Dell PowerStore

Hardware Information Guide for PowerStore 1000, 1200, 3000, 3200, 5000, 5200, 7000, 9000, and 9200

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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

Preface

As part of an improvement effort, revisions of the software and hardware are periodically released. Some functions that are described in this document are not supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information about product features. Contact your service provider if a product does not function properly or does not function as described in this document.

NOTE: PowerStore X model customers: For the latest how-to technical manuals and guides for your model, download the *PowerStore 3.2.x Documentation Set* from the PowerStore Documentation page at dell.com/powerstoredocs.

Where to get help

Support, product, and licensing information can be obtained as follows:

- **Product information**—For product and feature documentation or release notes, go to the PowerStore Documentation page at dell.com/powerstoredocs.
- **Troubleshooting**—For information about products, software updates, licensing, and service, go to Dell Support and locate the appropriate product support page.
- **Technical support**—For technical support and service requests, go to Dell Support and locate the **Service Requests** page. To open a service request, you must have a valid support agreement. Contact your Sales Representative for details about obtaining a valid support agreement or to answer any questions about your account.

1

Platform overview

Topics:

Description

The PowerStore platform has a flexible design capable of meeting the requirements of multiple different storage applications with support for high availability.

PowerStore appliances serve Block and File services, and the software stack is deployed directly on the system.

PowerStore hardware consists of a 2U, two node storage solution. The enclosure as a whole is called a base enclosure.

Between the front and rear of the enclosure, a mid-plane distributes power and signals to all the enclosure components. On the front of the base enclosure, drives connect to the mid-plane. On the rear of the base enclosure, the nodes and power supply modules connect to the mid-plane. The I/O modules connect directly to the node. Each node contains an internal battery backup module, redundant fan modules, DDR4 memory, and two Intel Skylake processors.

2

Base enclosure component descriptions

Topics:

Base enclosure component overview

The 2U, 25-drive base enclosure consists of the following components:

- Slots for 25 2.5-inch drives
- Midplane
- Nodes
- Power supply modules
- EMI shielding

Drives

Each drive resides in a drive carrier. The drive carriers are metal and plastic assemblies that provide smooth, reliable contact with the enclosure slot guides and mid-plane connectors. Each carrier has a handle with a latch and spring clips. The latch holds the drive in place to ensure proper connection with the mid-plane. Drive activity and fault LEDs are on the front of the enclosure.

There are three supported drive types:

- NVMe NVRAM
- NVMe SSD
  - The NVMe SSD drives in the PowerStore 3200Q are QLC-based.
  - The NVMe SSD drives in all other PowerStore models are TLC-based.
- NVMe SCM

You can visually distinguish between drive types by their different latch and handle mechanisms and by the labels on each drive.

Slots 0 through 20 can be populated with NVMe SSD and NVMe SCM drives. You can mix NVMe SSD and NVMe SCM drives in the same base enclosure. If you mix drive types, the system uses the NVMe SCM drives for metadata tiering.

NOTE: NVMe NVRAM drives are used for system caching and can only be installed in the last four slots (21 through 24) of the base enclosure. In configurations that only use two NVMe NVRAM drives, slots 21 and 22 should remain empty. The system will allow you to install SSD or SCM drives in slots 21 and 22, but doing so will make future upgrades to systems with four NVMe NVRAM drives more difficult. If there are drives in slots 21 and 22, you will need to migrate the data from the drives so they can be removed and replaced with NVMe NVRAM drives.

NOTE: A minimum of six NVMe SSD or NVMe SCM drives and two or four NVMe NVRAM drives, depending on the model, must be installed in the base enclosure. If the minimum number of drives are not populated, the base enclosure cannot be initialized.

NOTE: You cannot add additional NVMe NVRAM drives to models that ship with two.

WARNING: NVMe NVRAM drives are used for caching and are battery backed up. Never remove NVMe NVRAM drives unless you are replacing a faulted drive. Improperly removing an NVMe NVRAM drive could result in data loss.

Midplane

The midplane separates the front-facing drives from the rear-facing nodes. It distributes power and signals to all components in the enclosure. The nodes and drives plug directly into the midplane.

Node

Each base enclosure contains two nodes. The node is the intelligent component providing the compute capability of the base enclosure.

Node power supply module

Each node contains a power supply module that connects the system to an exterior power source. If one power supply fails, redundant power supplies can keep the entire base enclosure running. The power supplies include LEDs to indicate component status. A latch on the module locks it into place to ensure proper connection.

EMI shielding

EMI compliance requires a properly installed electromagnetic interference (EMI) shield in front of the base enclosure drives. When installed in cabinets that include a front door, the base enclosure includes a simple EMI shield. Other installations require a front bezel that has a locking latch and integrated EMI shield. Remove the bezel or shield to remove and install the drives.

Base enclosure front view

The front of the base enclosure contains the following elements:

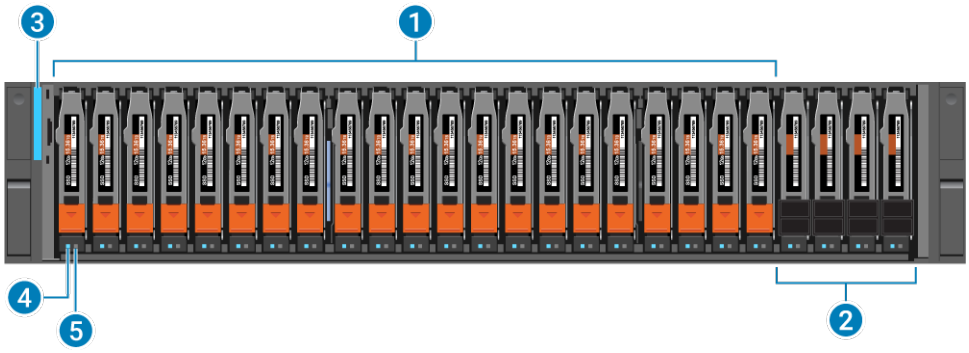

Figure 1. Base enclosure front view

Table 1. Base enclosure component locations

Location	Description
1	NVMe SSD or SCM drives
2	NVRAM NVMe drives **NOTE:** In configurations that only use two NVMe NVRAM drives, slots 21 and 22 must remain empty.
3	Base enclosure power on LED
4	Drive power and activity LED
5	Drive fault LED

Figure 2. Base enclosure and drive LEDs

Table 2. Base enclosure and drive LEDs

LED	Location	State	Description
Drive fault	1	Amber	Fault has occurred.
		Off	No fault has occurred.
Drive activity	2	Blue	Drive activity.
		Off	Drive is powered off.
Base enclosure power and fault	3	Blue	Power is on. No fault has occurred.
		Amber*	Power is on. Fault has occurred within the enclosure.
		Blue and amber alternating	System uninitialized.
		Off	Power is off.

* Failure of the following components will result in the amber fault state:

- Fan module
- Power supply
- DIMM
- Internal battery backup module
- Node
- Embedded module
- 4-port card
- I/O module
- Internal M.2 boot module
- NVMe NVRAM drive

System identification tags

The Service Tag and World Wide Name Seed are serialized labels for tracking hardware components.

Service Tag

The Service Tag for the 25-slot base enclosure is a black pull-out tag that is located between the drives in slots 16 and 17. The Service Tag includes the following information:

- Quick Resource Locator (QRL)
- Array Model Name
- Dell Service Tag Number (ST) with seven alphanumeric characters
- Express Service Number (EX)

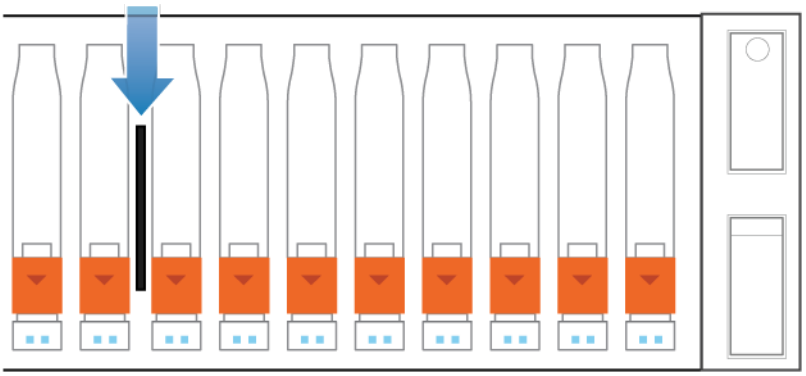

Figure 3. Service Tag location

World Wide Name Seed Tag

The World Wide Name (WWN) Seed Tag is a blue pull-out tag that is located between the drives in slots 7 and 8. The WWN Seed Tag includes the following information:

