2002 Series
Setup Guide

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Contents

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Tables

Preface

This guide provides information about the 2002 Series storage management products:

Fibre Channel Controller Enclosure

- 2722
- 2732

Serial-attached SCSI Controller Enclosure

- 2522
- 2532

Internet SCSI Controller Enclosure

- 2322
- 2332

Intended audience

This guide is intended for use by system administrators and technicians who are experienced with the following:

- Direct attach storage (DAS) or storage area network (SAN) management
- Network administration
- Network installation
- Storage system installation and configuration

Prerequisites

Prerequisites for installing and configuring this product include familiarity with:

- Servers and computer networks
- Fibre Channel (FC), Serial-attached SCSI (SAS), Internet SCSI (iSCSI), and Ethernet protocols

Related documentation

In addition to this guide, please refer to other documents for this product line:

- R/EvolutionRackmount Bracket Kit Installation
- R/Evolution 2002 Series Installation sheets:
  - 2722/2732 Installation
  - 2522/2532 Installation
  - 2322/2332 Installation
- R/Evolution 2002 Series FRU Installation and Replacement Guide
- R/Evolution 2002 Series RAIDar User Guide
- R/Evolution 2002 Series CLI Reference Guide
- Online help for R/Evolution 2002 Series management interfaces
- R/Evolution Installing Optional Software for Microsoft Windows® Server
- R/Evolution 2002 Series Release Notes
- R/Evolution Product Regulatory Compliance and Safety

See Dot Hill's customer resource center (CRC) web site for additional information:

crc.dothill.com

Select R/Evolution Products and go to R/Evolution 2002 Series.

Document conventions and symbols

Table 1 Document conventions

Convention	Element
Navy blue text	Cross-reference links and e-mail addresses
Navy blue text	Web site addresses
Bold font	• Key names • Text typed into a GUI element, such as into a box • GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes
Italics font	Text emphasis
Monospace font	• File and directory names • System output • Code • Text typed at the command-line
Monospace, italic font	• Code variables • Command-line variables
Monospace, bold font	Emphasis of file and directory names, system output, code, and text typed at the command line

⚠ **WARNING!** Indicates that failure to follow directions could result in bodily harm or death.

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

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

📝 **NOTE:** Provides additional information.

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

1   Components

2722/2522/2322 front panel components
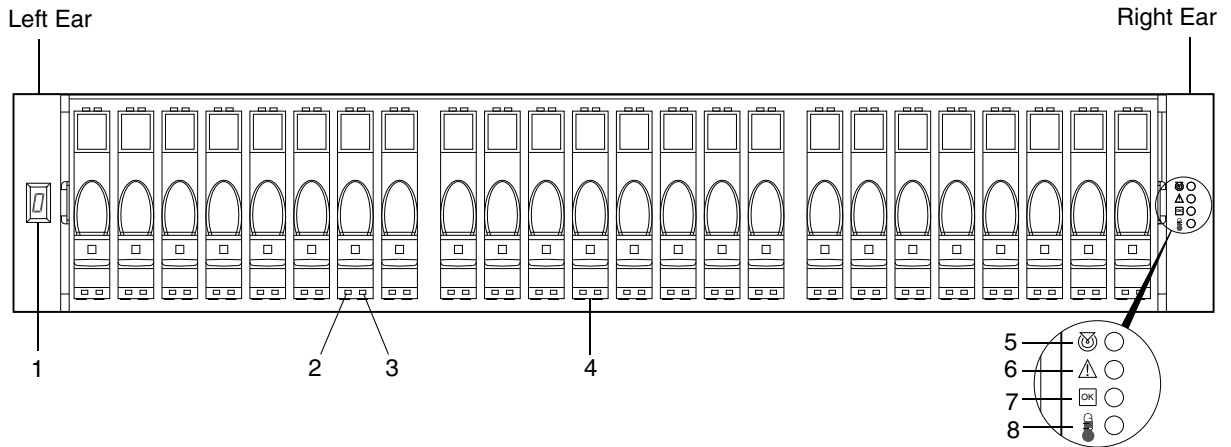
Left Ear   Right Ear

1	Enclosure ID LED	5	Enclosure status LED: Unit Locator
2	Disk drive status LED: OK to Remove	6	Enclosure status LED: Fault/Service Required
3	Disk drive status LED: Power/Activity/Fault	7	Enclosure status LED: FRU OK
4	2.5" disk or drive blank (typical 24 slots)	8	Enclosure status LED: Temperature Fault

2722/2522/2322 disk drive slot numbers
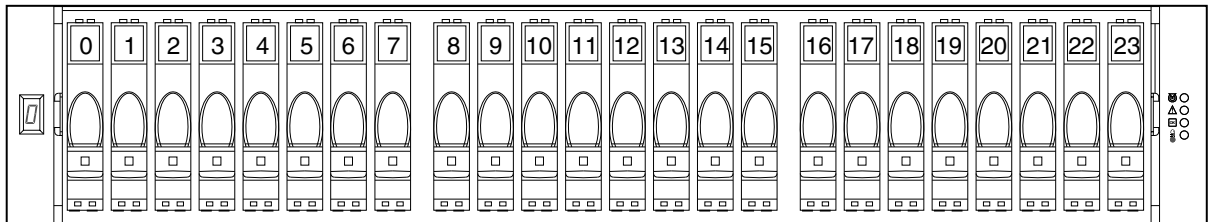
2732/2532/2332 front panel components
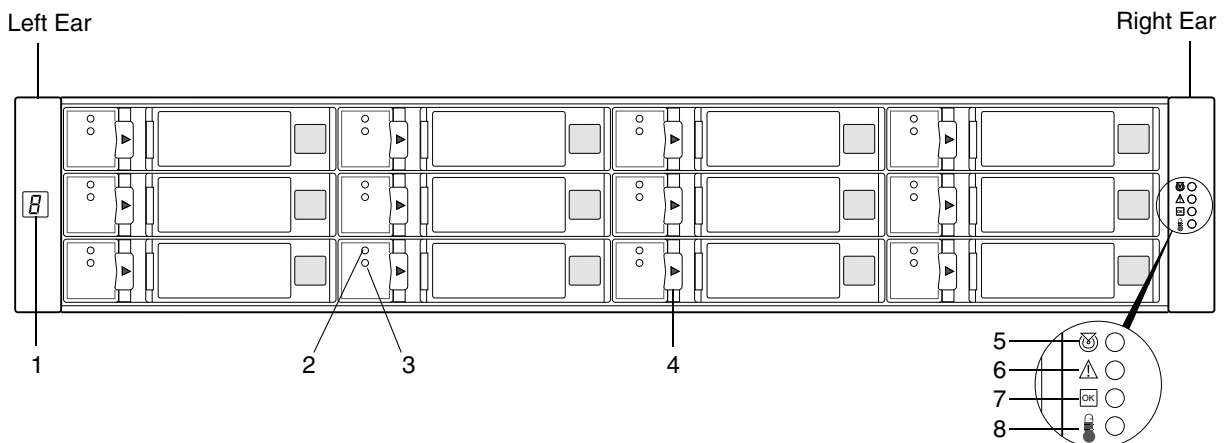
Left Ear   Right Ear

1	Enclosure ID LED	5	Enclosure status LED: Unit Locator
2	Disk drive status LED: OK to Remove	6	Enclosure status LED: Fault/Service Required
3	Disk drive status LED: Power/Activity/Fault	7	Enclosure status LED: FRU OK
4	3.5" disk or drive blank (typical 12 slots)	8	Enclosure status LED: Temperature Fault

2732/2532/2332 disk drive slot numbers
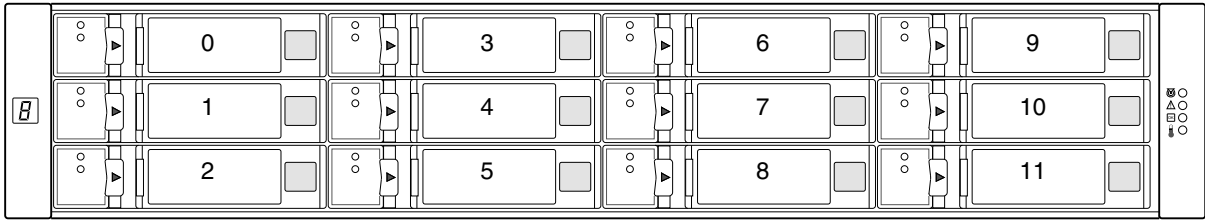
Rear panel views — controller modules

The R/Evolution 2002 Series controller modules shown below are not proportionately sized relative to preceding controller enclosure views. Controller module face plates are enlarged to show relevant detail.

2722/2732 controller module face plate — Fibre Channel
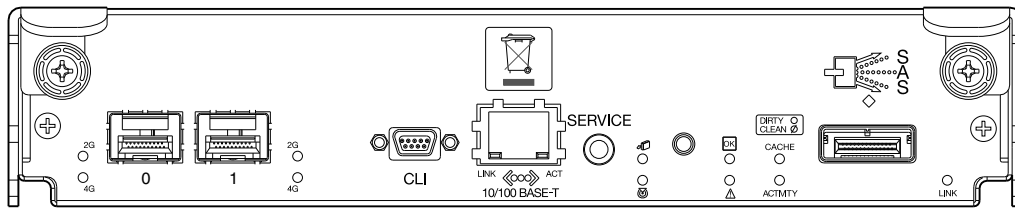
2522/2532 controller module face plate — Serial-attached SCSI
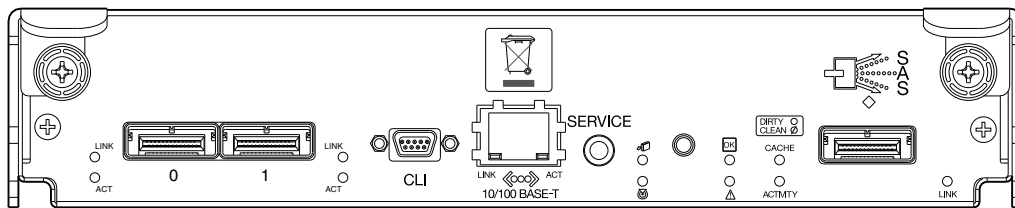
2322/2332 controller module face plate — Internet SCSI
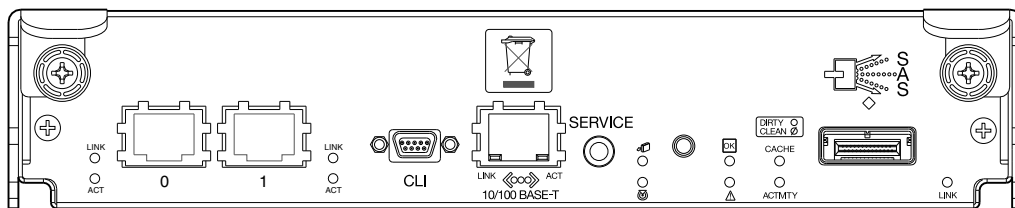
2722/2732 controller enclosure rear panel components

(DC power supply unit (PSU) is mutually exclusive to the AC model)
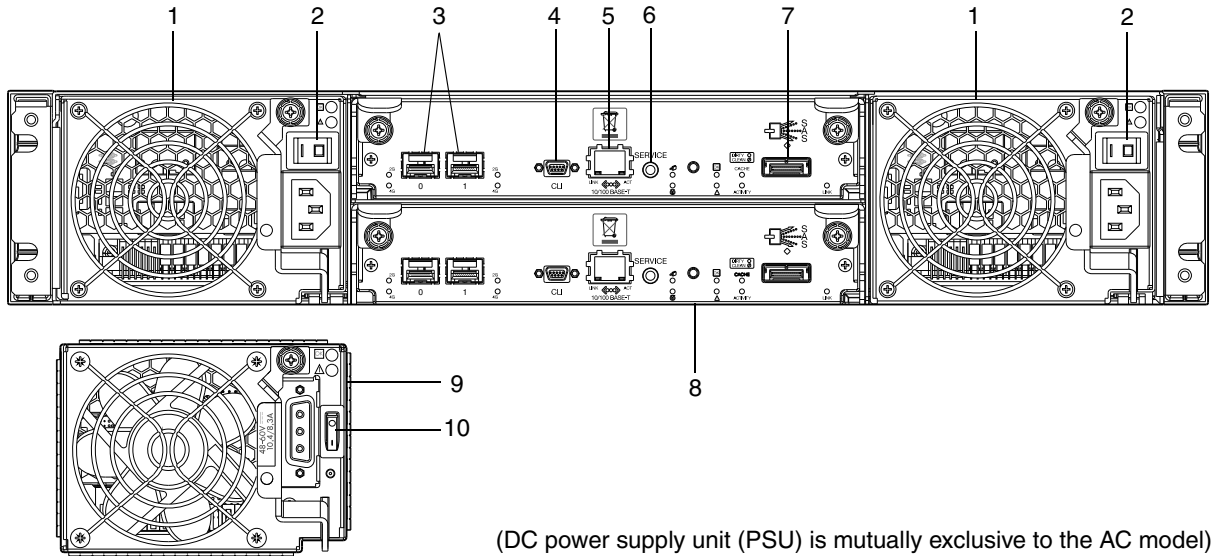
1 AC power supplies
2 AC power switches
3 Host ports (FC)
4 CLI port
5 Network port

