application and when you are ready to power down the storage enclosure, press the power switch to the OFF position for each PCM.
2. Disconnect each power connector from its PCM socket or from the PDU.
3. You must wait a minimum of 15 seconds before power cycling the PCM and a minimum of 30 seconds after successful completion of the power on sequence before you attempt to place the PCM in standby or remove power again.

Set the unit identification number

The storage enclosure does not provide a default unit identification (UID) number during initial installation and setup. The enclosure management software contained in the controller module (CM) controls how the system uses the UID. For the first power on, the operator's (ops) panel flashes the numeric 00 and the storage enclosure continues its power on sequence, even though it does not have a valid UID. Valid values are 00–99.

Once you set a UID for the storage enclosure, the enclosure management software stores that value in the midplane Vital Product Data (VPD) and remains there through power cycles. In instances where the enclosure management software cannot read the VPD, the storage enclosure displays the numeric 00.

If you configure the UID for other purposes, set the value using alternate software methods, rather than the following method.

To set the unit identification number (UID):

1. Press and hold the ops panel input switch above the *Power on* LED for 5 seconds until the left digit flashes.
2. Increment the number with each subsequent press of the input switch until you reach the desired value for that digit.

3. Press and hold the input switch for 5 seconds until the right digit flashes.
4. Increment the number with each subsequent press of the input switch until you reach the desired value for that digit.
5. Press and hold the input switch for 5 seconds to set the UID to the values on the display.
6. (Optional) To clear the UID back to the reserved value of 00, press and hold the input switch for 5 seconds.

To assist in locating the storage enclosure, particularly in a large data center, you can configure the UID as a unit location identifier (ULI). To set the UID as a ULI, press the input button or issue a `Locate` command with one of the following enclosure management software options:

- The command line interface (CLI)
- A Redfish command
- A SCSI enclosure services (SES) command
- An IPMI command

To distinguish the UID is configured as a ULI, the value flashes to indicate it is configured as a ULI. To cancel its status as a ULI, issue a second `Locate` command or press the input switch.

In models with an alternate ops panel, a flashing blue LED indicates it is configured as a ULI.

Interpret system LEDs

Visual cues provide you with the means to monitor the storage enclosure and its components and reinforce software messages about system health. Use LEDs throughout the storage enclosure to determine if there is a critical fault.

The storage enclosure registers the following states using the identified LED colors.

1. **Green or unlit LED:** Indicates a module is functioning normally
2. **Flashing green or amber LED:** Indicates a non-critical condition
3. **Amber LED:** Indicates a critical fault
4. **Blue LED:** Indicates system component identification, so is not a fault or critical condition

Since an amber fault LED uses fast or slow flashes to cover multiple conditions, this is the priority for simultaneous indications:

Table 3 Fault LED prioritization

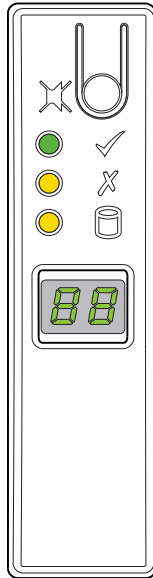
Priority	Flash rate	Indication	Description
Top priority	Fast flash (1s on, 1s off)	Identify	Locate the enclosure or module
Priority 2	On	Fault	Fault condition detected
Priority 3	Slow flash (3s on, 1s off)	Logical or non-critical fault	Logical fault or non-critical notification
Lowest priority	Off	No indication	System functioning normally

The front panel area, controller module, and expansion module LEDs require further elaboration.

Interpret 2U12 and 2U24 operator's panel LEDs

The storage enclosure operator's (ops) panel contains a series of LEDs to reflect system status. You can monitor the ops panel LEDs to determine system status in combination with the user interface content. Some systems have an ops panel with a logical fault symbol, while others have an ops panel with a unit identification number symbol. The LEDs behave differently, so use the proper graphic and table for your storage enclosure.

In the case of a system fault condition, identified in the state column with an asterisk (*), troubleshoot the fault. See the baseboard management controller (BMC) system event log (SEL) for detailed information.







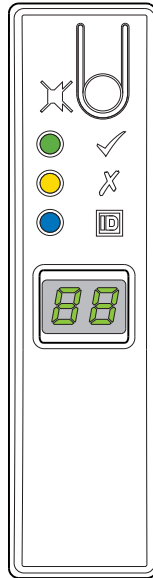
LED	Type	Color	State	Status
	Power on or standby	Green	On	Storage enclosure power is on
			Flashing	Storage enclosure in standby, coming online
			Off	Storage enclosure power off
	Module fault	Amber	On*	Storage enclosure hardware module fault
			Flashing*	Vital product data (VPD) configuration error or 1°C bus failure
			Off	Storage enclosure hardware modules functioning properly
	Logical fault	Amber	On*	Storage enclosure logical fault
			Off	Storage enclosure functioning properly
	LED display	Green	On	Unit identification (UID) of storage enclosure
			Flashing	SCSI enclosure services (SES) controlled UID, based on input switch press or enclosure management software <code>Locate</code> command

Figure 34 2U12 and 2U24 operator's panel LEDs with logical fault option



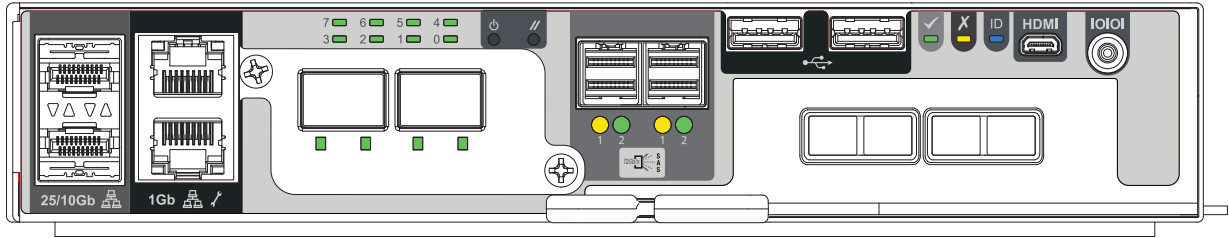
LED	Type	Color	State	Status
	Power on or standby	Green	On	Storage enclosure power is on
			Off	Storage enclosure power off
	Module fault	Amber	On*	Storage enclosure drive module fault, when paired with drive fault LED
			Off	Storage enclosure functioning properly
	Unit ID (UID)	Blue	Flashing	Storage enclosure unit identification (UID) request active
			Off	No UID request is active
	LED display	Green	On	Unit identification value for storage enclosure




Figure 35 2U12 and 2U24 operator's panel LEDs with UID option

Interpret controller module LEDs

Both redundant controller modules (CMs) use a series of LEDs to reflect host connectivity status. Monitor the LEDs from the rear panel area to determine system status in combination with the user interface content.

In the case of a fault condition, identified in the state column with an asterisk (*), troubleshoot the fault and take appropriate corrective action. See the baseboard management controller (BMC) system event log (SEL) for detailed information.


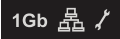



LED	Type	Color	State	Status
7, 6, 5, and 4	BIOS POST LEDs ¹	Green	On	POST in progress, reflects most significant nibble of status hex code
3, 2, 1, and 0			Off	POST in progress, reflects least significant nibble of status hex code
All			Off	POST successfully complete
	Hardware status	Green	Off	CM power is off or no power supply
			Fast flash (4x/s)	Part of sequence as BMC comes online
			Slow flash (2x/s)	Part of sequence, BMC functioning properly
			On	CM functioning properly, in a ready state
	Hardware fault	Amber	On*	CM hardware fault
			Flashing	Part of sequence as CM comes online, indicates power supply failure during power on
			Off	CM functioning properly
	Unit ID	Blue	Flashing*	During initial power on, power fault
			On	During normal operation, unit identification (UID) active
			Off	Normal state, no query for UID active

¹ If a controller hangs in a BIOS POST state for ≥ 2 minutes, reset or power down and try again. If the condition persists, contact Technical Support.

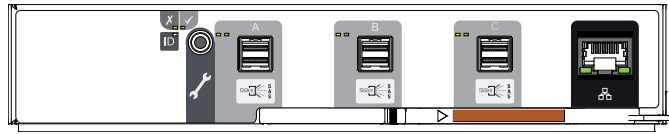
Figure 36 Controller module LEDs, shown with OCP and PCIe optional cards

Additional LEDs on the CM relate to host connectivity.

LED	Type	Color	State	Status
	SFP28 25Gb Ethernet link activity	Green	On	Link is up
			Flashing	Link activity
			Off	Link is down
	SFP28 25Gb Ethernet network speed	Amber	On	10 Gb link speed
	Green	On	25 Gb link speed	
	1Gb Ethernet link activity, left LED	Green	On	Connection link is up
			Flashing	Connection link is active
			Off	Connection link is down
	1Gb Ethernet network speed, right LED	Green	On	1 Gb/s connection speed
		Off	100Mb/s or 10Mb/s connection speed	
	SAS expansion port	Green	On	Connected, link is up
			Off	Not connected or link is down
		Amber	On*	Critical SAS cable fault
			Fast flash (1s on, 1s off)	SAS Unit identification (UID) active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
Off	SAS expansion port functioning properly			

Interpret SAS 12Gb expansion module LEDs

Expansion modules (EMs) in an expansion enclosure provide optional added storage. Expansion module LEDs are similar in function to controller module (CM) LEDs, reflecting host connectivity status and EM fault conditions.



LED	Type	Color	State	Status
	Module fault	Amber	On*	Ops panel undergoing 5s test
			Flashing*	Rear panel area fault: CM, fan, PSU, when paired with CM fault LED
				Drive module hardware fault, paired with drive module fault LED
			Off	Rear panel area modules functioning properly
	Power on or standby	Green	On	EM power is on
		Amber	On	Part of standby sequence as EM comes online
		None	Off	EM power is off
	Unit identification (UID)	White	On	EM UID active to locate or identify for service activity
			Off	EM UID not active
	SAS port	Green	On	Connected, link is up
			Off	Not connected or link is down
		Amber	On*	Critical SAS cable fault
			Fast flash (1s on, 1s off)	SAS UID active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
Off	SAS expansion port functioning properly			
	Ethernet port	Green	On	Connected, link is up
			Off	Not connected or link is down

Figure 37 SAS 12Gb expansion module LEDs

7 Operation of 5U enclosures

CAUTION Only operate the storage enclosure in a dust-free environment to meet temperature control and airflow requirements.

CAUTION If you partially populate the storage enclosure with drives in their carriers (DDICs), you must comply with several additional requirements.

- You must install a minimum of 14 DDICs. Populate in rows, 14 DDICs at a time, from front to back of the drawer, and alternate between drawers.
 - a. Fill the front row in Drawer 1, then front row in Drawer 2.
 - b. Fill the middle row in Drawer 1, then the middle row in Drawer 2.
 - c. Fill the back row in Drawer 1, then the back row in Drawer 2.The total number of populated drawer rows cannot differ by more than 1 row.
 - Populate rows with DDICs that have the same form factor and same rotational speed.
 - Do not mix drive types within the same drawer.
-

Before you power on the storage enclosure, you must take the following actions:

1. Review the installation checklist, confirming the successful completion of the entire sequence.
2. Verify that all drive modules in their carriers (DDICs) are in their correct slots, that you install them in sets of 14, and that you properly engaged them by pressing firmly until each one locks into place on its midplane.
3. Confirm you have met ambient temperature requirements identified in the Environmental Reqs section.
4. Confirm that airflow paths at the front and rear of the enclosure chassis are clear and remain clear.
5. Proceed to the power on task.
6. Load the system OS and appropriate applications to the controller module (CM).
7. Access the software management interface to complete your system setup.

Apply power to the 5U enclosure

The storage enclosure relies on main power provided through separate, independent power distribution. If you lose main power for any reason, the storage enclosure automatically restarts after power restoration.

CAUTION Adhere to the following electrical safety guidelines:

- During installation, never connect a power cord to a power supply unit (PSU) before installing it in the appropriate storage enclosure slot.
 - Only connect the power cord to power that complies with the product specifications within a range of 200 to 240VAC, per the hazardous voltage warning label on the PSU.
 - During service, always remove the PSU from power by disconnecting the power connector before removal of the PSU.
-

! **IMPORTANT** Only after you successfully complete the installation checklist can you complete system setup and begin operation of the storage enclosure.

To apply power to the 5U enclosure:

1. If you removed power to repair the storage enclosure, begin by facing the rear of the rack cabinet and connect the plug for each of the power to an independent power distribution unit (PDU). The second power supply unit (PSU) provides the first PSU with redundant power.

! **IMPORTANT** The storage enclosure design requires two redundant power supply units (PSUs). You must plug each power cord into an independent power distribution unit (PDU) that connects to an uninterruptible power system.

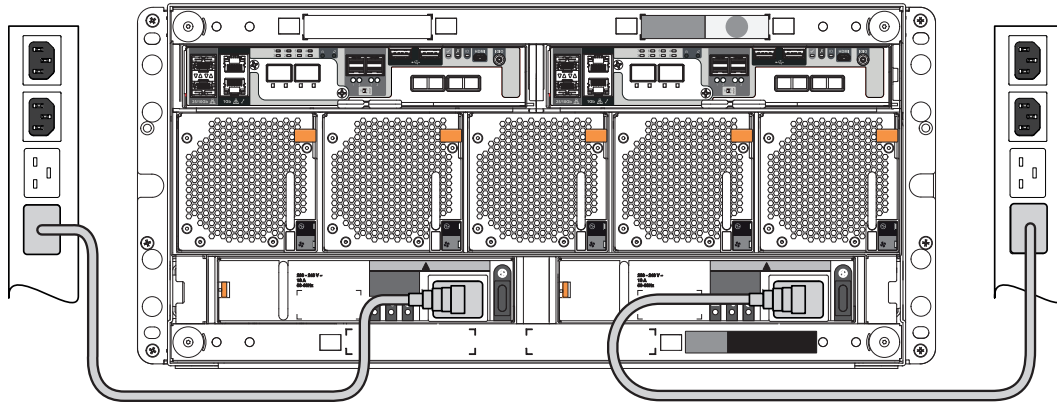


Figure 38 Route 5U power cords to redundant PDUs

2. Press the power switch to the ON position for each power supply unit (PSU).
3. Facing the front, observe the LEDs on the front panel area and confirm the *Power On* LED is in a steady green state. If it is flashing amber, proceed to ["Hardware installation and basic configuration issues"](#) on page 87.

Remove power from the 5U enclosure

The storage enclosure relies on main power provided through separate, independent power distribution. If you lose main power for any reason, the storage enclosure automatically restarts after power restoration.

You must quiesce all data exchange before removing power to the storage enclosure.

To remove power from the 5U enclosure:

△ CAUTION Never remove power from a redundant power supply unit (PSU) when the other PSU has a fault condition, indicated by an amber LED.

1. After you complete the proper shut down of the application and when you are ready to power down the storage enclosure, press the power switch to the OFF position for each PSU.
2. Disconnect each power connector from its PSU socket or from the PDU.
3. You must wait a minimum of 15 seconds before power cycling the PSU and a minimum of 30 seconds after successful completion of the power on sequence before you attempt to place the PSU in standby or remove power again.

Set the unit identification number

The storage enclosure does not provide a default unit identification (UID) number during initial installation and setup. The enclosure management software contained in the controller module (CM) controls how the system uses the UID. For the first power on, the operator's (ops) panel flashes the numeric 00 and the storage enclosure continues its power on sequence, even though it does not have a valid UID. Valid values are 00–99.

Once you set a UID for the storage enclosure, the enclosure management software stores that value in the midplane Vital Product Data (VPD) and remains there through power cycles. In instances where the enclosure management software cannot read the VPD, the storage enclosure displays the numeric 00.

If you configure the UID for other purposes, set the value using alternate software methods, rather than the following method.

To set the unit identification number (UID):

1. Press and hold the ops panel input switch above the *Power on* LED for 5 seconds until the left digit flashes.
2. Increment the number with each subsequent press of the input switch until you reach the desired value for that digit.
3. Press and hold the input switch for 5 seconds until the right digit flashes.
4. Increment the number with each subsequent press of the input switch until you reach the desired value for that digit.
5. Press and hold the input switch for 5 seconds to set the UID to the values on the display.
6. (Optional) To clear the UID back to the reserved value of 00, press and hold the input switch for 5 seconds.

To assist in locating the storage enclosure, particularly in a large data center, you can configure the UID as a unit location identifier (ULI). To set the UID as a ULI, press the input button or issue a `Locate` command with one of the following enclosure management software options:

- The command line interface (CLI)
- A Redfish command
- A SCSI enclosure services (SES) command
- An IPMI command

To distinguish the UID is configured as a ULI, the value flashes to indicate it is configured as a ULI. To cancel its status as a ULI, issue a second `Locate` command or press the input switch.

In models with an alternate ops panel, a flashing blue LED indicates it is configured as a ULI.

Interpret system LEDs

Visual cues provide you with the means to monitor the storage enclosure and its components and reinforce software messages about system health. Use LEDs throughout the storage enclosure to determine if there is a critical fault.

The storage enclosure registers the following states using the identified LED colors.

1. **Green or unlit LED:** Indicates a module is functioning normally
2. **Flashing green or amber LED:** Indicates a non-critical condition
3. **Amber LED:** Indicates a critical fault
4. **Blue LED:** Indicates system component identification, so is not a fault or critical condition

Since an amber fault LED uses fast or slow flashes to cover multiple conditions, this is the priority for simultaneous indications:

Table 4 Fault LED prioritization

Priority	Flash rate	Indication	Description
Top priority	Fast flash (1s on, 1s off)	Identify	Locate the enclosure or module
Priority 2	On	Fault	Fault condition detected

Table 4 Fault LED prioritization (continued)

Priority	Flash rate	Indication	Description
Priority 3	Slow flash (3s on, 1s off)	Logical or non-critical fault	Logical fault or non-critical notification
Lowest priority	Off	No indication	System functioning normally

The front panel area, controller module, and expansion module LEDs require further elaboration.

Interpret 5U enclosure operator's panel LEDs

The storage enclosure operator's (ops) panel contains a series of LEDs to reflect system status. You can monitor the ops panel LEDs to determine system status in combination with the user interface content.

In the case of a system fault condition, identified in the state column with an asterisk (*), troubleshoot the fault.



LED	Type	Color	State	Status
02	Unit ID	Green	On	Unit identification (UID) of storage enclosure (0-99)
			Flashing (1s on, 1s off)	SCSI enclosure services (SES) controlled UID or locate active
✓	Power on or standby	Green	On	Storage enclosure power is on
		Amber	On	Storage enclosure has AC power and is on standby as enclosure comes online
		None	Off	Storage enclosure AC power is off
X	Module fault	Amber	On*	Ops panel completing 5s test
				Module fault in rear panel area, when paired with module fault LED
				Drive fault, when paired with drive fault LED
			Flashing*	Unknown, invalid, or mixed module types, such as mixed drive modules or PSUs
Off	Vital product data (VPD) configuration error or 1°C bus fault			
Cylinder icon	Logical status	Amber	On*	System component hardware fault: drive, cable, or fanout card
				System component hardware change of status
				Drive fault caused loss of redundancy
			Flashing*	System software reports an informational condition for the array, such as a rebuild operation, with corresponding drives registering a fault
Off	System component hardware functioning properly, no errors			
Cube icons	Drawer 1, Drawer 2 hardware fault	Amber	On*	Upper, lower drawer hardware fault: drive, cable, or fanout card
			Flashing (1s on, 1s off)	UID or locate active for Drawer 1, Drawer 2 sideplane or drive
			Off	Upper, lower drawer hardware functioning properly

Figure 39 5U84 operator's panel LEDs

Interpret drawer LED panels

Each storage enclosure drawer bezel contains 2 LED panels to reflect drawer status and activity, 1 for each sideplane. Each sideplane represents a data path within the drawer. You can monitor the drawer LED panels to determine drawer status in combination with the user interface content.

In the case of a fault condition, identified in the state column with an asterisk (*), troubleshoot the fault. If a fault exists on a single data path, only the related LED panel reports the fault, just as it would with a cable module, cable link, or drive faults.








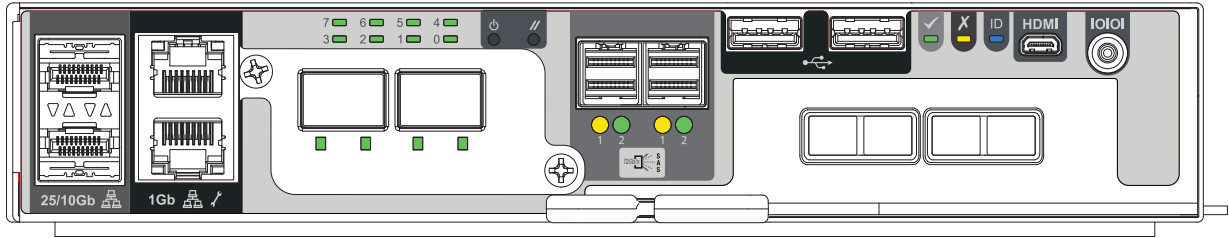
LED	Type	Color	State	Status
	Power and sideplane OK	Green	On	Drawer power on and sideplane hardware functioning properly
			Off	Power to drawer off
	Drawer module fault	Amber	On*	Drawer module fault condition that includes the CM, FCM, and PSU, when paired with a module fault LED
			Flashing (1s on, 1s off)	Unit identification (UID) or locate active for drawer sideplane or drive
			Off	Drawer modules functioning properly
	Logical status	Amber	On*	Drive hardware fault condition
			Flashing* (3s on, 1s off)	One or more arrays impacted by drive hardware fault conditions
			Off	Drive module hardware functioning properly
	Drawer cable fault	Amber	On*	Cable between rear panel area and drawer fault condition
			Off	Cables functioning properly
	Drawer data activity bar	Green	Flashing (1s on, 1s off)	Segments reflect amount of data activity: greater numbers of segments reflect greater data activity
			Off	No data activity

Figure 40 5U84 drawer LED panel

Interpret controller module LEDs

Both redundant controller modules (CMs) use a series of LEDs to reflect host connectivity status. Monitor the LEDs from the rear panel area to determine system status in combination with the user interface content.

In the case of a fault condition, identified in the state column with an asterisk (*), troubleshoot the fault and take appropriate corrective action. See the baseboard management controller (BMC) system event log (SEL) for detailed information.



LED	Type	Color	State	Status
7, 6, 5, and 4	BIOS POST LEDs ¹	Green	On	POST in progress, reflects most significant nibble of status hex code
3, 2, 1, and 0			Off	POST in progress, reflects least significant nibble of status hex code
All			Off	POST successfully complete
	Hardware status	Green	Off	CM power is off or no power supply
			Fast flash (4x/s)	Part of sequence as BMC comes online
			Slow flash (2x/s)	Part of sequence, BMC functioning properly
			On	CM functioning properly, in a ready state
	Hardware fault	Amber	On*	CM hardware fault
			Flashing	Part of sequence as CM comes online, indicates power supply failure during power on
			Off	CM functioning properly
	Unit ID	Blue	Flashing*	During initial power on, power fault
			On	During normal operation, unit identification (UID) active
			Off	Normal state, no query for UID active

¹ If a controller hangs in a BIOS POST state for ≥ 2 minutes, reset or power down and try again. If the condition persists, contact Technical Support.

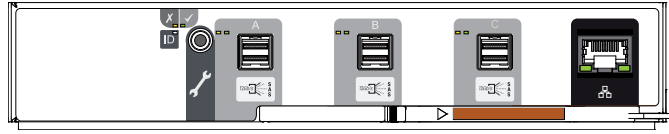
Figure 41 Controller module LEDs, shown with OCP and PCIe optional cards

Additional LEDs on the CM relate to host connectivity.

LED	Type	Color	State	Status
	SFP28 25Gb Ethernet link activity	Green	On	Link is up
			Flashing	Link activity
			Off	Link is down
	SFP28 25Gb Ethernet network speed	Amber	On	10 Gb link speed
	Green	On	25 Gb link speed	
	1Gb Ethernet link activity, left LED	Green	On	Connection link is up
			Flashing	Connection link is active
			Off	Connection link is down
	1Gb Ethernet network speed, right LED	Green	On	1 Gb/s connection speed
	Off	Off	100Mb/s or 10Mb/s connection speed	
	SAS expansion port	Green	On	Connected, link is up
			Off	Not connected or link is down
		Amber	On*	Critical SAS cable fault
			Fast flash (1s on, 1s off)	SAS Unit identification (UID) active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
Off	SAS expansion port functioning properly			

Interpret SAS 12Gb expansion module LEDs

Expansion modules (EMs) in an expansion enclosure provide optional added storage. Expansion module LEDs are similar in function to controller module (CM) LEDs, reflecting host connectivity status and EM fault conditions.