- Serial Number (SN) that matches the Dell Service Tag Number on the black Service Tag
- Part Number (PN)
- Serial Number (SN) with 14 alphanumeric characters
- WWN Seed

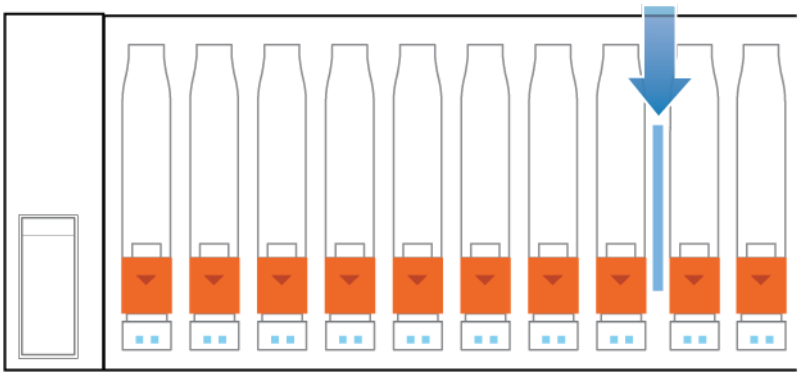

Figure 4. WWN Seed Tag location

Base enclosure rear view

The rear of the base enclosure contains two nodes: node A and node B.

Each node contains the following hardware components:

- One embedded module
- Two optional I/O modules
- One power supply module

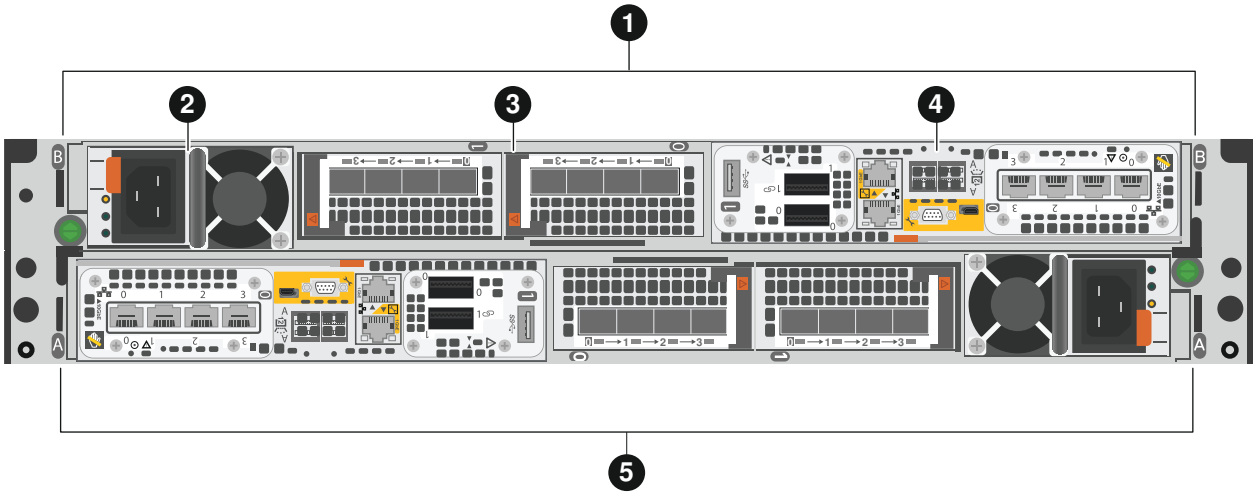

Figure 5. Base enclosure rear view with hardware component locations

Table 3. Base enclosure hardware component locations

Location	Description
1	Node B
2	Power supply module
3	I/O module slots 0 and 1
4	Embedded module
5	Node A

Base enclosure embedded modules

About embedded modules

Each node contains one embedded module that can hold one 4-port card for front-end connectivity and internal communication between nodes and appliances. The first two ports of the 4-port card on the embedded module connect to the Top-of-Rack (ToR) switches.

The 4-port card is located within the embedded module. There are two supported 4-port cards: the 4-port 25 GbE SFP-based card and the 4-port 10GBaseT card.

- The 4-port 25 GbE SFP-based card supports 10 GbE or 25 GbE SFP28, 25 GbE passive TwinAx, and 10 GbE active or passive TwinAx. Depending on the installed SFP or TwinAx cable, the following speeds are supported: 1 GbE, 10 GbE, and 25 GbE. The ports may be configured individually with TwinAx or any of the supported SFPs.

  NOTE: 25 GbE SFPs only support 25 GbE speed.

- The 4-port 10GBaseT card serves Ethernet traffic and iSCSI block protocol and supports speeds of 1 GbE and 10 GbE.

Embedded module v1

The embedded module v1 ships with the PowerStore 1000, 3000, 5000, 7000, and 9000.

The embedded module v1 contains the following components:

- One 4-port card
- One non-maskable interrupt (NMI) button (password reset)
- Two mini-SAS HD back-end ports
- Two RJ45 LAN connectors

- System management port ( )
- Service port ( )

- One USB port (unused)
- One mini-serial port (unused)
- One micro DB9 serial port (service)

NOTE: The following figure shows the location of these components on the embedded module in node A. The locations of the components in node B are mirrored.

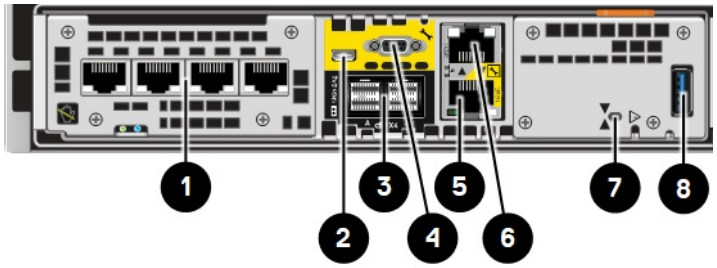

Figure 6. Embedded module v1 rear view with component locations

Table 4. Embedded module v1 component locations

Location	Description
1	4-port card
2	Mini serial port (unused)
3	Mini-SAS HD back-end ports
4	Micro DB9 serial port (service)
5	RJ45 LAN connector - service port
6	RJ45 LAN connector - system management port.
7	Non-maskable interrupt (NMI) button (password reset)
8	USB port (unused)

Embedded module v1 LEDs

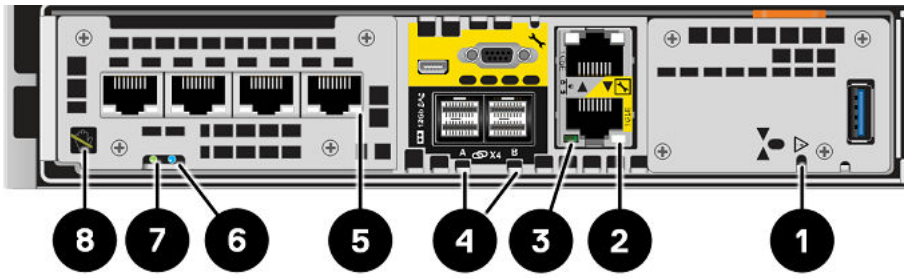

Figure 7. Embedded module LEDs

Table 5. Embedded module LEDs

LED	Location	State	Description
Embedded module fault	1	Amber	Embedded module has faulted.
		Off	No fault has occurred, normal operation.
Ethernet port link	2	Green	Link established.
		Off	No link established.

Table 5. Embedded module LEDs (continued)

LED	Location	State	Description
Ethernet port activity	3	Amber blinking	Port activity.
		Off	No port activity.
SAS port/activity Link	4	Blue	SAS port link is up.
		Off	No link established.
Port link	5	Green	Link up with high speed.
		Amber	Link up with degraded speed.
		Off	Link down.
Node fault	6	Amber	Fault has occurred.
		Blue	Node in Degraded Mode.
		Amber or blue blinking	The system is booting.
		Blue and amber alternating (green for 3 seconds)	System uninitialized. A management IP address has not been assigned.
		Blue and amber alternating at one second intervals	Node in Service Mode.
		Off	No fault has occurred, normal operation.
Node power	7	Green	Node is on (main power).
		Green blinking	Node is initializing a serial over LAN session.
		Off	Node is off.
Unsafe to remove	8	White	Do not remove the node. Improper removal could cause data loss.
		Off	Safe to remove the node or embedded module when the node or embedded module has been properly prepared.