6 Service port (used by service personnel only)
7 Expansion port
8 Optional FC controller module
9 DC Power supply (2) — (DC model only)
10 DC Power switch

2522/2532 controller enclosure rear panel components

(DC power supply unit (PSU) is mutually exclusive to the AC model)
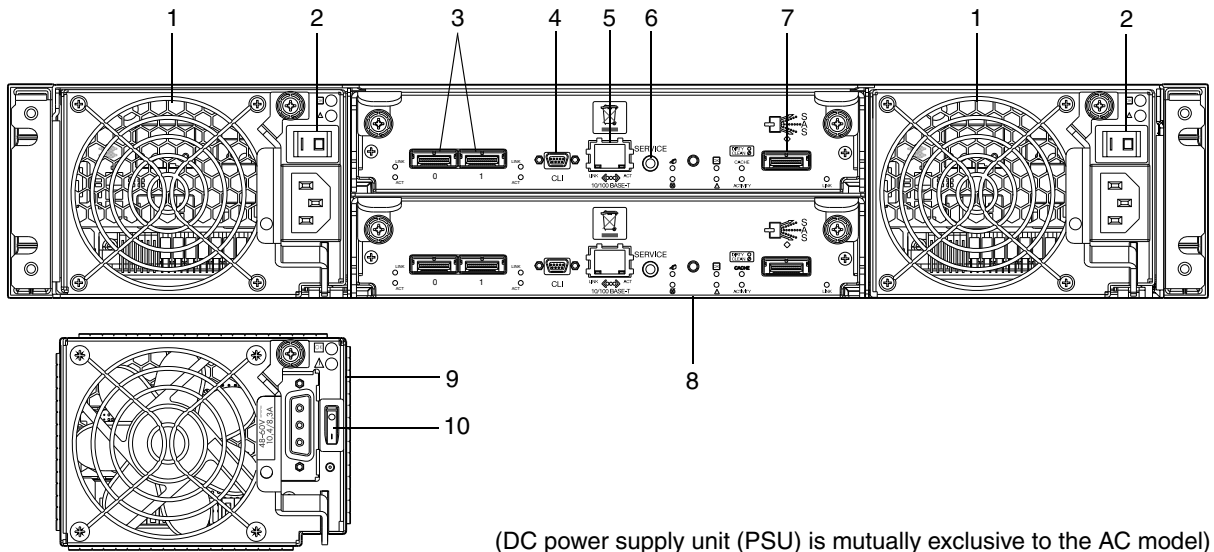
1 AC power supplies
2 AC Power switches
3 Host ports (SAS)
4 CLI port
5 Network port

6 Service port (used by service personnel only)
7 Expansion port
8 Optional SAS controller module
9 DC Power supply (2) — (DC model only)
10 DC power switch

2322/2332 controller enclosure rear panel components

(DC power supply unit (PSU) is mutually exclusive to the AC model)
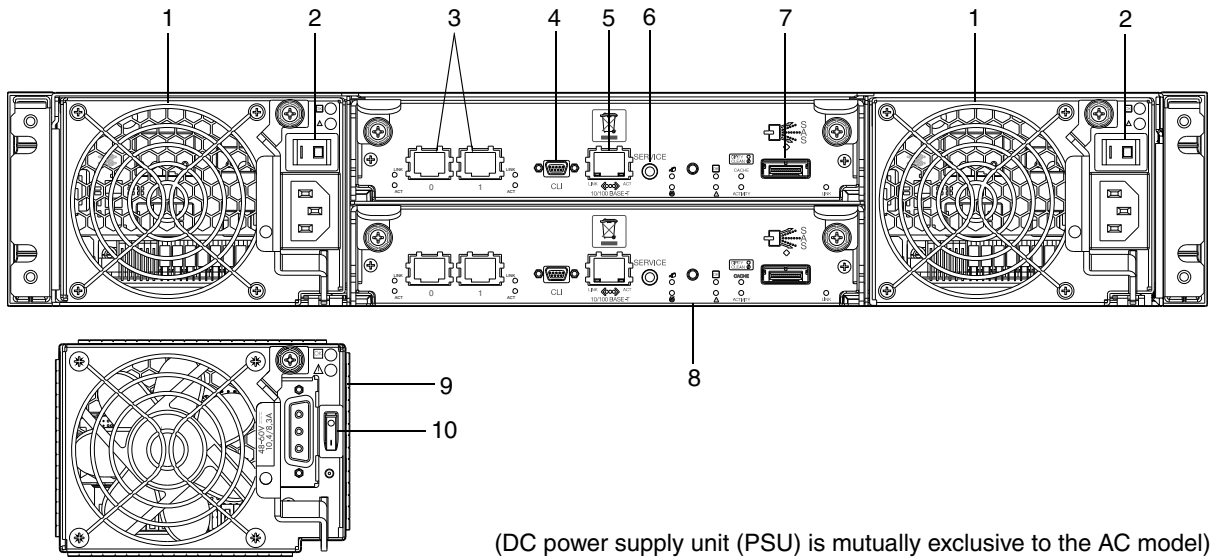
1	AC power supplies	6	Service port (used by service personnel only)
2	AC power switches	7	Expansion port
3	Host ports (iSCSI)	8	Optional iSCSI controller module
4	CLI port	9	DC Power supply (2) — (DC model only)
5	Network port	10	DC Power switch

2122 24-drive enclosure rear panel components

R/Evolution 2002 Series controller enclosures can be attached to 2122 drive enclosures. See Cable requirements for drive enclosures on page 20, or the installation instruction sheet for your controller enclosure product, regarding cabling information.
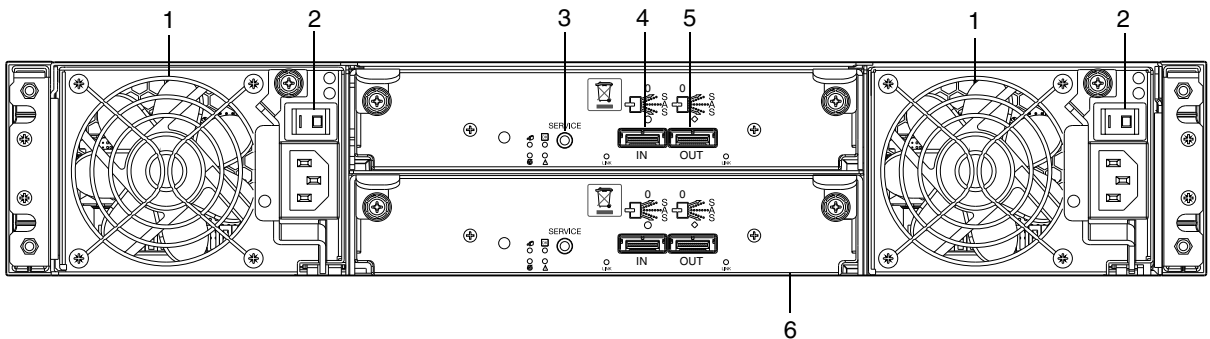
1	Power supplies	5	SAS Out port (connects to another drive enclosure)
2	Power switches		
3	Service port (used by service personnel only)	6	Optional expansion module
4	SAS In port (connects to controller enclosure)		

2130 12-drive enclosure rear panel components

R/Evolution 2002 Series controller enclosures can be attached to 2130 drive enclosures. See Cable requirements for drive enclosures on page 20, or the installation instruction sheet for your controller enclosure product, regarding cabling information.
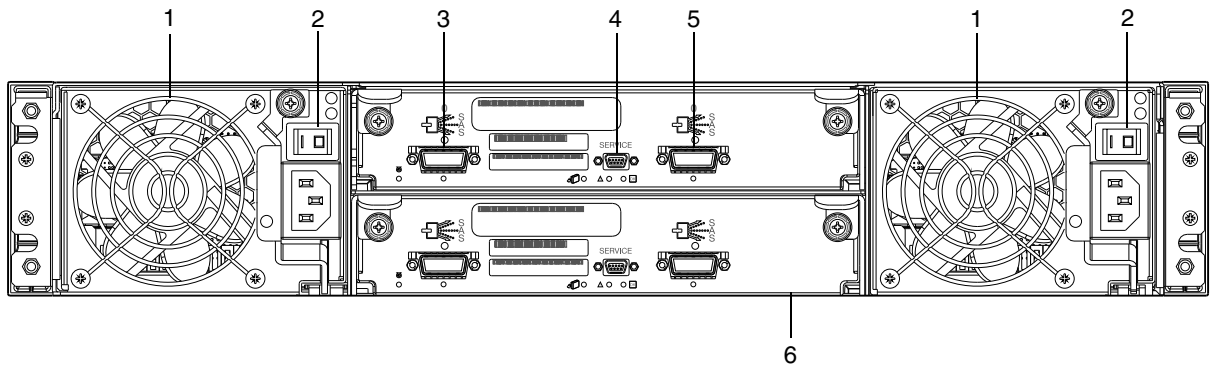
1 Power supplies	5 SAS Out port (connects to another drive enclosure)
2 Power switches	
3 SAS In port (connects to a controller enclosure)	6 Optional expansion module
4 Service port (used by service personnel only)	

Cache

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

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

CompactFlash

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

Controller Module
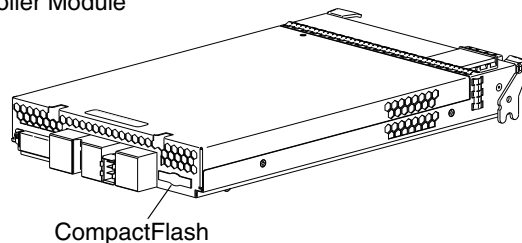
CompactFlash

IMPORTANT: Customer removal of CompactFlash will void the product warranty.

Super-capacitor pack

To protect controller module cache in case of power failure, the 2722/2522/2322 and 2732/2532/2332 are equipped with super-capacitor technology, in conjunction with CompactFlash memory, built into each controller module to provide unlimited cache memory backup time. The super-capacitor pack

provides energy for backing up unwritten data in the write cache to the CompactFlash, in the event of a power failure. Unwritten data in CompactFlash memory are automatically committed to disk media when power is restored. In the event of power failure, while cache is maintained by the super-capacitor pack, the Cache Status LED flashes at a rate of 1/10 second on and 9/10 second off.

2   Installing the enclosures

Installation checklist

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

Table 2   Installation checklist

Step	Task	Where to find procedure
1.	Install the controller enclosure and optional drive enclosures in the rack, and attach ear caps.[1]	See the Rackmount Bracket Kit Installation.
2.	Connect controller enclosure and drive enclosures.	See Connecting controller and drive enclosures on page 20.
3.	Connect power cords.	See the installation poster for your 2002 Series controller enclosure.
4.	Test enclosure connectivity.	See Testing enclosure connections on page 26.
5.	Obtain IP values and set management (network) port IP properties on the controller enclosure.	See Obtaining IP values on page 27.
6.	Install required host software.	See Host system requirements on page 31.
7.	Connect hosts.[2]	See Connecting the enclosure to hosts on page 31.
8.	Connect remote management hosts.[2]	See Connecting a management host on the network on page 35.
9.	Perform initial configuration tasks[3]:	
	• Sign in to the web-based storage management application (RAIDar).	See "Getting Started" in the web-posted R/Evolution 2002 Series RAIDar User Guide.
	• Initially configure and provision the system using RAIDar.	See "Configuring the System" and "Provisioning the System" topics in the RAIDar user guide or online help.

[1]See R/Evolution 2002 Series FRU Installation and Replacement Guide for illustrations showing installation of ear caps.
[2]For more about hosts, see the R/Evolution 2002 Series RAIDar User Guide.
[3]RAIDar is introduced in Accessing RAIDar on page 37. See the RAIDar user guide or online help for additional information.

Connecting controller and drive enclosures

R/Evolution 2002 Series controller enclosures support up to 96 disk drives. You can connect up to three 2122 drive enclosures to a controller. You can connect up to six 2130 drive enclosures to a 2722/2522/2332; and seven 2130 drive enclosures to a 2732/2532/2332. You can also configure mix-connect 2122 and 2130 drive enclosures in keeping with the maximum drive limit. The firmware supports both direct and reverse SAS cabling. Reverse (fault-tolerant) cabling allows any drive enclosure to fail — or be removed — while maintaining access to other enclosures.

The cabling diagrams in this section show recommended fault-tolerant cabling patterns. Maximum SAS cable length currently supported for the 2722/2732 is 0.6 meters. Maximum cable length for other 2002 Series controllers is 2.0 meters.

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

For example, Figure 4 on page 23 shows fault tolerant cabling wherein controller 0A is connected to expansion module 1A, with a chain of connections continuing down. Controller 0B is connected to the lower expansion module (B) of the last drive enclosure in the chain, with connections moving in the opposite direction. Several cabling examples are provided on the following pages.

Cable requirements for drive enclosures

Observe the following guidelines when installing SAS cables:

- Use only R/Evolution or OEM-qualified SAS cables providing a 3-Gbps data rate per lane with four lanes (4x) per 3Gb SAS connector.