LED	Type	Color	State	Status	
	Module fault	Amber	On*	Ops panel undergoing 5s test Rear panel area fault: CM, fan, PSU, when paired with CM fault LED Drive module hardware fault, paired with drive module fault LED	
			Flashing*	Unknown, invalid, or mixed module type Vital product data (VPD) configuration error or 1°C bus failure	
			Off	Rear panel area modules functioning properly	
	Power on or standby	Green	On	EM power is on	
		Amber	On	Part of standby sequence as EM comes online	
		None	Off	EM power is off	
	Unit identification (UID)	White	On	EM UID active to locate or identify for service activity	
			Off	EM UID not active	
	SAS port	Amber	Green	On	Connected, link is up
			Green	Off	Not connected or link is down
			On*	Critical SAS cable fault	
			Fast flash (1s on, 1s off)	SAS UID active	
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault	
Off	SAS expansion port functioning properly				
	Ethernet port	Green	On	Connected, link is up	
			Off	Not connected or link is down	

Figure 42 SAS 12Gb expansion module LEDs

8 System installation and configuration

The AP-BV-1 series requires the installation of an operating system (OS) on each controller module (CM). You can also optionally load other software and device drivers onto the OS to support your system configuration.

NOTE The Linux OS kernel must be version 4.18 or later.

Since this line of controller modules each contain a complete server, each requires the installation of an OS as part of the CM configuration. The CM controller configuration either includes OS installation at the time of manufacture or during post-manufacture integration, or you must install the OS at the time of initial system installation or CM FRU replacement. The interactive OS installation process is the same as installation to a server but is more complex because of the number of variables. The tasks required to complete an interactive OS installation to the CM involve the following sequence:

1. Access the system console through one of the specified methods. See ["System console access options"](#) below , ["Synchronize service passwords"](#) on the next page, and ["Obtain and set BMC IP addresses"](#) on page 65.

For additional information on the interface of your choice, see ["Use the BMC web-based management interface \(BMC WMI\)"](#) on page 66, ["Use console redirection "](#) on page 67, ["Use a Serial over LAN session"](#) on page 67, and ["Command-line interface usage"](#) on page 68.

2. Select the installation media boot method. See ["Select installation media boot method"](#) on page 71.
3. Pre-configure the BIOS to boot from the desired installation media type. See ["BIOS"](#) on page 72.
4. Reboot the CM to install the OS. See ["Install an operating system"](#) on page 74.

NOTE Automated installation of an OS is also possible. See your OS documentation for details.

System console access options

Select a method for accessing the controller module (CM), based on your own system requirements.

Table 5 Methods of access to controller module

Access type	Description	Mode	Hardware requirements
Local, physical console connection	Access to CM using a keyboard, video or monitor, and mouse	Text and graphics	<ul style="list-style-type: none">• USB keyboard• Micro-HDMI adapter• Computer monitor• (Optional) USB mouse• (Optional) USB hub to connect all three USB devices: keyboard, mouse, and the flash drive
Remote BMC IP console redirection (iKVM)	Access to CM using virtual keyboard, video or monitor, and mouse in web browser		<ul style="list-style-type: none">• BMC network access• BMC user credentials• Supported web browser
Remote serial over LAN (SOL)	Access to CM redirected serial port input and output to network	Text only	<ul style="list-style-type: none">• BMC network access• BMC user credentials• Supported <code>ipmitool</code> utility
Local serial port connection and a terminal emulator	Access to CM using serial port input and output		<ul style="list-style-type: none">• Serial cable• Terminal emulator• (Optional) USB-to-serial adapter

Select an interface that best fits your requirements to directly or remotely monitor and manage storage enclosure activity.

Table 6 Interface options

Method	Description
Command-line interface (CLI)*	Supports interactive and scripted commands
BMC web-based management interface (BMC WMI)*	Provides web-based GUI
Redfish-based API	Provides means to conduct Redfish operations
XML-based Application Programming Interface (API)	Provides means to conduct XML-based operations
*Access method discussed in the following content	

Synchronize service passwords

Factory power-on defaults exist for interface sign in access to the BMC WMI, IPMI over LAN, or Redfish. Initial sign in requires you to change factory default passwords. You can always reset passwords back to the factory default.

To synchronize service passwords:

1. Choose one of the following processes, based on the interface type and outcome:

Table 7 Power-on factory default password credentials

Type	IPMI account	Redfish account	Process
IPMI over LAN and BMC WMI	Account2: admin	Account4: admin	<ol style="list-style-type: none"> 1. For an existing IPMI admin account2, sign in with the IPMI username and password credential defaults, which synchronizes the Redfish account. <hr/> <p>NOTE Ignore the Redfish Administrator account1.</p> <ol style="list-style-type: none"> 2. To create a new IPMI account, which requires Redfish account permission, take one of the following actions: <ol style="list-style-type: none"> a. Sign in with the Redfish original Administrator account1. b. Change the IPMI admin account2 , which makes the Redfish account4 available.
Redfish	Account3: Administrator	Account1: Administrator	<ol style="list-style-type: none"> 1. For an existing Redfish Administrator account1, sign in with the Redfish username and password credential defaults, which synchronizes the IPMI account. 2. To create a new Redfish account, which requires IPMI account permission, take one of the following actions: <ol style="list-style-type: none"> a. Sign in with the IPMI original admin account2. b. Change the Redfish Administrator account1 , which makes the IPMI Administrator account3 available.
Both	Account2: admin Account3: Administrator	Account1: Administrator Account4: admin	<ol style="list-style-type: none"> 1. Sign in with the primary account username and password credentials. 2. Sign in with the secondary account username and password credentials.

2. To reset to factory defaults, choose one of the following actions:

- a. Issue an IPMI raw command.

```
ipmitool raw 0x32 0x66
```

- b. Issue a Redfish command.

```
POST /redfish/v1/Managers/Self/Oem/IpmiCommand/
```



```
{
  "netfn": "0x32",
  "command": "0x66"
}
```

Obtain and set BMC IP addresses

Baseboard management controller (BMC) IP addresses are either static or dynamic. The default is dynamic. To obtain BMC IP addresses, use one of three methods: through the BIOS, using IPMI, or the Dynamic Host Configuration Protocol (DHCP) allocation method.

- One BMC MAC address connects with the controller module (CM) on-board Ethernet switch. Depending on the VLAN configuration, access using the internal Ethernet adapter or one of the on-board RJ-45 ports.
- The other BMC MAC address connects with the CM on-board NCSI, a sideband LAN. The CM has an onboard NCSI MUX where the default is the onboard CX4, but you can switch it to the OCP card, if it is installed. A change to the NCSI MUX requires a BMC reset to reinitialize the NCSI if the BMC has already begun initialization.

! **IMPORTANT** The BMC IP address is different from the controller module server address.

Table 8 NCSI MAC address using an OCP card

Value	Description	MAC addresses
0	Switch to onboard NCSI	<ul style="list-style-type: none"> • 25Gb 0= CX4 MAC#1 + BMC MAC#2 (default)
1	Switch to OCP	<ul style="list-style-type: none"> • 25Gb 1= CX4 MAC#2 + BMC MAC#2 (failover when Port 0 is not linked)
2	Switch depends upon OCP present pin (GPIOB2)	

To obtain and set BMC IP addresses, use one of the identified methods.

Table 9 Methods to obtain and set BMC IP addresses

Method	Process
DHCP server method	<ol style="list-style-type: none"> Identify the IP address source for items related to Controller A or Controller B. Obtain the Parameter 04h data. Use the vendor MAC address of 00:50:CC. <p>NOTE If the primary boots with a DHCP-provided IP address, but experiences a power fail or loss of connection to the DHCP, it retains the IP address configuration, and retains its IP address as a static address until the DHCP server replaces the IP address.</p>
BIOS method	<ol style="list-style-type: none"> Connect to the controller module (CM) system console with an identified local access method. See "System console access options" on page 63. Boot the controller module to which you are connected, then repeatedly press Del or F2 to enter the BIOS. Navigate to Server Mgmt>BMC network configuration. <ul style="list-style-type: none"> • Use management port 1 to configure the BMC network on the 1GbE interface. • Use management port 2 to configure the BMC network on the NCSI 25GbE or OCP interface. Enter the related network details you want to change, such as: IP source, address, subnet mask, gateway address. Save the settings and then sign out.

Table 9 Methods to obtain and set BMC IP addresses (continued)

Method	Process
IPMI method	<p>a. Connect to the serial port and use a terminal emulator. See "System console access options" on page 63.</p> <p>b. Log on.</p> <p>c. To identify the IP address, issue the following commands:</p> <ul style="list-style-type: none"> • 1GbE: <code>ipmitool lan print 1</code> • 25GbE (or OCP): <code>ipmitool lan print 8</code> <p>d. To set the IP address, issue the following commands:</p> <ul style="list-style-type: none"> • <code>ipmitool lan set 1 access off ipmitool lan set 1 ipsrc static</code> • <code>ipmitool lan set 1 ipaddr <IP_Address> ipmitool lan set 1 netmask <Subnet></code> • <code>ipmitool lan set 1 defgw ipaddr <Gateway> ipmitool lan set 1 access on</code> <p>where:</p> <ul style="list-style-type: none"> <IP_Address> is the IP address to assign <Subnet> is the subnet mask <Gateway> is the default gateway <p>e. Verify that the new IP address is correct using <code>ipmitool lan print 1</code>.</p>

Use the BMC web-based management interface (BMC WMI)

The baseboard management control (BMC) chip contains a Java-based BMC web-based management interface (BMC WMI) from American Megatrends. The BMC WMI is system-agnostic and provides a method to configure and monitor the controller module (CM).

! **IMPORTANT** Access to the BMC WMI requires AC power, which boots the BMC operating system (OS). It does not require a functioning CM OS.

There are advantages to using a web browser to access the BMC GUI, with related widgets, depending on your own system.

To use the BMC web-based management interface :

1. Confirm you set the BMC IP addresses using BIOS SETUP.
2. Use one of the identified methods to connect to a controller module (CM) port.
3. Connect to the BMC, after obtaining the BMC IP addresses.
4. Enter <https://BMC IP> to log on to the BMC from your remote or local computer with your username and password credentials. See "Synchronize service passwords" on page 64. Factory defaults are:

Username: admin

Password: admin

NOTE If this is a first-time install, you must configure yourself as a user and add your password at the login screen.

5. Select a menu option from the menu. The default selection is the dashboard, which contains any widgets with active data from the system.

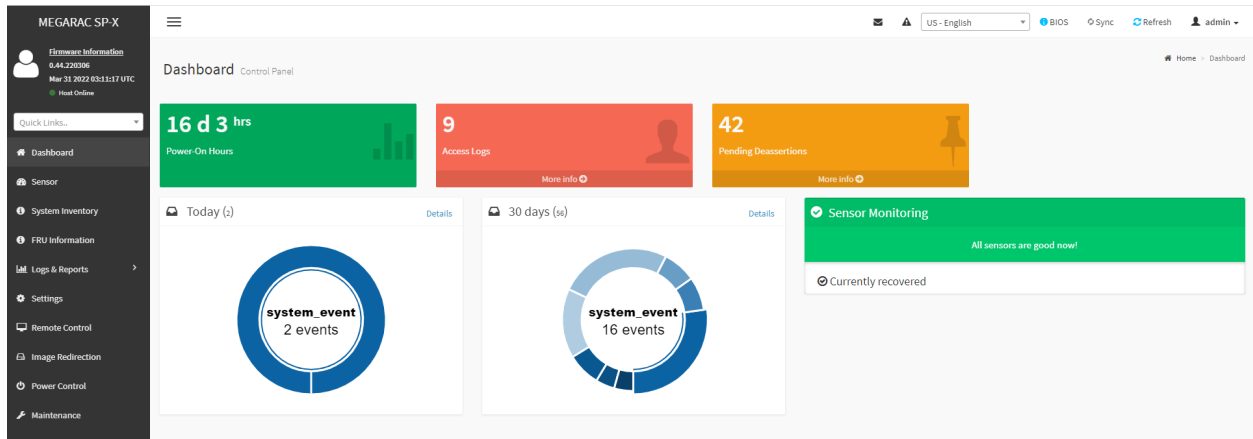


Figure 43 Default BMC WMI dashboard

Use the online help to determine how to use the pages that are most helpful for your situation.

Table 10 BMC WMI menu options

Menu option	Description
Dashboard	Default control panel contains active system widgets and provides x86 subsystem status
Sensor	Contains the latest sensor detail readings organized by type and status
System inventory	Contains a set of tabbed pages, each with a list of system items with related serial number, states, LED state, and unit identification (UID) data: System, processor, memory controller, baseboard, power, thermal, PCIe device, PCIe function, and storage
	NOTE The BMC cannot access SAS expanders to obtain inventory data.
FRU Information	Contains a list of FRUs with related chassis, board, and product information
Logs & Reports	Contains system logs, such as the IPMI event log, the system log, the audit log, and the video log
Settings	Provides access to configure BMC options, such as date and time, log and network settings, and user management
Remote Control	Contains console redirection (iKVM) screens for H5Viewer and JViewer
Image Redirection	Contains options for managing local and remote media, such as images or videos
Power Control	Contains current host power state data and power action options for both CMs
Maintenance	Contains system configuration options, such as firmware update, system administrator, and BMC recovery options
Sign Out	Provides users with dialog to confirm or cancel WMI exit

Use console redirection

The USB and HDMI ports support console redirection with a keyboard, video, and mouse (iKVM) connection.

To use console redirection:

1. Use one or both ports, depending on your hardware configuration, to connect to the controller module (CM) ports.
2. Depending on the system state, access the BIOS, boot menu, or installed operating system (OS).
3. After completing a task or set of tasks, disconnect from the CM hardware.

Use a Serial over LAN session

Serial over LAN (SOL) access provides for remote access to the controller module (CM) and its installed operating system (OS). Particularly useful is the access to the BIOS POST and early OS boot stages.

! **IMPORTANT** During any SOL session, the serial port is disabled, so is not viable for SOL access for the duration of the session.

To use a serial over LAN session:

1. Configure the OS to send output to the serial port.
2. Start a SOL session with IPMI, using the `sol activate` command.

```
ipmitool -I lanplus -H <BMC_IP> -U <Username> -P <Password> sol activate
```

where:

<BMC BMC_IP> is the hostname or dotted decimal IP address (n.n.n.n) of the BMC

<Username> is the username of a valid user on the BMC, with admin as the default

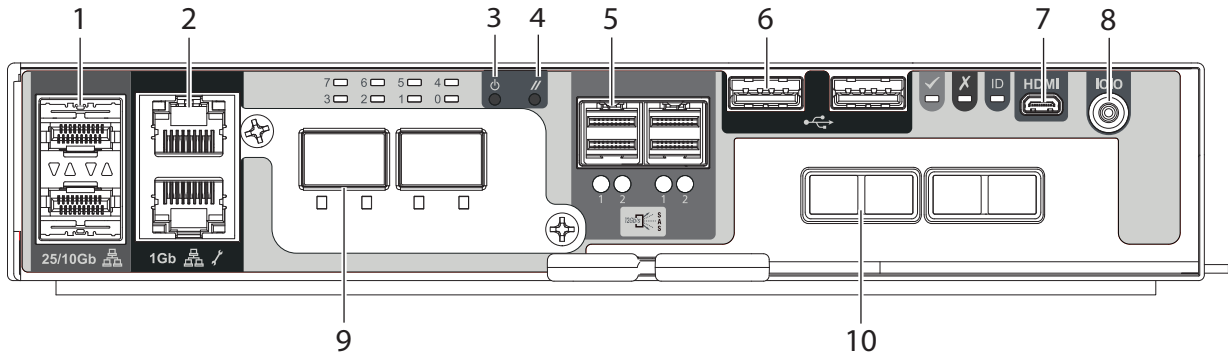
<Password> is the user password, with admin as the default

3. (Optional) Simultaneously press `~` and `?` to access online help for the SOL session.
4. Simultaneously press `~` and `.` to end the SOL session.

Command-line interface usage

One of the simplest methods of monitoring and managing activities performed by the storage enclosure system is to use the command-line interface (CLI) embedded in each . There are two primary access methods:

- Direct connection to the serial port of the using a terminal emulator installed on a management host
- Remote connection to a secure LAN using either SSH or HTTPS



Item	Icon	Type	Description
1		Port: SFP28	Supports 25 or 10 Gb/s Ethernet data exchanges
2		Port: RJ-45	Supports 1 Gb/s Ethernet 1000/100/10 Base-T data exchanges
3		Button: Power on	Provides power to CM
4		Button: Reset	Provides soft reset to CM
5		Port: Mini-SAS	Supports 12 GB/s data exchanges
6		Port: USB 3.0	Provides access for uploads and downloads
7		Port: uHDMI	Supports video access for monitoring streams from the AST2500 BMC chip
8		Port: RS-232, 3.5mm	Supports COM1 maintenance functions, reserved for Seagate use
9	N/A	Port: OCP 2.0	(Optional) Provides Mezzanine Interface Module (MIM) connection at 16GT/s
10	N/A	Port: PCIe	(Optional) Provides inter-controller connection at 16GT/s

Figure 44 AP controller module ports and buttons, assuming non-inverted orientation

All setup and configuration tasks identified in this section assume you have a direct connection between the management host and the controller using the supplied or a tested, good serial cable. The connection you establish is an out-of-band connection, since it does not use a data path to transfer information between the controller and the management host.

The host computer or server can be either Linux- or Windows-based. Certain operating systems require a special mode of operation or the installation of a device driver.

Configure the management host for serial communication

After you successfully connect the serial cable to the controller module (CM), the next step is to establish communication between the management host and the CM.

NOTE This topic assumes a USB-to-serial adapter connected to the CM with a supported serial console cable.

Once you successfully install and run a supported terminal emulator, the controller presents a single serial port that uses the related USB vendor identification (ID) and product ID hex codes.

Table 11 Supported terminal emulator applications

Operating system	Supported application
Microsoft Windows (all versions)	HyperTerminal, TeraTerm, PuTTY
Linux (all versions)	Minicom

Configure Linux for serial communication

If you do not have a terminal emulator, such as Minicom, you must obtain one prior to completion of this task.

To configure Linux for serial communication:

1. Determine if the operating system recognizes the USB (ACM) device by entering a command:

```
cat /proc/devices |grep -iE "ttyUSB|ttyACM"  
ls -l /dev/ttyUSB*  
ls -l /dev/ttyACM*
```

If the OS discovers a device driver, it responds with the device number followed by `ttyACM`, for example:

```
116 ttyACM  
/dev/ttyUSB0  
/dev/ttyUSB1
```

2. To query the system about USB buses and the devices connected to them, use the list USB command:

```
lsusb
```

If the OS discovers a USB device driver, it responds with the single serial port using the USB parameter hex codes, for example:

```
ID 210c:a4a7
```

This confirms that the appropriate USB (ACM) device is visible to the management computer.

3. Invoke Minicom to configure it.

```
minicom -s
```

4. Select `Serial Port Setup` from the menu.
5. Select the parameter setting you want to change at the prompt by typing the related setting letter (A-G).

Table 12 Sample Linux Minicom serial port parameter settings

Setting	Description	Parameter settings
A	Serial device	/dev/ttyACM0, /dev/ttyUSB0, /dev/ttyUSB1
B	Lockfile location	/var/lock
C	Callin program	
D	Callout program	
E	Bps/Par/Bits	11520 8N1
F	Hardware flow control	No
G	Software flow control	No

6. Press the ESC key to shift from the parameters to the configuration menu.

7. Select `Save setup as dfl` to save the parameter settings to default.
8. Select `Exit` from `Minicom`.

Configure Windows for serial communication

Use the terminal emulator to launch the device driver window and directly communicate with each controller module, after meeting the following prerequisites:

- An installed and tested terminal emulator.
- An installed and tested Windows USB device driver to connect to the USB-to-serial adapter, by using the native USB serial driver for Windows 10/Server 2016 or higher.

To configure Windows for serial communication:

1. Start and configure the terminal emulator, using the specified settings.

Table 13 Terminal emulator port connection settings

Parameter	Value	Parameter	Value
Connector	COM3 ¹	Parity	None
Baud rate	115,200	Stop bits	1
Data bits	8	Flow control	None

¹ Your configuration determines the COM port used for USB connection. Verify you have the correct COM port.

2. In the terminal emulator, right-click on the connected and identified COM port and select **Enable**.

NOTE You must change the Flow Control selection to NONE when using Windows 10/Server 2016 with PuTTY. Then you can open the COM port.

3. For a connection that stops responding, take the following corrective actions:
 - a. Validate the terminal emulator configuration is correct and you selected the correct COM port.
 - b. Quit the terminal emulator program.
 - c. In the Windows Device Manager window, right-click on the problem COM port and select **Disable**.
 - d. Confirm the COM port disabled status.
 - e. Right-click on COM port you just disabled and select **Enable** to re-enable it.
 - f. Start the terminal emulator program again and connect to the COM port, then validate the port settings again.

Select installation media boot method

The controller module (CM) supports several options to boot ISO or disk image installation media. You must configure the identified CM BIOS Settings.

- Default UEFI boot or legacy boot
- Boot options

NOTE If your OS requires a legacy boot, you must change the applicable settings from UEFI to Legacy.

To select an installation media boot method, follow one of the identified processes:

Table 14 Installation media options

Method	Requirements	Process
USB flash drive	<ul style="list-style-type: none"> Working access to system console, see "System console access options" on page 63 CM BIOS pre-configured to boot from the USB flash drive USB flash drive with sufficient capacity for installation media (Optional) USB hub so you can connect all three USB devices 	<ol style="list-style-type: none"> (Optional) Insert a USB hub. Insert the USB flash drive with the bootable OS.
BMC IP remote media	<ul style="list-style-type: none"> Working access to system console, see "System console access options" on page 63 CM BIOS settings, pre-configured to boot from the virtual USB CDROM BMC network access BMC user credentials Supported web browser 	<ol style="list-style-type: none"> Configure BMC network access, referring to "Obtain and set BMC IP addresses" on page 65 Access the BMC IP console, referring to "Use console redirection" on page 67. Sign in with your BMC username and password credentials, referring to "Synchronize service passwords" on page 64 Launch a supported web browser. Open the assigned BMC IP address URI in the web browser, using https://n.n.n.n (the IP address). Navigate to Remote Control>Launch H5Viewer. Navigate to CD Image>Browse File, and then select Installation Media ISO Image. Select Start Media.
Preboot eXecution Environment (PXE) server	<ul style="list-style-type: none"> Working access to system console, see "System console access options" on page 63 CM BIOS settings, pre-configured to boot from the Ethernet option ROMs A local area network (LAN) or virtual local area network (VLAN) DHCP and PXE services on the selected network 	<ol style="list-style-type: none"> Connect the CM to a PXE server. Configure the CM BIOS to boot from the selected source, based on OS documentation.

BIOS

Controller modules use a customizable BIOS, but ship with preset defaults. You can always restore the BIOS to its original shipped state.

Invoke the BIOS setup utility

The BIOS installed on each controller module (CM) is available to you for customization and is based on the Aptio UEFI BIOS by American Megatrends. You can always restore the BIOS defaults to its initial state as it shipped from Seagate.

The BIOS setup screen depends entirely on the method of access:

- Local, physical system console connection or local serial port connection and a terminal emulator, which accesses the Aptio Setup Utility (ASU)
- BMC console redirection (iKVM) or serial over LAN (SOL), which accesses the ASU
- BMC WMI, after navigation to Dashboard>BIOS, which accesses the AMI Remote utility (ARU)

NOTE Use the AMI Remote utility while keeping in mind the following qualifiers:

- You cannot enter a custom BMC Network static address, as you can with the ASU.
 - To activate any new BIOS settings, you must first select **Save and Exit**, then reboot the controller module.
-

To invoke the BIOS setup utility:

1. Connect to the CM using one of the identified access methods.
2. Power up or reboot the CM.
3. Invoke the BIOS setup utility by pressing **DEL** or **F2**.
4. For ASU users, choose from the following actions:
 - a. Access options on the Main screen.
 - b. Access the other menu tabs: Advanced, Chipset, Security, Boot, Save & Exit, AMD CBS, Event Logs, and Server Mgmt, using the right or left arrows to access the menu tabs that are not visible on the screen.

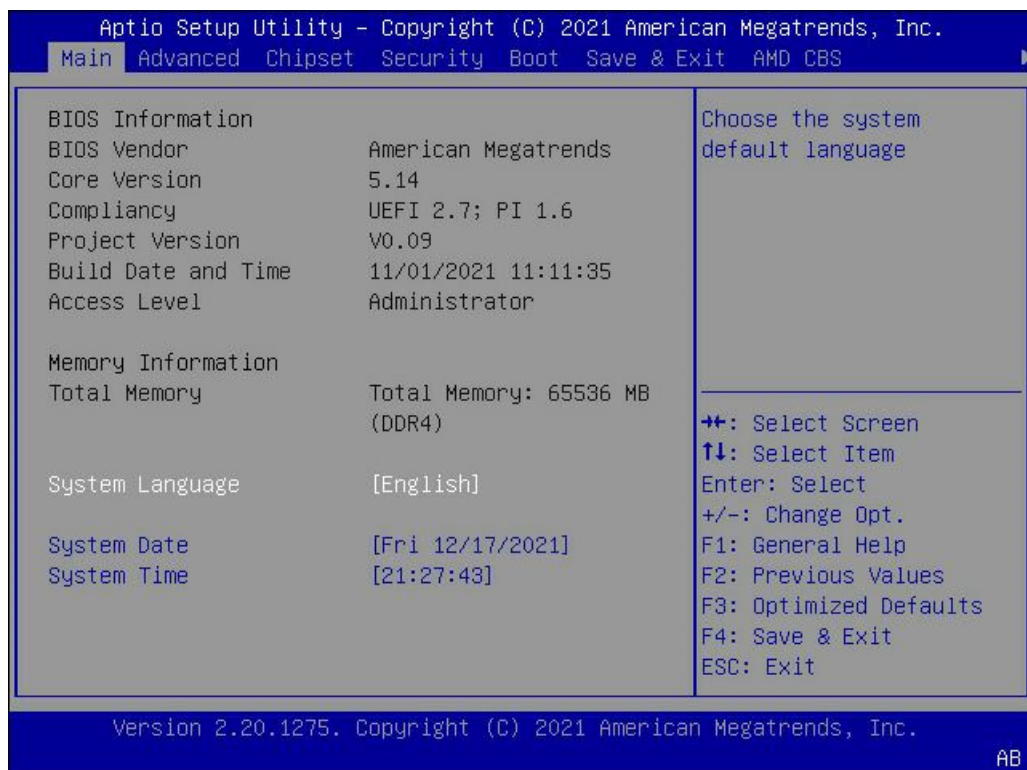


Figure 45 Main menu for ASU version of BIOS setup utility



Figure 46 Main menu for ARU version of BIOS setup utility

5. In the BIOS, navigate to BIOS: Advanced > CSM Configuration > Boot Option Filter.
6. Select either the UEFI boot or legacy boot method.
7. Configure the identified boot options.
 - a. Navigate to BIOS: Advanced > CSM Configuration > Option ROM Execution and select the ROM type.
 - b. Navigate to BIOS: Boot > Boot Option Priorities and select the boot device order. See "Specify the boot device order" below.

