Dell EMC PowerStore

Hardware Information Guide for PowerStore 1000, 3000, 5000, 7000, and 9000

Version 2.x

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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.

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 https://www.dell.com/powerstoredocs.

- **Troubleshooting**

  For information about products, software updates, licensing, and service, go to https://www.dell.com/support and locate the appropriate product support page.

- **Technical support**

  For technical support and service requests, go to https://www.dell.com/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

Description

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

- PowerStore T model appliances
- PowerStore X model appliances

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

PowerStore X model appliances serve Block services, and a hypervisor is installed on the system. The system software stack is deployed on the hypervisor, and the hypervisor enables deployment of VMs and applications within the PowerStore hardware.

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
- Node
- Power supply module
- 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
- 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.

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 must remain empty.

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 is not populated, the base enclosure will not initialize.

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 mid-plane 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 mid-plane.

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:

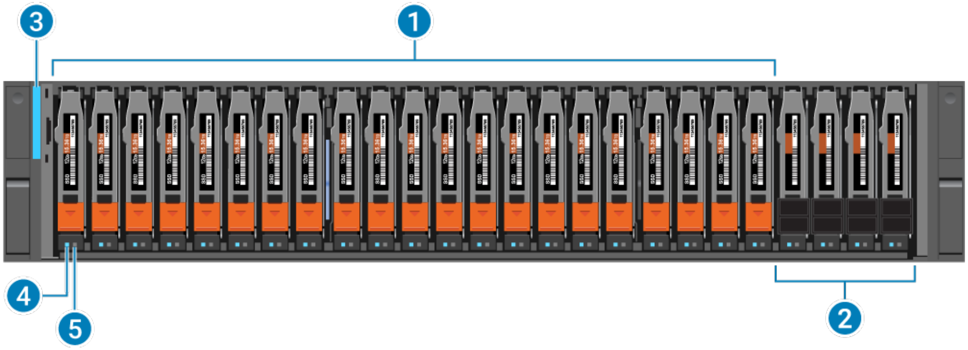

Figure 1. Base enclosure front view

Table 1. Base enclosure component locations

Location	Description
❶	SSD or SCM NVMe drives
❷	NVRAM NVMe drives ⓘ **NOTE:** In configurations that only use two NVMe NVRAM drives, slots 21 and 22 must remain empty.
❸	Base enclosure power on LED
❹	Drive power and activity LED
❺	Drive fault LED

Figure 2. Base enclosure and drive LEDs

Table 2. Base enclosure and drive LEDs

LED	Location	State	Description
Drive fault	❶	Amber	Fault has occurred.
		Off	No fault has occurred.
Drive activity	❷	Blue	Drive activity.
		Off	Drive is powered off.
Base enclosure power and fault	❸	Blue	Power is on. No fault has occurred.
		Amber	Power is on. Fault has occurred within the enclosure.
		Blue and amber alternating	System not initialized.
		Off	Power is off.

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 Part Number, Dell Service Tag, and System Serial Number.

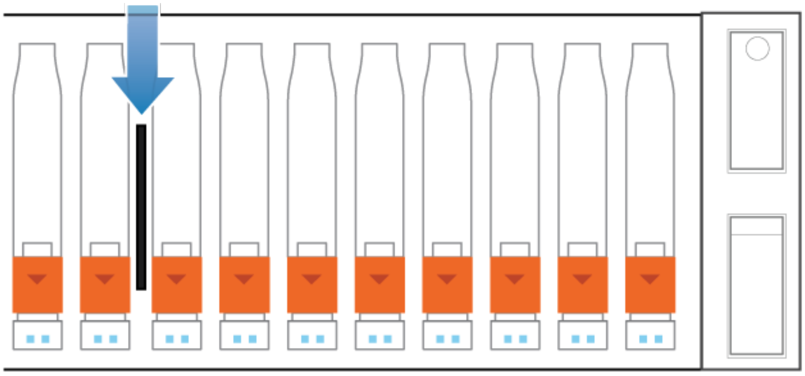

Figure 3. Service Tag location

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.