Embedded module v2

The embedded module v2 ships with the PowerStore 1200, 3200, 5200, and 9200. The optional 100 GbE 2-port card is required if you plan to connect NVMe expansion enclosures.

The embedded module v2 contains the following components:

- One 4-port card
- 100 GbE 2-port QSFP28 card (optional)
- Two RJ45 LAN connectors
  - System management port
  - Service port
- One USB port (unused)
- One mini-serial port (unused)
- One micro DB9 serial port (unused)
- One non-maskable interrupt (NMI) button (password reset)

NOTE: The following figure shows the location of these components on the embedded module in node A. The locations of the components in node B are mirrored.

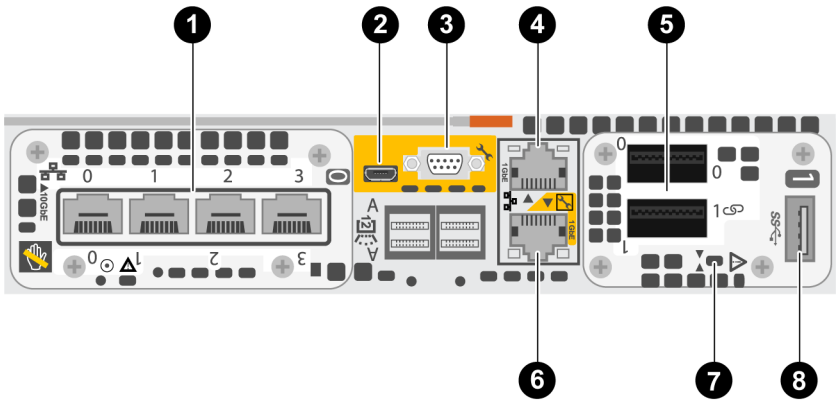

Figure 8. Rear view with component locations

Table 6. Embedded module v2 component locations

Location	Description
1	4-port card
2	Mini serial port (unused)
3	Micro DB9 serial port (unused)
4	RJ45 LAN connector - system management port
5	100 GbE 2-port QSFP28 card (Required for connecting NVMe expansion enclosures)
6	RJ45 LAN connector (service)
7	NMI button (password reset)
8	USB port (unused)

Embedded module v2 LEDs

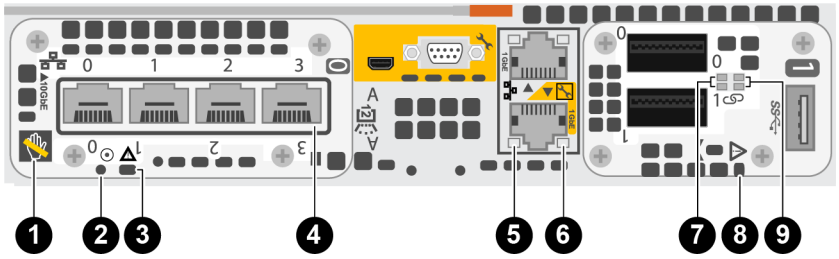

Figure 9. Embedded module LEDs

Table 7. Embedded module LEDs

LED	Location	State	Description
Unsafe to remove	1	White	Do not remove the node. Improper removal could cause data loss.
		Off	Safe to remove the node when the node has been properly prepared.
Node power	2	Green	Node is on (main power).
		Green blinking	Node is initializing a serial over LAN session.
		Off	Node is off.

Table 7. Embedded module LEDs (continued)

LED	Location	State	Description
Node fault	3	Amber	A fault has occurred.
		Blue	Node in Degraded Mode.
		Amber or blue blinking	The system is booting.
		Blue and amber alternating (green for 3 seconds)	The system is uninitialized. A management IP address has not been assigned.
		Blue and amber alternating at one second intervals	Node in Service Mode.
Port link	4	Green	The link is up with high speed.
		Amber	The link is up with degraded speed.
		Off	The link is down.
Ethernet port activity	5	Amber blinking	There is port activity.
		Off	There is no port activity.
Ethernet port link	6	Green	There is a link established.
		Off	There is no link established.
2-port 100GbE card port activity	7	Green blinking	There is port activity.
		Off	There is no port activity.
Embedded module fault	8	Amber	The Embedded module has faulted.
		Off	No fault has occurred. The system is operating normally.
2-port 100GbE card port link	9	Green	There is a link established.
		Off	There is no link established.

Base enclosure I/O module types

2-port 100GbE I/O module

The 2-port 100GbE I/O module is an Ethernet I/O module that is used to serve Ethernet network traffic and iSCSI block protocol to hosts for the platform. The 2-port 100GbE I/O module supports optical QSFPs or direct attach copper cables.

NOTE: For optimal performance, the 2-port 100GbE I/O module must be in slot 0.

4-port 25GbE SFP based I/O module

The 4-port 25GbE SFP based I/O module is an Ethernet I/O module that is used to serve Ethernet network traffic and iSCSI block protocol to hosts for the platform. The I/O module uses an optical 1G, 10G, or 25G capable SFP+ connection to a host or switch port.

4-port BaseT I/O module

The 4-port BaseT I/O module can interface at speeds of 1 Gb/s and 10 Gb/s and supports both Ethernet network traffic and iSCSI block protocol on the same node. Ports can be configured as both IP and iSCSI simultaneously. The I/O module comes with four 10 Gb/s RJ45 ports, one power/fault LED, activity LED, and link LED for each port.

4-port 32Gb Fibre Channel I/O module

The 4-port 32Gb Fibre Channel I/O module is used to serve Fibre Channel block protocol using SAN to hosts for the platform. The I/O module is available with either 16G FC SFP modules or with 32G FC SFP modules. Each port has an optical 16G/32G capable SFP connection to a host or switch port.

I/O module LED status

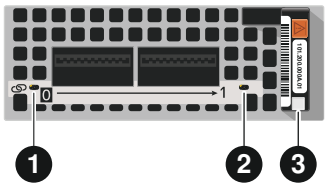

Figure 10. Base enclosure 2-port I/O module LEDs

Table 8. Base enclosure 2-port I/O module LEDs

LED	Location	State	Description
Port links	1 and 2	Green or blue	Link up
		Off	Link down
Power fault	3	Green	Power on
		Amber	Power fault

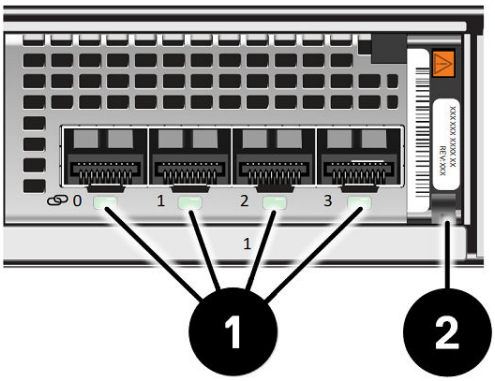

Figure 11. Base enclosure 4-port I/O module LEDs

Table 9. Base enclosure 4-port I/O module LEDs

LED	Location	State	Description
Port link	1	Green or blue	Link up
		Off	Link down
Power fault	2	Green	Power on
		Amber	Power fault

Port labels in PowerStore Manager

In PowerStore Manager, on the **Hardware** > **Rear View** tab for an appliance, the following port abbreviations are used:

- FEPort - Physical Frontend Port
- hFEPort - Hypervisor Frontend Port
- vFEPort - Virtual Frontend Port

Base enclosure AC power supply

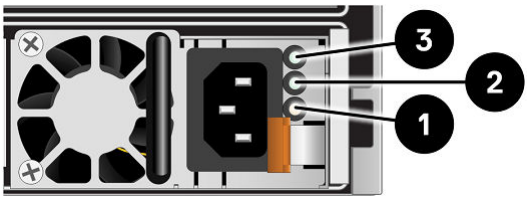

Figure 12. Base enclosure AC power supply LEDs

Table 10. Base enclosure AC power supply LEDs

LED	Location	State	Description
Fault	1	Solid amber	Power supply or backup fault. Check the cable connection.
		Off	No fault.
Supply output status	2	Green	Outputs are normal.
		Off	Outputs are faulted or disabled.
AC power (input)	3	Green	AC power is on.
		Off	AC power is off. Verify the source power.

Node internal components

Included within the node are the following components:

- Dual inline memory modules (DIMMs)
- Internal battery backup module
- Internal M.2 boot module
- Fan modules

Dual inline memory modules

Twenty-four, 288-pin DIMM sockets support up to 24 DDR4 DIMMs capable of up to 1,280 GB of memory.

