MD2412 and MD2424

Direct-Attach Storage for PowerEdge Servers

Owner's Manual

Regulatory Model: QUIAE/CONAE/QUIAE-DC/CONAE-DC
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Rev. A06

DELL Technologies

Notes, cautions, and warnings

NOTE: A NOTE indicates important information that helps you make better use of your product.

CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

WARNING: A WARNING indicates a potential for property damage, personal injury, or death.

Contents

1

System overview

The MD2412 and MD2424 enclosures provide direct-attach storage to servers. They connect directly to the SAS ports on the back of a host system, and the management software running on the host system manages the enclosure.

The MD2412 2U enclosure supports up to 12 3.5-inch drives installed in a four-column, three-row configuration. The MD2424 2U enclosure supports up to 24 2.5-inch drives installed vertically side by side.

Each MD2412 and MD2424 enclosure contains two redundant power supply units (PSUs) and two redundant enclosure management modules (EMMs).

Locate the service tag

Each PowerVault MD expansion enclosure is identified by a unique Service Tag and Express Service Code. The Service Tag and Express Service Code are found on the front of the system by pulling out the information tag. This information is used to route support calls to appropriate personnel.

MD2412 and MD2424 front view

The front of the enclosure contains an LED panel and provides access to the service tag. Removing the front bezel provides access to the enclosure drives.

- The MD2412 enclosure supports up to 12 - 3.5 in. drives, mounted horizontally in the chassis.

  NOTE: The MD2412 enclosure does not support 2.5 in. drives.

- The MD2424 enclosure supports up to 24 - 2.5 in. drives, mounted vertically in the chassis.

A minimum of two drives are required in either enclosure.

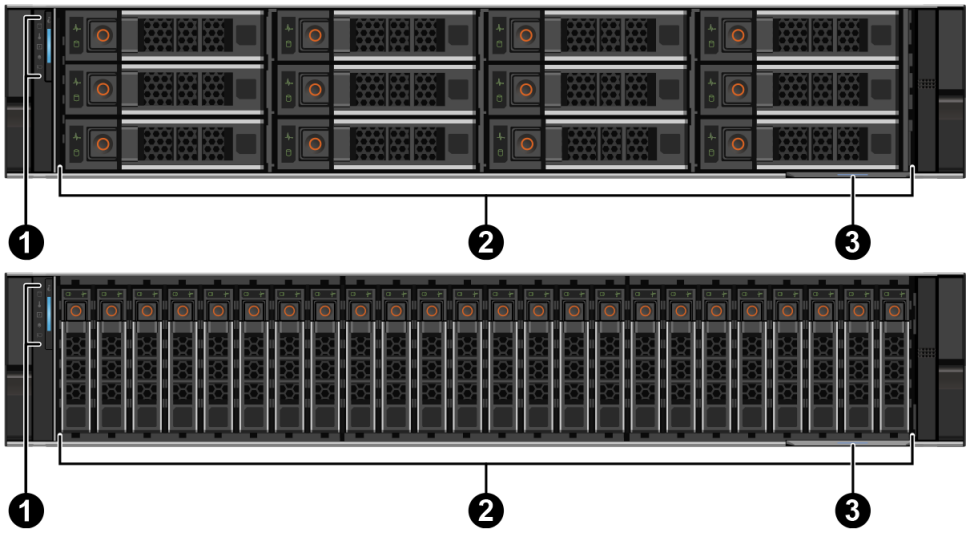

Figure 1. MD2412 and MD2424 front view

1. LED panel
2. Drives
3. Service tag

MD2412 and MD2424 back view

The MD24 Series systems contain two hot-swappable EMMs and two hot-swappable PSUs.

NOTE: The EMMs are not interchangeable between MD2412 and MD2424 systems.

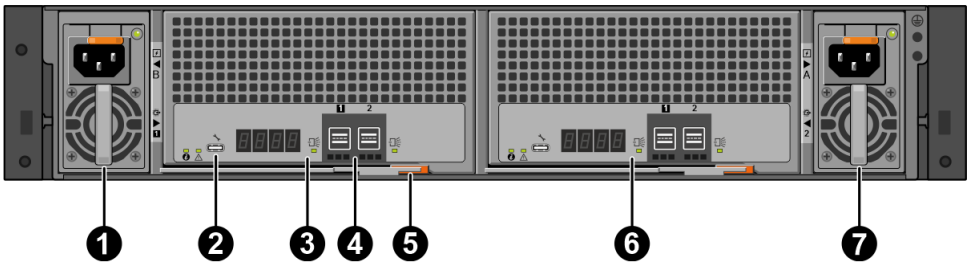

Figure 2. MD2412 and MD2424 back view (AC PSU)

1. AC PSU-B
2. Debug port
3. EMM 1 (EMM-A/Slot1)
4. SAS ports
5. Latch/handle
6. EMM 2 (EMM-B/Slot2)
7. AC PSU-A

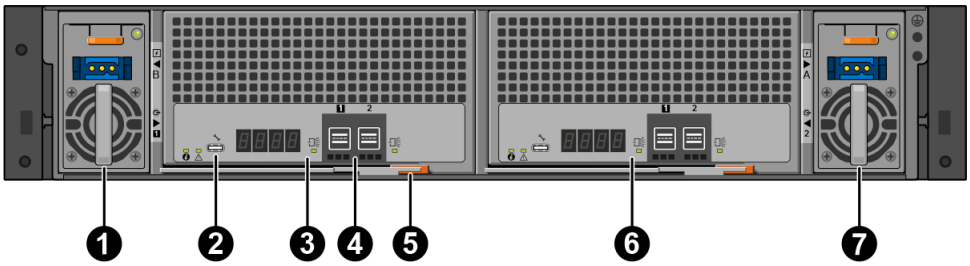

Figure 3. MD2412 and MD2424 back view (DC PSU)

1. DC PSU-B
2. Debug port
3. EMM 1 (EMM-A/Slot1)
4. SAS ports
5. Latch/handle
6. EMM 2 (EMM-B/Slot2)
7. DC PSU-A

MD2412 and MD2424 LEDs

LEDs on the front and back of the expansion enclosure provide status of the system and its components.

Front panel LEDs

The front panel of the enclosure contains indicators that provide status information about the system.

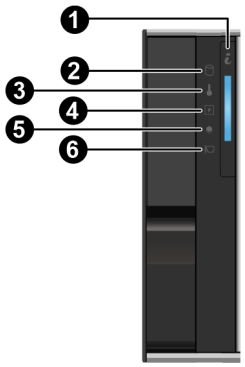

Figure 4. Front panel LEDs

Table 1. States of front panel LEDs

Index No.	Indicator	Description	Color	Status
1		System health	Blue	• On solid: Normal operation • Blinking (1 sec. on, 1 sec. off): Identify
			Amber	Blinking (2 sec. on, 1 sec. off): Fault
2		Drive fault	Amber	• Off: Normal operation • On: Failed drive in the enclosure
3		Temperature fault	Amber	• Off: Normal operation • On: Thermal fault such as temperature, fan, and heatsink fault
4		Electrical fault	Amber	• Off: Normal operation • On: Electrical fault related to voltage or PSU
5		Memory fault	Not used	N/A
6		PCI fault	Not used	N/A

2U enclosure drive carrier module LEDs

Two LEDs mounted on the front of each drive carrier module provide drive status.

The drive module LEDs are identified in the figure, and the LED behavior is described in the table following the figure.

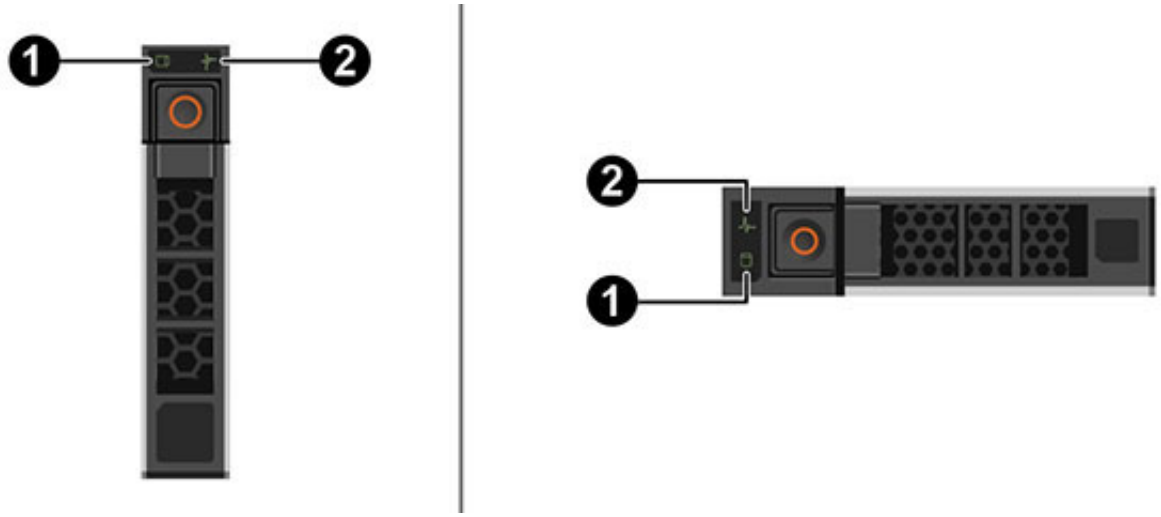

Figure 5. Drive carrier LEDs

Table 2. States of drive carrier LEDs

Index No.	Indicator	Description	Color	Status
1		Drive activity	Green	• Blinking green (500 msec on 500 msec off): Drive is spinning up or spinning down • Blinking green (100 msec on, 100 msec off): Drive activity • Blinking green (50 msec on, 50 msec off): Active, idle, or standby power condition
2		Drive status	Green/Amber	• On solid green: Normal operation • Blinking green (2 sec. on, 1 sec. off): Identify • Blinking green (400 msec on, 100 msec off): Drive rebuilding • Blinking amber (150 msec on, 150 msec off): Fault

NOTE: If the system is attached to a PERC controller in RAID, the drive LED status will not illuminate. This is by design and does not indicate a fault.

EMM LEDs

The EMM indicators provide status information about the system.

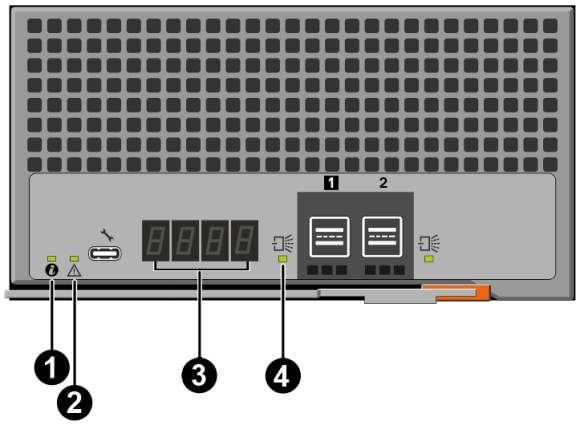

Figure 6. EMM LEDs

Table 3. States of the EMM LEDs

Index No.	Indicator	Description	Color	Status
1		EMM ID	Blue	• Off: Normal operation • Blinking (1 sec. on, 1 sec. off): Identify
2		EMM status	Green	On solid: Normal operation
			Amber	Blinking (2 sec. on, 1 sec. off): Fault
3		Not used	N/A	Off
4		Mini SAS status	Green	• On solid: Port link is up and connected to a SAS4 port. • Blinking: (1 sec on., 1 sec. off): Identify
			Amber	• On solid: Link is up, but with degraded speed. • Blinking (2 sec. on, 1 sec. off): Fault

PSU LEDs

The power supply indicator provides the PSU status. The LED is in the same position on the AC and the DC PSUs. The following figure shows the location of the LED on the AC PSU.

