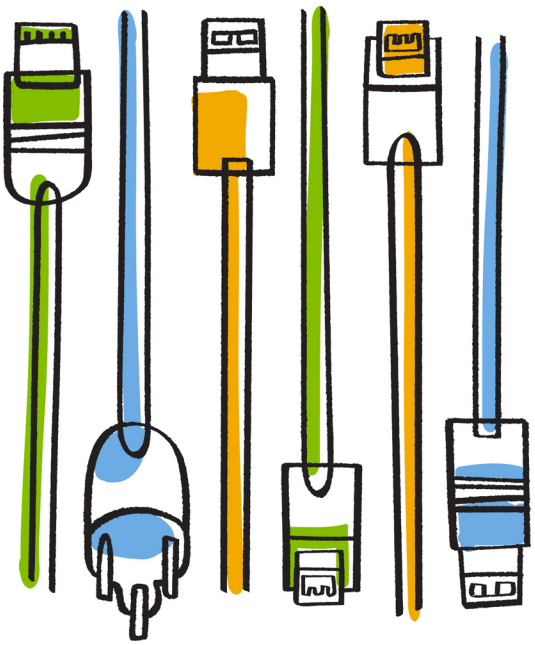
NetApp®

E-Series Systems

E5600 Controller-Drive Tray and Related Drive Trays Installation Guide



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Deciding whether to use this guide

This guide is intended for hardware installers and system administrators who are installing an E5600 controller-drive tray and the related drive trays.

This guide does not provide extensive conceptual background or information about how to install and configure the SANtricity® Storage Manager software. Refer to the appropriate SANtricity documentation to learn how to install and configure the storage management software.

NetApp Documentation: Express Guides for SANtricity Storage Manager

This guide is based on the following assumptions:

- You have consulted the *Site Preparation Guide* to plan the installation of this hardware in a cabinet.
- You have all the necessary hardware required to install the controller-drive tray and drive trays for the storage array.

Where to find the latest information about the product

You can find links to documentation and information about the latest version of the product at the *NetApp E-Series and EF-Series Systems Documentation Center*.

Step 1 - Preparing to install a controller-drive tray

Use this document to install one of the following controller-drive tray models and all necessary drive trays for your configuration:

- E5612 controller-drive tray
- E5624 controller-drive tray
- E5660 controller-drive tray

The following tables show the configuration options.

Table 1: E5612 controller-drive tray and E5624 controller-drive tray options

Configuration	Options
Duplex E5612 controller-drive tray with a host interface card or duplex E5624 controller-drive tray with a host interface card	Any combination of controller-drive trays attached to DE1600 drive trays, DE5600 drive trays, or DE6600 drive trays not to exceed a maximum of 384 drive slots or 16 total trays in the storage array. One of the following host interface cards (per controller): • Two 56-Gb/s IB ports • Four 12-Gb/s SFF-8644 mini SAS-HD ports • Four 16-Gb/s Fibre Channel ports • Four 10-Gb/s iSCSI ports Three 4-GB DIMM memory for 12-GB capacity per controller.

Table 2: E5660 controller-drive tray options

Configuration	Options
Duplex E5660 controller-drive tray with a host interface card	The following configurations are supported: • A single E5660 controller-drive tray attached to no more than five DE6600 drive trays, for a maximum of 360 drives in the storage array. • A single E5660 controller-drive tray attached to DE1600 drive trays, DE5600 drive trays, or DE6600 drive trays not to exceed a maximum of 384 drive slots or 16 total trays in the storage array. One of the following host interface cards (per controller): • Two 56-Gb/s IB ports • Four 12-Gb/s SFF-8644 mini SAS-HD ports • Four 16-Gb/s Fibre Channel ports • Four 10-Gb/s iSCSI ports Three 4-GB DIMM memory for 12-GB capacity per controller.

Attention: Possible hardware damage – To prevent electrostatic discharge damage to the tray, use proper antistatic protection when handling tray components.

Attention: Possible hardware damage – To prevent potential damage to the tray and enhance serviceability, install any 60-drive trays towards the bottom of the cabinet.

Key terms

Storage array

A collection of both physical components and logical components for storing data. Physical components include solid state drives (SSDs), controllers, ESMs, fans, and power supplies. Logical components include disk pools, volume groups, and volumes. These components are managed by the storage management software.

Controller-drive tray

One tray with drives, one or two controllers, fans, and power supplies. The controller-drive tray provides the interface between a host and a storage array.

Note: The E5600 controller-drive tray does not have a simplex option.

Controller

A circuit board and firmware that is located within a controller-drive tray. A controller manages the input/output (I/O) between the host system and data volumes.

Drive tray

One tray with drives, two environmental services modules (ESMs), fans, and power supplies. A drive tray does not contain controllers.

Environmental services module (ESM)

A canister in the drive tray that monitors the status of the components. An ESM also serves as the connection point to transfer data between the drive tray and the controller.

Gathering items

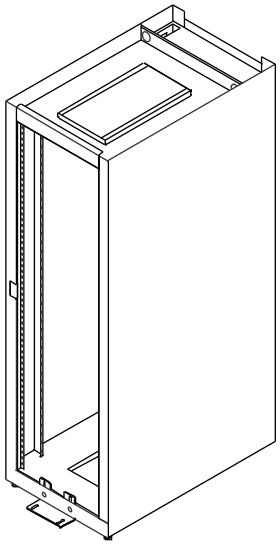
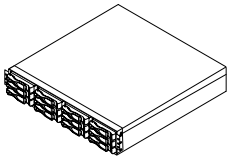
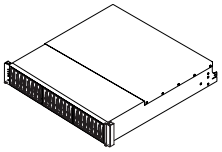
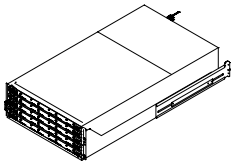
Before you start installing the controller-drive tray, you must have installed the cabinet in which it will be mounted.

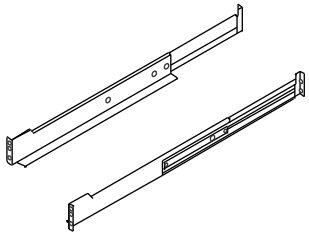
Use the tables in this section to verify that you have all of the necessary items to install the controller-drive tray.

Attention: Possible hardware damage – To prevent electrostatic discharge damage to the tray, use proper antistatic protection when handling tray components.

Basic hardware

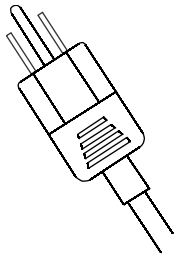
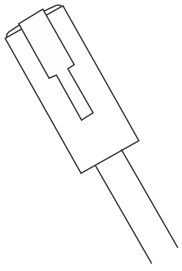
Table 3: Basic hardware

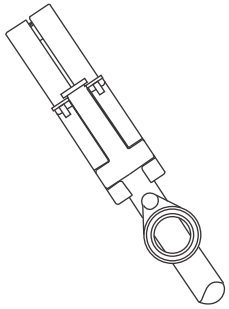
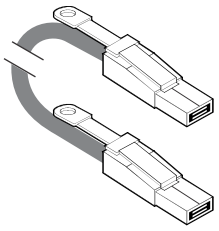
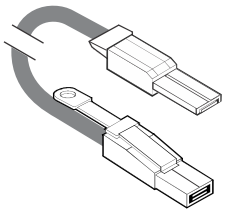
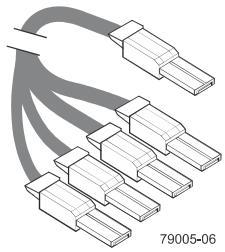
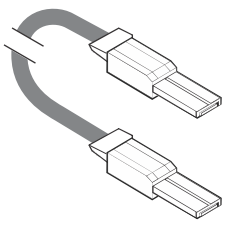
	Item
	Cabinet • Ensure that your cabinet meets the installation site specifications of the various storage array components. Refer to the *Site Preparation Guide* for more information. • Depending on the power supply limitations of your cabinet, you might need to install more than one cabinet to accommodate the different components of the storage array. Refer to the installation guide for your cabinet for instructions on installing the cabinet.
	DE1600 drive tray with end caps that are packaged separately. This drive tray ships with the drives installed and can be used with all variations of the controller-drive tray.
	DE5600 drive tray with end caps that are packaged separately. This drive tray ships with the drives installed and can be used with all variations of the controller-drive tray.
	DE6600 drive tray (shown with the separately packaged mounting rails attached). This drive tray can be used with all variations of the controller-drive tray. The DE6600 drive tray ships empty so you must install the drives when you install the drive tray into the cabinet.

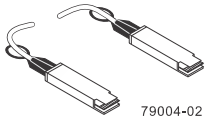
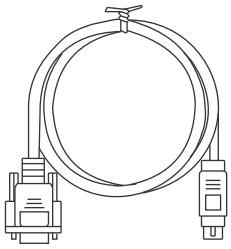
	Item
	Mounting rails and screws The mounting rails that are available with the drive tray are designed for an industry-standard cabinet.
	InfiniBand switch (optional)
	Gigabit Ethernet switch for Management (optional)
	• Host with InfiniBand host channel adapters (HBAs) (optional) • Host with SAS HBAs (optional) • Host with Fibre Channel HBAs (optional) • Host with iSCSI HBAs (optional)

Configuration cables and connectors

Table 4: Configuration cables and connectors

	Item
	AC power cords. The and the drive trays ship with power cords for connecting to an external power source, such as a wall plug. Your cabinet might have special power cords that you use instead of the power cords that ship with the and the drive trays.
	Ethernet cable For information about out-of-band storage array management, see the description for “Deciding on the management method” in the *SANtricity Storage Manager Software Installation Reference*.

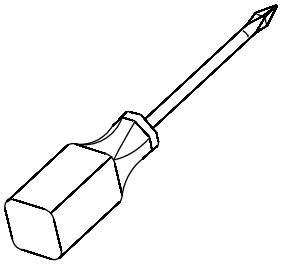
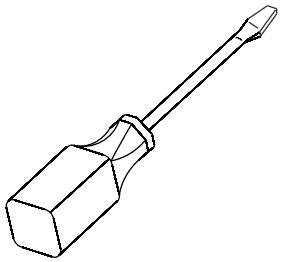
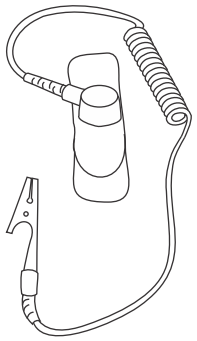
	Item
	SAS host cables for the 6-Gb/s SAS HIC. 1m-to-5m passive cables 5m-to-100m optical SAS cables 15m and 20m active cables
 79005-05	Host mini-SAS-HD to mini-SAS-HD cables for the 12-Gb/s SAS HIC. 1m-to-5m passive cables 5m-to-100m optical SAS cables 15m and 20m active cables
 79005-04	Host mini-SAS-HD to mini-SAS cables for the 12-Gb/s SAS HIC. 1m-to-5m passive cables 5m-to-100m optical SAS cables 15m and 20m active cables
 79005-06	1m-to-2m fan-out single x4 port to 4-single port passive cables
 79005-03	SAS drive tray cables 1m-to-5m passive cables for Mini SAS 8088 ports. Both controllers must be individually connected to the drive tray.

	Item
	InfiniBand cables Use these cables for InfiniBand connections to hosts with the host interface card. 1m-to-3m passive cables used to connect the 56-Gb InfiniBand HIC to the host. 5m-to-100m optical cables used to connect the 56-Gb InfiniBand HIC to the host.
	Optical Fibre Channel with SFP transceivers SFP transceivers are only included with the when a Fibre Channel HIC is ordered. 2, 3, 5, 10 or 25m OM2 cables 50-to-100m OM3 cables 300m OS1 or OS2 cables
	iSCSI with SFP+ transceivers 2m-to-7m twin-ax passive copper cables Cat5 2m-to-7m RJ-45 passive cables 2m-to-7m RJ-45 passive cables 2, 3, 5, 10 or 25m OM2 cables 25-to-300m OM3 cables
	DB9-to-PS2 adapter cable This cable adapts the DB9 connector on commercially available serial cables to the PS2 connector on the ESM for drive trays in the storage array. This cable is used for support only. You do not need to connect it during installation.
	DB9-to-Mini-USB adapter cable This 2-m cable adapts the DB9 connector on commercially available serial cables to the mini-USB port on the controller. This cable is used for support only. You do not need to connect it during initial installation.

Tools and other items

Table 5: Tools and other items

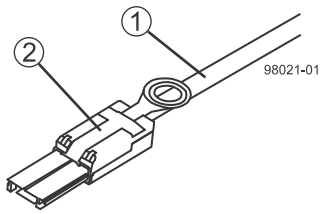
	Item
	Labels Help you to identify cable connections and lets you more easily trace cables from one tray to another
	A cart Holds the tray and components
	A mechanical lift (optional)

	Item
	A Phillips screwdriver
	A flat-blade screwdriver
	Anti-static protection
	A flashlight

Things to know - More details about cables, SFPs, and QSFPs

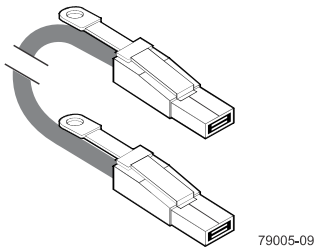
The controller-drive tray supports SAS drive connections and SAS, InfiniBand, Fibre Channel, or iSCSI host connections.

- **SAS host cable connection**

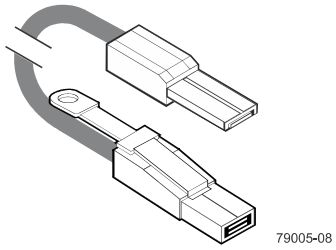


1	SAS cable
2	SFF-8088 connector

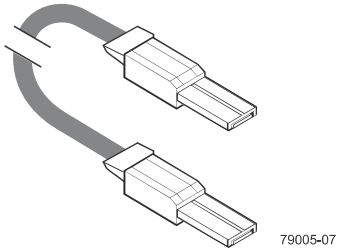
- **SAS host mini-SAS-HD to mini-SAS-HD cable connection**



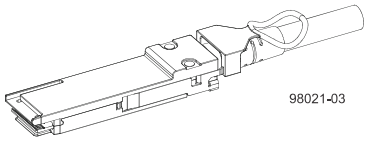
- **SAS host mini-SAS-HD to mini-SAS cable connection**



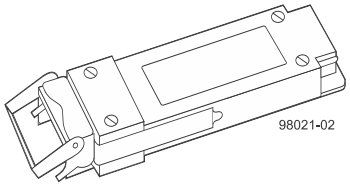
- **Mini-SAS to mini-SAS cable connection**



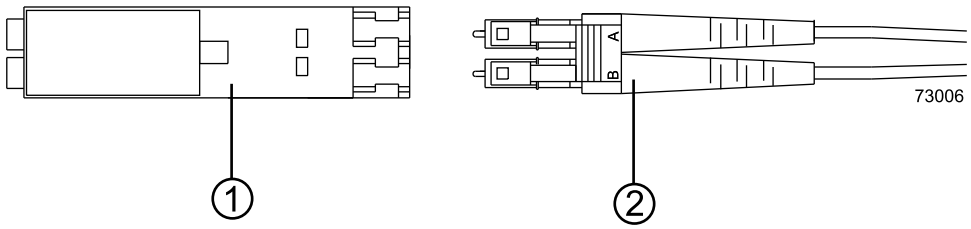
- **InfiniBand QSFP host connection with copper cables**



- **InfiniBand QSFP transceiver for use with optical host cables**

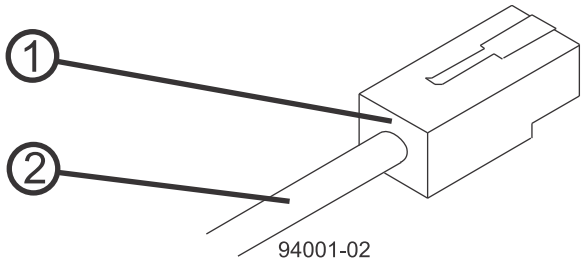


- **SFP transceiver and drive tray fiber optic host cable for controller-drive tray connections**



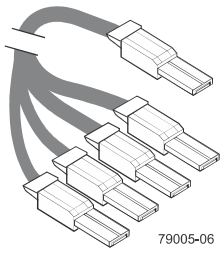
1	SFP transceiver
2	Fiber optic cable

- **iSCSI host cable with an RJ-45 connector**



1	SFP transceiver
2	Fiber optic cable

- **1m-to-2m fan-out single x4 port to 4-single port passive host cables**



The table references the SFP transceivers that apply if you are using Fibre Channel host connections.

Table 6: Supported SFP transceivers*

Vendor	Model	Version/Data Rate*
Avago	AFBR-57D9AMZ	8 Gb/s
	AFBR-57D9AMZ-EP1	8 Gb/s
	AFBR-703SDZ	10 Gb/s
	AFBR-709SMZ	SFP+ 10 GbE/s for iSCSI
	AFBR-709SMZ-EP1	SFP+ 10 GbE/s for iSCSI
	AVAGO AFBR-57F5MZ-EP1	16 Gb/s for FC
	AVAGO AFBR-57F5MZ-NA2	16 Gb/s for FC
Finisar	FTLF 8521-3	1 Gb/s
	FTLF8528P2BCV-LS	8 Gb/s
	FTLF8528P3BCV-LS	8 Gb/s
	FTLX8571D3BCL-LS	10 Gb/s
	FTLF142P3BNV	16 Gb/s for FC
	FTLF8529P3BCV	16 Gb/s for FC
	FTLF8529P3BCVA-LS	16 Gb/s for FC
JDSU	PLRXPL-VC-SH4-23-N	8 Gb/s
	PLRXPL-VC-SH4-NA	8 Gb/s
	PLRXPL-SC-S43-22-N	10 Gb/s
	PLRXPL-SC-S43-NAe	SFP+ 10 GbE/s for iSCSI
	UNIPHASE PLRXPL-SC-S43-22N	SFP+ 10 GbE/s for iSCSI
Molex	74741-0005	1 Gb/s
Opnext	TRS2001EN-0001	10 Gb/s
*All SFP transceivers can connect and run at lower speeds, even though this is not optimal.		

Things to know - Taking a quick glance at the hardware in a controller-drive tray configuration

Each 12-drive or 24-drive tray in a storage array must have a minimum of two drives for proper operation, while each 60-drive tray must have a minimum of 20 drives (4 drives in the front row of each drawer) for proper operation.

All 60-drive trays have a limit of five solid state drives (SSDs) per drawer. If you exceed this limit for SSDs in a particular drawer, the power source in the drawer could fail.

This section provides an overview of the hardware described in this document. For specific details about how LEDs operate, see *Step 10 - Turning on the power and checking for problems in a controller-drive tray configuration* on page 101.

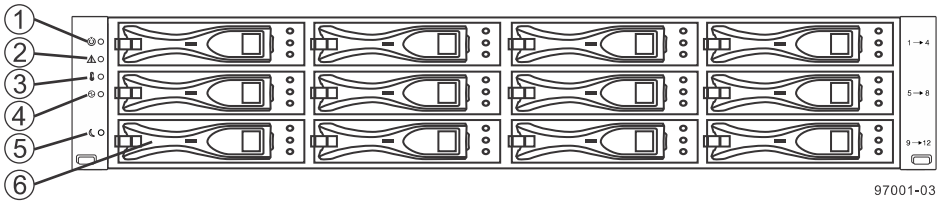
- The top of the controller-drive tray is the side with labels.

- The configuration of the host ports might appear different on your system depending on which host interface card configuration is installed.

Refer to the *Site Preparation Guide* for information about the installation requirements of these components.

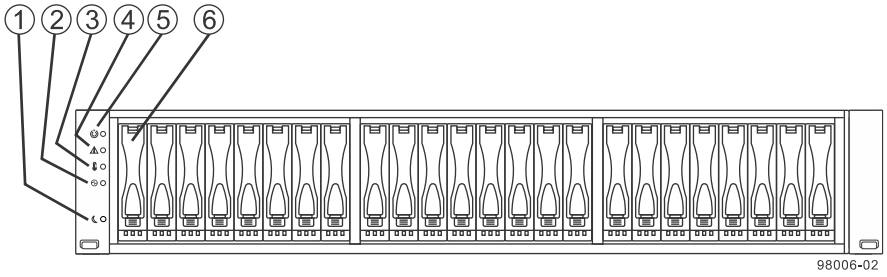
Controller-drive trays

- **E5612 controller-drive tray – Front view**



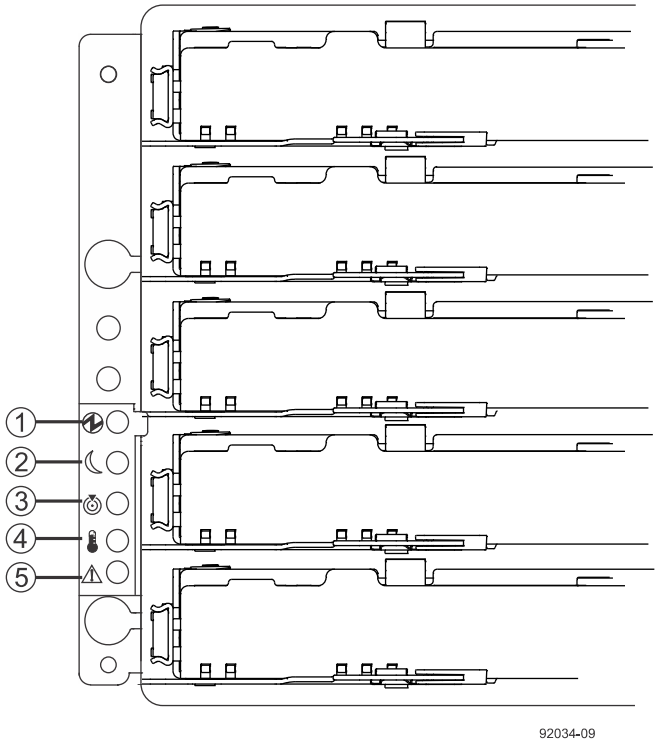
1	End Cap Locate LED
2	End Cap Service Action Required LED
3	End Cap Over-Temperature LED
4	End Cap Power LED
5	End Cap Standby Power LED
6	Drive canister

- **E5624 controller-drive tray – Front view**



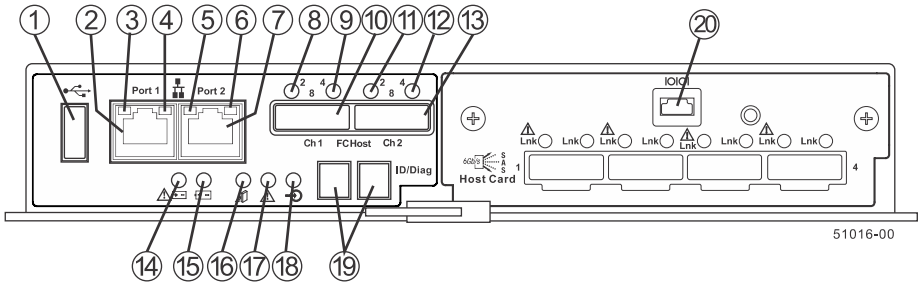
1	End Cap Standby Power LED
2	End Cap Power LED
3	End Cap Over-Temperature LED
4	End Cap Service Action Required LED
5	End Cap Locate LED
6	Drive canister

- **E5660 controller-drive tray – Front view with bezel removed**



1	End Cap Power LED
2	End Cap Standby Power LED
3	End Cap Locate LED
4	End Cap Over-Temperature LED
5	End Cap Service Action Required LED

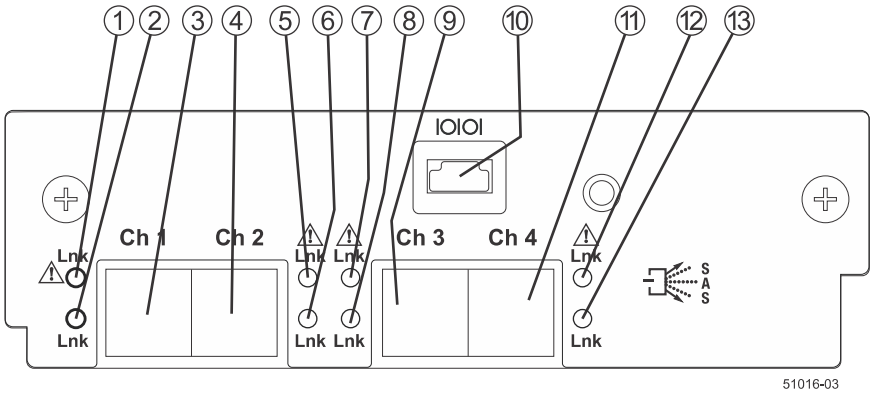
- **Controller with a SAS HIC – Rear view**



1	USB connector	11	SAS Expansion Link 2 Fault LED
2	1GbE Management connector 1	12	SAS Expansion Link 2 Up LED
3	1GbE Link 1 Fault LED	13	SFF-8088 SAS connector 2 (Expansion)
4	1GbE Link 1 Up LED	14	BBU Fault
5	1GbE Link 2 Fault LED	15	BBU Charging

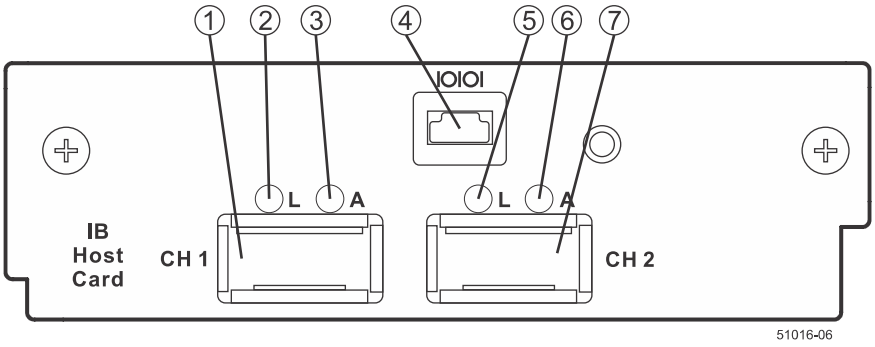
6	1GbE Link 2 Up LED	16	SAA LED
7	1GbE Management connector 2	17	Fault LED
8	SAS Expansion Link 1 Fault LED	18	Cache Active
9	SAS Expansion Link 1 Up LED	19	Seven-segment display
10	SFF-8088 SAS connector 1 (Expansion)	20	Mini USB port

- **Right-rear subplate with a 12-Gb SAS-3 HIC**



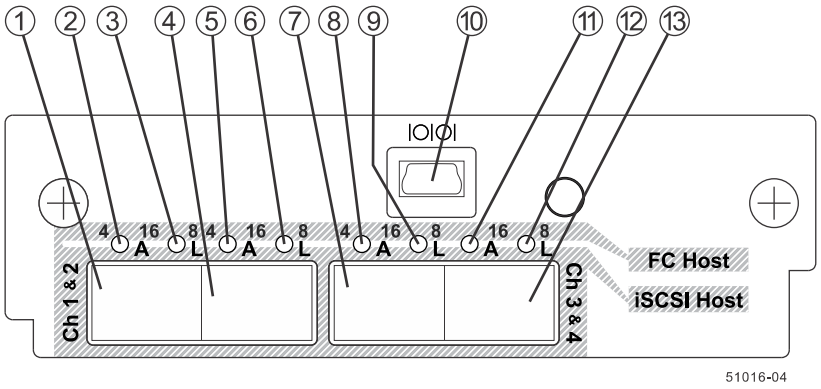
1	Host Interface Card Link 1 Fault LED	8	Host Interface Card Link 3 Active LED
2	Host Interface Card Link 1 Active LED	9	Mini SAS-HD Host Interface Card Channel 3
3	Mini SAS-HD Host Interface Card Channel 1	10	Mini USB port
4	Mini SAS-HD Host Interface Card Channel 2	11	Mini SAS-HD Host Interface Card Channel 4
5	Host Interface Card Link 2 Fault LED	12	Host Interface Card Link 4 Fault LED
6	Host Interface Card Link 2 Active LED	13	Host Interface Card Link 4 Active LED
7	Host Interface Card Link 3 Fault LED		

- **Right-rear subplate with a 56-Gb Infiniband HIC**



1	Host Interface Card QSFP Channel 1
2	Host Interface Card Logical Link 1 Active LED
3	Host Interface Card Physical Link 1 Active LED
4	Mini USB port
5	Host Interface Card Logical Link 2 Active LED
6	Host Interface Card Physical Link 2 Active LED
7	Host Interface Card QSFP Channel 2

- **Right-rear subplate with a 16-Gb Fibre Channel or a 10-Gb iSCSI HIC**



1	SFP+ Host Interface Card Channel 1	8	Host Interface Card Link 3 Fault LED
2	Host Interface Card Link 1 Fault LED	9	Host Interface Card Link 3 Active LED
3	Host Interface Card Link 1 Active LED	10	Mini USB port
4	SFP+ Host Interface Card Channel 2	11	Host Interface Card Link 4 Fault LED
5	Host Interface Card Link 2 Fault LED	12	Host Interface Card Link 4 Active LED

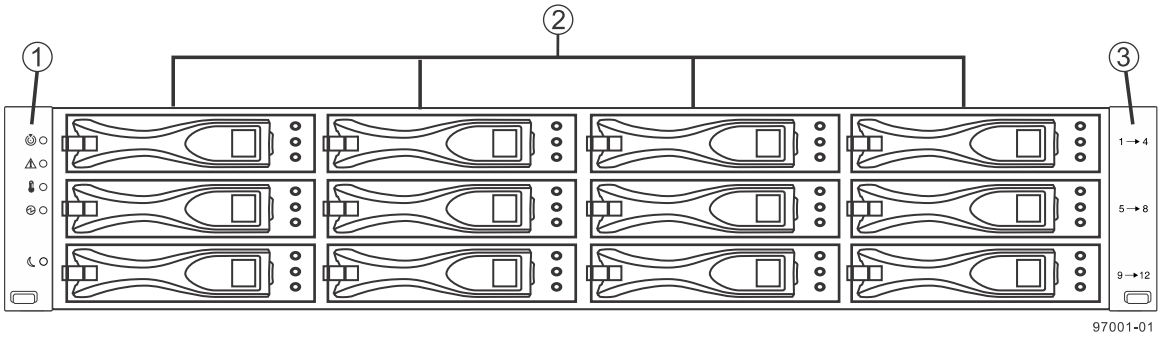
6	Host Interface Card Link 2 Active LED	13	SFP+ Host Interface Card Channel 4
7	SFP+ Host Interface Card Channel 3		

Drive trays

Attention: Possible equipment damage – You must use the supported drives in the drive tray to ensure proper operation. For information about supported drives, contact technical support.

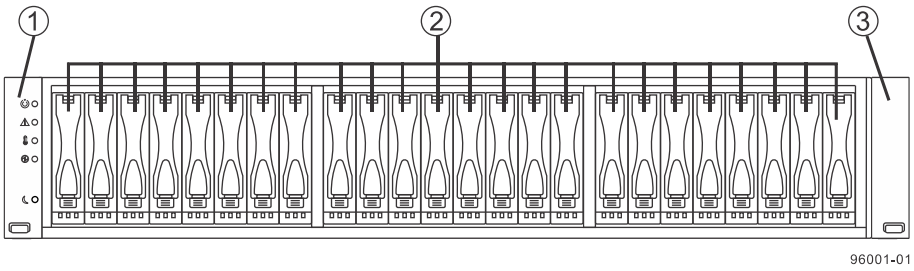
Attention: Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by NetApp, Inc. Not all controller-drive trays are shipped with pre-populated drives. System integrators, resellers, system administrators, or users of the controller-drive tray can install the drives.

- **DE1600 drive tray – Front view**



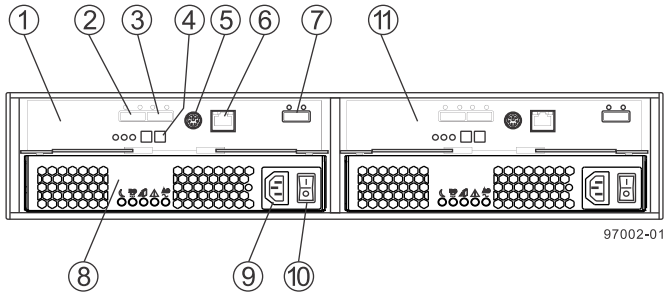
1	Left end cap (has the drive tray LEDs)
2	Drives
3	Right end cap

- **DE5600 drive tray – Front view**



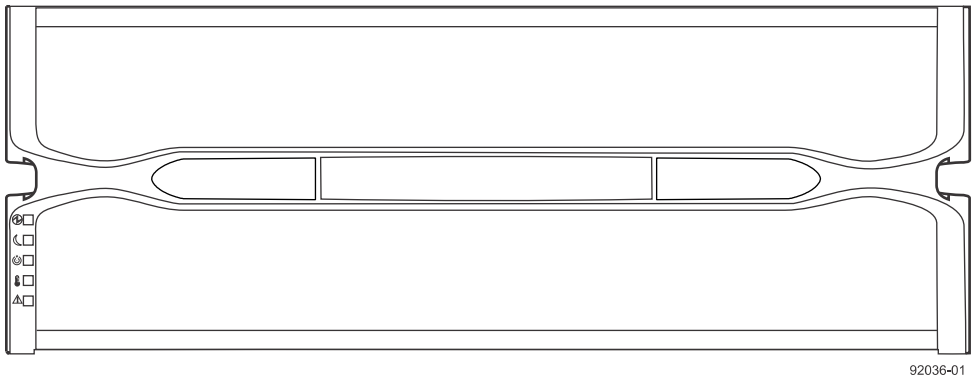
1	Left end cap (has the drive tray LEDs)
2	Drives
3	Right end cap

- **DE1600 or DE5600 drive tray with AC power option – Rear view**

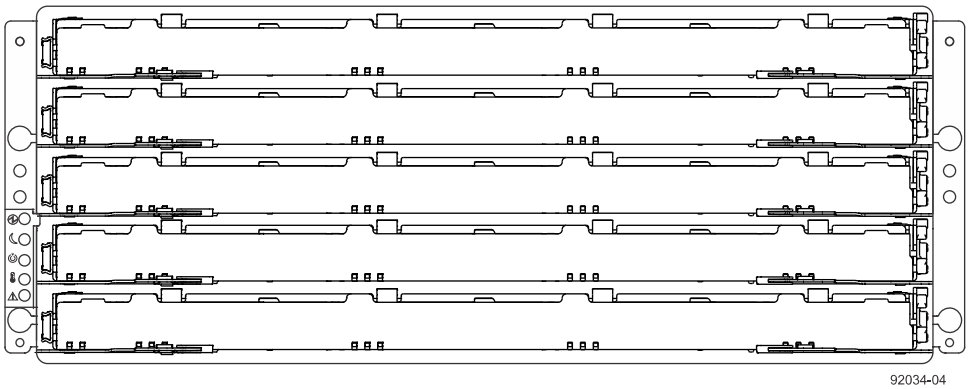


1	ESM A canister
2	Expansion port SFF-8088 connector 1 (IN)
3	Expansion port SFF-8088 connector 2 (IN)
4	Seven-segment display
5	Serial port
6	RJ-45 Ethernet connector
7	Expansion port SFF-8088 connector (OUT)
8	Power-fan canister
9	Power connector
10	Power switch
11	ESM B canister

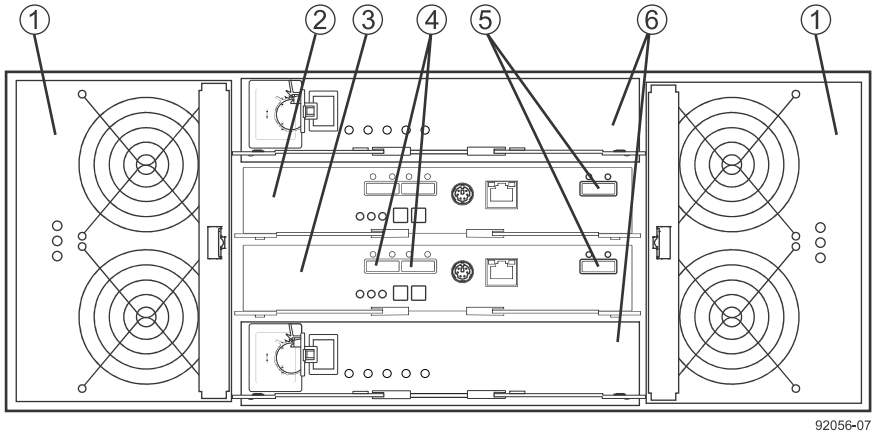
- **DE6600 drive tray – Front view with bezel**



- **DE6600 drive tray – Front view with bezel removed**



- **DE6600 drive tray – Rear view**



1	Fan canister
2	ESM A
3	ESM B
4	Expansion port SFF-8088 connectors (IN)
5	Expansion port SFF-8088 connector (OUT)
6	Power canister

Step 2 - Installing and configuring the switches

Things to know - Switches and routers

Note: Most of the switches and routers, as shipped from the vendor, require an update to either their firmware or their settings to work correctly with the storage array.