Internal battery backup module

The node includes a Lithium-ion (Li-ion) internal battery that powers the associated NVRAM cache drives during a power event.

Internal M.2 boot module

Each node has two internal M.2 boot modules on an M.2 boot module adapter that is located between DIMM slots 11 and 12. One internal M.2 boot module is used for general system operations, and the other internal M.2 boot module is used for recovery.

Fan modules

Seven redundant fan modules connect to the motherboard within the node. These fan modules provide continuous airflow through the front drives and through the rear of the node to keep the components at optimal operating temperatures. Each fan module contains two fan rotors.

NOTE: If two fan rotors fail within the same node, the system performs a protective thermal shutdown of the node.

3

25 Drive 2.5 Inch SAS expansion enclosure (ESS25) component descriptions

Topics:

- SAS expansion enclosure

SAS expansion enclosure

The SAS expansion enclosure includes slots for 25 2.5-inch drives. It uses a 12-Gb/s SAS interface for communication between the nodes and the expansion enclosure.

NOTE: The SAS expansion enclosure is not supported on systems that include NVMe expansion enclosures.

SAS expansion enclosure front view

The front of the SAS expansion enclosure includes the following components:

- Drives in 2.5-inch carriers (hot-swappable)
- Status LEDs

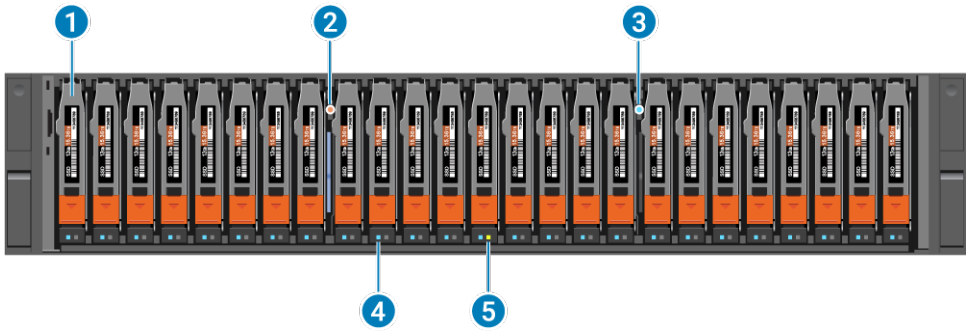

Figure 13. SAS expansion enclosure front view

Table 11. SAS expansion enclosure component locations

Location	Description
1	2.5-inch, 12-Gb/s SAS drives
2	Expansion enclosure fault LED (amber)
3	Expansion enclosure power status LED (blue)
4	Drive status and activity (blue)
5	Drive fault LED (amber)

Table 12. SAS expansion enclosure and drive status LEDs

LED	Location	Color	State	Description
Expansion enclosure fault	2	Blue	On	No fault
		Amber	On	Fault

Table 12. SAS expansion enclosure and drive status LEDs (continued)

LED	Location	Color	State	Description
Expansion enclosure power	3	Blue	On	Powering up and powered up
		—	Off	Powered off
Drive fault	4	Amber	On	Fault
		—	Off	No fault
Drive power and activity	5	Blue	On	Powering up and powered up
			Blinking	Drive activity

SAS expansion enclosure rear view

The rear of the SAS expansion enclosure includes the following components:

- Two 12-Gb/s SAS link control cards (LCC); A (4) and B (2)
- Two power supply and cooling modules; A (3) and B (1)

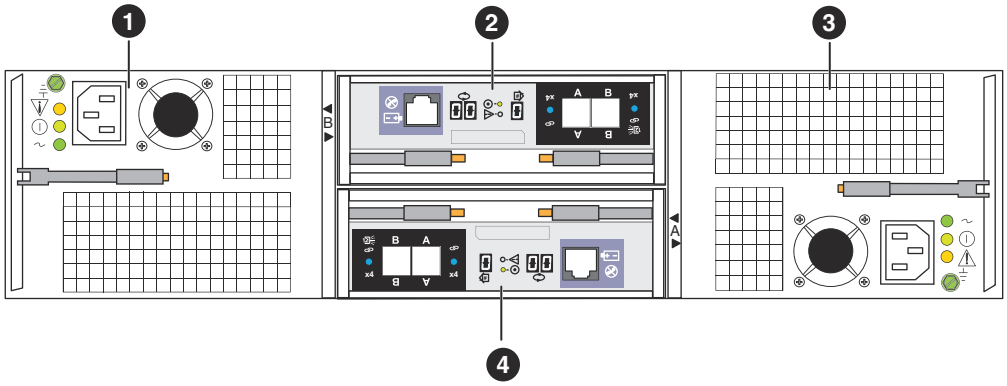

Figure 14. SAS expansion enclosure rear component locations

SAS expansion enclosure link control card

Link control card functions and features

The link control card (LCC) supports, controls, and monitors the SAS expansion enclosure, and is the primary interconnect management element. Each LCC includes connectors for input and output to downstream devices.

The LCCs in a SAS expansion enclosure connect to the node and other expansion enclosures. The cables connect the LCCs in a system in a daisy-chain topology.

Internally, each SAS expansion enclosure LCC uses protocols to emulate a loop. The LCC connects to the drives in its enclosure in a point-to-point fashion through an internal switch. The LCC independently receives and electrically terminates incoming signals. For traffic from the node, the LCC switch passes the signal from the input port to the drive being accessed. The switch then forwards the drive output signal to the port.

Each LCC independently monitors the environmental status of the entire enclosure, using a microcomputer-controlled monitor program. The monitor communicates the status to the nodes, which poll the SAS expansion enclosure status. LCC firmware also controls the SAS and drive-module status LEDs.

Each LCC includes an enclosure ID display.

12-Gb/s LCC ports, LEDs, and connectors

Each SAS expansion enclosure LCC shows the following ports, LEDs, and connectors:

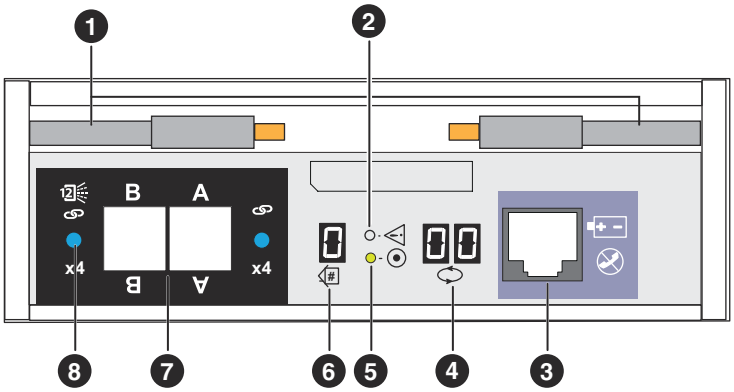

Figure 15. SAS expansion enclosure LCC ports, LEDs, and connectors

Table 13. SAS expansion enclosure LCC component locations

Location	Description
1	Ejector latch handles
2	LCC fault LED
3	LCC management port (RJ-12) (not used)
4	Back-end bus ID display (always displays 01)
5	LCC power LED
6	Enclosure ID display
7	12-Gb/s SAS ports
8	SAS port status LED

Table 14. 12-Gb/s LCC LED status

LED	Location	Color	State	Description
LCC fault LED	2	Amber	On	Fault within the LCC
		—	Off	No fault or powered off
LCC power LED	5	Green	On	Powered on and no fault
		—	Off	Powered off
SAS port status LED	8	Amber	On	SAS port faulted
		Blue	On	SAS port linked up
		—	Off	No connector in port

SAS expansion enclosure power supply and cooling module

Power supply and cooling module functions and features

The power supply and cooling modules are located to the left and right of the LCCs. The units integrate independent power supply and two dual-blower cooling assemblies into a single module.

Each power supply is an auto-ranging, power-factor-corrected, multi-output, offline converter with its own line cord. Each power supply supports a fully configured SAS expansion enclosure and shares load currents with the other supply. The drives and LCCs have individual soft-start switches that protect the drives and LCCs when they are installed while the SAS expansion enclosure is powered on. The enclosure cooling system includes two dual-blower modules.

Power supply and cooling module connectors and LEDs

The following figure shows an example of a SAS expansion enclosure AC power supply and cooling module with a recessed power in plug and status LEDs.