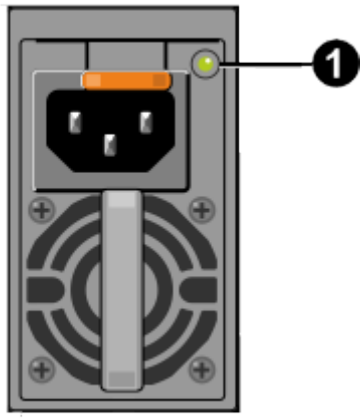

Figure 7. PSU LEDs

Table 4. States of the PSU LEDs

Index No.	Description	Color	Status
1	Power supply status	Green	• On solid: Normal operation • Off: No input power • Blinking (0.25 sec on, 0.25 sec off.): Power supply firmware update in process
		Amber	• On: No input power, second PSU is still operating. Or a critical power supply event is causing a PSU shutdown • Blinking (0.5 sec on, 0.5 off): Power supply warning; power supply continues to operate, but in a degraded condition.

2

Safety precautions

Always follow these safety precautions to avoid injury and damage to the PowerVault MD equipment.

If equipment described in this guide is used in a manner that is not specified by Dell , the protection provided by the equipment could be impaired.

For your safety and protection, observe the rules described in the following sections.

Installation safety precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions and instructions that are marked on the equipment.
- Ensure that the voltage and frequency of your power source match the voltage and frequency that is inscribed on the equipment electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages, energy, or moving parts may be present. Conductive external objects could produce a short circuit that could cause a fire, an electric shock, or other damage to your equipment.
- Do not block or cover the openings of your product. Never place a product near a radiator or heat register. Failure to follow these guidelines can cause overheating and affect the reliability of your product.
- Do not operate products without the cover in place. Failure to take this precaution may result in system damage.
- Do not drop the product or subject it to physical shock.
- Keep the product away from water or any liquid.
- To ship the product, pack it inside the qualified package and ship with a pallet.
- This product is intended for restricted access that is controlled by using a means of security (for example, key, lock, tool, badge access). Personnel that are authorized for access must have been instructed on the reasons for the restrictions and any precautions that must be taken.
- The equipment is designed for use in a data center or lab environment.

Power cable connection

Installation of this equipment must comply with local and regional electrical regulations governing the installation of information technology equipment by licensed electricians. For electrical power ratings on options, see the power rating label or the user documentation that is supplied with that option.

CAUTION: This product is designed to work with power systems that have a grounded neutral (grounded return for DC-powered products). To reduce the risk of electric shock, do not plug products 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.

CAUTION: Not all power cables have the same current ratings. Do not use the power cable that is provided with your equipment for any other products or use. Do not use household extension cords with your product.

CAUTION: The power cable attached to this unit is designed to connect to and be used by this device, and its safety has been confirmed. Never use the power cable for other equipment or purposes, as this may cause fire or electric shock.

CAUTION: For products with multiple power cables, all power cables must be disconnected to completely remove power from the system.

The following label indicates when multiple power supplies are installed in a system:

Moving fan blade precaution

A warning symbol as shown below (or similar) that is combined with the triangle shaped warning sign from ISO 3864-2 indicates a moving part.

CAUTION: Keep fingers and other body parts away from the moving blade. Failure to take this precaution may result in personal injury.

Rack system safety

Follow these safety guidelines to protect against personal injury or damage to the equipment.

- Do not use rack-mounted equipment as a shelf or workspace.
- Do not add weight to rack-mounted equipment.
- When installing multiple enclosures in a rack, fill the rack from the bottom up and empty the rack from the top down.
- Deploy the anti-tilt bar on the rack to prevent the rack from tipping during equipment installation.
- Ensure that all cables are installed and removed safely. Unplug the cables before moving the equipment.
- Insert and unplug cables in a horizontal orientation. Do not drag or apply excessive force, which may damage the cables, connectors, and the motherboard.

WARNING: The storage enclosure is heavy. To reduce the risk of personal injury or damage to the equipment:

- **Observe local occupational health and safety requirements and guidelines for manual material handling.**
- **Get help to lift and stabilize the enclosure during installation or removal, especially when the product is not fastened to the rails. When the enclosure weighs more than 22.5 kg (50 lb), at least two people must lift the enclosure into the rack together. A third person may be required to help align the enclosure if it is installed higher than chest level.**

3

Installing the enclosure in the rack

The rack mounting rails provided with the enclosure fit in 19-inch rack cabinets. The rails have been designed and tested for the maximum enclosure weight and rack capacity. Use of other mounting hardware may cause some loss of rack space.

Installing rails onto the rack

First install the rails that were shipped with the unit onto your rack.

Steps

1. Identify the rack holes to use for installing the rails in the racks.
2. Press the latch on the rear rail bracket and insert the rail into the rack post. Release the latch to lock the rail in place.

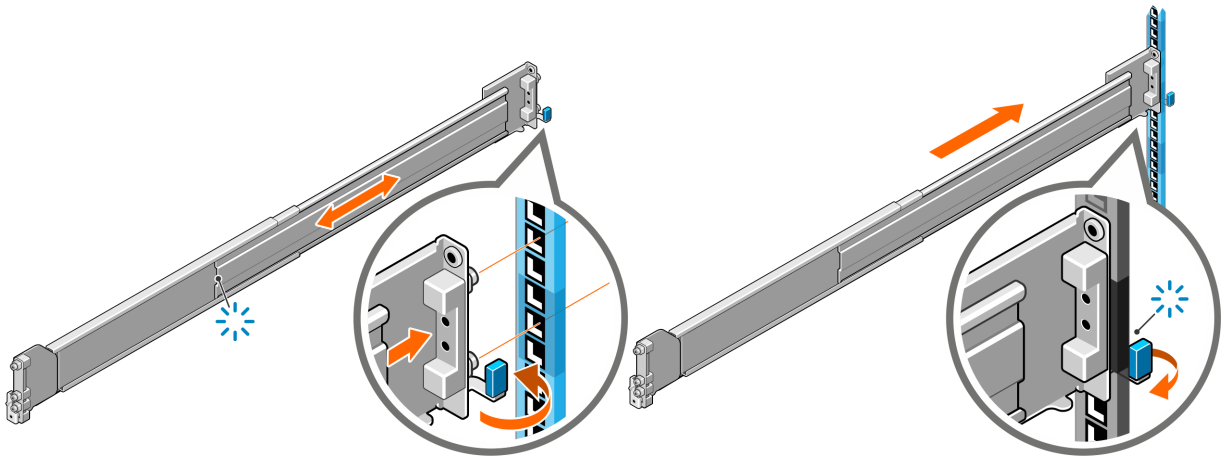

Figure 8. Connecting the rail to the back post

3. Extend the rail to fit between the front and rear rack posts.
4. Insert the pins on the front of the rail into the rack holes of the front rack post.

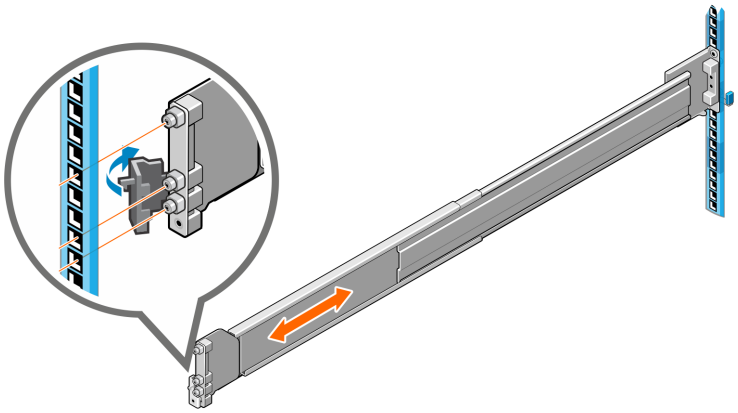

Figure 9. Attaching the rail to the front post

5. Secure the front rail bracket with one screw.
6. Secure the rear rail bracket with one screw.

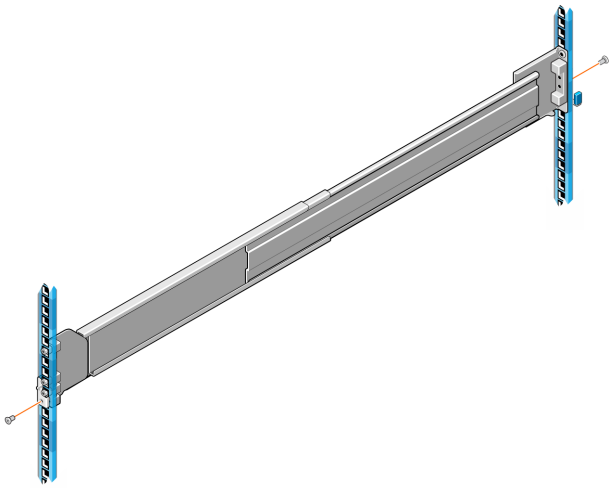

Figure 10. Securing the rails to the rack

7. Repeat these steps for the second rail.

Install the enclosure into the rack

Steps

1. Use two people to lift the enclosure and align it with the installed rails.

   NOTE: Ensure that the enclosure remains level while inserting it in the rack.

2. Slide the enclosure onto the rails.

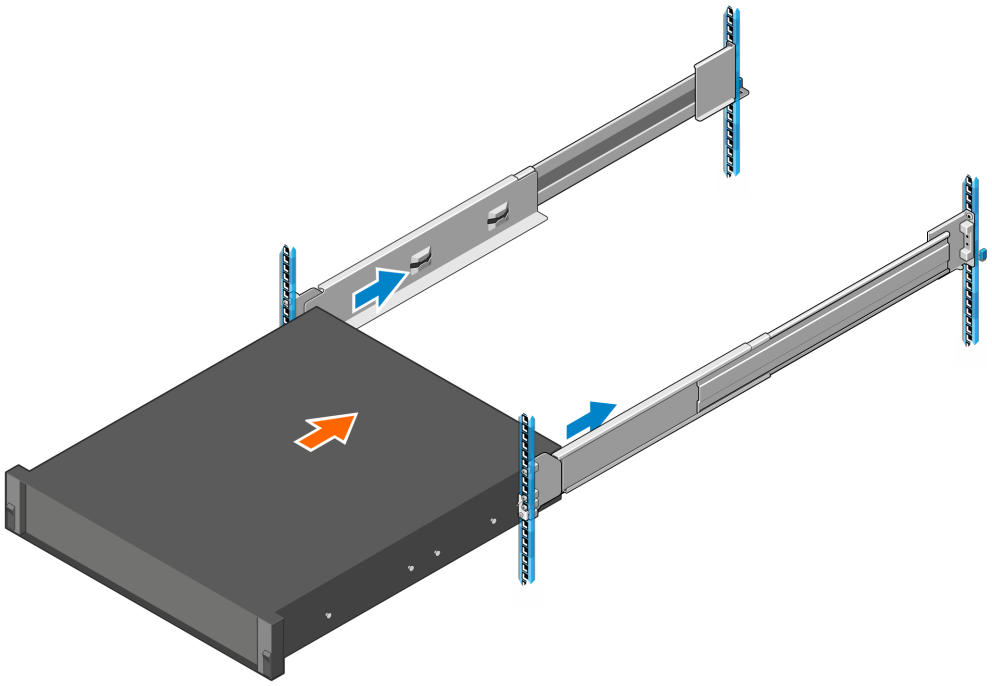

Figure 11. Installing the enclosure into the rack

3. Secure the enclosure to the rack using the enclosure fastening screws in the rack mount ears on each side of the enclosure.