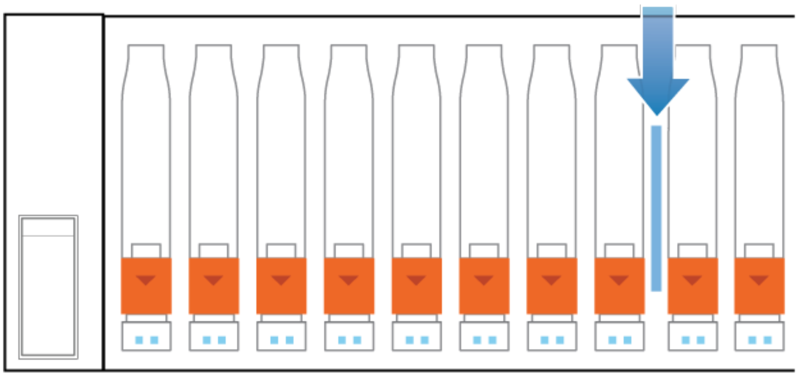

Figure 4. WWN Seed Tag location

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

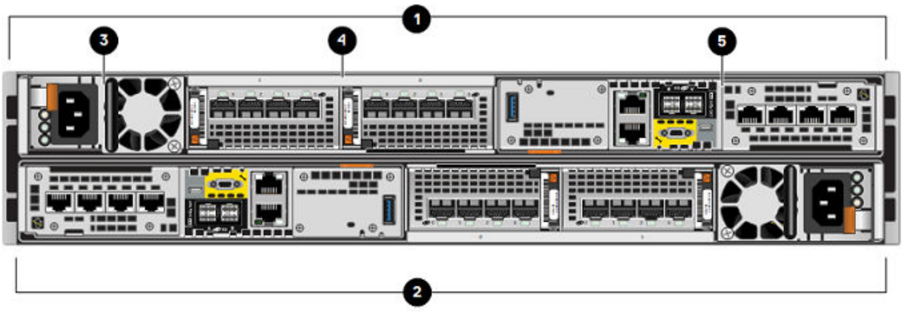

Figure 5. Base enclosure rear view with hardware component locations

Table 3. Base enclosure hardware component locations

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

Base enclosure embedded modules and 4-port cards

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 a Top-of-Rack (ToR) switch.

NOTE: Both nodes must have the same type of embedded modules in the same slots.

The embedded module contains the following components:

- One 4-port card
- One non-maskable interrupt (NMI) button
- Two mini-SAS HD back-end ports
- Two RJ-45 LAN connectors
  - System management port (🖧)
  - Service port (🔧)
- One USB port
- One mini-serial port (unused)
- One 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.

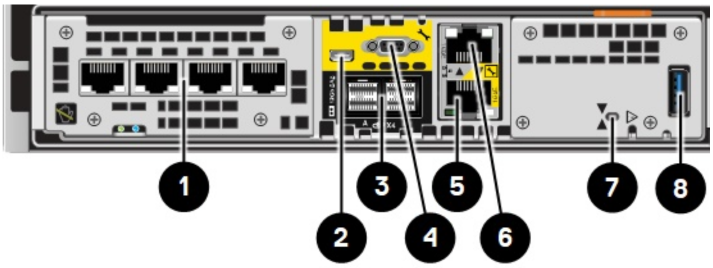

Figure 6. Embedded module rear view with component locations

Table 4. Embedded module component locations

Location	Description
①	4-port card
②	Mini serial port (unused)
③	Mini-SAS HD back-end ports
④	DB9 serial port (service)
⑤	RJ-45 LAN connector - service port
⑥	RJ 45 LAN connector - system management port. Only used on PowerStore T model. Not used on PowerStore X model.
⑦	Non-maskable interrupt (NMI) button
⑧	USB port

About 4-port cards

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

The 4-port 25GbE SFP based embedded module supports 1GbE SFP to RJ45, 10GbE or 25GbE SFP28, 25GbE passive TwinAx, and 10GbE active or passive TwinAx. Depending on the installed SFP or TwinAx cable, the following speeds are supported: 1GbE, 10GbE, and 25GbE. The ports may be configured individually with TwinAx or any of the supported SFPs.

NOTE: 25GbE SFPs only support 25GbE speeds.

The 4-port 10GBaseT embedded module serves Ethernet traffic and iSCSI block protocol. Speeds of 1GbE and 10 GbE are supported.