  Although you can connect 6 Gb drive enclosures to a 2002 Series controller enclosure, data throughput occurs at the controller enclosure's 3-Gbps data rate.
- Use only the 0.6 meter SAS cables provided for connecting a 2722/2732 controller enclosure to *any* drive enclosure.
- When configuring three or more drive enclosures to a 2722/2732, the 0.6 meter cable lengths require placement of a rack mounted controller enclosure in the middle of the component stack, adjacent to the first and last expansion enclosures identified during discovery (see Figure 3 on page 22).
- Refer to the Table 3 when cabling storage system components. The following terms supplement those defined in the table footer.
  - Mini-SAS to mini-SAS cables denote SFF-8088 to SFF-8088
  - Mini-SAS to SAS cables denote SFF-8088 to 8470
  - SAS to SAS cables denote 8470 to 8470
- You may need to order additional or longer cables when cabling a fault-tolerant configuration (see Figure 4 on page 23).

Table 3 SAS cable requirements

Model	2x22 controller enclosure (2U24)	2x32 controller enclosure (2U12)	2122 drive enclosure (2U24)	2130 drive enclosure (2U12)
2x22ce	Not applicable	Not applicable	mini-SAS to mini-SAS	mini-SAS to SAS
2x32ce	Not applicable	Not applicable	mini-SAS to mini-SAS	mini-SAS to SAS
2122	mini-SAS to mini-SAS	mini-SAS to mini-SAS	mini-SAS to mini-SAS	mini-SAS to SAS
2130	mini-SAS to SAS	mini-SAS to SAS	mini-SAS to SAS	SAS to SAS
2x22ce = 2002 Series controller enclosures (2722/2522/2322) (2.5" drives in 2U24 enclosure) 2x32ce = 2002 Series controller enclosures (2732/2532/2332) (3.5" drives in 2U12 enclosure) 2122 = 24-drive expansion enclosure (2U24) 2130 = 12-drive expansion enclosure (2U12) 2u24 = Enclosure measuring two rack units high, providing 24-drives and smaller depth dimension than 2U12. 2u12 = Enclosure measuring two rack units high, providing 12-drives, and larger footprint than 2U24.				

NOTE: For clarity, the schematic illustrations show only relevant details such as expansion ports. For detailed illustrations showing all components, see Rear panel views — controller modules on page 14.
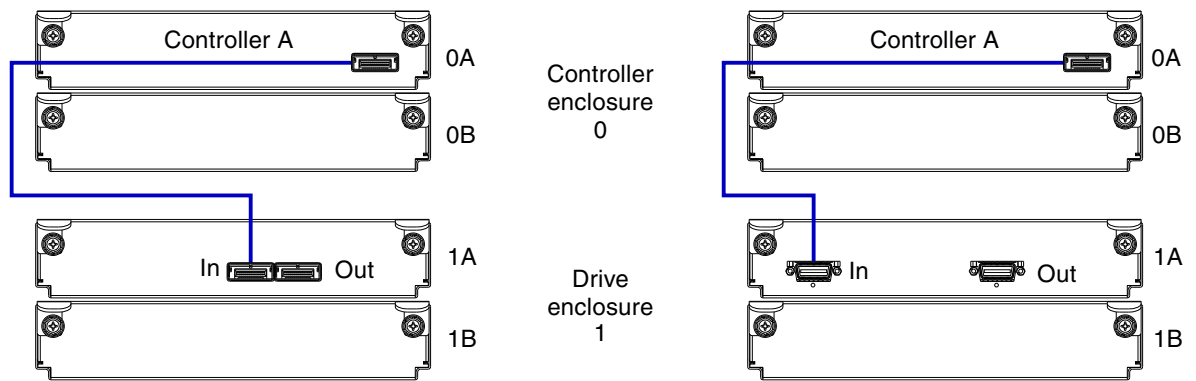
Figure 1 Cabling connections between a single-controller enclosure and one drive enclosure

The diagram at left (above) shows a 2722/2522/2322 single-controller enclosure connected to a 2122 (single expansion module); whereas the diagram at right shows the controller enclosure connected to a 2130 (single expansion module).

NOTE: The 2122 uses a SFF-8088 connector interface for drive expansion, whereas the 2130 uses SAS 8470. Refer to Table 3 on page 20 for SAS cable requirements *before* cabling enclosures.
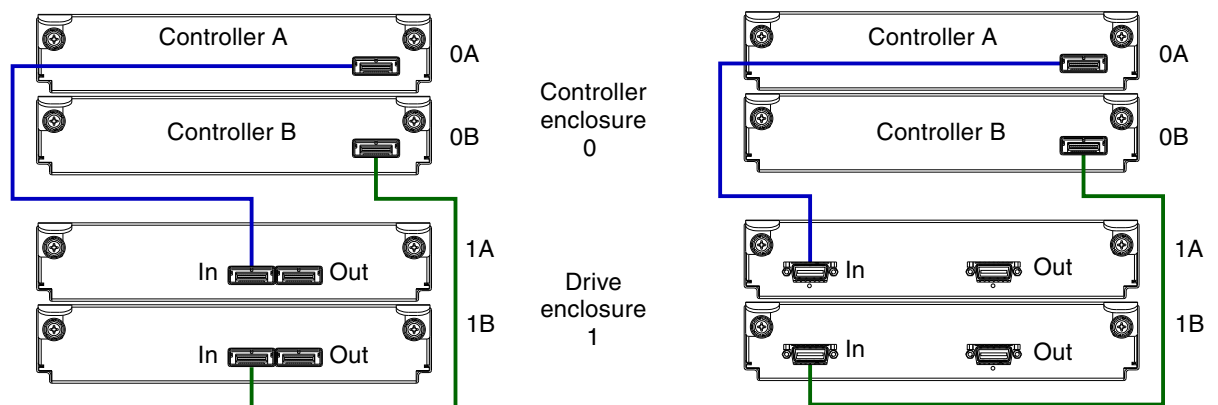
Figure 2 Cabling connections between a dual-controller enclosure and one drive enclosure

The diagram at left (above) shows a 2722/2522/2322 dual-controller enclosure connected to a 2122 (two expansion modules); whereas the diagram at right shows the dual-controller enclosure connected to a 2130 (two expansion modules).

Figure 3 Fault-tolerant cabling between a dual-controller enclosure and four 2130 drive enclosures

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📝 **NOTE:** This cabling scheme pertains to the 2722/2732 storage systems exclusively.

The diagram above shows a dual-controller FC enclosure cabled to 2130 drive enclosures featuring dual-expansion modules. Controller enclosure ID number 0, attached to four expansion enclosures, must have enclosure IDs 3 and 4 positioned above the controller enclosure, and enclosure IDs 1 and 2 positioned below the controller enclosure. Accordingly, the first and last drive enclosures are positioned adjacent to the controller enclosure to provide redundancy. The requirement for two 0.6 meter cables is shown.

The same logic applies if cabling 2122 drive enclosures, or mixed-connect drive enclosures, in lieu of the 2130 drive enclosures shown above.

It is conceivable that FRU updates may negate the need for the sandwich-style stacking of a controller enclosure between drive enclosures, thereby allowing for the more conventional approach to fault-tolerant cabling, described in .

Controller
enclosure
0

Controller A   0A

Controller B   0B

Drive
enclosure
1

In   Out   1A

In   Out   1B

Drive
enclosure
2

In   Out   2A

In   Out   2B

Drive
enclosure
3

In   Out   3A

In   Out   3B

Drive
enclosure
4

In   Out   4A

In   Out   4B
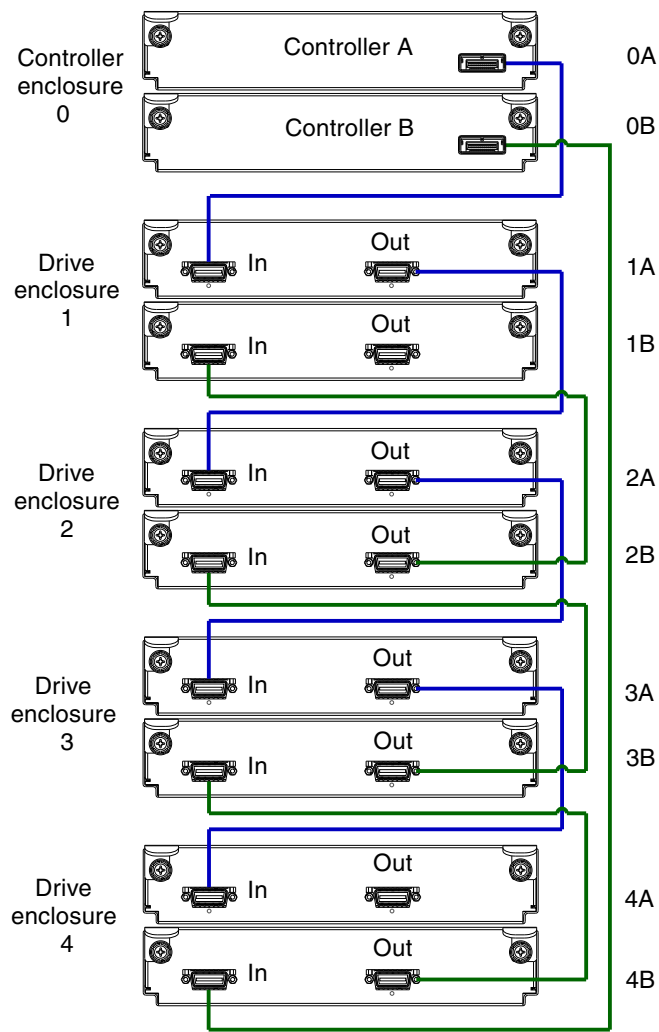
Figure 4 Fault-tolerant cabling between a dual-controller enclosure and four 2130 drive enclosures

NOTE: This cabling scheme pertains to 2522/2532 and 2322/2332 storage systems.

The diagram above shows a dual-controller enclosure cabled to 2130 drive enclosures featuring dual-expansion modules. Controller module 0A is connected to expansion module 1A, with a chain of connections continuing down (blue). Controller module 0B is connected to the lower expansion module (4B), of the last drive enclosure, with connections moving in the opposite direction (green).
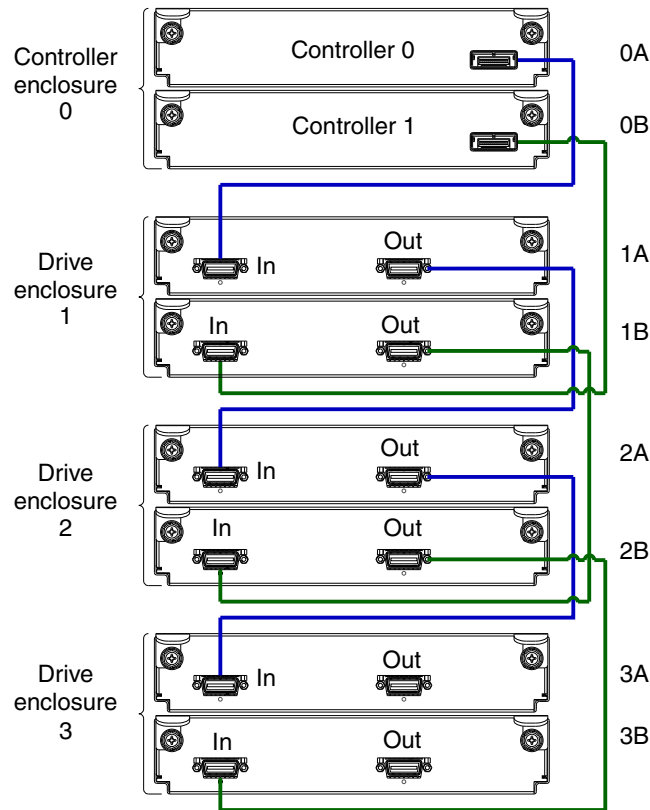
Figure 5 Non-fault-tolerant cabling between a dual-controller enclosure and 2130 drive enclosures

📝 **NOTE:** This cabling scheme pertains to 2522/2532 and 2322/2332 storage systems.

The diagram above shows a dual-controller enclosure cabled to 2130 drive enclosures featuring dual-expansion modules. Controller enclosure ID number 0, featuring dual controllers, is attached to three drive enclosures in straight-through fashion.
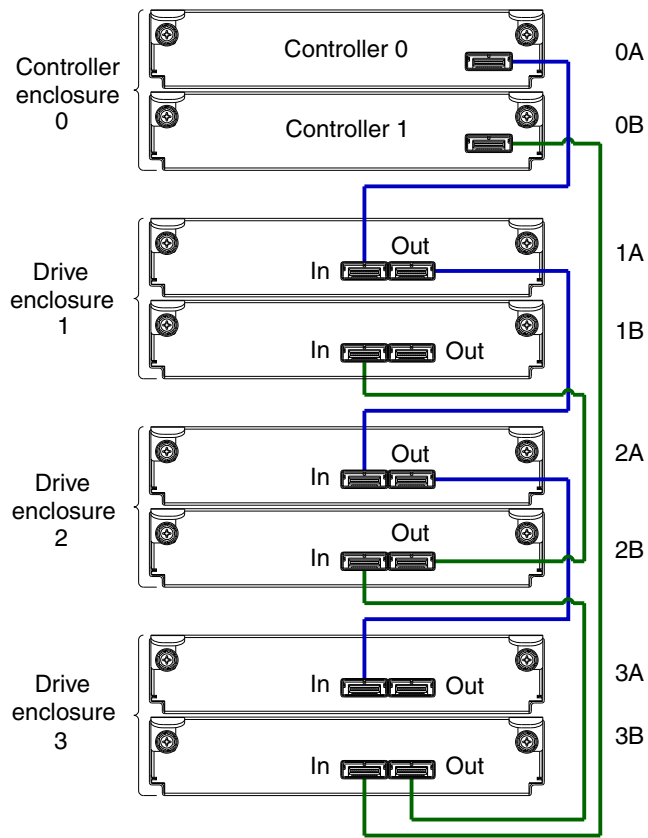
Figure 6 Fault-tolerant cabling between a dual-controller enclosure and three 2122 drive enclosures

NOTE: This cabling scheme pertains to 2522/2532 and 2322/2332 storage systems.