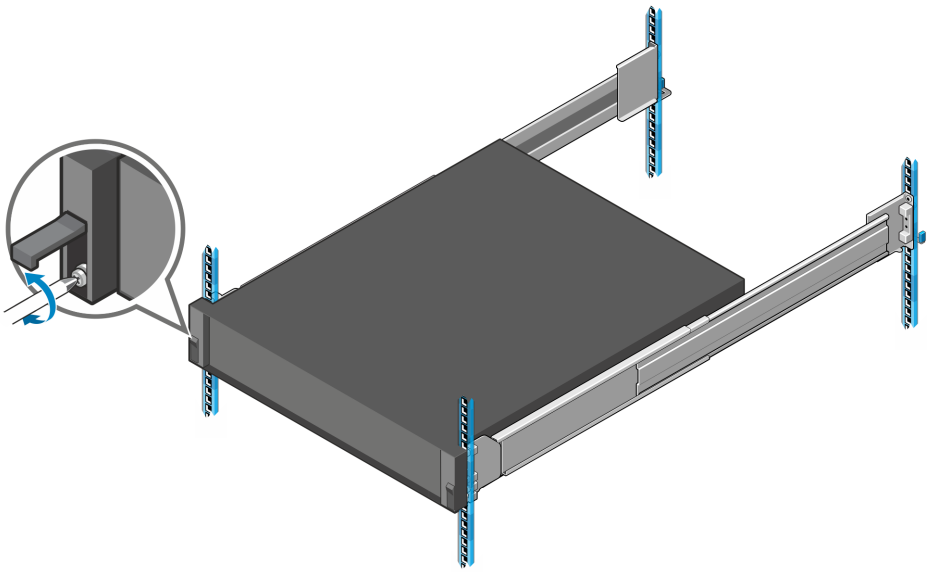

Figure 12. Securing the enclosure to the rack

Installing the ground lug assembly

The ground lug assembly is used to safely and effectively ground the chassis to the cabinet in which it is installed. This is an important task in the overall installation process of the storage enclosure.

Install the ground lug assembly

You must install the ground lug assembly onto your DC chassis to ensure safe operating conditions.

Prerequisites

- The ground lug assembly kit must be on-site.
- The customer must supply the #10 AWG wire.
- The chassis must be installed into the cabinet.

About this task

NOTE: This procedure applies to DC units only.

Tools required:

- Ground lug assembly kit
- #2 Phillips screwdriver
- 8-mm socket
- Inch pound torque wrench
- #10 AWG wire (customer supplied)
- Wire stripper
- Crimping tool

Steps

1. Using the #2 Phillips screwdriver, attach the bracket assembly to the chassis using two screws. Using the torque wrench, tighten both screws to 4.5 inch/pounds (+/- 0.5 in/lb).

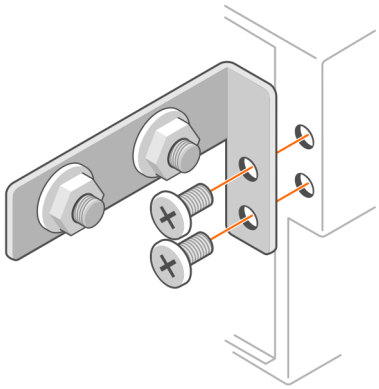

Figure 13. Remove screw from bracket

2. Using the 8-mm socket, remove the nuts and washers from the bracket assembly.

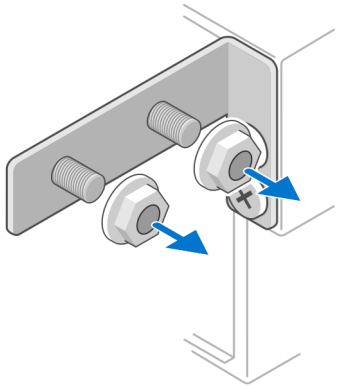

Figure 14. Remove nuts and washers

3. Place the terminal lug over the bolts on the bracket assembly, and attach the terminal lug by re-installing the nuts and washers. Using the torque wrench, tighten both screws to 4.5 inch/pounds (+/- 0.5 in/lb).

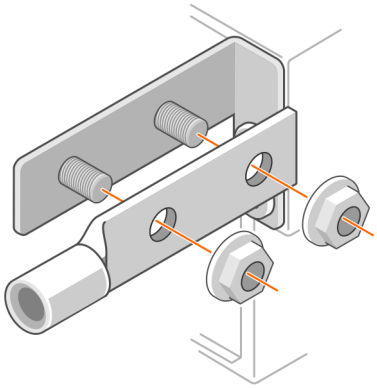

Figure 15. Attach terminal lug to bracket

4. Using the wire stripper, remove 0.38 inches of shielding from the #10 AWG wire.
5. Insert the exposed metal wire into the terminal lug and crimp the terminal to secure the wire in place.

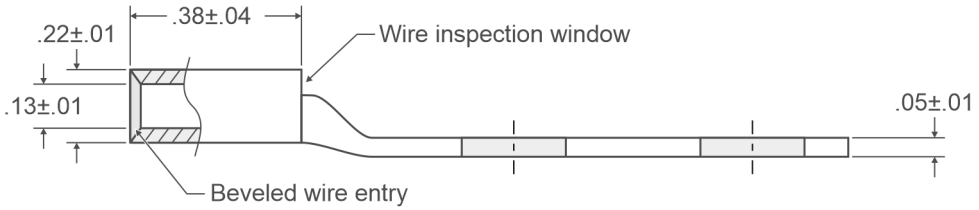

Figure 16. Schematic for metal wire and terminal lug

6. Attach the other end of the #10 AWG wire to an unpainted surface in the cabinet.

Attach the bezel

The enclosure includes an optional bezel that you can attach to the front of the enclosure.

Steps

1. Hook the right side of the bezel onto the right ear cover of the chassis.
2. Close the bezel and secure it with the keylock.

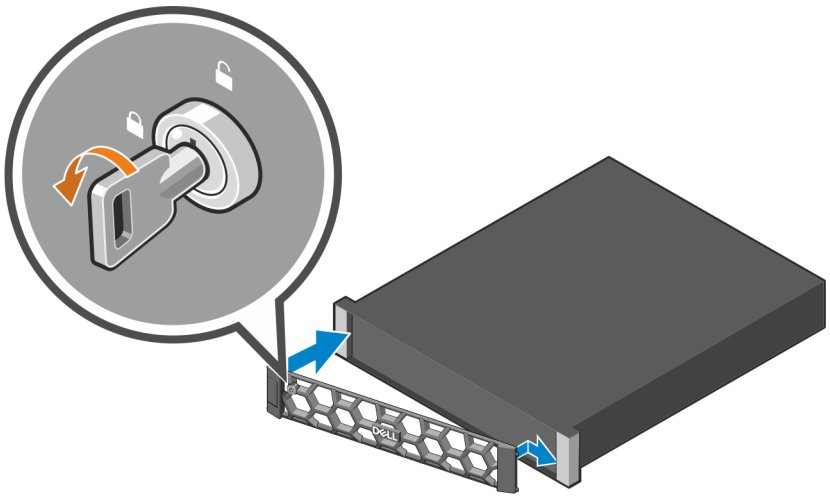

Figure 17. Installing the front bezel

4

Connecting SAS and power cables

Connect SAS cables to the host system and then connect the power cables to the enclosure.

Connect SAS cables

You can cable the storage enclosure using either a four-port a two-port adapter:

- A four-port HBA355e supports up to eight MD2412 or eight MD2424 enclosures. The HBA 355e is supported on PowerEdge 14G, 15G, and 16G servers.
- A four-port PERC H965e supports up to eight enclosures (either MD2412 or MD2424). The PERC H965e is supported only on PowerEdge 16G servers.
- A two-port PERC H840 supports up to four MD2412 or MD2424 enclosures. The PERC H840 is supported on PowerEdge 14G and 15G servers.
- A four-port HBA465e supports up to eight MD2412 or eight MD2424 enclosures. The HBA465e is supported on PowerEdge 16G servers

Ensure that you follow these instructions when you are connecting enclosures in a chain configuration:

- Always use SAS4 cables for connections between enclosures. See your system deployment information for specific details about connecting enclosures.
  - When a SAS4 cable is connected to a SAS4 HBA, the SAS LEDs on the EMMs turn green. This indicates that the port link is working at the SAS4 speed.
  - When a SAS4 cable is connected to a SAS3 HBA, the SAS LEDs on the EMMs turn amber. This indicates that the port link is working, but at a degraded speed.
- This enclosure only supports redundant configurations. Both EMMs must be connected to the server for the enclosure to function properly.
- These enclosures do not support asymmetrical cabling. All cables must run from top to bottom or bottom to top in a stack.
- Do not connect different enclosure models in a chain configuration.
- If port chain rules and max drive counts are not exceeded, mixing different MD24 Series enclosures on the same adapter is supported.

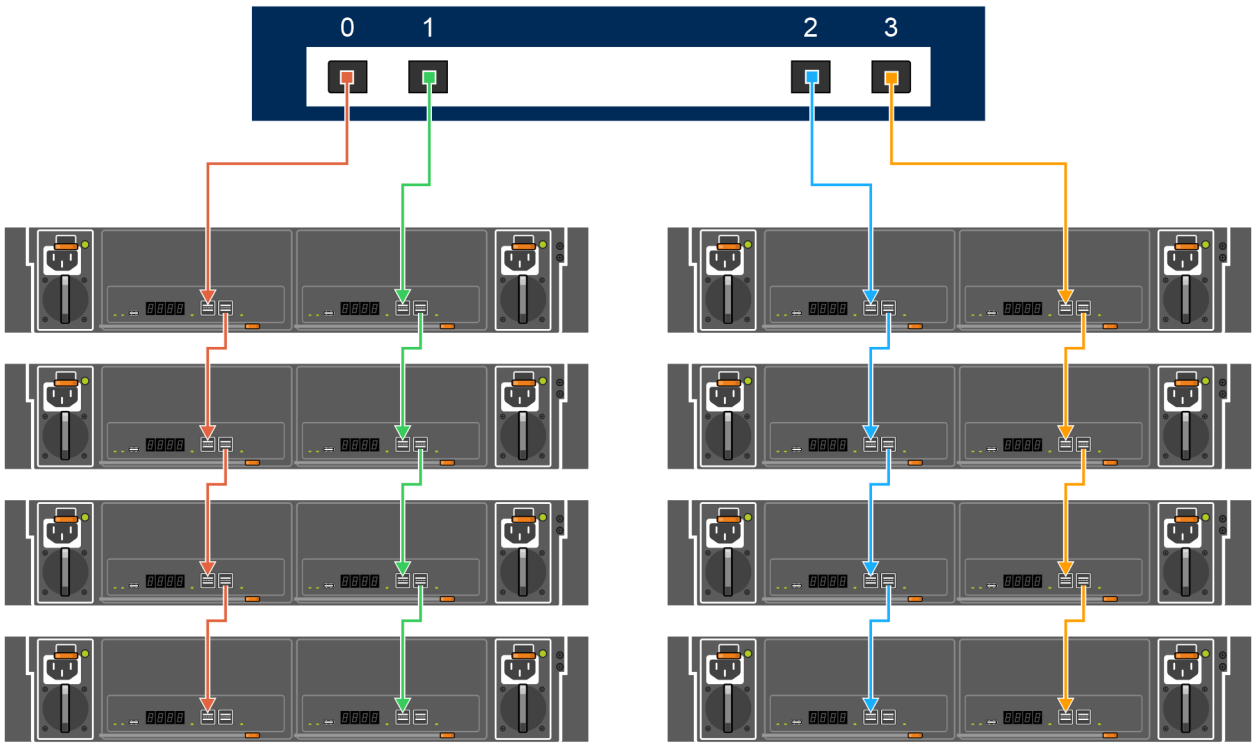

Figure 18. Example of SAS4 redundant-path cabling using a four-port HBA355e or HBA465e

NOTE: The MD2424 enclosure connected to an HBA355e or HBA465e supports a maximum of four enclosures.