Embedded module and 4-port card LED status

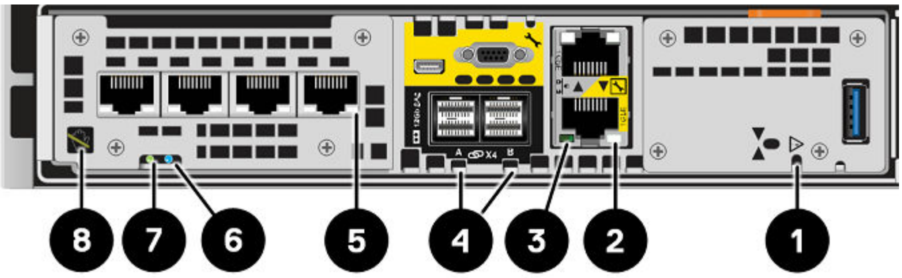

Figure 7. Embedded module LEDs

Table 5. Embedded module LEDs

LED	Location	State	Description
Embedded module power	①	Amber	Embedded module has faulted.
		Off	No fault has occurred, normal operation.
Ethernet port link	②	Green	Link established.
		Off	No link established.
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	System is booting.
		Blue and amber alternating (green for 3 seconds)	System not initialized. 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.

Table 5. Embedded module LEDs (continued)

LED	Location	State	Description
		Off	Safe to remove the node or embedded module when the node or embedded module has been properly prepared.

Base enclosure I/O module types

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) on the same node. Ports can be configured as both IP and iSCSI simultaneously. The I/O module comes with four 10-Gb/s RJ-45 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 via 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

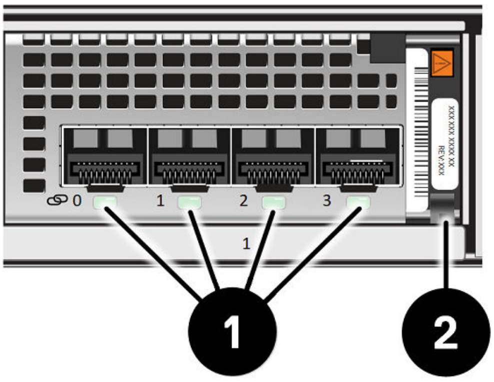

Figure 8. Base enclosure I/O module LEDs

Table 6. Base enclosure I/O module LEDs

LED	Location	State	Description
Port link	❶	Green or blue	Link up
		Off	Link down
Power fault	❷	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 power supply

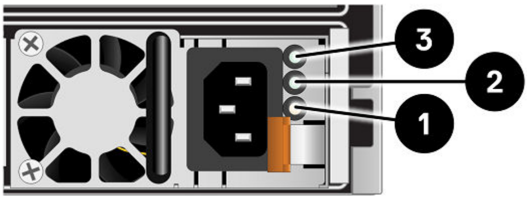

Figure 9. Base enclosure power supply LEDs

Table 7. Base enclosure power supply LEDs

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

Node internal components

Included within the node are the following components:

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

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 adaptor 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 module

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

ⓘ **NOTE:** If two cooling modules fault within the same node, the node performs a protective thermal shutdown.

3

Expansion enclosure component descriptions

Topics:

- 2U, 25-drive expansion enclosure

2U, 25-drive expansion enclosure

The 2U, 25-drive 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.

2U, 25-drive expansion enclosure front view

The front of the 2U, 25-drive expansion enclosure includes the following components:

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

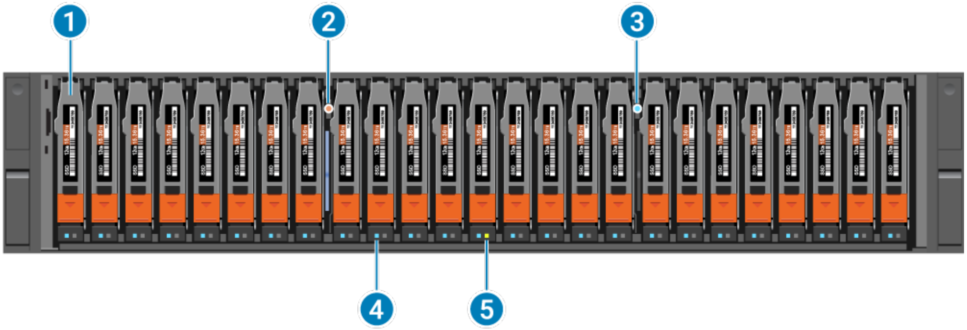

Figure 10. 2U, 25-drive expansion enclosure front view

Table 8. 2U, 25-drive 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 9. 2U, 25-drive expansion enclosure and drive status LEDs

LED	Location	Color	State	Description
Expansion enclosure fault	②	Blue	On	No fault
		Amber	On	Fault
Expansion enclosure power	③	Blue	On	Powering up and powered up

Table 9. 2U, 25-drive expansion enclosure and drive status LEDs (continued)

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

2U, 25-drive expansion enclosure rear view

The rear of the 2U, 25-drive 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)