The diagram above shows a dual-controller enclosure cabled to 2122 drive enclosures featuring dual-expansion modules. Controller module 0A is connected to expansion module 1A, with a chain of connections continuing down (blue). Controller module 0B is connected to the lower expansion module (3B), of the last drive enclosure, with connections moving in the opposite direction (green).

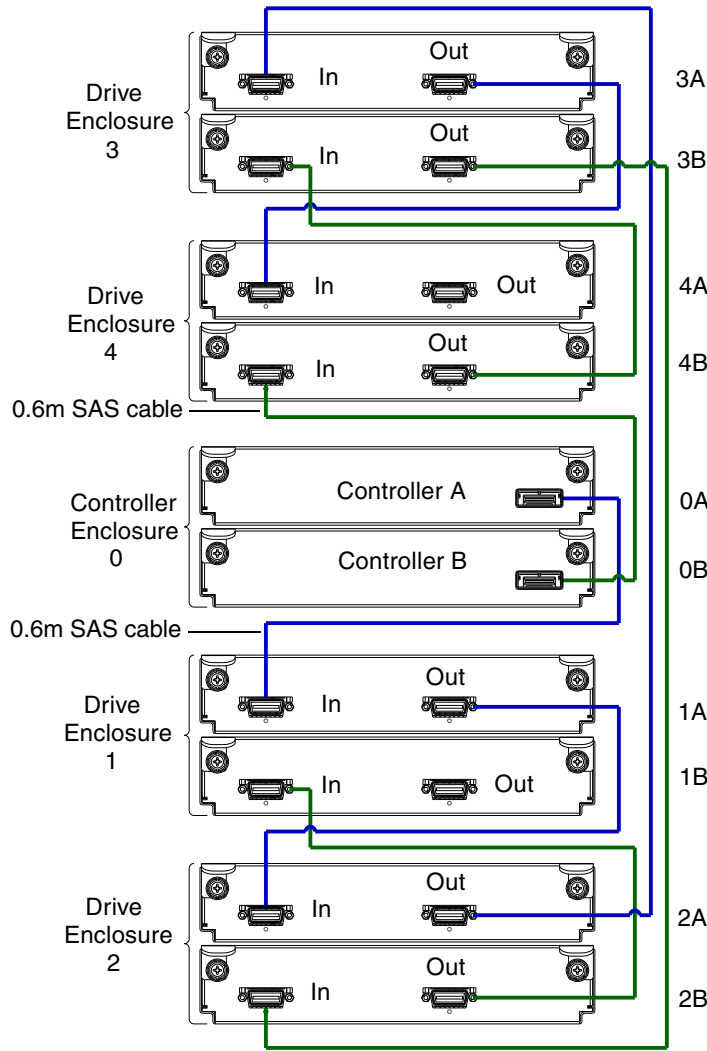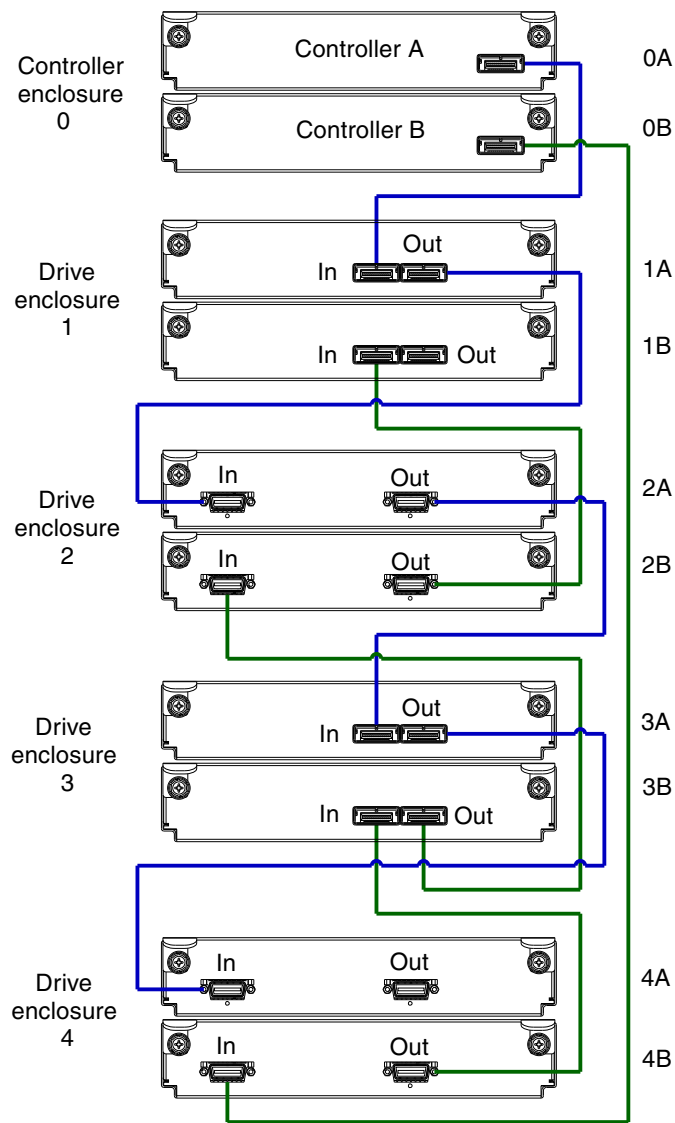**Figure 7** Fault-tolerant cabling between a dual-controller enclosure and mixed drive enclosures

📝 **NOTE:** This cabling scheme pertains to 2522/2532 and 2322/2332 storage systems.

The diagram above shows a dual-controller enclosure cabled to mixed-connect 2122 and 2130 drive enclosures featuring dual-expansion modules. Controller module 0A is connected to expansion module 1A, with a chain of connections continuing down (blue). Controller module 0B is connected to the lower expansion module (4B), of the last drive enclosure, with connections moving in the opposite direction (green).

Testing enclosure connections

1. Turn on both power supplies in each drive enclosure. This ensures that the disks in the drive enclosure have enough time to completely spin up before being scanned by the controller module(s) in the controller enclosure.

   While enclosures power up, their LEDs blink. After the LEDs stop blinking, if no LEDs on the front and back of the enclosure are amber, the power-on sequence is complete and no faults have been detected.

   For a description of LED behavior and status, see LED descriptions on page 51.

2. Turn on both power supplies in the controller enclosure.

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

If the enclosure's power-on sequence succeeds as described in step 1, the system is ready to be connected to hosts.

Obtaining IP values

Setting network port IP addresses using DHCP

1. Look in the DHCP server's pool of leased addresses for two IP addresses assigned to your 2002 Series controller enclosure.
2. Use a network management utility to discover 2002 Series storage devices on the local LAN through SNMP.
3. Use a `ping` broadcast to try to identify the device through the host's ARP table.

If you do not have a DHCP server, you will need to ask your system administrator to allocate two IP addresses and set them using the CLI (Command Line Interface) during initial configuration (see Setting network port IP addresses using the CLI).

Setting network port IP addresses using the CLI

If you did not use DHCP to set network port IP values, set them manually (default method) as described below.

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

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

If the default IP addresses are not compatible with your network, you must set an IP address for each management port using the command-line interface (CLI) embedded in each controller module. The CLI enables you to access the system using RS-232 communication and terminal emulation software.

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

Once new IP addresses are set, you can change them as needed using RAIDar. Be sure to change the IP address via RAIDar before changing the network configuration. See Accessing RAIDar on page 37 for more information concerning the web-based storage management application.

1. From your network administrator, obtain an IP address, subnet mask, and gateway address for controller A and controller B.
2. Use the provided micro-DB9 serial cable to connect the A controller to a serial port on a host computer (generic 2002 Series controller module shown).

Connect serial cable to port
on controller faceplate
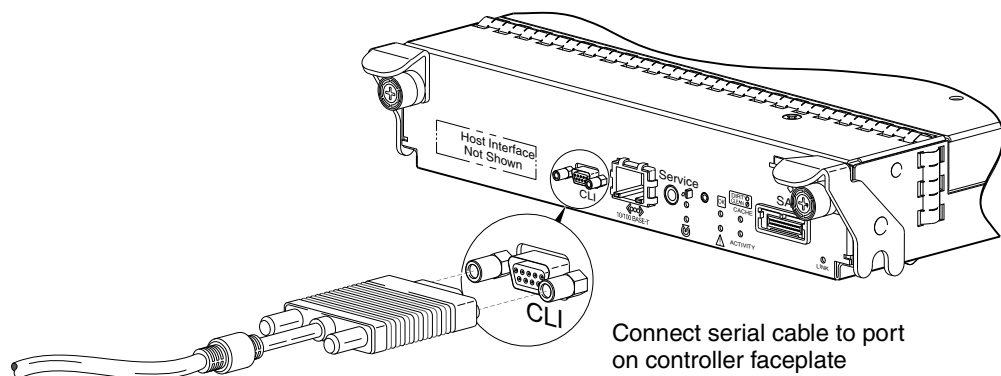
Your package includes a micro-DB9-to-DB9 serial cable. If necessary, use a DB9-to-DB25 adapter (not included) for connecting the serial cable to a DB25 serial port on the host computer.

3. Start and configure a terminal emulator, such as HyperTerminal or VT-100, using the display settings in Table 4 and the connection settings in Table 5.

Table 4 Terminal emulator display settings

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

Table 5 Terminal emulator connection settings

Parameter	Value
Connector	COM1 (typically)
Baud rate	115,200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

4. In the terminal emulator, connect to controller A.
5. Press Enter to display the CLI prompt (#).
6. At the prompt, enter the following command to set the values you obtained in step 1 for each Network port, first for controller A, and then for controller B:

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

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

   # set network-parameters ip 192.168.0.11 netmask 255.255.255.0 gateway
   193.168.0.1 controller b
   ```
7. Type the following command to verify the new IP addresses:
   ```
   show network-parameters
   ```
   Network parameters, including the IP address, subnet mask, and gateway address are displayed for each controller.
8. Use the `ping` command to verify network connectivity.

   For example:
   ```
   # ping 192.168.0.10 (gateway)
   Info: Pinging 192.168.0.10 with 4 packets.
   Success: Command completed successfully. The remote computer responded with 4
   packets.
   ```
9. In the host computer's command window, type the following command to verify connectivity, first for controller A and then for controller B:
   ```
   ping controller-IP-address
   ```
   If you cannot access your system for at least three minutes after changing the IP address, you might have to restart the Management Controller(s) using the serial CLI. When you restart a Management Controller, communication with it is temporarily lost until it successfully restarts.

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