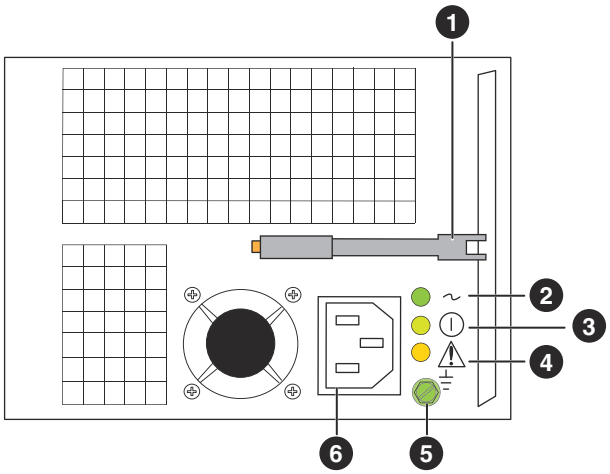

Figure 16. SAS expansion enclosure AC power supply and cooling module

Table 15. SAS expansion enclosure descriptions

Location	Description
1	Ejector latch handle
2	AC power LED (input)
3	DC power LED (input) - (not supported)
4	Power supply and cooling module fault LED
5	Grounding screw
6	Power supply AC power in (recessed plug)

Table 16. SAS expansion enclosure AC power supply and cooling module LED status

LED	Location	Color	State	Description
AC power LED (input)	2	Green	On	AC power on
		—	Off	AC power off. Verify the source power.
DC power LED (output)	3	Green	On	DC power on (not supported)
		—	Off	DC power off. Verify the source power.
Power supply and cooling module fault LED	4	Amber	On	Fault
			Blinking	During power shutdown and during overvoltage (OVP) and undervoltage protection (UVP) fault
		—	Off	No fault or power off

4

24 Drive 2.5 Inch NVMe expansion enclosure (ENS24) component descriptions

Topics:

NVMe expansion enclosure

The NVMe expansion enclosure includes slots for 24 2.5-inch NVMe SSD drives. It uses an NVMe interface for communication between the nodes and the NVMe expansion enclosure. The NVMe expansion enclosure uses the RDMA over Converged Ethernet (RoCE) network protocol to enable Remote Direct Memory Access (RDMA). This allows the system to encapsulate RDMA packets over Ethernet, which results in low latency, lower CPU usage, and higher bandwidth. Because PowerStore utilizes an NVMe over Fabric (NVMe/OF) standard, the NVMe expansion enclosure delivers an end-to-end NVMe solution.

NOTE: The NVMe expansion enclosure is not supported on systems that include SAS expansion enclosures.

NOTE: The NVMe expansion enclosure requires that the base enclosure includes the v2 embedded module and a 100 GbE 2-port card.

NOTE: The NVMe expansion enclosure does not support NVMe SCM drives and is not supported with SCM-only base enclosures.

NVMe expansion enclosure front view

The NVMe expansion enclosure front view includes the following components:

- PCIe NVMe SSD drives in 2.5-inch carriers (hot-swappable)
- Status LEDs

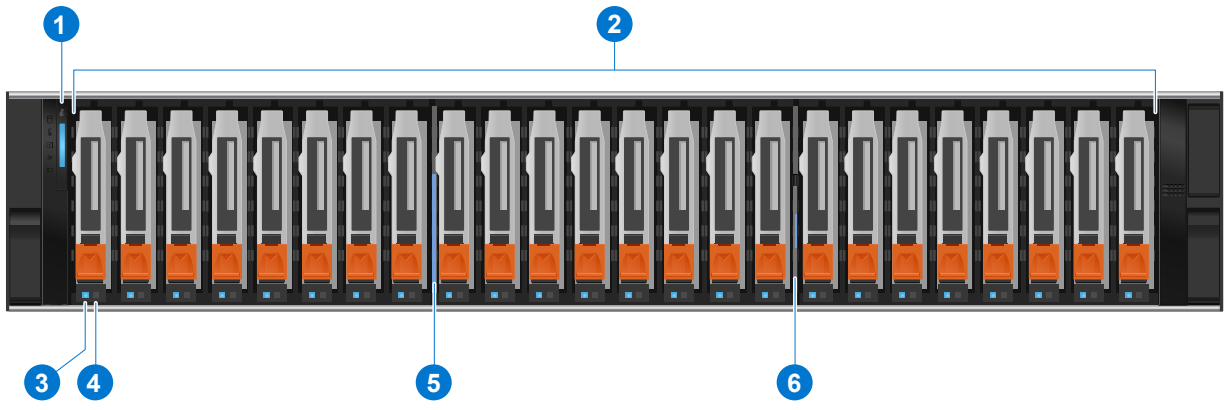

Figure 17. NVMe expansion enclosure front view front view

Table 17. NVMe expansion enclosure front view component locations

Location	Description
1	Expansion enclosure status LEDs

Table 17. NVMe expansion enclosure front view component locations (continued)

Location	Description
2	2.5-inch NVMe drives
3	Drive status and activity (blue)
4	Drive fault LED (amber)
5	World Wide Name (WWN) Seed Tag
6	Service Tag

Table 18. Drive status LEDs

LED	Location	Color	State	Description
Drive power and activity	3	Blue	On	Powering up and powered up
			Blinking	Drive activity
Drive fault	4	Amber	On	Fault
		—	Off	No fault

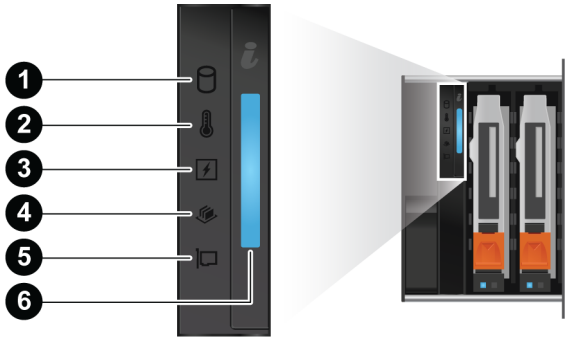

Figure 18. NVMe expansion enclosure front view status LEDs

Table 19. NVMe expansion enclosure front view status LEDs

LED	Location	Color	State	Description
Drive Status	1	Amber	On	Drive fault, unsupported drive, or rebuilding
		Green	On	No fault
Temperature Status	2	Amber	On	Overheating component
		Green	On	No fault
Electrical Status	3	Amber	On	PSU failure or incorrect voltage range
		Green	On	No fault
Memory Status	4	Amber	On	DIMM failure
		Green	On	No fault
Drive Interface Status	5	Amber	On	Clockboard or Ethernet interface failure
		Green	On	No fault
Indication LED	6	—	Off	Powered on and healthy
		Blue	Blinking	System ID mode enabled
		Amber	Blinking	Hardware fault

NVMe expansion enclosure rear view

The rear of the NVMe expansion enclosure includes the following components:

- Two Link Controller Cards (LCCs) that contain the following components:
  - Access Module
  - Drive Interface Board located behind the Access Module
- Two power supply modules

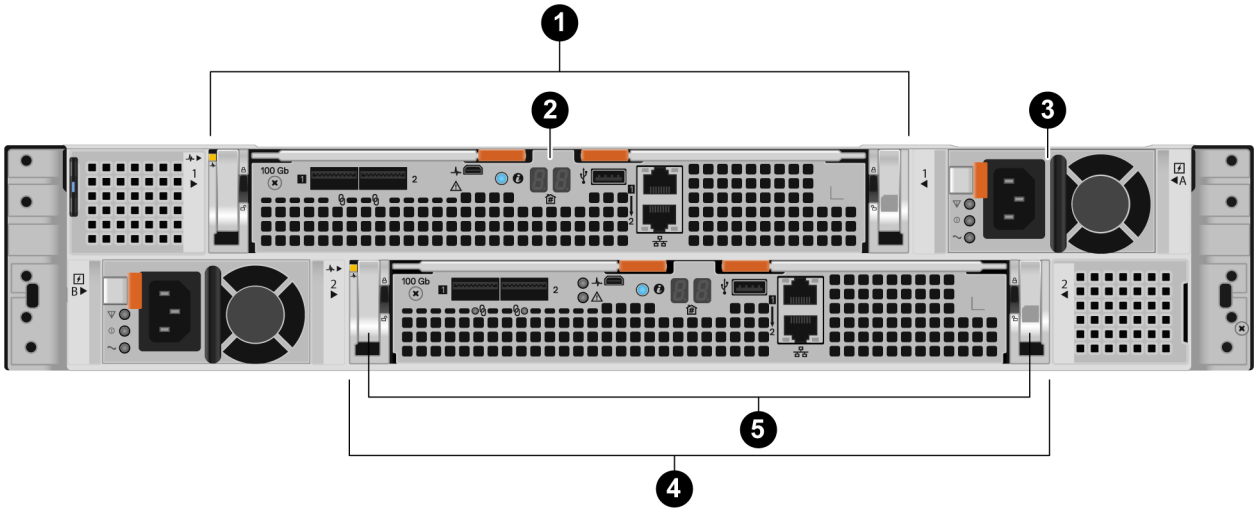

Figure 19. NVMe expansion enclosure rear component locations

Table 20. NVMe expansion enclosure hardware component locations

Location	Description
1	LCC 1
2	Access Module
3	Power supply module
4	LCC 2
5	Drive Interface Board

NVMe expansion enclosure LCC

About LCCs

Each NVMe expansion enclosure contains two LCCs, and each LCC contains an Access Module and a Drive Interface Board that is located behind the Access Module. The Drive Interface Board connects the front-end to the back-end and contains the PCIe switches that connect the drives and the Access Module.