Depending on the configuration of your storage array, you might use either Fibre Channel switches, iSCSI switches, or InfiniBand switches.

The switches and routers in the following tables are certified for use with an E55612, E5624, and E5660 storage array using SANtricity Storage Manager Version 11.20.

If required, make the appropriate configuration changes for *each* switch or router that is connected to the storage array.

Refer to the switch's documentation for information about how to install the switch or router and how to use the configuration utilities that are supplied with the switch or router.

Table 7: Supported FC switches

Vendor	Model	Version/Data Rate
Brocade	300	8 Gb/s
	5100	8 Gb/s
	5300	8 Gb/s
	8000	8 Gb/s
	DCX	8 Gb/s
	DCX-4S	8 Gb/s
	7800 EXT	8 Gb/s
	6505	16 Gb/s
	6510	16 Gb/s
	6520	16 Gb/s
	DCX8510-x	16 Gb/s
Qlogic SANbox	3800	8 Gb/s
	5800	8 Gb/s
	9000	8 Gb/s

Vendor	Model	Version/Data Rate
Cisco	9148	8 Gb/s
	9506	8 Gb/s
	9509	8 Gb/s
	9513	8 Gb/s
	B-Series 8/24c for HP Blade Center AJ821B	8 Gb/s
	MDS for HP Blade Center AW564A	8 Gb/s
	9710	16 Gb/s
Cisco Nexus	5010	8 Gb/s
	5020	8 Gb/s

Table 8: Supported InfiniBand switches

Vendor	Model	Speed
Mellanox	SX6012 Edge Switch	56 Gb/s (FDR)
	SX6018 Edge Switch	56 Gb/s (FDR)
	SX6036 Edge Switch	56 Gb/s (FDR)
	IS5030 Edge Switch	40 Gb/s (QDR)
	IS5035 Edge Switch	40 Gb/s (QDR)
	4036 Edge Switch	40 Gb/s (QDR)
	4036E Edge Switch	40 Gb/s (QDR)
	IS5100 Director Switch	40 Gb/s (QDR)
	IS5200 Director Switch	40 Gb/s (QDR)
	IS5300 Director Switch	40 Gb/s (QDR)
	IS5600 Director Switch	40 Gb/s (QDR)
	4200 Director Switch	40 Gb/s (QDR)
	4700 Director Switch	40 Gb/s (QDR)
	SX6506 Director Switch	56 Gb/s (FDR)
	SX6512 Director Switch	56 Gb/s (FDR)
	SX6518 Director Switch	56 Gb/s (FDR)
	SX6536 Director Switch	56 Gb/s (FDR)

Table 9: Supported routers

Vendor	Model	Speed
Cisco	9222i	8 Gb/s
Brocade	7800	8 Gb/s

Vendor	Model	Speed
Qlogic	6240	• 8 Gb/s FC • 10 Gb/s iSCSI
	6250	• 8 Gb/s FC • 10 Gb/s iSCSI
	6260	8 Gb/s FC

Refer to technical support for the latest information about new switches that are tested and certified to work with various hardware and software combinations.

Procedure - Installing and configuring switches

Steps

1. Install your switch according to the vendor's documentation.
2. Contact technical support to obtain this information:
   - The latest hardware compatibility information
   - The models of the switches that are supported
   - The firmware requirements and the software requirements for the switches
3. Update the switch's firmware from the *NetApp Interoperability* site.

   This update might require that you cycle power to the switch.
4. Find your switch in the following table to see whether you need to make further configuration changes. Use your switch's configuration utility to make the changes.

Switch vendor	Configuration changes required?	Next step
Brocade	Yes Change the In-Order Delivery (IOD) option to ON.	Make the change, and go to *Step 3 - Installing the host bus adapters for the controller-drive tray* .
Cisco	Yes Change the in-order guarantee option to ON.	Make the change, and go to *Step 3 - Installing the host bus adapters for the controller-drive tray* .
Mellanox	No	Go to *Step 3 - Installing the host bus adapters for the controller-drive tray* .
PowerConnect	No	

Step 3 - Installing the host bus adapters for the controller-drive tray

Key terms

Host bus adapter (HBA)

A physical board that resides in the host. The HBA provides for data transfer between the host and the controllers in the storage array over the I/O host interface. Each HBA contains one or more physical ports.

Host channel adapter (HCA)

A physical board that resides in the host. The HCA provides for data transfer between the host and the controllers in a storage array over the Infinitude I/O host interface. Each HCA contains one or more physical ports.

Note: For the 56 Gb/s IB host interface card, you must configure the HCA to support the iSER protocol (the iSCSI Extensions for Remote Direct Memory Access (RDMA)) for an IP-based target discovery.

HBA host port

The physical and electrical interface on the host board adapter (HBA) that provides for the connection between the host and the controller. Most HBAs have either one or two host ports. The HBA has a unique World Wide Identifier (WWID) and each HBA host port has a unique WWID.

HBA host port world wide name (WWN)

A 16-character unique name that is provided for each port on the host bus adapter (HBA).

HCA host port

The physical and electrical interface on the host channel adapter (HCA) that provides for the connection between the host and the controller. Most HCAs have either one or two host ports. The HCA has a global unique identifier (GUID).

HCA host port Global Unique Identifier (GUID)

A 16-character unique name that is provided for each port on the host channel adapter (HCA).

Network interface card (NIC)

A hardware component that connects the host to the controller.

Things to know - Host bus adapters, host channel adapters, and Ethernet network interface cards

The controller-drive tray supports host interface cards (HICs) for one of the following:

- Four 12-Gb/s SAS host ports
- Two 56-Gb/s InfiniBand host ports

By default, the 56-Gb/s InfiniBand HIC supports the iSCSI Extensions for Remote Direct Memory Access (iSER) protocol. If you want to convert this to SCSI RDMA Protocol (SRP), you can apply a feature pack key file in SANtricity Storage Manager. For more information, see the *Upgrade/Convert the Host Interface Card* section in the *E-Series and EF-Series Systems Documentation Center*.

- Four 10-GB/s iSCSI host ports
- Four 16-Gb/s Fibre Channel host ports

The HBAs, HCAs, or NICs on a host must support the type of port (SAS, InfiniBand, iSCSI, or Fibre Channel) to which they connect on the controller-drive tray. For the best performance, the HBAs, HCAs, or NICs should support the highest data rate supported by the HICs to which they connect.

For maximum hardware redundancy, you must install a minimum of two HBAs, HCAs, or NICs (for either SAS, InfiniBand, iSCSI or Fibre Channel host connections) in each host. Using both ports of a dual-port HBA, HCA, or NIC provides two paths to the storage array but does not ensure redundancy if an HBA, HCA, or NIC fails.

Note: Consult technical support to obtain information about the supported models of the HBAs and their requirements to make sure you have an acceptable configuration.

Most of the HBAs, HCAs, and NICs require updated firmware and software drivers to work correctly with the storage array. For information about the updates, go to *NetApp Interoperability*.

Procedure - Installing host bus adapters

Steps

1. Check with technical support to make sure you have an acceptable configuration. Before installing an HBA, you must have the following information:
   - The latest hardware compatibility information
   - The models of the HBAs that are supported
   - The firmware requirements and the software requirements for the HBAs
2. Refer to *NetApp Interoperability* for more information about installing the HBA.

   Note: If your operating system is either Windows Server 2008 Server Core, or Windows 2012 Sever, you might have additional installation requirements. Refer to the Microsoft Developers Network (MSDN) for more information about Windows Server 2008 Server Core. You can access these resources from *msdn.microsoft.com*.
3. Install the latest version of the firmware and software drivers for the HBA. You can find the latest version of the firmware for the HBA at *NetApp Interoperability*.
4. Check to see if the SMagent application is installed on all of your hosts:
   - If **Yes**, you have completed this procedure.
   - If **No**, continue with step *5* to obtain the HBA host port world wide name from the HBA BIOS utility.
5. Reboot or start your host.
6. While your host is booting, look for the prompt to access the HBA BIOS utility.
7. Select each HBA to view its HBA host port world wide name.
8. Record the following information for each host and for each HBA connected to the storage array:

- The name of each host
- The HBAs in each host
- The HBA host port world wide name of each port on the HBA

The following table shows examples of the host and HBA information that you must record.

Host name	Associated HBA	HBA host port world wide name
ENGINEERING	Vendor x, Model y (dual port)	• 37:38:39:30:31:32:33:32 • 37:38:39:30:31:32:33:33
	Vendor a, Model y (dual port)	• 42:38:39:30:31:32:33:42 • 42:38:39:30:31:32:33:44
FINANCE	Vendor a, Model b (single port)	57:38:39:30:31:32:33:52
	Vendor x, Model b (single port)	57:38:39:30:31:32:33:53

Procedure - Installing host channel adapters

Before you begin

Before installing a host channel adapter (HCA), review the following information to confirm you have an acceptable configuration:

- The latest hardware compatibility information
- The models of the HCAs that are supported
- The firmware requirements and the software requirements for the HCAs

Note: As needed, refer to *NetApp Interoperability* to verify your configuration.

Steps

1. Install your HCA, including the appropriate version of the firmware. Refer to *NetApp Interoperability* for information.
2. To get the GUID for each HCA port, run the command `ibstat` under Linux and look for a line that looks like this:

```
Port GUID: 0x0002c9030005ca3f
```

Step 4 - Installing the controller-drive tray

Things to know - General installation

The power supplies meet standard voltage requirements for both domestic and worldwide operation.

Note: Ensure that the combined power requirements of your trays do not exceed the power capacity of your cabinet. For power ratings on the controller-drive trays and its related drive trays, refer to the *Site Preparation Guide*.

Procedure - Installing the E5612 or E5624 controller-drive tray

About this task

Warning: (W08) **Risk of bodily injury** – Two persons are required to safely lift the component.

Warning: (W05) **Risk of bodily injury** – If the bottom half of the cabinet is empty, do not install components in the top half of the cabinet. If the top half of the cabinet is too heavy for the bottom half, the cabinet might fall and cause bodily injury. Always install a component in the lowest available position in the cabinet.

You can install the controller-drive tray into an industry-standard cabinet.

This procedure describes how to install the mounting rails into an industry-standard cabinet.

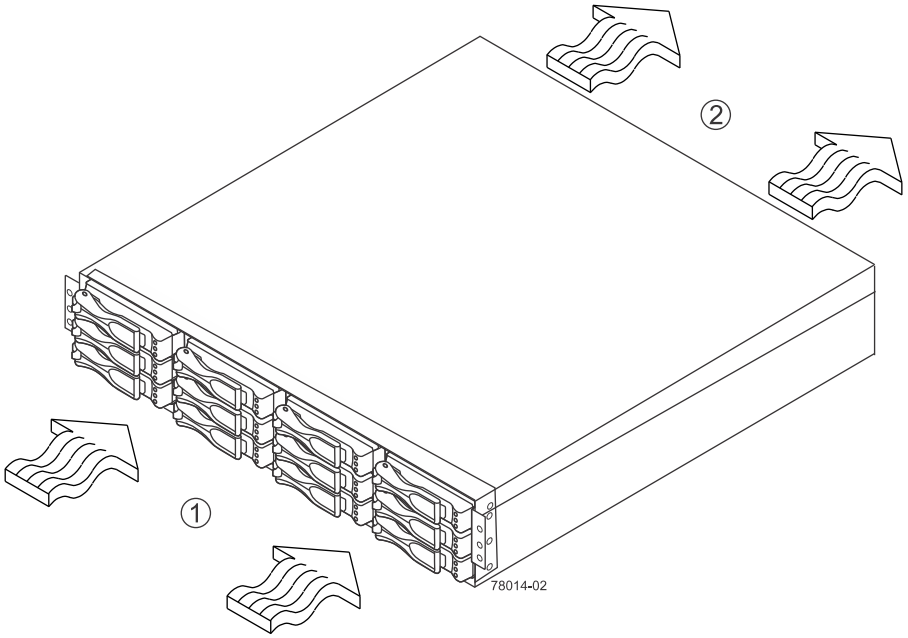
Attention: **Possible hardware damage** – To prevent electrostatic discharge damage to the tray, use proper antistatic protection when handling tray components.

Steps

1. Ensure that the cabinet is in the final location and the cabinet installation site meets the clearance requirements for air flow as shown in the figures.

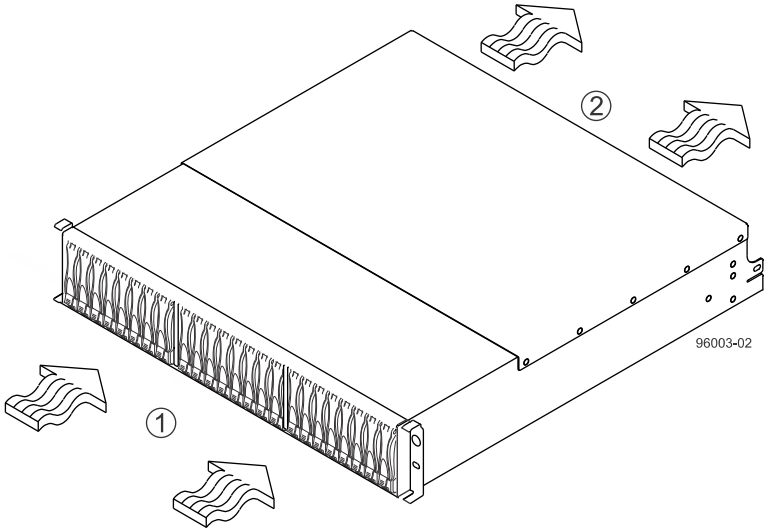
   Note: Fans pull air through the tray from front to back across the drives.

   - **E5612 controller-drive tray – Airflow and clearance requirements**



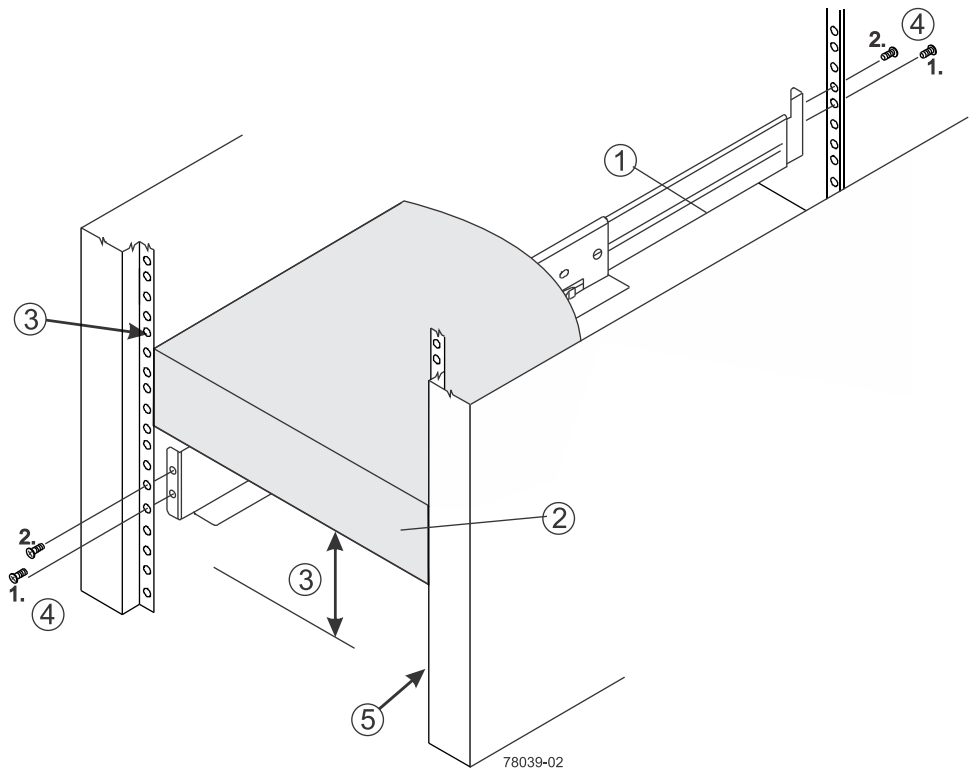
1	76 cm (30 in.) clearance in front of the cabinet
2	61 cm (24 in.) clearance behind the cabinet

- **E5624 controller-drive tray – Airflow and clearance requirements**



1	76 cm (30 in.) clearance in front of the cabinet
2	61 cm (24 in.) clearance behind the cabinet

2. Lower the feet on the cabinet, if required, to keep it from moving.
3. Remove the controller-drive tray and all contents from the shipping carton.
4. Position the mounting rails in the cabinet. For more information, refer to the installation instructions that are included with your mounting rails.



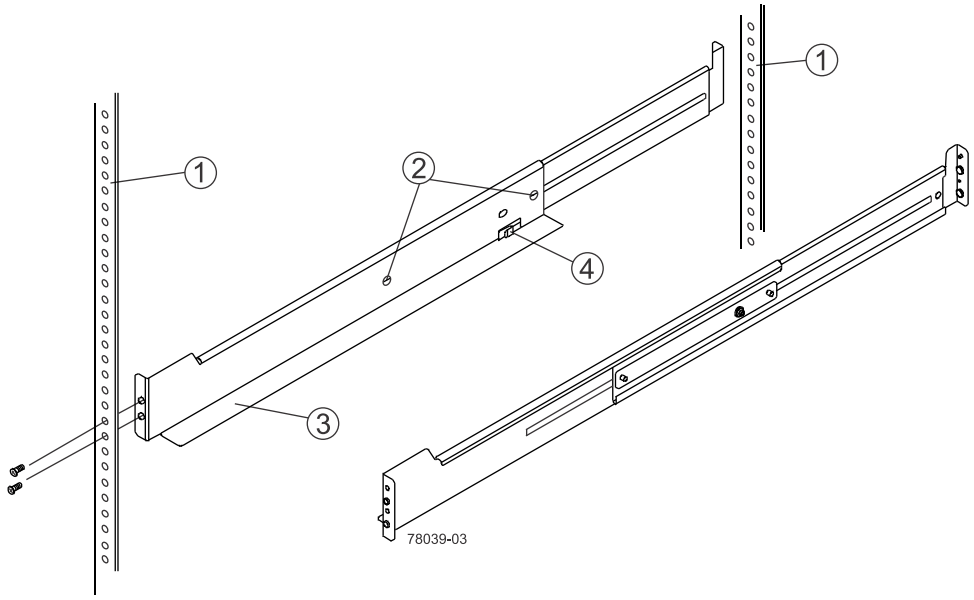
1	Mounting rail
2	Existing tray
3	Clearance above and below the existing tray
4	Screws for securing the mounting rail to the cabinet (front and rear)
5	Industry-standard cabinet

- If you are installing the mounting rails above an existing tray, position the mounting rails directly above the existing tray.
- If you are installing the mounting rails below an existing tray, allow 8.7-cm (3.4 in.) clearance below the existing tray for the E5612 controller-drive trays and 8.9-cm (3.5 in.) for the E5624 controller-drive trays. .

  Attention: Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by NetApp, Inc. Not all controller-drive trays are shipped with pre-populated drives. System integrators, resellers, system administrators, or users of the controller-drive tray can install the drives.

5. Attach the mounting rails to the cabinet.

a. Ensure that the adjustment screws on the mounting rail are loose so that the mounting rail can extend or contract as needed.



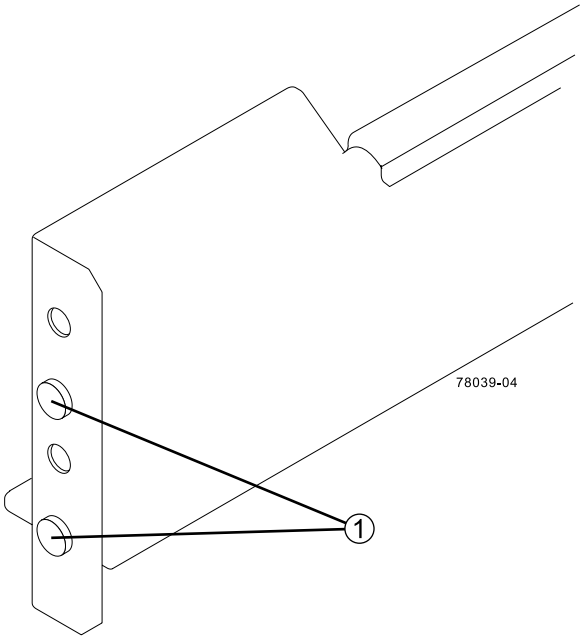
1	Cabinet mounting holes
2	Adjustment screws for locking the mounting rail length
3	Mounting rails
4	Clip for securing the rear of the controller-drive tray

b. Place the mounting rail inside the cabinet, and extend the mounting rail until the flanges on the mounting rail touch the inside of the cabinet.

c. Ensure that the alignment spacers on the front flange of the mounting rail fit into the mounting holes in the cabinet.

   The front flange of each mounting rail has two alignment spacers. The alignment spacers are designed to fit into the mounting holes in the cabinet. The alignment spacers help position and hold the mounting rail.

   Note: If the cabinet in which you are installing this tray has square holes, insert the shoulder washers into the square holes when mounting the rail.



1	Alignment spacers

d. Insert one M5 screw through the front of the cabinet and into the top captured nut in the mounting rail. Tighten the screw.

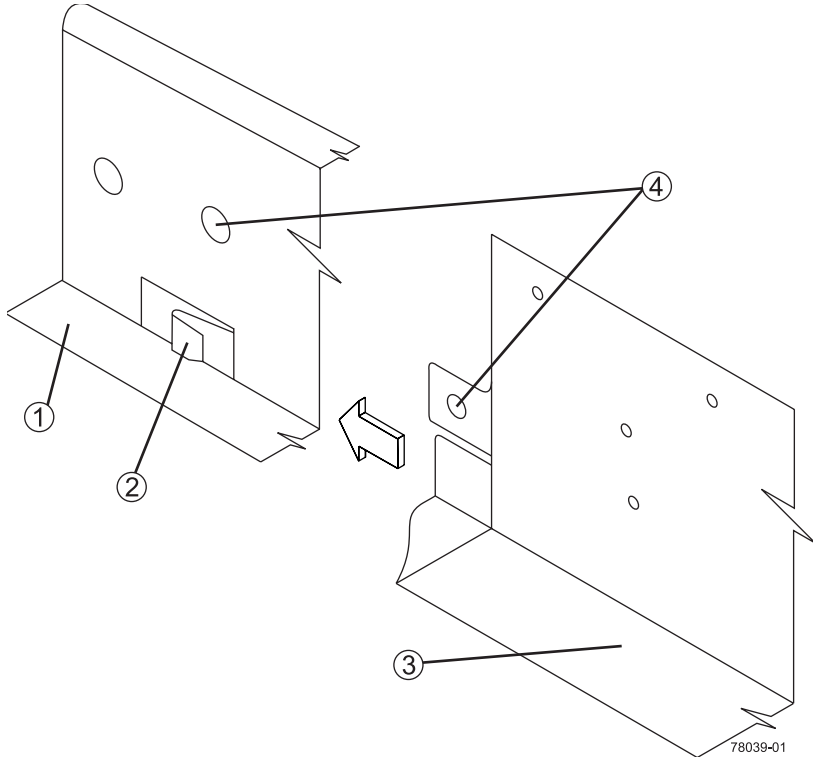
e. Insert two M5 screws through the rear of the cabinet and into the captured nuts in the rear flange in the mounting rail. Tighten the screws.

f. Tighten the adjustment screws on the mounting rail.

g. Repeat these steps to install the second mounting rail.

6. With the help of one other person, slide the rear of the controller-drive tray onto the mounting rails. The rear edge of the controller-drive tray must fit into the clip on the mounting rail. The controller-drive tray is correctly aligned when these conditions are met:

- The mounting holes on the front flanges of the drive tray align with the mounting holes on the front of the mounting rails. See item 4 in the following figure.
- The rear edge of the controller-drive tray sheet metal fits into the clip on the mounting rail.
- The holes in the controller-drive tray sheet metal for the rear hold-down screws align with the captured nuts in the side of the mounting rails.



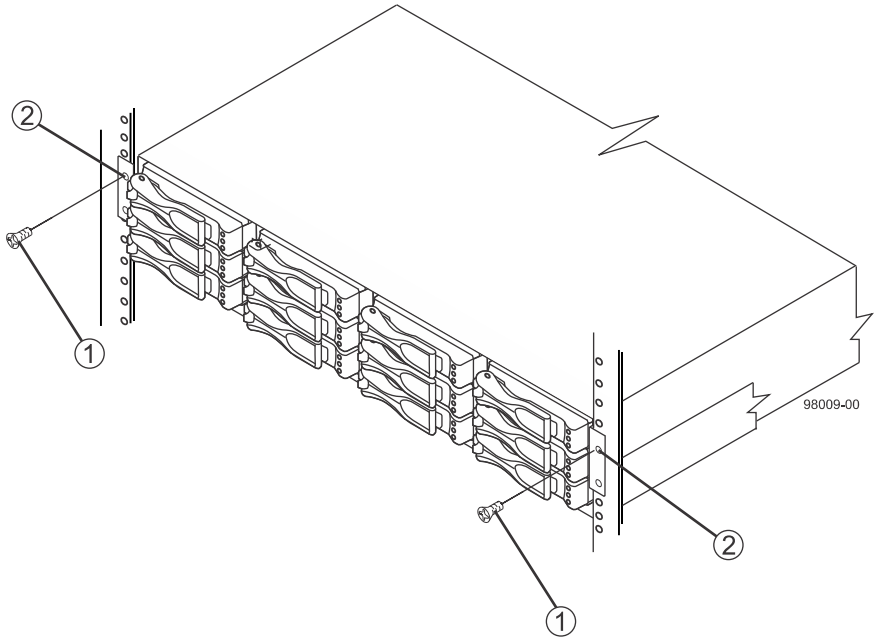
1	Mounting rail
2	Clip
3	Partial view of the controller-drive tray rear sheet metal
4	Mounting holes

7. Secure the front of the controller-drive tray to the cabinet. Use the two screws to attach the flange on each side of the front of the controller-drive tray to the mounting rails.

a. Insert one M5 screw through the bottom hole of a flange on the controller-drive tray so that the screw goes through the cabinet rail and engages the bottom captured nut in the mounting rail. Tighten the screw.

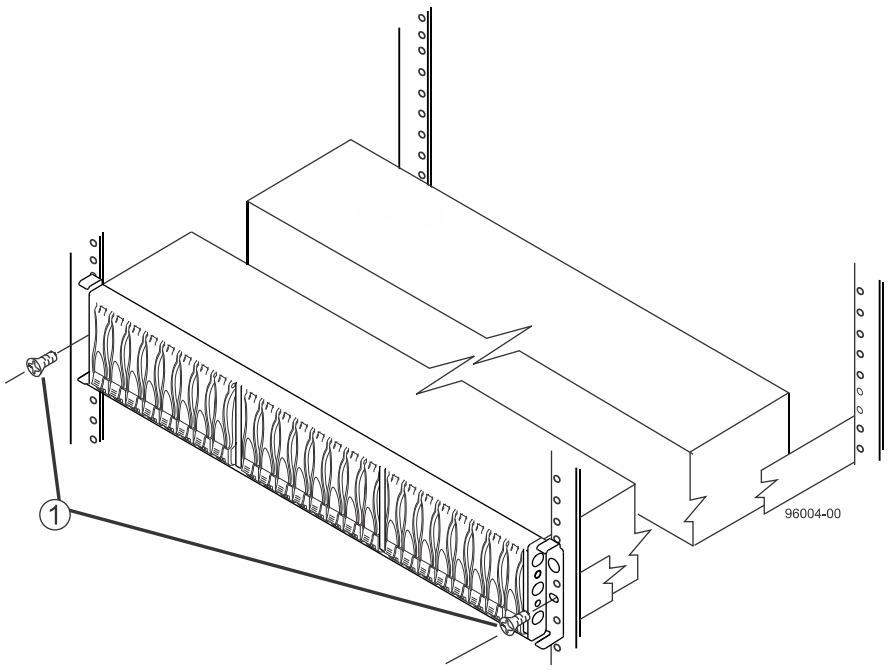
b. Repeat the step for the second flange.

- **Securing the E5612 controller-drive tray to the cabinet**



1	Screw
2	Mounting hole

- **Securing the E5624 controller-drive tray to the cabinet**



1	Screw

Note: The rear of the controller-drive tray contains two controllers. The top of the controller-drive tray is the side with the labels.

8. Secure the side of the controller-drive tray to the mounting rails by performing these steps:
   a. Insert one M4 screw through the side sheet metal of the controller-drive tray into the captured nut on the side of the mounting rail. Tighten the screw.
   b. Repeat the step for the other side.
9. Attach the plastic end caps onto the front of the controller-drive tray.
   a. Put the top of the end cap on the hinge tab that is part of the controller-drive tray mounting flange.
   b. Gently press on the bottom of the end cap until it snaps into place over the retainer on the bottom of the controller-drive tray mounting flange.
10. Install the drive trays.

Procedure - Installing drives in the E5612 or E5624 controller-drive tray

About this task

In some situations, the controller-drive tray might be delivered without the drives installed. Follow the steps in this procedure to install the drives. If your controller-drive tray already has drives

installed, you can skip this step and go to *Step 5 - Connecting the controller-drive tray to the hosts* on page 53.

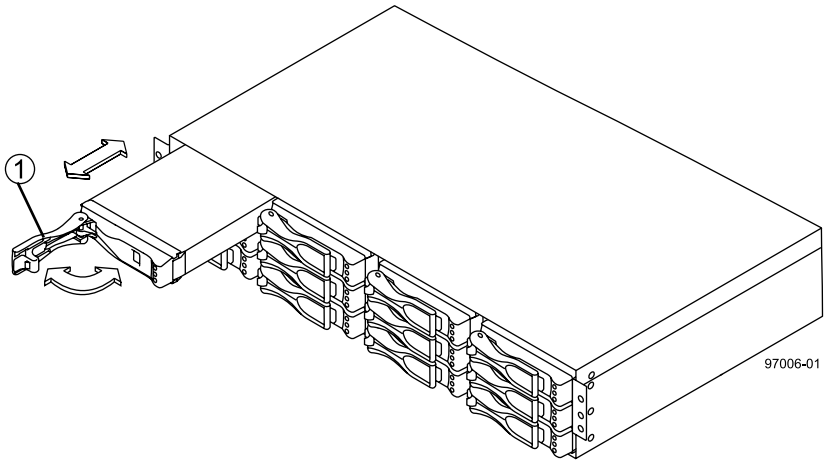
Attention: Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by NetApp, Inc. Drives might be shipped but not installed. System integrators, resellers, system administrators, or users can install the drives.

Note: For the E5612, the installation order is from top to bottom and from left to right. For the E5624, the installation order is from left to right. The installation order is important because the drives might already contain configuration information that depends upon the correct sequence of the drives in the tray.

Steps

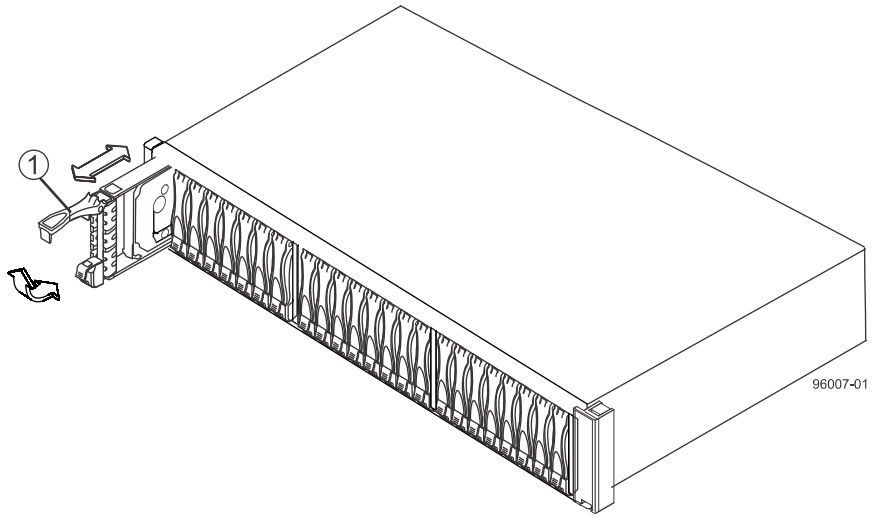
1. Beginning with the first drive slot (the upper-left slot in the E5612 or the left slot in the E5624), place the drive in the slot guides, and slide the drive all the way into the slot.
2. Push the drive handle to the right (in E5612) or down (in E5624) to lock the drive securely in place.

- **Installing a drive in E5612**



1	Drive handle

- **Installing a drive in E5624**



1	Drive handle

Note: In some applications, the drive handle might have the hinge on the right.

3. For the E5612, install the second drive beneath the first drive. For the E5624, install the second drive to the right of the first drive.
4. For the E5612 controller-drive tray, install the other drives from top to bottom and then from left to right. For the E5624 controller-drive tray, install the other drives to the right.