```
restart mc both
```

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

Powering on/powering off

Before powering on the enclosure for the first time:

- Install all disk drives in the enclosure so the controller can identify and configure them at power-up.
- Connect the cables and power cords to the enclosure as explained in the Installation poster.
- Generally when powering up, make sure to power up the enclosures and associated data host in the following order:
  - Drive enclosures first
  - Controller enclosure next
  - Data hosts last (if they are powered down for maintenance purposes)

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

To power on the system:

1. Press the power switches at the back of each drive enclosure to the On position.
2. Press the power switches at the back of the controller enclosure to the On position.

To power off the system:

1. Stop all I/O from hosts to the system.
2. Shut down both controllers, using either substep *a* or *b* below:
   a. Use RAIDar to shut down both controllers as described in the online help and R/Evolution 2002 Series RAIDar User Guide.

   Proceed to step 3; or
   b. Use CLI to shut down both controllers as described in the R/Evolution 2002 Series CLI Reference Guide.
3. Press the power switches at the back of the controller enclosure to the Off position.
4. Press the power switches at the back of each drive enclosure to the Off position.

3 Connecting hosts

Host system requirements

Hosts connected to a 2002 Series controller enclosure must meet the following requirements:

- Depending on your system configuration, host operating systems may require that multipathing is supported.

> ☼ **TIP:** See the web-posted R/Evolution Installing Optional Software for Microsoft Windows® Server to aid in planning and implementing your MPIO DSM installation.

If fault tolerance is required, then multipathing software may be required. Host-based multipath software should be used in any configuration where two logical paths between the host and any storage volume may exist at the same time. This would include most configurations where there are multiple connections to the host or multiple connections between a switch and the storage.

- Use R/Evolution MPIO DSM with **Windows Server 2003**. Download the software from crc.dothill.com.
- Use native Microsoft MPIO DSM support with **Windows Server 2008**. Use either the Server Manager or the command line interface (*mpclaim* CLI tool) to perform the installation.

    See R/Evolution Installing Optional Software for Microsoft Windows® Server and the following web sites for information about using native Microsoft MPIO DSM:

    http://support.microsoft.com/gp/assistsupport

    http://technet.microsoft.com (search the site for "multipath I/O overview")

- To prevent **Microsoft Windows 2003** hosts from displaying the Found New Hardware Wizard when the storage system is discovered, install the R/Evolution SCSI Enclosure Services driver from crc.dothill.com.

> 📝 **NOTE:** The R/Evolution SCSI Enclosure Services driver is *required* for Windows Server 2003.

Connecting the enclosure to hosts

A *host* identifies an external port to which the storage system is attached. Cable connections vary depending on configuration. This section describes host interface protocols supported by 2002 Series controller enclosures, while showing a few common cable configurations.

> 📝 **NOTE:** 2002 Series controllers use Unified LUN Presentation (ULP) — a controller firmware feature enabling hosts to access mapped volumes via host ports — without the need for internal or external switches.

FC host ports

The 2722 and 2732 use Fibre Channel interface protocol for host port connection, featuring either one or two controller modules. Each controller provides two host ports supporting data rates up to 4 Gb per second, with an 800 MHz processor and 1 GB cache.

The 2722 and 2732 support Fibre Channel Arbitrated Loop (loop) topology by default. Connection mode can be set to loop or point-to-point. Loop protocol can be used in a physical loop or in a direct connection between two devices. Point-to-point protocol can only be used on a direct physical connection between exactly two devices.

SAS host ports

The 2522 and 2532 use Serial-attached SCSI interface protocol for host port connection, featuring either one or two controller modules. Each controller provides two SAS host ports supporting data rates up to 3 Gb/second per lane — and 4-lanes per SAS connector — featuring a 1.8 GHz processor with 128 MB memory, and 1 GB cache.

iSCSI host ports

The 2322 and 2332 use Internet SCSI interface protocol for host port connection, featuring either one or two controller modules. Each controller provides two iSCSI host ports — supporting data rates up to 1 Gb/second, featuring a 1.8 GHz processor with 128 MB memory, and 1 GB cache — using either one-way or mutual CHAP (Challenge-Handshake Authentication Protocol).

Connecting direct attach configurations

The 2002 Series controller enclosures each support up to four direct-connect server connections, two per controller module. Connect appropriate cables from the server's HBAs to the controller module's host ports as described below, and shown in the following illustrations.

- To connect the 2722 or 2732 to a server HBA or switch, use Fibre Channel cables supporting 1/2/4 Gb data rates, that are compatible with the controller module's host port SFP (small form pluggable transceiver) connector (850nm application).
- To connect the 2522 or 2532 to a server HBA or switch, use R/Evolution or OEM-qualified mini-SAS 4x cables. SAS cables connecting to host ports must support the SFF-8088 host port connector (also see Table 3 on page 20).
- To connect the 2322 or 2332 to a server or switch, use (CAT5-E minimum) Ethernet cables supporting the 1 Gb RJ-45 copper host port iSCSI connector.

Single-controller configurations

One server/one HBA/single path

Model-specific illustrations show single-controller configurations for 2002 Series controller enclosures supporting Fibre Channel, SAS, and iSCSI host interface protocols.
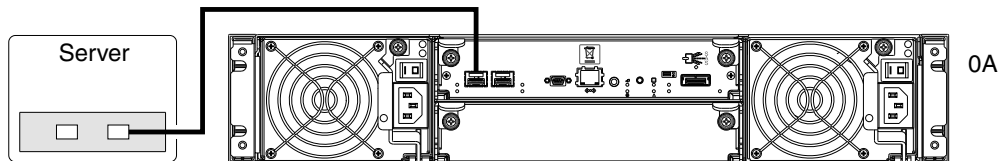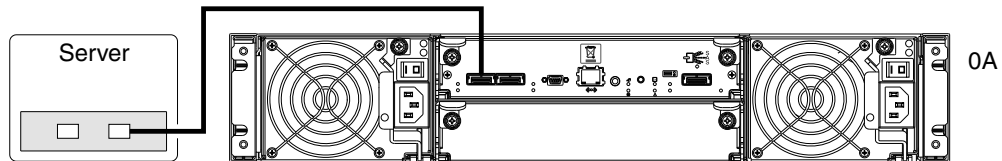
Dual-controller configurations

In a dual-controller system, hosts use LUN-identifying information from both controllers to determine that up to four paths are available to a given storage volume. A host can use any available data path to access a volume owned by either controller. The path providing the best performance is through host

ports on the volume's owning controller. Controllers share one set of 512 LUNs (0-511) for use in mapping volumes to hosts (see "ULP" in the R/Evolution 2002 Series RAIDar User Guide).

One server/one HBA/dual path

Model-specific illustrations show dual-controller configurations for 2002 Series controller enclosures supporting Fibre Channel, SAS, and iSCSI host interface protocols.

2722/2732
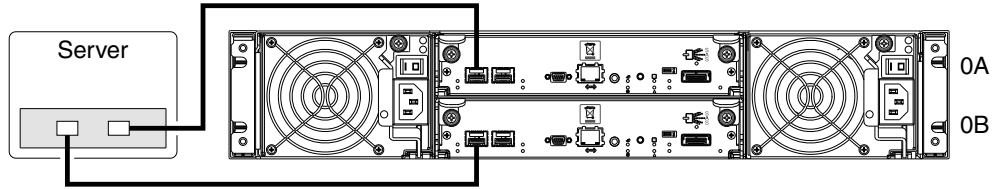
2522/2532
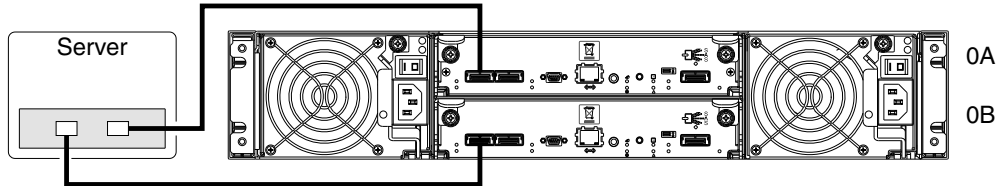
2322/2332
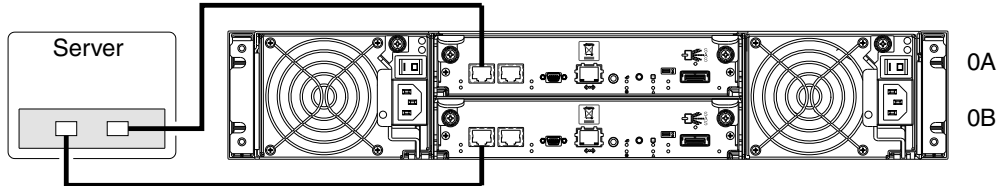
Two servers/one HBA per server/dual path

Model-specific illustrations show two-server/dual-controller configurations for 2002 Series controller enclosures supporting Fibre Channel, SAS, and iSCSI host interface protocols.

2722/2732
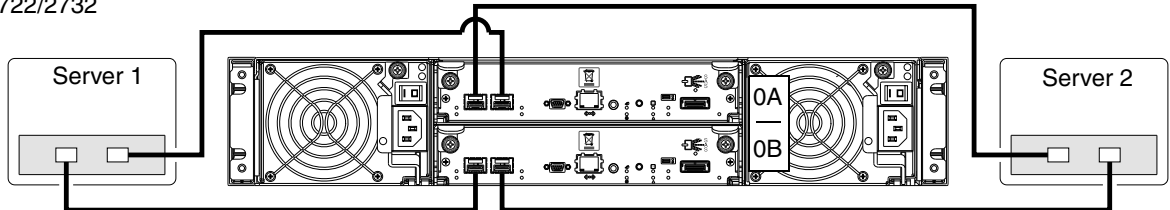
2522/2532
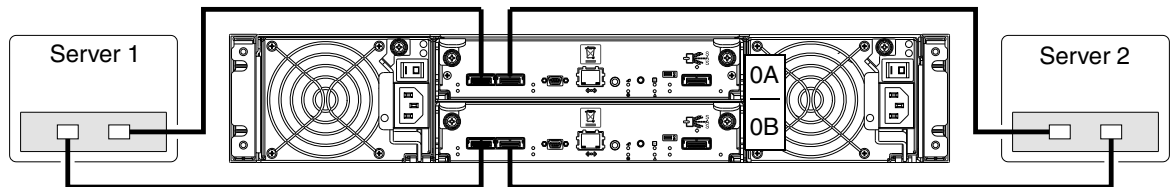
2322/2332
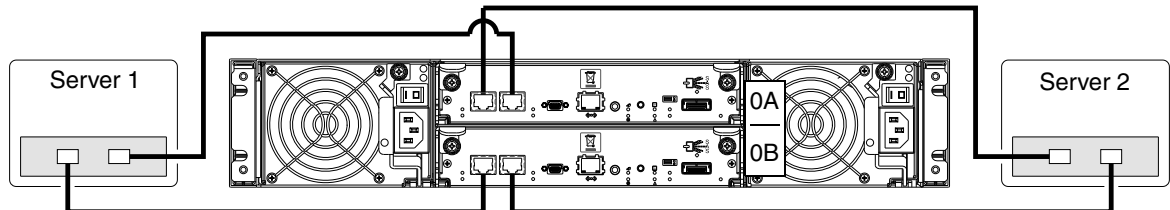
Connecting switch attach configurations

## Two servers/two switches

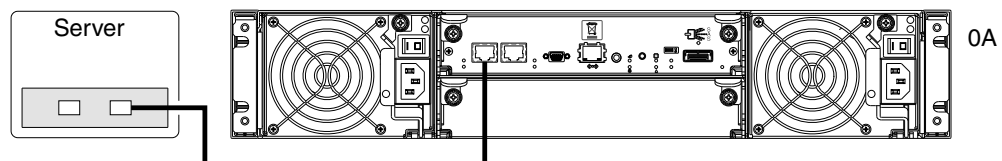Model-specific illustrations show switch-connect configurations for 2002 Series controller enclosures supporting Fibre Channel, SAS, and iSCSI host interface protocols. Connect appropriate cables from controller host ports to switch ports, and from switch ports to hosts.

2722/2732
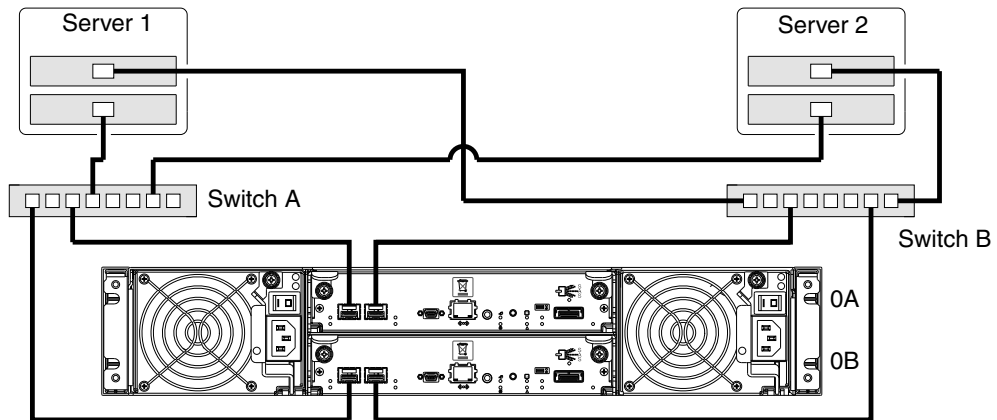
2522/2532
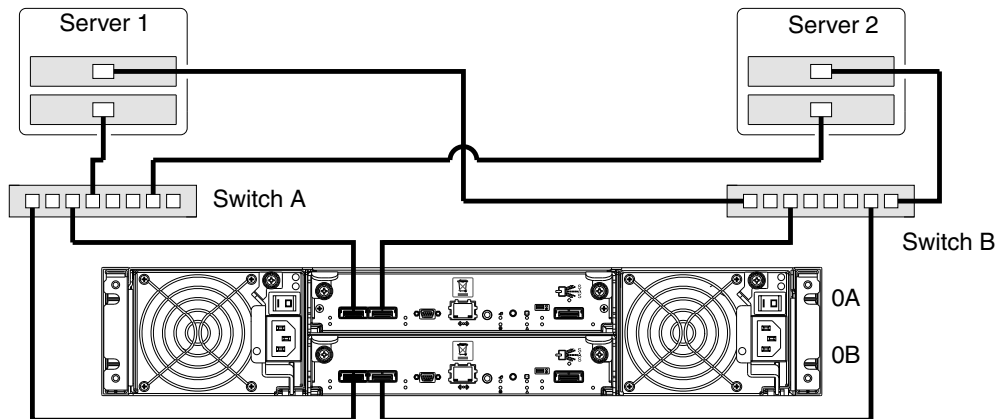
2322/2332
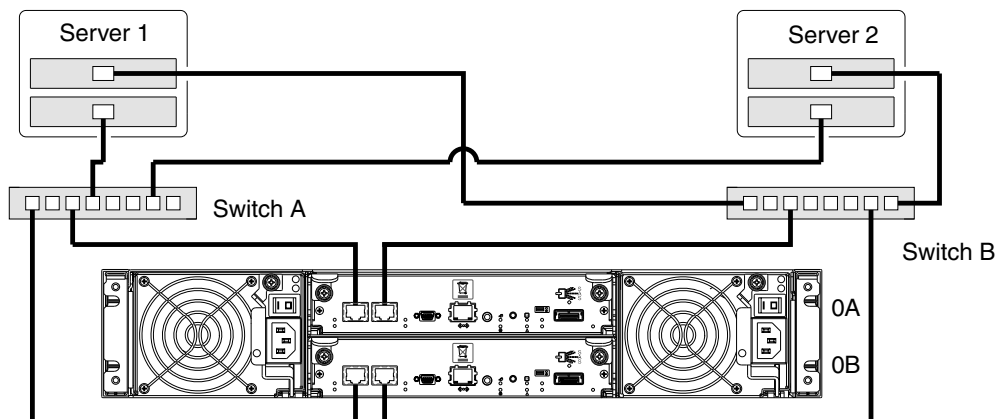
Connecting a management host on the network

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

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

📝 **NOTE:** Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations. See R/Evolution Product Regulatory Compliance and Safety (included in your product's ship kit).

Alternatively, you can access the document online. See Dot Hill's customer resource center (CRC) web site for additional information:

crc.dothill.com

Select R/Evolution Products and go to R/Evolution 2002 Series.

4   Basic operation

Accessing RAIDar

Once the hardware installation is complete, you can access the storage system's web-based management interface, RAIDar, to manage and monitor its functions. To sign in to RAIDar, use the default user name **manage** and password **!manage**.

For detailed information on accessing and using RAIDar, see the "Getting Started" section in the web-posted R/Evolution 2002 Series RAIDar User Guide. The section provides instructions for signing in to RAIDar, introduces key system concepts, addresses browser setup, and provides tips for using the main window and the help window.

☼ **TIP:**   After signing into RAIDar, you can use its online help as an alternative to consulting the user guide.

Configuring and provisioning the storage system

Once you have familiarized yourself with RAIDar, use it to configure and provision the storage system. Refer to the following topics within the RAIDar user guide or online help:

- Configuring the system
- Provisioning the system

5   Troubleshooting

Fault isolation methodology

R/Evolution 2002 Series storage systems provide many ways to isolate faults. This section presents the basic methodology used to locate faults within a storage system, and to identify the pertinent FRUs (Field Replaceable Units) affected.

The basic fault isolation steps are:

- Gather fault information, including using system LEDs
- Determine where in the system the fault is occurring
- Review event logs
- If required, isolate the fault to a data path component or configuration

Gather fault information

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

Begin by reviewing the reported fault:

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

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

Determine where the fault is occurring

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

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

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

Review the event logs

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

Isolate the fault

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

If the enclosure does not initialize

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

- Perform a rescan

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

Correcting enclosure IDs

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

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