The Access Module manages and reports the environmental conditions of the NVMe expansion enclosure such as power, thermal, status indicators, and component presence. The Access Module employs NVMe-oF (NVMe over Fabrics) technology by using RDMA over Converged Ethernet (RoCE) for Ethernet. This technology allows the Access Module to perform the translation of the persistent storage data received over the Ethernet interfaces and transfer it onto the PCIe connections of the NVMe drives. The Access Module also applies the data protection that is deployed by the system.

The Access Module contains the following components:

- Two 100GbE ports (QSFP28) for connecting the NVMe expansion enclosure to the base enclosure and for daisy chaining additional NVMe expansion enclosures.
- One micro USB port (not used)
- One USB port (not used)
- Two 1GbE RJ45 management ports (for support only)

The following figure shows the location of these components:

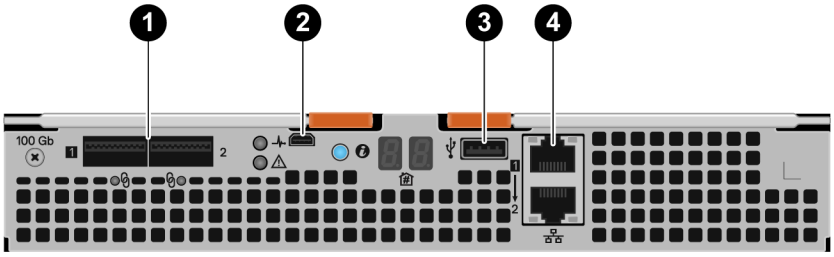

Figure 20. Access Module rear view with component locations

Table 21. Access Module component locations

Location	Description
1	100GbE ports (QSFP28)
2	Micro USB port (not used)
3	USB port (not used)
4	1GbE RJ45 management ports (for support only)

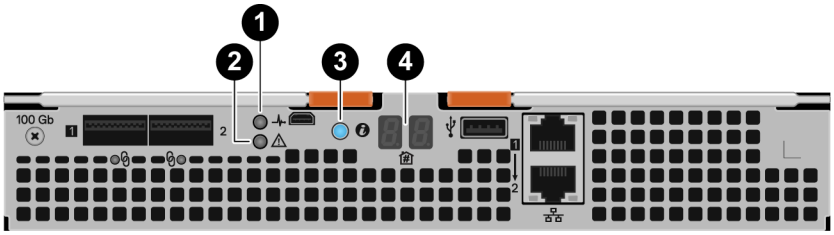

Figure 21. Access Module LEDs

Table 22. Access Module LEDs

LED	Location	State	Description
Power status	1	Green	Power on.
		Off	Power off.
Fault status	2	Amber	Faulted hardware.
		Off	No fault has occurred. Normal operation.
System ID	3	Blinking blue	System ID mode is enabled.
		Off	System ID mode is not enabled.
Daisy chain ID	4	50–52	Identifies where in the daisy chain the expansion enclosure is located: • 50 - First expansion enclosure • 51 - Second expansion enclosure • 52 - Third expansion enclosure

NVMe expansion enclosure AC power supply

The NVMe expansion enclosure includes two 1800W AC power supplies.

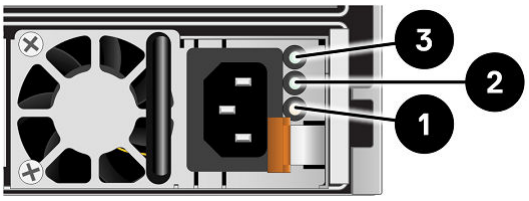

Figure 22. NVMe expansion enclosure AC power supply LEDs

Table 23. NVMe expansion enclosure AC power supply LEDs

LED	Location	State	Description
Fault	1	Solid amber	Power supply or backup fault. Check the cable connection.
		Off	No fault.
DC power (output) - Not supported	2	Green	N/A
		Off	N/A
AC power (input)	3	Green	AC power is on.
		Off	AC power is off. Verify the source power.

NVMe expansion enclosure internal components

Included within the NVMe expansion enclosure are the following components:

Fan modules

Six redundant fan modules provide continuous airflow through the front drives and through the rear of the expansion enclosure to keep the components at optimal operating temperatures. Each fan module contains two fan rotors.

NOTE: If three fan rotors fail in an expansion enclosure, the system performs a protective thermal shutdown of the expansion enclosure.

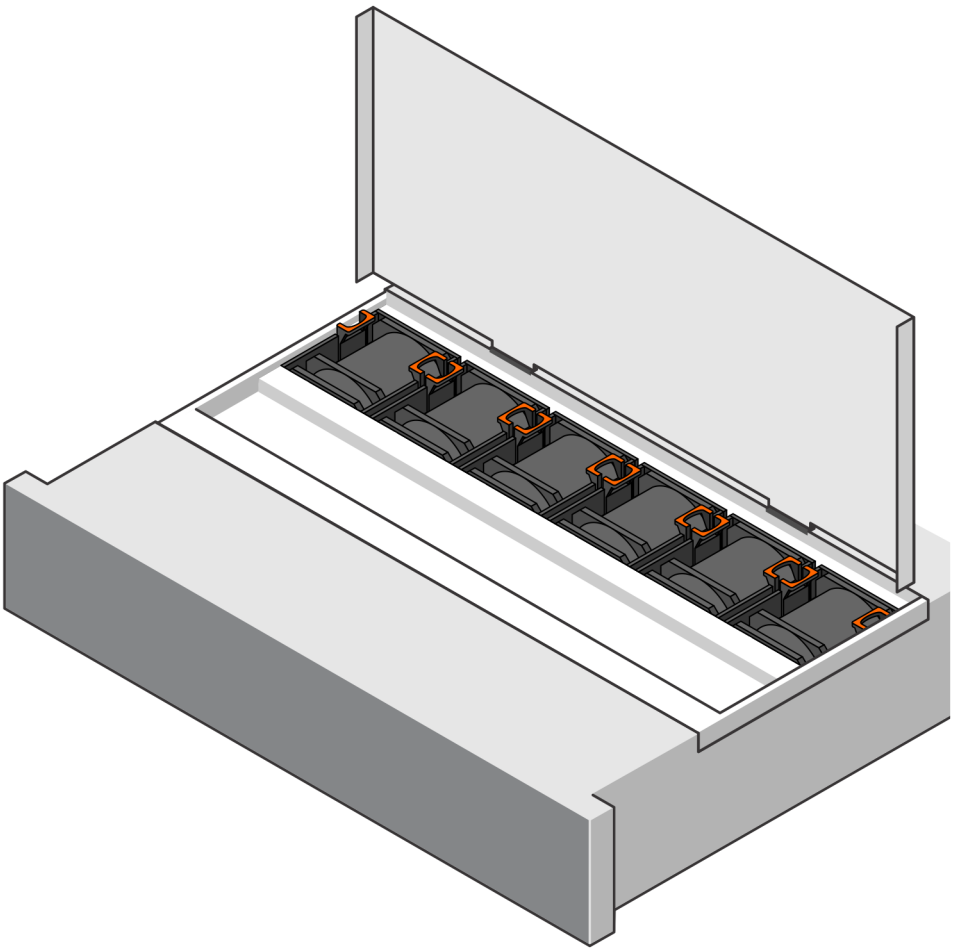

Figure 23. NVMe expansion enclosure fan modules

Clock Distribution Boards

Two Clock Distribution Boards provide a common clock to the drives.