Procedure - Installing the E5660 controller-drive tray

About this task

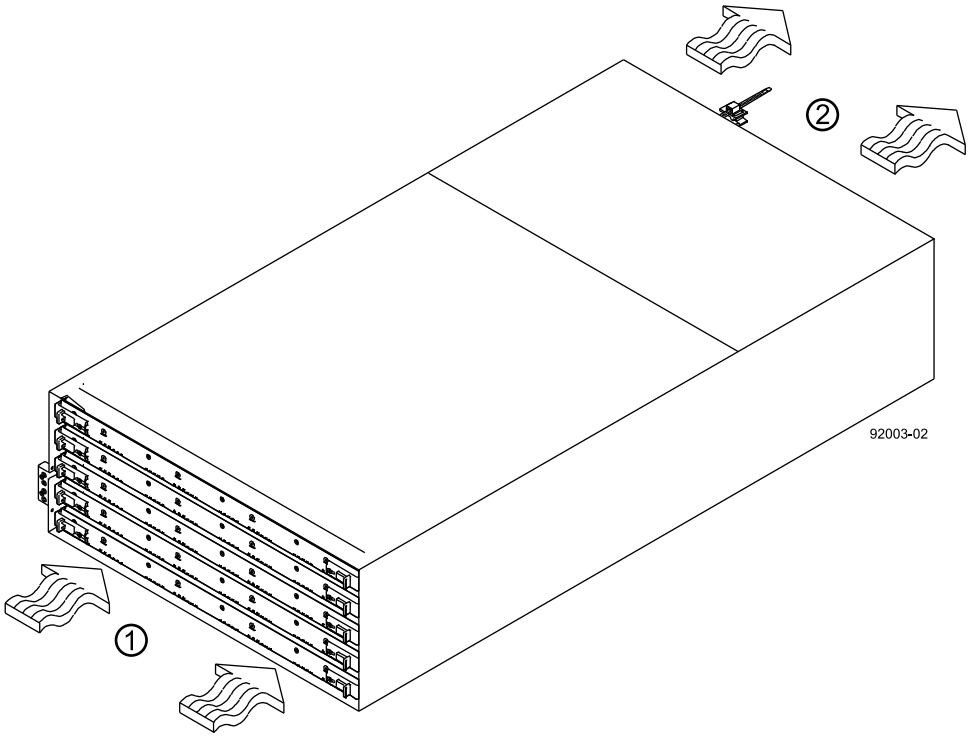
Attention: Risk of equipment malfunction – To avoid possible equipment damage and ensure safe and efficient servicing of the equipment, install the 60-drive trays toward the bottom of a cabinet.

You can install the controller-drive tray into an industry-standard cabinet, provided it has a depth of 100 cm (40 in.). A minimum depth of 76 cm (30 in.) between the front EIA support rails and the rear EIA support rails is required.

Note: If you are installing the controller-drive tray in a cabinet with square holes, use the eight conical washers in the rail kit to align the screws in the holes (see step *4* through step *7*).

Steps

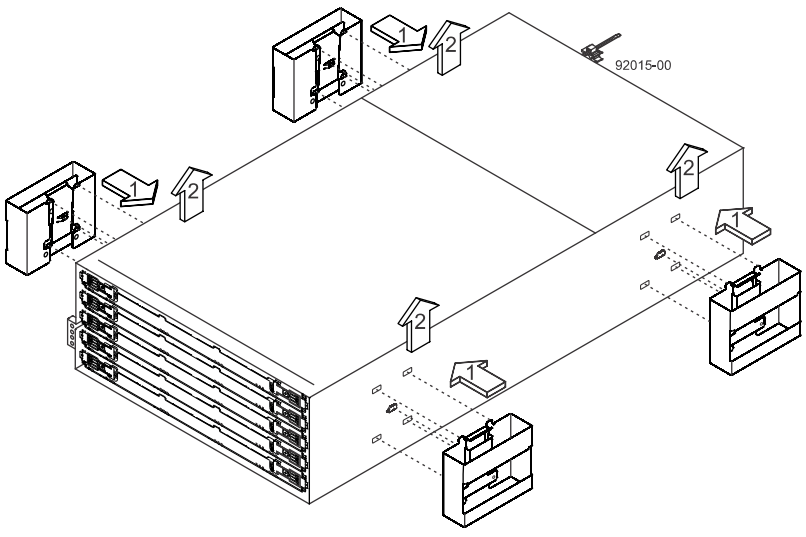
1. Ensure that the cabinet is in the final location and you meet the clearance requirements shown in the following figure.



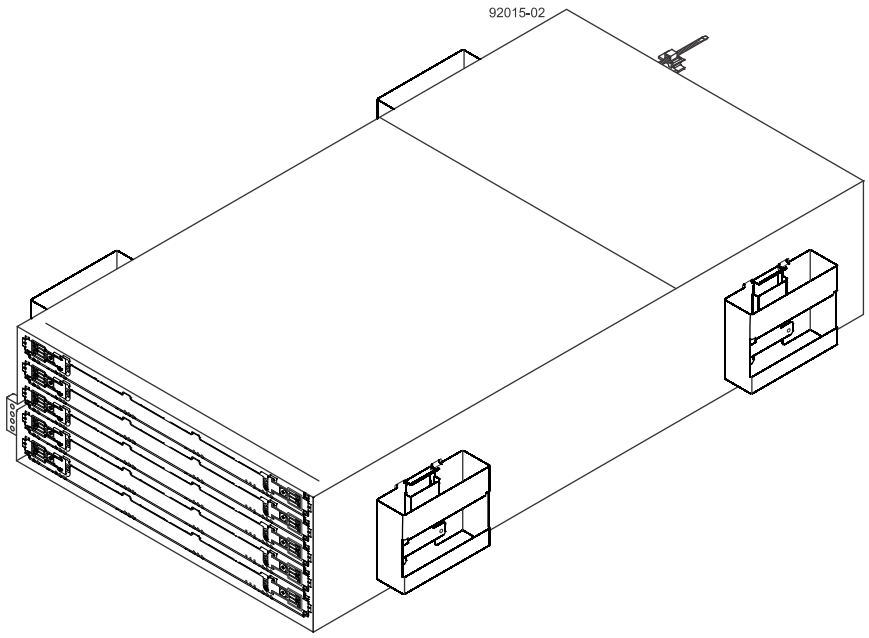
1	81 cm (32 in.) clearance in front of the cabinet
2	61 cm (24 in.) clearance behind the cabinet

Note: Fans pull air through the controller-drive tray from front to back across the drives.

2. Lower the feet on the cabinet to keep the cabinet from moving.
3. Before removing the controller-drive tray and all of the contents from the shipping carton, locate the tray handles and attach them to the controller-drive tray:
   a. Align the handle just under the thumb latch.
   b. Push the handle up until it clicks in place with the thumb latch.

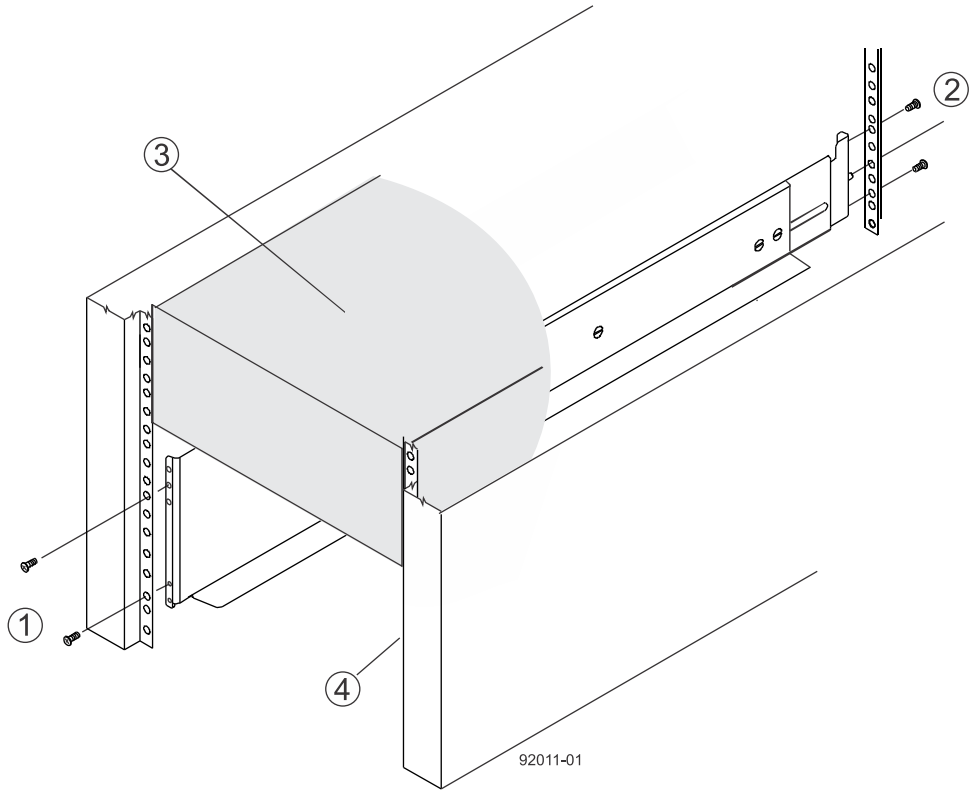


4. With the help of at least three other persons, remove the controller-drive tray and all of the contents from the shipping carton, using the four controller-drive tray handles (two to a side) as shown in the following figure. Set the controller-drive tray aside.



Warning: (W10)**Risk of bodily injury** – Four or more persons are required to safely lift the component.

5. Position the mounting rails in the cabinet as shown in the following figure.



1	Screws for securing the mounting rail to the cabinet (front)
2	Screws for securing the mounting rail to the cabinet (rear)
3	Existing tray
4	Industry standard cabinet

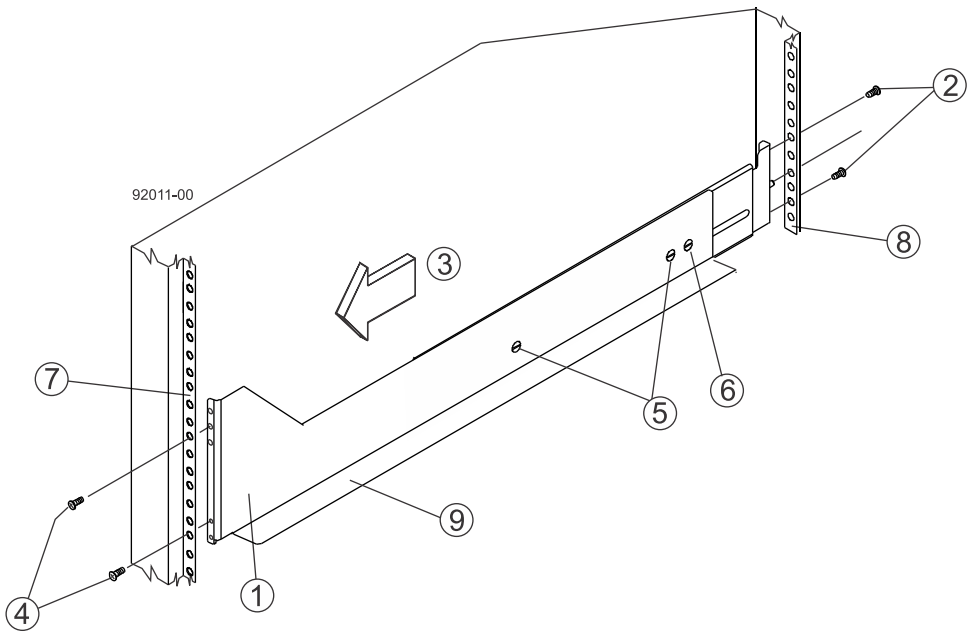
- If you are installing the mounting rails above an existing tray, position the mounting rails directly above the tray.
- If you are installing the mounting rails below an existing tray, allow 17.8-cm (7-in.) vertical clearance for the controller-drive tray.

6. To attach the mounting rails to the cabinet, perform one of the following actions:

- If you are using the long, fixed-size mounting rails, go to step *7*.
- If you are using the shorter adjustable mounting rails, go to step *8*.

7. Attach the long, fixed-size rails to the cabinet.

a. Ensure that the adjustment screws on the mounting rail are loose so that the mounting rail can extend or contract as needed.



1	Front of the mounting rail
2	Two M5 screws for the rear EIA support rail
3	Front of the cabinet
4	Two M5 screws for the front EIA support rail
5	Adjustment screws
6	Rear hold-down screw
7	Cabinet mounting holes on the front EIA support rail
8	Cabinet mounting holes on the rear EIA support rail
9	Mounting rail lip

b. Remove the rear hold-down screw. It protrudes from the inside of the rail and prevents you from sliding the controller-drive tray onto the rails.

c. Place the mounting rail inside the cabinet, and extend the mounting rail until the flanges on the mounting rail touch the inside of the cabinet.

d. Insert one M5 screw through the front of the cabinet, and screw it into the top captured nut in the mounting rail.

e. Insert two M5 screws through the rear of the cabinet, and screw them into the captured nuts in the rear flange in the mounting rail.

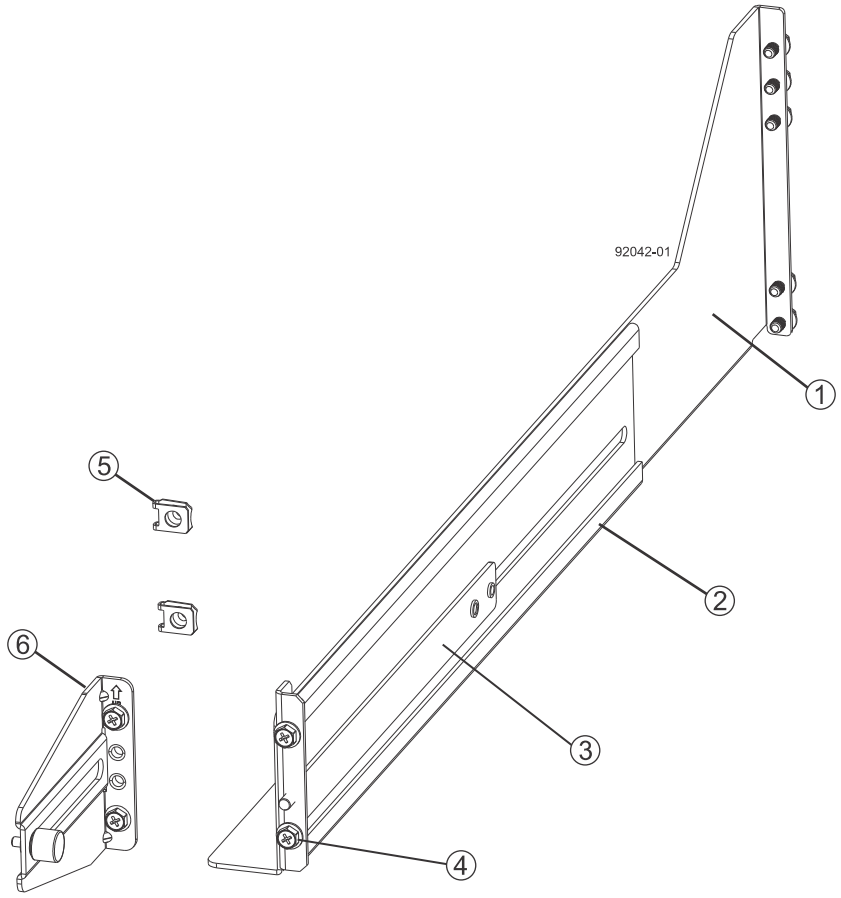
f. Counting up from the bottom of the mounting rail, place the bottom of the screw of the rear bracket in the 8th hole of the cabinet so that the top of the rear bracket is in the 11th hole. The distance between the two holes should be 1U or 4.45 cm (1.75 in).

g. Tighten the adjustment screws on the mounting rail.

h. Repeat these steps to install the second mounting rail.

i. Insert one M5 screw through the front of the mounting rail. You use this screw to attach the controller-drive tray to the cabinet.

8. Attach the shorter, adjustable size mounting rails to the cabinet.

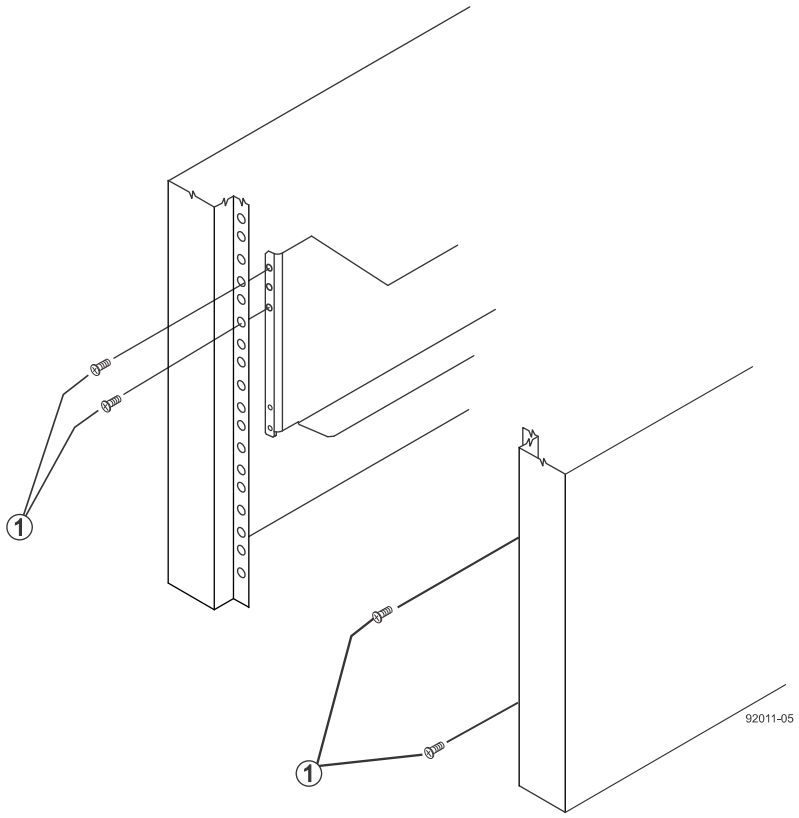


1	Front of the mounting rail
2	Rear of the mounting rail
3	Rail fix bar
4	Two M5 screws for the front EIA support rail
5	Two clips for the front EIA support rail
6	Rear bracket

a. Ensure that the adjustment screws on the mounting rail are loose but not detached so that the mounting rail can extend or contract as needed.

b. Place the mounting rail inside the cabinet, and extend the mounting rail until the flanges on the mounting rail touch the inside of the cabinet.

c. Insert two M5 screws through the front of the cabinet, and screw them into the second and fourth threaded holes from the top captured nut in the mounting rail.



1	M5 screws

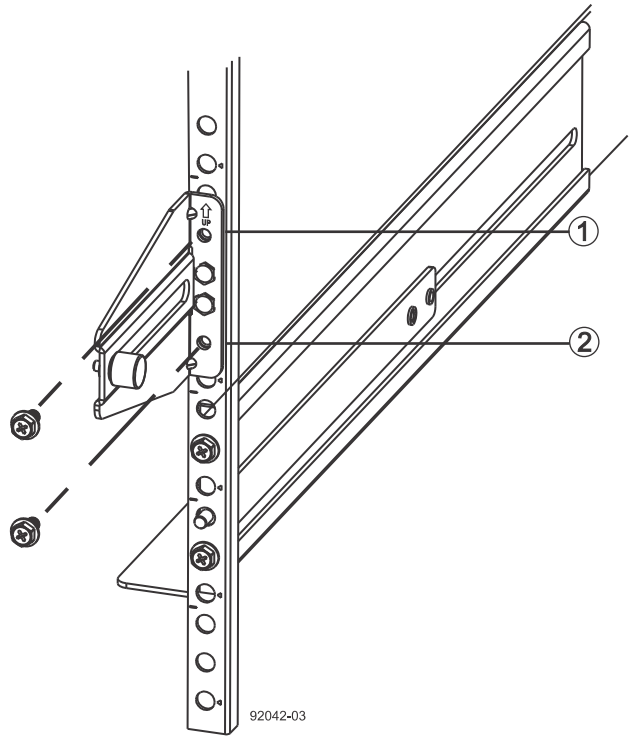
d. Insert two M5 screws through the rear of the cabinet, and screw them into the captured nuts in the rear flange in the mounting rail.

e. Counting up from the bottom of the mounting rail, place the bottom screw of the rear bracket in the 8th hole of the cabinet so that the top of the rear bracket is in the 11th hole. The distance between the two holes should be 1U or 4.45 cm (1.75 in).

f. Tighten the adjustment screws on the mounting rail.

g. Repeat these steps to install the second mounting rail.

h. Insert one M5 screw through the front of the mounting rail. This screw attaches the controller-drive tray to the cabinet.



1	Top cabinet mounting hole on the rear EIA support rail
2	Bottom cabinet mounting hole on the rear EIA support rail

9. Remove the bezel from the front of the controller-drive tray.

10. With the help of at least three other persons, slide the rear of the controller-drive tray onto the mounting rails. The controller-drive tray is correctly aligned when the mounting holes on the front flanges of the controller-drive tray align with the mounting holes on the front of the mounting rails.

Warning: (W10)**Risk of bodily injury** – Four or more persons are required to safely lift the component.

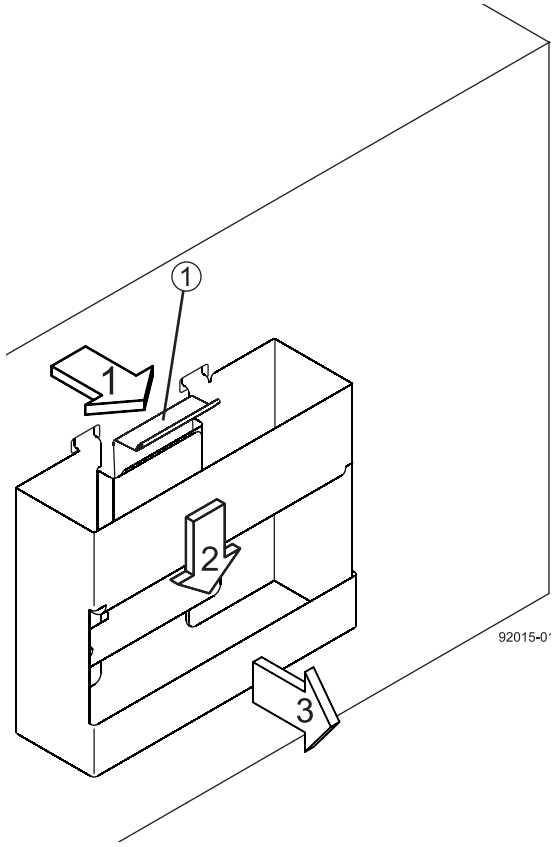
11. After the controller-drive tray is correctly aligned, remove the enclosure lift handles as shown in the figure:

a. Use your thumb to unlatch and remove the rear controller-drive tray lift handles (two to a side).

b. Use the front controller-drive tray lift handles to slide the drive tray all the way into the cabinet.

c. After the drive tray is secure in the cabinet, use your thumb to unlatch and remove the front controller-drive tray lift handles (two to a side).

d. Insert the remainder of the tray into the cabinet.



1	Pull the thumb latch away from the controller-drive tray to detach the hook.
2	Shift the handle down to release the other four hooks.
3	Move the handle away from the controller-drive tray.

12. Secure the front of the controller-drive tray to the cabinet. Use the four screws to attach the flange on each side of the front of the controller-drive tray to the mounting rails.

a. Insert two M5 screws through the bottom holes of a flange on the controller-drive tray so that the screws go through the EIA support rail and engage the bottom captured nuts in the mounting rail. Tighten the screws.

You had attached the second and fourth threaded holes in step *8.c*.

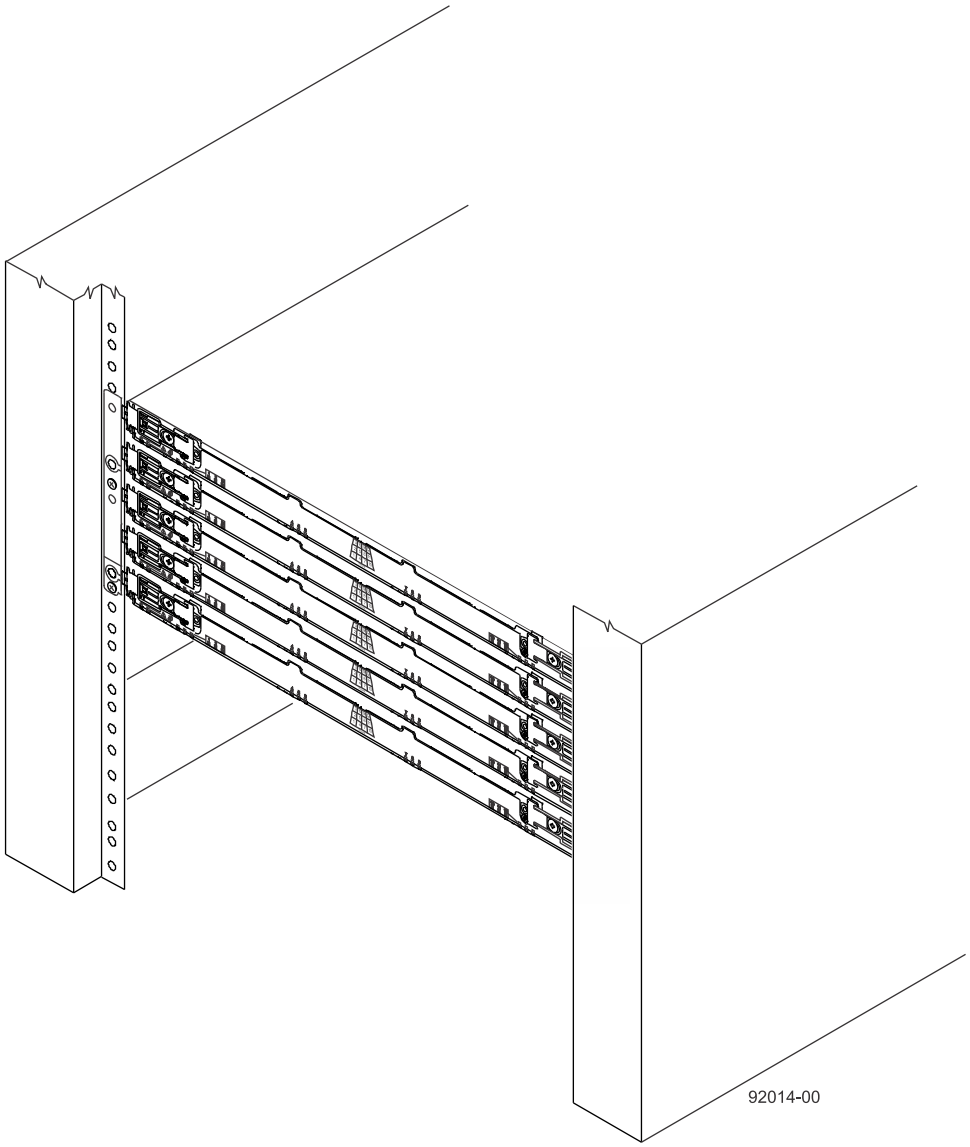
b. Repeat this step for the second flange.

13. Secure the side of the controller-drive tray to the mounting rails

a. Tighten the thumbscrew on the rear mounting bracket that you installed in step *7.f* to secure the controller-drive tray to the mounting rails.

b. Repeat this step for the other side.

Note: Ensure that each drive drawer in the controller-drive tray is securely latched to ensure proper air flow to the drives.



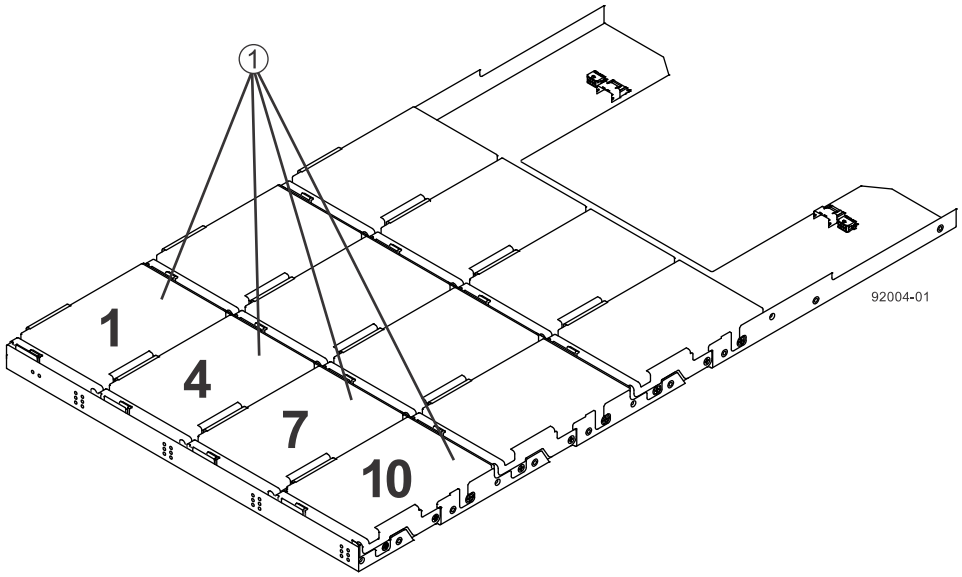
Procedure - Installing the drives in the E5660 controller-drive tray

About this task

The controller-drive tray is shipped with the drive drawers installed, but the drives are not installed. Follow the steps in this procedure to install the drives.

Attention: Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by NetApp, Inc. Drives might be shipped but not installed. System integrators, resellers, system administrators, or users can install the drives.

Attention: Risk of equipment malfunction – All 60-drive trays have a limit of five solid state drives (SSDs) per drawer. If you exceed this limit for SSDs in a particular drawer, the power source in the drawer could fail.

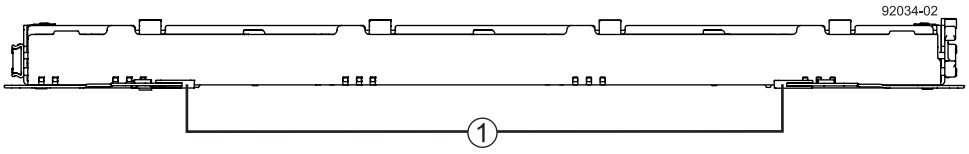


1	Slots requiring drives in each drawer

Note: The installation order within each drawer is from left to right in rows. You must install drives in slots 1, 4, 7 and 10 to make sure there is sufficient air flow to the drives. To verify these slots, consult the overlay on the front of each of the five drive drawers. Make sure the four drives in each row are adjacent to each other. The long edge of each drive should touch the drive next to it. To maintain a uniform airflow across all drive drawers, the controller-drive tray must be configured with a minimum of 20 drives, with four drives in the front row of each of the five drive drawers.

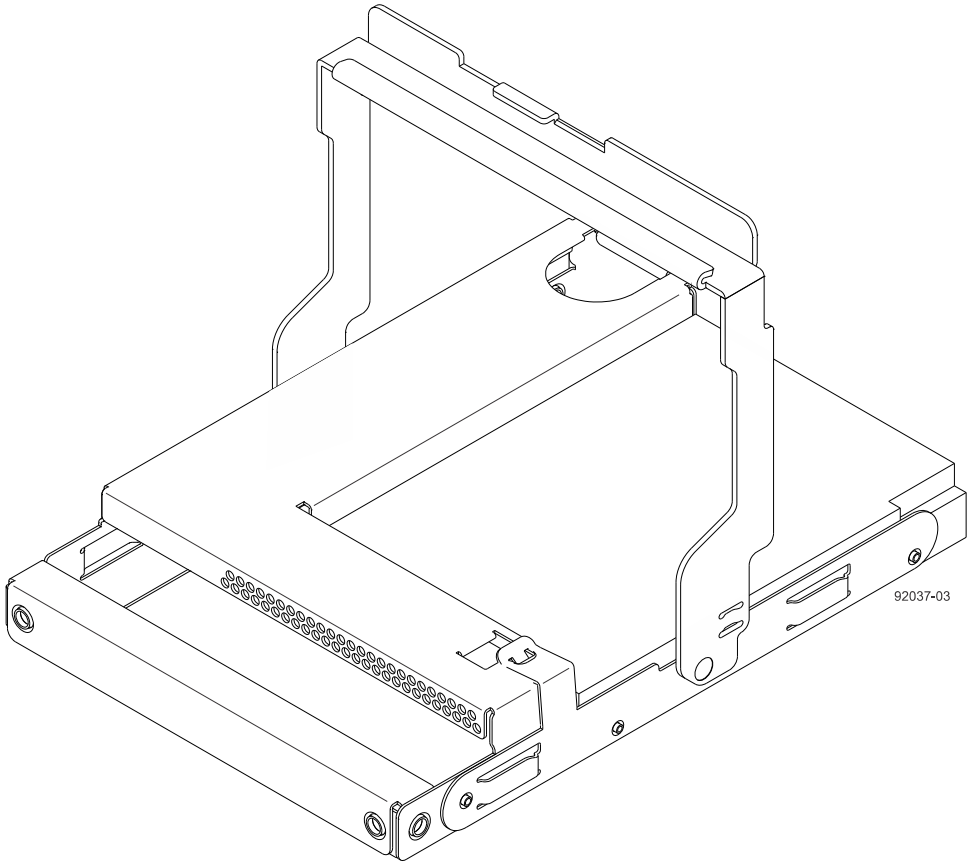
Steps

1. Beginning with the top drawer in the controller-drive tray, release the levers on each side of the drawer by pulling both towards the center.

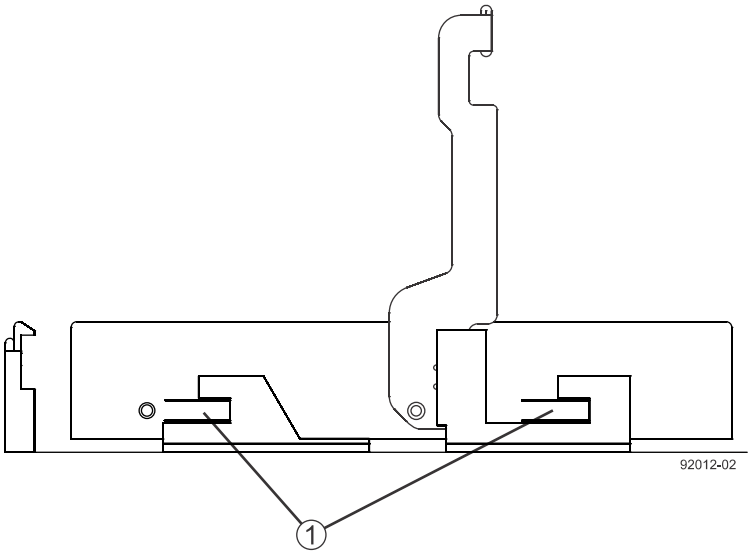


1	Levers to release the drive drawer

2. Pull on the extended levers to pull the drive drawer out to its full extension without removing it from the controller-drive tray.
3. Starting with the first drive, raise the drive handle to the vertical position.