Specify the boot device order

A controller module (CM) depends on its configuration for booting from a specific device. The BIOS boot device order specifies the default boot device sequence.

To specify the boot device order:

1. Invoke the BIOS setup utility.
2. Select the Boot option.
3. Set boot option #1 to the boot device you select.
4. Progress through the remaining boot options to set the boot device order.

Install an operating system

Since this line of controller modules (CMs) each contain a complete server, each requires the installation of an operating system (OS) as part of the CM configuration. The CM configuration either includes OS installation at the time of manufacture or during post-manufacture integration, or you must install the OS at the time of initial system installation or CM replacement.

The interactive OS installation process mimics that of OS installations on servers, but is more complex, given the quantity of variables and choices.

NOTE Automated installation of an OS is also possible. See your OS documentation for details.

To install an operating system:

1. Either preconfigure the BIOS to boot from the USB flash drive media type or during BIOS POST, press **F11** to access the boot menu and select the USB flash drive from the install media list. See "Specify the boot device order" on the previous page or "Select installation media boot method" on page 71.
2. Access the system console through one of the specified methods. See "System console access options" on page 63.
3. Select the UEFI or legacy boot method and select an installation media. See "Select installation media boot method" on page 71.
4. Reboot the CM.
5. Use the up or down arrow to select the USB flash drive boot device for the OS installation media.

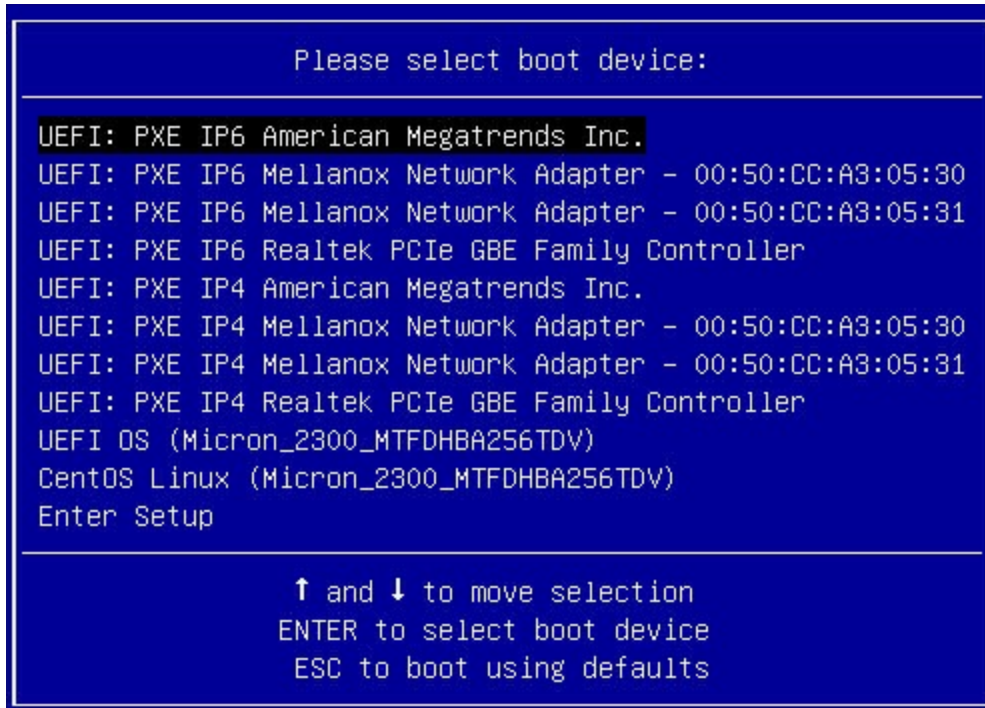


Figure 47 Sample AMI boot device selection screen

6. Press **Enter** to boot the selected device, so the CM boots to the OS installer.
7. Follow the OS instructions.
8. (Optional) Reboot the storage enclosure or expansion enclosure.

The following scenario uses one of the many possible methods available for OS installation and is derived from all related content in this chapter as a sample process. It uses the local, physical console access method and USB flash drive as the installation media.

1. Either preconfigure the BIOS to boot from the USB flash drive media type or during BIOS POST, press **F11** to access the boot menu and select the USB flash drive from the install media list.
2. Access the local, physical system console through the specified method.
3. Select the UEFI boot method and USB flash drive installation media.
4. Reboot the CM.
5. Use the up or down arrow to select the USB flash drive boot device for the OS installation media.

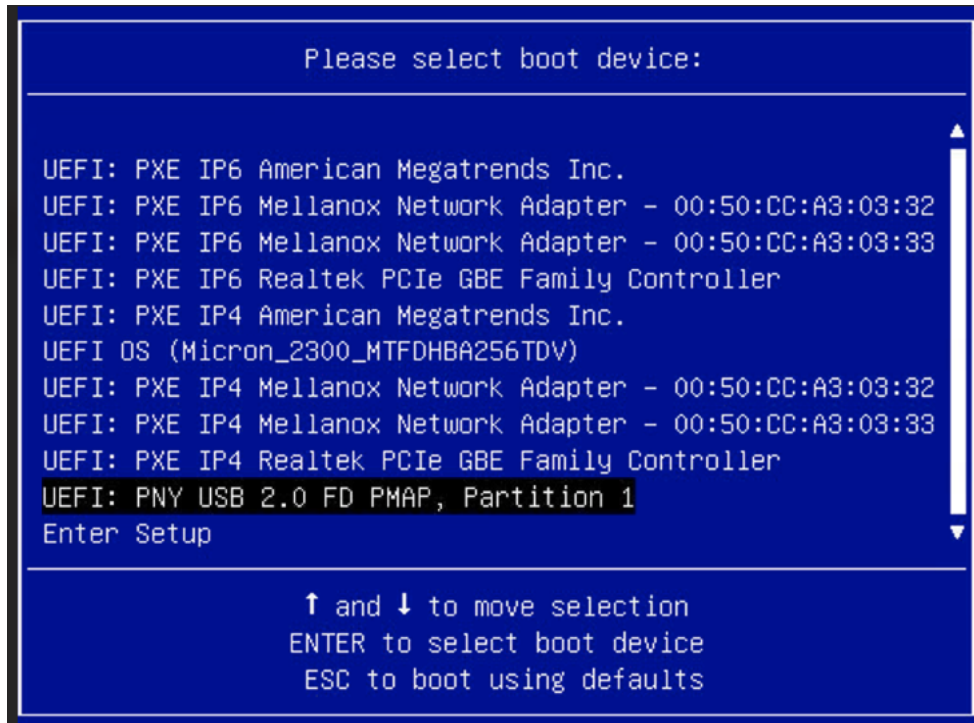


Figure 48 Sample AMI boot device selection screen of USB flash drive

6. Press **Enter** to boot the USB flash drive boot device, so the CM boots to the OS installer.
7. Follow the OS instructions.

SAS zone modes

The SAS subsystem includes both SAS3816 initiators and 12Gb/s PM8055 expanders. The SAS3816 is not a single x16 SAS, but 2 separate x8 lanes. All lanes of an initiator connect directly to its expander. Zoning-enabled expanders cooperate with one another to control PHY access using a zoned portion of a service delivery system (ZPSDS).

Problem: An initiator can only form wide ports within a given SAS core, so there are 2 discrete wide-port paths between the initiator and the expander. Most operating systems (OSs) do not properly handle a multipath scenario that includes multiple wide-port paths to a given target where the separate paths are between the selfsame initiator and expander. In such instances, only one generally gets used, negating both the redundancy and performance benefits of the multiple paths.

Resolution: Leverage SAS zoning to separate targets into discrete zone groups (ZGs) and utilize the full bandwidth of all 16 lanes between an initiator and expander. The current implementation supports three different zone modes to accommodate different combinations of enclosures and possible related expansion enclosures.

Table 15 Zone mode types

Zone mode	Zone groups	Description and requirements
1	ZG-A x8 lane, port 0, local ZG-B x8 lane, port 1, local	<p>Purpose is high performance.</p> <p>A single storage enclosure uses two zone groups, so local drive modules are split with x8 lanes going to ZG-A, the other x8 lanes going to ZG-B.</p> <p>There are 2 enclosure targets, enumerated by the host, 1 per SAS core.</p> <p>All enclosures must be members of the same ZPSDS.</p>
2	ZG-A x8 lane, port 0, local ZG-B x8 lane, port 1, expansion	<p>Purpose is balanced performance, using multi-expansion zoning.</p> <p>Multiple storage enclosures: a primary and a secondary. The primary local storage enclosure is ZG-A, the secondary remote expansion enclosure is ZG-B.</p> <p>Two enclosure targets, enumerated by the host, with one per SAS core.</p> <p>The expansion enclosures do not need to support zoning to handle Zone Mode 2.</p>
3	ZG-A x8 lane, port 0, local ZG-B x8 lane, logically split to x4 and x4 lanes, port 1, expansion	<p>Purpose is high performance, using multi-expansion zoning.</p> <p>Multiple storage enclosures: a primary and a secondary. The primary storage enclosure is ZG-A, the secondary expansion enclosure is ZG-B, but split into two x4 lanes.</p> <p>Two enclosure targets, enumerated by the host, with one per SAS core.</p> <p>The expansion enclosures do not need to support zoning to handle Zone Mode 3.</p>

```

> phydump
State: E(nabled)
      B(Bypassed (drive only))
      L(ink up)
      S(spin-up request actioned)
      R(equested spin-up)
      *(SATA spin-up hold)
Type : SAS/SATA
Flags: Rx (Rx invert enabled)
      Tx (Tx invert enabled)
      Sb (Subtractive)
      La (Analogue loopback)
      Ld (Digital loopback)
      Li (Internal loopback)

49 PHYs
PHY | Type | Index | Flags | State | Speed | Type | WWN |
-----|-----|-----|-----|-----|-----|-----|-----|
0 | Port | 0 | | | | | | < Expansion Port
1 | Port | 0 | | | | | | < Expansion Port
2 | Port | 0 | | | | | | < Expansion Port
3 | Port | 0 | | | | | | < Expansion Port
4 | Port | 1 | | | | | | < Expansion Port
5 | Port | 1 | | | | | | < Expansion Port
6 | Port | 1 | | | | | | < Expansion Port
7 | Port | 1 | | | | | | < Expansion Port
8 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
9 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
10 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
11 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
12 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
13 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
14 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
15 | Port | 3 | | E L | 12.0Gbps | SAS | 50050cc130802231 | < Initiator SAS Core 1
16 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
17 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
18 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
19 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
20 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
21 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
22 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
23 | Port | 2 | | E L | 12.0Gbps | SAS | 50050cc130802230 | < Initiator SAS Core 0
24 | Drive | 0 | | E L S | 12.0Gbps | SAS | 5000c5003e80a73a | < Drive Slot 0
25 | Drive | 4 | | E L S | 12.0Gbps | SAS | 5000c5003e80a726 | < Drive Slot 4
26 | Drive | 8 | | E L S | 12.0Gbps | SAS | 5000c5003ad2c89a | < Drive Slot 8
27 | Drive | 9 | | E L S | 12.0Gbps | SAS | 5000c5003ad2c48e | < Drive Slot 9
28 | Drive | 5 | | E L S | 12.0Gbps | SAS | 5000c500a63669de | < Drive Slot 5
29 | Drive | 1 | | E L S | 12.0Gbps | SAS | 5000c5003ad2c25a | < Drive Slot 1
30 | Drive | 10 | | E L S | 12.0Gbps | SAS | 5000c5003ad2c74e | < Drive Slot 10
31 | Drive | 6 | | E L S | 12.0Gbps | SAS | 5000c500a624673a | < Drive Slot 6
32 | Drive | 11 | | E L S | 12.0Gbps | SAS | 5000c500a6362732 | < Drive Slot 11
33 | Drive | 7 | | E L S | 12.0Gbps | SAS | 5000c500a621a97e | < Drive Slot 7
34 | Drive | 2 | | E L S | 12.0Gbps | SAS | 5000c5003ad2bb86 | < Drive Slot 2
35 | Drive | 3 | | E L S | 12.0Gbps | SAS | 5000c5003ad2bf8e | < Drive Slot 3
36 | Unmapped | 0 | | | | | | < Unused in 2U12
37 | Unmapped | 0 | | | | | | < Unused in 2U12
38 | Unmapped | 0 | | | | | | < Unused in 2U12
39 | Unmapped | 0 | | | | | | < Unused in 2U12
40 | Unmapped | 0 | | | | | | < Unused in 2U12
41 | Unmapped | 0 | | | | | | < Unused in 2U12
42 | Unmapped | 0 | | | | | | < Unused in 2U12
43 | Unmapped | 0 | | | | | | < Unused in 2U12
44 | Unmapped | 0 | | | | | | < Unused in 2U12
45 | Unmapped | 0 | | | | | | < Unused in 2U12
46 | Unmapped | 0 | | | | | | < Unused in 2U12
47 | Unmapped | 0 | | | | | | < Unused in 2U12
48 | Virtual | 0 | | E L | | | SAS | 50050cc13080223e. | < Enclosure Target

```

Figure 49 Sample phydump with comments for 2U12 storage enclosure

Set SAS zone mode 1

SAS Zone Mode 1 is optimized for high performance. A single storage enclosure uses two zone groups, so local drive modules are split with x8 lanes going to ZG-A, the other x8 lanes going to ZG-B. There are 2 enclosure targets, enumerated by the host, 1 per SAS core.

- All enclosures must be members of the same ZPSDS.
- All zone group numbers must abide by T-10 SAS rules and requires collaboration with and approval by Seagate prior to configuration and implementation.
- A storage enclosure without zoning enabled is likely to encounter erratic discovery of related drive modules.

Table 16 Zone mode 1 host port settings matrix

Source or destination	Zone Group A	Zone Group B	Zone Group C	Zone Group D
Zone Group A	1	0	1	0
Zone Group B	0	1	0	1
Zone Group C	1	0	1	0
Zone Group D	0	1	0	1

To set SAS zone mode 1:

1. If you have not installed or set up the multipath (MPIO) for Windows or Linux, do so using the related link.
 - **Multipath for Windows Server**—<https://docs.microsoft.com/en-us/azure/storsimple/storsimple-8000-configure-mpio-windows-server>
 - **Multipath tools for Linux**—https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html/single/configuring_device_mapper_multipath/index
2. If the Broadcom driver is not v17 or newer, install the latest using the related link.

<https://www.broadcom.com/products/storage/host-bus-adapters/sas-nvme-9500-16i>
3. Set the zone mode to zone mode 1 with the `set_zone_mode 1` command, and then reboot.

```
fwdownloader -d 0 -wbcli set_zone_mode 1
```

4. Confirm the zone mode with the `set_zone_mode` command without any parameters on the secondary controller module (CM) after setting the zone mode on the primary CM. The example assumes the primary CM is CM 0A.

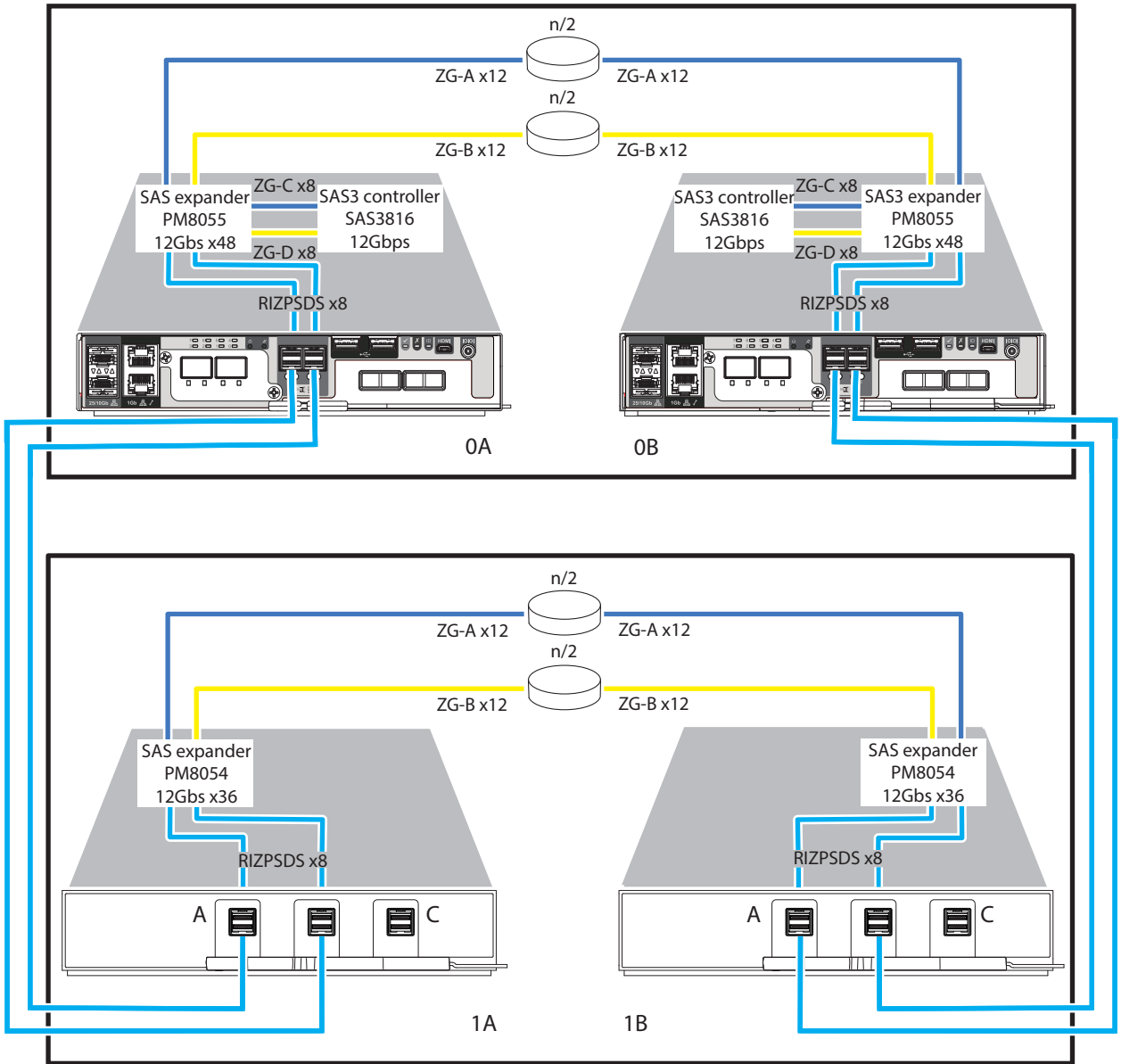


Figure 50 Sample storage enclosure cabling for SAS zone mode 1, using local storage enclosure resources


```

### Enclosure Info: /dev/sg13 SEAGATE SP-3212-AP-BV-1 16360AFC27 500c0ff00afc273c IOM:0
### HBA Info: HBA_Driver:mpt3sas HBA_SCSI_HOST_ID:0 HBA_SAS_ADDRESS:50050cc130802230
Bay SG Path SD Path Vendor Product Rev Serial SAS Port Address Att. SAS Address Bay Status
---
000 /dev/sg1 /dev/sda SEAGATE XS400ME70004 A005 HLJ0320Q0000822150Z3 5000c5003e80a73a 50050cc13080223f OK
001 /dev/sg6 /dev/sdf SEAGATE ST10000NM0096 E005 ZA232S1J0000C7258TXA 5000c5003ad2c25a 50050cc13080223f OK
002 /dev/sg11 /dev/sdk SEAGATE ST10000NM0096 E005 ZA200ZAH0000J6397LA7 5000c5003ad2bb86 50050cc13080223f OK
003 /dev/sg12 /dev/sdl SEAGATE ST10000NM0096 E005 ZA23C13W0000C83280CN 5000c5003ad2bf8e 50050cc13080223f OK
004 /dev/sg2 /dev/sdb SEAGATE XS400ME70004 A005 HLJ031T30000822150Z3 5000c5003e80a726 50050cc13080223f OK
005 /dev/sg5 /dev/sde SEAGATE ST10000NM0096 E005 ZA26YD7B0000C8433T19 5000c500a63669de 50050cc13080223f OK
006 -- -- -- -- -- -- -- -- -- No Access Allowed
007 -- -- -- -- -- -- -- -- -- No Access Allowed
008 -- -- -- -- -- -- -- -- -- No Access Allowed
009 -- -- -- -- -- -- -- -- -- No Access Allowed
010 -- -- -- -- -- -- -- -- -- No Access Allowed
011 -- -- -- -- -- -- -- -- -- No Access Allowed

### Enclosure Info: /dev/sg0 SEAGATE SP-3212-AP-BV-1 16360AFC27 500c0ff00afc273c IOM:0
### HBA Info: HBA_Driver:mpt3sas HBA_SCSI_HOST_ID:0 HBA_SAS_ADDRESS:50050cc130802230
Bay SG Path SD Path Vendor Product Rev Serial SAS Port Address Att. SAS Address Bay Status
---
000 -- -- -- -- -- -- -- -- -- No Access Allowed
001 -- -- -- -- -- -- -- -- -- No Access Allowed
002 -- -- -- -- -- -- -- -- -- No Access Allowed
003 -- -- -- -- -- -- -- -- -- No Access Allowed
004 -- -- -- -- -- -- -- -- -- No Access Allowed
005 -- -- -- -- -- -- -- -- -- No Access Allowed
006 /dev/sg17 /dev/sdr SEAGATE ST10000NM0096 E005 ZA26NS470000C840GCTT 5000c500a624673a 50050cc13080223f OK
007 /dev/sg19 /dev/sdr SEAGATE ST10000NM0096 E005 ZA26LGW50000C83733NY 5000c500a621a97e 50050cc13080223f OK
008 /dev/sg14 /dev/sdm SEAGATE ST10000NM0096 E005 ZA21XKZG0000C83166F7 5000c5003ad2c89a 50050cc13080223f OK
009 /dev/sg15 /dev/sdn SEAGATE ST10000NM0096 E005 ZA228X0B0000C831692R 5000c5003ad2c48e 50050cc13080223f OK
010 /dev/sg16 /dev/sdq SEAGATE ST10000NM0096 E005 ZA21DKVN0000C83168ZA 5000c5003ad2c74e 50050cc13080223f OK
011 /dev/sg18 /dev/sdq SEAGATE ST10000NM0096 E005 ZA26YMHQ0000C840JNUJ 5000c500a6362732 50050cc13080223f OK

```

Figure 51 Sample zone mode 1 data for 2U12 storage enclosure

Set SAS zone mode 2

SAS zone mode 2 is optimized for balanced performance, using multi-expansion zoning. It involves multiple enclosures: a primary storage enclosure and a secondary expansion enclosure. There are two enclosure targets, enumerated by the host, with one per SAS core.

- The primary local storage enclosure is ZG-A, the secondary remote expansion enclosure is ZG-B.
- The expansion enclosures do not need to support zoning to handle zone mode 2.

With SAS zone mode 2, the expansion chassis does not require you to set the zone mode, since the bandwidth is split in half between the storage enclosure controller module (CM) node and the expansion enclosure input/output module (IOM) node. In this instance, it does not require a zoned portion of a service delivery system (ZPSDS) beyond the host port of each CM.

NOTE If the expansion chassis does not have the zone mode set, it essentially inherits Zone Group A (ZG-A), with the result that all drives are visible to both HBA ports. The controller module (CM) does not set the zone mode of expansion enclosures.

Table 17 Zone mode 2 host port settings matrix

Source or destination	Zone Group A	Zone Group B	Zone Group C	Zone Group D
Zone Group A	1	0	1	0
Zone Group B	0	1	0	1
Zone Group C	1	0	1	0
Zone Group D	0	1	0	1

To set SAS zone mode 2:

1. If you have not installed or set up the multipath (MPIO) for Windows or Linux, do so using the related link.
 - **Multipath for Windows Server**—<https://docs.microsoft.com/en-us/azure/storsimple/storsimple-8000-configure-mpio-windows-server>
 - **Multipath tools for Linux**—https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html-single/configuring_device_mapper_multipath/index

2. If the Broadcom driver is not v17 or newer, install the latest using the related link.

<https://www.broadcom.com/products/storage/host-bus-adapters/sas-nvme-9500-16i>

3. Set the zone mode to zone mode 2 with the `set_zone_mode 2` command, and then reboot.

```
fwdownload -d 0 -wbcli set_zone_mode 2
```

4. Confirm the zone mode with the `set_zone_mode` command without any parameters on the secondary controller module (CM) after setting the zone mode on the primary CM. The example assumes the primary CM is CM 0A.