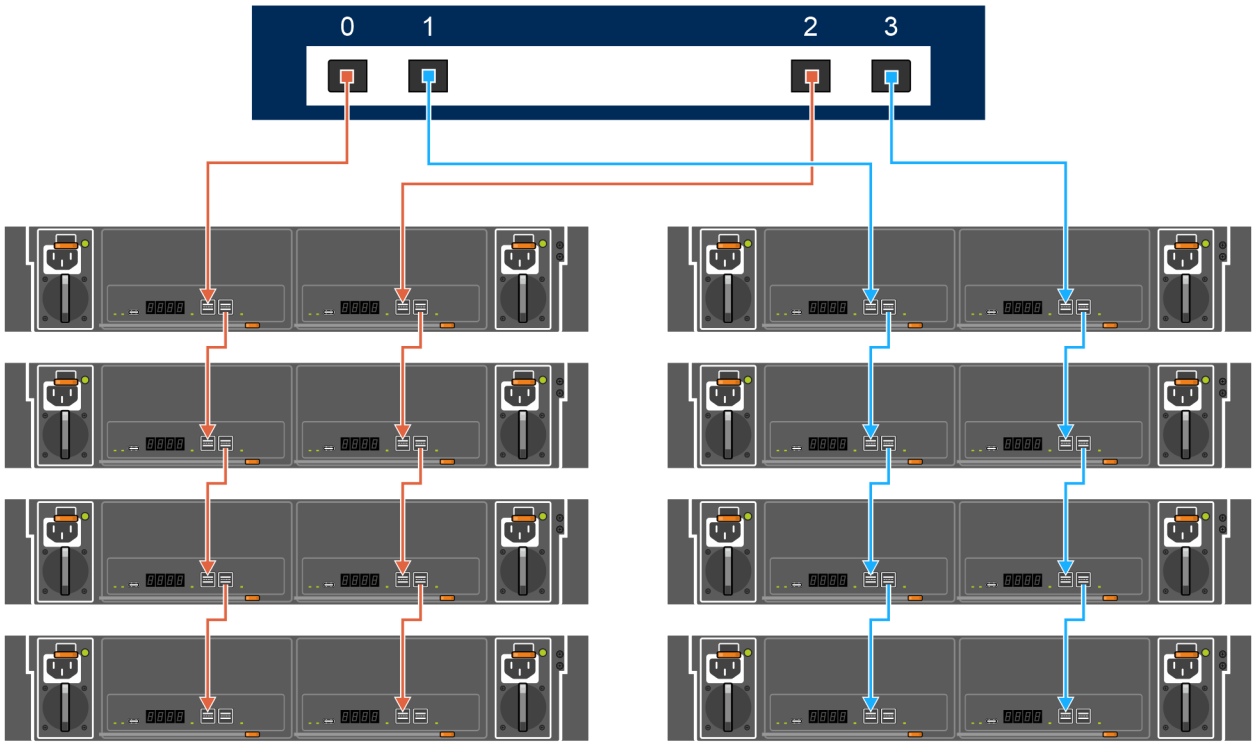

Figure 19. Example of SAS4 redundant-path cabling using a four-port H965e PERC

Figure 20. Example of SAS4 redundant-path cabling using a two-port PERC H840

Mixed configuration

This section shows examples of the cabling for mixed configurations. See the previous section for rules governing cabling configurations.

NOTE: In mixed configurations, only like enclosures can be in chain configurations.

NOTE: The MD2424 enclosure connected to an HBA355e or HBA465e supports a maximum of four enclosures.

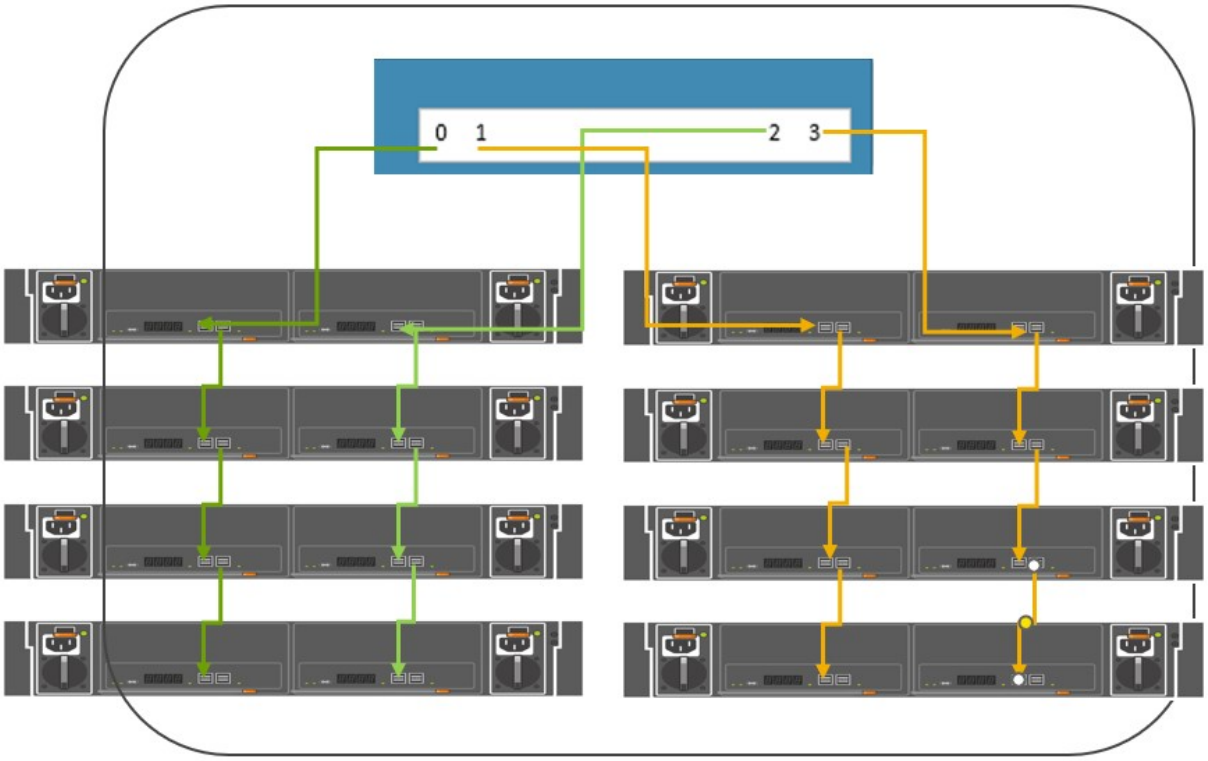

Figure 21. Mixed configuration MD2412 and MD2424 on separate chains.

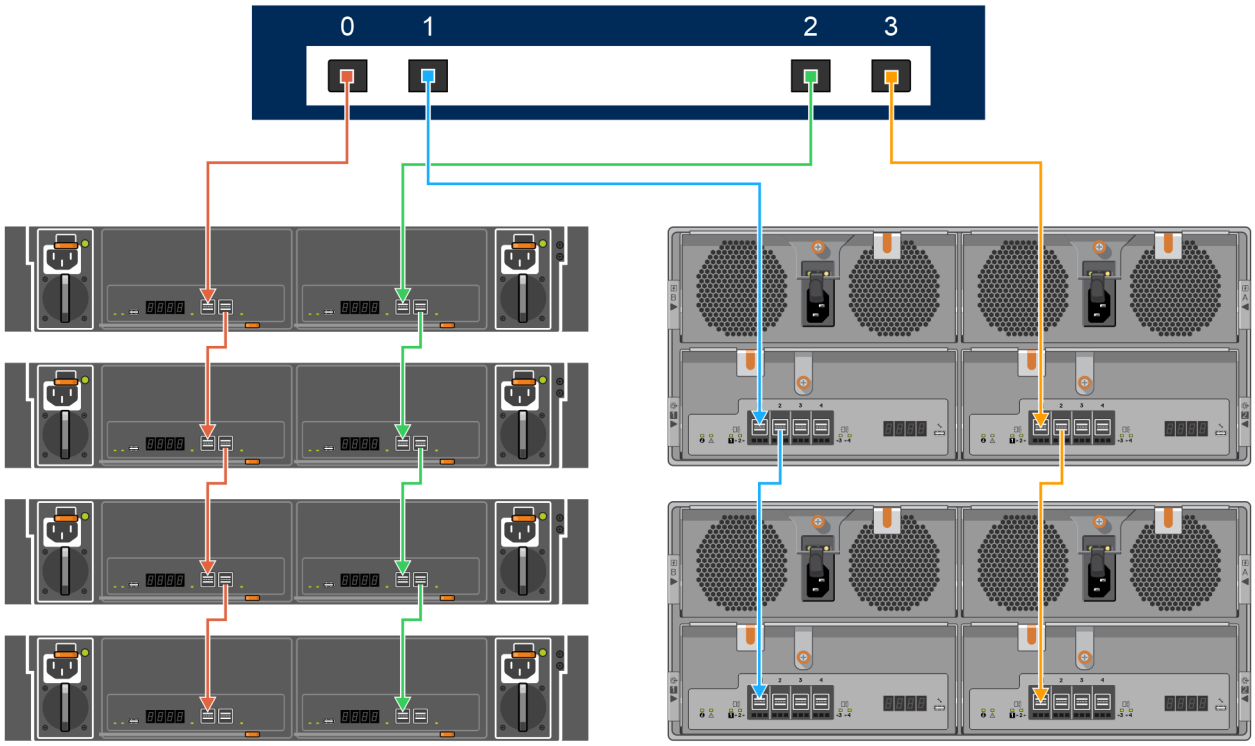

Figure 22. Mixed configuration - 2U and 4U (2U12 or 2U24 on left two ports)

Connect power cables

Connect power cables to the enclosure after you connect the SAS cables to the host system.

Steps

1. Plug each power cable into a power supply unit (PSU).
   If the power cable is connected to the facility power, the power supply starts up immediately when the power cable is connected to the chassis.
2. Secure each power cable to the handle using the cable strap provided.