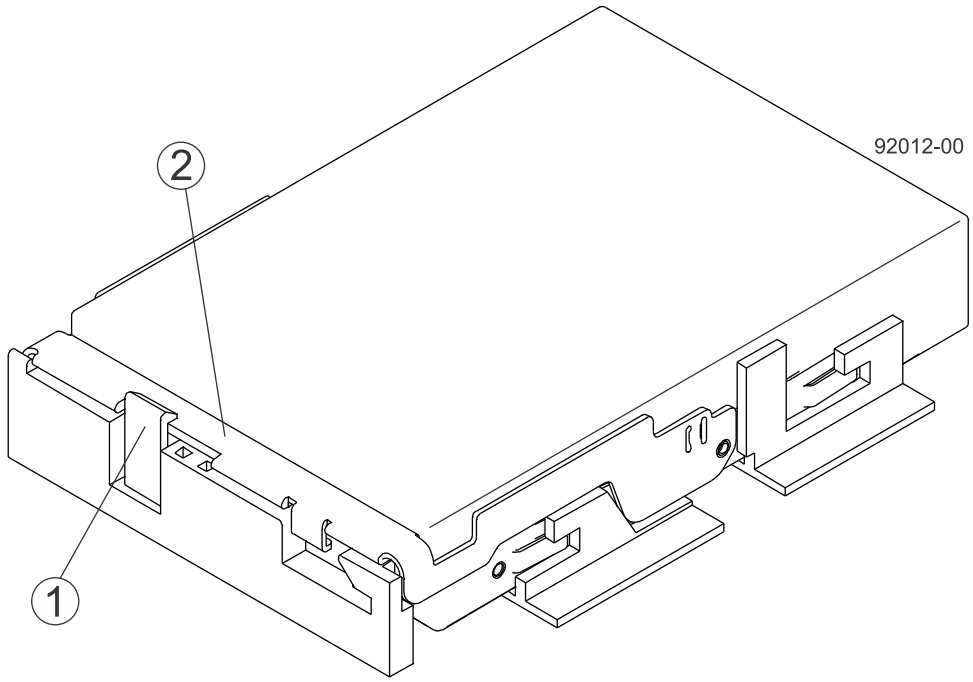


4. Align the two raised buttons on each side of the drive with the matching gap in the drive channel on the drawer.



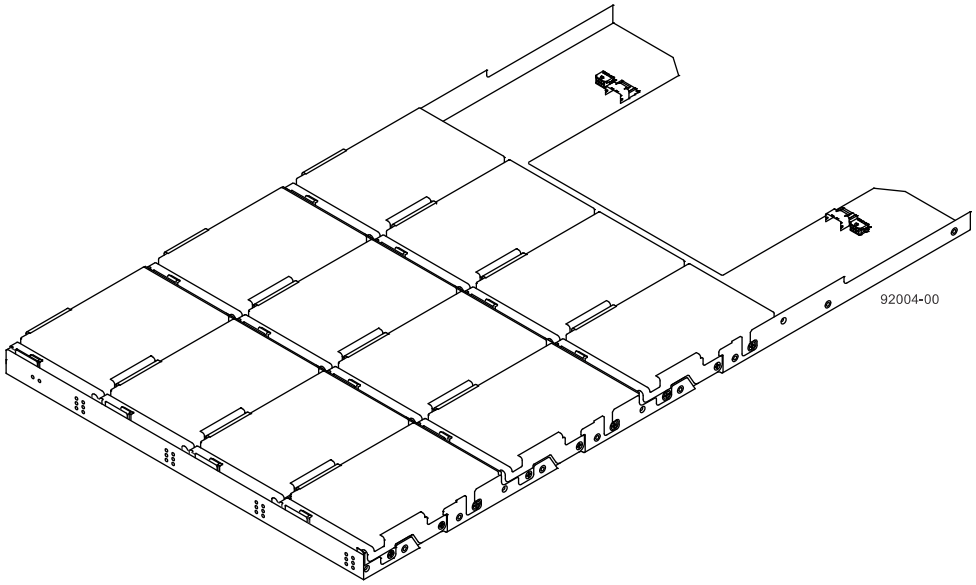
1	Raised buttons on the side of the drive

5. Lower the drive straight down, and then rotate the drive handle down until the drive snaps into place under the drive release lever.



1	Drive release lever
2	Drive handle

6. Install the other drives in rows from left to right, ensuring that the front row of the drive drawer contains at least four drives.



7. Push the drive drawer all the way back into the controller-drive tray, closing the levers on each side of the drive drawer.

Attention: Risk of equipment malfunction – Make sure you push both levers to each side so the drive drawer is completely closed. The drive drawer must be completely closed to prevent excess airflow, which has the potential to damage the drives.

8. Repeat these steps for each drive drawer in the configuration.

Step 5 - Connecting the controller-drive tray to the hosts

Key terms

Topology

The logical layout of the components of a computer system or network and their interconnections. Topology deals with questions of what components are directly connected to other components from the standpoint of being able to communicate. It does not deal with questions of physical location of components or interconnecting cables. (*The Dictionary of Storage Networking Terminology*)

Direct topology

A topology that does not use a switch.

Switch or fabric topology

A topology that uses a switch.

Things to know - Storage array configuration specifications

Table 10: Storage array configuration specifications

Item	Specification
Number of controllers	Two
Number of host connectors per controller	• Four SAS host connectors if the SAS HIC is installed. • Two InfiniBand host connectors if the InfiniBand HIC is installed. • Four FC host connectors if the Fibre Channel HIC is installed. • Four iSCSI host connectors if the iSCSI HIC is installed.
Maximum HBA host ports	2048
Maximum SAS HBA logins per controller	128
Maximum InfiniBand logins per controller	256
Maximum Fibre Channel logins per controller	4096
SAS HIC host port link rate (Gb/s)	3, 6, 12
InfiniBand HIC host port link rate (Gb/s)	40, 56
Fibre Channel HIC host port rate (Gb/s)	4, 8, 16

Item	Specification
iSCSI HIC host port rate (Gb/s)	1, 10 (auto-negotiated)
Supported combined cache and processor memory sizes	12 GB per controller
Maximum number of drive trays supported in a storage array	15 drive trays
Maximum number of drive slots supported	384
Maximum number of host logins	1024
Maximum number of hosts per storage partition	1024
Maximum number of volumes per storage array	2048
Maximum number of storage partitions	512
Maximum number of volumes per storage partition	256
Node fail-over	• Windows 2002 R2 and Windows 2012 support 64 nodes • Windows 2008 R2 supports 16 nodes • Oracle Solaris Cluster 4.2 (Sol 11.2) • Oracle Solaris Cluster 4.1 (Sol 11.1) • Oracle Solaris Cluster 3.3 U2 (Sol 10 u11) • SteelEye LifeKeeper (SIOS) on SLES# • Red Hat Cluster Server on RHEL • VMware HA • Power HA (HACMP)

Things to know - Host channels

Attention: Possible hardware damage – To prevent electrostatic discharge damage to the tray, use proper antistatic protection when you handle tray components.

The controller-drive trays contain no native host ports.

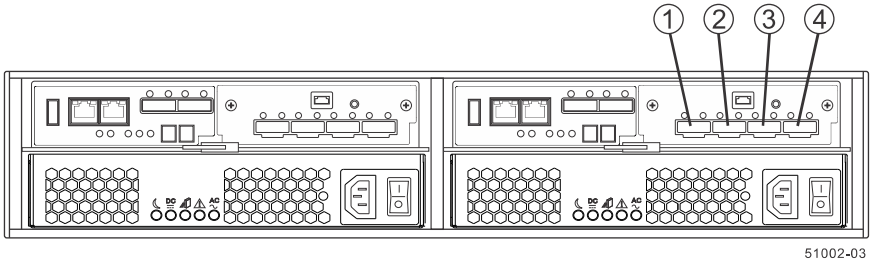
One of the following host interface cards (HICs) is installed on each controller:

- Four SAS ports at either 6 Gb/s or 12 Gb/s
- Two IB ports at either 40 Gb/s or 56 Gb/s
- Four Fibre Channel ports at 16 Gb/s

- Four iSCSI ports at 10 Gb/s

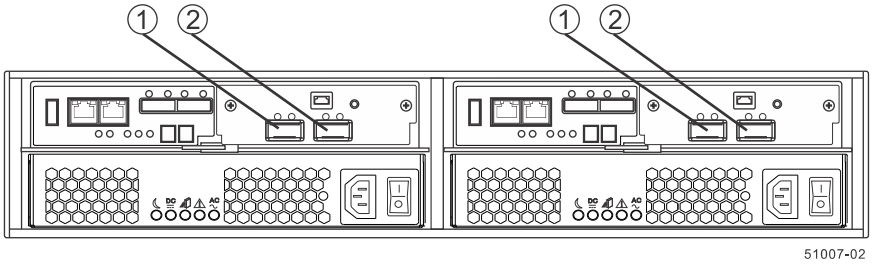
A HIC of the same interface and number of ports must be installed on each controller.

- **Host channels on the E5612 and E5624 with SAS HIC - Rear view**



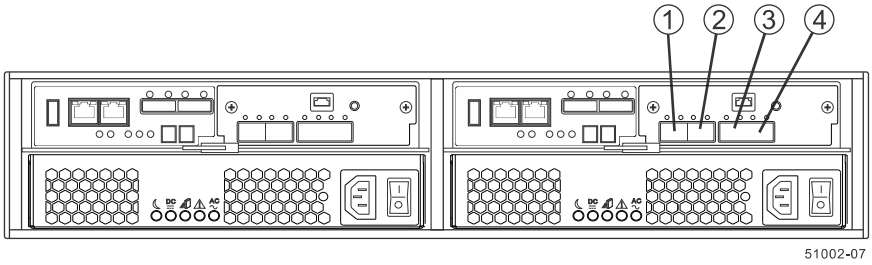
1	Mini-SAS host interface card port 1
2	Mini-SAS host interface card port 2
3	Mini-SAS host interface card port 3
4	Mini-SAS host interface card port 4

- **Host channels on the E5612 and E5624 with Infiniband HIC - Rear view**



1	QSFP channel 1
2	QSFP channel 2

- **Host channels on the E5612 and E5624 with an FC HIC or an iSCSI HIC - Rear view**



1	SFP+ host channel 1
2	SFP+ host channel 2

3	SFP+ host channel 3
4	SFP+ host channel 4

Procedure - Connecting host cables on a controller-drive tray

About this task

The type of host interface cards (HICs) (SAS, iSCSI, Fibre Channel, or InfiniBand) must match the type of the host bus adapters (HBAs) to which you connect them.

Note: Ensure that you have installed the HBAs. See *Step 3 - Installing the host bus adapters for the controller-drive tray* on page 27 for information about how to install the HBA and how to use the supplied configuration utilities.

See the examples in the following section for example cabling patterns.

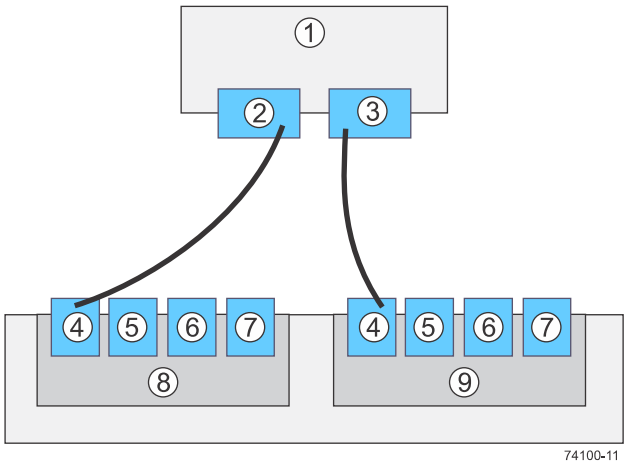
Steps

1. Based on the type of host interface card and cables you are using, do one of the following:

   - If your configuration contains an InfiniBand, Fibre Channel, or iSCSI host interface card and uses optical cables, start with the first host InfiniBand, Fibre Channel, or iSCSI channel of each controller, and plug one end of the cable into the QSFP or SFP transceiver in the host channel and go to step *3*.
   - If your configuration uses copper cables, go to step *2*.

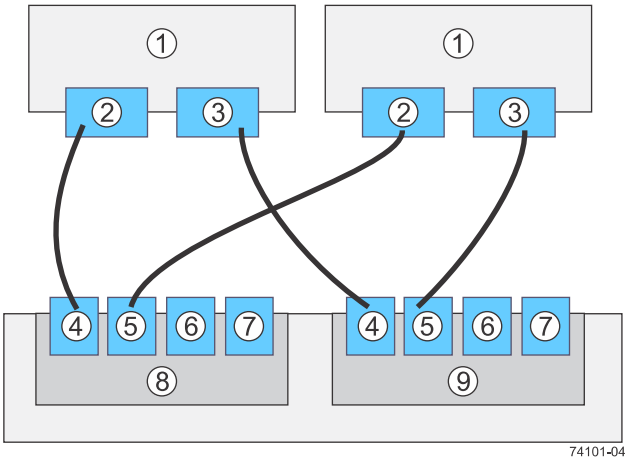
   The following four figures display valid host-to-controller-drive-tray configurations when using a controller-drive tray.

   - **Direct topology – One host and a dual controller-drive tray with a four-port connection**



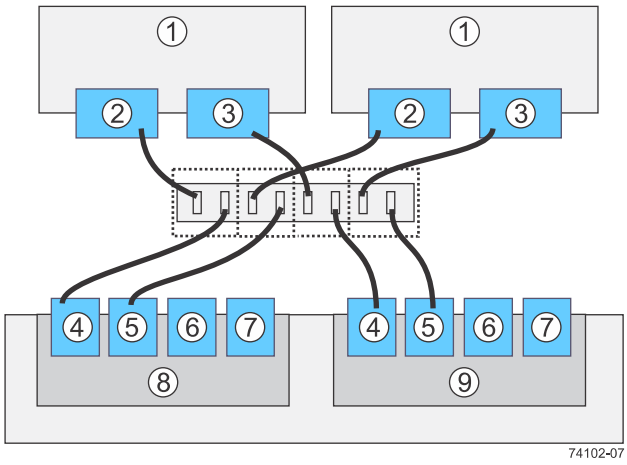
1	Host
2	HBA 1 or NIC 1
3	HBA 2 or NIC 2
4	Host port 1
5	Host port 2
6	Host port 3
7	Host port 4
8	Controller A
9	Controller B

- **Direct topology – Two hosts and a dual controller-drive tray with a four-port connection for maximum redundancy**



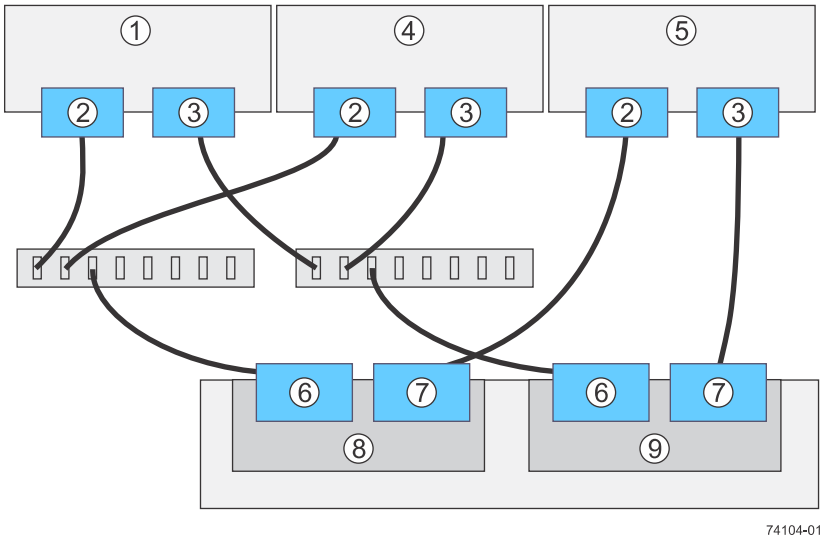
1	Host
2	HBA 1 or NIC 1
3	HBA 2 or NIC 2
4	Host port 1
5	Host port 2
6	Host port 3
7	Host port 4
8	Controller A
9	Controller B

- **Switch or fabric topology – Two hosts and a dual controller-drive tray with a four-port connection and a zoned switch**



1	Host
2	HBA 1 or NIC 1
3	HBA 2 or NIC 2
4	Host port 1
5	Host port 2
6	Host port 3
7	Host port 4
8	Controller A
9	Controller B

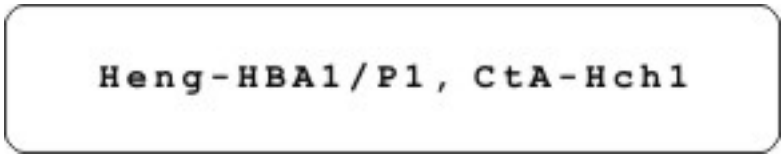
- **Mixed topology – Three hosts and a dual controller-drive tray**



1	Host
2	HBA 1 or NIC 1
3	HBA 2 or NIC 2
4	Host port 1
5	Host port 2
6	Host port 3
7	Host port 4
8	Controller A
9	Controller B

2. Plug either the SAS cable or copper IB cables into the controller.
3. Plug the other end of the cable either into an HBA in the host (direct topology) or into a switch (fabric topology).
4. Affix a label to each end of the cable with this information. A label is very important if you need to disconnect cables to service a controller. Include this information on the labels:
   - The host name and the HBA port (for direct topology)
   - The switch name and the port (for fabric topology)
   - The controller ID (for example, controller A)
   - The host channel ID (for example, host channel 1)

   Example label abbreviation – Assume that a cable is connected between port 1 in HBA 1 of a host named Engineering and host channel 1 of controller A. A label abbreviation could be as follows:



5. Repeat these steps for each controller and host channel that you intend to use.

Step 6 - Installing the drive trays for the controller-drive tray configurations

Things to know - General installation of drive trays

Note: If you are installing the drive tray in a cabinet with other trays, ensure that the combined power requirements of the drive tray and the other trays do not exceed the power capacity of your cabinet.

If you are performing a hot add of a tray to an existing storage array, refer to the *Hardware Cabling Guide*.

- Special site preparation is not required for any of these drive trays beyond what is normally found in a computer lab environment.
- The power supplies meet standard voltage requirements for both domestic and worldwide operation.
- Keep as much weight as possible in the bottom half of the cabinet.

Refer to the *Site Preparation Guide* for important considerations about cabinet installation.

Procedure - Installing the DE1600 drive trays and DE5600 drive trays

About this task

Warning: (W08) **Risk of bodily injury** – Two persons are required to safely lift the component.

Warning: (W05) **Risk of bodily injury** – If the bottom half of the cabinet is empty, do not install components in the top half of the cabinet. If the top half of the cabinet is too heavy for the bottom half, the cabinet might fall and cause bodily injury. Always install a component in the lowest available position in the cabinet.

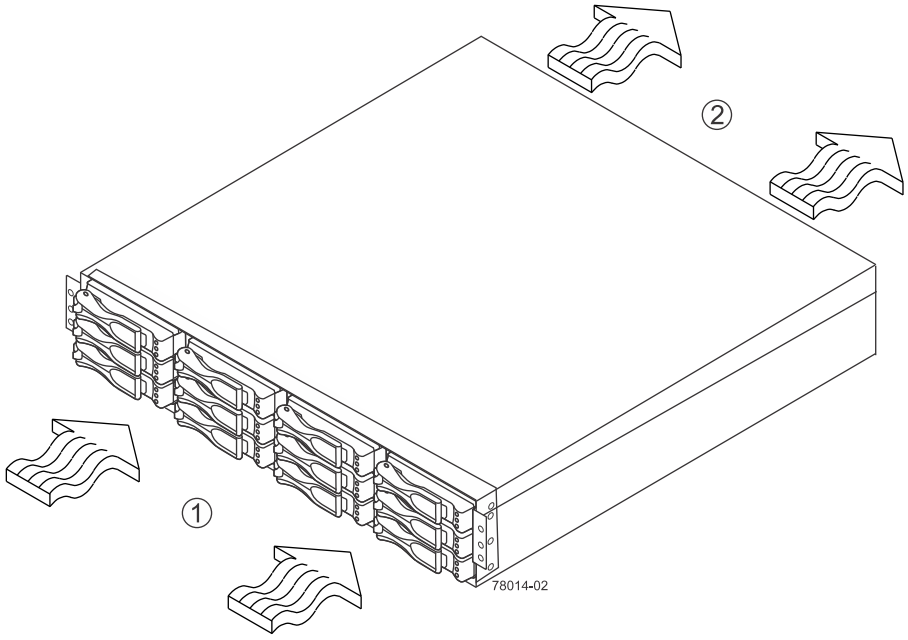
You can install the drive tray into an industry-standard cabinet.

This procedure describes how to install the mounting rails into an industry-standard cabinet.

Attention: Possible hardware damage – To prevent electrostatic discharge damage to the tray, use proper antistatic protection when handling tray components.

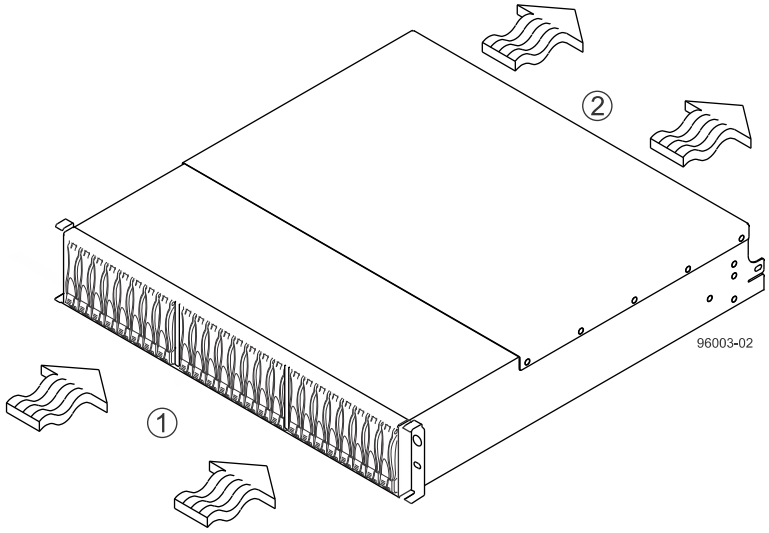
Steps

1. Ensure that the cabinet is in the final location and that you meet the clearance requirements as shown.
   - **DE1600 drive tray – Airflow and clearance requirements**



1	76 cm (30 in.) clearance in front of the cabinet
2	61 cm (24 in.) clearance behind the cabinet

- **DE5600 drive tray – Airflow and clearance requirements**

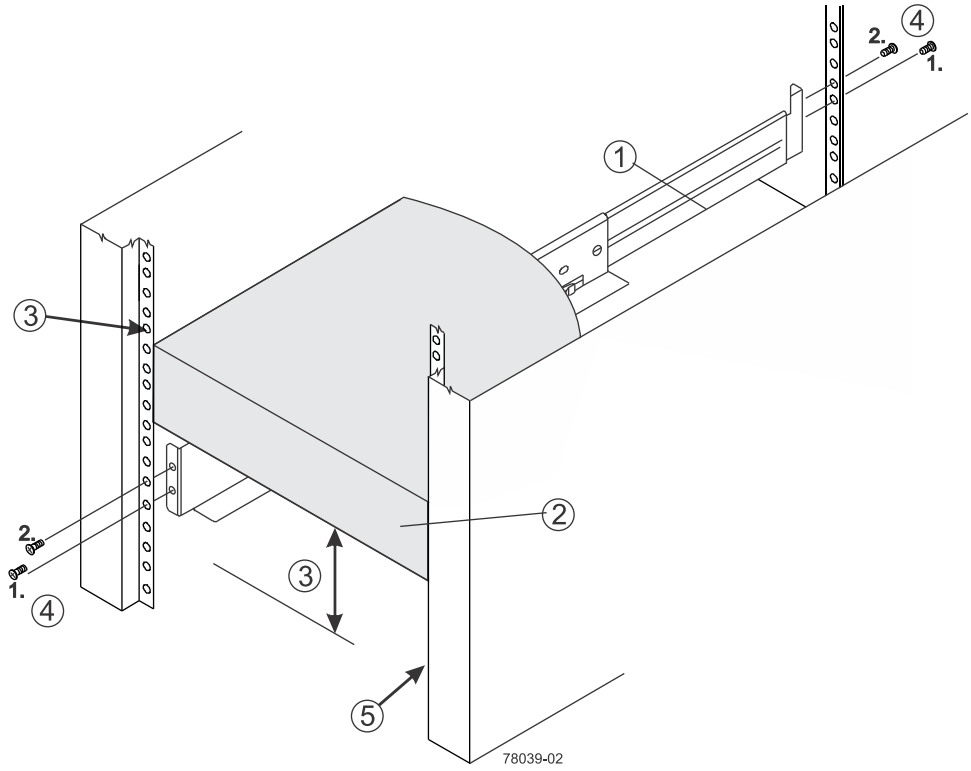


1	76 cm (30 in.) clearance in front of the cabinet
2	61 cm (24 in.) clearance behind the cabinet

Note: Fans pull air through the tray from front to back across the drives.

2. Lower the feet on the cabinet to keep the cabinet from moving.
3. Remove the drive tray and all contents from the shipping carton.
4. Position the mounting rails in the cabinet, as follows: For more information, refer to the installation instructions that are included with your mounting rails.
   - If you are installing the mounting rails above an existing tray, position the mounting rails directly above the tray.

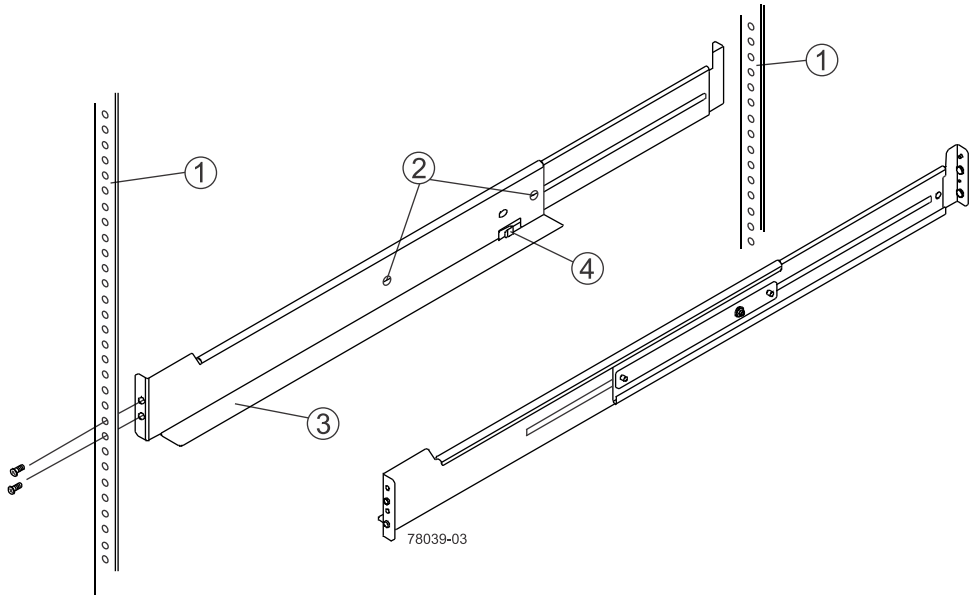
- If you are installing the mounting rails below an existing tray, allow either 8.7-cm (3.4-in.) vertical clearance for the DE1600 drive tray or 8.8-cm (3.5-in.) vertical clearance for the DE5600 drive tray.



1	Mounting rail
2	Existing tray
3	Clearance above and below the existing tray
4	Screws for securing the mounting rail to the cabinet (front and rear)
5	Industry-standard cabinet

5. Attach the mounting rails to the cabinet.

a. Ensure that the adjustment screws on the mounting rail are loose so that the mounting rail can extend or contract as needed.



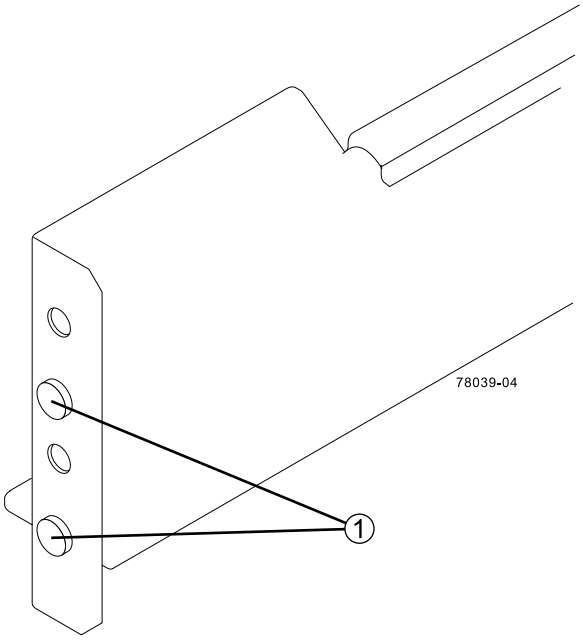
1	Cabinet mounting holes
2	Adjustment screws for locking the mounting rail length
3	Mounting rails
4	Clip for securing the rear of the drive tray

b. Place the mounting rail inside the cabinet, and extend the mounting rail until the flanges on the mounting rail touch the inside of the cabinet.

c. Ensure that the alignment spacers on the front flange of the mounting rail fit into the mounting holes in the cabinet.

   The front flange of each mounting rail has two alignment spacers. The alignment spacers are designed to fit into the mounting holes in the cabinet. The alignment spacers help position and hold the mounting rail.

   Note: If the cabinet in which you are installing this tray has square holes, there are larger spacers that can be used to mount the rail.



1	Alignment spacers

d. Insert one M5 screw through the front of the cabinet and into the top captured nut in the mounting rail. Tighten the screw.

e. Insert two M5 screws through the rear of the cabinet and into the captured nuts in the rear flange in the mounting rail. Tighten the screws.

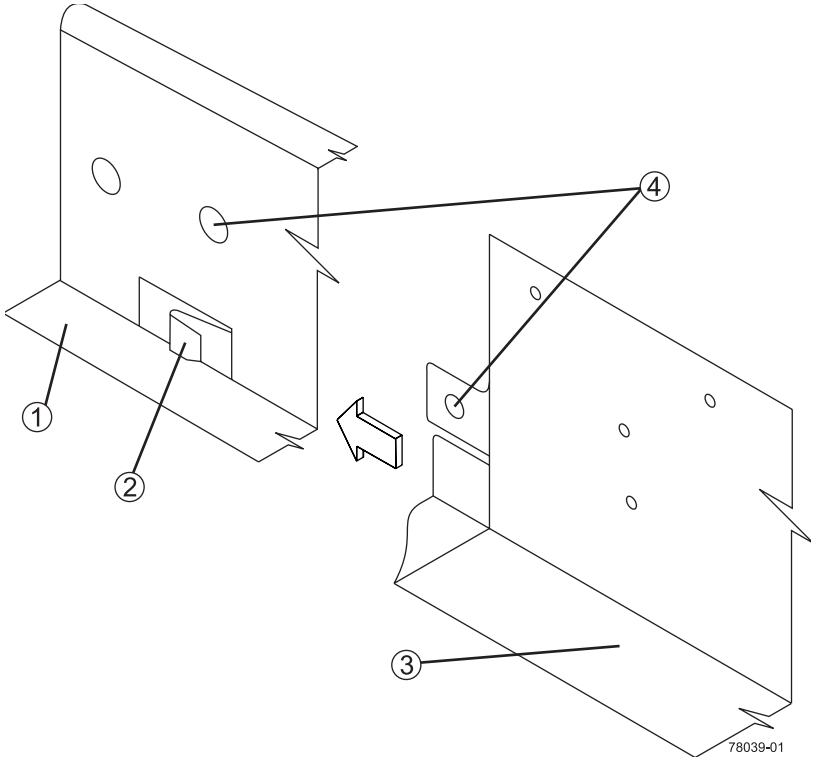
f. Tighten the adjustment screws on the mounting rail.

g. Repeat these steps to install the second mounting rail.

6. With the help of one other person, slide the rear of the drive tray onto the mounting rails. The rear edge of the drive tray must fit into the clip on the mounting rail.

The drive tray is correctly aligned when these conditions are met:

- The mounting holes on the front flanges of the drive tray align with the mounting holes on the front of the mounting rails. See item 4 in the following figure.
- The rear edge of the drive tray sheet metal fits into the clip on the mounting rail.
- The holes in the drive tray sheet metal for the rear hold-down screws align with the captured nuts in the side of the mounting rails.



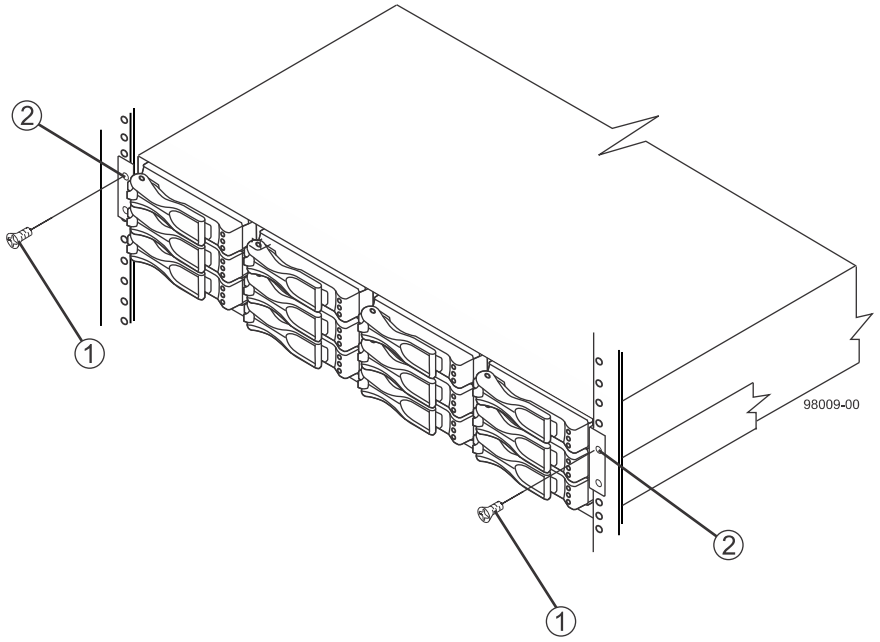
1	Mounting rail
2	Clip
3	Partial view of the drive tray rear sheet metal
4	Mounting holes

7. Secure the front of the drive tray to the cabinet. Use the two screws to attach the flange on each side of the front of the drive tray to the mounting rails.

a. Insert one M5 screw through the bottom hole of a flange on the drive tray so that the screw goes through the cabinet rail and engages the bottom captured nut in the mounting rail. Tighten the screw.

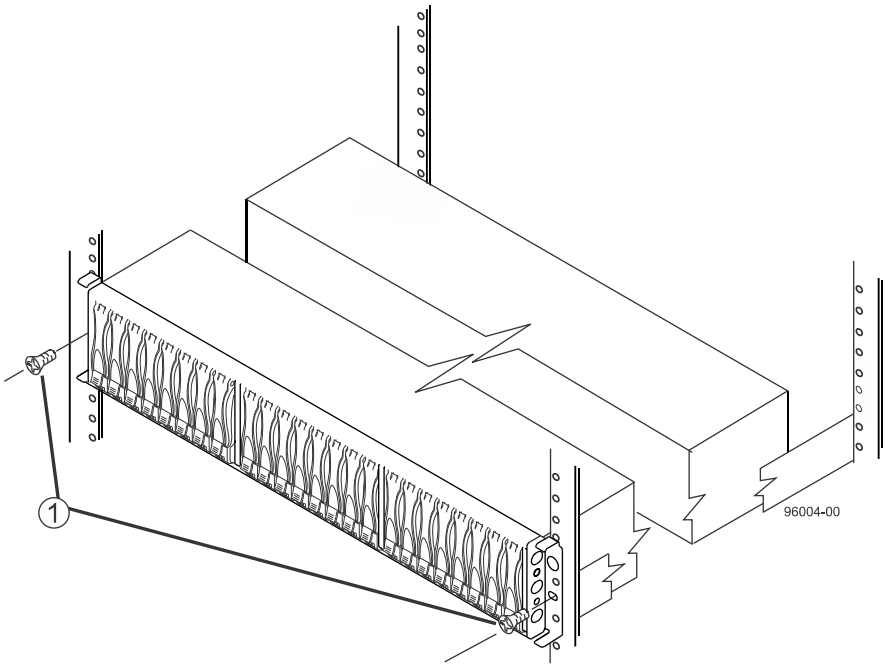
b. Repeat this step for the second flange.