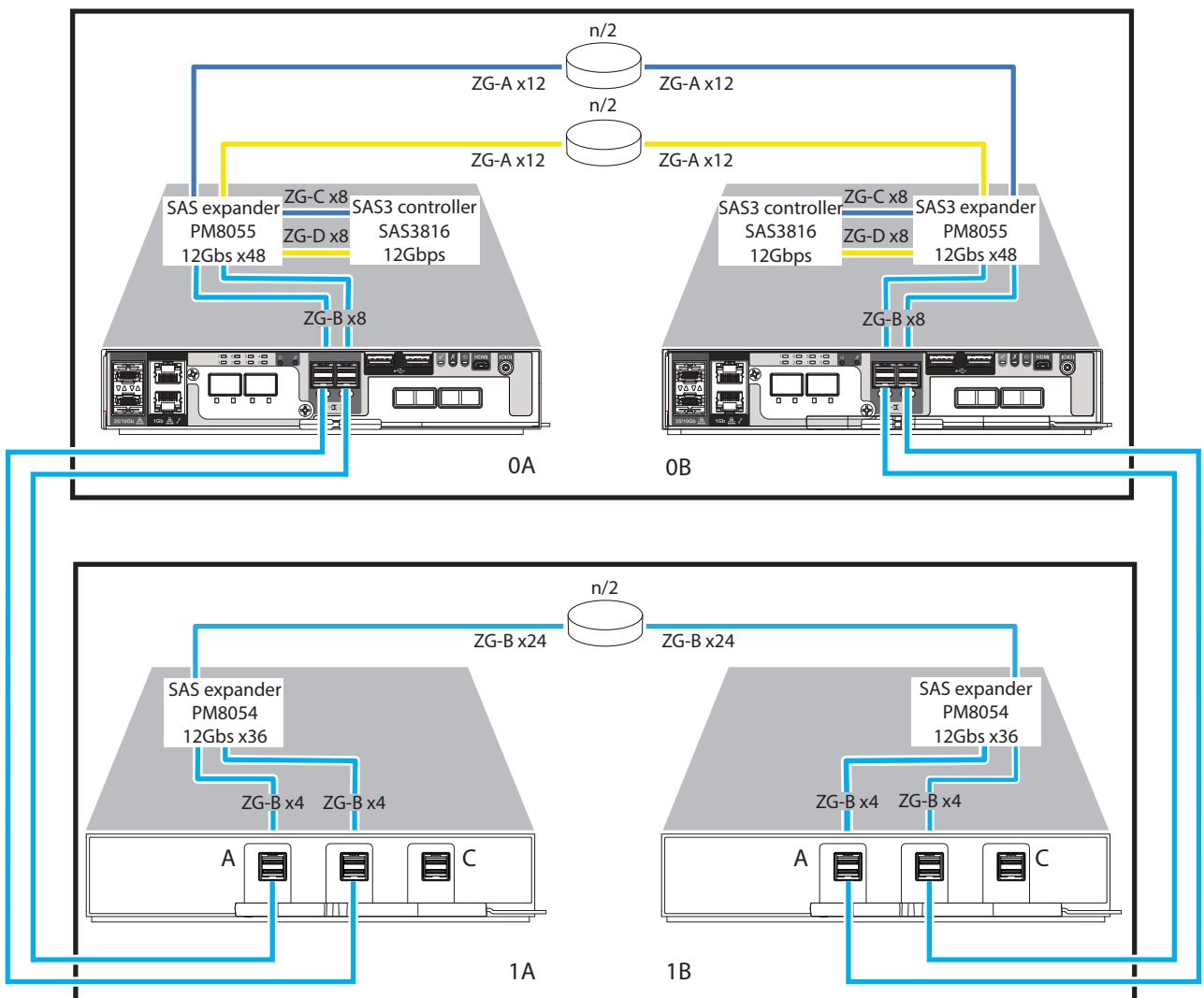


Figure 52 Sample storage and expansion enclosure cabling for SAS zone mode 2

```

### Enclosure Info: /dev/sg13 SEAGATE SP-3212-AP-BV-1 16360AFC27 500c0ff00afc273c IOM:0
### HBA Info: HBA_Driver:mpt3sas HBA_SCSI_HOST_ID:0 HBA_SAS_ADDRESS:50050cc130802230
Bay SG Path SD Path Vendor Product Rev Serial SAS Port Address Att. SAS Address Bay Status
=====
000 /dev/sg1 /dev/sda SEAGATE XS400ME70004 A005 HLJ0320Q0000822150Z3 5000c5003e80a73a 50050cc13080223f OK
001 /dev/sg6 /dev/sdf SEAGATE ST1000NM0096 E005 ZA23251J0000C7258TXA 5000c5003ad2c25a 50050cc13080223f OK
002 /dev/sg11 /dev/sdk SEAGATE ST1000NM0096 E005 ZA200ZAH0000J6397LA7 5000c5003ad2bb86 50050cc13080223f OK
003 /dev/sg12 /dev/sdl SEAGATE ST1000NM0096 E005 ZA23C13W0000C83280CN 5000c5003ad2bf8e 50050cc13080223f OK
004 /dev/sg2 /dev/sdb SEAGATE XS400ME70004 A005 HLJ031T30000822150Z3 5000c5003e80a726 50050cc13080223f OK
005 /dev/sg5 /dev/sde SEAGATE ST1000NM0096 E005 ZA26YD7B0000C8433T19 5000c500a63669de 50050cc13080223f OK
006 /dev/sg8 /dev/sdh SEAGATE ST1000NM0096 E005 ZA26NS470000C840GCTT 5000c500a624673a 50050cc13080223f OK
007 /dev/sg10 /dev/sdj SEAGATE ST1000NM0096 E005 ZA26LGW50000C83733NY 5000c500a621a97e 50050cc13080223f OK
008 /dev/sg3 /dev/sdc SEAGATE ST1000NM0096 E005 ZA21XKZG0000C831G6F7 5000c5003ad2c89a 50050cc13080223f OK
009 /dev/sg4 /dev/sdd SEAGATE ST1000NM0096 E005 ZA228X0B0000C831G92R 5000c5003ad2c48e 50050cc13080223f OK
010 /dev/sg7 /dev/sdg SEAGATE ST1000NM0096 E005 ZA21DKVN0000C831G8ZA 5000c5003ad2c74e 50050cc13080223f OK
011 /dev/sg9 /dev/sdi SEAGATE ST1000NM0096 E005 ZA26YHQ0000C840JNUJ 5000c500a6362732 50050cc13080223f OK

### Enclosure Info: /dev/sg0 SEAGATE SP-3212-AP-BV-1 16360AFC27 500c0ff00afc273c IOM:0
### HBA Info: HBA_Driver:mpt3sas HBA_SCSI_HOST_ID:0 HBA_SAS_ADDRESS:50050cc130802230
Bay SG Path SD Path Vendor Product Rev Serial SAS Port Address Att. SAS Address Bay Status
=====
000 -- -- -- -- -- -- -- -- -- No Access Allowed
001 -- -- -- -- -- -- -- -- -- No Access Allowed
002 -- -- -- -- -- -- -- -- -- No Access Allowed
003 -- -- -- -- -- -- -- -- -- No Access Allowed
004 -- -- -- -- -- -- -- -- -- No Access Allowed
005 -- -- -- -- -- -- -- -- -- No Access Allowed
006 -- -- -- -- -- -- -- -- -- No Access Allowed
007 -- -- -- -- -- -- -- -- -- No Access Allowed
008 -- -- -- -- -- -- -- -- -- No Access Allowed
009 -- -- -- -- -- -- -- -- -- No Access Allowed
010 -- -- -- -- -- -- -- -- -- No Access Allowed
011 -- -- -- -- -- -- -- -- -- No Access Allowed

```

Figure 53 Sample zone mode 2 data for 2U12 storage enclosure

Set SAS zone mode 3

SAS zone mode 3 is optimized for high performance, using multi-expansion zoning. It involves multiple enclosures: a primary storage enclosure and a secondary expansion enclosure. There are two enclosure targets, enumerated by the host, with one per SAS core.

- The primary storage enclosure is ZG-A, the secondary expansion enclosure is ZG-B, but split into two x4 lanes.
- The expansion enclosures do not need to support zoning to handle zone mode 3.

If the expansion chassis does not have the zone mode set, it essentially inherits Zone Group A (ZG-A), with the result that all drives are visible to both HBA ports. The controller module (CM) does not set the zone mode of expansion enclosures.

Table 18 Zone mode 3 host port settings matrix

Source or destination	Zone Group A	Zone Group B	Zone Group C	Zone Group D	Zone Group E	Zone Group F
Zone Group A	1	0	1	0	0	0
Zone Group B	0	1	0	1	0	0
Zone Group C	1	0	1	0	1	0
Zone Group D	0	1	0	1	0	1
Zone Group E	0	0	1	0	1	0
Zone Group F	0	0	0	1	0	1

To set SAS zone mode 3:

1. If you have not installed or set up the multipath (MPIO) for Windows or Linux, do so using the related link.
 - **Multipath for Windows Server**—<https://docs.microsoft.com/en-us/azure/storsimple/storsimple-8000-configure-mpio-windows-server>
 - **Multipath tools for Linux**—https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html-single/configuring_device_mapper_multipath/index
2. If the Broadcom driver is not v17 or newer, install the latest using the related link.

<https://www.broadcom.com/products/storage/host-bus-adapters/sas-nvme-9500-16i>

3. Set the zone mode to zone mode 3 with the `set_zone_mode 3` command, and then reboot.

```
fwdownloader -d 0 -wbcli set_zone_mode 3
```

4. Confirm the zone mode with the `set_zone_mode` command without any parameters on the secondary controller module (CM) after setting the zone mode on the primary CM. The example assumes the primary CM is CM 0A.

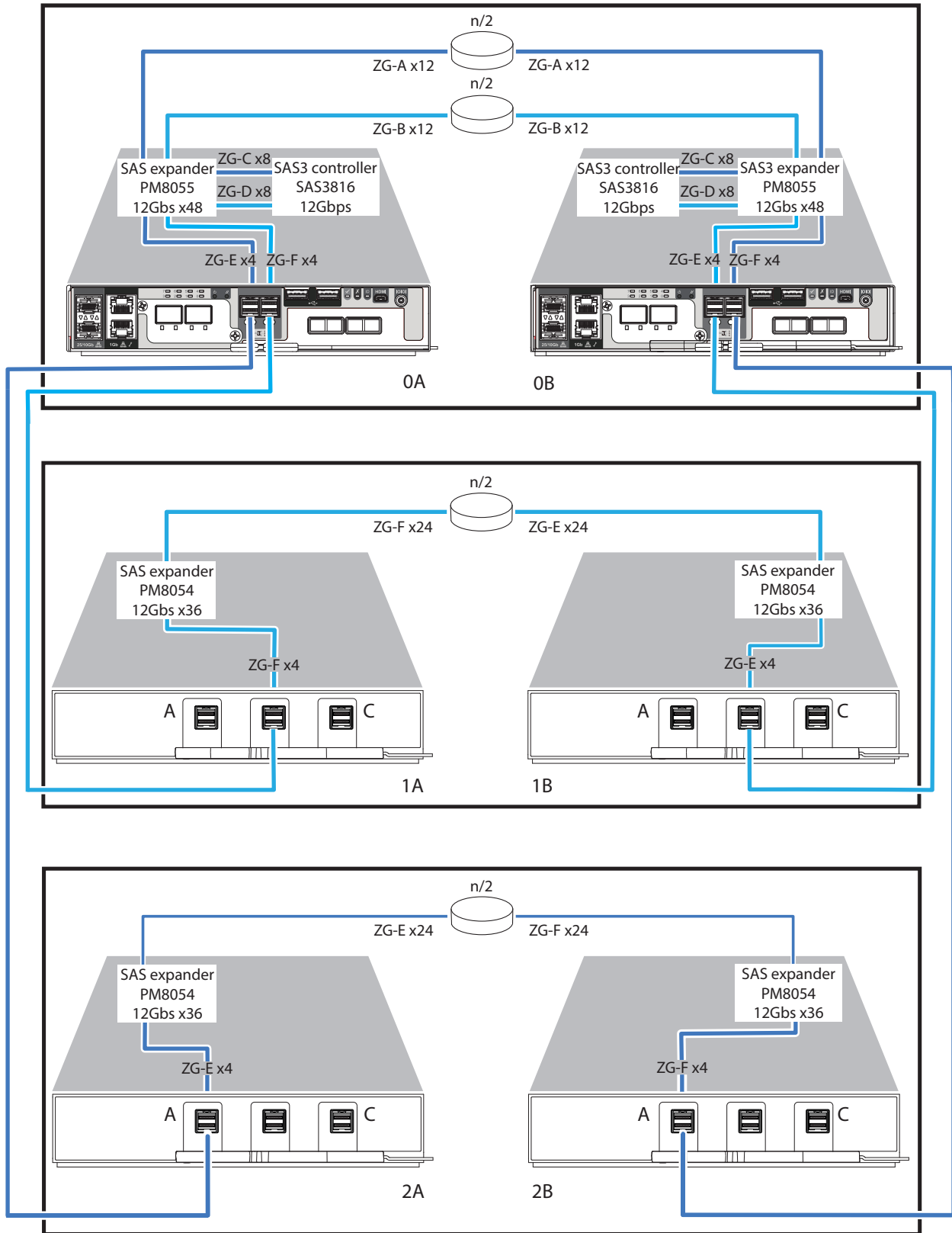


Figure 54 Sample storage enclosure cabling for SAS zone mode 3

```

### Enclosure Info: /dev/sg13 SEAGATE SP-3212-AP-BV-1 16360AFC27 500c0ff00afc273c IOM:0
### HBA Info: HBA_Driver:mpt3sas HBA_SCSI_HOST_ID:0 HBA_SAS_ADDRESS:50050cc130802230
Bay SG Path SD Path Vendor Product Rev Serial SAS Port Address Att. SAS Address Bay Status
=====
000 /dev/sg1 /dev/sda SEAGATE XS400ME70004 A005 HLJ0320Q0000822150Z3 5000c5003e80a73a 50050cc13080223f OK
001 /dev/sg6 /dev/sdf SEAGATE ST1000NM0096 E005 ZA232S1J0000C7258TXA 5000c5003ad2c25a 50050cc13080223f OK
002 /dev/sg11 /dev/sdg SEAGATE ST1000NM0096 E005 ZA200ZAH0000J6397LA7 5000c5003ad2bb86 50050cc13080223f OK
003 /dev/sg12 /dev/sdi SEAGATE ST1000NM0096 E005 ZA23C13W0000C83280CN 5000c5003ad2bf8e 50050cc13080223f OK
004 /dev/sg2 /dev/sdb SEAGATE XS400ME70004 A005 HLJ031T30000822150Z3 5000c5003e80a726 50050cc13080223f OK
005 /dev/sg5 /dev/sde SEAGATE ST1000NM0096 E005 ZA26YD7B0000C8433T19 5000c500a63669de 50050cc13080223f OK
006 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
007 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
008 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
009 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
010 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
011 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed

### Enclosure Info: /dev/sg0 SEAGATE SP-3212-AP-BV-1 16360AFC27 500c0ff00afc273c IOM:0
### HBA Info: HBA_Driver:mpt3sas HBA_SCSI_HOST_ID:0 HBA_SAS_ADDRESS:50050cc130802230
Bay SG Path SD Path Vendor Product Rev Serial SAS Port Address Att. SAS Address Bay Status
=====
000 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
001 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
002 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
003 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
004 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
005 -- -- -- -- -- -- -- -- -- -- -- No Access Allowed
006 /dev/sg17 /dev/sdp SEAGATE ST1000NM0096 E005 ZA26NS470000C840GCTT 5000c500a624673a 50050cc13080223f OK
007 /dev/sg19 /dev/sdr SEAGATE ST1000NM0096 E005 ZA26LGN50000C83733NY 5000c500a621a97e 50050cc13080223f OK
008 /dev/sg14 /dev/sdm SEAGATE ST1000NM0096 E005 ZA21XKZG0000C831G6F7 5000c5003ad2c89a 50050cc13080223f OK
009 /dev/sg15 /dev/sdo SEAGATE ST1000NM0096 E005 ZA228X0B0000C831G92R 5000c5003ad2c48e 50050cc13080223f OK
010 /dev/sg16 /dev/sdq SEAGATE ST1000NM0096 E005 ZA21DKVN0000C831G8ZA 5000c5003ad2c74e 50050cc13080223f OK
011 /dev/sg18 /dev/sda SEAGATE ST1000NM0096 E005 ZA26YMHQ0000C840JNUJ 5000c500a6362732 50050cc13080223f OK

```

Figure 55 Sample zone mode 3 data for 2U12 storage enclosure

9 Hardware installation and basic configuration issues

The storage enclosure management interface allows for provisioning, monitoring, and managing the storage enclosure. It uses the baseboard management controller (BMC) and associated monitoring and control logic, such as the SCSI Enclosure Services (SES) service, Intelligent Platform Management Interface (IPMI), or Redfish, to assess and diagnose power, drive modules, and cooling systems. Temperature sensors throughout the enclosure and its components monitor the thermal health of the storage system. If a critical sensor value exceeds a threshold limit, you receive a system notification that requires your attention.

If you encounter any issues during installation or initial configuration, use the topics in this section to assist you in fault isolation and correction.

! **IMPORTANT** Do not use this section for configured systems already interacting with production data. For the kind of assistance you need in such cases, contact Seagate for technical support.

Address initial start-up issues

You must successfully complete the installation tasks in the identified sequence. You must use the power cords provided with the system and install interface cables that meet system requirements.

To address initial start-up issues:

1. Complete the following actions to eliminate POST issues:
 - a. Examine the BIOS POST state for each controller. If any of the 8 LEDs are flickering, it is not in a ready state.
 - b. For dual controller configurations, wait a minimum of 10 minutes for each controller to complete synchronization with the other controller and to reach a ready state.
 - c. For single controller configurations, wait a minimum of 2 minutes for the storage enclosure to reach a ready state.
2. Complete the following actions to eliminate power cord issues during installation:
 - a. Request a replacement for damaged or missing power cords.
 - b. Request a replacement for cords with plugs that do not match your outlets or voltage requirements
 - c. Request a replacement for power cords that are too short to reach a power distribution unit.
3. Use LEDs throughout the storage enclosure as a means to determine if there is a critical fault. See "[2U12 and 2U24 enclosure fault LEDs](#)" on the next page or "[5U84 enclosure fault LEDs](#)" on page 92.
4. Complete the following actions to verify your installation if the host system does not recognize the storage enclosure:
 - a. Verify the interface cables you connected from the storage enclosure to each host bus adapter are not damaged, loose, or wired improperly.
 - b. Look for any host connection indicators on both controller modules.
 - c. Look for drive or disk group target visibility on the host side.
 - d. Verify you correctly installed the operating system software driver.
5. Complete the following actions if the storage enclosure does not initialize:
 - a. Verify each power cord is properly and securely connected on both ends.
 - b. Reconfirm that the power source used to power the storage enclosure, is viable, and meets the installation criteria.
 - c. Power cycle the storage enclosure.
 - d. Examine the controller module system log for errors.

6. Complete the following actions if the storage enclosure does not report as much capacity as expected:
 - a. Verify you correctly installed the drive modules, and they are all latched to the baseplane connectors.
 - b. Verify all installed drive module carriers display green LEDs, rather than fault LEDs. See ["Replace a 2U enclosure drive module in its carrier" on page 107](#) or ["Replace a 5U enclosure drive module in its carrier" on page 115](#), following replacement procedures for any with fault LEDs.

Interpret storage and expansion enclosure fault LEDs

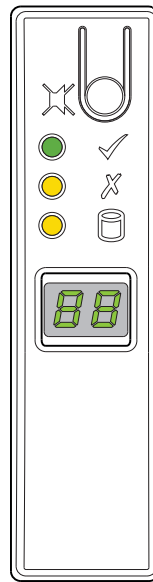
Throughout the storage and expansion enclosures, steady amber LEDs indicate a fault condition, but flashing indicates a non-critical condition. Some FRUs have more than one fault condition. An asterisk (*) indicates a fault condition.

2U12 and 2U24 enclosure fault LEDs

Visually inspect the front panel area for fault LEDs, then locate the component fault LEDs, based on identified general location, identified on the operator's panel or the drive modules. If a hardware issue prevents access to the BMC WMI, this is the only option available. The asterisk (*) indicates a fault condition.

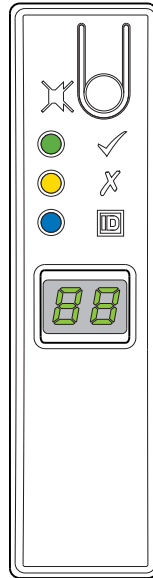
Operator's panel fault LEDs

The operator's (ops) panel uses green and amber LEDs to identify various states. Use the amber fault conditions identified on the ops panel to direct you to the fault LEDs on suspect modules. The asterisk (*) indicates a fault condition.



LED	Type	Color	State	Status
	Module fault	Amber	On*	Storage enclosure hardware module fault
			Flashing*	Vital product data (VPD) configuration error or 1°C bus failure
			Off	Storage enclosure hardware modules functioning properly
	Logical fault	Amber	On*	System enclosure logical fault or change of status, typically a drive module
		None	Off	System enclosure functioning properly

Figure 56 2U12 and 2U24 operator's panel fault LEDs with logical fault option

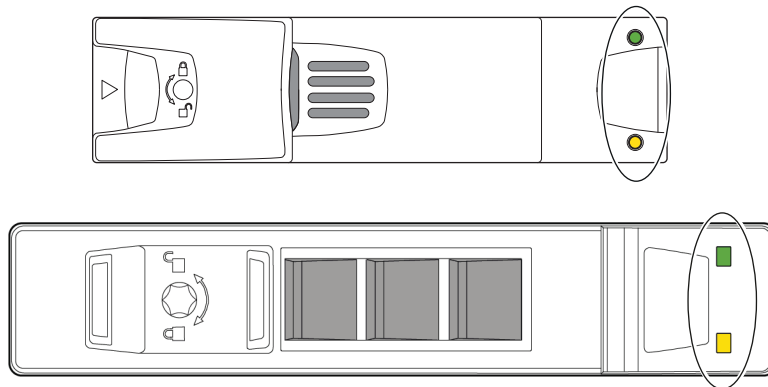


LED	Type	Color	State	Status
X	Module fault	Amber	On*	Storage enclosure rear panel area module fault or temperature issue
			Off	Storage enclosure rear panel area modules functioning properly

Figure 57 2U12 and 2U24 operator's panel fault LEDs with UID option

Drive carrier fault LED

The drive module in its carrier (DDIC) uses an amber LED to identify various states and fault conditions. The asterisk (*) indicates a fault condition.

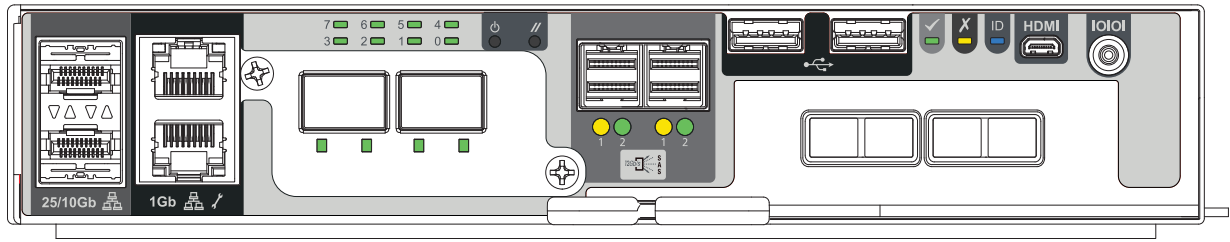


Color	State	Status
Amber	On*	The drive module has a hardware fault, so replace as soon as possible
		The power control circuit has a hardware fault
	Fast flash (1s on, 1s off)	Unit identification (UID) bit is set
	Slow flash*(3s on, 1s off)	Failed array
	Off	Drive is functioning normally
		No AC power is present

Figure 58 2U12 and 2U24 fault LEDs on carrier bezel

Controller module fault LEDs

The AP controller module (CM) has several ports, some with independent status LEDs. The amber LEDs listed below are the only ones that provide fault condition status. The asterisk (*) indicates a fault condition.