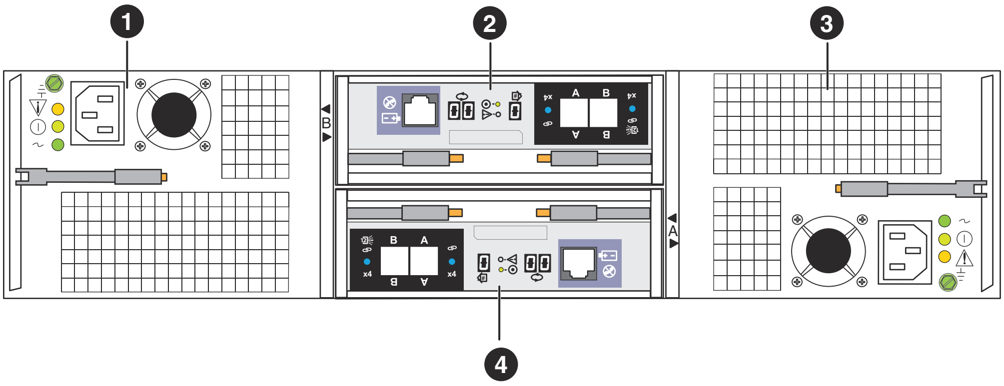

Figure 11. 2U, 25-drive expansion enclosure rear component locations

2U, 25-drive expansion enclosure link control card

Link control card functions and features

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

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

Internally, each 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 storage processor, which polls 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 2U, 25 expansion enclosure LCC shows the following ports, LEDs, and connectors:

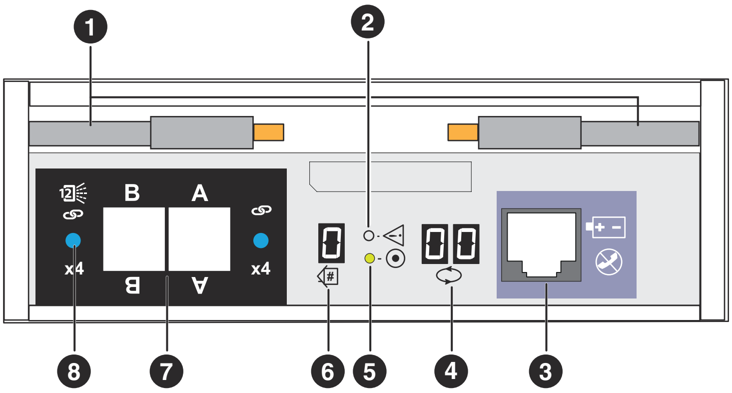

Figure 12. 2U, 25-drive expansion enclosure LCC ports, LEDs, and connectors

Table 10. 2U, 25 (2.5-inch) 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 11. 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

2U, 25-drive 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 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 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 2U, 25-drive expansion enclosure AC power supply and cooling module with a recessed power in plug and status LEDs.

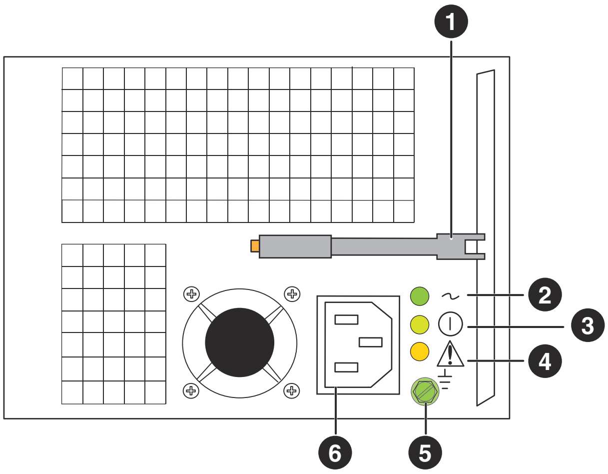

Figure 13. 2U, 25-drive expansion enclosure AC power supply and cooling module

Table 12. 2U, 25-drive expansion enclosure descriptions

Location	Description
❶	Ejector latch handle
❷	AC power LED (input)
❸	DC power LED (input) - (not supported)
❹	Power supply and cooling module fault LED
❺	Grounding screw
❻	Power supply AC power in (recessed plug)

Table 13. 2U, 25-drive expansion enclosure AC power supply and cooling module LED status

LED	Location	Color	State	Description
AC power LED (input)	❷	Green	On	AC power on
		—	Off	AC power off, verify source power
DC power LED (output)	❸	Green	On	DC power on (not supported)
		—	Off	DC power off, verify source power
Power supply and cooling module fault LED	❹	Amber	On	Fault
			Blinking	During power shutdown and during overvoltage (OVP) and undervoltage protection (UVP) fault
		—	Off	No fault or power off