- **DE1600 drive tray**



1	Screw
2	Mounting hole

- **DE5600 drive tray**



1	Screw

Note: The rear end contains two controllers. The top of the is the side with the labels.

8. Secure the side of the drive tray to the mounting rails by performing these steps:
   a. Insert one M4 screw through the side sheet metal of the drive tray into the captured nut on the side of the mounting rail. Tighten the screw.
   b. Repeat this step for the other side.
9. Attach the plastic end caps onto the front of the drive tray.
   a. Put the top of the end cap on the hinge tab that is part of the drive tray mounting flange.
   b. Gently press on the bottom of the end cap until it snaps into place over the retainer on the bottom of the drive tray mounting flange.

Procedure - Installing drives in the DE1600 and DE5600 drive trays

About this task

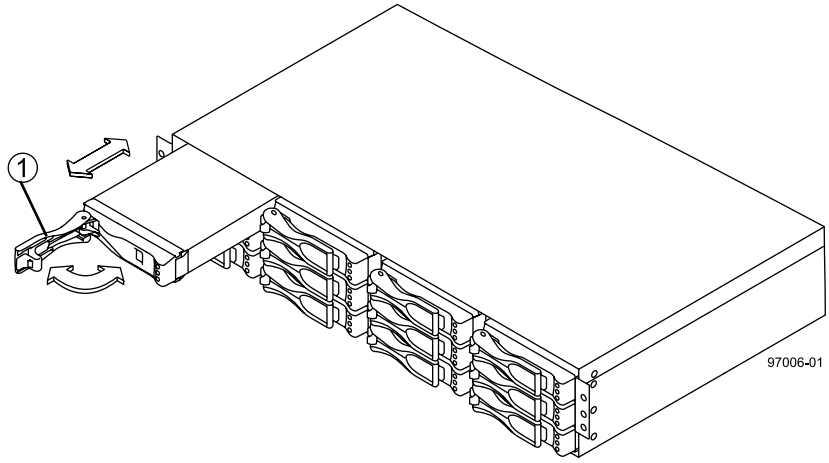
In some situations, the drive tray might be delivered without the drives installed. Follow the steps in this procedure to install the drives.

Attention: Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by NetApp. Drives might be shipped but not installed. System integrators, resellers, system administrators, or users can install the drives.

Note: For the DE1600 drive tray, the installation order of the drives is from top to bottom and from left to right. For the DE5600 drive tray, the installation order is from left to right. The installation order is important because the drives might already contain configuration information that depends upon the correct sequence of the drives in the tray.

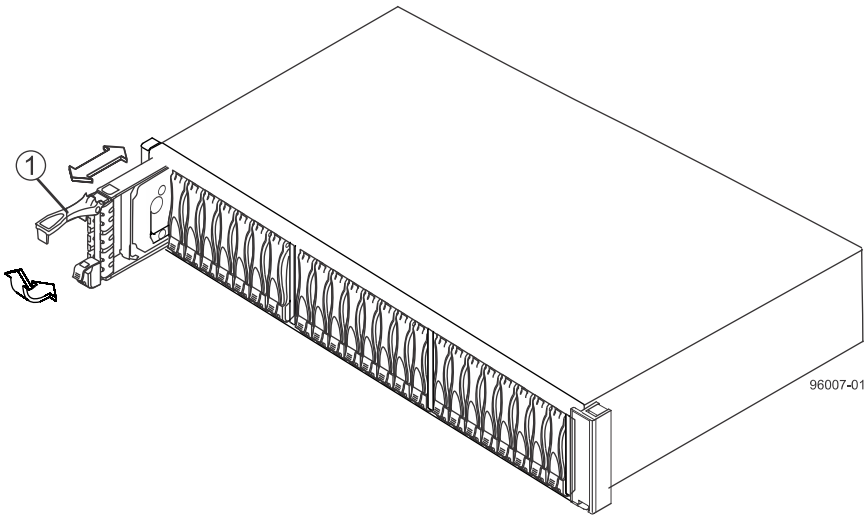
Steps

1. Beginning with the first drive slot (the upper-left slot of the DE1600 drive tray or the left slot of the DE5600 drive tray), place the drive in the slot guides, and slide the drive all the way into the slot.
2. Push the drive handle to the right (DE1600 drive tray) or down (DE5600 drive tray)
   - **Installing a drive in the DE1600 drive tray**



1	Drive handle

- **Installing a drive in the DE5600 drive tray**



1	Drive handle

Note: In some applications, the drive handle might have the hinge on the right.

3. For the DE1600 drive tray, install the second drive beneath the first drive. For the DE5600 drive tray, install the second drive to the right of the first drive.
4. For the DE1600 drive tray, install the other drives from top to bottom and then from left to right. For the DE5600 drive tray, install the other drives to the right.

Procedure - Installing the DE6600 drive tray

About this task

Warning: (W10) **Risk of bodily injury** – Four or more persons are required to safely lift the component.

Attention: Risk of equipment malfunction – To avoid possible equipment damage and ensure safe and efficient servicing of the equipment, install DE6600 drive trays towards the bottom of a cabinet.

Warning: (W05) **Risk of bodily injury** – If the bottom half of the cabinet is empty, do not install components in the top half of the cabinet. If the top half of the cabinet is too heavy for the bottom half, the cabinet might fall and cause bodily injury. Always install a component in the lowest available position in the cabinet.

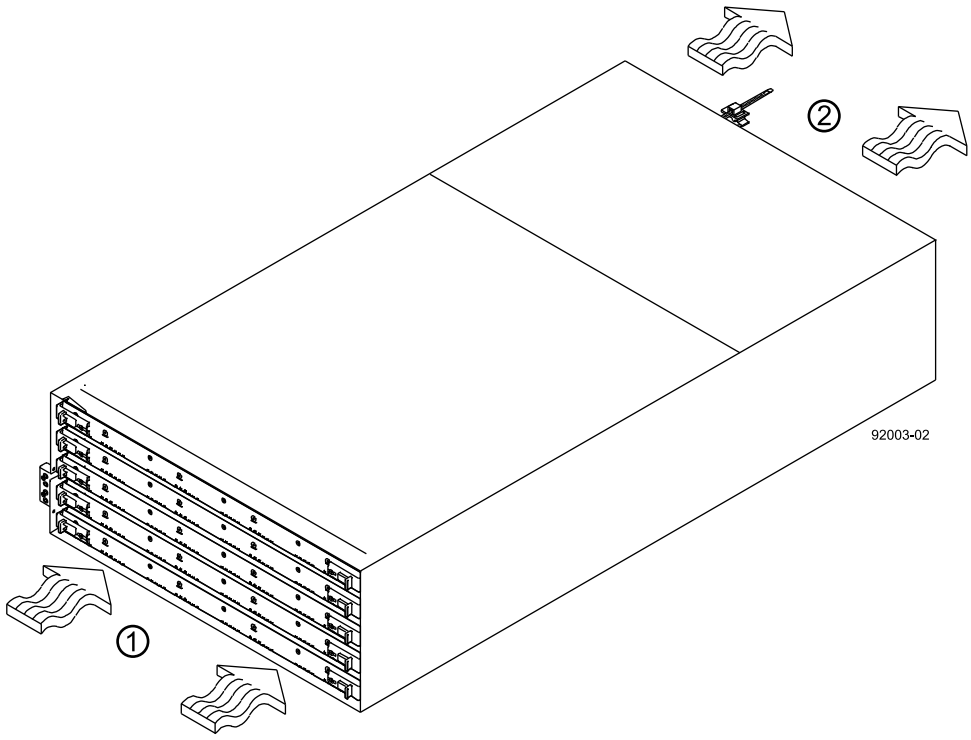
You can install the high-density, 6-Gb SAS SBB 2.0-compliant DE6600 drive tray into an industry-standard cabinet, provided it has a depth of 100 cm (40 in.). A minimum depth of 76 cm (30 in.) between the front EIA support rails and the rear EIA support rails is required.

This procedure describes how to install the mounting rails into an industry-standard cabinet.

Attention: Possible hardware damage – To prevent electrostatic discharge damage to the tray, use proper antistatic protection when handling tray components.

Steps

1. Make sure that the cabinet is in the final location. Make sure that you meet the airflow and clearance requirements shown in the following figure.

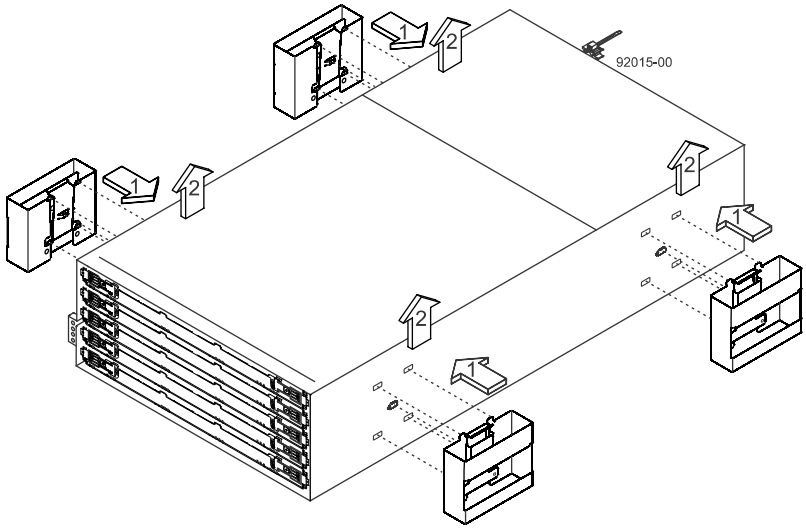


1	91 cm (36 in.) clearance in front of the cabinet
2	61 cm (24 in.) clearance behind the cabinet

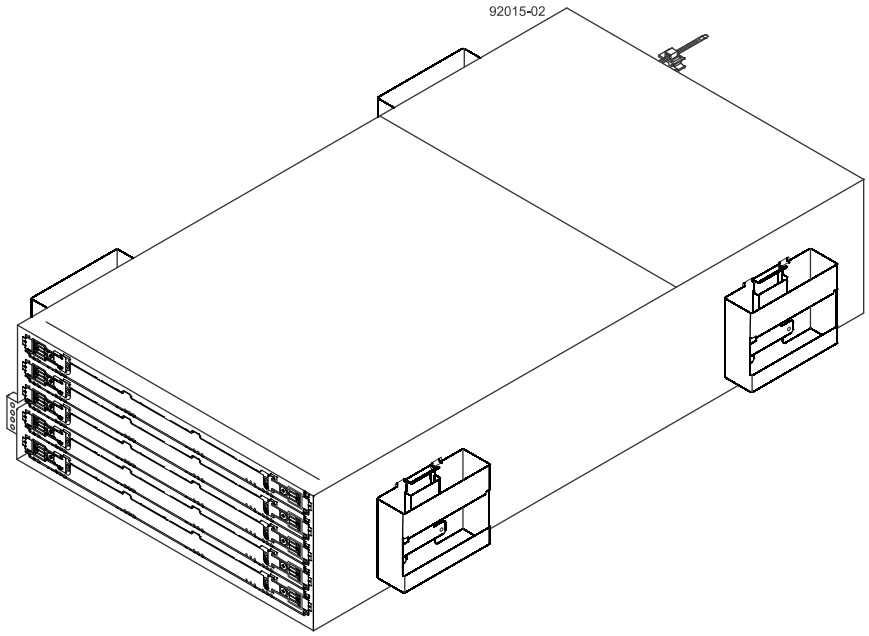
Note: Fans pull air through the drive tray from front to back across the drives.

2. Lower the feet on the cabinet to keep the cabinet from moving.
3. Before removing the drive tray and all of the contents from the shipping carton, locate the tray handles and attach them to the drive tray.
   a. Align the handle just under the thumb latch.

b. Push the handle up until it clicks in place with the thumb latch.

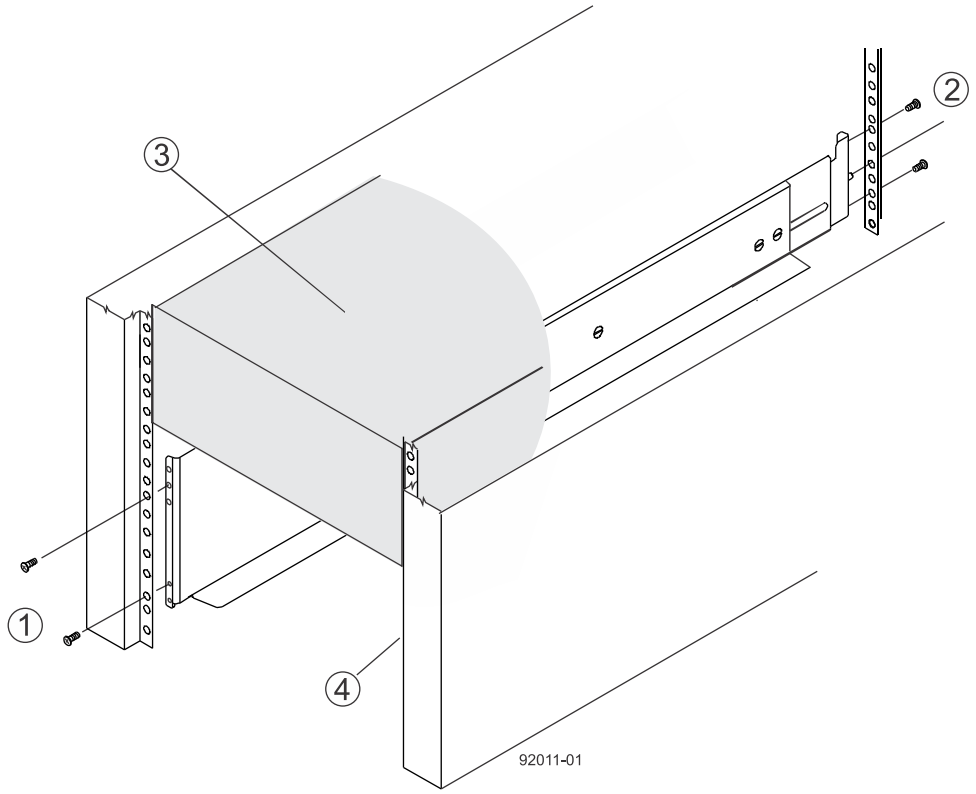


4. With the help of at least three other persons, remove the drive tray and all of the contents from the shipping carton, using the four drive tray handles (two to a side) as shown in the following figure. Set the drive tray aside.



5. Position the mounting rails in the cabinet.

- If you are installing the mounting rails above an existing tray, position the mounting rails directly above the tray.
- If you are installing the mounting rails below an existing tray, allow 17.8 cm (7 in.) vertical clearance for a DE6600 drive tray.



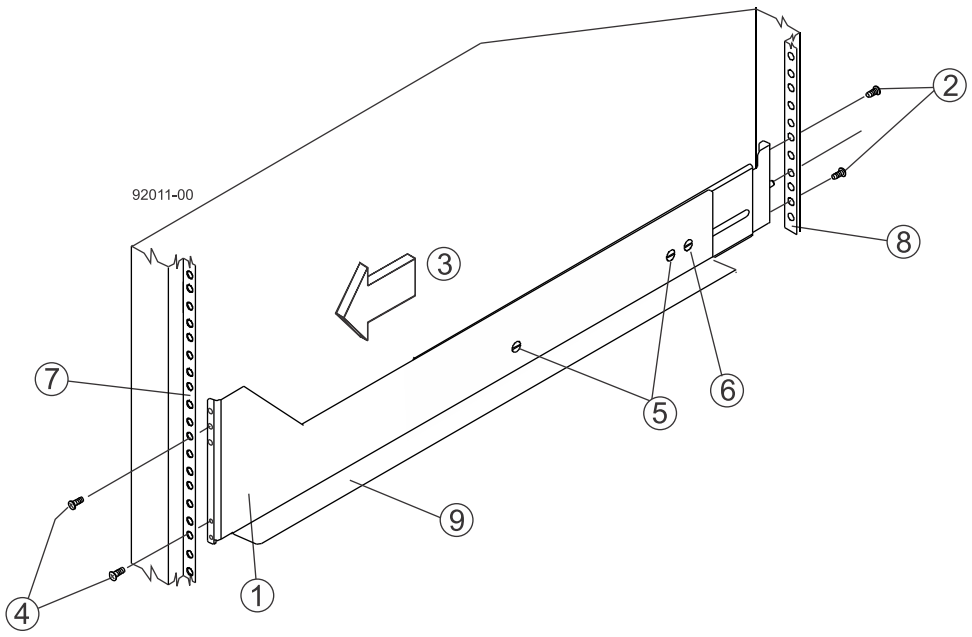
1	Screws for securing the mounting rail to the cabinet (front)
2	Screws for securing the mounting rail to the cabinet (rear)
3	Existing tray
4	Industry-standard cabinet

6. To attach the mounting rails to the cabinet, do one of the following:

- If you are using the long fixed-size mounting rails, go to step *7*.
- If you are using the shorter adjustable mounting rails, go to step *8*.

7. Attach the long fixed-size mounting rails to the cabinet.

a. Make sure that the adjustment screws on the mounting rail are loose so that the mounting rail can extend or contract as needed.



1	Front of the mounting rail
2	Two M5 screws for the rear EIA support rail
3	Front of the cabinet
4	Two M5 screws for the front EIA support rail
5	Adjustment screws
6	Rear hold-down screw
7	Cabinet mounting holes on the front EIA support rail
8	Cabinet mounting holes on the rear EIA support rail
9	Mounting rail lip

b. Remove the rear hold-down screw. It protrudes from the inside of the rail and prevents you from sliding the drive tray onto the rails.

c. Place the mounting rail inside the cabinet, and extend the mounting rail until the flanges on the mounting rail touch the inside of the cabinet.

   Note: If you are mounting the DE6600 drive tray in a cabinet with square holes, use the square hole-to-round hold adapters in the rail kit to align the screws in the holes. The square hole-to-round hold adapters are round washers with shallow shoulders that fit snugly into the square holes in the rack.

d. Insert one M5 screw through the front of the cabinet, and screw it into the top captured nut in the mounting rail.

e. Insert two M5 screws through the rear of the cabinet, and screw them into the captured nuts in the rear flange in the mounting rail.

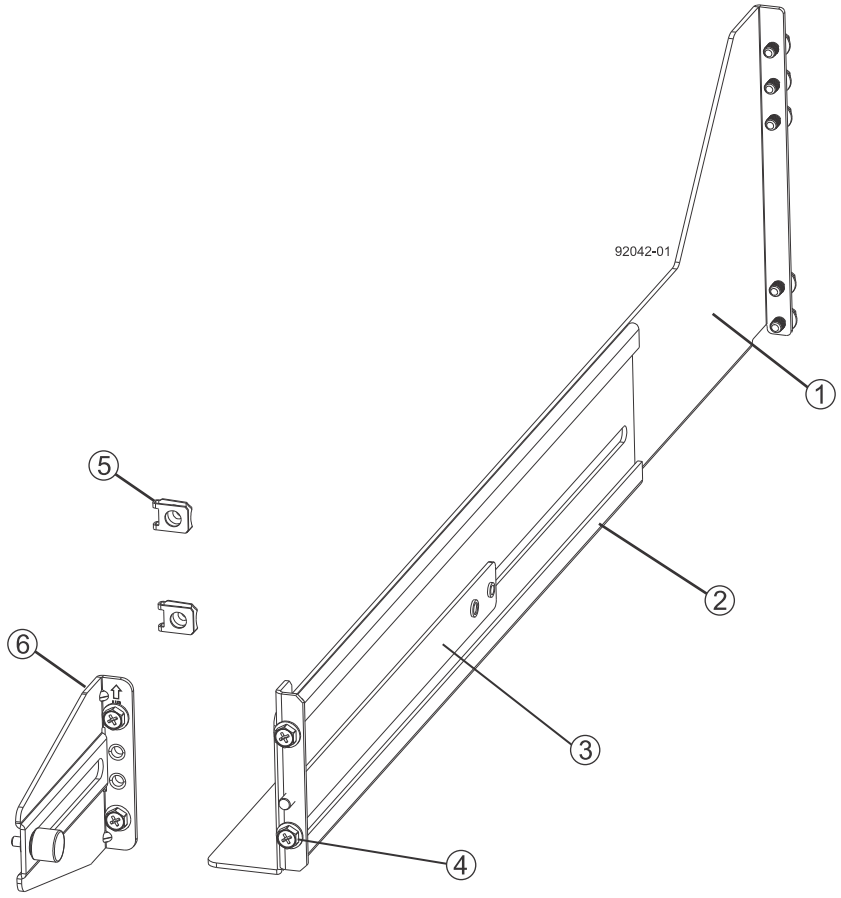
f. Counting up from the bottom of the mounting rail, place the bottom of the rear bracket in the 8th hole of the cabinet, so that the top of the rear bracket is in the 11th hole. The distance between the two holes should be 1U or 4.45 cm (1.75 in).

g. Tighten the adjustment screws on the mounting rail.

h. Repeat these steps to install the second mounting rail.

i. Insert one M5 screw through the front of the mounting rail. You use this screw to attach the drive tray to the cabinet.

8. Attach the shorter, adjustable size mounting rails to the cabinet.

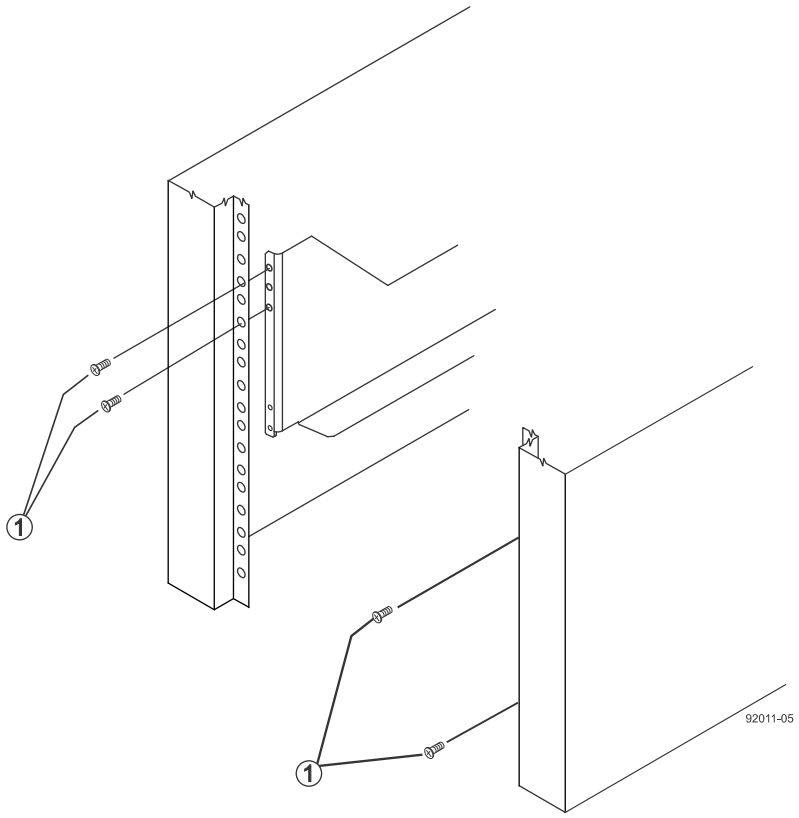


1	Front of the mounting rail
2	Rear of the mounting rail
3	Rail fix bar
4	Two M5 screws for the front EIA support rail
5	Two clips for the front EIA support rail
6	Rear bracket

a. Make sure that the adjustment screws on the mounting rail are loose so that the mounting rail can extend or contract as needed. The adjustment screws are on the other side of the previous figure.

b. Place the mounting rail inside the cabinet, and extend the mounting rail until the flanges on the mounting rail touch the inside of the cabinet.

c. Insert one M5 screw through the front of the cabinet, and screw it into the top captured nut in the mounting rail.



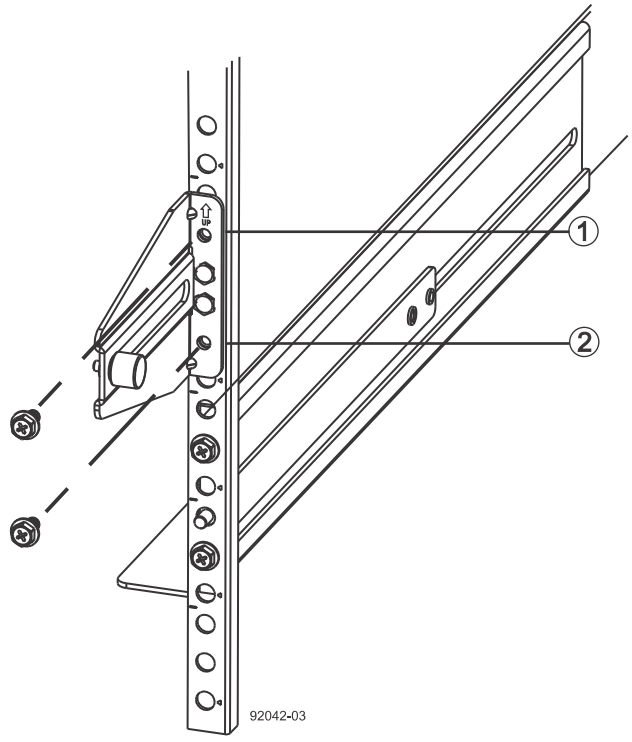
1	M5 screws

d. Insert two M5 screws through the rear of the cabinet, and screw them into the captured nuts in the rear flange in the mounting rail.

e. Counting up from the bottom of the mounting rail, place the bottom of the rear bracket in the 8th hole of the cabinet, so that the top of the rear bracket is in the 11th hole. The distance between the two holes should be 1U or 4.45 cm (1.75 in).

f. Tighten the adjustment screws on the mounting rail.

g. Repeat these steps to install the second mounting rail.



1	Top cabinet mounting hole on the rear EIA support rail
2	Bottom cabinet mounting hole on the rear EIA support rail

9. Remove the bezel from the front of the drive tray.

10. With the help of at least three other persons, slide the rear of the drive tray onto the mounting rails. The drive tray is correctly aligned when the mounting holes on the front flanges of the drive tray align with the mounting holes on the front of the mounting rails.

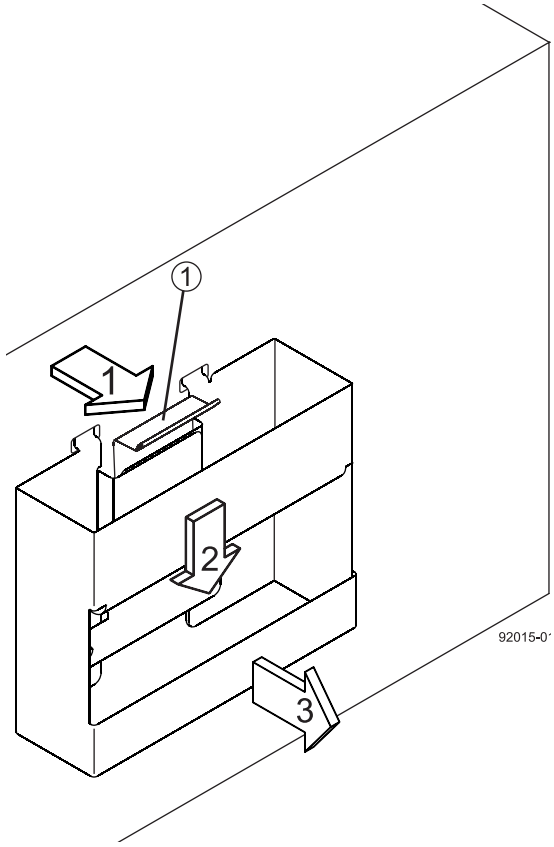
Warning: (W10) **Risk of bodily injury** – Four or more persons are required to safely lift the component.

11. After the controller-drive tray is correctly aligned, remove the enclosure lift handles as shown in the following figure:

a. Use your thumb to unlatch and remove the rear enclosure lift handles (two to a side).

b. Use the front enclosure lift handles to slide the drive tray all the way into the cabinet.

c. After the drive tray is secure in the cabinet, use your thumb to unlatch and remove the front enclosure lift handles (two to a side).



1	Pull the thumb latch away from the controller-drive tray to detach the hook.
2	Shift the handle down to release the other four hooks.
3	Move the handle away from the controller-drive tray.

12. Secure the front of the drive tray to the cabinet. Use the four screws to attach the flange on each side of the front of the drive tray to the mounting rails.

a. Insert two M5 screws through the bottom holes of a flange on the drive tray so that the screws go through the EIA support rail and engage the bottom captured nuts in the mounting rail. Tighten the screws.

You had attached the second and fourth threaded holes in step 8c.

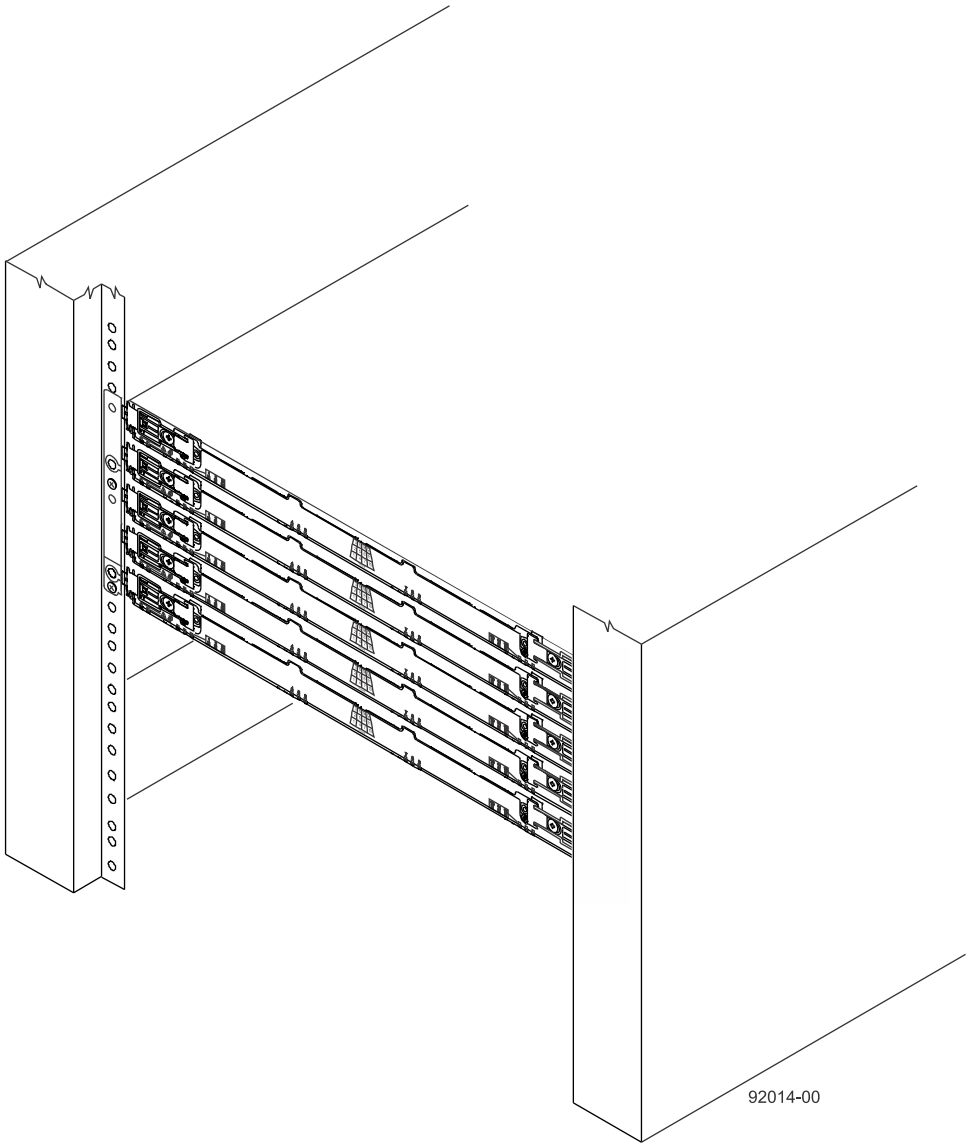
b. Repeat substep *a* for the second flange.

13. Secure the side of the drive tray to the mounting rails.

a. Tighten the thumbscrew on the rear mounting bracket that you installed in step 8e to secure the drive tray to the mounting rails.

b. Repeat substep *a* for the other side.

Note: Make sure that each drive drawer in the drive tray is securely fastened to ensure proper air flow to the drives.



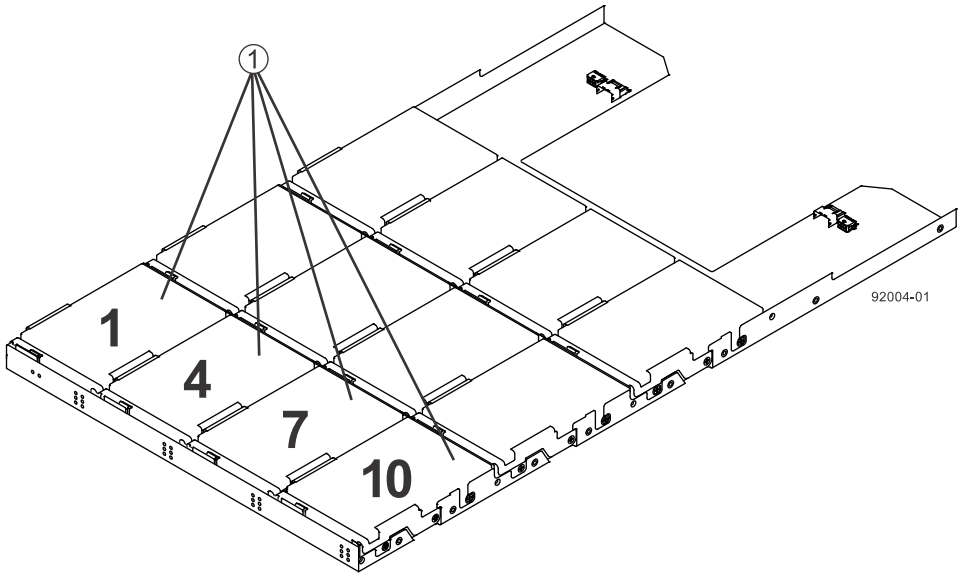
Procedure - Installing the drives in the DE6600 drive tray

About this task

The DE6600 drive tray is shipped with the drive drawers installed, but the drives are not installed. Follow the steps in this procedure to install the drives.

Attention: Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by NetApp. Drives might be shipped but not installed. System integrators, resellers, system administrators, or users can install the drives.

Attention: Risk of equipment malfunction – All DE6600 drive trays have a limit of five solid state drives (SSDs) per drawer. If you exceed this limit for SSDs in a particular drawer, the power source in the drawer could fail.