LED	Type	Color	State	Status
	SAS expansion port	Amber	On*	Critical SAS cable fault
			Fast flash* (1s on, 1s off)	SAS unit identification (UID) active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
			Off	SAS expansion port functioning properly
	Hardware fault	Amber	On*	CM hardware fault
			Fast flash (1s on, 1s off)	Part of sequence as CM comes online
			Off	CM functioning properly

Figure 59 Controller module fault LEDs, shown with OCP and PCIe optional cards

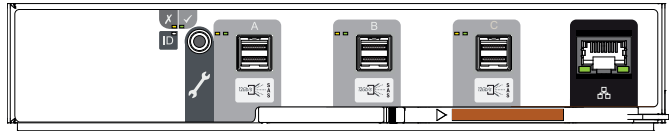
Consult your solution service documentation for details on how to minimize system disruption during service replacement of a controller module. Fault conditions include the following:

- Logs or events indicate a fault condition for the CM.
- The *Hardware fault* LED on the CM is steady or flashing amber.
- The *Hardware fault* LED for the SAS expansion port on the CM is steady or flashing amber.
- The *Hardware fault* LED for one of the four SAS 12Gb ports on the CM is steady or flashing amber.
- The *Module fault* LED on the storage enclosure ops panel is steady amber.
- Troubleshooting indicates a problem with the CM. When you are isolating connectivity or drive module fault conditions, stop the data flow to the affected disk groups from all hosts as a data protection precaution and perform a backup of your data.

When all prior LED fault conditions occur simultaneously, it is a clear indication of component failure.

Expansion module fault LEDs

The expansion module has several ports, some with independent status LEDs. The amber LEDs listed below are the only ones that provide fault condition status. The asterisk (*) indicates a fault condition.





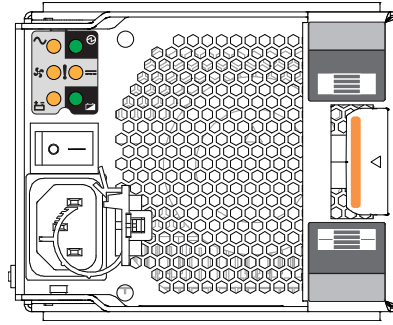
LED	Type	Color	State	Status
	Module fault	Amber	On	Drive link is down
			On*	Expansion enclosure hardware fault
			Fast flash (1s on, 1s off)	Unit identification (UID) bit is set
			Slow flash* (3s on, 1s off)	Expansion enclosure degraded or offline
			Off	Expansion enclosure functioning properly Expansion enclosure not present
	SAS expansion port	Amber	On*	Critical SAS cable fault
			Fast flash (1s on, 1s off)	SAS unit identification (UID) active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
			Off	SAS expansion port functioning properly

Figure 60 SAS 12Gb expansion module fault LEDs

Power cooling module fault LEDs

The 764W power cooling module (PCM) has 6 LEDs to identify various states: 4 as primary thermal and power status indicators and another 2 that used to indicate battery status, but are no longer used. When no LEDs are on, there is no AC power to the PCM. The asterisk (*) indicates a fault condition.







LED					Status
Type	AC fault	PCM OK	Fan fault	DC fault	N/A
Color	Amber	Green	Amber	Amber	
State	Off				AC power not present on either PCM
	On*	Off		On*	AC power not present on this PCM
	Off	On	Off		AC power present, power switch is on; PCM OK
	Off	On	Off	On*	PCM fan speed is out of tolerance
	Off		On*	Off	PCM fan fault
	On	Off	On*		PCM hardware fault: over temperature, over voltage, over current
	Off	Flashing	Off		PCM is in standby mode
	Flashing	Off	Flashing		Firmware update to PCM in progress

Figure 61 Power cooling module fault LEDs

5U84 enclosure fault LEDs

Visually inspect the front panel area for fault LEDs, then locate the component fault LEDs, based on general location identified on the operator's panel or the drawer indicators. If a hardware issue prevents access to the BMC WMI, this is the only option available. An asterisk (*) indicates a fault condition.

Operator's panel fault LEDs

The operator's (ops) panel uses several green and amber LEDs to identify various states. Use the amber fault conditions identified on the operator's (ops) panel to direct you to the fault LEDs on suspect modules. The asterisk (*) indicates a fault condition.






LED	Type	Color	State	Status
	Module fault	Amber	On*	Ops panel completing 5s test
				Storage enclosure rear panel area module fault: CM, fan, or PSU when paired with module fault LED
				Drive fault, when paired with drive fault LED
			Flashing*	Unknown, invalid, or mixed module type, such as drive or PSU
			Off	Storage enclosure rear panel area modules functioning properly
	Logical status	Amber	On*	System component hardware fault: drive, cable, or fanout card
				System component hardware change of status
			Flashing*	Drive fault caused loss of redundancy
			Off	System component hardware functioning properly
	Drawer 1, Drawer 2 hardware fault	Amber	On*	Upper, lower drawer hardware fault: drive, cable, or fanout card
			Flashing*	Unit ID (UID) or locate is active for Drawer 1, Drawer 2 sideplane or drive
			Off	Upper, lower drawer hardware functioning properly

Figure 62 5U84 operator's panel fault LEDs

Drawer panel fault LEDs

Each drawer contains up to 42 drive modules in their carriers (DDICs) and retains cable connections inside the enclosure chassis. Drawer panel fault LEDs register whether the failure is a hardware failure, a logical failure, or a cabling failure for that drawer or its related components. The asterisk (*) indicates a fault condition.



LED	Type	Color	State	Status
	Drawer module fault	Amber	On*	Component within drawer fault condition ¹ Drive fault ¹
			Flashing*	Unit ID (UID) or locate is active for drawer sideplane or drive
			Off	Drawer modules functioning properly
	Logical fault	Amber	On*	Drive hardware fault condition
			Flashing*	One or more arrays impacted by drive hardware fault conditions
	Drawer cable fault	Amber	On*	Cable from rear panel to drawer fault condition ²
			Off	Cables functioning properly

¹ If all drives are functioning properly, contact Technical Support for assistance.
² Contact Technical Support for assistance.

Figure 63 5U84 drawer fault LEDs on drawer LED panel

Drive carrier fault LED

The drive module in its carrier (DDIC) uses a single amber fault LED to identify various states. The asterisk (*) indicates a fault condition.

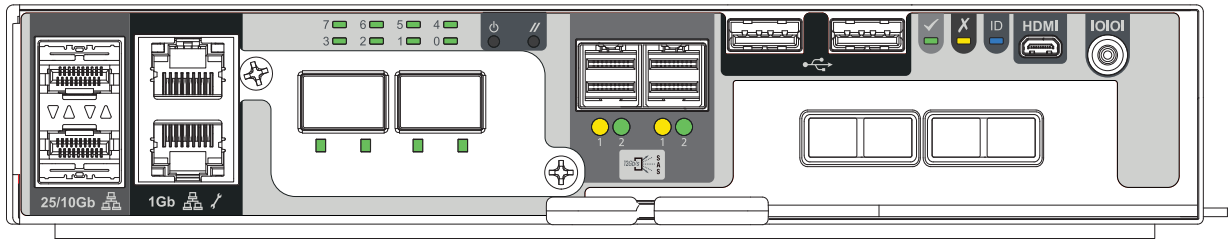


Color	State	Status
Amber	On*	Drive has hardware fault, replace as soon as possible Drive link down
	Fast flash (1s on, 1s off)	Unit identification (UID) or locate is active for drive
	Slow flash* (3s on, 1s off)	Drive in critical condition
		Failed array
Off	Off	No AC power present
		Drive initialization in process
		Drive quarantined

Figure 64 Drive fault LED on carrier bezel

Controller module fault LEDs

The AP controller module (CM) has a number of ports, some with independent status LEDs. The amber LEDs listed below are the only ones that provide fault condition status. The asterisk (*) indicates a fault condition.





LED	Type	Color	State	Status
	SAS expansion port	Amber	On*	Critical SAS cable fault
			Fast flash* (1s on, 1s off)	SAS unit identification (UID) active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
			Off	SAS expansion port functioning properly
	Hardware fault	Amber	On*	CM hardware fault
			Fast flash (1s on, 1s off)	Part of sequence as CM comes online
			Off	CM functioning properly

Figure 65 Controller module fault LEDs, shown with OCP and PCIe optional cards

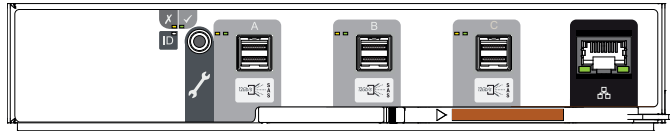
Consult your solution service documentation for details on how to minimize system disruption during service replacement of a controller module. Fault conditions include the following:

- Logs or events indicate a fault condition for the CM.
- The *Hardware fault* LED on the CM is steady or flashing amber.
- The *Hardware fault* LED for the SAS expansion port on the CM is steady or flashing amber.
- The *Hardware fault* LED for one of the four SAS 12Gb ports on the CM is steady or flashing amber.
- The *Module fault* LED on the storage enclosure ops panel is steady amber.
- Troubleshooting indicates a problem with the CM. When you are isolating connectivity or drive module fault conditions, stop the data flow to the affected disk groups from all hosts as a data protection precaution and perform a backup of your data.

When all of the prior LED fault conditions occur simultaneously, it is a clear indication of component failure.

Expansion module fault LEDs

The expansion module has a number of ports, some with independent status LEDs. The amber LEDs listed below are the only ones that provide fault condition status. The asterisk (*) indicates a fault condition.

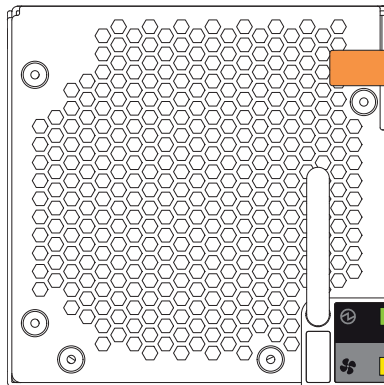


LED	Type	Color	State	Status
	Module fault	Amber	On	Drive link is down
			On*	Expansion enclosure hardware fault
			Fast flash (1s on, 1s off)	Unit identification (UID) or locate is active for expansion module
			Slow flash* (3s on, 1s off)	Expansion module degraded or offline
			Off	Expansion module functioning properly
	SAS expansion port	Amber	On*	Critical SAS cable fault
			Fast flash (1s on, 1s off)	Unit identification (UID) or locate is active for SAS expansion port
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
			Off	SAS expansion port functioning properly

Figure 66 SAS 12GB expansion module fault LEDs

Fan cooling module fault LEDs

The fan cooling module (FCM) has a green and an amber fault LED to identify various states. The asterisk (*) indicates a fault condition.

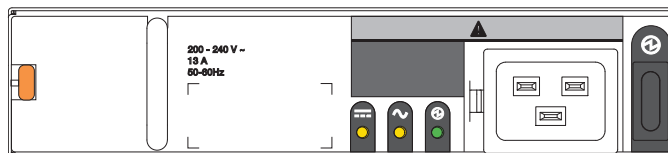


LED	Type	Color	State	Status
	FCM OK	Green	On	FCM hardware functioning properly
			Off*	FCM hardware fault
	FCM fault	Amber	On*	Fan speed is out of tolerance
				Communication with controller module (CM) lost
			Off	FCM hardware functioning properly

Figure 67 Fan cooling module fault LEDs

Power supply unit fault LEDs

Each power supply unit (PSU) has three status LEDs. The asterisk (*) indicates a fault condition.



LED				Status
Type	PSU fault	AC fault	PSU OK	N/A
Color	Amber	Amber	Green	
State	Off			AC power not present
	On*		Off	PSU present, but not supplying power
	Flashing		Off	Firmware download to PSU in progress
	Off		On	AC power present, power switch is on, providing power
	Off		Flashing	AC power present, PSU on standby, other PSU providing power
	On*			Communication with controller module (CM) lost
	On*	N/A	Off	PSU hardware fault
	On*			PSU alert state or hardware fault: over temperature, over voltage, or over current
	Off	On*	Off	AC power failed, PSU not providing power, other PSU providing power
	Off		On*	AC power failed, PSU running on battery

Figure 68 Power supply unit fault LEDs

Identify 2U enclosure fault conditions

Fault conditions do not necessarily cause the storage enclosure to cease functioning. Fault conditions do require a system administrator to take an appropriate action to clear the fault condition.

The controller modules allow you to choose from multiple fault isolation methods. This section provides the basic methodology used to locate faults within a storage system, then identify the affected FRUs.

When performing fault isolation and troubleshooting steps, select the option or options that best suit your site environment. Use of any one of the following options is not mutually exclusive to the use of another option. The order for the options is based on frequency of use.

To identify 2U enclosure fault conditions:

1. Monitor event and alert notifications through your host system interface or your preferred alternate method and based on the notification settings you enable.
 - a. **Event notifications:** The system event logs record all system events and identifies the event type and its severity.
 - b. **Alert notifications:** An alert reports a system fault, registers the type and severity, then tracks its resolution.
2. Alerts fall into three categories, listed in order of severity. Resolve them, moving from most severe to least severe.
 - a. **Critical alerts:** Such alerts require immediate resolution since they may cause a controller module to shut down or place data at risk.
 - b. **Warnings:** Such alerts require immediate attention so you can evaluate the problem and correct it.
 - c. **Informational alerts:** Such alerts neither require immediate attention nor immediate action.
3. Use the command line interface (CLI). If you discover a problem, review the CLI for any recommended actions.

4. Visually inspect front panel area fault LEDs, then locate component fault LEDs, based on LED-identified general location. If a hardware issue prevents access to the CLI, it is the only option available.

Table 19 2U enclosure non-fault conditions

Symptom	Cause	Recommended Action
Operator's panel area LEDs, no fault conditions		
System power, system ID, and host connectivity LEDs with no module or logical fault LEDs	System functioning properly	No action required
Drive module LEDs, no fault conditions		
Amber flashing LED: 1 second on, 1 second off	Drive unit identification (UID) bit is set	No action required
Controller or expansion module LEDs, no fault conditions		
LEDs other than: -Controller or expansion module amber fault LEDs -SAS port amber fault LEDs	System likely functioning properly	Often, no action required. See " Interpret controller module LEDs " on page 60.
PCM LEDs, no fault conditions		
PCM OK amber LED flashing	PCM is in standby mode	No action required

Identify 5U enclosure fault conditions

Fault conditions do not necessarily cause the storage enclosure to cease functioning. Fault conditions do require a system administrator to take an appropriate action to clear the fault condition.

The controller modules allow you to choose from multiple fault isolation methods. This section provides the basic methodology used to locate faults within a storage system, then identify the affected FRUs.

When performing fault isolation and troubleshooting steps, select the option or options that best suit your site environment. Use of any one of the following options is not mutually exclusive to the use of another option. The order for the options is based on frequency of use.

To identify 5U enclosure fault conditions:

1. Monitor event and alert notifications through your host system interface.
 - a. **Event notifications:** The system event logs record all system events and identifies the event type and its severity.
 - b. **Alert notifications:** An alert reports a system fault, registers the type and severity, then tracks its resolution.
2. Alerts fall into three categories, listed in order of severity. Resolve them, moving from most severe to least severe.
 - a. **Critical alerts:** Such alerts require immediate resolution, since they may cause a controller module to shut down or place data at risk.
 - b. **Warnings:** Such alerts require immediate attention so you can evaluate the problem and correct it.
 - c. **Informational alerts:** Such alerts neither require immediate attention nor immediate action.
3. Use the command line interface (CLI). If you discover a problem, review the CLI for any recommended actions.
4. Visually inspect front panel fault LEDs, then locate component fault LEDs, based on LED-identified general location. If a hardware issue prevents access to the CLI, it is the only option available.

Table 20 5U enclosure non-fault conditions

Symptom	Cause	Recommended Action
Operator's panel area LEDs, no fault conditions		
System power, system ID, and host connectivity LEDs with no module, logical, or drawer fault LEDs	System functioning properly	No action required.
Drawer panel LEDs, no fault conditions		
Drawer power and sideplane OK LED	System functioning properly	No action required.
Drawer data activity bar		
Drive module LEDs, no fault conditions		
Amber flashing LED: 1 second on, 1 second off	Drive unit identification (UID) bit is set	No action required.
Controller or expansion module LEDs, no fault conditions		
LEDs other than: -Controller or expansion module amber fault LEDs -SAS port amber fault LEDs	System likely functioning properly	Often, no action required. See "Interpret controller module LEDs" on page 60.
FCM LEDs, no fault conditions		
FCM OK amber LED flashing	PCM is in standby mode	No action required.
PSU LEDs, no fault conditions		
PSU OK amber LED flashing	PCM is in standby mode	No action required.

Isolate hardware and connectivity faults

You may occasionally have to isolate a fault related to the storage enclosure hardware or related to data connections associated with the storage enclosure. This is particularly true with data paths because of the number of components involved along the data path and the complexity of the interactions. For example, if a host-side data error occurs, it could be caused by any of the involved hardware components. It could be on the host side, such as a faulty host bus adapter (HBA) or switch. It could be on the storage enclosure side, such as a faulty controller module (CM), cable, or connector. It also could be a failure involving more than one of these components.

Use this section to gather common installation hardware fault information and isolate the fault.

CAUTION When you suspect a drive module or connection is the fault, halt all input and output operations to the disk group or groups from all hosts as a data protection precaution. Make sure your regularly scheduled backup is good and that you conduct another backup at the time of failure as an additional data protection precaution.

To isolate hardware and connectivity faults associated with the storage enclosure:

1. Complete the following actions to gather fault information:
 - a. Examine host application or operating system logs for fault identification.
 - b. Examine system logs from both controller modules for errors, such as log and status output for fault identification.
 - c. Use system alerts to help narrow the fault to an area of the storage enclosure.
 - d. Visually inspect the operator's panel LEDs. A hardware fault LED indicates there is a hardware issue and a logical fault LED indicates there could be a drive or disk group issue.
 - e. Access the identified location, then look for an amber fault LED to help identify a faulty module.
 - f. If you cannot find a fault in any of the listed areas, the fault most likely lies outside the storage enclosure.

2. Isolate the fault to one of the components in the storage enclosure. There can be a significant number of components interacting to create a viable data path, each potentially creating an issue. For example, if a host-side data error occurs, it could be hardware, such as the controller module or a faulty cable, or it could be the data host.
3. Proceed to the next section and take the recommended corrective action. This may mean obtaining a replacement FRU of the same type before replacing the faulty module.

Isolate system application faults

System application faults generally fall into two categories: drive faults or controller module (CM) faults. With AP storage enclosures, there are too many different types of applications with entirely different fault mechanisms, so use this section as a very simplified set of guidelines. If you continue to experience system application fault conditions, contact Seagate for assistance.

In the case of a faulty CM or power loss, and if your model has an NVDIMM installed, the system memory flushes to nonvolatile NVDIMM memory. During the process of writing to NVDIMM, only those components used in the flush process receive super-capacitor power. The system memory flush typically takes 60 seconds.

To isolate system application faults:

1. If a drive is at fault and does not have power, replace the drive.
2. If a CM fault condition occurs, discover the status of the *Hardware fault* LED and if it is on, replace the CM. If it is flashing, wait for the CM to come online.
3. For expansion enclosure system application faults, determine the cause of a SAS port host-side or CM-side connection fault.
 - a. Halt all input and output from the host to the storage enclosure.
 - b. Verify there is no activity on the SAS host port activity LED for that data port. If there is, halt all applications that access the storage enclosure.
 - c. Reseat the host cable after inspecting it for damage to the cable and connectors.
 - d. After reconnection, if the fault condition persists, move the host cable to a port with a tested, good link status to isolate the issue to the external data path or the CM data port.
 - e. After reseating the host cable, if the fault condition persists, replace the host cable with a tested, good one.
 - f. Verify that the host bus adapter (HBA) is fully seated and the PCI slot is powered on and functioning.
 - g. If the fault condition persists, reseat the HBA.
 - h. If the SAS host port activity LED still flashes amber, replace the HBA and reconnect the cable.
 - i. If the fault condition persists, replace the CM.
4. For still unaddressed issues, proceed to the next section and take the recommended corrective action, based on the symptom. This may mean obtaining a replacement FRU of the same type before replacing the faulty module.

Take corrective action for 2U enclosures

After you follow the process above and isolate the fault to an area of the storage enclosure or to a particular module, use the following chart to determine the type of corrective action you should take.

Table 21 2U enclosure corrective action for fault conditions









Symptom	Cause	Recommended action
Front operator's (ops) panel fault LED for logical faults		
<p>Logical fault LED is on</p> 	A fault condition related to the system application logic	<ol style="list-style-type: none"> 1. Scan the enclosure event log for specific information for the fault. 2. For system application faults, see Isolate system application faults. 3. If the above actions do not resolve the fault, isolate the fault to the failing component identified in the rear panel area and follow the instructions below.
Ops panel fault LED for drive module faults		
<p>Module fault LED is on</p>  <p>and a carrier fault LED is on</p> 	A fault condition related to the hardware in the front or rear panel areas	<ol style="list-style-type: none"> 1. Inspect the LEDs on the carriers for these conditions: <ul style="list-style-type: none"> • Both carrier LEDs are off. • A fault amber LED is on, not flashing. 2. Select one of the following actions: <ul style="list-style-type: none"> • Reseat the drive module in its carrier (DDIC). • If both LEDs are off, verify that the DDIC is fully inserted, the latch is fully engaged, and the storage enclosure is powered on. • If the fault LED is on, narrow the fault to the drive module, the carrier, a connection, or both. 3. Scan the enclosure event log for specific fault information and follow recommended actions. 4. If the above actions do not resolve the fault, replace the faulty drive module or carrier as soon as you have a replacement.
Ops panel fault LEDs that identify rear panel area faults		
<p>Module fault LED is on</p>  <p>and a controller module (CM) fault LED is on</p> 	A fault condition related to the CM hardware in the rear panel area	<ol style="list-style-type: none"> 1. Restart the CM with a Redfish command. 2. Confirm the redundant CM is properly functioning. 3. Select one of the following actions: <ul style="list-style-type: none"> • If both CMs are failing, follow shut down instructions and power off the system enclosure by removing power to both PCMs. Do not power on until after you successfully replace them both. • If one CM is failing, remove power, wait 1 minute, then reset the CM. 4. If the CM is still failing, and the failure is related to a CM host port, follow the steps associated with system application faults below. 5. If the CM is still failing, remove the power cord, wait 1 minute, then reseat the CM. 6. If the CM is still failing, replace it within the specified 8 minutes with a new one. 7. If installing a new CM that is still failing, remove it, inspect connections for bent pins, reinstall it, then check the event log for errors.
<p>Module fault LED is on</p>  <p>and one or more power cooling module (PCM) fault LEDs are on</p> 	A fault condition related to the PCM	<ol style="list-style-type: none"> 1. Verify AC mains connections to the PCM are live. 2. Confirm the redundant PCM is properly functioning. 3. Select one of the following actions: <ul style="list-style-type: none"> • If both PCMs are failing, follow shut down instructions and power off the system enclosure by removing power to both PCMs. Do not power on until after you successfully replace them both. • If only one PCM is failing, either power cycle the PCM and wait 1 minute or remove the power cord, wait 1 minute, then reseat the power cord. 4. If the PCM still fails, remove it, wait 1 minute, then reseat it. 5. If the PCM still fails, replace it within the specified 10 minutes. 6. If the power fault condition persists, contact your vendor for support.
Thermal monitoring and control		

Table 21 2U enclosure corrective action for fault conditions (continued)

Symptom	Cause	Recommended action
<p>Module fault LED is on</p>  <p>and fault LEDs for both PCMs are on</p>	Internal temperature exceeds the present threshold for the storage enclosure	<ol style="list-style-type: none"> 1. Confirm you have met ambient temperature requirements identified in the <i>Environmental Requirements</i> section and that the air flow moves from the front to the rear of the storage enclosure. 2. Remove the PCM with the fault, wait 1 minute, then reseal it. 3. Determine if only one of the PCMs failed or is in the process of failing. Verify all fans are running at a similar RPM. If the impellers of a fan turn more than 2K RPM slower than the other fan, replace the PCM. 4. Follow instructions related to increases in fan speed, identified below. 5. Shut down the storage enclosure and investigate before continuing.
Increased fan speed is greater than 12K RPM when the ambient temperature is below 23°C (73.4°F). Factors such as ambient temperature, number of installed drives, and altitude each influence fan speed.	Increases in fan speed are associated with reaching a thermal threshold as the first stage of the thermal control process. If you encounter fan speeds greater than 12K RPM when the ambient temperature is below 23°C (73.4°F), the likely cause is reduced airflow through the system.	<ol style="list-style-type: none"> 1. Confirm all hardware is properly installed, including blanks. Recommendation: Visually inspect hardware during installation or replacement to fully engage or secure it. 2. Look for airflow restrictions at the front and rear of the storage enclosure. Recommendation: If a rack door blocks airflow by more than 60%, make sure it has a front minimum gap of 75mm (3 in) and a rear minimum gap of 152mm (6 in). 3. Confirm there are no restrictions based on contaminants, such as dust. Recommendation: Improve removal of contaminants and keep area clean. 4. Look for excessive re-circulation of heated air from the rear to the front of the storage enclosure. Recommendation: Avoid mounting in rack cabinets that are fully enclosed. 5. Verify temperature is within product specifications. See Standards and regulations. Recommendation: Reduce the ambient temperature in the room.

Take corrective action for 5U enclosures

After you follow the process above and isolate the fault to an area of the storage enclosure or to a particular module, use the following chart to determine the type of corrective action you should take.

Table 22 5U enclosure corrective action for fault conditions


Symptom	Cause	Recommended action
Operator's (ops) panel fault LED for logical faults		
<p>Logical fault LED is on</p> 	A fault condition related to the system application logic	<ol style="list-style-type: none"> 1. Scan the enclosure event log for specific information for the fault. 2. For system application faults, see Isolate system application faults. 3. If the above actions do not resolve the fault, isolate the fault to the failing component identified in the rear panel area and follow the instructions below.