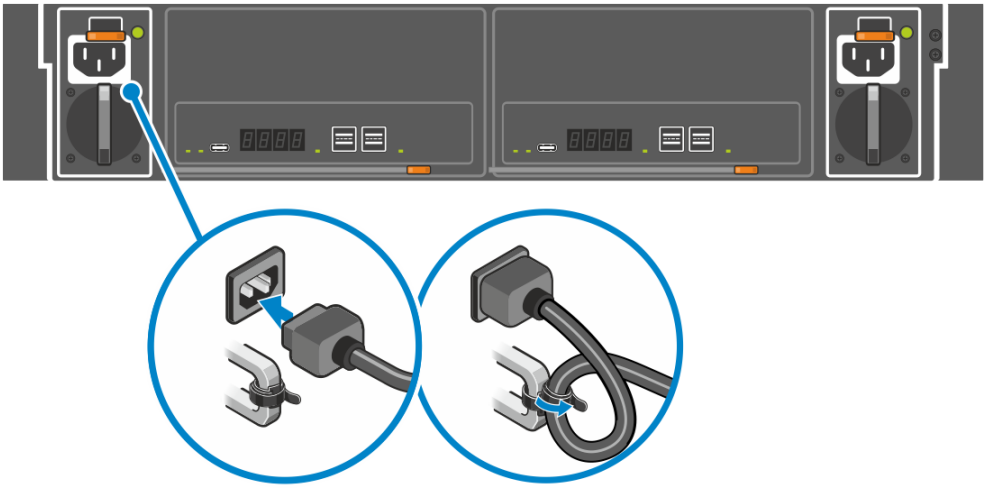

Figure 23. AC PSU cabling (one of two connections identified)

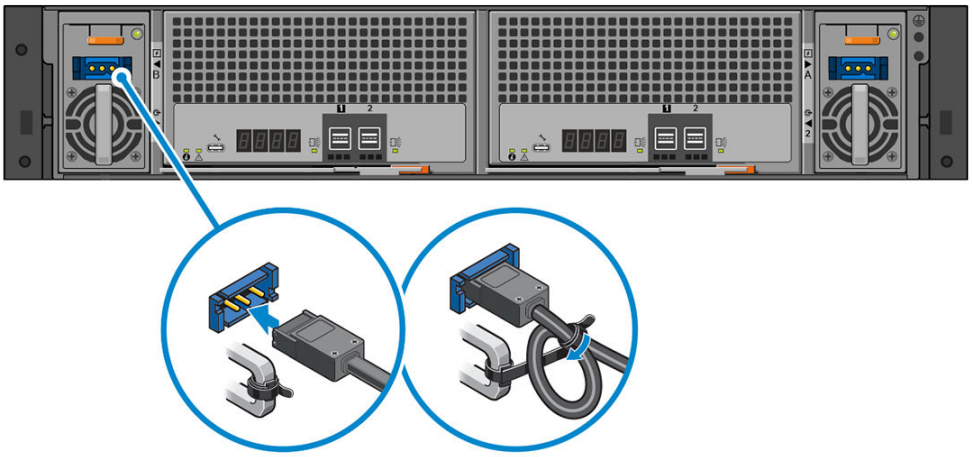

Figure 24. DC PSU cabling (one of two connections identified)

Verify connections

Use iDRAC or PowerTools SHM CLI to verify that the enclosures are connected to your system.

Steps

1. To use iDRAC, go to the **Storage>Enclosures** view and verify that the enclosure is listed.
   See the *Integrated Dell Remote Access Controller User's Guide* for details about using iDRAC.

2. To use PowerTools SHM CLI, run the following command:

```
shmcli list enclosures
```

See the *PowerTools Server Hardware Manager Administrator's Guide* for details about using these commands.

Configure MPIO

If you are connecting the MD24 Series enclosure to the host through a SAS HBA, configure MPIO on the host to direct I/O through the redundant cabling.

NOTE: If you are connecting to the host through a PERC adapter, you do not need to configure MPIO.

Configure MPIO in Windows

When connecting to the host using a SAS adapter, follow these steps to configure MPIO.

Steps

1. In the Server Manager Tools menu, select **MPIO**.
2. Select the **Discover Multi-Paths** tab.
3. Select **Add support for SAS**, and then click **OK**.
4. When prompted, reboot the system.
   When the reboot is complete, MPIO is ready to use.

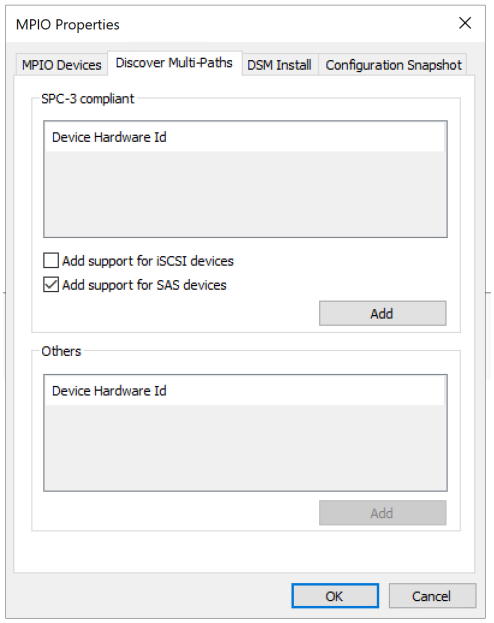

Figure 25. MPIO properties dialog box

Verifying Multipath in Linux

For Linux, Multipath should already be configured. When connecting to the host using a SAS adapter, follow these steps to ensure that Multipath is configured for the enclosures.

Steps

1. Run the following command to verify that the multipath is active (running):

```
systemctl status multipathd
```

2. If status is inactive, run the following command to start the service:

```
systemctl start multipathd
```

3. Run the following command to verify disk drives are listed.

```
multipath -ll
```

2U enclosure rear panel

Alphabetic designators on controller modules or IOMs and numeric designators on PCMs indicate slot sequencing for the modules used in 2U enclosures. Controller modules, IOMs, and PCMs are available as CRUs. The ME4 Series RBODs use 4-port controller modules. These RBODs support the ME412/MD2424/ME484 EBODs for optionally adding storage.

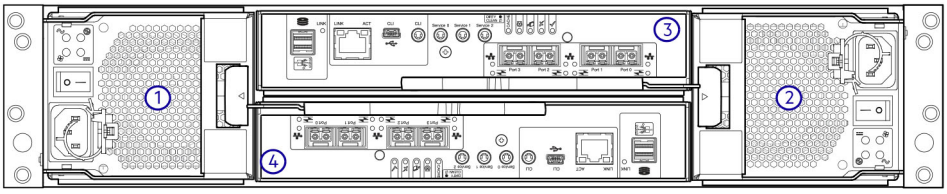

Figure 26. 2U controller enclosure—rear panel components (4-port FC/iSCSI)

1. Power cooling module slot 0
2. Power cooling module slot 1
3. Controller module slot A
4. Controller module slot B

Figure 27. 2U controller enclosure—rear panel components (4-port iSCSI 10Gbase-T)

1. Power cooling module slot 0
2. Power cooling module slot 1
3. Controller module slot A
4. Controller module slot B

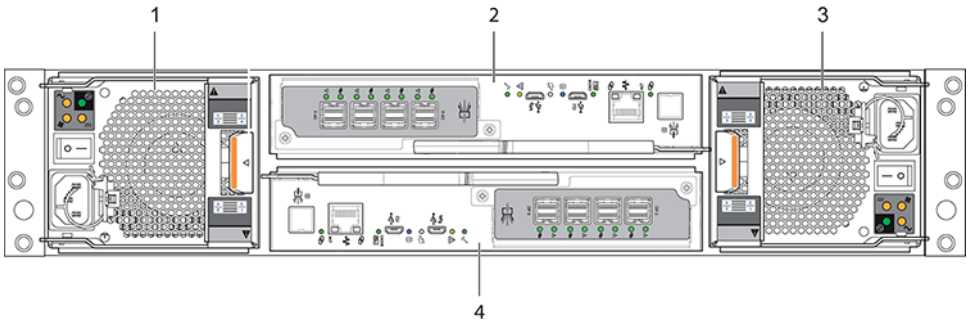

Figure 28. 2U controller enclosure—rear panel components (4-port SAS)

1. Power cooling module slot 0
2. Power cooling module slot 1
3. Controller module slot A
4. Controller module slot B

NOTE: The preceding figures show dual controller module configurations. Alternatively, you can configure the 2U controller enclosure with a single controller module. In single controller module configurations, the controller module is installed in slot A, and a blank plate is installed in slot B.

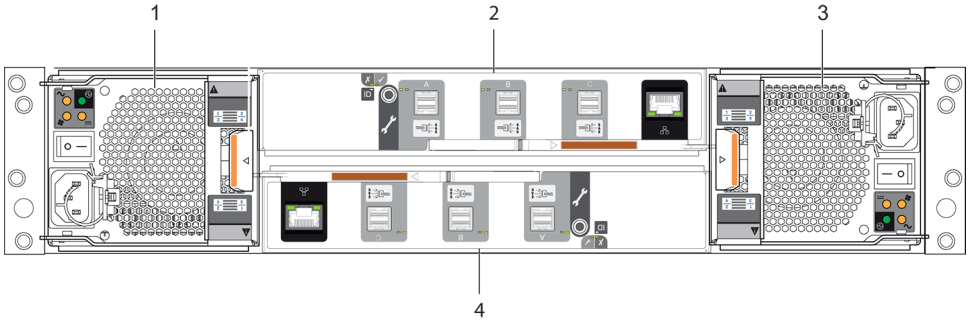

Figure 29. 2U expansion enclosure—rear panel components

1. Power cooling module slot 0
2. IOM slot A
3. Power cooling module slot 1
4. IOM slot B

5

Replacing components

Most components in the enclosure can be replaced without removing power from the unit.

Always follow safety and ESD precautions described in this manual when performing maintenance on the enclosure.

- ESD precautions
- Safety precautions

ESD precautions

Before you begin any of the procedures, review the following precautions and preventive measures.

Preventing electrostatic discharge

To prevent electrostatic discharge (ESD) from damaging the system, be aware of the precautions to consider 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.

CAUTION: Parts can be damaged by electrostatic discharge. Follow these precautions:

- **Avoid hand contact by transporting and storing products in static-safe containers.**
- **Keep electrostatic-sensitive parts in their containers until they arrive at static-protected workstations.**
- **Place parts in a static-protected area before removing them from their containers.**
- **Avoid touching pins, leads, or circuitry.**
- **Always be properly grounded when touching a static-sensitive component or assembly.**
- **Remove clutter (plastic, vinyl, foam) from the static-protected workstation.**

Grounding methods to prevent electrostatic discharge

Several methods are used for grounding. Adhere to the following precautions when handling or installing electrostatic-sensitive parts.

CAUTION: Parts can be damaged by electrostatic discharge. Use proper anti-static protection:

- **Keep the replacement CRU in the ESD bag until needed; and when removing a CRU from the enclosure, immediately place it in the ESD bag and anti-static packaging.**
- **Wear an ESD wrist strap connected by a ground cord to a grounded workstation or unpainted surface of the 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.**
- **If an ESD wrist strap is unavailable, touch an unpainted surface of the chassis before handling the component.**
- **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 technician install the part.
For more information about static electricity or assistance with product installation, contact customer support. For additional information, see Dell Support.

Updating firmware

You can use either the Dell Update Package or PowerTools SHM CLI for firmware updates.

CAUTION: Before updating firmware, stop I/O to the storage system. During the update all volumes will be temporarily inaccessible to hosts. If I/O is not stopped, mapped hosts will report I/O errors. Volume access is restored after the update completes.