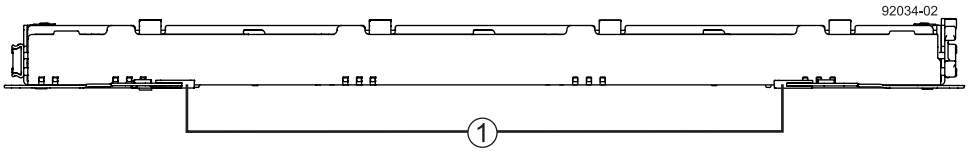


1	Slots requiring drives in each drawer

Note: The installation order within each drawer is from left to right in rows. You must install drives in slots 1, 4, 7 and 10 to make sure there is sufficient air flow to the drives. To verify these slots, consult the overlay on the front of each of the five drive drawers. Make sure the four drives in each row are adjacent to each other. The long edge of each drive should touch the drive next to it. To maintain a uniform airflow across all drive drawers, the controller-drive tray must be configured with a minimum of 20 drives, with four drives in the front row of each of the five drive drawers.

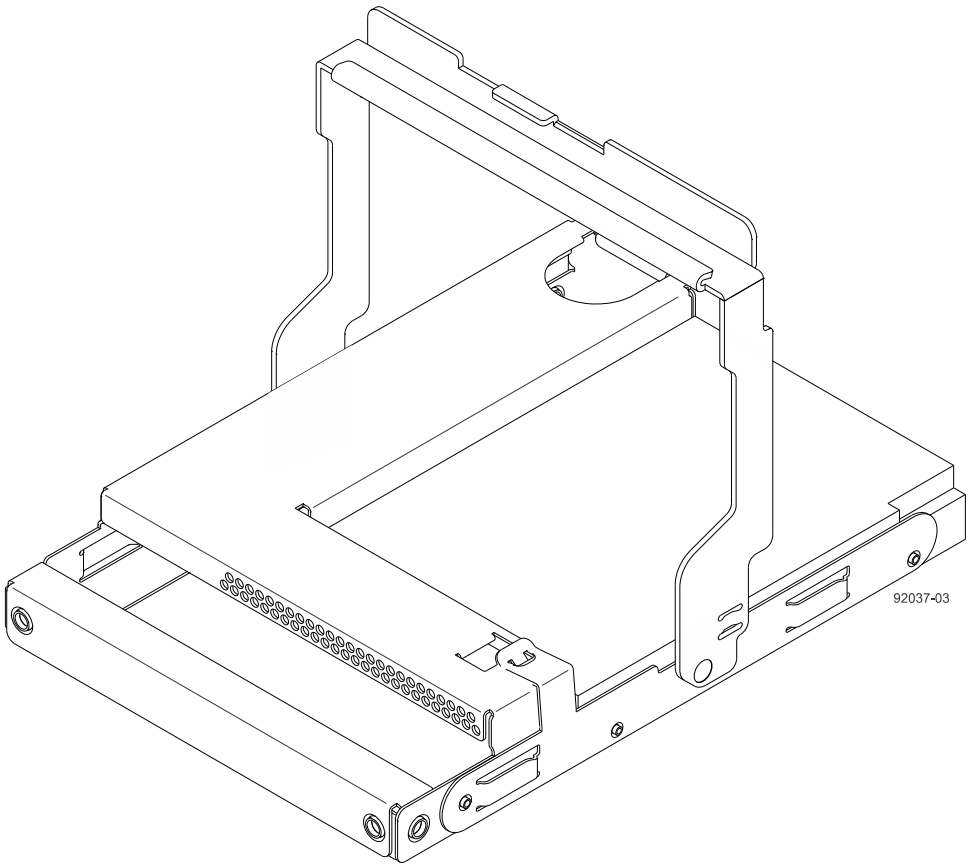
Steps

1. Beginning with the top drawer in the drive tray, release the levers on each side of the drawer by pulling both towards the center.

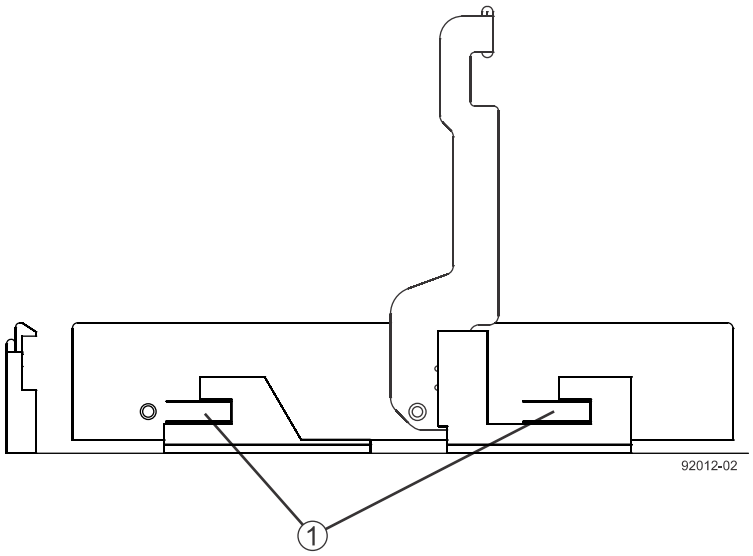


1	Levers to release the drive drawer

2. Pull on the extended levers to pull the drive drawer out to its full extension without removing it from the drive tray.
3. Starting with the first drive, raise the drive handle to the vertical position.

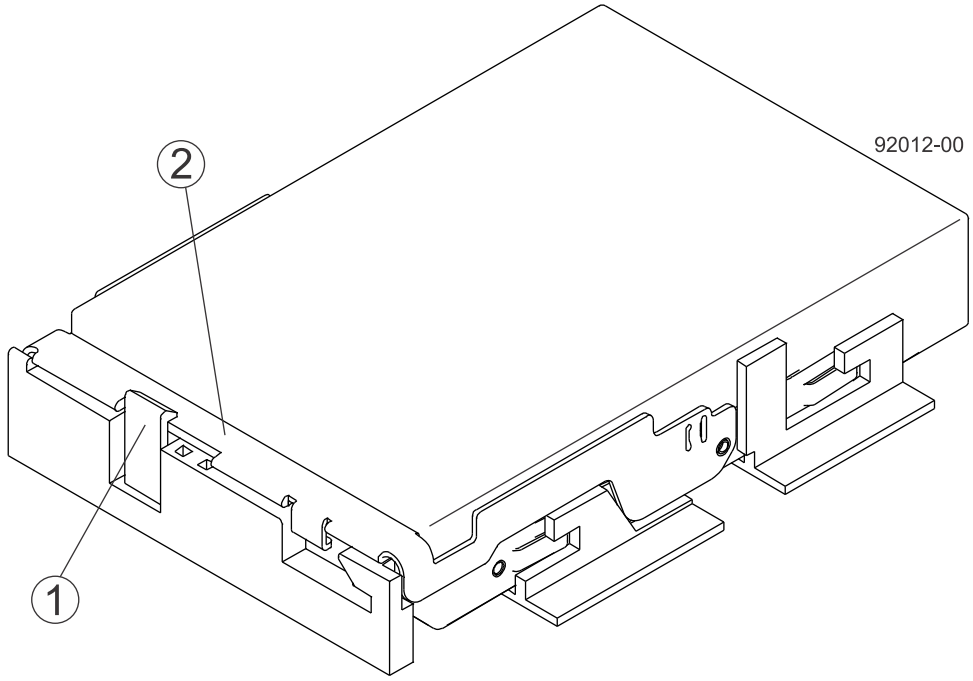


4. Align the two raised buttons on each side of the drive with the matching gap in the drive channel on the drawer.



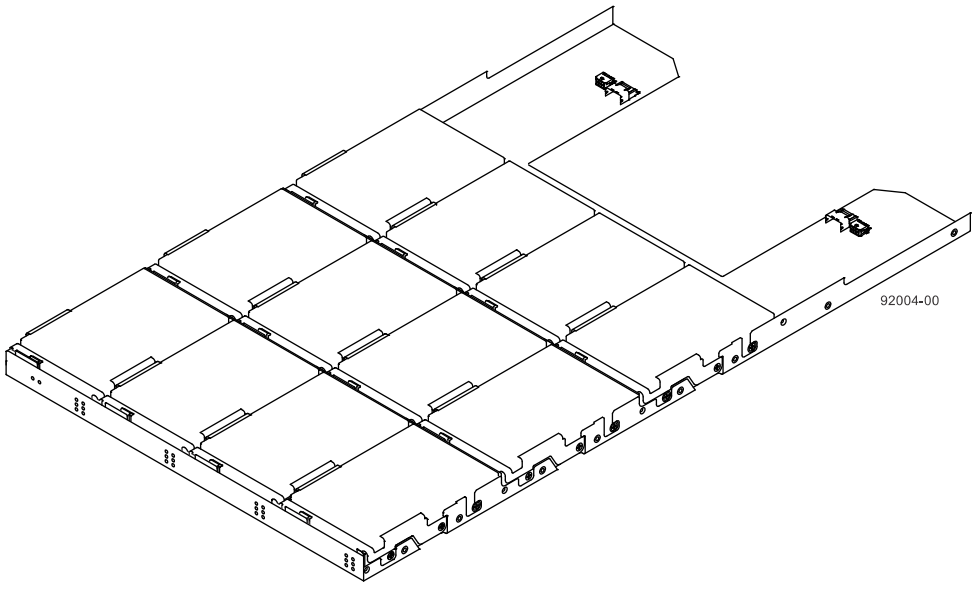
1	Raised buttons on the side of the drive

5. Lower the drive straight down, and then rotate the drive handle down until the drive snaps into place under the drive release lever.



1	Drive release lever
2	Drive handle

6. Install the other drives in rows from left to right, ensuring that the front row of the drive drawer contains at least four drives.



7. Push the drive drawer all the way back into the drive tray, closing the levers on each side of the drive drawer.

   Attention: Risk of equipment malfunction – Make sure you push both levers to each side so the drive drawer is completely closed. The drive drawer must be completely closed to prevent excess airflow, which has the potential to damage the drives.

8. Repeat these steps for each drive drawer in the configuration.

Things to know - Connecting the power cords

- For each AC power connector on the drive tray, make sure that you use a separate power source in the cabinet. Connecting to independent power sources maintains power redundancy.
- To ensure proper cooling and ensure availability, the drive tray always uses two power supplies.
- You can use the power cords shipped with the drive tray with typical outlets used in the destination country, such as a wall receptacle or an uninterrupted power supply (UPS). These power cords, however, are not intended for use in most EIA-compliant cabinets.

Note: Make sure that you do not turn on the power to the drive tray until this installation guide instructs you to do so.

Procedure - Connecting the power cords

Steps

1. Make sure that the circuit breakers in the cabinet are turned off.
2. Make sure that both of the power switches on the drive trays are turned off.
3. Connect the primary power cords from the cabinet to the external power source.

Step 7 - Connecting the controller-drive tray to the drive trays

Use this step to cable the controller-drive tray and related drive trays. For additional information, see the *Hardware Cabling Guide*.

Key terms

Drive channel

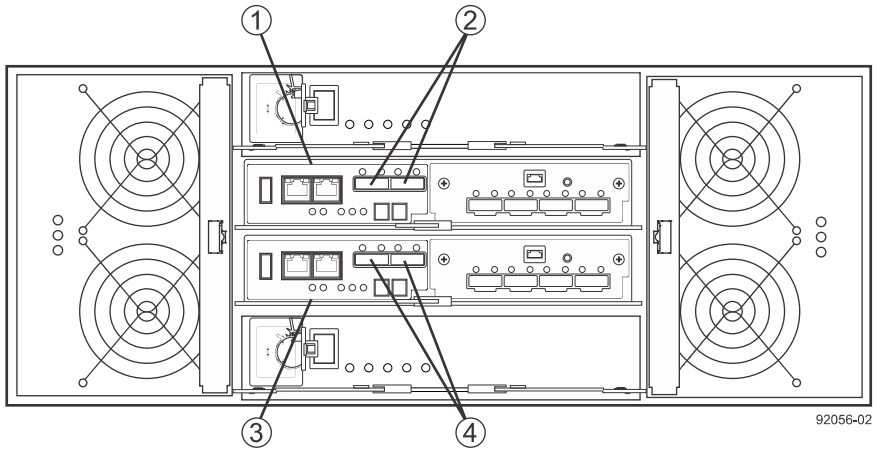
The path for the transfer of data between controllers and the drives in the storage array.

Things to know - E5600 controller-drive tray

- The controller-drive trays support the DE1600, DE5600, and DE6600 drive trays for expansion.
- For any one controller-drive tray, you must not exceed the limit of 15 connected drive trays or the limit for the total number of drive slots in the storage array. The drive slot limit is 384. The drive slot limit includes drives installed in the controller-drive tray
- Each controller has two SAS expansion connectors that must both be connected (one to the ESM A side and the other to the ESM B side) to the drive tray to ensure path redundancy.

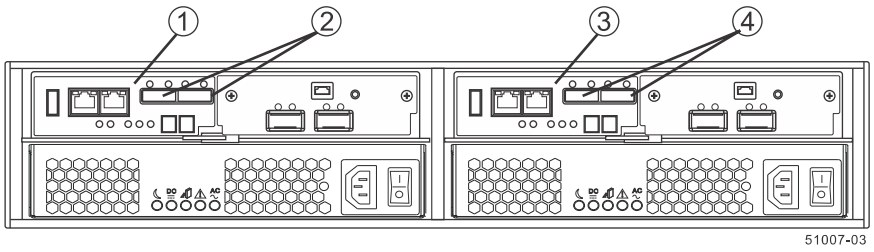
Note: Ensure that you do not turn on the power to the drive tray until this installation guide instructs you to do so. For the correct procedure for turning on the power, see *Step 10 - Turning on the power and checking for problems in a controller-drive tray configuration* on page 101.

- **Drive channel ports on the E5660**



1	Controller canister A
2	SFF-8088 SAS channels (drive expansion)
3	Controller canister B
4	SFF-8088 SAS channels (drive expansion)

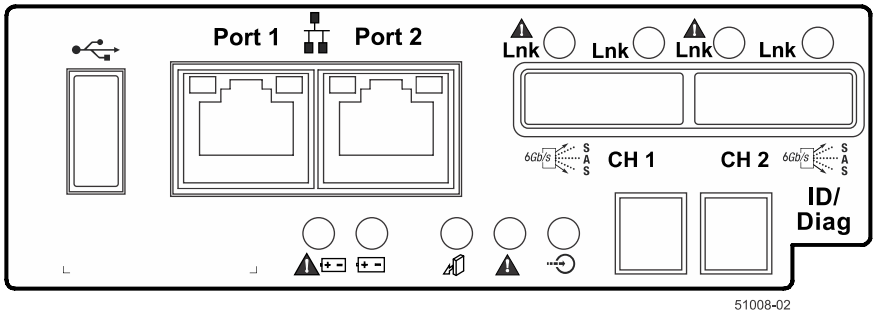
- **Drive channel ports on the E5612 or E5624**



1	Controller canister A
2	SFF-8088 SAS channels (drive expansion)
3	Controller canister B
4	SFF-8088 SAS channels (drive expansion)

Note: To maintain data access in the event of the failure of a controller, an ESM, or a drive channel, you must connect a drive tray or a string of drive trays to both drive channels on a redundant path pair.

- **Controller canister with drive channel ports (CH1 and CH2)**



Things to know - Drive trays

The following table lists the specifications for each type of drive tray.

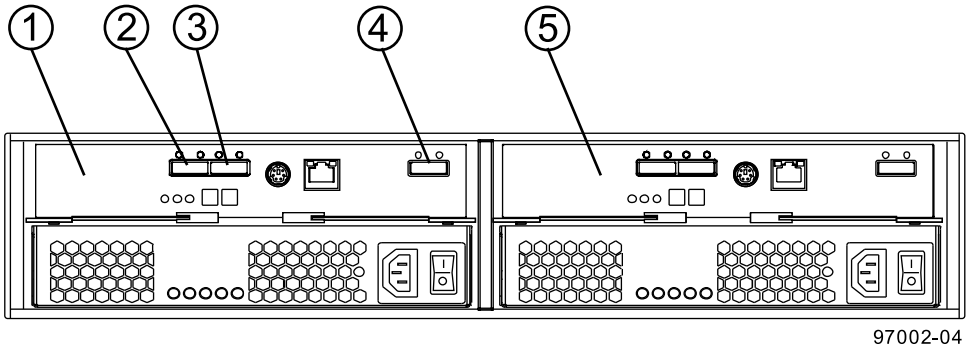
Table 11: Drive trays

Drive tray	Maximum number of drives	Drive size	Number of SAS In connectors	Number of SAS Expansion (Out) connectors
DE1600	12	8.89 cm (3.5 in.)	2	1
DE5600	24	6.35 cm (2.5 in.)	2	1
DE6600	60	• 8.89 cm (3.5 in.) • 6.35 cm (2.5 in.)	2	1

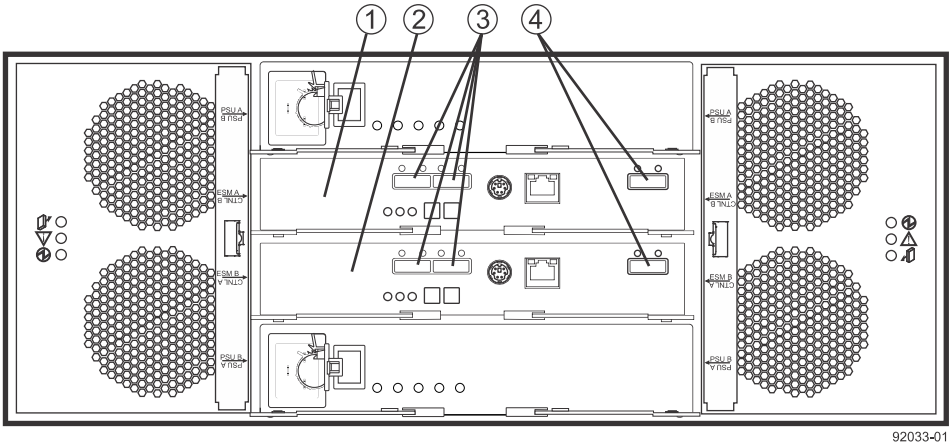
Note: The drive limit might be lower than 384 for some sub-models of the controller-drive tray. You are notified through the Major Event Log (MEL) if you attempt to install drives in excess of the limit for your storage array. If this occurs, contact technical support.

- **DE1600 and DE5600 drive trays - Rear view**

1	ESM A
2	SAS In connector
3	SAS In connector
4	SAS Expansion (Out) connector
5	ESM B



- **DE6600 drive tray - Rear view**



1	ESM A
2	ESM B
3	SAS In connectors
4	SAS Expansion (Out) connectors

Things to know - Cabling configurations for the E5612 and E5624 controller-drive trays

The figures in this section show representative cabling configurations. The configurations shown guarantee that redundant data paths exist between the controller-drive tray and all attached drive trays in a storage array. You can attach the E5612 and E5624 controller-drive trays to the following drive trays:

- DE1600
- DE5600
- DE6600

You can attach the controller-drive trays to various combinations of all three drive tray models.

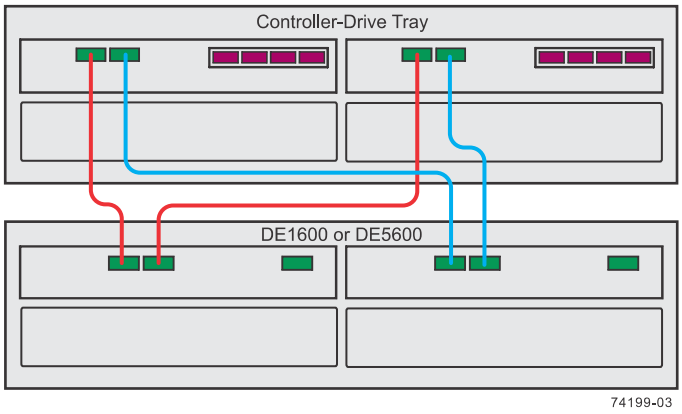
You must ensure that both controllers have access to all available drive trays by making sure that:

- Expansion port 1 from both controllers is connected to the same ESM in slot A of the first drive tray in the stack.
- Expansion port 2 from both controllers is connected to the same ESM in slot B of the last drive tray in the stack.

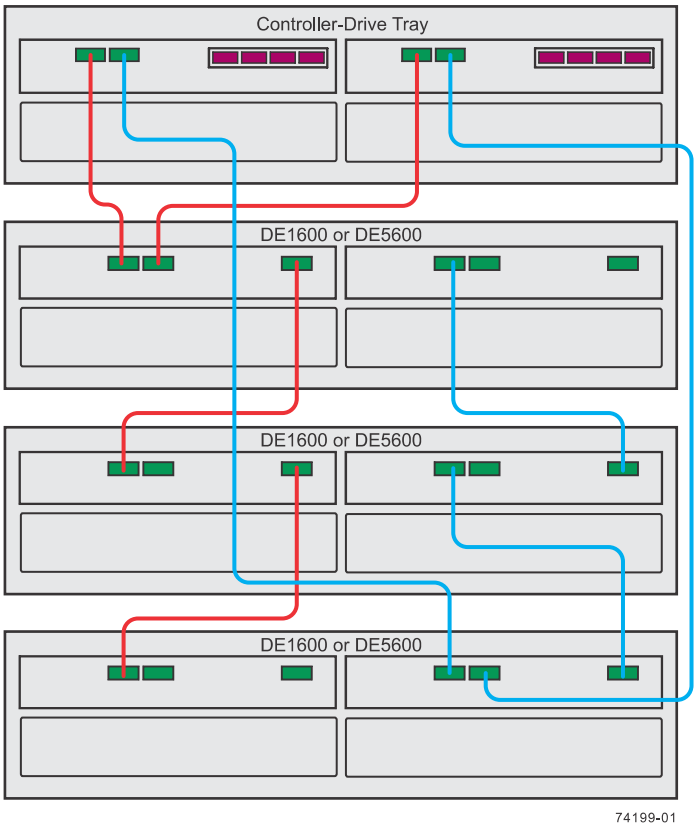
Except for the ESMs connected directly to the controllers and the last ESMs in the stack, each ESM should have only a single connection to the ESM that follows it.

Note: The expansion connectors to the drive trays are always on the left side of the controllers from the rear view.

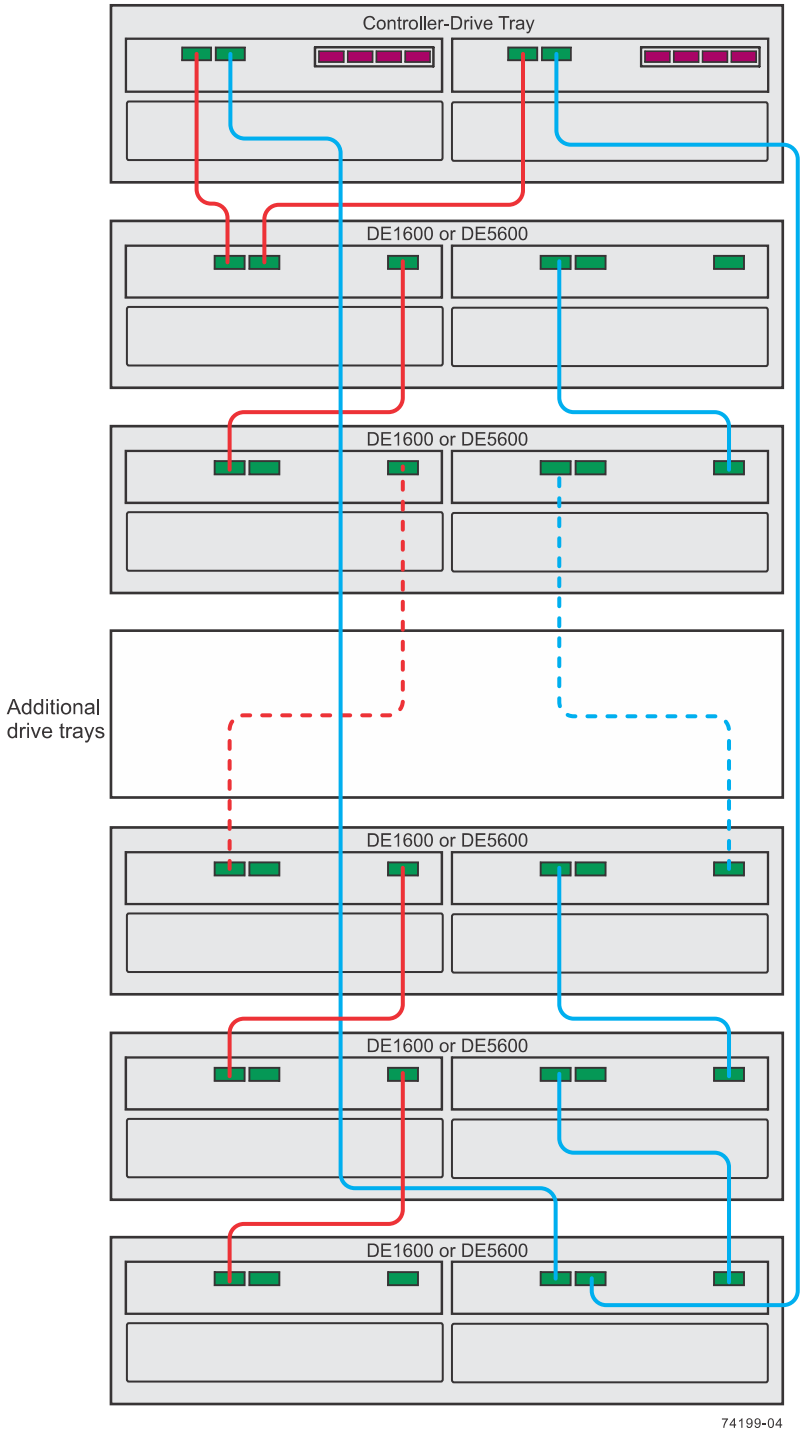
- **One controller drive tray and one DE1600 or DE5600 drive tray**



- **One controller drive tray and three DE1600 or DE5600 drive trays**



- **One controller drive tray and five or more DE1600 or DE5600 drive trays**



Things to know - Cabling configurations for the E5660 controller-drive tray

The figures in this section show representative cabling configurations. The configurations shown guarantee that redundant data paths exist between the controller-drive tray and all attached drive trays in a storage array. You can attach the controller-drive tray to the following drive trays:

- DE1600

- DE5600
- DE6600

You can attach the controller-drive tray to various combinations of all three drive tray models.

You must ensure that both controllers have access to all available drive trays by making sure that:

- Expansion port 1 from both controllers is connected to the same ESM in slot A of the first drive tray in the stack.
- Expansion port 2 from both controllers is connected to the same ESM in slot B of the last drive tray in the stack.

Except for the ESMs connected directly to the controllers, each ESM should have only a single connection to the ESM that follows it.

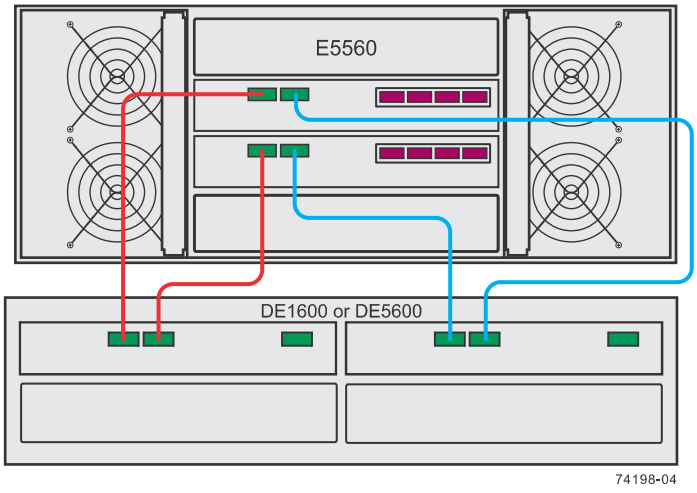
Note: The expansion connectors to the drive trays are always on the left side of the controllers from the rear view.

All controller-drive trays have a limit of 15 drive trays or a 384 drive-slot limit on the total number of drives in the storage array. In addition, DE1600 and DE5600 drive trays can be included in the storage array, as long as the same cabling pattern, connecting SAS expansion ports to SAS In ports, is followed.

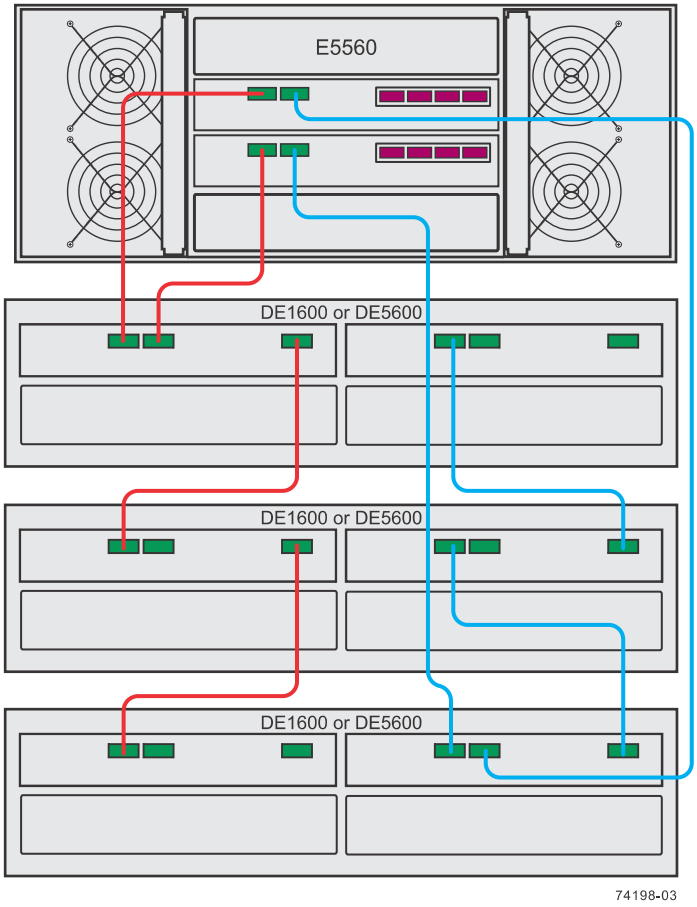
Warning: (W10) **Risk of bodily injury** – Four or more persons are required to safely lift the component.

Note: The cabling pattern is independent of the physical location of the trays in the rack. If the storage array includes DE6600 drive trays, install those drive trays beginning from the bottom of the rack so that the rack does not become top-heavy. A top-heavy rack has a greater risk of falling over.