```
rescan
```

To rescan using RAIDar:

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

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

Diagnostic steps

This section describes possible reasons and actions to take when an LED indicates a fault condition. See Appendix A – LED descriptions for descriptions of all LED statuses.

Is the front panel Fault/Service Required LED amber?

Answer	Possible Reasons	Actions
No	System functioning properly.	No action required.
Yes	A fault condition exists.	• Check the LEDs on the back of the controller to narrow the fault to a FRU, connection, or both. • Check the event log for specific information regarding the fault.

Is the controller back panel FRU OK LED off?

Answer	Possible Reasons	Actions
No (blinking)	System functioning properly. System is booting.	No action required. Wait for system to boot.
Yes	The controller module is not powered on. The controller module has failed.	• Check that the controller module is fully inserted and latched in place, and that the enclosure is powered on. • Check the event log for specific information regarding the failure.

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

Answer	Possible Reasons	Actions
No	System functioning properly.	No action required.
Yes (blinking)	One of the following errors occurred: • Hardware-controlled power-up error • Cache flush error • Cache self-refresh error	• Restart this controller from the other controller using RAIDar or the CLI • Remove the controller and reinsert it • Contact an authorized service provider for assistance • Replace the controller

Are both drive module LEDs off?

Answer	Possible Reasons	Actions
Yes	• There is no power • The drive is offline • The drive is not configured	• Check that the drive is fully inserted and latched in place, and that the enclosure is powered on

Is the drive module Power/Activity/Fault LED blinking amber?

Answer	Possible Reasons	Actions
No, but the **Online/Activity LED** is **blinking**.	The drive is rebuilding.	No action required. △ **CAUTION:** Do not remove a drive that is rebuilding. Doing so may terminate the current operation and cause data loss.
Yes, and the **Online/Activity LED** is **off**.	The drive is offline. A predictive failure alert may have been received for this device.	• Check the event log for specific information regarding the fault • Isolate the fault • Contact an authorized service provider for assistance
Yes, and the **Online/Activity LED** is **blinking**.	The drive is active, but a predictive failure alert may have been received for this device.	• Check the event log for specific information regarding the fault • Isolate the fault • Contact an authorized service provider for assistance

Is a connected host port's Host Link Status LED off?

Answer	Possible Reasons	Actions
No	System functioning properly.	No action required (see Link LED note: page 57).
Yes	The link is down.	• Check cable connections and reseat if necessary • Inspect cable for damage • Swap cables to determine if fault is caused by a defective cable. Replace cable if necessary • Verify that the switch, if any, is operating properly. If possible, test with another port • Verify that the HBA is fully seated, and that the PCI slot is powered on and operational • In RAIDar, review event logs for indicators of a specific fault in a host data path component • Contact an authorized service provider for assistance • See Isolating a host-side connection fault on page 44

Is a connected port's Expansion Port Status LED off?

Answer	Possible Reasons	Actions
No	System functioning properly.	No action required.
Yes	The link is down.	• Check cable connections and reseat if necessary • Inspect cable for damage • Swap cables to determine if fault is caused by a defective cable. Replace cable if necessary • In RAIDar, review the event logs for indicators of a specific fault in a host data path component • Contact an authorized service provider for assistance • See Isolating a controller module expansion port connection fault on page 46

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

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

Is the power supply's AC Power Good LED off?

Answer	Possible Reasons	Actions
No	System functioning properly.	No action required.
Yes	The power supply is not receiving adequate power.	• Verify that the power cord is properly connected and check the power source it is connected to • Check that the power supply FRU is firmly locked into position • Check the event log for specific information regarding the fault • Isolate the fault • Contact an authorized service provider for assistance

Is the drive enclosure back panel OK LED off?

Answer	Possible Reasons	Actions
No	System functioning properly.	No action required.
Yes	The power supply unit or a fan is operating at an unacceptable voltage/RPM level, or has failed.	When isolating faults in the power supply, remember that the fans in both modules receive power through a common bus on the midplane, so if a power supply unit fails, the fans continue to operate normally. • Verify that the power supply FRU is firmly locked into position • Verify that the AC cord is connected to a power source • Verify that the AC cord is connected to the enclosure's power supply unit

Is the drive enclosure Fault/Service Required LED amber?

Answer	Possible Reasons	Actions
No	System functioning properly.	No action required.
Yes (blinking)	One of the following errors occurred: • Hardware-controlled power-up error • Cache flush error • Cache self-refresh error	• Check the event log for specific information regarding the fault • Isolate the fault • Contact an authorized service provider for assistance • Replace if necessary
Yes	A fault occurred. If installing an I/O module FRU, the module has not gone online and likely failed its self-test.	• Check the event log for specific information regarding the fault • Isolate the fault • Contact an authorized service provider for assistance • Replace if necessary • If installing an I/O module FRU, try removing and reinstalling the new I/O module, and check the event log for errors

Controller failure in a single-controller configuration

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

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

Answer	Actions
No, the Cache LED status is off, and the controller does not boot.	If valid data is thought to be in Flash, see Transporting cache via professional services; otherwise, replace the controller.
No, the Cache Status LED is off, and the controller boots.	The system is flushing data to disks. If the problem persists, replace the controller.
Yes, at a strobe 1:10 rate - 1 Hz, and the controller does not boot.	See Transporting cache via professional services.
Yes, at a strobe 1:10 rate - 1 Hz, and the controller boots.	The system is flushing data to disks. If the problem persists, replace the controller.
Yes, at a blink 1:1 rate - 1 Hz, and the controller does not boot.	See Transporting cache via professional services.
Yes, at a blink 1:1 rate - 1 Hz, and the controller boots.	The system is flushing data to disks. If the problem persists, replace the controller.

Transporting cache via professional services

IMPORTANT: Transportable cache only applies to single-controller configurations. In dual-controller configurations, there is no need to transport a failed controller's cache to a replacement controller because the cache is duplicated between the controllers.

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

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

Isolating a host-side connection fault

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

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

2722/2732 host-side connection troubleshooting

The procedure below pertains to the R/Evolution 2002 Series Fibre Channel host port controller enclosures possessing the small form factor pluggable (SFP) transceiver connector.

1. Halt all I/O to the storage system.
2. Check the host activity LED.
   If there is activity, halt all applications that access the storage system.
3. Inspect the cable for damage.
4. Reseat the SFP and FC cable.
   Is the host link status LED on?
   - Yes – Monitor the status to ensure that there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
   - No – Proceed to the next step.
5. Move the SFP and cable to a port with a known good link status.
   This step isolates the problem to the external data path (SFP, host cable, and host-side devices) or to the controller module port.
   Is the host link status LED on?
   - Yes – You now know that the SFP, host cable, and host-side devices are functioning properly. Return the SFP and cable to the original port. If the link status LED remains off, you have isolated the fault to the controller module's port. Replace the controller module.
   - No – Proceed to the next step.
6. Swap the SFP with the known good one.
   Is the host link status LED on?
   - Yes – You have isolated the fault to the SFP. Replace the SFP.
   - No – Proceed to the next step.
7. Re-insert the original SFP and swap the cable with a known good one.
   Is the host link status LED on?
   - Yes – You have isolated the fault to the cable. Replace the cable.
   - No – Proceed to the next step.
8. Verify that the switch, if any, is operating properly. If possible, test with another port.
9. Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.
10. Replace the HBA with a known good HBA, or move the host side cable and SFP to a known good HBA.
    Is the host link status LED on?
    - Yes – You have isolated the fault to the HBA. Replace the HBA.
    - No – It is likely that the controller module needs to be replaced.
11. Move the cable and SFP back to its original port.
    Is the host link status LED on?
    - No – The controller module's port has failed. Replace the controller module.
    - Yes – Monitor the connection for a period of time. It may be an intermittent problem, which can occur with SFPs, damaged cables, and HBAs.

General host-side connection troubleshooting

The procedure below applies to the R/Evolution 2002 Series SAS and iSCSI host port controller enclosures.

1. Halt all I/O to the storage system.
2. Check the host activity LED.
   If there is activity, halt all applications that access the storage system.
3. Inspect the cable for damage.
4. Reseat the cable.
   Is the host link status LED on?

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

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

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

Is the host link status LED on?

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

6. Verify that the switch, if any, is operating properly. If possible, test with another port.
7. Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.
8. Replace the HBA with a known good HBA, or move the host side cable to a known good HBA.

Is the host link status LED on?

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

9. Move the cable back to its original port.

Is the host link status LED on?

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

Isolating a controller module expansion port connection fault

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

This procedure requires scheduled downtime.

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

---

1. Halt all I/O to the storage system.
2. Check the host activity LED.

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

3. Reseat the expansion cable, and inspect it for damage.

Is the expansion port status LED on?

- Yes – Monitor the status to ensure there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
- No – Proceed to step 4.

4. Move the expansion cable to a port on the controller enclosure with a known good link status.

This step isolates the problem to the expansion cable or to the controller module's expansion port.

Is the expansion port status LED on?