- Dell Update Package (DUP): Can be used to update both drive and EMM firmware. See the *Dell Update Packages User's Guide* for information about how to update firmware. If you receive a `generation code mismatch` error and the firmware only updates on one EMM, follow these steps to resolve the issue:
  1. Cycle power on the enclosure and then rerun enclosure DUP.
  2. Reset the EMM that did not update and then rerun enclosure DUP.
  3. Cycle power on the server and then rerun enclosure DUP.
- PowerTools SHM CLI: Can be used to update drive firmware using the `update drive` command. You will need the latest firmware file (*.fwh) from Dell.com/support. The CLI can only be used for drive firmware updates.

For information about the latest drive and EMM firmware versions, go to Dell.com/support.

Customer replaceable units (CRUs)

This section describes procedures for replacing parts that are accessible to customers.

Bezel

If installed, remove the bezel to access the drives and drive slots.

Steps

1. Unlock the bezel on the left side of the chassis.
2. Unhook the right side of the bezel from the right ear cover of the chassis.

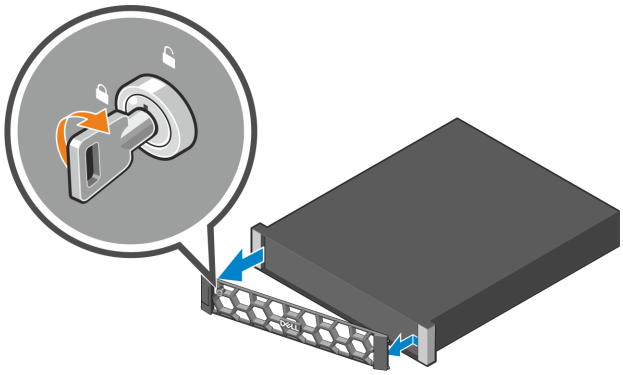

Figure 30. Removing the front bezel

3. To attach the front bezel to the enclosure, reverse the order of the preceding steps.

SAS Drives

To replace a drive, remove the drive carrier from the expansion enclosure and replace the drive in the carrier.

Drives are hot-swappable, which means they can be replaced without powering off the enclosure. Failed disk drives must be replaced with approved disk drives.

NOTE:

- The MD2412 enclosures do not support SATA, SSD, NVMe, vSAS, or 2.5 in. drives.
- The MD2424 enclosures do not support SATA, NVMe, or vSAS drives.

If you insert a SATA drive into the enclosure and then replace it with a SAS drive, the enclosure will not recognize the SAS drive. See Troubleshooting drives for information about how to recover from this state.

Removing a drive blank

About this task

CAUTION: To maintain proper system cooling, drive blanks must be installed in all empty drive slots. If you replace a drive blank with a drive, store the drive blank for future use.

Steps

Press the release button and slide the drive blank out of the drive slot.

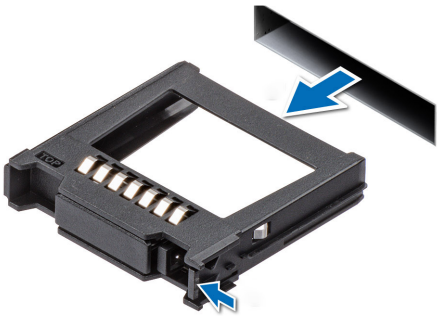

Figure 31. Removing a drive blank

Installing a drive blank

Steps

Insert the drive blank into the drive slot until the release button clicks into place.

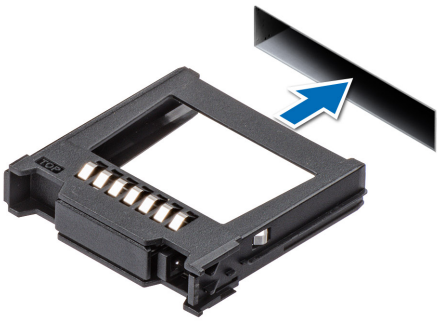

Figure 32. Installing a drive blank

Removing the drive carrier

Remove the drive carrier from the enclosure to replace the drive.

Prerequisites

Use the system manager software to prepare the drive for removal. If the drive is online, the green activity or fault indicator blinks while the drive is powering off. When the drive indicators are off, the drive is ready for removal.

Steps

1. If installed, remove the front bezel.
2. Press the release button to open the drive carrier release handle.
3. Holding the drive carrier release handle, slide the drive carrier out of the drive slot.

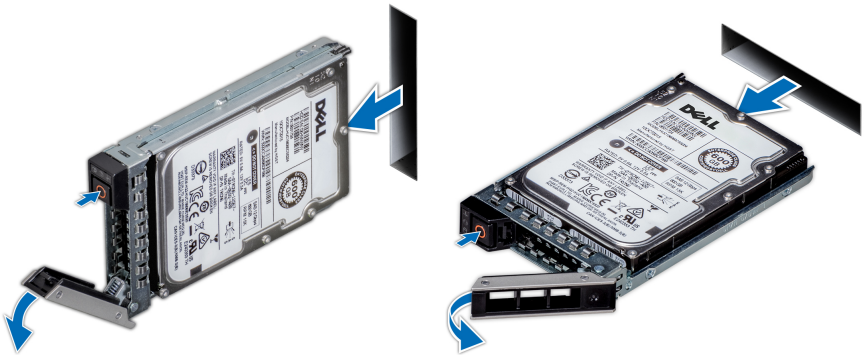

Figure 33. Removing a drive carrier

Removing the drive from the drive carrier

Steps

1. Using a Phillips #1 screwdriver, remove the screws from the slide rails on the drive carrier.

   NOTE: If the carrier has a Torx screw, use a Torx 6 (for 2.5-inch drive) or Torx 8 (for 3.5-inch drive) screwdriver to remove the drive.

2. Lift the drive out of the drive carrier.

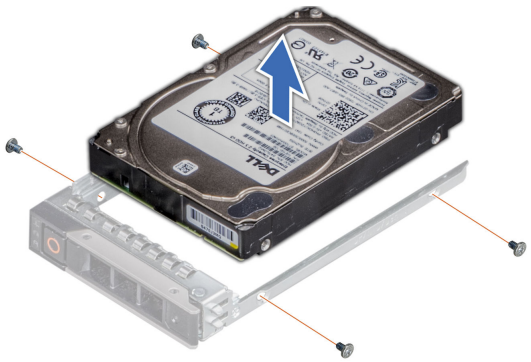

Figure 34. Removing the drive from the drive carrier

Installing a drive into a drive carrier

Steps

1. Insert the drive into the drive carrier with the connector end of the drive at the back.
2. Align the screw holes on the drive with the back set of holes on the drive carrier.
   When aligned correctly, the back of the drive is flush with the back of the drive carrier.
3. Install and tighten the four screws to secure the drive to the drive carrier.

Installing a drive carrier

Prerequisites

NOTE: Ensure that the drive carrier release handle is in the open position before inserting the carrier into the slot.

Steps

1. Open the drive carrier release handle and slide the drive carrier into the drive slot.
2. Close the drive carrier release handle to lock the drive in place.

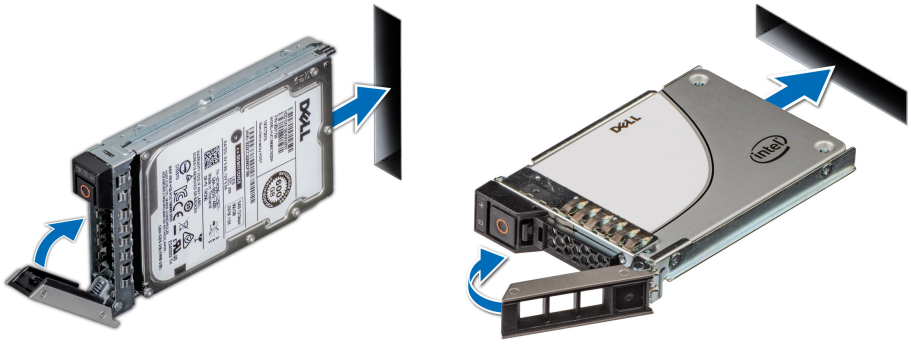

Figure 35. Installing a drive carrier

3. Ensure that the drive fault indicator turns off, and use your system manager software to verify that the drive is operating properly.

Power supply unit

You may need to replace a power supply unit (PSU) if your system manager or the PSU LED shows a failure. The PSU is hot-swappable—you can replace a PSU without turning off the enclosure.

1. Follow the safety guidelines listed in the Safety instructions.
2. Follow all guidelines listed in the ESD instructions.

The process for replacing a DC or AC power supply is the same. These instructions show how to replace an AC power supply.

Removing the PSU

Steps

1. Identify the failed PSU in your system management software, or by the solid amber indicator on the PSU.
2. Disconnect the power strap and cable from the PSU. The PSU immediately shuts down.

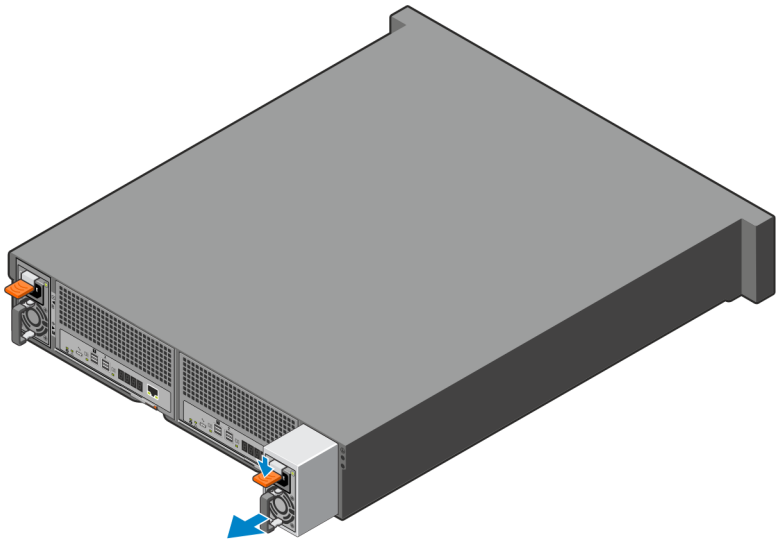

Figure 36. Removing the PSU

3. (Optional) Rotate the PSU handle to a vertical position.
4. Hold the PSU handle and press the latch down to disengage the PSU from the chassis connectors.
5. Guide the PSU out of the chassis.

Installing the PSU

When you connect the power cable, the PSU immediately starts up.

Steps

1. Guide the PSU into the chassis.

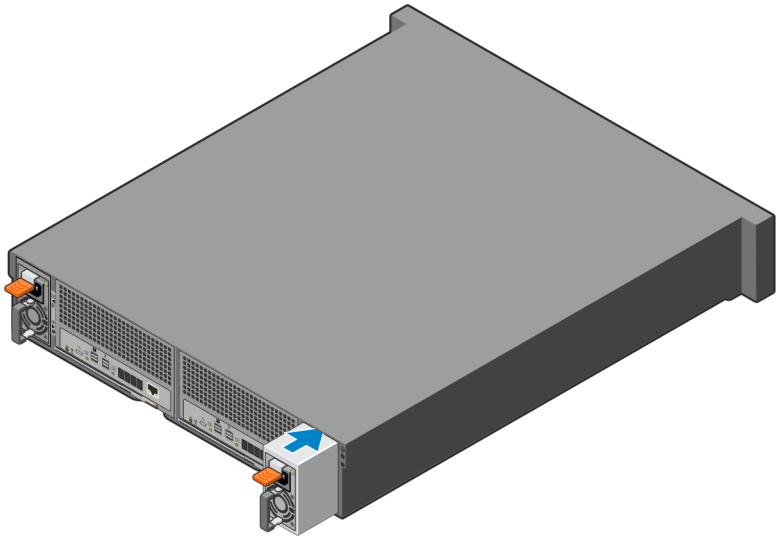

Figure 37. Installing the PSU

2. Push the PSU into the chassis.
3. Ensure that the latch clicks into place, which engages the PSU into the chassis connectors.
4. Rotate the handle to the vertical position.
5. Connect the power cable to the PSU.
   The power supply turns on immediately when the cable is connected.
6. Secure the power cable to the handle with the cable strap.