Table 22 5U enclosure corrective action for fault conditions (continued)









Symptom	Cause	Recommended action
<p><i>Module fault</i> LED is on</p>  <p>and <i>Drawer logical fault</i> LED is on</p> 	A fault condition related to the hardware or system application logic	<ol style="list-style-type: none"> Inspect the drawer panel for a fault amber LED that is on. Inspect the LEDs on the carriers in the drawer for these conditions: <ul style="list-style-type: none"> The carrier LED is off. The carrier fault amber LED is on, not flashing. Select one of the following actions: <ul style="list-style-type: none"> If the carrier LED is off, verify that the carrier is fully inserted, the latch is fully engaged, and the storage enclosure is powered on. If the fault LED is on, narrow the fault to the drive module, a connection, or both. Inspect the LEDs on the drawer sideplanes. If a sideplane fault condition exists, contact your support representative. Scan the enclosure event log for specific fault information and follow recommended actions. If the above actions do not resolve the fault, replace the faulty drive module or carrier as soon as you have a replacement.
Ops panel fault LEDs for hardware faults		
<p><i>Module fault</i> LED is on</p>  <p>and <i>Drawer module fault</i> LED is on</p>  <p>and carrier LED is on</p> 	A fault condition related to the hardware in the related drawer	<ol style="list-style-type: none"> Inspect the drawer panel for a fault amber LED that is on. Inspect the LEDs on the carriers in the drawer for these conditions: <ul style="list-style-type: none"> The carrier LED is off. The carrier fault amber LED is on, not flashing. Select one of the following actions: <ul style="list-style-type: none"> If the carrier LED is off, verify that the carrier is fully inserted, the latch is fully engaged, and the storage enclosure is powered on. If the fault LED is on, narrow the fault to the drive module, a connection, or both. Scan the enclosure event log for specific fault information and follow recommended actions. If the above actions do not resolve the fault, replace the faulty drive module or carrier as soon as you have a replacement.
<p><i>Module fault</i> LED is on</p>  <p>and <i>Logical fault</i> LED is on</p>  <p>and carrier LED is on</p> 	A fault condition related to the hardware in the related drawer	<ol style="list-style-type: none"> Inspect the drawer panel for a fault amber LED that is on. Inspect the LEDs on the carriers in the drawer for these conditions: <ul style="list-style-type: none"> The carrier LED is off. The carrier fault amber LED is on, not flashing. Select one of the following actions: <ul style="list-style-type: none"> If the carrier LED is off, verify that the carrier is fully inserted, the latch is fully engaged, and the storage enclosure is powered on. If the fault LED is on, narrow the fault to the drive module, a connection, or both. Scan the enclosure event log for specific fault information and follow recommended actions. If the above actions do not resolve the fault, replace the faulty drive module or carrier as soon as you have a replacement.

Table 22 5U enclosure corrective action for fault conditions (continued)




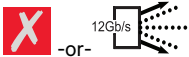







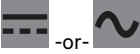
Symptom	Cause	Recommended action
<p>Drawer 1 fault or Drawer 2 fault LED is on</p>  <p>-or-</p> <p>and Cable fault LED is on</p> 	<p>A fault condition related to the cabling to the related drawer</p>	<p>The cabling between the drawer and the midplane failed. Contact your vendor for assistance.</p>
<p>Ops panel fault LEDs that identify rear panel area faults</p>		
<p>Module fault LED is on</p>  <p>and a controller module (CM) fault LED is on</p> 	<p>A fault condition related to the hardware in the rear panel area</p>	<ol style="list-style-type: none"> Restart the CM with a Redfish command. Confirm the redundant CM is properly functioning. Select one of the following actions: <ul style="list-style-type: none"> If both have fault conditions, follow shut down instructions and power off the system enclosure by removing power to both PSUs. Do not power on until after you successfully replace both CMs. If one CM is failing, remove power, wait 1 minute, then reset the CM. If the CM still has a fault, and the failure is related to a CM host port, follow the steps associated with system application faults below. If the CM still has a fault, remove the power cord, wait 1 minute, then reseal the CM. If the CM still has a fault, replace it within the specified 8 minutes with a new one. If installing a new CM that still has a fault, remove it, inspect connections for bent pins, reinstall it, then check the event log for errors.
<p>Module fault LED is on</p>  <p>and a fan cooling module (FCM) fault LED is on</p> 	<p>A fault condition related to the system fan</p>	<ol style="list-style-type: none"> Select one of the following actions: <ul style="list-style-type: none"> For instances where both FCM fault LEDs are on, see the <i>Thermal Monitoring</i> section of this table. If only one fan is failing, remove the FCM, wait 1 minute, then reseal. If the FCM is still failing, replace it within the specified 10 minutes.
<p>Module fault LED is on</p>  <p>and a PSU fault LED is on</p> 	<p>A fault condition related to the PSU, such as a power fault condition</p>	<ol style="list-style-type: none"> Verify AC mains connections to the PSU are live. Confirm the redundant PSU is properly functioning. Select one of the following actions: <ul style="list-style-type: none"> If both are failing, follow shut down instructions and power off the system enclosure by removing power to both PSUs. Do not power on until after you successfully replace them both. If only one PSU is failing, remove the power cord, wait 1 minute, then reseal the power cord. If the PSU is still failing, remove it, wait 1 minute, then reseal it. If the PSU is still failing, replace it within the specified 6 minutes. If the power fault condition persists, contact Seagate for support.

Table 22 5U enclosure corrective action for fault conditions (continued)

Symptom	Cause	Recommended action
<p>Module fault LED is on</p>  <p>and an expansion module fault LED is on</p> 	<p>A fault condition related to the hardware in the rear panel area</p>	<ol style="list-style-type: none"> Restart the expansion module with a Redfish command. Confirm the redundant expansion module is properly functioning. Select one of the following actions: <ul style="list-style-type: none"> If both have fault conditions, follow shut down instructions and power off the system enclosure by removing power to both PSUs. Do not power on until after you successfully replace both expansion modules. If only one expansion module is failing, remove power, wait 1 minute, then reset the expansion module. If the expansion module still has a fault, and the failure is related to a host port, follow the steps associated with system application faults below. If the expansion module still has a fault, remove the power cord, wait 1 minute, then reseal the expansion module. If the expansion module still has a fault, replace it within the specified ten minutes with a new one. If installing a new expansion module that still has a fault, remove it, inspect connections for bent pins, reinstall it, then check the event log for errors.
<p>Thermal monitoring and control</p>		
<p>Module fault LED is on</p>  <p>and a PSU fault LED is on</p> 	<p>Internal temperature exceeds the present threshold for the storage enclosure</p>	<ol style="list-style-type: none"> Confirm you have met ambient temperature requirements identified in the Environmental Requirements section and that the air flow moves from the front to the rear of the storage enclosure. Confirm you fully closed both main bay and auxiliary bay covers so latches fully engage. Determine if one of the PCMs failed or is in the process of failing. Verify all fans are running at a similar RPM. If the impellers of a fan turn more than 2K RPM slower than the other fan, replace the PCM. Follow instructions related to increases in fan speed, identified below. Shut down the storage enclosure and investigate before continuing.
<p>Increased fan speed is greater than 12K RPM when the ambient temperature is below 23°C (73.4°F). Factors such as ambient temperature, number of installed drives, and altitude each influence fan speed.</p>	<p>Increases in fan speed are associated with reaching a thermal threshold as the first stage of the thermal control process. If you encounter fan speeds greater than 12K RPM when the ambient temperature is below 23°C (73.4°F), the likely cause is reduced airflow through the system.</p>	<ol style="list-style-type: none"> Confirm all hardware is properly installed, all drives are level and latched, and both drawers are fully closed and latched. <p>Recommendation: Visually inspect hardware during installation or replacement to fully engage or secure it.</p> Look for airflow restrictions at the front and rear of the storage enclosure. <p>Recommendation: If a rack door blocks airflow by more than 60%, make sure it has a front minimum gap of 75mm (3 in) and a rear minimum gap of 152mm (6 in).</p> Confirm there are no restrictions based on contaminants, such as dust. <p>Recommendation: Improve removal of contaminants and keep area clean.</p> Look for excessive re-circulation of heated air from the rear to the front of the storage enclosure. <p>Recommendation: Avoid mounting in rack cabinets that are fully enclosed.</p> Verify temperature is within product specifications. See Standards and regulations. <p>Recommendation: Reduce the ambient temperature in the room.</p>

10 In-service field maintenance for 2U enclosures

You may service the identified storage enclosure FRUs and still maintain continuous operation during the replacement, but with two very important qualifiers:

- You must determine whether your system allows for continuous operation during service replacement of the storage enclosure drive modules in their carriers (DDICs) without interrupting access to enclosure file systems.
- You must complete the replacement in the allotted time, replacing only one FRU at a time. The storage enclosure design provides for redundancy, so the loss of a single FRU does not impact functionality for a limited time.

The tasks identified in this chapter first cover FRUs in the drawers, followed by FRUs accessible from the rear panel area. It is essential you adhere to all safety precautions when servicing storage enclosure FRUs.

CAUTION When performing maintenance on the storage enclosure or its components:

- Observe the caution label affixed to each drive module or FRU prior to handling or replacing it.
- Do not remove a defective FRU until you have its functional replacement ready for insertion.

To adhere to safety precautions when replacing a FRU in a storage enclosure:

1. Replace any defective FRU with a fully operational one as soon as possible.
2. Replace any defective FRU within the identified replacement time to minimize air loss and maintain optimum cooling within the storage enclosure.

Table 23 2U enclosure time limits for FRU replacement

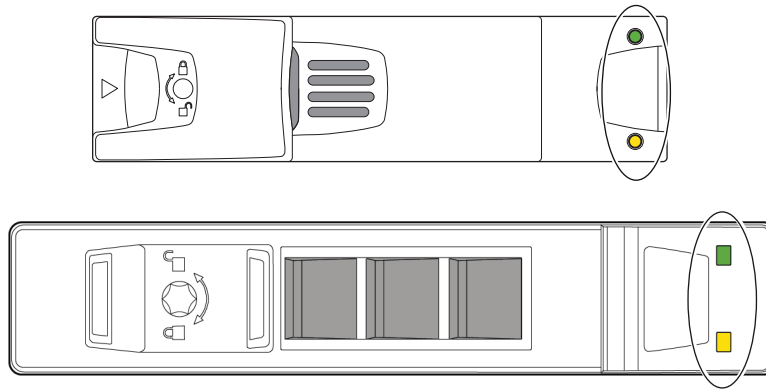
Defective FRU	Replacement time limit
Front panel area	
Drive, LFF or SFF, in carrier (DDIC)	Five (5) minutes
Rear panel area	
Power cooling module (PCM)	Five (5) minutes
AP controller module (CM)	Five (5) minutes
Attachments	
Rackmount rail kit	N/A
Cable kits: Standard HD mini-SAS to HD mini-SAS (SF-8644)	N/A
AC power cord, compatible	N/A

3. Prevent electrostatic discharge from damaging the storage enclosure or its components.
 - a. Keep a static-protected work surface clear of clutter, including plastic, vinyl, and foam.
 - b. Transport and store FRUs in static-safe containers.
 - c. Keep FRUs in their containers until reaching a clear, static-protected work surface.
 - d. Always wear a grounded ESD wrist strap that meets a minimum 1 megohm (± 10 percent) resistance standard and that is snug against your skin.
 - e. Use heel straps, toe straps, or boot straps on both feet to ground to your conductive floor or dissipating floor mat or use a portable field service kit with a grounded, static-dissipating work mat.
 - f. Use conductive field service tools.

- g. When removing a FRU, immediately place it in anti-static packaging.
- h. Avoid touching pins, leads, or circuitry.

Replace a 2U enclosure drive module in its carrier

The operator's (ops) panel registers either a logical fault or a hardware fault or both. The drive module in its carrier (DDIC) uses an amber LED to identify various states and fault conditions. The asterisk (*) indicates a fault condition.



Color	State	Status
Amber	On*	The drive module has a hardware fault, so replace as soon as possible
		The power control circuit has a hardware fault
	Fast flash (1s on, 1s off)	Unit identification (UID) bit is set
	Slow flash* (3s on, 1s off)	Failed array
	Off	Drive is functioning normally
		No AC power is present

Figure 69 2U12 and 2U24 fault LEDs on carrier bezel

An important feature of the storage enclosure design is redundancy. The enclosure will maintain continuous operation during the replacement of a single DDIC, if it is within the time limit of 5 minutes, since opening a drawer to remove a DDIC significantly reduces airflow in the storage enclosure.

CAUTION If you remove any FRU while the storage enclosure is powered up, you must replace it with a tested, good spare within the allotted time for that FRU. If you do not replace the FRU and, when applicable, fully close the related drawer within the identified time limit, you void the product warranty and the storage enclosure might overheat, causing equipment failure and possible data loss.

CAUTION Do not remove covers from any FRU. There is a danger of electric shock inside. Return the FRU to your supplier for repair.

Drives in their carriers (DDICs) are hot-swappable, but you must replace the DDIC with one of the same type and with an equal or greater capacity. The steel carrier provides thermal conduction, radio frequency, electromagnetic induction, and physical protection. For this task, treat the drive carrier and its installed drive as a single FRU.

To replace a 2U enclosure drive module in its carrier:

1. Complete the following actions to remove a faulty DDIC:
 - a. Facing the front of the storage enclosure, locate the DDIC with a fault condition.
 - b. Using a thumb and forefinger, squeeze the carrier release latch to release the connection to the midplane.
 - c. Grasping the carrier handle, pull it outward approximately 25mm (1 in) and wait for 30 seconds.

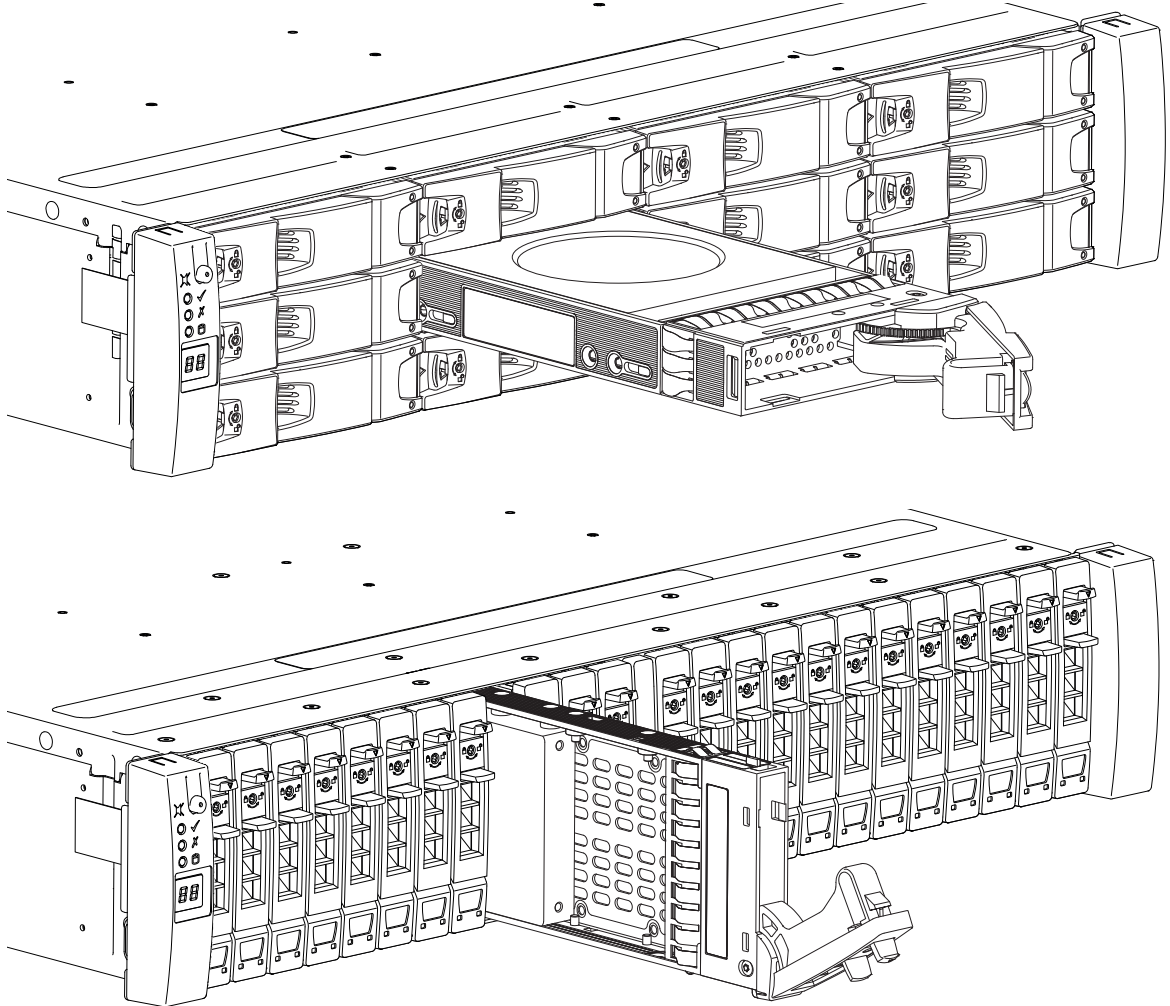


Figure 70 Removal of 2U12 and 2U24 drive in carrier

- d. Use one hand to support the weight of the DDIC and the other to pull the handle outward to fully withdraw the DDIC.
 - e. Place it in a static-protected location.
2. Complete the following actions to replace it with a tested, good DDIC:

- a. Using a thumb and forefinger, squeeze the carrier release latch to release the carrier handle.

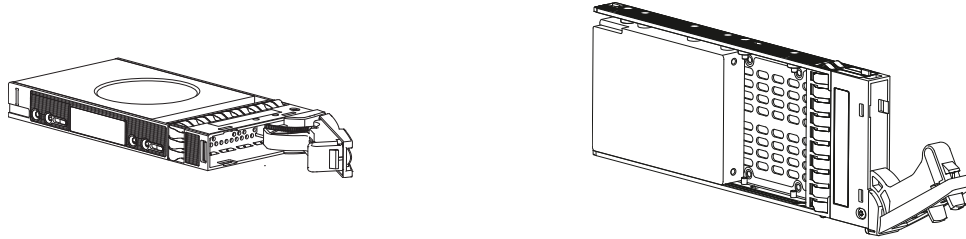


Figure 71 Open 2U12 and 2U24 carrier handle

- b. Use one hand to support the weight of the DDIC and the other to holding it against the bottom of the slot.
 - c. Slide the carrier inward until the cam lever of the handle is flush with the chassis.
 - d. Firmly press the handle closed until you hear an audible click as it engages the midplane and locks in place.
3. Confirm that the DDIC fault condition LED is off and the operator's (ops) panel is clear of any fault conditions.

Replace a 2U enclosure controller module

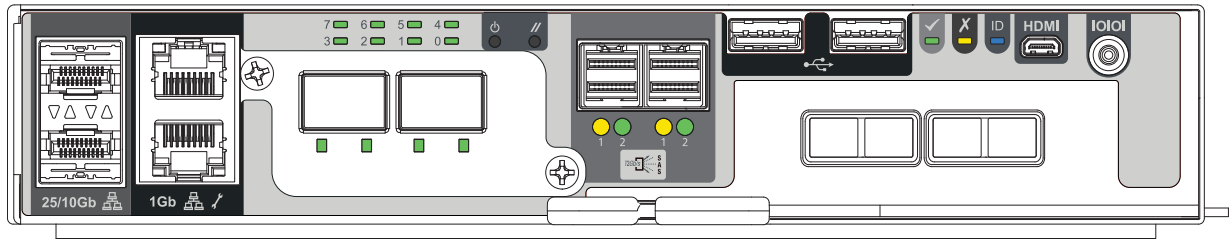
The 2 controller modules (CMs) manage the flow of data to and from the storage enclosure. Each CM provides a very specialized, solutions-specific interaction that depends on your system configuration and software implementation, including SAS zoning, failover and failback procedures, and multi-path procedures.

An important feature of the storage enclosure design is redundancy. The enclosure will maintain continuous operation during the replacement of a single CM, as long as it is within the time limit of 5 minutes, since removal of a CM significantly reduces airflow in the storage enclosure.

CAUTION If you remove any FRU while the storage enclosure is powered up, you must replace it with a tested good spare within the allotted time for that FRU. If you do not replace the FRU within the identified time limit, you void the product warranty and the storage enclosure might overheat, causing equipment failure and possible data loss.

CAUTION Do not remove covers from any FRU. There is a danger of electric shock inside. Return the FRU to your supplier for repair.

The CM has a number of ports, each with independent status LEDs. Those items in the state column with an asterisk (*) indicate a fault condition.





LED	Type	Color	State	Status
	SAS expansion port	Amber	On*	Critical SAS cable fault
			Fast flash* (1s on, 1s off)	SAS Unit identification (UID) active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
			Off	SAS expansion port functioning properly
	Hardware fault	Amber	On*	CM hardware fault
			Fast flash (1s on, 1s off)	Part of sequence as CM comes online
			Off	CM functioning properly

Figure 72 Controller module LEDs to examine for fault conditions

To replace a 2U enclosure controller module:

1. Complete the following actions to remove the faulty CM:
 - a. Facing the rear of the storage enclosure, grasp the CM release latch between thumb and forefinger, then squeeze together to release the latch and handle.

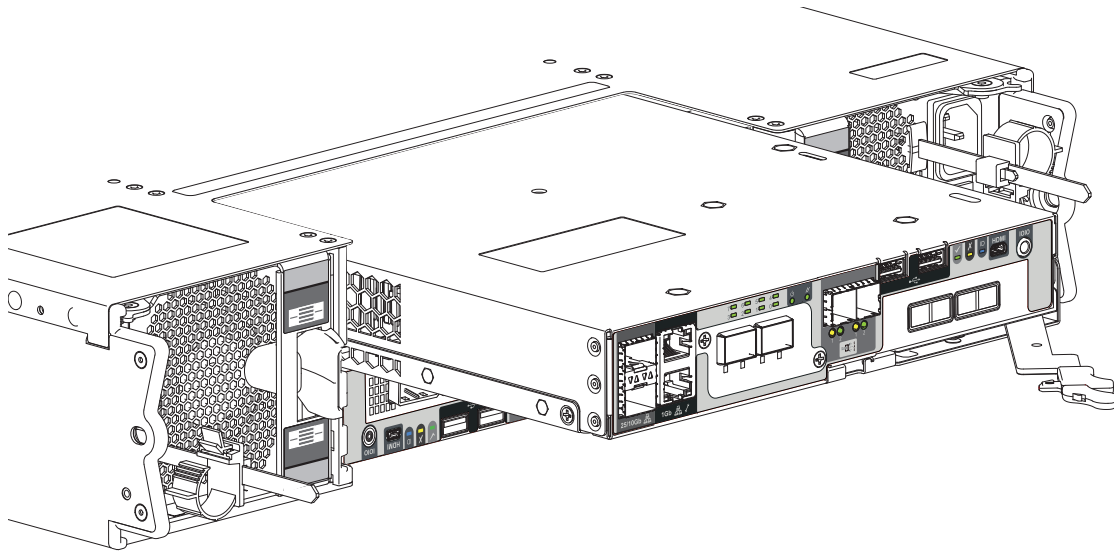


Figure 73 Controller module removal, upper

- b. Pull the handle outward to lever the CM away from the midplane.
 - c. Use one hand to support the weight of the CM and the other to gently withdraw the CM from its slot.
 - d. Place it in a static-protected location.
2. Complete the following actions to replace it with a tested good CM:

- a. Examine the tested good CM to make sure it is undamaged with pins that are straight, not bent.

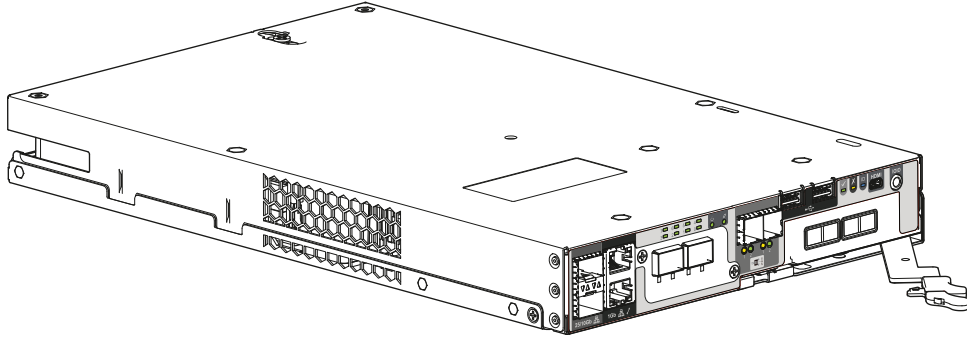


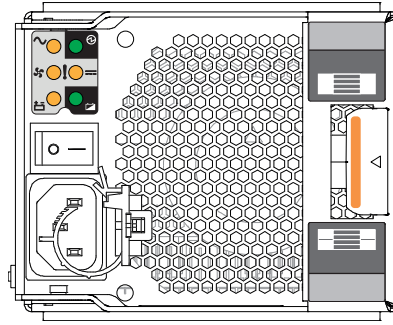
Figure 74 Controller module

- b. Facing the rear of the storage enclosure, orient the CM with the open latch identically to the one you just removed.
 - c. Use one hand to support the weight of the CM and the other to guide it into the empty CM slot.
 - d. Exerting even pressure to the center, gently press it against the midplane until the latch closes and it locks in place.
3. After verifying the connectors are all undamaged, reconnect all cables as they were connected before.
 4. Verify that the **CM OK** LED is lit green on the replaced CM after properly inserting and seating it in the empty slot.
 5. Facing the front of the storage enclosure, verify that the **Power On** LED is green and there are no fault conditions.