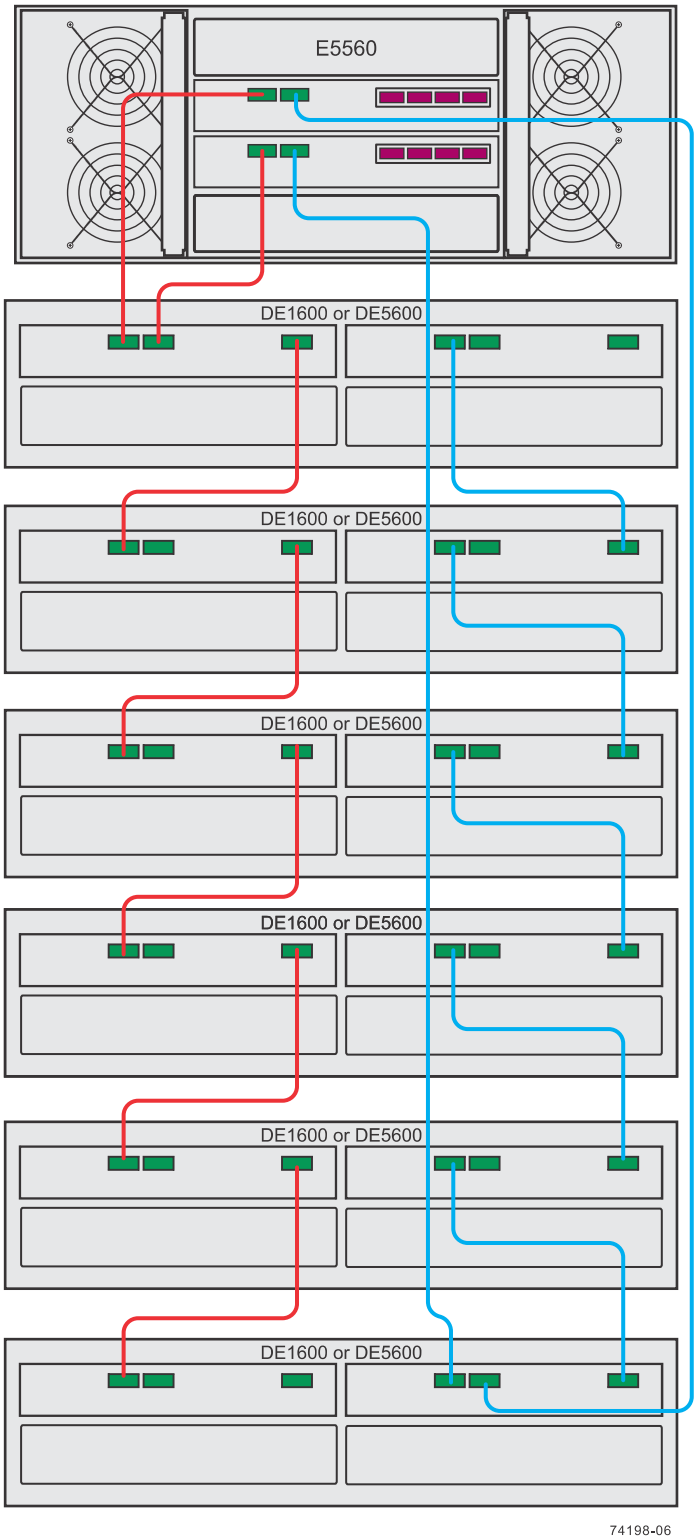
- **One controller-drive tray and one DE1600 or DE5600**



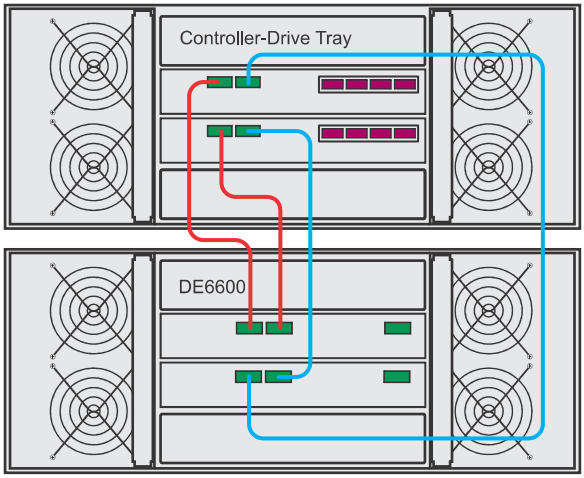
- **One controller-drive tray and three DE1600 or DE5600 drive trays**



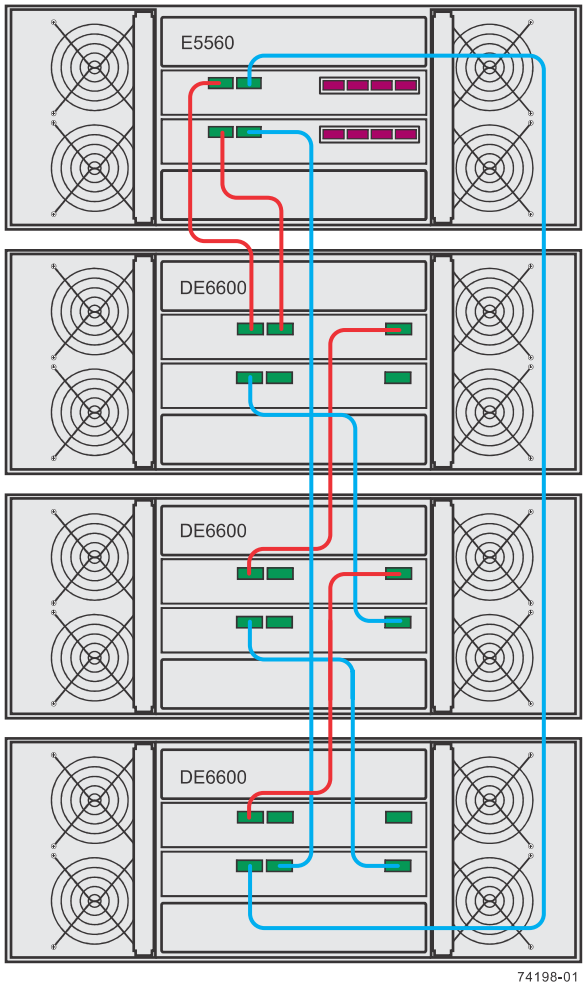
- **One controller-drive tray and six or more DE1600 or DE5600 drive trays**



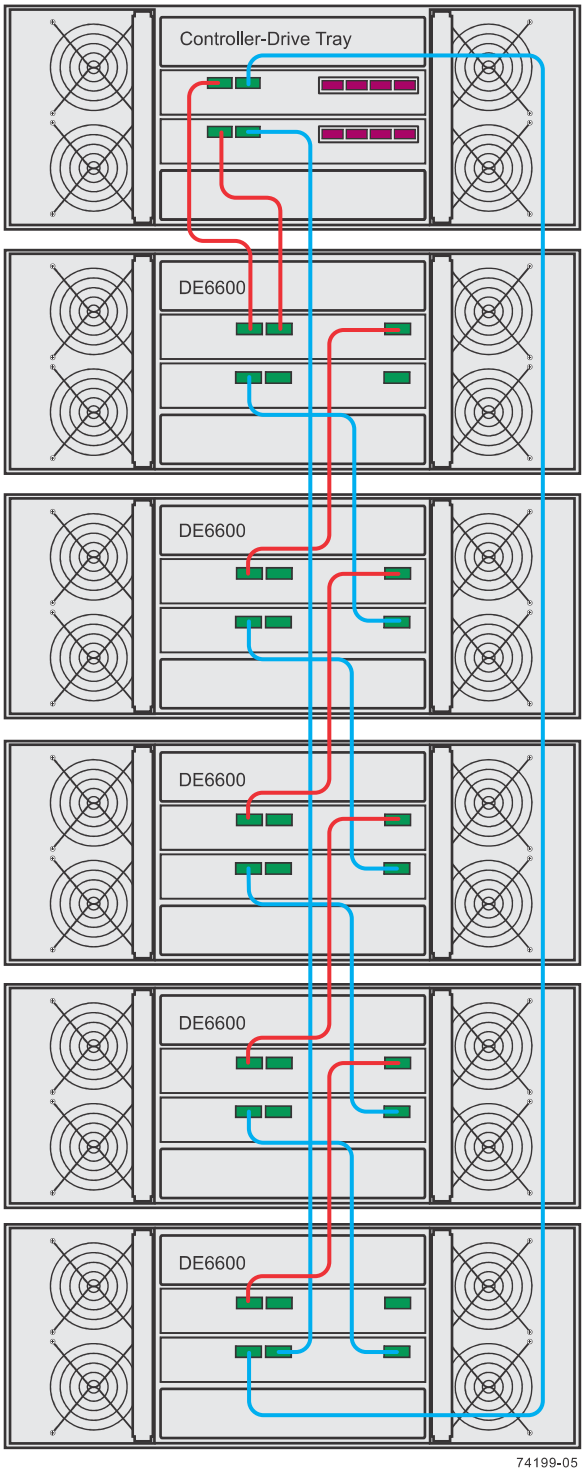
- **One controller-drive tray and one DE6600 drive tray**



- **One controller-drive tray and three DE6600 drive trays**



- **One controller-drive tray and five DE6600 drive trays**


Controller-Drive Tray
DE6600
DE6600
DE6600
DE6600
DE6600
74199-05

Procedure - Connecting the drive trays to the controller-drive tray

About this task

- Expansion Channel 1 from both controllers must be connected to the same ESM A of the first drive tray in the drive tray stack. Expansion Channel 2 from both controllers must be connected to the same ESM B of the last drive tray in the drive tray stack.
- The expansion channels must not be connected together: Do not connect a cable between ESM A of a drive tray to ESM B of another drive tray.
- SAS channels are not tolerant of loops. Except for the ESM connected directly to the controllers, each ESM should only have a single connection to the ESM before it and a single connection to the ESM that follows it (unless it is the last ESM in the channel). Do not connect additional cables to ESMs to provide short-cut paths because this step creates a loop in the topology.
- The drive trays in the chain of connections from controller A are in the reverse order from those whose connections start from controller B. That is, the last drive tray in the chain from controller A must be the first drive tray in the chain from controller B.

Note: It does not matter which of the two SAS In ports on an ESM you use for a connection, but it is best to follow the conventions described in the documentation so your storage management software represents the storage array consistently.

Note: Some SAS ports might have a black plastic plug installed. Remove the plug before you attach a cable to the port.

- The controller ID (for example, controller A)
- The ESM ID (for example, ESM A)
- The ESM connector (In or Out)
- The drive tray ID

```
CtA-Dch1, Dm1-ESM_A (left), In – Controller End
```

```
Dm1-ESM_A (left), In, CtrlA
```

```
Dm1-ESM_A (left), OUT, DM2 ESM_A (left)
```

Steps

1. Attach a cable from the SAS Expansion (Ch1) connector on controller A in the controller-drive tray to a SAS In connector on ESM A in the first drive tray.
2. Attach a cable from the SAS Expansion (Ch 1) connector on controller B in the controller-drive tray to the second SAS In connector on ESM A in the first drive tray.
3. Are you adding more drive trays?
   - **Yes** – Go to step *4*.
   - **No** – Go to step *6*.

4. Attach a cable from the SAS Expansion (Out) connector on ESM A of the previous drive tray that you cabled to a SAS In connector on ESM A in the next drive tray.
5. Are you adding more drive trays?
   - **Yes** – Go to step *4*.
   - **No** – Go to step *6*.
6. Attach a cable from the SAS Expansion (Ch2) connector on controller A in the controller-drive tray to a SAS In connector on ESM B in the last drive tray.
7. Attach a cable from the SAS Expansion (Ch2) connector on controller B in the controller-drive tray to the second SAS In connector on ESM B in the last drive tray (in reverse order from step *3* on page 95).
8. Do one of the following:
   - If there are no more drive trays in the storage array, you are done.
   - If there are more drive trays, attach a cable from the SAS Expansion (Ch2) connector on ESM B of the previous drive tray that you cabled to a SAS In connector on ESM B in the next drive tray (in reverse order from step *3*) and continue with step *9*.
9. Return to step *8*.

Step 8 - Connecting the Ethernet cables

Use this step if you are using out-of-band management for your storage array. If you use in-band management, you can ignore this step and continue with *Step 9 - Connecting the power cords* on page 99.

Key terms

In-band management

A method to manage a storage array in which a storage management station sends commands to the storage array through the host input/output (I/O) connection to the controller. The SMagent must be installed for this method to work correctly.

Out-of-band management

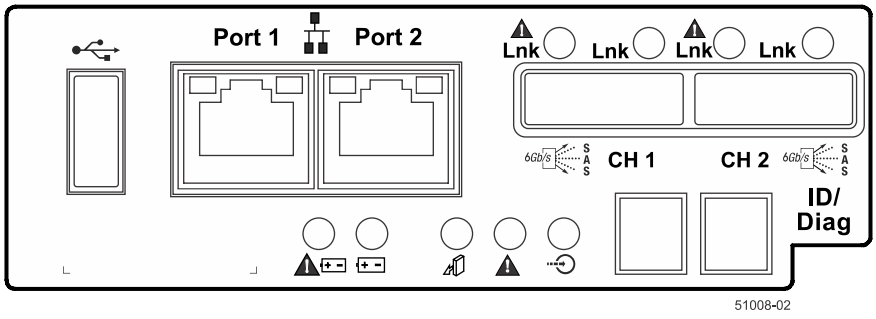
A method to manage a storage array in which a storage management station sends commands to the storage array through the Ethernet connections to the controller. This is the recommended management method.

Things to know - Connecting Ethernet cables

This topic describes Ethernet management connections. It does not describe the Ethernet iSCSI connections that might be used through a host interface card connection.

Attention: Risk of security breach – Connect the Ethernet ports on the controller-drive tray to a private network segment behind a firewall. If the Ethernet connection is not protected by a firewall, your storage array might be at risk of being accessed from outside of your network.

The figure shows a controller with Ethernet port 1 and Ethernet port 2 (left side).



Note: Ethernet port 2 on each controller is reserved for access by technical support.

Because the controllers support the Auto-MDIX feature, you do not need an Ethernet crossover cable.

Procedure - Connecting Ethernet cables

About this task

Perform these steps to connect Ethernet cables for out-of-band management.

Steps

1. Connect one end of an Ethernet cable into the Ethernet port 1 on controller A.
2. Connect the other end of the cable to the applicable network connection.
3. Repeat these steps for controller B.

Step 9 - Connecting the power cords

Use the following information to connect the power cords in your storage array.

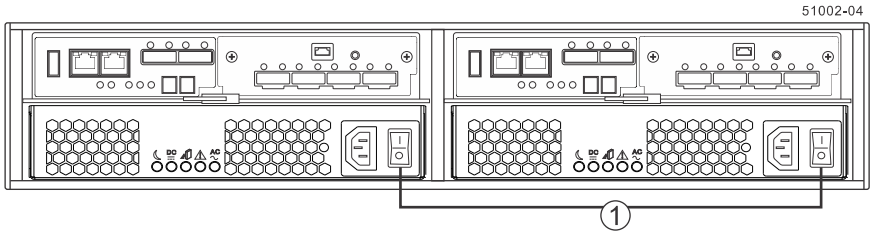
Things to know - AC power cords

- For each AC power connector on the drive tray, make sure that you use a separate power source in the cabinet. Connecting to independent power sources maintains power redundancy.
- To ensure proper cooling, do not operate a drive tray with one of its power supplies removed, unless instructed to do so by the Recovery Guru.
- You can use the power cords shipped with the controller-drive tray with typical outlets used in the destination country, such as a wall receptacle or an uninterrupted power supply (UPS). These power cords, however, are not intended for use in most EIA-compliant cabinets.

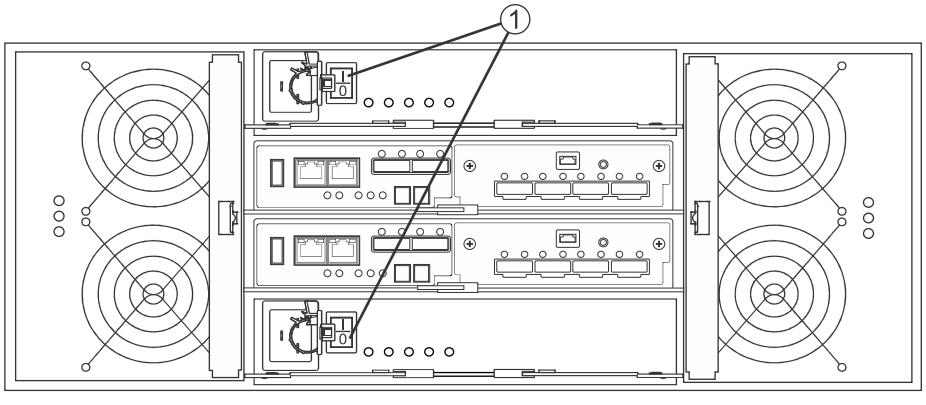
Procedure - Connecting AC power cords

Steps

1. Ensure that the circuit breakers in the cabinet are turned off.
2. Ensure that both of the power switches on the controller-drive tray are turned off.
   - **Power switches on the E5512 and E5524**



   - **Power switches on the E5660**



1	Power switches

3. Connect the primary power cords from the cabinet to the external power source.
4. Connect either a cabinet interconnect power cord, the power cords provided with the drive tray, or the power cords specific to your particular cabinet to the AC power connector on each power canister in the drive tray.
5. If you are installing other drive trays in the cabinet, connect a power cord to each power canister in the drive trays.

Step 10 - Turning on the power and checking for problems in a controller-drive tray configuration

After you complete this task, you can install the software and perform basic configuration tasks on your storage array. Continue with either the appropriate Express Guide or the *SANtricity Software Installation Reference*, available from the *NetApp E-Series and EF-Series Systems Documentation Center*.

Procedure - Turning on the power to the storage array and checking for problems in a controller-drive tray configuration

About this task

Note: If you are running a controller-drive tray that has drive trays attached, the controller-drive tray must have a 725-watt power supply. If the controller-drive tray contains a 585-watt power supply, the storage array will not be operational. Each power supply has a label with the rated power.

You must turn on the power to all of the connected drive trays before you turn on power for the controller-drive trays. Performing this action ensures that the controllers recognize each attached drive tray.

Note: While the power is being applied to the trays, the LEDs on the front and the rear of the trays come on and go off intermittently.

Steps

1. Turn on both power switches on each drive tray that is attached to the controller-drive tray. Depending on your configuration, it can take several minutes for each drive tray to complete the power-on process.
2. Check the ESM Power LED and the Host Link Active LEDs on the drive trays to verify that the power was successfully applied to all of the drive trays. You must wait for all the drives to come online (persistent green LEDs) before turning on the power to the controller-drive tray.
3. Turn on both power switches on the rear of the controller-drive tray.

   Depending on your configuration, it can take up to ten minutes for the controller-drive tray to complete the power-on process. The controllers reboot several times during the initial startup sequence, which causes the fans to ramp up and down and the LEDs to flash on and off.
4. Check the LEDs on the front and the rear of the controller-drive trays and the attached drive trays.
5. If you see any amber LEDs, make a note of their location.

Things to know - LEDs on the E5612 or E5624 controller-drive tray

- **LEDs on the left end cap**

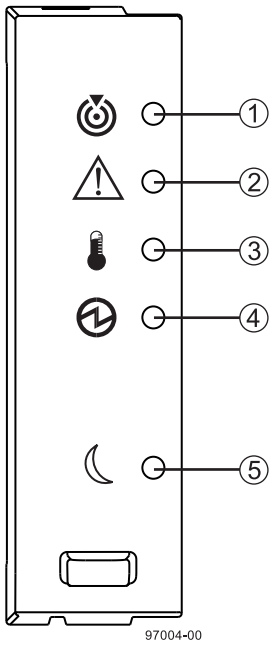


Table 12: LEDs on the left end cap

Location	LED	Color	On	Off
1	Controller-Drive Tray Locate	White	Identifies a controller-drive tray that you are trying to find.	Normal status.
2	Service Action Required	Amber	A component within the controller-drive tray needs attention.	Normal status.
3	Controller-Drive Tray Over-Temperature	Amber	The temperature of the controller-drive tray has reached an unsafe level.	Normal status.
4	Power	Green	Power is present.	Power is not present.
5	Standby Power	Green	The controller-drive tray is in Standby Power mode.	The controller-drive tray is not in Standby Power mode.

- **LEDs on the drive**

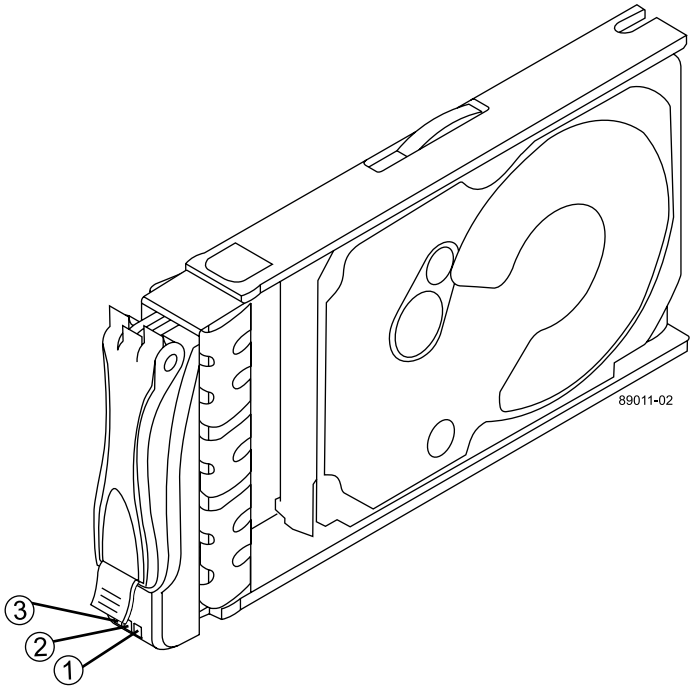


Table 13: LEDs on the drive

Location	LED	Color	On	Blinking	Off
1	Drive Power	Green	The power is turned on, and the drive is operating normally.	Drive I/O activity is taking place.	The power is turned off.
2	Drive Service Action Required	Amber	An error has occurred.		Normal status.
3	Drive Service Action Allowed	Blue	The drive canister can be removed safely from the controller-drive tray.		The drive canister cannot be removed safely from the controller-drive tray.

- **Drive states represented by LEDs**

Table 14: Drive states represented by LEDs

Drive state	Drive Power LED (Green)	Drive Service Action Required LED (Amber)
Power is not applied.	Off	Off
Normal operation – The power is turned on, but drive I/O activity is not occurring.	On	Off
Normal operation – Drive I/O activity is occurring.	Blinking	Off

Drive state	Drive Power LED (Green)	Drive Service Action Required LED (Amber)
Service action required – A fault condition exists, and the drive is offline.	On	On

- **LEDs on the controller canister – Main faceplate**

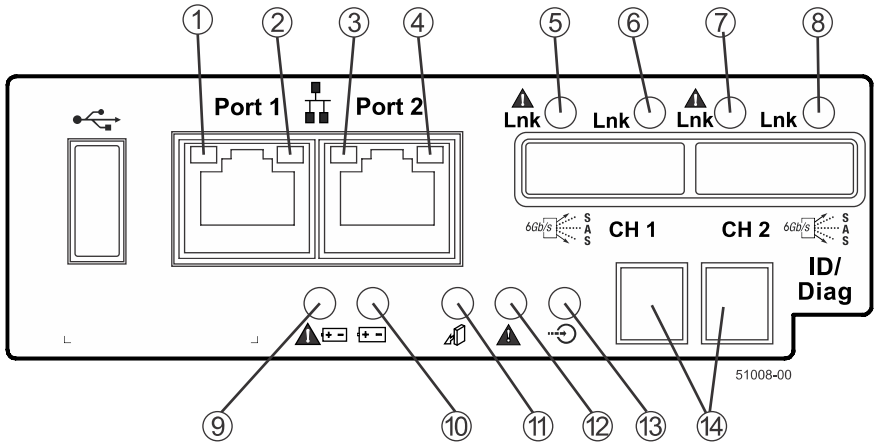


Table 15: LEDs on the controller canister – Main faceplate

Location	LED	Color	On	Off
1	Ethernet Connector 1 Link Rate LED	Green	There is a 1 Gb/s rate.	There is a 100 MB/S rate.
2	Ethernet Connector 1 Link Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
3	Ethernet Connector 2 Link Rate LED	Green	There is a 1 Gb/s rate.	There is a 100 Mb/s rate.
4	Ethernet Connector 2 Link Active LED	Green	The link is up (the LED blinks when there is activity).	The link is not active.
5	Native Host Link 1 Service Action Required LED	Amber	At least one of the four PHYs is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector.	No link error has occurred.

Location	LED	Color	On	Off
6	Native Host Link 1 Service Action Allowed LED	Green	At least one of the four PHYs in the Host IN port is working and a link exists to the device connected to the IN port connector.	A link error has occurred.
7	Native Host Link 2 Service Action Required LED	Amber	At least one of the four PHYs is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector.	No link error has occurred.
8	Native Host Link 2 Service Action Allowed LED	Green	At least one of the four PHYs in the Host IN port is working and a link exists to the device connected to the IN port connector.	A link error has occurred.
9	Battery Service Action Required LED	Amber	The battery in the controller canister has failed.	Normal status.
10	Battery Charging LED	Green	The battery is fully charged. The LED blinks when the battery is charging.	The controller canister is operating without a battery or the existing battery has failed.
11	Controller Service Action Allowed LED	Blue	The controller canister can be removed safely from the controller-drive tray.	The controller canister cannot be removed safely from the controller-drive tray.
12	Controller Service Action Required LED	Amber	A fault exists within the controller canister.	Normal status.
13	Cache Active LED	Green	The cache contains data not yet written to disk.	Cache is inactive or the controller canister has been removed from the controller-drive tray.
14	Seven Segment Display	Green	For more information, see *Things to know - Display sequence code definitions* on page 128.	

- **LEDs on the controller canister – SAS host interface card subplates**

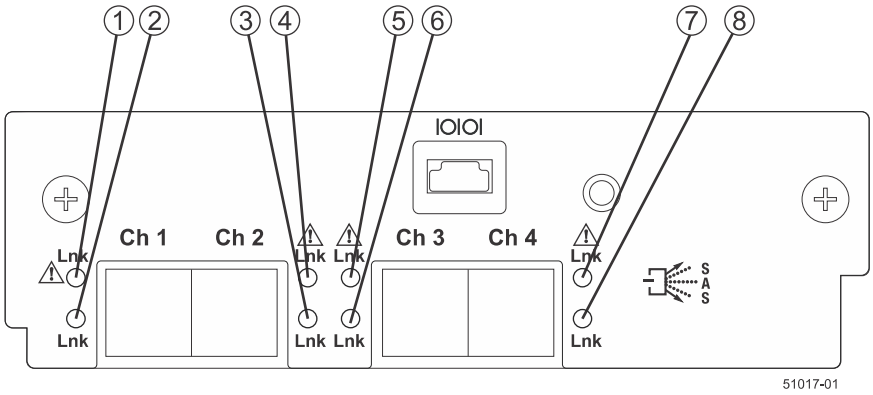


Table 16: LEDs on the controller canister – SAS host interface card subplates

Location	LED	Color	On	Off
1	Host Interface Card Link 1 Fault LED	Amber	At least one link is active and at least one link has failed (degraded mode).	The SAS link is down. If both LEDs are off, a cable is unplugged.
2	Host Interface Card Link 1 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
3	Host Interface Card Link 2 Fault LED	Amber	At least one link is active.	The Ethernet link is down. If both LEDs are off, a cable is unplugged.
4	Host Interface Card Link 2 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
5	Host Interface Card Link 3 Fault LED	Amber	At least one link is active.	The Ethernet link is down. If both LEDs are off, a cable is unplugged.
6	Host Interface Card Link 3 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
7	Host Interface Card Link 4 Fault LED	Amber	At least one link is active.	The Ethernet link is down. If both LEDs are off, a cable is unplugged.
8	Host Interface Card Link 4 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.

- **LEDs on the controller canister – FC or iSCSI host interface card subplates**

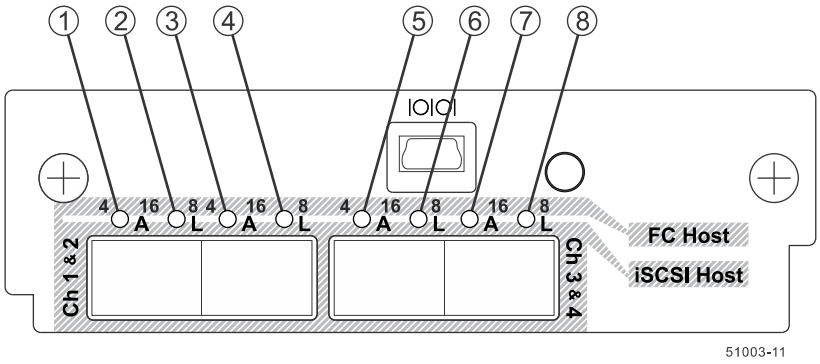


Table 17: LEDs on the controller canister – FC or iSCSI host interface card subplates

Location	LED	Color	On	Off
1	SFP+ Channel 1 Logical Link Up LED	Green	The link is up (LED blinks when there is activity).	The controller has not yet loaded the driver for the ConnectX Host Channel Adapter.
2	SFP+ Channel 1 Physical Link Up LED	Green	The physical link is active.	The physical link is not active.
3	SFP+ Channel 2 Logical Link Up LED	Green	The link is up (LED blinks when there is activity).	The controller has not yet loaded the driver for the ConnectX Host Channel Adapter.
4	SFP+ Channel 2 Physical Link Up LED	Green	The physical link is active.	The link is not active.
5	SFP+ Channel 3 Logical Link Up LED	Green	The link is up (LED blinks when there is activity).	The controller has not yet loaded the driver for the ConnectX Host Channel Adapter.
6	SFP+ Channel 3 Physical Link Up LED	Green	The physical link is active.	The physical link is not active.
7	SFP+ Channel 4 Logical Link Up LED	Green	The link is up (LED blinks when there is activity).	The controller has not yet loaded the driver for the ConnectX Host Channel Adapter.

Location	LED	Color	On	Off
8	SFP+ Channel 4 Physical Link Up LED	Green	The physical link is active.	The physical link is not active.

- **LEDs on the controller canister – Infiniband host interface card subplates**

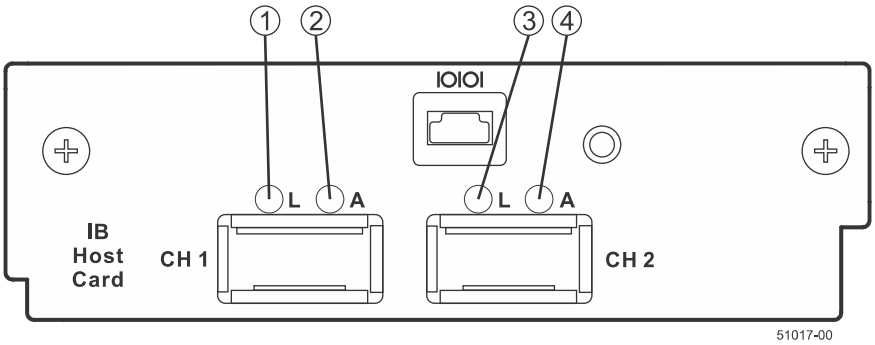


Table 18: LEDs on the controller canister – Infiniband host interface card subplates

Location	LED	Color	On	Off
1	QSFP Channel 1 Logical Link Up LED	Green	The link is up (LED blinks when there is activity).	The controller has not yet loaded the driver for the ConnectX Host Channel Adapter.
2	QSFP Channel 1 Physical Link Up LED	Amber	The physical link is active.	The physical link is not active.
3	QSFP Channel 2 Logical Link Up LED	Green	The link is up (LED blinks when there is activity).	The controller has not yet loaded the driver for the ConnectX Host Channel Adapter.
4	QSFP Channel 2 Physical Link Up LED	Amber	The physical link is active.	The link is not active.

- **LEDs on the power-fan canister**

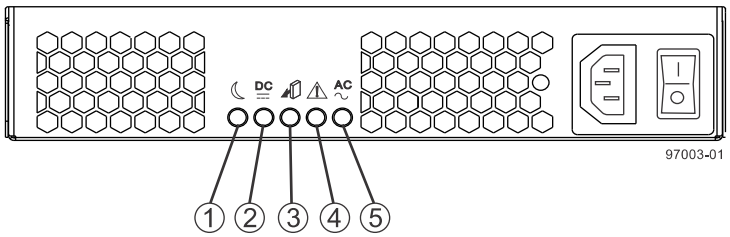


Table 19: LEDs on the power-fan canister

Location	LED	Color	On	Off
1	Standby Power	Green	The controller-drive tray is in Standby mode, and DC power is not available.	The controller-drive tray is not in Standby mode, and DC power is available.
2	Power-Fan DC Power	Green	DC power from the power-fan canister is available.	DC power from the power-fan canister is not available.
3	Power-Fan Service Action Allowed	Blue	The power-fan canister can be removed safely from the controller-drive tray.	The power-fan canister cannot be removed safely from the controller-drive tray.
4	Power-Fan Service Action Required	Amber	A fault exists within the power-fan canister.	Normal status.
5	Power-Fan AC Power	Green	AC power to the power-fan canister is present.	AC power to the power-fan canister is not present.

Things to know - LEDs on the E5660 controller-drive tray

The following sections provide information about the LEDs found on the E5660.

- **LEDs on the left bezel**

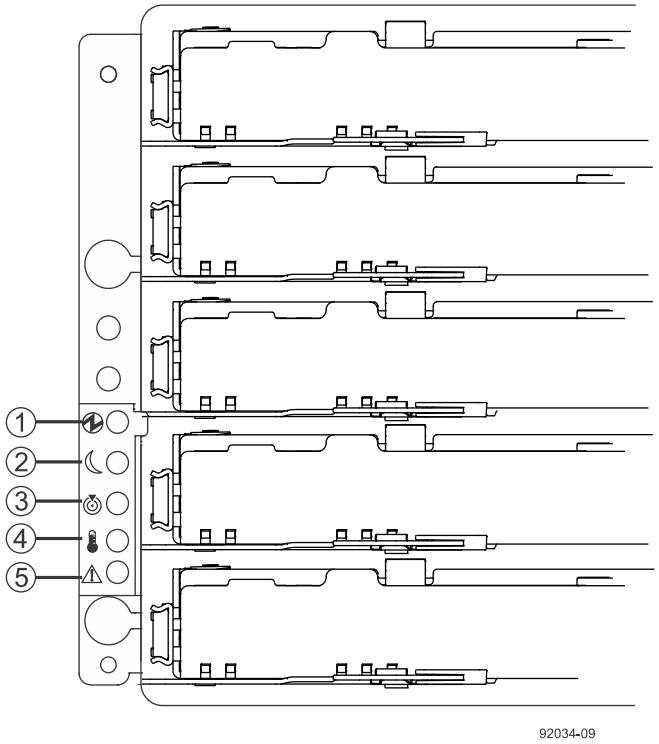


Table 20: LEDs on the left bezel

Location	LED	Color	On	Off
1	Power	Green	Power is present.	Power is not present.
2	Standby Power	Green	The controller-drive tray is in Standby Power mode.	The controller-drive tray is not in Standby Power mode.
3	Controller-Drive Tray Locate	White	Identifies a controller-drive tray that you are trying to find.	Normal status.
4	Controller-Drive Tray Over-Temperature	Amber	The temperature of the controller-drive tray has reached an unsafe level.	Normal status.
5	Service Action Required	Amber	A component within the controller-drive tray needs attention.	Normal status.

- **LEDs on the power canister**

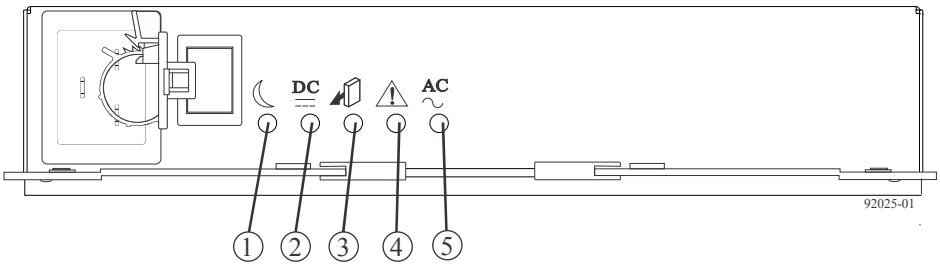


Table 21: LEDs on the power canister

Location	LED	Color	On	Off
1	Standby Power	Green	The controller-drive tray is in Standby mode.	The controller-drive tray is not in Standby mode.
2	Power DC Power	Green	DC power from the power canister is available.	DC power from the power canister is not available.
3	Power Service Action Allowed	Blue	The power canister can be removed safely from the controller-drive tray.	The power canister cannot be removed safely from the controller-drive tray.
4	Power Service Action Required	Amber	A fault exists within the power canister.	Normal status.
5	Power AC Power	Green	AC power to the power canister is present.	AC power to the power canister is not present.

- **LEDs on the fan canister**

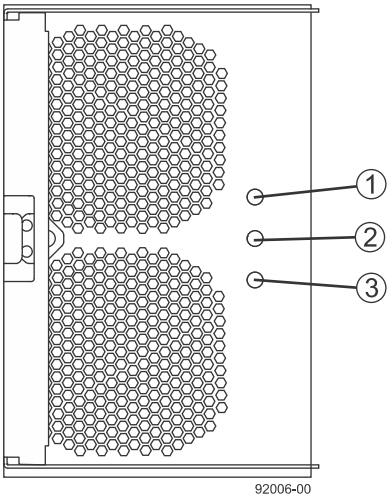


Table 22: LEDs on the fan canister

Location	LED	Color	On	Off
1	Fan Power	Green	Power to the fan canister is available.	Power to the fan customer-replaceable unit (CRU) is not available.
2	Fan Service Action Required	Amber	A fault exists within the fan canister.	Normal status.
3	Fan Service Action Allowed	Blue	The fan canister can be removed safely from the drive tray.	The fan canister cannot be removed safely from the drive tray.

Things to know - General behavior of the LEDs on the controller-drive tray

Table 23: General behavior of the LEDs

LED	Symbol	Location (Canisters)	Function
Power		Power-fan	• **On** – The controller has power. • **Off** – The controller does not have power. **Note:** The controller canisters do not have a Power LED. They receive their power from the power supplies inside the power-fan canisters.
Battery Fault		Battery	• **On** – The battery is missing or has failed. • **Off** – The battery is operating normally. • **Blinking** – The battery is charging.
Service Action Allowed		Drive (left LED, no symbol) Power-fan Controller Battery	**On** – You can remove the canister safely (see *Things to know - Service Action Allowed LEDs* on page 115).

LED	Symbol	Location (Canisters)	Function
Service Action Required (Fault)		Drive	• **On** – When the drive tray LED is on, the cable is attached and at least one lane has a link up status, but at least one lane has a link down status. • **Off** – One of the following conditions exists: ◦ No cable is attached. ◦ A cable is attached, and all lanes have a link up status. ◦ A cable is attached, and all lanes have a link down status.
Service Action Required (Fault)		Controller Power-fan canister	• **On** – The controller or the power-fan canister needs attention. • **Off** – The controller and the power-fan canister are operating normally.
Locate		Front frame	**On** – Assists in locating the tray.
Host Channel Connection (iSCSI)		Controller	The status of the host channel is indicated: • **"L" LED on** – A link is established. • **"A" LED on** – Activity (data transfer) is present.
Cache Active		Controller	The activity of the cache is indicated: • **On** – Data is in the cache. • **Off** – No data is in the cache.