- Yes – You now know that the expansion cable is good. Return the cable to the original port. If the expansion port status LED remains off, you have isolated the fault to the controller module's expansion port. Replace the controller module.
- No – Proceed to the next step.

5. Move the expansion cable back to the original port on the controller enclosure.
6. Move the expansion cable on the drive enclosure to a known good expansion port on the drive enclosure.

Is the expansion port status LED on?

- Yes – You have isolated the problem to the drive enclosure's port. Replace the expansion module.
- No – Proceed to step 7.

7. Replace the cable with a known good cable, ensuring the cable is attached to the original ports used by the previous cable.

Is the host link status LED on?

- Yes – Replace the original cable. The fault has been isolated.
- No – It is likely that the controller module must be replaced.

Resolving voltage and temperature warnings

1. Check that all of the fans are working by making sure each power supply's DC Voltage/Fan Fault/Service Required LED is off, or by using RAIDar to check for yellow yield icon hardware warnings. (In the Configuration View panel, right click the enclosure and click **View > Overview**.)
2. Make sure that all modules are fully seated in their slots and that their latches are locked.
3. Make sure that no slots are left open for more than two minutes.

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

Sensor locations

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

The following sections describe each element and its sensors.

Power supply sensors

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

Table 6   Power supply sensors

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

Cooling fan sensors

Each power supply includes two fans. The normal range for fan speed is 4000 to 6000 RPM. When a fan's speed drops below 4000 RPM, the EMP considers it a failure and posts an alarm in the storage system's event log. The following table lists the description, location, and alarm condition for each fan. If the fan speed remains under the 4000 RPM threshold, the internal enclosure temperature may continue to rise. Replace the power supply reporting the fault.

Table 7 Cooling fan sensor descriptions

Description	Location	Event/Fault ID LED condition
Fan 1	Power supply 1	< 4000 RPM
Fan 2	Power supply 1	< 4000 RPM
Fan 3	Power supply 2	< 4000 RPM
Fan 4	Power supply 2	< 4000 RPM

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

Temperature sensors

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

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

Table 8 Controller module temperature sensors

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

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

Table 9 Power supply temperature sensors

| Description	Normal operating range
Power Supply 1 temperature	−10–80°C
Power Supply 2 temperature	−10–80°C

Power supply module voltage sensors

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

Table 10 Voltage sensor descriptions

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

A   **LED descriptions**

2722/2522/2322 front panel LEDs

Left ear   Right ear
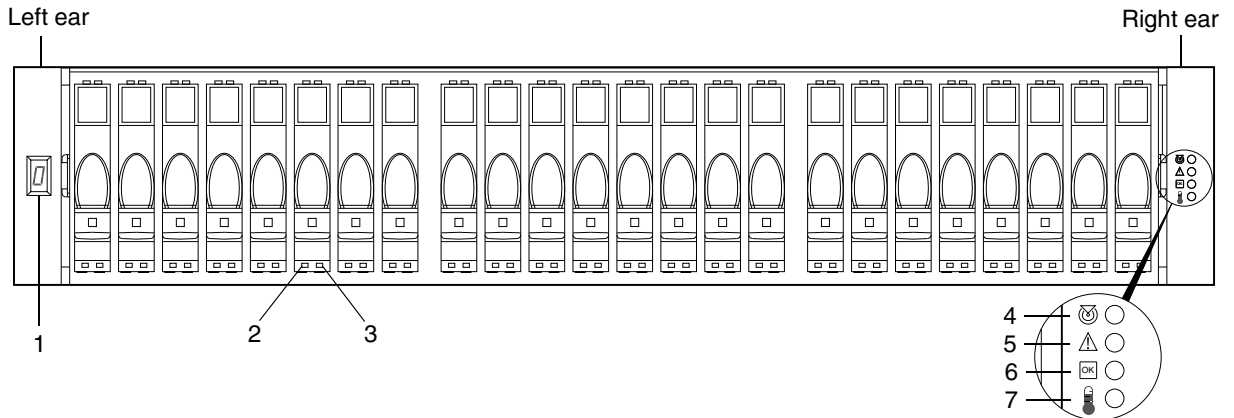
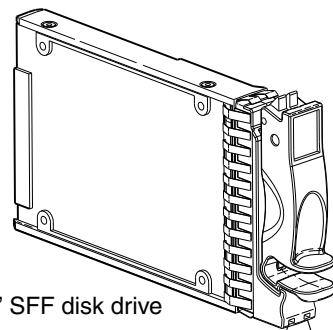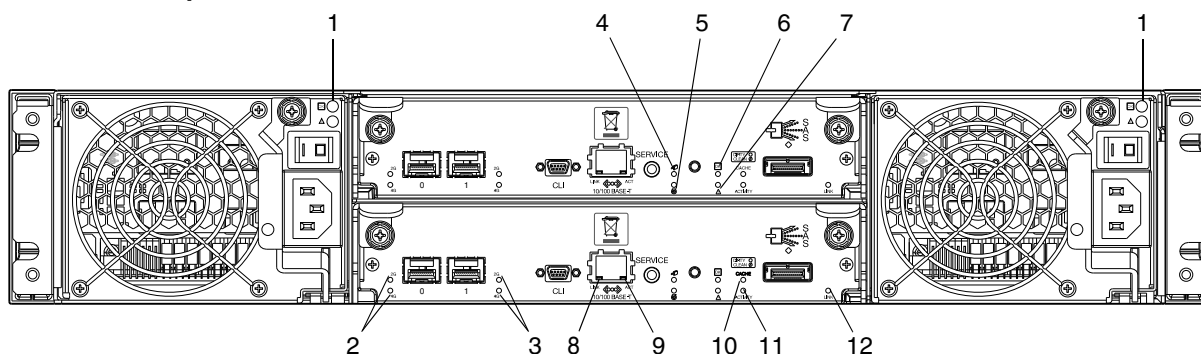| LED	Description	Definition
1	Enclosure ID	Green — On Enables you to correlate the enclosure with logical views presented by management software. Sequential enclosure ID numbering of controller enclosures begins with the integer 0. The enclosure ID for an attached drive enclosure is nonzero.
2	Disk drive — Left LED	See Table 11 on page 53, Disk drive LEDs.
3	Disk drive — Right LED	See Table 11 on page 53, Disk drive LEDs.
4	Unit Locator ID	White blink — Enclosure is identified Off — Normal operation
5	Fault/Service Required ID	Yellow — On Enclosure-level fault condition exists. The event has been acknowledged but the problem needs attention. Off — No fault condition exists.
6	FRU OK (Heartbeat)	Green — On The enclosure is powered on with at least one power supply operating normally. Off — Both power supplies are off; the system is powered off.
7	Temperature Fault	Green — Off The enclosure temperatures is normal. Yellow — On The enclosure temperature is above threshold.

2732/2532/2332 front panel LEDs
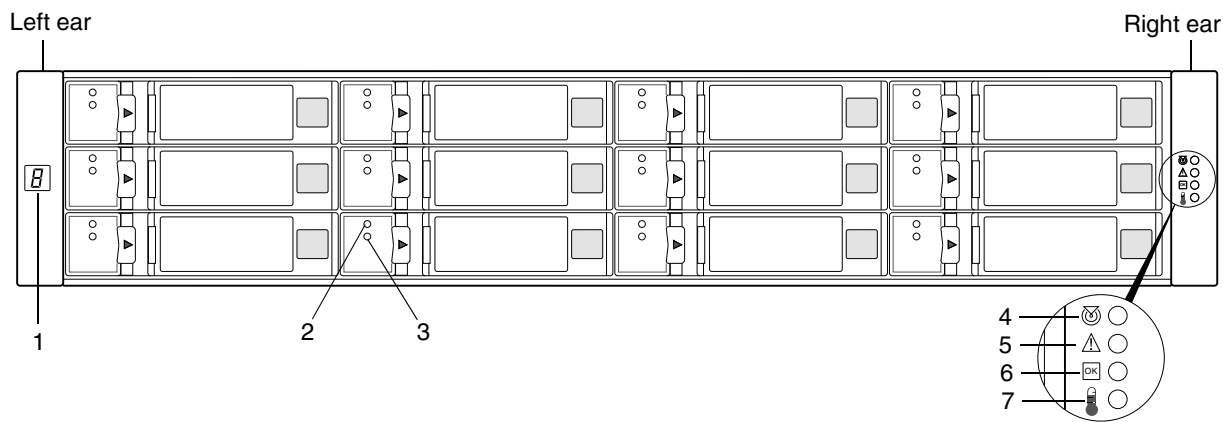
LED	Description	Definition
1	Enclosure ID	Yellow — On Enables you to correlate the enclosure with logical views presented by management software. Sequential enclosure ID numbering of controller enclosures begins with the integer 0. The enclosure ID for an attached drive enclosure is nonzero.
2	Disk drive — Upper LED	See Table 11 on page 53, Disk drive LEDs.
3	Disk drive — Lower LED	See Table 11 on page 53, Disk drive LEDs.
4	Unit Locator ID	White blink — Enclosure is identified Off — Normal operation
5	Fault/Service Required ID	Yellow — On Enclosure-level fault condition exists. The event has been acknowledged but the problem needs attention. Off — No fault condition exists.
6	FRU OK (Heartbeat)	Green — On The enclosure is powered on with at least one power supply operating normally. Off — Both power supplies are off; the system is powered off.
7	Temperature Fault	Green — Off The enclosure temperature is normal. Yellow — On The enclosure temperature is above threshold.

Disk drive LEDs
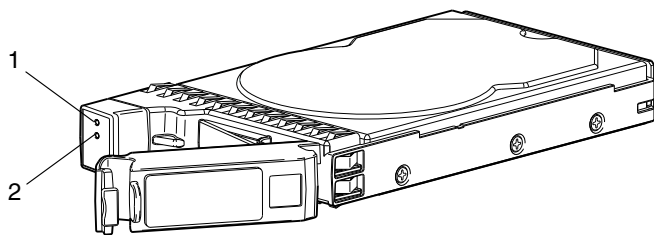
3.5" LFF disk drive   2.5" SFF disk drive

Table 11   LEDs for LFF and SFF disk drives

LED No./Description	Color	State	Definition
1— OK to Remove	Blue	On	The drive module has been removed from any active virtual disk, spun down, and prepared for removal.
		Off	The drive module is not prepared for removal.
2—Power/Activity/Fault	Green	On	The drive module is operating normally.
		Blink	The drive module is active and processing I/O, or is performing a media scan.
		Off	If neither green nor yellow, the drive module is not powered on.
2—Power/Activity/Fault	Yellow	On	The drive has experienced a fault, or has failed; the vdisk is initializing or rebuilding; or the vdisk is down or critical.
		Blink	Physically identifies the drive module.
		Off	If neither green nor yellow, the drive module is not powered on.

2722/2732 rear panel LEDs

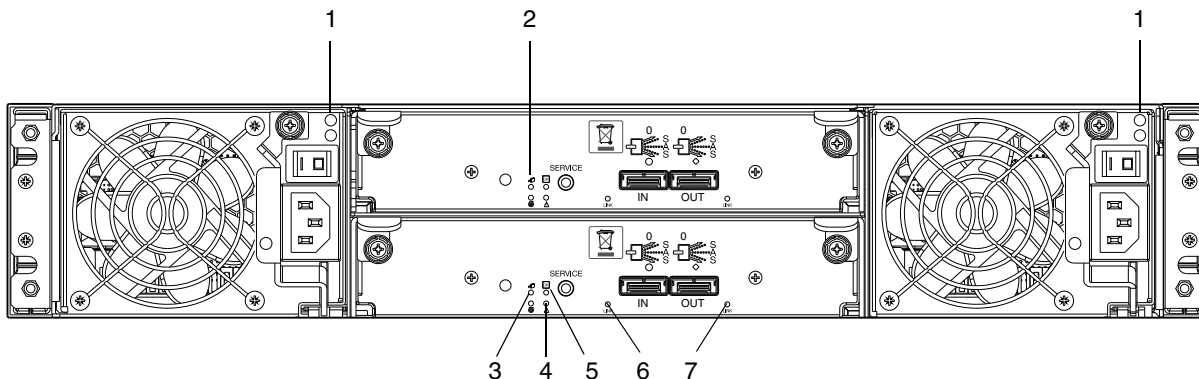| LED No./Description	Color	State	Definition
1 — Power Supply	—	—	See Power supply LEDs on page 59.
2 — Host Link Status/ Activity FC port 0 3 — Host Link Status/ Activity FC port 1	Green	On Off Blink	2G LED illuminates — link speed is 2-Gbps 4G LED illuminates — link speed is 4-Gbps Both LEDs off — link speed is 1-Gbps 1Hz — no link detected
4 — OK to Remove	Blue	On Off	The controller module can be removed. The controller module is not prepared for removal.
5 — Unit Locator	White	Off Blink	Normal operation. Physically identifies the controller module.
6 — FRU OK	Green	On Off Blink	Controller module is operating normally. Controller module is not OK. System is booting.
7 — Fault/Service Required	Yellow	On Blink	A fault is detected or a service action is required. Hardware-controlled power-up, or a cache flush or restore error.
8 — Network Port Link Status	Green	On Off	The Ethernet link is up. Ethernet port is not connected or the link is down.
9 — Network Port Activity	Green	Off Blink	Ethernet link has no I/O activity. Ethernet link has I/O activity.
10 — Cache Status	Green	On Off Blink	Cache is dirty and operation is normal. Cache is clean (contains no unwritten data). Compact Flash flush or cache self-refresh is in progress, indicating cache activity.
11 — Host Activity	Green	Off Blink	Host ports have no I/O activity. At least one host port has I/O activity.
12 — Expansion Port Status	Green	On Off	Port is connected and the link is up. Port is empty or link is down.

2522/2532 rear panel LEDs

LED No./Description	Color	State	Definition
1 — Power Supply	—	—	See Power supply LEDs on page 59.
2 — Host 3 Gb SAS (Port 0) Link Status	Green	On Off	The port is connected and the link is up. The port is empty or the link is down.
Link Activity	Green	Blink Off	Link has I/O activity. Link is idle.
3 — Host 3 Gb SAS (Port 1) Link Status	Green	On Off	The port is connected and the link is up. The port is empty or the link is down.
Link Activity	Green	Blink Off	Link has I/O activity. Link is idle.
4 — OK to Remove	Blue	On Off	The controller module can be removed. The controller module is not prepared for removal.
5 — Unit Locator	White	Off Blink	Normal operation. Physically identifies the controller module.
6 — FRU OK	Green	On Off Blink	Controller module is operating normally. Controller module is not OK. System is booting.
7 — Fault/Service Required	Yellow	On Blink	A fault is detected or a service action is required. Hardware-controlled power-up, or a cache flush or restore error.
8 — Network Port Link Status	Green	On Off	Ethernet link is up. Ethernet port is not connected or the link is down.
9 — Network Port Activity	Green	Off Blink	Ethernet link has no I/O activity. Ethernet link has I/O activity.
10 — Cache Status	Green	On Off Blink	Cache is dirty and operation is normal. Cache is clean (contains no unwritten data). CompactFlash flush or cache self-refresh is in progress, indicating cache activity.
11 — Host Activity	Green	Off Blink	Host ports have no I/O activity. At least one host port has I/O activity.
12 — Expansion Port Status	Green	On Off	The port is connected and the link is up. The port is empty or the link is down.

2322/2332 rear panel LEDs

LED No./Description	Color	State	Definition
1 — Power Supply	—	—	See Power supply LEDs on page 59.
2 — Host 1 Gb iSCSI (Port 0) Link Status	Green	On Off	The port is connected and the link is up. The port is empty or the link is down.
Link Activity	Green	Blink Off	Link has I/O activity. Link is idle.
3 — Host 1 Gb iSCSI (Port 1) Link Status	Green	On Off	The port is connected and the link is up. The port is empty or the link is down.
Link Activity	Green	Blink Off	Link has I/O activity. Link is idle.
4 — OK to Remove	Blue	On Off	The controller module can be removed. The controller module is not prepared for removal.
5 — Unit Locator	White	Off Blink	Normal operation. Physically identifies the controller module.
6 — FRU OK	Green	On Off Blink	Controller module is operating normally. Controller module is not OK. System is booting.
7 — Fault/Service Required	Yellow	On Blink	A fault is detected or a service action is required. Hardware-controlled power-up, or a cache flush or restore error.
8 — Network Port Link Status	Green	On Off	Ethernet link is up. Ethernet port is not connected or the link is down.
9 — Network Port Activity	Green	Off Blink	Ethernet link has no I/O activity. Ethernet link has I/O activity.
10 — Cache Status	Green	On Off Blink	Cache is dirty and operation is normal. Cache is clean (contains no unwritten data). CompactFlash flush or cache self-refresh is in progress, indicating cache activity.
11 — Host Activity	Green	Off Blink	Host ports have no I/O activity. At least one host port has I/O activity.
12 — Expansion Port Status	Green	On Off	The port is connected and the link is up. The port is empty or the link is down.

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

When a controller is shut down or otherwise rendered inactive — its Link Status LED remains illuminated—falsely indicating that the controller can communicate with the host. Though a link exists between the host and the chip on the controller, the controller is not communicating with the chip. To reset the LED, the controller must be power-cycled (see Powering on/powering off on page 29).

2122 24-drive enclosure rear panel LEDs

LED No./Description	Color	State	Definition
1 — Power Supply	—	—	See Power supply LEDs on page 59.
2 — Unit Locator	White	Off Blink	Normal operation. Physically identifies the expansion module.
3 — OK to Remove	Blue	Off	Not implemented.
4 — Fault/Service Required	Yellow	On Blink	A fault is detected or a service action is required. Hardware-controlled power-up, or a cache flush or restore error.