Replace a 2U power cooling module

The 2 auto-ranging power cooling modules (PCMs) provide power and cooling to storage enclosure modules and components. The power supply portion of the PCM provides power to the storage enclosure within 100-240VAC at 50-60Hz. The PCM uses standard industrial wiring with line-to-neutral or line-to-line power connections.

The 764W DC PCM input range is -40V to -72V DC with 25 to 14A current. Each PCM has 6 LEDs to identify various states: 4 as primary thermal and power status indicators and another 2 that used to indicate battery status but are no longer in use. When no LEDs are on, there is no AC power to the PCM. The asterisk (*) indicates a fault condition.







LED					Status
Type	AC fault	PCM OK	Fan fault	DC fault	N/A
Color	Amber	Green	Amber	Amber	
State	Off				AC power not present on either PCM
	On*	Off		On*	AC power not present on this PCM
	Off	On	Off		AC power present, power switch is on; PCM OK
	Off	On	Off	On*	PCM fan speed is out of tolerance
	Off		On*	Off	PCM fan fault
	On	Off	On*		PCM hardware fault: over temperature, over voltage, over current
	Off	Flashing	Off		PCM is in standby mode
	Flashing	Off	Flashing		Firmware update to PCM in progress

Figure 75 Power cooling module fault LEDs

An important feature of the storage enclosure design is redundancy. The enclosure will maintain continuous operation during the replacement of a single PCM, as long as it is within the time limit of 5 minutes, since removal of a PCM significantly reduces airflow in the storage enclosure.

CAUTION Use only power cords supplied in the installation kit or those that meet product specifications.

CAUTION Adhere to power source and power connection requirements to avoid harm to equipment.

- Only connect the power cooling module (PCM) to power sources that comply with product specifications and labels.
 - Always remove all power connections before you remove a PCM from the storage or expansion enclosure.
-

CAUTION Do not remove covers from any FRU. There is a danger of electric shock inside. Return the FRU to your supplier for repair.

CAUTION If you remove any FRU while the storage enclosure is powered up, you must replace it with a tested, good spare within the allotted time for that FRU. If you do not replace the FRU and, when applicable, fully close the related drawer within the identified time limit, you void the product warranty and the storage enclosure might overheat, causing equipment failure and possible data loss.

To replace a power cooling module:

1. Retrieve the new PCM in its static-protected container, ready to immediately replace the faulty one.
2. Complete the following actions to remove the faulty PCM:
 - a. Facing the rear of the rack cabinet, switch off the power for that PCM.
 - b. Release the PCM power cord from its secure tie, and then disconnect the power cord from the PCM connector.
 - c. Release and pivot the latch of each PCM to the open position.
 - d. Use one hand to support the weight of the PCM and the other to gently withdraw the PCM.

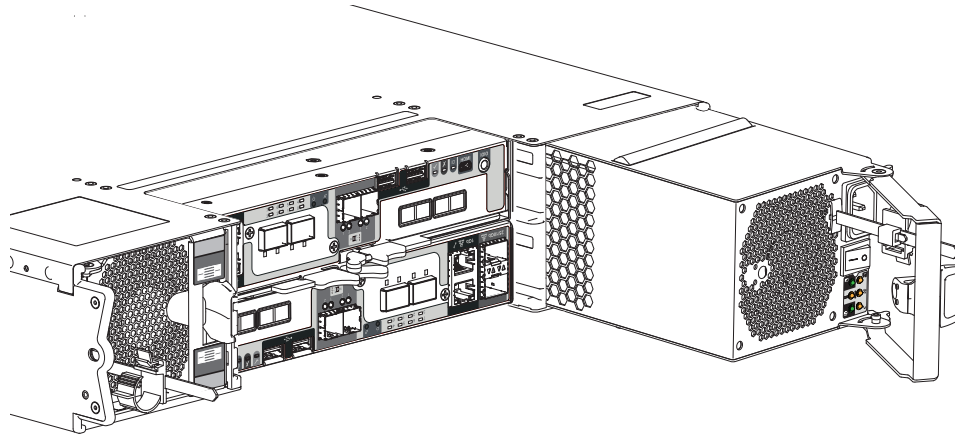


Figure 76 Power cooling module removal

- e. Temporarily store the PCM in a static-protected environment.
3. Complete the following actions to install a tested good PCM:
 - a. Orient the new PCM with the open latch to the outside of the chassis opening.

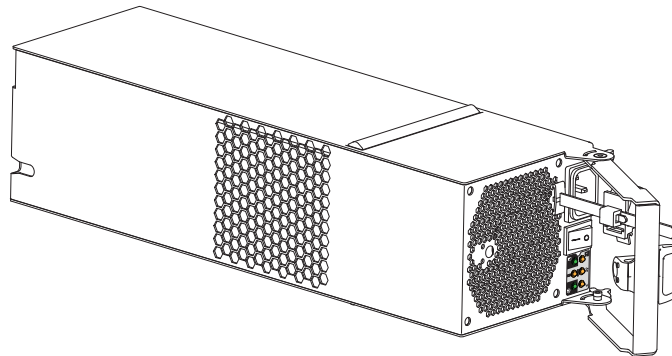


Figure 77 Power cooling module

- b. Use one hand to support the weight of the PCM and the other to guide it into the empty PCM slot.
 - c. Exerting even pressure to the center, gently press inward until it connects with the midplane.
 - d. Swing the latch closed until it locks in place.
 - e. Reconnect the power cord, and then tighten the secure tie around it.
4. Verify that the *PCM OK* LED is lit green on the replaced PCM after properly inserting and seating it in the empty slot.
5. Facing the front of the storage enclosure, verify that the *Power On* LED is green and there are no fault conditions.

11 In-service field maintenance for 5U enclosures

You may service the identified storage enclosure FRUs and still maintain continuous operation during the replacement, but with two very important qualifiers:

- You must determine whether your system allows for continuous operation during service replacement of the storage enclosure drive modules in their carriers (DDICs) without interrupting access to enclosure file systems.
- You must complete the replacement in the allotted time, replacing only one FRU at a time. The storage enclosure design provides for redundancy, so the loss of a single FRU does not impact functionality for a limited time.

The tasks identified in this chapter first cover FRUs in the drawers, followed by FRUs accessible from the rear panel area. It is essential you adhere to all safety precautions when servicing storage enclosure FRUs.

CAUTION When performing maintenance on the storage enclosure or its components:

- Observe the caution label affixed to each drive module or FRU prior to handling or replacing it.
- Do not remove a defective FRU until you have its functional replacement ready for insertion.

To adhere to safety precautions when replacing a FRU in a storage enclosure:

1. Replace any defective FRU with a fully operational one as soon as possible.
2. Replace any defective FRU within the identified replacement time to minimize air loss and maintain optimum cooling within the storage enclosure.

Table 24 5U enclosure time limits for FRU replacement

Defective FRU	Replacement time limit
Drawers	
Drive, LFF or SFF, in carrier (DDIC)	Seven (7) minutes, including drawer closure
Rear panel area	
Fan cooling module (FCM)	Seven (7) minutes
Power supply unit (PSU)	Seven (7) minutes
AP controller module (CM)	Seven (7) minutes
Attachments	
Rackmount rail kit	N/A
Cable kits: Standard HD mini-SAS to HD mini-SAS (SF-8644)	N/A
AC power cord, compatible	N/A

3. Prevent electrostatic discharge from damaging the storage enclosure or its components.
 - a. Keep a static-protected work surface clear of clutter, including plastic, vinyl, and foam.
 - b. Transport and store FRUs in static-safe containers.
 - c. Keep FRUs in their containers until reaching a clear, static-protected work surface.
 - d. Always wear a grounded ESD wrist strap that meets a minimum 1 megohm (± 10 percent) resistance standard and that is snug against your skin.
 - e. Use heel straps, toe straps, or boot straps on both feet to ground to your conductive floor or dissipating floor mat or use a portable field service kit with a grounded, static-dissipating work mat.

- f. Use conductive field service tools.
- g. When removing a FRU, immediately place it in anti-static packaging.
- h. Avoid touching pins, leads, or circuitry.

Replace a 5U enclosure drive module in its carrier

The operator's (ops) panel registers either a logical fault or a drawer hardware fault or both. You must locate a faulty drive in its carrier (DDIC) within the related drawer by its amber fault condition LED.



Color	State	Status
Amber	On*	Drive has hardware fault, replace as soon as possible
		Drive link down
	Fast flash (1s on, 1s off)	Unit identification (UID) or locate is active for drive
	Slow flash* (3s on, 1s off)	Drive in critical condition
Failed array		
Off	Off	No AC power present
		Drive initialization in process
		Drive quarantined

Figure 78 Drive fault LED on carrier bezel

An important feature of the storage enclosure design is redundancy. The enclosure will maintain continuous operation during the replacement of a single DDIC, if it is within the time limit of 7 minutes, since opening a drawer to remove a DDIC significantly reduces airflow in the storage enclosure.

CAUTION If you remove any FRU while the storage enclosure is powered up, you must replace it with a tested, good spare within the allotted time for that FRU. If you do not replace the FRU and, when applicable, fully close the related drawer within the identified time limit, you void the product warranty and the storage enclosure might overheat, causing equipment failure and possible data loss.

CAUTION Do not remove covers from any FRU. There is a danger of electric shock inside. Return the FRU to your supplier for repair.

The steel carrier provides thermal conduction, radio frequency, electro-magnetic induction, and physical protection. For this task, treat the drive carrier and its installed drive as a single FRU.

To replace a 5U enclosure drive module in its carrier:

1. Complete the following actions to open the related drawer:
 - a. Facing the front of the storage enclosure, determine which drawer has a fault condition by the fault LEDs on the ops panel and drawer panels.



Figure 79 Operator's panel



Figure 80 Drawer panel

- b. If the anti-tamper lock is engaged, use a T20 Torx driver to unlock both drawer pull handles.
- c. Simultaneously press both drawer latches inward and hold them there while exerting even outward pressure until all three rows are visible and the drawer slide latch locks in the open position.

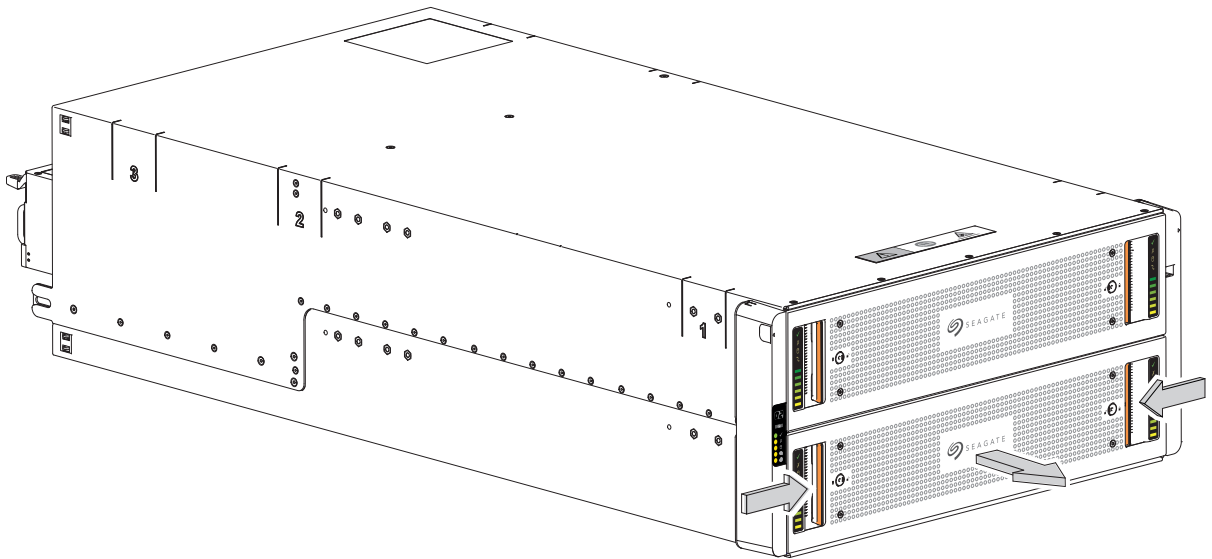


Figure 81 Drawer release and access

- d. Stop when the drawer rails engage the safety lock latches as the drawer reaches the open position, so that you can access all three rows of DDICs.
2. Complete the following actions to remove a faulty DDIC:

- a. Locate the DDIC with a fault condition.

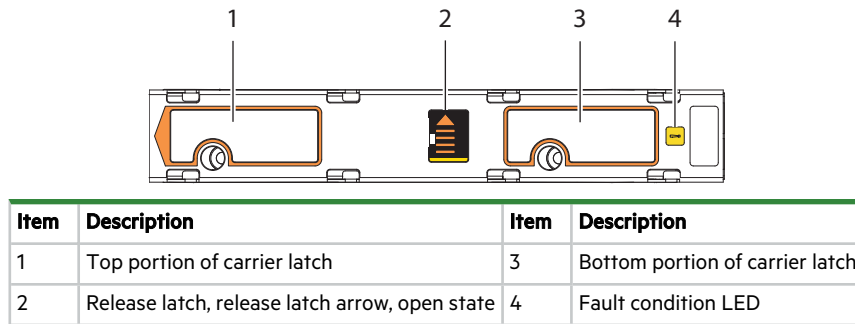


Figure 82 Carrier latch features

- b. Using a thumb, press the DDIC release latch arrow to the right to release the DDIC from its seated position.
- c. Grasping the top of the carrier, pull it upwards until it clears its drawer slot.

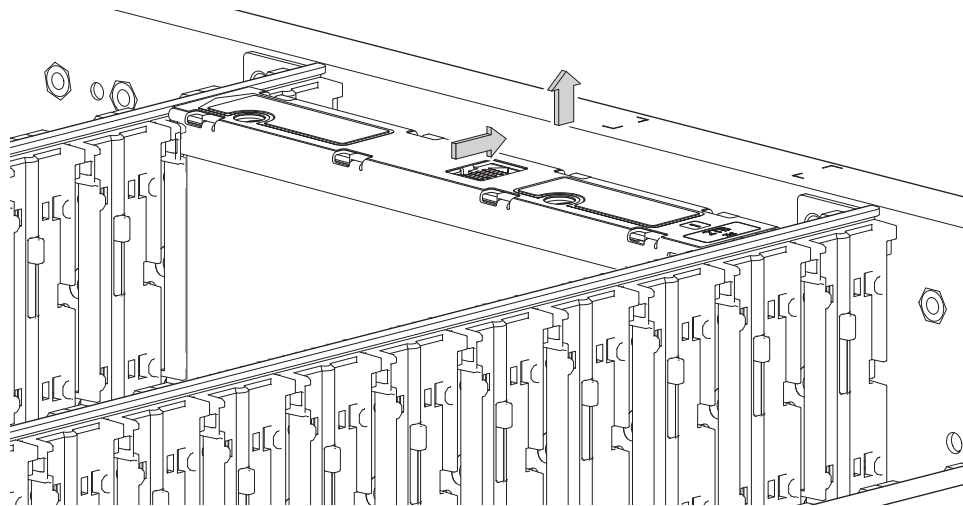


Figure 83 Removal of drive in its carrier

- d. Place it in a static-protected location.
3. Complete the following actions to replace it with a tested, good DDIC:
 - a. Select a new DDIC, orient it so the LED is towards the drawer front, and the release latch arrow towards the rear.
 - b. Align the carrier with the empty drawer slot, then lower it fully into the slot.

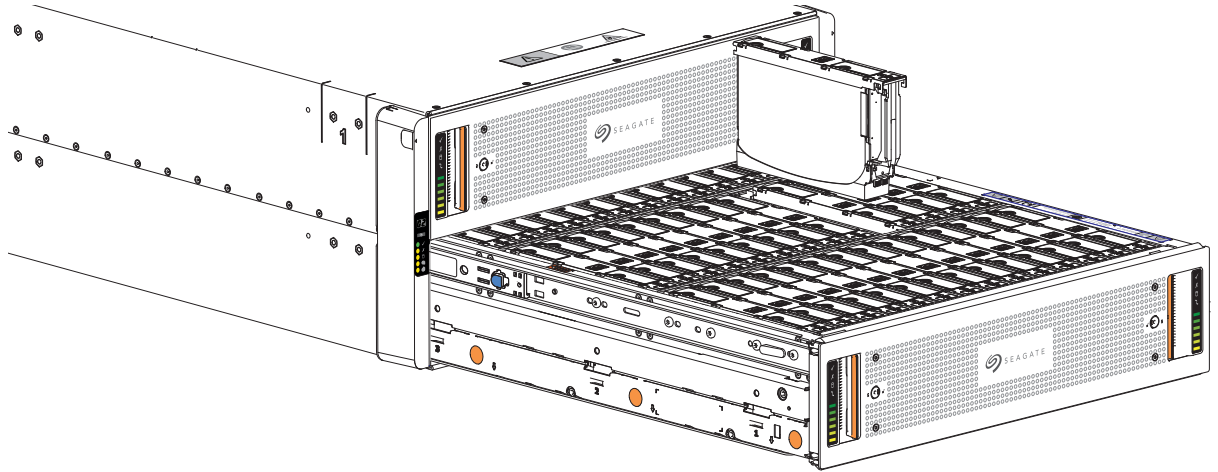


Figure 84 Replacement of drive in its carrier

- c. Push the DDIC down until the top is flush with the top of the slot.
- d. While holding it against the bottom of the slot, slide the top latch toward the rear of the drawer until it locks into place and the DDIC release latch locks.



Figure 85 Release latch open and unlocked



Figure 86 Release latch properly locked

- e. Verify that all drives are at the same level and all DDIC release latches are properly locked.

CAUTION Do not proceed to close the drawer unless all DDICs are in a fully locked position or DDIC height can inhibit or completely prevent drawer access once you close it.

- f. Confirm that the DDIC fault condition LED is off.

4. Complete the following actions to close the related drawer:
 - a. Press and hold the safety lock latches with the blue touchpoint at the front of both extended drawer slide rails.

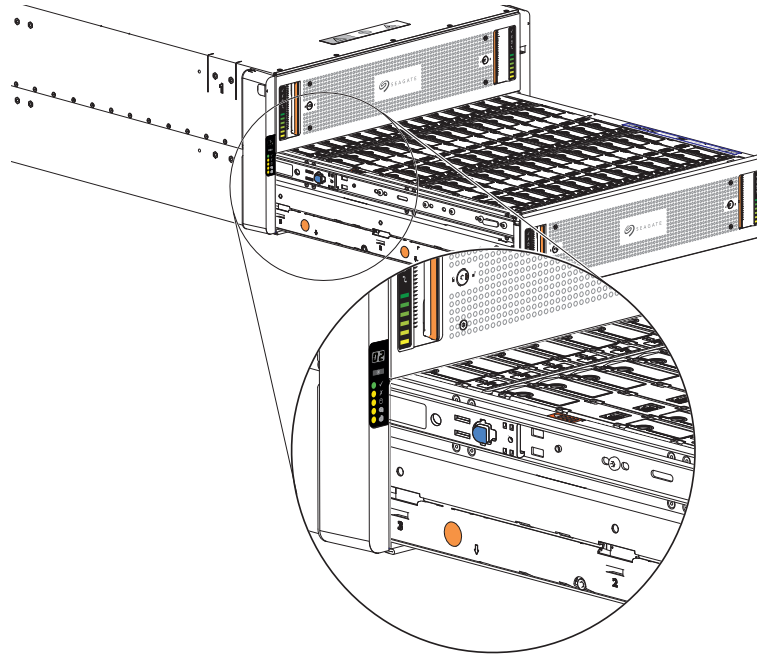


Figure 87 Safety lock to release left drawer slide rail of lower drawer

- b. Pressing simultaneously inward, begin sliding the drawer back into place until the safety lock clears the opening.
 - c. Placing the heels of both palms against the face of the drawer near the anti-tamper locks, exert even inward pressure until the drawer is almost flush with the rack ear flanges.
 - d. Simultaneously press inward and hold both drawer pull handles as you push the drawer closed until it fully latches.
5. Verify that the fault LED on the replaced DDIC is off after properly inserting and seating it in the empty slot.
6. Facing the front of the storage enclosure, verify that the *Power On* LED is green and there are no fault conditions.

Replace a 5U enclosure controller module

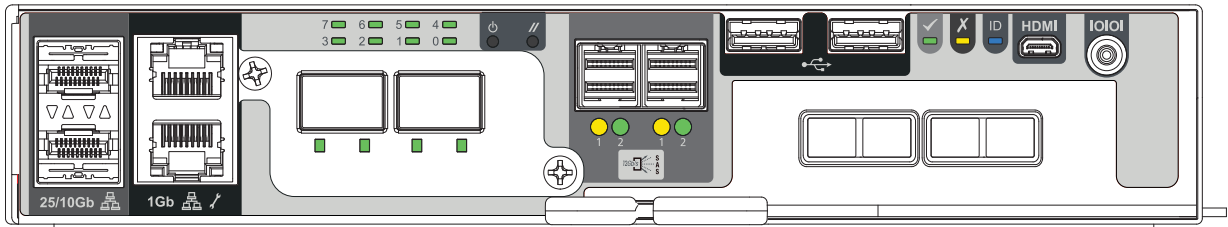
Both controller modules (CMs) manage the flow of data to and from the storage enclosure. Each CM provides a very specialized, solutions-specific interaction that depends on your system configuration and software implementation, including SAS zoning, failover and failback procedures, and multi-path procedures.

An important feature of the storage enclosure design is redundancy. The enclosure will maintain continuous operation during the replacement of a single CM as long as it is within the time limit of 7 minutes, since removing a CM significantly alters airflow in the storage enclosure.

CAUTION If you remove any FRU while the storage enclosure is powered up, you must replace it with a tested good spare within the allotted time for that FRU. If you do not replace the FRU within the identified time limit, you void the product warranty and the storage enclosure might overheat, causing equipment failure and possible data loss.

CAUTION Do not remove covers from any FRU. There is a danger of electric shock inside. Return the FRU to your supplier for repair.

The CM has a number of ports, each with independent status LEDs. Those items in the state column with an asterisk (*) indicate a fault condition.





LED	Type	Color	State	Status
	SAS expansion port	Amber	On*	Critical SAS cable fault
			Fast flash* (1s on, 1s off)	SAS Unit identification (UID) active
			Slow flash* (3s on, 1s off)	Non-critical SAS cable fault
			Off	SAS expansion port functioning properly
	Hardware fault	Amber	On*	CM hardware fault
			Flashing	Part of sequence as CM comes online, on standby
			Off	CM functioning properly

Figure 88 Controller module LEDs to examine for fault conditions

To replace a 5U enclosure controller module:

1. Complete the following actions to remove the faulty CM:
 - a. Facing the rear of the storage enclosure, carefully remove all CM connections.
 - b. Grasp the CM release latch between thumb and forefinger, then squeeze together to release the latch and handle.

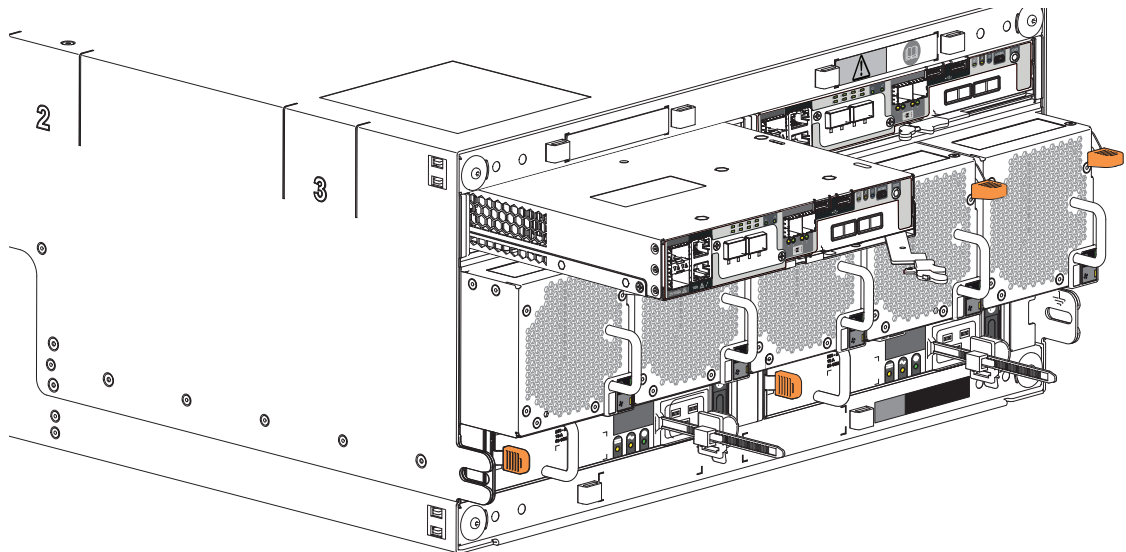


Figure 89 Controller module removal, left

- c. Pull the handle outward to lever the CM away from the midplane.