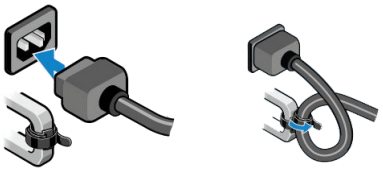

Figure 38. Connecting PSU power

7. Ensure that the power supply indicator turns on solid green, and use your system manager software to verify that the PSU is operating properly.

EMM

The MD2412 and MD2424 enclosures support two redundant EMMs. If an EMM fails, the enclosure will run on a single EMM until the redundancy is restored. You can replace one EMM without powering off the enclosure. However, if you do not have MPIO configured on your system, Dell recommends that you stop all I/O before removing the EMM.

CAUTION: The EMMs are not interchangeable between MD2412 and MD2424 enclosures. Do not attempt to replace an EMM with an EMM intended for a different product model.

You may need to replace an EMM if your system manager or the EMM LED status shows a failure. You also need to remove the EMMs to replace a failed fan.

Removing the EMM

Steps

1. Disconnect the SAS cables from the EMM.

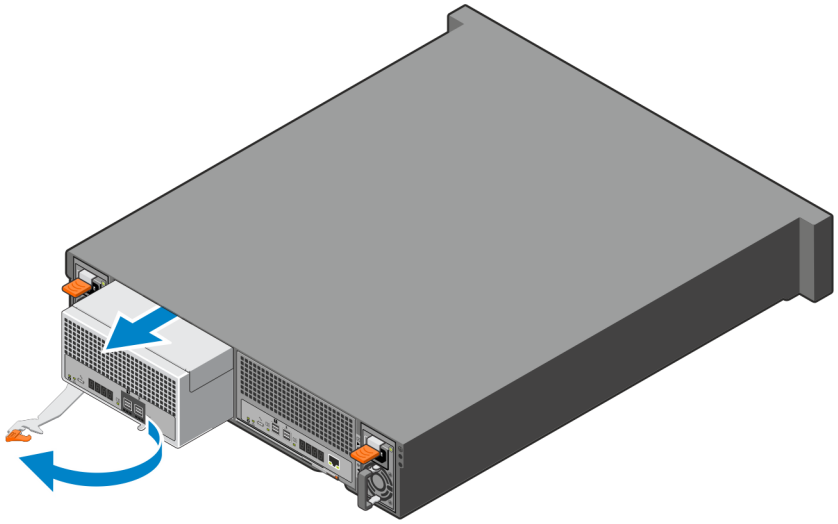

Figure 39. Removing the EMM

2. Rotate the handle to release the EMM from the chassis.
3. Hold the handle and guide the EMM out of the chassis.

Installing the EMM

Steps

1. Rotate the release latch on the EMM 45°.

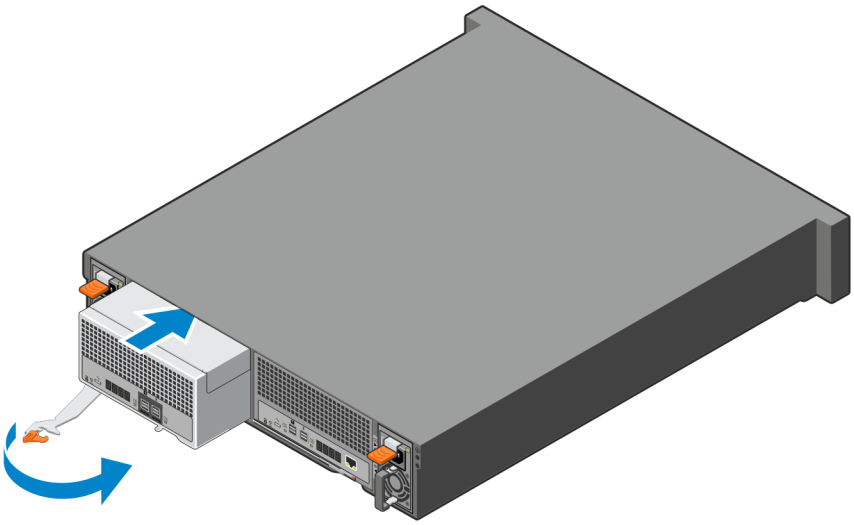

Figure 40. Installing the EMM

2. Hold the latch and guide the EMM into the chassis.
3. Rotate the latch, securing the EMM into the chassis.
4. Connect the SAS cables to the SAS ports on the EMM.
5. Ensure that the EMM status indicator turns on solid green, and use your system manager software to verify that the EMM is operating properly.

Removing the EMM cover

You need to remove the EMM to replace a failed fan.

Steps

1. Remove the EMM from the enclosure. See Removing the EMM.
2. Press the lock on the top of the EMM and slide the cover toward the back of the unit.

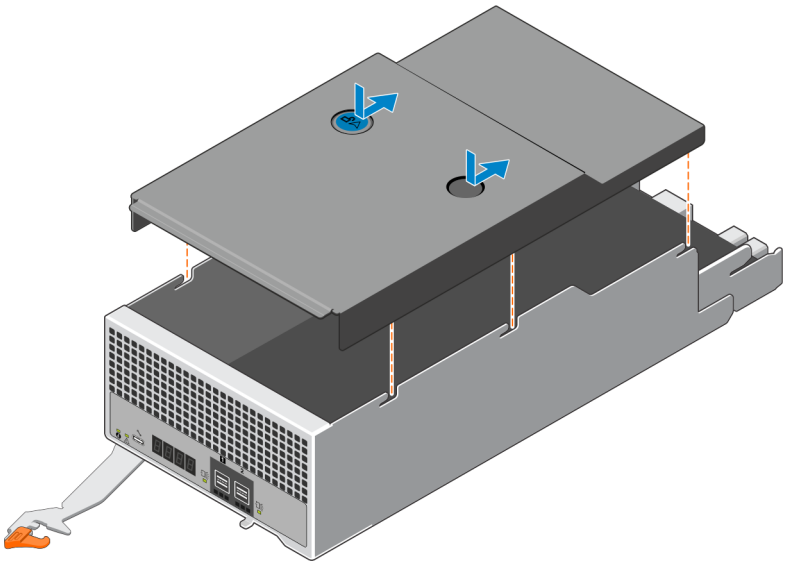

Figure 41. Removing the EMM cover

Installing the EMM cover

Steps

1. Slide the cover onto the EMM from the back of the unit.

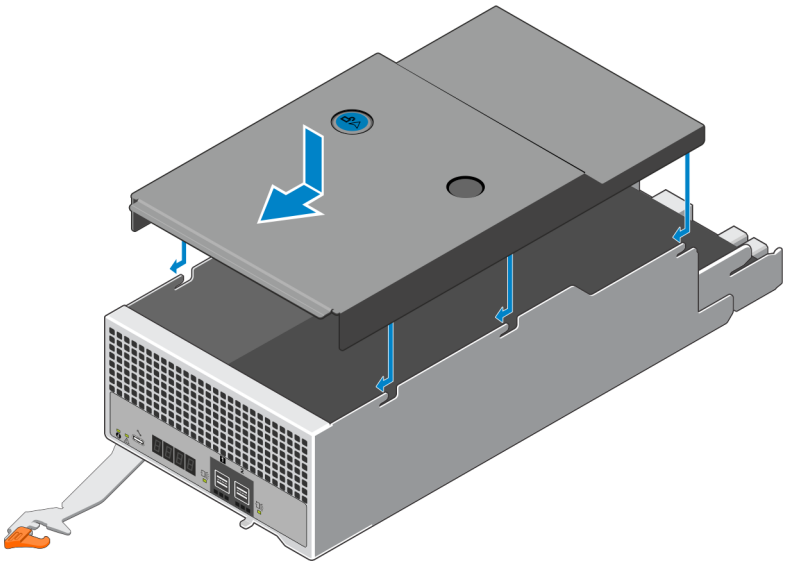

Figure 42. Installing the EMM cover

2. Slide the cover forward until the lock clicks.
3. Install the EMM into the enclosure. See Installing the ESM.

Fans

Each EMM contains three fans. The temperature icon on the front of the enclosure turns amber to indicate a fan failure, and your system manager shows more details about the failed fan.

You need to remove the EMM to access the fans.

Removing a fan

The fan is located inside the EMM.

Steps

1. Remove the EMM from the enclosure. See Removing the EMM .
2. Remove the cover from the EMM. See Removing the EMM cover.
3. Identify the failed fan.
   Fans are numbered 1-3 as viewed from the front of the EMM.
4. Press the front and back latches on the failed fan and lift the fan out of the EMM.

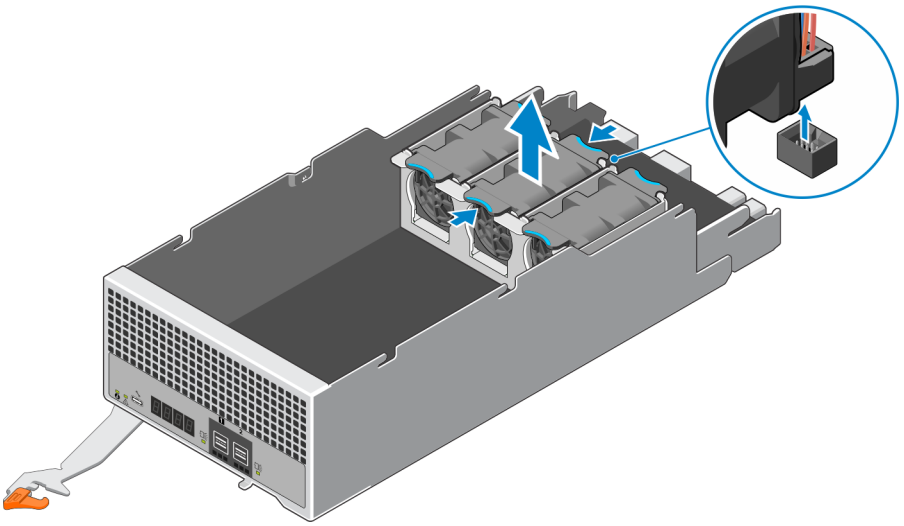

Figure 43. Removing a fan

Installing a fan

Steps

1. Insert the new fan into the EMM and push down until it engages in the connector.
2. Press the cable harness into the connector to ensure that the connection is secure.