LED	Symbol	Location (Canisters)	Function
Controller-Drive Tray Over-Temperature		Front bezel on the controller-drive tray	• **On** – The temperature of the drive tray has reached an unsafe condition. • **Off** – The temperature of the drive tray is within operational range.
Standby Power		Front bezel on the controller-drive tray	• **On** – The Controller-Drive Tray is in standby mode and the main DC power is off. • **Off** – The Controller-Drive Tray is not in standby mode and the main DC power is on.
Seven-Segment ID Diagnostic Display		Controller	The tray ID or a diagnostic code is indicated. For example, if some of the cache memory dual in-line memory modules (DIMMs) are missing in a controller, error code L8 appears in the diagnostic display (see *Things to know - Lock-down codes* on page 130).
AC power		Power-fan **Note:** The LED is directly above or below the AC power switch and the AC power connector.	Indicates that the power supply is receiving AC power input.
DC power		Power-fan **Note:** The LED is directly above or below the DC power switch and the DC power connector.	Indicates that the power supply is receiving DC power input.

LED	Symbol	Location (Canisters)	Function
Ethernet Speed and Ethernet Activity		Controller	The speed of the Ethernet ports and whether a link has been established are indicated: • **Left LED On** – 1-Gb/s speed. • **Left LED Off** – 100BASE-T or 10BASE-T speed. • **Right LED On** – A link is established. • **Right LED Off** – No link exists. • **Right LED blinking** – Activity is occurring.

Things to know - Service Action Allowed LEDs

Each controller canister, power-fan canister, and battery canister has a Service Action Allowed LED. The Service Action Allowed LED lets you know when you can remove a canister safely.

Attention: Possible loss of data access – Never remove a controller canister, a power-fan canister, or a battery canister unless the appropriate Service Action Allowed LED is on.

If a controller canister or a power-fan canister fails and must be replaced, the Service Action Required (Fault) LED on that canister comes on to indicate that service action is required. The Service Action Allowed LED also comes on if it is safe to remove the canister. If data availability dependencies exist or other conditions that dictate a canister should not be removed, the Service Action Allowed LED stays off.

The Service Action Allowed LED automatically comes on or goes off as conditions change. In most cases, the Service Action Allowed LED comes on when the Service Action Required (Fault) LED comes on for a canister.

If the Service Action Required (Fault) LED comes on but the Service Action Allowed LED is off for a particular canister, you might need to service another canister first. Check your storage management software to determine the action that you should take.

When a service action is required for a controller canister, you must place that controller offline before removing it from the enclosure. This prerequisite ensures that the storage array maintains accurate expansion cabling.

Things to know - LEDs on the DE1600 and DE5600 drive trays

- **LEDs on the left end cap**

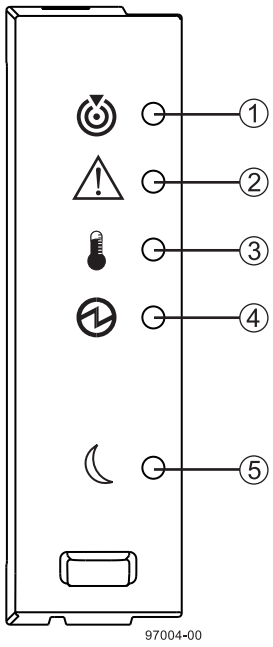


Table 24: LEDs on the left end cap

Location	LED	Color	On	Off
1	Drive Tray Locate	White	Identifies a drive tray that you are trying to find.	Normal status.
2	Drive Tray Service Action Required	Amber	A component within the drive tray needs attention.	Normal status.
3	Drive Tray Over-Temperature	Amber	The temperature of the drive tray has reached an unsafe level.	Normal status.
4	Drive Tray Power	Green	Power is present.	Power is not present.
5	Drive Tray Standby Power	Green	The drive tray is in Standby Power mode.	The drive tray is not in Standby Power mode.

- **LEDs on the drive**

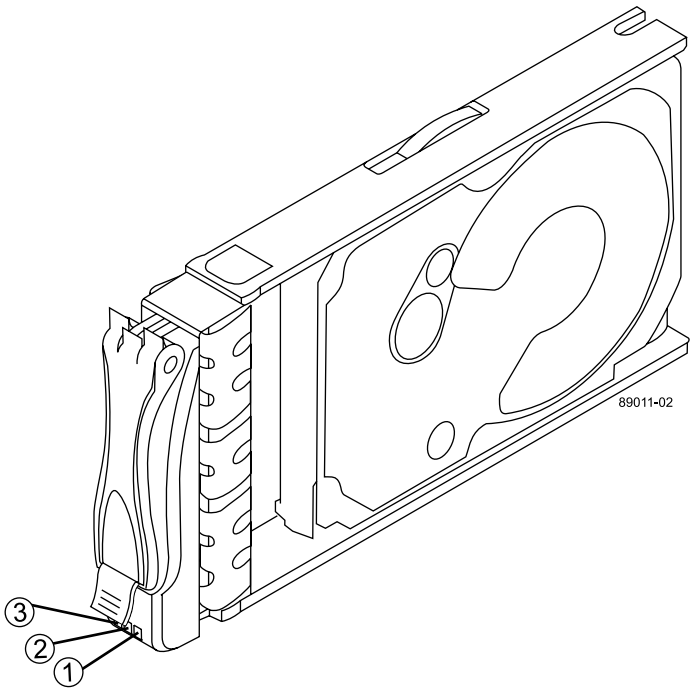


Table 25: LEDs on the drive

Location	LED	Color	On	Blinking	Off
1	Drive Power	Green	The power is turned on, and the drive is operating normally.	Drive I/O activity is taking place.	The power is turned off.
2	Drive Service Action Required	Amber	An error has occurred.		Normal status.
3	Drive Service Action Allowed	Blue	The drive canister can be removed safely from the drive tray.		The drive canister cannot be removed safely from the drive tray.

- **Drive state represented by LEDs**

Table 26: Drive state represented by LEDs

Drive state	Drive Power LED (Green)	Drive Service Action Required LED (Amber)
Power is not applied.	Off	Off
Normal operation – The power is turned on, but drive I/O activity is not occurring.	On	Off
Normal operation – Drive I/O activity is occurring.	Blinking	Off
Service action required – A fault condition exists, and the drive is offline.	On	On

- **LEDs on the ESM canister**

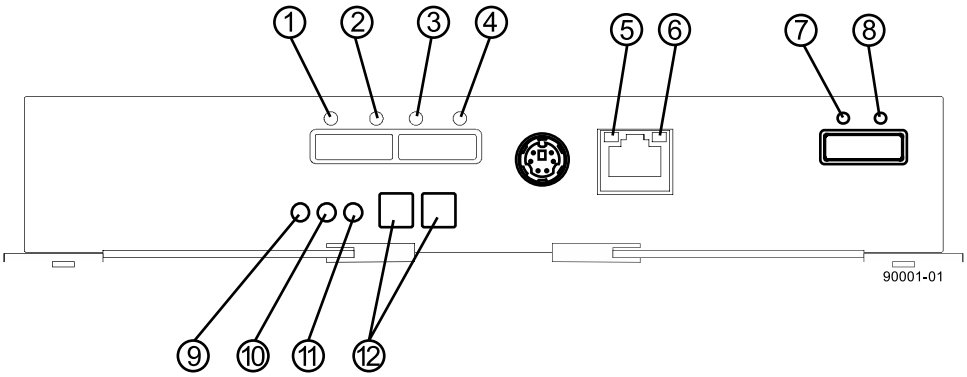


Table 27: LEDs on the ESM canister

Location	LED	Color	On	Off
1	Host Link 1 Fault	Amber	At least one PHY of the four connectors is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector.	No link error has occurred.
2	Host Link 1 Active	Green	At least one of the four PHYs in the In port is working, and a link exists to the device connected to the Host In connector.	A link error has occurred.
3	Host Link 2 Fault	Amber	At least one PHY of the four connections is working, but another PHY cannot establish the same link to the device connected to the Host In port connector.	No link error has occurred.
4	Host Link 2 Active	Green	At least one of the four PHYs in the IN port is working, and a link exists to the device connected to the Host In connector.	A link error has occurred.
5	Ethernet Link Active	Green	The link is up. (The LED blinks when there is activity.)	The link is not active.
6	Ethernet Link Rate	Green	There is a 100BASE-T rate.	There is a 10BASE-T rate.

Location	LED	Color	On	Off
7	ESM Expansion Link Fault	Amber	At least one of the four PHYs in the Out port is working, but another PHY cannot establish the same link to the Expansion Out connector.	Normal status.
8	ESM Expansion Link Active	Green	At least one of the four PHYs in the Out port is working, and a link exists to the device connected to the Expansion Out connector.	A link error has occurred.
9	ESM Service Action Allowed	Blue	The ESM can be removed safely from the drive tray.	The ESM cannot be removed safely from the drive tray.
10	ESM Service Action Required	Amber	A fault exists within the ESM. (This LED defaults on at power up. This LED turns off after the software has completed its power up self-test sequence.)	Normal status.
11	ESM Power	Green	12V power to the ESM is present.	Power is not present to the ESM.
12	Seven-Segment Tray ID	Green	See note.	Not applicable.
Note: For more information about the seven-segment tray IDs, see *Things to know - Seven-segment display for the ESMs on the drive trays* on page 134.				

- **LEDs on AC power-fan canister**

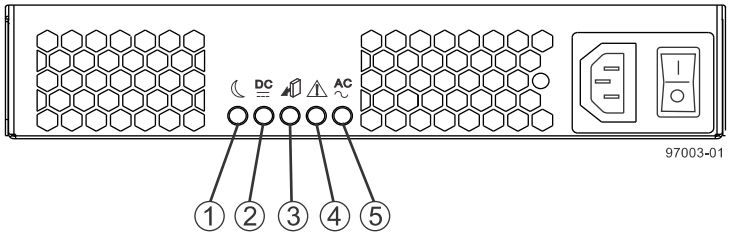


Table 28: LEDs on AC power-fan canister

Location	LED	Color	On	Off
1	Standby Power	Green	The drive tray is in Standby mode, and DC power is not available.	The drive tray is not in Standby mode.
2	Power-Fan DC Power	Green	DC power from the power-fan canister is available.	DC power from the power-fan canister is not available.
3	Power-Fan Service Action Allowed	Blue	The power-fan canister can be removed safely from the drive tray.	The power-fan canister cannot be removed safely from the drive tray.
4	Power-Fan Service Action Required	Amber	A fault exists within the power-fan canister.	Normal status.
5	Power-Fan AC Power	Green	AC power to the power-fan canister is present.	AC power to the power-fan canister is not present.

Things to know - LEDs on the DE6600 drive tray

- **LEDs on the left bezel**

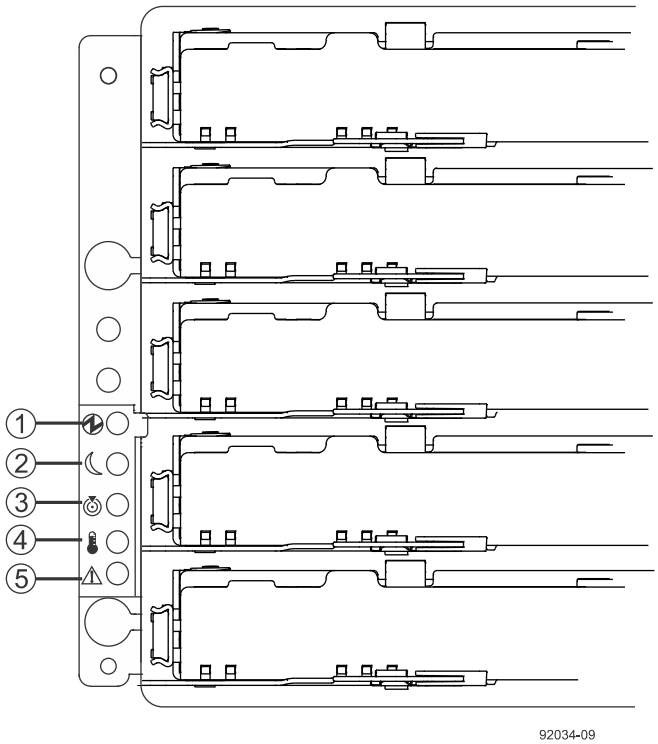


Table 29: LEDs on the left bezel

Location	LED	Color	On	Off
1	Drive Tray Power	Green	Power is present.	Power is not present.
2	Drive Tray Standby Power	Green	The drive tray is in Standby Power mode.	The drive tray is not in Standby Power mode.
3	Drive Tray Locate	White	Identifies a drive tray that you are trying to find.	Normal status.
4	Drive Tray Over-Temperature	Amber	The temperature of the drive tray has reached an unsafe level.	Normal status.
5	Drive Tray Service Action Required	Amber	A component within the drive tray needs attention.	Normal status.

- **LEDs on the ESM canister**

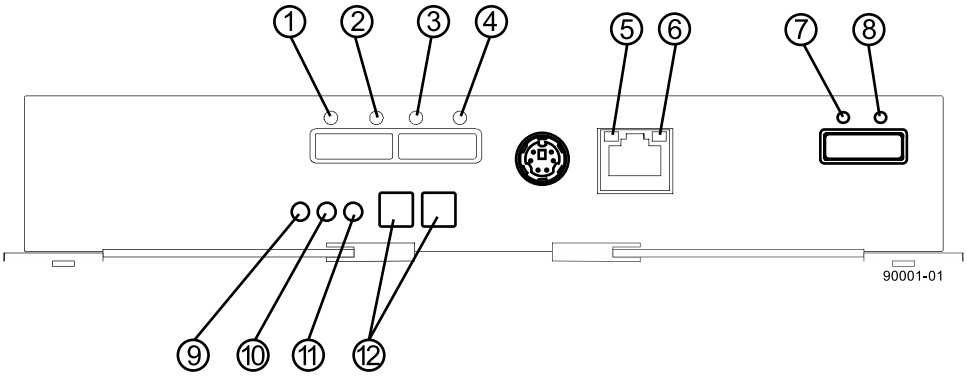


Table 30: LEDs on the ESM canister

Location	LED	Color	On	Off
1	Host Link 1 Fault	Amber	At least one PHY of the four connectors is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector.	No link error has occurred.
2	Host Link 1 Active	Green	At least one of the four PHYs in the In port is working, and a link exists to the device connected to the Host In connector.	A link error has occurred.

Location	LED	Color	On	Off
3	Host Link 2 Fault	Amber	At least one PHY of the four connections is working, but another PHY cannot establish the same link to the device connected to the Host In port connector.	No link error has occurred.
4	Host Link 2 Active	Green	At least one of the four PHYs in the IN port is working, and a link exists to the device connected to the Host In connector.	A link error has occurred.
5	Ethernet Link Active	Green	The link is up. (The LED blinks when there is activity.)	The link is not active.
6	Ethernet Link Rate	Green	There is a 100BASE-T rate.	There is a 10BASE-T rate.
7	ESM Expansion Link Fault	Amber	At least one of the four PHYs in the Out port is working, but another PHY cannot establish the same link to the Expansion Out connector.	Normal status.
8	ESM Expansion Link Active	Green	At least one of the four PHYs in the Out port is working, and a link exists to the device connected to the Expansion Out connector.	A link error has occurred.
9	ESM Service Action Allowed	Blue	The ESM can be removed safely from the drive tray.	The ESM cannot be removed safely from the drive tray.
10	ESM Service Action Required	Amber	A fault exists within the ESM. (This LED defaults on at power up. This LED turns off after the software has completed its power up self-test sequence.)	Normal status.
11	ESM Power	Green	12V power to the ESM is present.	Power is not present to the ESM.
12	Seven-Segment Tray ID	Green	See note.	Not applicable.

Location	LED	Color	On	Off
Note: For more information about the seven-segment tray IDs, see *Things to know - Seven-segment display for the ESMs on the drive trays* on page 134.				

- **LEDs on the AC power canister**

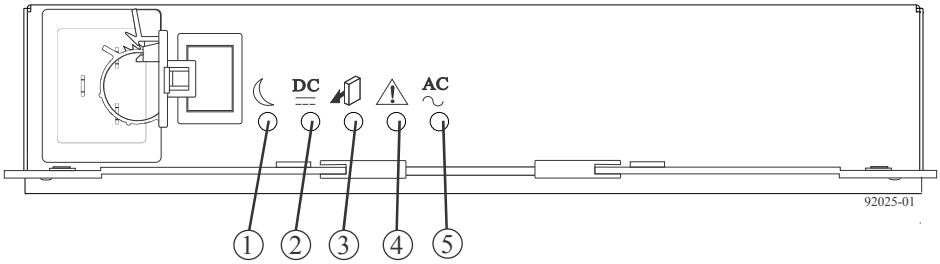


Table 31: LEDs on the AC power canister

Location	LED	Color	On	Off
1	Power Standby Power	Green	The drive tray is in Standby mode and DC power is not available.	The drive tray is not in Standby mode.
2	Power DC Power	Green	DC power from the power canister is available.	DC power from the power canister is not available.
3	Power Service Action Allowed	Blue	The power canister can be removed safely from the drive tray.	The power canister cannot be removed safely from the drive tray.
4	Power Service Action Required	Amber	A fault exists within the power canister.	Normal status.
5	Power AC Power	Green	AC power to the power canister is present.	AC power to the power canister is not present.

- **LEDs on the fan canister**

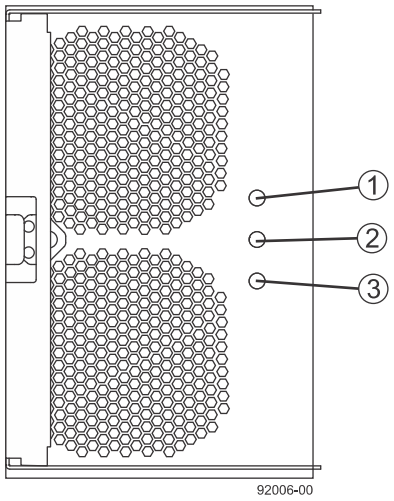


Table 32: LEDs on the fan canister

Location	LED	Color	On	Off
1	Fan Power	Green	Power from the fan canister is available.	Power to the fan customer-replaceable unit (CRU) is not available.
2	Fan Service Action Required	Amber	A fault exists within the fan canister.	Normal status.
3	Fan Service Action Allowed	Blue	The fan canister can be removed safely from the drive tray.	The fan canister cannot be removed safely from the drive tray.

Things to know - LEDs on the DE6600 drive drawers

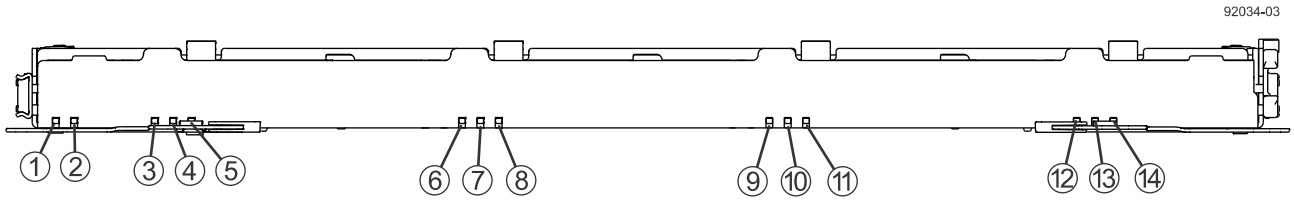
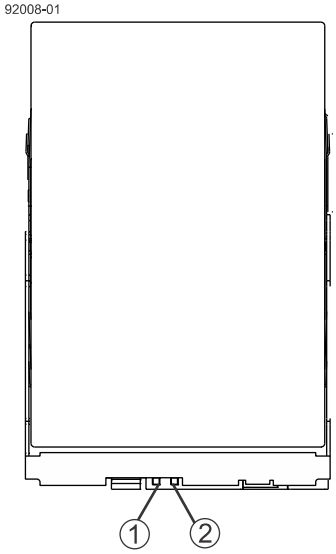


Table 33: LEDs on the drawer

Location	LED	Color	On	Blinking	Off
1	Drive or Drawer Service Action Allowed	Blue	The drive canister can be removed safely from the drive drawer in the drive tray.		The drive canister cannot be removed safely from the drive drawer in the drive tray.
2	Drive or Drawer Service Action Required	Amber	An error has occurred.		Normal status.
3–14	Drive Activity for drives 1 through 12 in the drive drawer	Green	The power is turned on, and the drive is operating normally.	Drive I/O activity is taking place.	The power is turned off.

Things to know - LEDs on the DE6600 drives

- **LEDs on the DE6600 drives**



1	Drive Service Action Allowed LED
2	Drive Service Action Required LED

Table 34: LEDs on the DE6600 drives

Location	LED	Color	On	Blinking	Off
1	Drive Service Action Allowed	Blue	The drive canister can be removed safely from the drive drawer in the drive tray.		The drive canister cannot be removed safely from the drive drawer in the drive tray.

Location	LED	Color	On	Blinking	Off
2	Drive Service Action Required	Amber	An error has occurred.		Normal status.

- **Drive state represented by the LEDs[1]**

Table 35: Drive state represented by the LEDs[1]

Drive State	Drive Activity LED (Green)[2]	Drive Service Action Required LED (Amber)
Power is not applied.	Off	Off
Normal operation – The power is turned on, but drive I/O activity is not occurring.	On	Off
Normal operation – Drive I/O activity is occurring.	Blinking	Off
Service action required – A fault condition exists, and the drive is offline.	On	On
[1] To see the drive states represented by the LEDs, you must open the drive drawers one after the other.		
[2] To see the Drive Activity LED, see *Things to know - LEDs on the DE6600 drive drawers* on page 124.		

Things to know - General behavior of the LEDs on the drive trays

Table 36: General behavior of the LEDs on the drive trays

LED	Symbol	Location	General Behavior
Power		• Drive tray • ESM canister • Power-fan canister	• **On** – Power is applied to the drive tray or the canister. • **Off** – Power is not applied to the drive tray or the canister.
Drive Tray Locate		Front bezel on the drive tray	**On or blinking** – Indicates the drive tray that you are trying to find.
Drive Tray Over-Temperature		Front bezel on the drive tray	• **On** – The temperature of the drive tray has reached an unsafe condition. • **Off** – The temperature of the drive tray is within operational range.

LED	Symbol	Location	General Behavior
Standby Power		Front bezel on the drive tray	• **On** – The drive tray is in Standby mode, and the main DC power is off. • **Off** – The drive tray is not in Standby mode, and the main DC power is on.
Service Action Allowed		• ESM canister • Power-fan canister • Drive	• **On** – It is safe to remove the ESM canister, the power-fan canister, or the drive. • **Off** – Do not remove the ESM canister, the power-fan canister, or the drive. **Note:** The drive has an LED but no symbol.
Service Action Required (Fault)		• ESM canister • Power-fan canister • Drive	• **On** – When the drive tray LED is on, a component within the drive tray needs attention. • **Off** – The ESM canister, the power-fan canister, and the drive are operating normally. **Note:** The drive has an LED but no symbol.
AC Power		• ESM canister • Power-fan canister	• **On** – AC power is present. • **Off** – AC power is not present.
Output DC Power		Power-fan canister	• **On** – Regulated DC output power from the power canister and the fan canister is present. • **Off** – Regulated DC output power from the power-fan canister is not present.
Input DC Power		Power-fan canister	• **On** – Regulated DC input power to the power canister and the fan canister is present. • **Off** – Regulated DC input power to the power-fan canister is not present.

LED	Symbol	Location	General Behavior
Link Service Action Required (Fault)		ESM canister	• **On** – The cable is attached and at least one lane has a link-up status, but one lane has a link-down status. • **Off** – The cable is not attached, the cable is attached and all lanes have a link-up status, or the cable is attached and all lanes have a link-down status.
Link Up	Two LEDs above each expansion connector	ESM canister	• **On** – The cable is attached and at least one lane has a link-up status. • **Off** – The cable is not attached, or the cable is attached and all lanes have a link-down status.

Things to know - Display sequence code definitions

During normal operation, the tray ID display on each controller canister shows the controller-drive tray ID. The Diagnostic LED (lower-digit decimal point) comes on when the display is used for diagnostic codes and goes off when the display is used to show the tray ID. The category code may be followed by a dash + and a "CF" followed by one of the component location codes described in *Things to know - Lock-down codes* on page 130.

Table 37: Sequence code definitions

Category	Category Code [1]	Detail Codes [2]
Startup error	SE+[3]	• 88+ Power-on default • dF+ Power-on diagnostic fault • Sx Power-on validation error
Operational error	OE+	Lx+ Lock-down codes. (See *Things to know - Lock-down codes* on page 130.)
Operational state	OS+	• OL+ = Offline. • bb+ = Battery backup (operating on batteries). • OH + CPU temperature exceeds the warning level • CF+ = Component failure. • Sd+ = Start of Day (SOD) processing

Category	Category Code [1]	Detail Codes [2]
Component failure	CF+	• dx+ = Processor or cache DIMM. • Cx = Cache DIMM. • Px+ = Processor DIMM. • Hx+ = Host interface card. • Fx+ = Flash drive. • bl + Base Controller Card
Diagnostic failure	dE+	Lx+ = Lock-down codes (See *Things to know - Lock-down codes* on page 130 and *Things to know - Seven-segment display use cases* on page 132.)
Category delimiter	dash+ (Appears as two short dashes: "--"). .	The separator between category-detail code pairs is used when more than one category detail code pair exists in the sequence.
End-of-sequence delimiter	blank - [4]	The end-of-sequence delimiter is automatically inserted by the hardware at the end of a code sequence.

Note:

[1] A two-digit code that starts a dynamic display sequence.

[2] A two-digit code that follows the category code with more specific information.

[3] The plus (+) sign indicates that a two-digit code appears and the Diagnostic LED is turned on.

[4] No codes display, and the Diagnostic LED is off.

Things to know - Component failure identifications

Use the seven segment-display values to identify the component.

Table 38: Failure identifications

Component	Seven-Segment Display Used in this Controller State		
Code [1]	**Power-on Diagnostics**	**Suspended**	**Operational**
Processor DIMM (dx +[2]) [3]	yes	yes	no
Cache DIMM (CX +)	yes	yes	no
Host Card (HX +)	yes	yes	yes
Flash Drive (FX +)	no	no	yes

Component	**Seven-Segment Display Used in this Controller State**		
Code [1]	**Power-on Diagnostics**	**Suspended**	**Operational**
Category delimiter (--) After (--), a "CF" (for Component Failure) is displayed, followed by one of the codes specified above.	The separator between category-detail code pairs is used when more than one category detail code pair exists in the sequence.		
End-of-sequence delimiter Appears as a blank space. (No codes appear, and the Diagnostic LED is off.)	The end-of-sequence delimiter is automatically inserted by the hardware at the end of a code sequence.		

Note:

[1] A two-digit code that starts a dynamic display sequence.

[2] A two-digit code that follows the category code with more specific information.

[3] The plus (+) sign indicates that a two-digit code appears with the Diagnostic LED on.

Things to know - Lock-down codes

Use the following table to determine the diagnostic lock-down code definitions on the seven-segment display in the controller canister. In general, these diagnostics display only when the controller is in a non-operational state. The controller can be in a non-operational state as a result of a configuration problem (such as mismatched controller types) or as a result of a hardware fault. If the amber Controller Service Action Required LED is on, the non-operational state is the result of a hardware fault.

Table 39: Supported diagnostic lock down codes on the seven-segment display

Diagnostic Code	Description
– –	The firmware is booting.
L0	The controller types are mismatched, which result in a suspended controller state.
L2	A persistent memory error has occurred, which results in a suspended controller state.
L3	A persistent hardware error has occurred, which results in a suspended controller state.
L4	A persistent data protection error has occurred, which results in a suspended controller state.
L5	An auto-code synchronization (ACS) failure has been detected, which results in a suspended controller state.

Diagnostic Code	Description
L6	An unsupported host interface card has been detected, which results in a suspended controller state.
L7	A sub-model identifier either has not been set or has been mismatched, which results in a suspended controller state.
L8	A memory configuration error has occurred, which results in a suspended controller state.
L9	A link speed mismatch condition has been detected in either the ESM or the power supply, which results in a suspended controller state.
Lb	A host interface card configuration error has been detected, which results in a suspended controller state.
LC	A persistent cache backup configuration error has been detected, which results in a suspended controller state.
Ld	A mixed cache memory DIMMs condition has been detected, which results in a suspended controller state.
LE	Uncertified cache memory DIMM sizes have been detected, which result in a suspended controller state.
LF	The controller has locked down in a suspended state with limited symbol support.
LH	A controller firmware mismatch has been detected, which results in a suspended controller state.
LJ	The controller does not have enough memory to support the configuration, which results in a suspended controller state.
LL	The controller cannot access either midplane SBB EEPROM, which results in a suspended controller state.
Ln	A canister is not valid for a controller, which results in a suspended controller state.
LP	Drive port mapping tables are not detected, which results in a suspended controller state.
Lr	A non field replaceable unit has been replaced, which results in a suspended controller state.
Lt	A configuration data base corruption has been detected, which results in a suspended controller state.
LU	The start-of-day (SOD) reboot limit has been exceeded, which results in a suspended controller state.
LY	During the start-of-day (SOD) one or more drives appear to be missing, which results in a self-clearing lock down. The lock down will clear itself if the drives return and the system is rebooted.
S1	The controller detects a checksum failure in EEPROM, which results in a suspended controller state.
S2	The SBB Signature/Revision is invalid, which results in a suspended controller state.
S3	An unsupported enclosure is detected in the storage array, which results in a suspended controller state.

Diagnostic Code	Description
S4	The power supply is incapable of powering the controller, which results in a suspended controller state.
S5	The SBB pairing fails, which results in a suspended controller state.

Things to know - Seven-segment display use cases

The following table shows both startup errors and operation errors that can be used to point to a component failure.

Seven-segment display uses cases with repeating sequences

Use cases	Repeating sequence
Use case: Controller power-on	
• Normal power-on controller insertion • Controller inserted while held in reset	`SE+ 88+ blank-`

Use cases	Repeating sequence
Use case: Operational states	
• Normal operation	`xy-` (static controller tray ID)
• Start-of-day (SOD) processing	`OS+ Sd+ blank-`
• The controller is placed in reset while showing the tray ID.	`OS+ OL+ blank-`
• The controller is operating on batteries (cache backup).	`OS+ bb+ blank-`
• The CPU temperature has exceeded the warning level.	`OS+ OH+ blank-`

Use cases	Repeating sequence
Use case: Component failure when the controller is operational.	
• Failed host interface card	`OS+ CF+ HX+ blank-`
• Failed flash drive	`OS+ CF+ Fx+ blank-`

Use Cases	Repeating sequence
Use case: Power-on diagnostic failure	

Use Cases	Repeating sequence
• A component that is not a field replaceable unit failure has been detected.	`SE+ dF+ blank-`
• A processor DIMM failure has been detected.	`SE+ dF+ "--"+ CF+ Px + blank-`
• A cache memory DIMM failure has been detected.	`SE+ dF+ "--"+ CF+ Cx + blank-`
• A processor DIMM or a cache memory DIMM failure has been detected.	`SE+ dF+ "--"+ CF+ dx + blank-`
• A host interface card failure has been detected.	`SE+ dF+ "--"+ CF+ Hx + blank-`
• An incorrect number of cache backup devices have been detected.	`SE+ LC+ "--"+ CF+ Fx + blank-`

Use cases	Repeating sequence
Use case: Controller is suspended and there are no other errors to report.	
• All lockdown conditions	`OH+ Lx+ blank-`

Use cases	Repeating sequence
Use case: The controller is suspended because of component errors.	
• Persistent processor DIMM error correcting code (ECC) errors have been detected.	`OE+ L2+ "--"+ CF+ CX+ blank-`
• Persistent cache DIMM ECC errors have been detected.	`OE+ L2+ "--"+ CF+ CX+ blank-`
• Persistent processor or cache DIMM ECC errors have been detected.	`OE+ L2+ "--"+ CF+ CX+ blank-`

Use cases	Repeating sequence
Use case: The controller has been suspended as a result of persistent cache backup configuration errors.	
• The write-protect switch is set during cache restore.	`OE+ LC+ blank-`
• The memory size changed with dirty data in the flash drives.	`OE+ LC+ dd+ blank-`

Use cases	Repeating sequence
Use case: The controller has been suspended as a result of diagnostic errors.	

Use cases	Repeating sequence
• A cache memory diagnostic failure has been detected.	`dE+ L2+ "--"+ CF+ Cx + blank-`
• A base controller diagnostic failure has been detected.	`dE+ L3+ "--"+ CF+ b1 + blank-`
• A base controller IOC diagnostic failure has been detected.	`dE+ L3+ "--"+ CF+ b2 + blank-`

Things to know - Seven-segment display for the ESMs on the drive trays

During normal operation, the tray ID display on each ESM shows the drive tray ID. The Diagnostic LED (lower-digit decimal point) comes on when the display is used for diagnostic codes and goes off when the display is used to show the tray ID.

If a power-on or reset occurs, the Diagnostic LED, the Heartbeat LED (upper-digit decimal point), and all seven segments of both digits come on. The Diagnostic LED remains on until the drive tray ID appears.

Table 40: Supported diagnostic codes on the ESM

Diagnostic Code	Description
– –	The firmware is booting.
.8, 8., or 88	This ESM is being held in reset by another ESM.
AA	ESM A firmware is in the process of booting (the diagnostic indicator is not yet set).
bb	ESM B firmware is in the process of booting (the diagnostic indicator is not yet set).
L0	The ESM types are mismatched.
L2	A persistent memory error has occurred.
L3	A persistent hardware error has occurred.
L9	An over-temperature condition has been detected in either the ESM or the power supply.
LL	The midplane SBB VPD EEPROM cannot be accessed.
Ln	The ESM canister is not valid for this drive tray.
LP	Drive port mapping tables are not found.
H2	The ESM configuration is invalid or incomplete, and it operates in a Degraded state.
H3	The maximum number of ESM reboot attempts has been exceeded.
H4	This ESM cannot communicate with the alternate ESM.
H5	A midplane harness failure has been detected in the drive tray.
H6	An ESM firmware failure has been detected.

Diagnostic Code	Description
H9	A non-catastrophic hardware failure has occurred. The ESM is operating in a Degraded state.
J0	The ESM canister is incompatible with the drive tray firmware.

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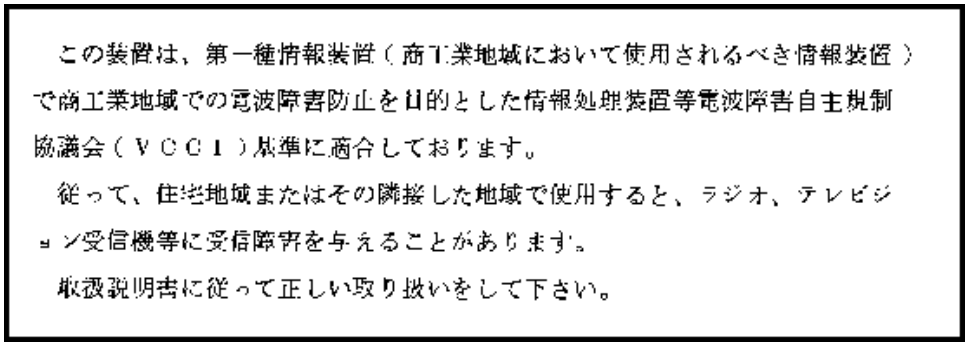
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