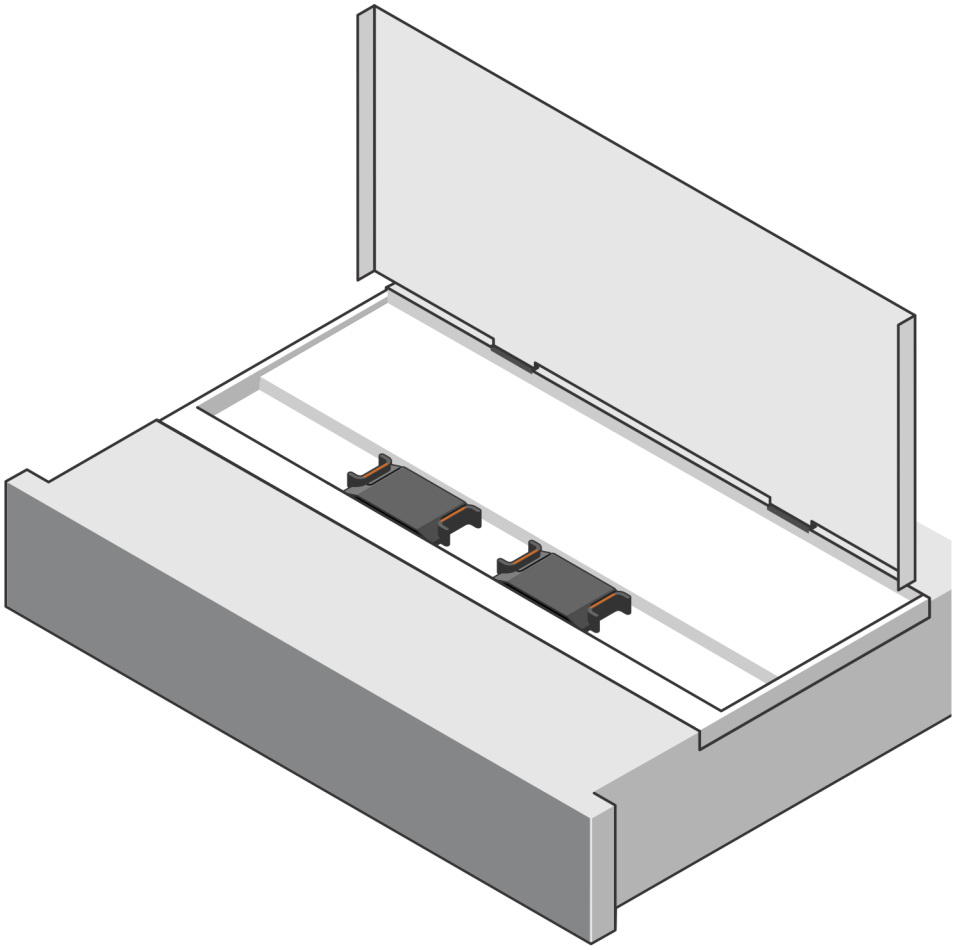

Figure 24. NVMe expansion enclosure Clock Distribution Boards

Dual inline memory modules (DIMMs)

Two 8 GB DDR4 DIMMs provide 16 GB of memory. The DIMMs are located inside the Access Module in slots 2 and 3.

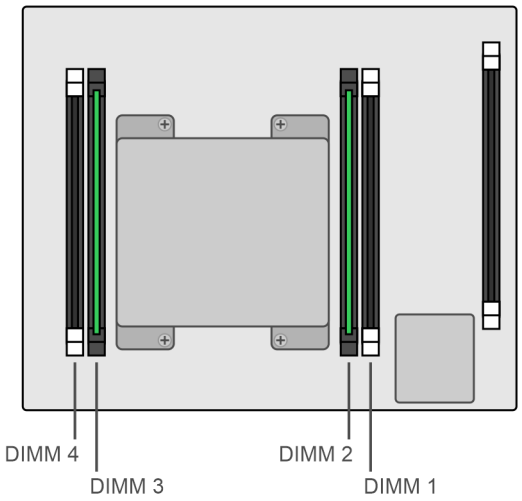

Figure 25. NVMe expansion enclosure DIMMs

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Technical specifications

Topics:

Dimensions and weight for the base enclosure

Table 24. Base enclosure dimensions and weight

Dimension	Value
Weight (fully populated)	41.7 kg (92 lbs)
Vertical size	Two NEMA units
Height	8.64 cm (3.4 in)
Width	44.45 cm (17.5 in)
Depth	79.5 cm (31.3 in)

Dimensions and weight for the SAS expansion enclosure

Table 25. SAS expansion enclosure dimensions and weight

Dimension	Value
Weight (fully populated)	34.98 kg (77.11 lb)
Vertical size	Two NEMA units
Height	8.64 cm (3.4 in)
Width	44.45 cm (17.5 in)
Depth	34.29 cm (13.5 in)

Dimensions and weight for the NVMe expansion enclosure

Table 26. NVMe expansion enclosure dimensions and weight

Dimension	Value
Weight (fully populated)	26.08 kg (57.5 lb) (not including cable management arms or mounting rails)
Vertical size	Two NEMA units
Height	8.89 cm (3.5 in)
Width	43.18 cm (17 in)
Depth	65.30 cm (25.71 in)
Depth with cable management arms	84.86 cm (33.41 in)

Power requirements for the base enclosure

Power requirements vary depending on system configuration, loading, and environmental conditions. The table below describes the maximum expected power draw. To estimate power consumption values for your specific environment, use the Dell Power Calculator.

Table 27. Power requirements for x000 models

Requirement	1000T	3000T	5000T	7000T	9000T
Maximum input power	240 VAC ± 10%, single phase For 100-120V, a customer-supplied step-up transformer is required.				
AC Line Current (operating maximum at 200 VAC)	6.7 A	8.1 A	9.0 A	9.3 A	10.4 A
Power Consumption (operating maximum at 200 VAC)	1385 VA (1316 W)	1629.6 VA (1597 W)	1792.9 VA (1757 W)	1868.4 VA (1831 W)	2088.8 VA (2047 W)
Heat Dissipation (operating maximum)	4.73 x 10^6 J/hr, (4,490 Btu/hr)	5.74 x 10^6 J/hr, (5,449 Btu/hr)	6.32 x 10^6 J/hr, (5,995 Btu/hr)	6.59 x 10^6 J/hr, (6,248 Btu/hr)	7.37 x 10^6 J/hr, (6,985 Btu/hr)
AC Inlet type	IEC320-C14 or IEC320-C20 appliance coupler per power zone			IEC320-C20 appliance coupler per power zone	
Normal input frequency	47 Hz–63 Hz				
Maximum inrush current	45 Apk "cold" per line cord at any line voltage				
AC protection	20 A fuse on each power supply, single line				
Ride-through time	10 ms min				
Current sharing	± 5 percent of full load between power supplies				
Startup Surge Current	120 Apk "hot" per line cord, at any line voltage				

Table 28. Power requirements for x200 models

Requirement	1200T	3200T	3200Q	5200T	9200T
Maximum input power	240 VAC ± 10%, single phase For 100-120V, a customer-supplied step-up transformer is required.				
AC Line Current (operating maximum at 200 VAC)	6.5 A	7.1 A	7.7 A	8.8 A	9.8 A
Power Consumption (operating maximum at 200 VAC)	1297.2 VA (1271.3 W)	1422 VA (1393.6 W)	1535.8 VA (1505.1 W)	1769.8 VA (1734.4 W)	1958.6 VA (1919.4 W)
Heat Dissipation (operating maximum)	4.58 x 10^6 J/hr, (4,338 Btu/hr)	5.02 x 10^6 J/hr, (4,755 Btu/hr)	5.42 x 10^6 J/hr, (5,136 Btu/hr)	6.24 x 10^6 J/hr, (5,918 Btu/hr)	6.91 x 10^6 J/hr, (6,549 Btu/hr)

Table 28. Power requirements for x200 models (continued)

Requirement	1200T	3200T	3200Q	5200T	9200T
AC Inlet type	IEC320-C14 or IEC320-C20 appliance coupler per power zone				IEC320-C20 appliance coupler per power zone
Normal input frequency	47 Hz–63 Hz				
Maximum inrush current	45 Apk "cold" per line cord at any line voltage				
AC protection	20 A fuse on each power supply, single line				
Ride-through time	10 ms min				
Current sharing	± 5 percent of full load between power supplies				
Startup Surge Current	120 Apk "hot" per line cord, at any line voltage				

Table 29. High ambient temperature shutdown

Ambient temperature	Hardware fault	Consequence
Above 45° C (113° F)	None	Noncritical warning generated.
Above 50° C (122° F)	None	Critical alert generated. The system shuts down after five minute timer expires. If the temperature returns to less than 45° C (113° F) , the system powers on.
Any	Three hottest drives have an average temperature of 50° C (122° F)	The system shuts down after five minute timer expires.
Any	Two fans fault	The system shuts down after five minute timer expires.