- d. Use one hand to support the weight of the CM and the other to gently withdraw the CM from its slot.
 - e. Place it in a static-protected location.
2. Complete the following actions to replace it with a tested good CM:
 - a. Examine the tested good CM to make sure it is undamaged with pins that are straight, not bent.

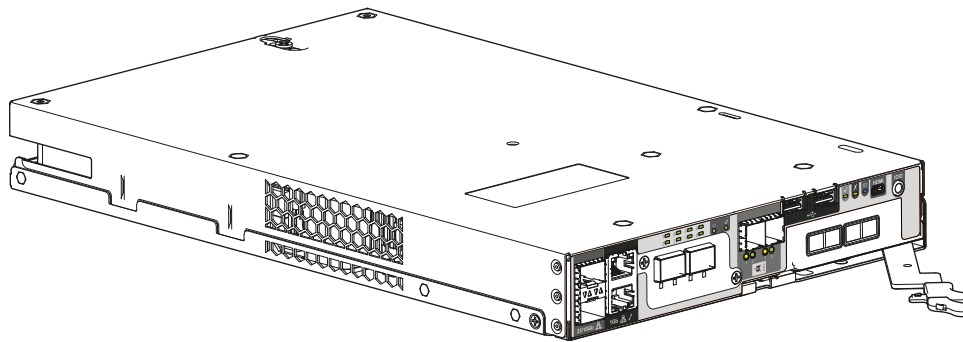
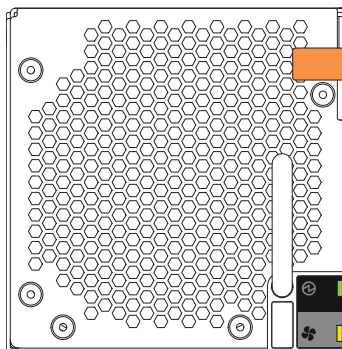


Figure 90 Replacement controller module

- b. Facing the rear of the storage enclosure, orient the CM with the open latch identically to the one you removed.
 - c. Use one hand to support the weight of the CM and the other to guide it into the empty CM slot.
 - d. Exerting even pressure to the center, gently press it against the midplane until the latch closes and locks in place.
3. After verifying the connectors are all undamaged, reconnect all cables as they were connected before.
 4. Verify that the *CM OK* LED is lit green on the replaced CM after properly inserting and seating it in the empty slot.
 5. Facing the front of the storage enclosure, verify that the *Power On* LED is green and there are no fault conditions.

Replace a 5U fan cooling module

The 5 fan cooling modules (FCMs) provide cooling to storage enclosure modules and components. The fan cooling module (FCM) has a green and an amber fault LED to identify various states. The asterisk (*) indicates a fault condition.





LED	Type	Color	State	Status
	FCM OK	Green	On	FCM hardware functioning properly
			Off*	FCM hardware fault
	FCM fault	Amber	On*	Fan speed is out of tolerance
				Communication with AP controller module (CM) lost
			Off	FCM hardware functioning properly

Figure 91 Fan cooling module fault LEDs

An important feature of the storage enclosure design is redundancy. The enclosure will maintain continuous operation during the replacement of a single FCM, if it is within the time limit of 7 minutes, since removal of an FCM significantly reduces airflow in the storage enclosure.

CAUTION If you remove any FRU while the storage enclosure is powered up, you must replace it with a tested, good spare within the allotted time for that FRU. If you do not replace the FRU and, when applicable, fully close the related drawer within the identified time limit, you void the product warranty and the storage enclosure might overheat, causing equipment failure and possible data loss.

CAUTION Do not remove covers from any FRU. There is a danger of electric shock inside. Return the FRU to your supplier for repair.

To replace a fan cooling module:

1. Retrieve the new FCM in its static-protected container, ready to access and use the new FCM immediately upon removal of the faulty one.
2. Complete the following actions to remove the faulty FCM:
 - a. Facing the rear of the rack cabinet, press downward to release the FCM latch.
 - b. Use one hand to support the FCM's weight and the other to gently withdraw the FCM all the way from its slot.

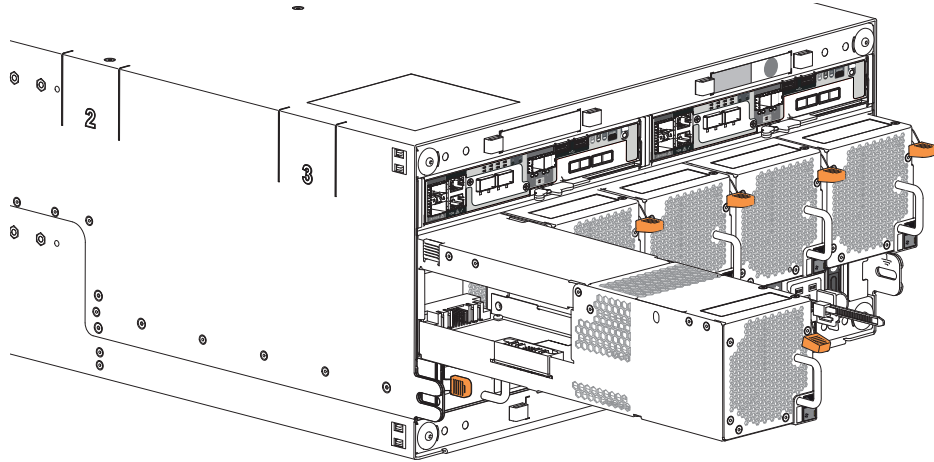


Figure 92 Fan cooling module removal

- c. Place it in a static-protected location.
- 3. Complete the following actions to replace the faulty FCM with a tested, good one:
 - a. Orient the new FCM with the latch to the right.

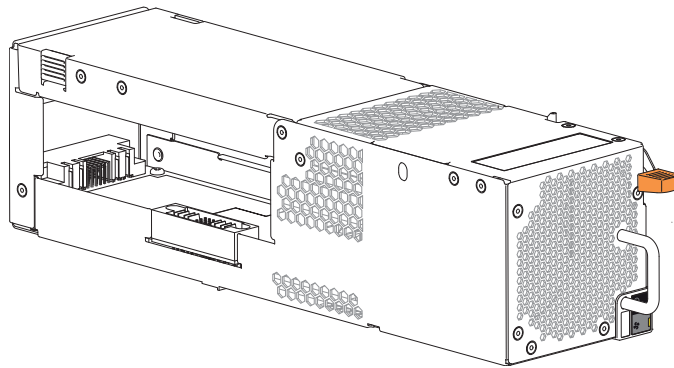
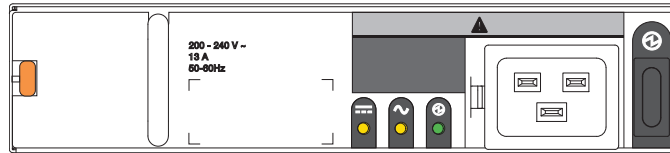


Figure 93 Fan cooling module

- b. Use one hand to support the weight of the FCM and the other to guide it into the empty FCM slot.
- c. Exerting even pressure to the center, gently press inward until it connects with the midplane and it locks in place.
- 4. Verify the *FCM OK* LED is lit green on the replaced FCM after properly inserting and seating it in the empty slot.
- 5. Facing the front of the storage enclosure, verify that the *Power On* LED is green and there are no fault conditions.

Replace a 5U power supply unit

Both power supply units (PSUs) provide power to the storage enclosure within 200-240VAC at 50-60Hz. Each PSU has three status LEDs. The asterisk (*) indicates a fault condition.



LED				Status
Type	PSU fault	AC fault	PSU OK	N/A
Color	Amber	Amber	Green	
State	Off			AC power not present
	On*		Off	PSU present, but not supplying power
	Flashing		Off	Firmware download to PSU in progress
	Off		On	AC power present, power switch is on, providing power
	Off		Flashing	AC power present, PSU on standby, other PSU providing power
	On*			Communication with AP controller module (CM) lost
	On*		N/A	PSU hardware fault
	On*		Off	PSU alert state or hardware fault: over temperature, over voltage, or over current
	Off	On*		AC power failed, PSU not providing power, other PSU providing power
Off	On*		AC power failed, PSU running on battery	

Figure 94 Power supply unit fault LEDs

An important feature of the storage enclosure design is redundancy. The enclosure will maintain continuous operation during the replacement of a single PSU, if it is within the time limit of 7 minutes, since removal of a PSU significantly reduces airflow in the storage enclosure.

CAUTION Use only power cords supplied in the installation kit or those that meet product specifications.

CAUTION Adhere to power source and power connection requirements to avoid harm to equipment.

- Only connect the power supply unit (PSU) to power sources that comply with product specifications and labels.
 - Always remove all power connections before you remove a PSU from the storage or expansion enclosure.
-

CAUTION If you remove any FRU while the storage enclosure is powered up, you must replace it with a tested, good spare within the allotted time for that FRU. If you do not replace the FRU and, when applicable, fully close the related drawer within the identified time limit, you void the product warranty and the storage enclosure might overheat, causing equipment failure and possible data loss.

CAUTION Do not remove covers from any FRU. There is a danger of electric shock inside. Return the FRU to your supplier for repair.

To replace a power supply unit:

1. Retrieve the new PSU in its static-protected container, ready to access and use the new PSU immediately upon removal of the faulty one.

2. Complete the following actions to remove the faulty PSU:
 - a. Facing the rear of the rack cabinet, switch off the power for that PCU, then disconnect its power cord.
 - b. Press the PSU release latch to the right to release the PSU from the midplane.
 - c. Use one hand to support the weight of the PSU and the other to pull the handle outward and withdraw the PSU.

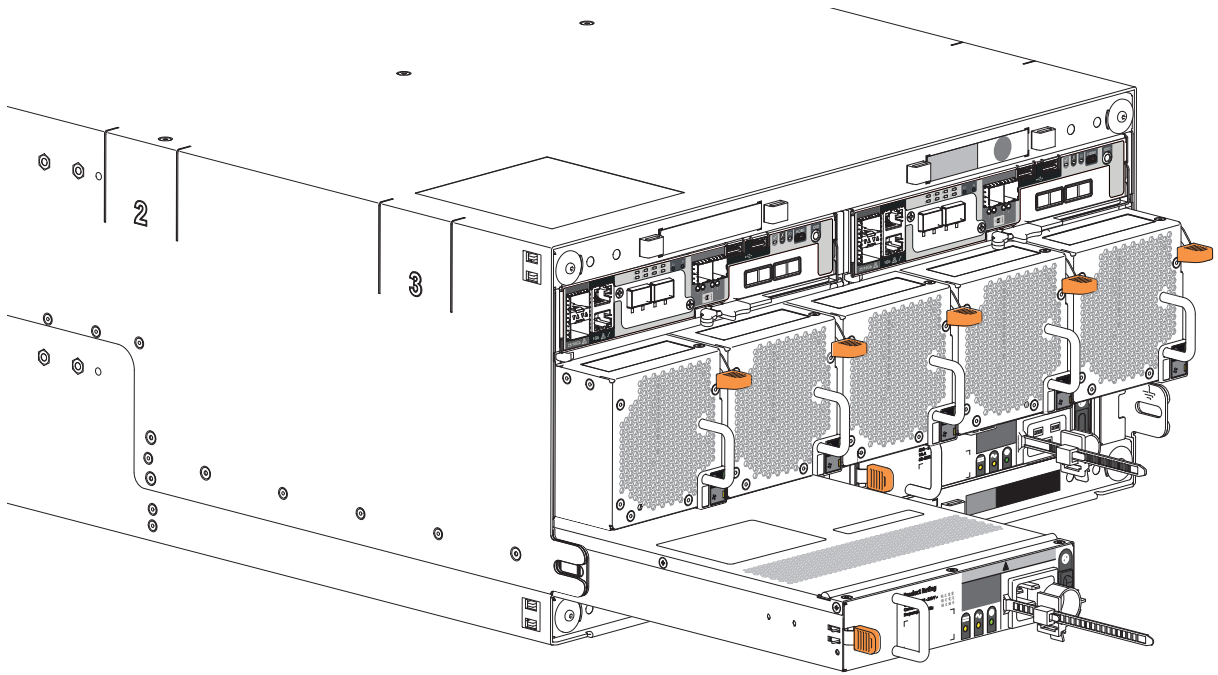


Figure 95 Power supply unit removal

- d. Place it in a static-protected location.
3. Complete the following actions to replace the faulty PSU with a tested good one:
 - a. Facing the rear of the storage enclosure, orient the new PSU with the latch to the left.

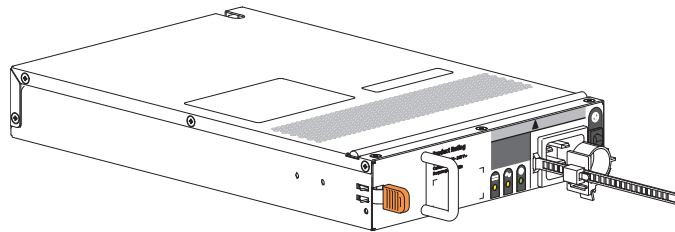


Figure 96 Power supply unit

- b. Use one hand to support the weight of the PSU and the other to guide it into the empty PSU slot.
- c. Exerting even pressure to the center, gently press inward until it connects with the midplane and it locks in place.
- d. Connect the power cord, then move the PSU power switch to the ON position.
4. Verify that the *PSU OK* LED is lit green on the replaced PSU after properly inserting and seating it in the empty slot.
5. Facing the front of the storage enclosure, verify that the *Power On* LED is green and there are no fault conditions.

A Technical specifications

Table 25 Storage enclosure dimensions

Dimension type	2U12, 2U24		5U84	
	Metric units	Imperial units	Metric units	Imperial units
Height	87.90mm	3.46 in	220.00mm	8.65 in
Width, excluding rails	483.00mm	19.01 in	483.00mm	19.00 in
Depth, excluding cables	630.00mm	24.80 in	933.00mm	36.75 in

Table 26 Storage enclosure FRU weights

FRU or component	Metric units	Imperial units
2U12 storage enclosure chassis plus midplane, no FRUs or rails	17.00Kg	38.00 lb
2U12 storage enclosure chassis, fully populated, no rails	up to 32.00Kg	up to 71.00 lb
2U24 storage enclosure chassis plus midplane, no FRUs or rails	17.00Kg	38.00 lb
2U24 storage enclosure chassis, fully populated	up to 30.00Kg	up to 66.00 lb
5U84 storage enclosure chassis plus midplane and drawers, no FRUs or rails	36.00Kg	79.40 lb
5U84 storage enclosure chassis, fully populated, no rails	up to 135.00Kg	up to 298.00 lb
Drive module, either 3.5-inch LFF in carrier or 2.5-inch SFF with adapter in carrier	up to 0.80Kg	up to 1.80 lb
Controller module (CM)	up to 3.11Kg	up to 6.88 lb
2U enclosure power cooling module (PCM)	1.45Kg	3.20 lb
5U enclosure fan cooling module (FCM)	0.80Kg	1.80 lb
5U enclosure power supply unit (PSU)	0.70Kg	1.50 lb
2U rack rails and hardware kit	2.75Kg	6.60 lb
5U rack rails and hardware kit	8.50Kg	18.74 lb

-All weights are nominal, can vary. Unit values for drives use the heaviest drive currently qualified.
 -Scale calibration impacts measured weights.

Table 27 Environmental specifications

Type	Operation	Storage, Non-operating	
		2U12, 2U24	5U84
Temperature, ASHRAE A2	5°C to 35°C (41°F to 95°F, derated by 1°C per 300m above 900m)	-40°C to +70°C (-40°F to +158°F) Maximum temperature change in an hour: 20°C	
Airflow	System must be operated with low pressure rear exhaust installation Back pressure created by rack doors and obstacles not to exceed 5 Pa (0.5mm H ₂ O)		
Altitude	-100 to 3,000 meters (-330 to 10,000 feet) Maximum operating temperature is de-rated by 1°C for each 300m above 900m (2952.76 ft)	-100 to 12,192m (-328 to 40,000 ft)	
Relative humidity	-12°C dew point minimum 8% to 85% maximum, non-condensing	21°C dew point maximum 5% to 100% maximum, non-condensing	
Shock	5.0g, 10ms (per axis)	15.0g, 10ms, 10 shock pulses (X, Y, and Z axes)	20.0g, 10ms (X and Y axes)
Vibration	0.21Grms 5Hz to 500Hz random, 30 min per axis	1.04Grms 2Hz to 200Hz random (ISTA 3E) Relocation: ISTA3H air ride for 60 min	
Acoustics	N/A		

Table 28 Power specifications

Type	Description	
	2U	5U
Input power requirements	100VAC to 240VAC, 50Hz to 60Hz	200VAC to 240VAC, 50Hz to 60Hz
Voltage	Max output: 764W	Max output: 2200W
	Range: 100-240VAC, rated	Range: 200-240VAC, rated
	Frequency: 50-60Hz	Frequency: 50-60Hz
Hot-swappable?	HDDs and SSDs (in chassis data slots), AP controller modules (CMs), and power cooling modules (PCMs)	HDDs and SSDs (in chassis data slots), AP controller modules (CMs), fan cooling modules (FCMs), and power supply units (PSUs)

B Standards and regulations

International standards

The storage enclosure complies with the requirements of the following agencies and latest editions of these standards:

Table 29 Standard and approvals

Type	Specification	
Safety certifications	UL 60950-1; UL & cUL to UL 62368-1 2nd Ed	
	CAN/CSA-C22.2 No. 60950-1-07; No. 62368-1-14, 2nd Ed	
	CE to EN 60950-1; 62368-1	
	IEC 60950-1; 62368-1 2nd Ed (International)	
	CCC (China PRC - CCC PSUs)	
	BIS (India - BIS PSUs)	
Ecodesign	Commission Regulation (EU) 2019/424 (Directive 2009/125/EC)	
Emissions (EMC)	FCC CFR 47 Part 15 Subpart B Class A (United States)	
	ICES/NMB-003 Class A (Canada)	
	EN 55032 Class A, EN 55024, EN 61000-3-2, EN 61000-3-3 (Europe)	
	AS/NZS CISPR 32 Class A (Australia/New Zealand)	
	VCCI Class A (Japan)	
	KN 32 Class A/KN 35 (S. Korea)	
	CNS 13438 Class A (Taiwan)	
Harmonics	EN 61000-3-2 (EU)	
Flicker	EN 61000-3-3 (EU)	
Immunity	EN 55024 (EU)	
	KN 24/KN 35 (S. Korea)	
Environmental standards	The RoHS Directive (2011/65/EU)	
	The WEEE Directive (2012/19/EU)	
	The REACH Directive (EC/1907/2006)	
	The Batteries Directive (2006/66/EC)	
Standard marks, approvals	North America (FCC, UL, cUL, ICES/NMB-003 Class A)	China (CCC – PSU only)
	European Union (CE)	Japan (VCCI)
	Australia/New Zealand (RCM)	Korea (KC)
		Taiwan (BSMI)

WEEE recycling

ⓘ IMPORTANT Observe all applicable safety precautions detailed in the preceding chapters when dismantling and disposing of this equipment.

At the end of the product's life, all scrap or waste electrical and electronic equipment, recycle it in accordance with national regulations applicable to the handling of hazardous or toxic electrical and electronic waste materials.

Contact your supplier for a copy of the Recycling Procedures applicable to your country.

C BIOS POST codes

If there is an issue during BIOS POST, the controller module (CM) communicates information using two rows of numeric LEDs.

Calculate the most significant nibble (MSN) of the hex code from the top row: LEDs 7, 6, 5, and 4.

Calculate the least significant nibble (LSN) of the hex code from the bottom row: LEDs 3, 2, 1, and 0.



Figure 97 Sample 0x9A hex code for AP controller module

Hex code states depend on if it is a cold boot, where the CM was powered off and then on, or if it is a warm boot from a reset.

Table 30 Warm and cold boot BIOS POST codes

Hex value	Code title	Description of state
0x15	PEI_CAR_NB_INIT	Pre-memory North Bridge initialization started
0x2B	PEI_MEMORY_SPD_READ	Memory initialization started: reading Serial Presence Detect (SPD) data
0x32	PEI_CPU_INIT	CPU post-memory initialization started
0x33	PEI_CPU_CACHE_INIT	CPU post-memory initialization: cache initialization started
0x3B	PEI_MEM_SB_INIT	South Bridge post-memory initialization started
0x4F	PEI_DXE_IPL_STARTED	DXE IPL started
0x60	DXE_CORE_STARTED	DXE core started
0x61	DXE_NVRAM_INIT	NVRAM initialization started
0x62	DXE_SBRUN_INIT	South Bridge runtime services initialization started
0x63	DXE_CPU_INIT	CPU DXE initialization started
0x68	DXE_NB_HB_INIT	PCI host bridge initialization started
0x69	DXE_NB_INIT	North Bridge DXE initialization started
0x6A	DXE_NB_SMM_INIT	North Bridge DXE SMM initialization started
0x70	DXE_SB_INIT	South Bridge DXE initialization started
0x78	DXE_ACPI_INIT	ACPI module initialization started
0x79	DXE_SB_SMM_INIT	South Bridge DXE SMM initialization started
0x90	DXE_BDS_STARTED	Boot device selection (BDS) phase started
0x91	DXE_BDS_CONNECT_DRIVERS	BDS phase: Driver connection started
0x92	DXE_PCI_BUS_BEGIN	PCIe bus initialization started
0x94	DXE_PCI_BUS_ENUM	PCIe bus enumeration started
0x95	DXE_PCI_BUS_REQUEST_RESOURCES	Request for PCIe bus resources started
0x96	DXE_PCI_BUS_ASSIGN_RESOURCES	Assignment for PCIe bus resources started
0x97	DXE_CON_OUT_CONNECT	Console output devices connection started
0x98	DXE_CON_IN_CONNECT	Console input devices connection started
0x99	DXE_SIO_INIT	Super I/O Initialization started
0x9A	DXE_USB_BEGIN	USB initialization started
0x9C	DXE_USB_DETECT	USB detection started
0x9D	DXE_USB_ENABLE	Enabling USB started

Table 30 Warm and cold boot BIOS POST codes (continued)

Hex value	Code title	Description of state
0xA0	DXE_IDE_BEGIN	IDE initialization started
0xA4	DXE_SCSI_BEGIN	SCSI initialization started
0xA6	DXE_SCSI_DETECT	SCSI detection started
0xAD	DXE_READY_TO_BOOT	Event: Ready to boot started
0xB4	DXE_USB_HOTPLUG	USB hot plug started

Index

2

2U12

large form factor (LFF) enclosure 11-12, 106, 114, 126

2U24

small form factor (SFF) enclosure 11-12, 106, 114, 126

B

baseboard management controller (BMC) 52, 60, 87

C

cabling

cable management system 17

power cords meeting product specifications 20, 22, 33, 47,
112, 124

route power cords 33, 47

components

enclosure front panel (84-drive) 14

enclosure front panel (LFF 12-drive) 12

enclosure front panel (SFF 24-drive) 12

controller module

fault LEDs 90

LEDs 52, 60, 90

corrective action 100, 102

D

data path

components 99

fault tolerance 11, 31, 44

disk groups 87, 90, 95, 99

drawers 42-43

E

electrical guidelines 21, 30, 33, 44, 48-49, 55-56

electrostatic discharge 106, 114

enclosure

cabling 30, 44

dimensions 126

installation checklist 20

safety requirements 21

site requirements 21

troubleshooting (basic steps) 99

weight 126

F

failure, hardware 99, 102

cable, connector, or switch 100, 103-104

drive module 103

fan modules 14, 111, 121

fault condition 97-98, 101-102

fault isolation 99

firmware update 92, 112

L

LEDs

controller module LEDs 52-53, 60-61, 98-99

drawer panel LEDs 59, 99

drive modules (SFF/LFF) 98-99

expansion module LEDs 54, 62, 98-99

front panel LEDs 98-99

operators panel LEDs 50, 58, 88

power cooling module LEDs 98

lift, mechanical

adjust height 28, 40

proper approach to rack cabinet 27-28, 39-40

N

notifications

alerts 97-98

events 97-98

P

power

cords 33, 47, 87

prerequisites 30, 44, 127

power cycle 87

power off, power down 49, 56

power on, power up 48, 56

R

rack cabinet 27, 39

leveling 22

prerequisites 22

rackmount rail system 25, 37

anatomy 25, 37

installation 25, 37

- safety guidelines 24, 36
- replacement, in-service FRU
 - controller module 109, 119
 - drive module or DDIC 107, 115
 - fan cooling module (FCM) 121
 - power cooling module (PCM) 111
 - power supply unit (PSU) 123
 - time limits 106, 114
- return
 - FRU for repair 107, 109, 115, 119
 - packaging 23, 35
 - storage enclosure 23, 35

S

- safety precautions
 - electrical 30, 44
 - equipment disposal 128
 - installation 21, 27, 39
 - rack cabinet 24, 36
- sensors
 - temperature 87
- shipment
 - original packaging damage 23, 35
 - plastic bag 23, 35
 - protective foam 23
- storage enclosure
 - lifting straps 36
 - proper rack cabinet door clearance 22
 - system airflow 11, 22, 48, 55, 122, 126
 - temperature control 11, 48, 55, 122, 126
 - total staff to install 22