4

Technical specifications

Topics:

Physical specifications for PowerStore X model and PowerStore T model

Table 14. Physical specifications

Per Appliance	1000	3000	5000	7000	9000
CPU	4 x Intel CPU sockets, 32 cores, 1.8 GHz	4 x Intel CPU sockets, 48 cores, 2.1 GHz	4 x Intel CPU sockets, 64 cores, 2.1 GHz	4 x Intel CPU sockets, 80 cores, 2.4 GHz	4 x Intel CPU sockets, 112 cores, 2.1 GHz
Memory	384 GB	768 GB	1,152 GB	1,536 GB	2,560 GB
Embedded SAS I/O ports	4 x 4 lane 12 Gb/s SAS ports for back-end connection				

Dimensions and weight for PowerStore X model and PowerStore T model

Base enclosure

Table 15. 2U, 25-drive base enclosure dimensions and weight

Dimension	Value
Weight (fully populated)	41.7 kg (92 lbs)
Vertical size	2 NEMA units
Height	8.64 cm (3.4 in)
Width	44.45 cm (17.5 in)
Depth	79.5 cm (31.3 in)

NOTE: The weight does not include mounting rails. Allow 3.6 kg (8 lbs) for a rail set.

2U, 25-drive expansion enclosure

Table 16. 2U, 25-drive expansion enclosure dimensions and weight

Dimension	Value
Weight (fully populated)	34.98 kg (77.11 lb)
Vertical size	2 NEMA units
Height	8.64 cm (3.4 in)
Width	44.45 cm (17.5 in)
Depth	34.29 cm (13.5 in)

NOTE: The weight does not include mounting rails. Allow 3.6 kg (8 lbs) for a rail set.

Power requirements for PowerStore X model and PowerStore T model

Power requirements will 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, go to https://powercalculator.emc.com/.

Table 17. Power requirements

Requirement	1000T/ 1000X	3000T/3000X	5000T	5000X	7000T/7000X	9000T/9000X
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)	8.1 A	8.1 A	9.0 A	9.0 A	9.3 A	10.4 A
Power Consumption (operating maximum at 200 VAC)	1629.6 VA (1597 W)	1629.6 VA (1597 W)	1792.9 VA (1757 W)	1792.9 VA (1757 W)	1868.4 VA (1831 W)	2088.8 VA (2047 W)
Heat Dissipation (operating maximum)	5.74 x 10^6 J/hr, (5,449 Btu/hr)	5.74 x 10^6 J/hr, (5,449 Btu/hr)	6.32 x 10^6 J/hr, (5,995 Btu/hr)	6.32 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 18. High ambient temperature shutdown

Ambient temperature	Hardware fault	Consequence
Above 45° C (113° F)	None	Non-critical warning generated .
Above 50° C (122° F)	None	Critical alert generated. 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 average temperature of 50° C (122° F)	System shuts down after five minute timer expires.
Any	Two fans fault	System shuts down after five minute timer expires.

Power requirements for the 2U 25-drive 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, go to https://powercalculator.emc.com/.

Table 19. 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
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

Operating limits

Table 20. Operating limits

Description	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/hr (25°C/hr).**

Table 21. Shipping and storage requirements

Requirement	Description
Ambient temperature	-40° F to 149°F (-40°C to 65°C)
Temperature gradient	45°F/hr (25°C/hr)
Relative humidity	10% to 90% noncondensing
Elevation	-50 to 35,000 ft (-16 to 10,600 m)
Storage time (unpowered) Recommendation	Do not exceed 6 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 22. 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. We do not make compatibility claims of any kind nor do we provide recommendations on fire suppression systems. It is not recommended to position storage equipment directly in the path of high pressure gas discharge streams or loud fire sirens so as 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:

Platform condition	Response measurement level
Non operational shock	10 G’s, 7 ms duration
Operational shock	3 G’s, 11 ms duration
Non operational random vibration	0.40 Grms, 5–500 Hz, 30 minutes
Operational random vibration	0.21 Grms, 5–500 Hz, 10 minutes

Systems that are mounted on an approved package have completed transportation testing to withstand the following shock and vibrations in the vertical direction only and shall not exceed:

Packaged system condition	Response measurement level
Transportation shock	10 G’s, 12ms duration
Transportation random vibration	● 1.15 Grms ● 1 hour Frequency range 1–200 Hz