5 — FRU OK	Green	On Off Blink	Expansion module is operating normally. Expansion module is not OK. System is booting.
6 — SAS In Port Status	Green	On Off	Port is connected and the link is up. Port is empty or link is down.
7 — SAS Out Port Status	Green	On Off	Port is connected and the link is up. Port is empty or link is down.

2130 12-drive enclosure rear panel LEDs

LED No./Description	Color	State	Definition
1 — Power Supply	—	—	See Power supply LEDs on page 59.
2 — Unit Locator	White	Off Blink	Normal operation. Physically identifies the expansion module.
3 — SAS In Port Status	Green	On Off	Port is connected and link is up. Port is empty or link is down.
4 — OK to Remove	Blue	Off	Not implemented.
5 — Fault/Service Required	Yellow	On Blink	A fault is detected or a service action is required. Hardware-controlled power-up, or a cache flush or restore error.
6 — FRU OK	Green	On Off Blink	Expansion module is operating normally. Expansion module is not OK. System is booting.
7 — SAS Out Port Status	Green	On Off	Port is connected and link is up. Port is empty or link is down.

Power supply LEDs

Power redundancy is achieved through two independent load-sharing power supplies. In the event of a power supply failure, or the failure of the power source, the storage system can operate continuously on a single power supply. Greater redundancy can be achieved by connecting the power supplies to separate circuits.
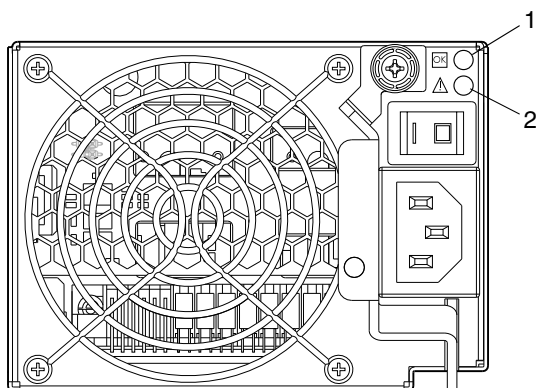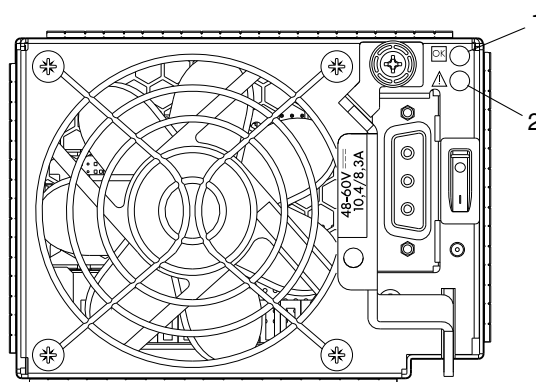
AC model   DC model

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

B   Environmental requirements and specifications

Safety requirements

Install the system in accordance with the local safety codes and regulations at the facility site. Follow all cautions and instructions marked on the equipment.

📝 **IMPORTANT:**   Also see the hard copy R/Evolution Product Regulatory Compliance and Safety document (included in your product's ship kit).

Alternatively, you can access the document online. See Dot Hill's customer resource center (CRC) web site for additional information:

crc.dothill.com

Select R/Evolution Products and go to R/Evolution 2002 Series.

Site requirements and guidelines

The following sections provide requirements and guidelines that you must address when preparing your site for the installation.

When selecting an installation site for the system, choose a location not subject to excessive heat, direct sunlight, dust, or chemical exposure. These conditions greatly reduce the system's longevity and might void your warranty.

Site wiring and AC power requirements

The following are required for all installations using AC power supplies:

- All AC mains and supply conductors to power distribution boxes for the rack-mounted system must be enclosed in a metal conduit or raceway when specified by local, national, or other applicable government codes and regulations.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- To ensure redundancy, provide two separate power sources for the enclosures. These power sources must be independent of each other, and each must be controlled by a separate circuit breaker at the power distribution point.
- The system requires voltages within minimum fluctuation. The customer-supplied facilities' voltage must maintain a voltage with not more than ± 5 percent fluctuation. The customer facilities must also provide suitable surge protection.
- Site wiring must include an earth ground connection to the AC power source. The supply conductors and power distribution boxes (or equivalent metal enclosure) must be grounded at both ends.
- Power circuits and associated circuit breakers must provide sufficient power and overload protection. To prevent possible damage to the AC power distribution boxes and other components in the rack, use an external, independent power source that is isolated from large switching loads (such as air conditioning motors, elevator motors, and factory loads).

Site wiring and DC power requirements

The following are required for all installations using DC power supplies:

- All DC mains and supply conductors to power distribution boxes for the rack-mounted system must comply with local, national, or other applicable government codes and regulations.
- Ensure that the voltage of your power source matches the voltage inscribed on the equipment's electrical label.

- To ensure redundancy, provide two separate power sources for the enclosures. These power sources must be independent of each other, and each must be controlled by a separate circuit breaker at the power distribution point.
- The system requires voltages within minimum fluctuation. The customer-supplied facilities' voltage must maintain a voltage within the range specified on the equipment's electrical rating label. The customer facilities must also provide suitable surge protection.
- Site wiring must include an earth ground connection to the DC power source. Grounding must comply with local, national, or other applicable government codes and regulations.
- Power circuits and associated circuit breakers must provide sufficient power and overload protection.

Weight and placement guidelines

Refer to Physical requirements on page 63 for detailed size and weight specifications.

- The weight of an enclosure depends on the number and type of modules installed.
- Ideally, use two people to lift an enclosure. However, one person can safely lift an enclosure if its weight is reduced by removing the power and cooling modules and drive modules.
- Do not place enclosures in a vertical position. Always install and operate the enclosures in a horizontal orientation.
- When installing enclosures in a rack, make sure that any surfaces over which you might move the rack can support the weight. To prevent accidents when moving equipment, especially on sloped loading docks and up ramps to raised floors, ensure you have a sufficient number of helpers. Remove obstacles such as cables and other objects from the floor.
- To prevent the rack from tipping and to minimize personnel injury in the event of a seismic occurrence, securely anchor the rack to a wall or other rigid structure that is attached to both the floor and to the ceiling of the room.

Electrical guidelines

- These enclosures work with single-phase power systems having an earth ground connection. To reduce the risk of electric shock, do not plug an enclosure into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.
- Enclosures are shipped with a grounding-type (three-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.
- Do not use household extension cords with the enclosures. Not all power cords have the same current ratings. Household extension cords do not have overload protection and are not meant for use with computer systems.

Ventilation requirements

Refer to Environmental requirements on page 64 for detailed environmental requirements.

- Do not block or cover ventilation openings at the front and rear of an enclosure. Never place an enclosure near a radiator or heating vent. Failure to follow these guidelines can cause overheating and affect the reliability and warranty of your enclosure.
- Leave a minimum of 6 inches (15 cm) at the front and back of each enclosure to ensure adequate airflow for cooling. No cooling clearance is required on the sides, top, or bottom of enclosures.
- Leave enough space in front and in back of an enclosure to allow access to enclosure components for servicing. Removing a component requires a clearance of at least 15 inches (37 cm) in front of and behind the enclosure.

Cabling requirements

- Keep power and interface cables clear of foot traffic. Route cables in locations that protect the cables from damage.
- Route interface cables away from motors and other sources of magnetic or radio frequency interference.
- Stay within the cable length limitations.

Management host requirements

A local management host with at least one serial port connection is recommended for the initial installation and configuration of a controller enclosure. After you configure one or both of the controller modules with an IP address, you then use a remote management host on an Ethernet network to manage and monitor.

NOTE: Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Physical requirements

The floor space at the installation site must be strong enough to support the combined weight of the rack, controller enclosures, drive enclosures, and any additional equipment. The site also requires sufficient space for installation, operation, and servicing the enclosures, together with sufficient ventilation to allow a free flow of air to all enclosures.

Table 12 and Table 13 list enclosure dimensions and weights. Weights are based on an enclosure having 12 drive modules, two controller or expansion modules, and two power supplies installed. "2U12" denotes the 3.5" 12-drive enclosure, and "2U24" denotes the 2.5" 24-drive enclosure.

Table 12   Rackmount enclosure dimensions

Specifications	Rackmount
2U Height (y-axis):	3.45 inches (8.7 cm)
Width (x-axis): • Chassis-only • Chassis with bezel ear caps	17.6 inches (44.7 cm) 18.9 inches (47.9 cm)
Depth (z-axis): 2722/2522/2322 Storage System (2U24): • Back of chassis ear to controller latch • Front of chassis ear to back of cable bend 2732/2532/2332 Storage System (2U12): • Back of chassis ear to controller latch • Front of chassis ear to back of cable bend	 20.7 inches (52.6 cm) 23.6 inches (59.9 cm) 23.7 inches (60.2 cm) 26.4 inches (67.1 cm)

Table 13   Rackmount enclosure weights

Specifications	Rackmount
2722/2522/2322 Storage System (2U24) • SAS drives • SATA drives	 56.0 lb (26.4 kg) 55.5 lb (26.2 kg)
2732/2532/2332 Storage System (2U12) • SAS drives • SATA drives	 65.4 lb (29.3 kg) 65.5 lb (29.8 kg)
2122 (2.5" 24 drive enclosure) • SAS drives • SATA drives	 55.5 lb (26.2 kg) 54.2 lb (24.6 kg)
2130 (3.5" 12-drive enclosure) • SAS drives • SATA drives	 62 lb (28.2 kg) 63 lb (28.6 kg)

Environmental requirements

Table 14 Operating environmental specifications

Specification	Range
Altitude	To 9842 feet (3000 meters), derate 35.6ºF (2ºC) for every 3281 feet (1 km) up to 9842 feet (3000 meters)
Relative humidity	10% to 90% RH, 104ºF (40ºC) non-condensing
Temperature	41ºF to 104ºF (5ºC to 40ºC)
Shock	5.0 g, 10 ms, half-sine
Vibration	0.5 g, 1 octave/minute, 5 Hz to 500 Hz to 5 Hz, swept-sine;

Electrical requirements

Site wiring and power requirements

Each enclosure has two power and cooling modules for redundancy. If full redundancy is required, use a separate power source for each module. The AC power supply unit in each power and cooling module is auto-ranging and is automatically configured to an input voltage range from 88–264 VAC with an input frequency of 47–63 Hz. The power and cooling modules meet standard voltage requirements for both U.S. and international operation. The power and cooling modules use standard industrial wiring with line-to-neutral or line-to-line power connections.

Power cord requirements

Each enclosure is shipped with two AC power cords that are appropriate for use in a typical outlet in the destination country. Each power cord connects one of the power and cooling modules to an independent, external power source. To ensure power redundancy, connect the two power cords to two separate circuits; for example, to one commercial circuit and one uninterruptible power source (UPS).

C Electrostatic discharge

Preventing electrostatic discharge

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

Grounding methods to prevent electrostatic discharge

Several methods are used for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground card to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm ± 10 percent resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an authorized reseller install the part. For more information on static electricity or assistance with product installation, contact an authorized reseller.

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