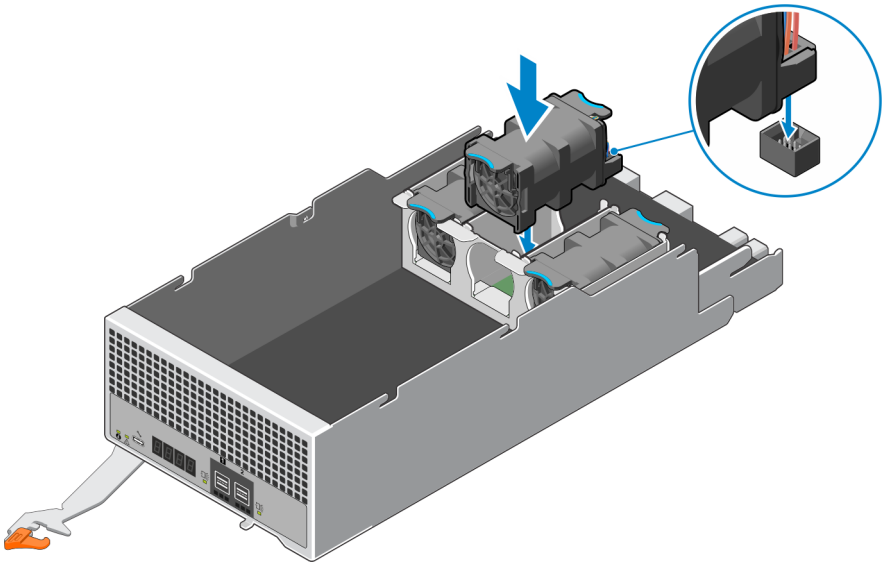

Figure 44. Installing a fan

3. Install the EMM cover. See Installing the EMM cover.
4. Install the EMM into the enclosure. See Installing the EMM.
5. Ensure that the temperature indicator on the front of the chassis is turned off, and use your system manager software to verify that the fan is operating properly.

6

Troubleshooting

This section provides information about troubleshooting your system.

Before troubleshooting your system, ensure that all cables are connected to the correct ports and that the cables are securely attached.

Troubleshooting startup failures

Check for the following if the enclosure fails to start up:

- Check the LED status indicators and ensure that all the enclosure components are working properly. See Front panel LEDs.
- Check for error messages in your system manager.
- Ensure that you do not hear any scraping or grinding sound from the hard drives.

Troubleshooting the power supply unit

The power supply unit (PSU) is hot-swappable. Leave the enclosure powered on when replacing a power supply.

NOTE: Always comply with all electrostatic and thermal guidelines to prevent bodily injury and to ensure that the system functions properly when performing hot-plug operations.

CAUTION: The enclosure can operate on a single power supply; however, both modules must be installed to ensure proper cooling.

1. Ensure that nothing is blocking the airflow through the PSU or the enclosure.
2. Reseat the power supply by removing and reinstalling it. See Power supply unit replacement.
3. Check the power cable and the power source into which the power supply is plugged.
4. Connect another device to the power source to verify that the power source is working.
5. Connect the cable to a different power source.
6. Replace the power cable.
7. If the problem is not resolved, swap or replace the PSU with a known good PSU.

After installing a PSU, allow several seconds for the enclosure to recognize the PSU and to determine if it is working properly.

Troubleshooting the EMM

The EMM is hot-swappable. Leave the enclosure powered on when replacing an EMM.

NOTE: Always comply with all electrostatic and thermal guidelines to prevent bodily injury and to ensure that the system functions properly when performing hot-plug operations.

1. Ensure that the EMM is running the current firmware version. If not, .
2. Remove the EMM and verify that the pins on the backplane and canister are not bent. See Replacing the EMM.
3. Ensure that nothing is blocking the airflow through the EMM.
4. Reinstall the EMM and wait for 30 seconds.
5. Turn on the enclosure.
6. Check the status LED.
7. If the problem is not resolved, swap or replace the EMM with a known good EMM.

Troubleshooting drives

Disk drives are hot-swappable. Leave the enclosure powered on when replacing drives.

Basic troubleshooting

NOTE: Always comply with all electrostatic and thermal guidelines to prevent bodily injury and to ensure that the system functions properly when performing hot-plug operations.

1. Check the drive activity LED and drive fault status. See Drive carrier LEDs.
2. Remove the drive from the enclosure. See Replacing drives.
3. Check the drives and the backplane to ensure that the connectors are not damaged.
4. Ensure that nothing is blocking the airflow through the enclosure.
5. Reinstall the drive into the enclosure.
6. Verify that the Mini-SAS status LED and the EMM status LED are solid green for each port that is connected to a cable.
7. Ensure that all cables are attached correctly.
8. If you reseated the cables, restart the enclosure.

Recovering from unsupported drive installation

SATA drives are not supported in MD24 Series enclosures. If you insert a SATA drive into the enclosure and then replace it with a SAS drive, the enclosure will not recognize the SAS drive.

To recover from this condition, insert the SAS drive into the enclosure and cycle power on the enclosure.

Troubleshooting enclosure connections

NOTE: Always comply with all electrostatic and thermal guidelines to prevent bodily injury and to ensure that the system functions properly when performing hot-plug operations.

1. Verify that the Mini-SAS status LED and the EMM status LED are lit green for each port that is connected to a cable.
2. Ensure that all cables are attached correctly.
3. Reseat the cables on the enclosure and the host.
4. Restart the storage enclosure and wait until the enclosure is fully booted.
5. Check the Mini-SAS status LED. If the Mini-SAS status LED is not lit, see Troubleshooting drives.

Troubleshooting a damaged enclosure

1. Ensure that the following components are properly installed:
   - Disk drives
   - EMMs
   - Cooling fans
   - Power supply units
   - Control panel
2. Ensure that all the cables are properly connected and that there are no damaged pins in the connectors. Connect all the cables and turn on the enclosure.

A

Technical specifications

This section describes the technical specifications of the MD2412 and the MD2424 enclosures.

Enclosure dimensions

Table 5. Enclosure dimensions

Specification	MD2412	MD2424
Height	2U 86.8 mm (3.4 in.)	2U 86.8 mm (3.4 in.)
Width	444 mm (17.5 in.)	444 mm (17.5 in.)
Depth	545 mm (21.5 in.)	497 mm (19.5 in.)

Enclosure weights

Table 6. Enclosure weights

Component	MD2412	MD2424
Storage enclosure (empty)	9.5 kg (21 lb)	9.2 kg (20.25 lb)
Drive with carrier (each)	0.8 kg (1.76 lbs)	0.24 kg (0.53 lbs)
EMM (each)	2.43 kg (5.36 lb)	2.52 kg (5.55 lb)
PSU (each)	0.81 kg (1.79 lb)	0.89 kg (1.96 lb)
System without drives	15.98 kg (35.23 lb)	16.0 kg (35.27 lb)
System with all drives installed	25.58 kg (56.39 lb)	21.76 kg (47.99 lb)

NOTE:

- Weights that are shown are nominal, and subject to variances.
- Weights may vary due to different canisters and power supplies; and differing calibrations between scales.
- Weights may also vary due to the number and type of disk drives (SAS or SSD) installed.

Environmental requirements

Table 7. Ambient temperature and humidity

Specification	Temperature range	Relative humidity	Max. Temperature Gradient
Operating	0°C to 40°C (32°F to 104°F)	8% to 85% non-condensing	20°C per hour
Operating (ASHRAE A3)	5°C to 40°C (41°F to 104°F)	8% to 85% non-condensing	20°C per hour
Non-operating	-40°C to +65°C (-40°F to +149°F)	10% to 95% non-condensing	-

Table 8. NEBS operating temperature requirements[1]

Specification	Temperature range	Relative humidity	Max. Temperature Gradient
Operating - altitude less than or equal to 1829 meters (6000 ft)	5°C to 40°C (41°F to 104°F)	5% to 85% non-condensing	30°C per hour
Short term [2]	-5°C to 50°C (23°F to 122°F)	5% to 93% not to exceed 0.026 kg water/kg of dry air	-
Short term with fan failure	-5°C to 40°C (23°F to 104°F)	-	-

[1] This table is a high-level summary of NEBS requiremetns. For a complete list of requirements see NEBS GR-63-CORE. All other requirements found in GR-63-CORE also apply.

[2]Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year. (This refers to a total of 360 hours in any given year, but not more than 15 occurrences during that 1-year period.)

Table 9. Other environmental requirements

Specification	Measurement or description
Altitude, operating	900 meters @ 45°C ; 3050 meters @ 33°C **NOTE:** Ramp Altitude at 3.81m/s and temperature at 20˚C/Hr
Altitude, non-operating	Maximum 12,000 m (39,370 ft)
Shock, operating	6.0 g, 11 ms. Four shocks positive and four negative in each of 3 axes, 24 total shocks.
Shock, non-operating square shock	25g, 3ms. Three shocks positive and three negative in each of 3 axes, 18 total shocks.
Shock, non-operating half sine shock	50g, 2ms. One time per face (except front and rear face), total 4 shocks.
Vibration, operating	0.21 G_{rms} 5 Hz–500 Hz random; 10 minutes/axis
Vibration, non-operating, random chassis	0.47 G_{rms}; 4–5 00Hz; vertical axis; random; 90 minutes per axis 0.39 G_{rms}; 4–500Hz; horizontal axis; random; 30 minutes per axis
Vibration, non-operating, random rack	0.88 G_{rms}; 2–200Hz; random; minutes in normal shipping orientation
Vibration, transporting	1.15G_{rms} 1 ~–200 Hz; 4 sides (bottom, top, left, right). 30 minutes per side based on ISTA 2A Standard
Acoustics	Operating sound power ≤ 8.0 Bels L_{WAd} (@ 23 ± 2°C)

Power-on and reset

The firmware boot time from power-on reset or soft reset to SMP target readiness is typically less than two minutes. Actual boot time may vary depending on your specific configuration.

Power supply unit

Table 10. AC Power supply unit specifications

Specification	Measurement
Maximum output power	800 W
Voltage	• Low line 100-127 VAC • High line 200-240 VAC • 240 VDC (China only)
Frequency	50/60 Hz

Table 10. AC Power supply unit specifications (continued)

Specification	Measurement
Holdup time	10 ms
Inrush current	55 A (maximum)
Leakage current	0.875 mA (maximum)
Efficiency	230 VRMS • >90% @ 10% load • >94% @ 20% load • >96% @ 50% load • >92% @ 100% load
Power factor	115 Vac 50Hz/240 Vac 60 Hz • >0.90 @ 5%-10% load • >0.96 @ 20% load • >0.98 @ 50% load • > 0.99 @ 100% load
iTHD	Maximum iTHD% • <20% @ 5%-10% load • <15% @ >10% load • ≤10% @ ≥20% load • ≤8% @ ≥40% load • ≤5% @ ≥50% load

Table 11. DC Power supply unit specifications

Specification	Measurement
Voltage	–40 VDC to –72 VDC (-48 VDC nominal)
Leakage current	3.5 mA (maximum)

- The MD24 Series enclosure using a DC power supply is suitable for installation as part of the common bonding network (CBN) of an isolated bonding network (IBN) or both.
- The battery return (BR) input for each DC-powered product is isolated from the MD24 Series enclosure common DC return.

B

Standards and regulations

Potential for radio frequency interference

USA Federal Communications Commission (FCC)

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

Any modifications made to this device that are not approved by Dell may void the authority that is granted to the user by the FCC to operate this equipment.

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

ICES-003 (Canada)

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Recycling of Waste Electrical and Electronic Equipment (WEEE)

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

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

NOTE: Observe all applicable safety precautions detailed in the preceding chapters (weight restrictions, handling batteries and lasers, and so on) when dismantling and disposing of this equipment.