Power requirements for the SAS expansion enclosure

Power requirements vary depending on system configuration, loading, and environmental conditions. The table below describes the maximum expected power draw. To estimate power consumption values for your specific environment, use the Dell Power Calculator.

Table 30. Power requirements

Requirement	Description
AC line voltage	100 to 240 VAC ± 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	3.32 A max at 100 VAC
	1.66 A max at 200 VAC
Power consumption (operating maximum)	308 VA (319 W) max at 100 VAC
	332 VA (315 W) max at 200 VAC
Power factor	0.95 minimum at full load, 100V/200V
Heat dissipation (operating maximum)	1.11 x 10^6 J/hr. (1,088 Btu/hr.) max at 100 VAC
	1.20 x 10^6 J/hr, (1,075 Btu/hr) max at 200 VAC
In-rush current	30 A max for 1/2 line cycle per line cord at 240 VAC

Table 30. Power requirements (continued)

Requirement	Description
Startup surge current	40 Amps peak max per line cord at any line voltage.
AC protection	15 A fuse on each power supply, both Line and Neutral
AC inlet type	IEC320-C14 appliance coupler, per power zone
Ride-through time	12-millisecond minimum
Current sharing	± 5% of full load between power supplies

Power requirements for the NVMe expansion enclosure

Power requirements vary depending on system configuration, loading, and environmental conditions. The table below describes the maximum expected power draw. To estimate power consumption values for your specific environment, use the Dell Power Calculator.

Table 31. Power requirements

Requirement	Description
AC line voltage	100 to 240 VAC +/- 10%, single-phase, 47 to 63 Hz
AC line current (operating maximum)	6.49 A max at 100 VAC
	3.31 A max at 200 VAC
Power consumption (operating maximum at 200 VAC)	663 VA (630 W)
Power factor	0.92 minimum at full load 100V/200V
Heat dissipation (operating maximum at 200 VAC)	2.27 x 10^6 J/hr (2,150 Btu/hr)
In-rush current	82A max for 1/2 Line cycle per line cord at 200 VAC
Startup surge current	100A Max for up to 125uSec
AC protection	15 A fuse on each power supply, both Line and Neutral
AC inlet type	IEC320-C14 appliance coupler, per power zone
Ride-through time	10-millisecond minimum
Current sharing	+/- 5% of full load between power supplies

Considerations for TLC and QLC drives

TLC drives retain data for up to 90 days while powered off. Data corruption may occur if the drives are powered off for more than 90 days. QLC drives retain data for up to 30 days while powered off. Data corruption may occur if the drives are powered off for more than 30 days. Data corruption may occur for either drive type if they are stored in temperatures above 40° C (104° F).

Operating environment limits

Table 32. Operating environment limits

Limit Type	Limit
Temperature	5°C through 35°C normal, 35°C through 40°C for 10% of the time
Humidity	-12°C DP and 8% to 85% RH (non-condensing)
Temperature Gradient (disk)	20°C/hr
Altitude Compensation	Normal: Lower temp 1°C per 300 M above 950 M
	Improbable: Lower temp 1°C per 175 M above 950 M

Shipping and storage requirements

CAUTION: Systems and components must not experience changes in temperature and humidity that are likely to cause condensation to form on or in that system or component. Do not exceed the shipping and storage temperature gradient of 45°F per hr (25°C per hr).

Table 33. Shipping and storage requirements

Requirement	Description
Ambient temperature	-40° F to 149°F (-40°C to 65°C)
Temperature gradient	45°F per hr (25°C per hr)
Relative humidity	10% to 90% noncondensing
Elevation	-50 ft to 35,000 ft (-16 m to 10,600 m)
Unpowered storage time	Do not exceed six consecutive months of unpowered storage.

Base enclosure airflow

The base enclosure uses an adaptive cooling algorithm that increases or decreases fan speed as the unit senses changes to the external ambient temperature. Exhaust increases with ambient temperature and fan speed, and is roughly linear within recommended operating parameters. Note that the information in the table below is typical, and was measured without cabinet front/rear doors that would potentially reduce front-to-back air flow.

Table 34. Base enclosure airflow

Max Airflow CFM	Min Airflow CFM	Max Power Usage (Watts)
165 CFM	50 CFM	850 W

Environmental recovery

If the system exceeds the maximum ambient temperature by approximately 10°C (18°F), the nodes in the system begin an orderly shutdown that saves cached data, and then shut themselves down. Link control cards (LCCs) in each expansion enclosure in the system power down drives but remain powered on.

If the system detects that the temperature has dropped to an acceptable level, it restores power to the base enclosures and the LCCs restore power to their drives.

Air quality requirements

The products are designed to be consistent with the requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Environmental Standard Handbook and the most current revision of Thermal Guidelines for Data Processing Environments, Second Edition, ASHRAE 2009b.

Cabinets are best suited for Class 1 datacom environments, which consist of tightly controlled environmental parameters, including temperature, dew point, relative humidity and air quality. These facilities house mission-critical equipment and are typically fault-tolerant, including the air conditioners.

The data center should maintain a cleanliness level as identified in ISO 14664-1, class 8 for particulate dust and pollution control. The air entering the data center should be filtered with a MERV 11 filter or better. The air within the data center should be continuously filtered with a MERV 8 or better filtration system. In addition, efforts should be maintained to prevent conductive particles, such as zinc whiskers, from entering the facility.

The allowable relative humidity level is 20 to 80% non condensing, however, the recommended operating environment range is 40 to 55%. For data centers with gaseous contamination, such as high sulfur content, lower temperatures and humidity are recommended to minimize the risk of hardware corrosion and degradation. In general, the humidity fluctuations within the data center should be minimized. It is also recommended that the data center be positively pressured and have air curtains on entry ways to prevent outside air contaminants and humidity from entering the facility.

For facilities below 40% relative humidity, it is recommended to use grounding straps when contacting the equipment to avoid the risk of Electrostatic discharge (ESD), which can harm electronic equipment.

As part of an ongoing monitoring process for the corrosiveness of the environment, it is recommended to place copper and silver coupons (per ISA 71.04-1985, Section 6.1 Reactivity), in airstreams representative of those in the data center. The monthly reactivity rate of the coupons should be less than 300 Angstroms. When monitored reactivity rate is exceeded, the coupon should be analyzed for material species and a corrective mitigation process put in place.

Storage time (unpowered) recommendation: do not exceed 6 consecutive months of unpowered storage.

Fire suppressant disclaimer

Fire prevention equipment in the computer room should always be installed as an added safety measure. A fire suppression system is the responsibility of the customer. When selecting appropriate fire suppression equipment and agents for the data center, choose carefully. An insurance underwriter, local fire marshal, and local building inspector are all parties that you should consult during the selection of a fire suppression system that provides the correct level of coverage and protection.

Equipment is designed and manufactured to internal and external standards that require certain environments for reliable operation. Compatibility claims and recommendations on fire suppression systems are not provided through Dell. It is not recommended to position storage equipment directly in the path of high-pressure gas discharge streams or loud fire sirens to minimize the forces and vibration adverse to system integrity.

NOTE: The previous information is provided on an as-is basis and provides no representations, warranties, guarantees, or obligations on the part of our company. This information does not modify the scope of any warranty set forth in the terms and conditions of the basic purchasing agreement between the customer and the manufacturer.

Shock and vibration

Products have been tested to withstand the shock and random vibration levels.

The levels apply to all three axes and should be measured with an accelerometer on the equipment enclosures within the cabinet and shall not exceed any of the values in this table.

Table 35. Platform Response Levels

Platform condition	Response measurement level
Nonoperational shock	25 Gs for 3-milliseconds
Operational shock	6 Gs for 11-milliseconds
Nonoperational random vibration	0.40 Grms at 5-500 Hz for 30 minutes
Operational random vibration	0.21 Grms at a frequency range between 5-500 Hz for 10 minutes

Systems that are mounted on an approved package have completed transportation testing to withstand shock and vibrations in the vertical direction only. The levels shall not exceed the values in this table.

Table 36. Packaged System Measurement Levels

Packaged system condition	Response measurement level
Transportation shock	10 Gs for 12-milliseconds
Transportation random vibration	0.28 Grms at a frequency range between 1-100 Hz for 4 hours