EMC® VNX® Family
VNX8000™

Hardware Information Guide

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Rev 04

February 25, 2015

This guide is a hardware overview guide for the EMC® VNX8000™ platform and provides an overview of the architecture, features, and components of the VNX8000 platform. The specific aspects of the VNX8000 platform and its major components include the front and rear connectors and LED indicators on the 4U, storage processor enclosure (SPE), the 1U Control Station (CS), the 2U Data Mover enclosure (DME), the 2U dual SPS, and the 2U, 25 (2.5-inch), the 3U, 15 (2.5- or 3.5-inch), the 3U, 120 (2.5-inch), and the 4U, 60 (2.5- or 3.5-inch) disk-array enclosures (DAEs).

This guide is available online at https://mydocs.emc.com/VNX/. Go to the **About VNX** section, and then select **Learn about VNX hardware**. Next, follow the steps in the wizard.

Topics include:

EMC²

About this guide

This guide is designed for personnel who install, configure, and maintain the VNX8000 platform. To use this hardware publication, you should be familiar with digital storage equipment and cabling.

⚠WARNING

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

Revision history

The following table presents the revision history of this document:

Revision	Date	Description
04	February 25, 2015	The following sections were updated: • SP Power supply (page 33) • Four-port 16 Gb/s optical FC I/O module (page 51) • 3U, 120 (2.5-inch) DAE "3U, 120 (2.5-inch) DAE (DAE8S)" on page 94 • Appendix B, Alum-A-Lift "Appendix B: Field lift tool and accessory kit" on page 168 • Miscellaneous edits
03	January 27, 2014	Miscellaneous edits
02	October 30, 2013	The following sections were updated: • Table 5 on page 22 • "VNX8000 DAE cabling" on page 130
01	July 23, 2013	First release of the *VNX8000 Hardware Information Guide*

Product software and hardware release revisions

As part of an effort to improve its product lines, EMC periodically releases revisions of its software and hardware. Therefore, some functions described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information on product features.

Contact your EMC representative if a product does not function properly or does not function as described in this document.

Note: This document was accurate at publication time. New versions of this document might be released on the EMC online support website. Check the EMC online support website to ensure that you are using the latest version of this document.

Where to get help

EMC support, product, and licensing information can be obtained as follows:

Product information — For documentation, release notes, software updates, or information about EMC products, licensing, and service, go to the EMC Online Support website (registration required) at:

https://Support.EMC.com

Technical support — For technical support, go to EMC online support website (registration required) and select Support. On the Support page, you will see several options, including one to create a service request. Note that to open a service request, you must have a valid support agreement. Contact your EMC sales representative for details about obtaining a valid support agreement or with questions about your account.

How this document is organized

The major sections of this guide are listed in Table 1.

Table 1 Organization

Title	Description
"Overview" on page 5	Describes the software and hardware features of a typical VNX8000 along with a front view example of the VNX8000.
"VNX8000 product description" on page 6	Describes and shows the front and rear views of a typical File and Unified VNX8000.
"System component description" on page 13	Provides a description of the components that comprise a File and Unified VNX8000. Along with a description, illustrations of each component are also shown.
"SPS front view" on page 14	Describes and illustrates the 2U SPS used in the VNX8000.
"SPE front view" on page 17	Describes and illustrates the front view of the SPE used in the VNX8000.
"Data Mover enclosure front view" on page 24	Describes and illustrates the front view of a DME and the components that comprise it.
"Control Station front view" on page 21	Describes and illustrates the front view of the Control Station used in the VNX8000.
"SPS rear view" on page 26	Describes and illustrates the rear view of the SPS used in the VNX8000.
"SPE rear view" on page 32	Describes and illustrates the rear of an SPE and the components that comprise the rear of the SPE.
"Control Station rear view" on page 37	Describes and illustrates the rear view of the Control Station used in the VNX8000.
"Data Mover enclosure rear view" on page 42	Describes and illustrates the rear of a DME and the components that comprise it.
"I/O modules" on page 45	Describes and illustrates the types of I/O modules supported in the File and Unified VNX8000.

Table 1 Organization (continued)

Title	Description
"Disk-array enclosures" on page 73	Describes and illustrates the three types of DAEs available for the File and Unified VNX8000.
"VNX8000 DAE cabling" on page 130	Describes the types of DAE cabling available for the Block and File/Unified VNX8000 platform. The cabling can be either stacked or interleaved depending on your specific requirements.
"Appendix B: Field lift tool and accessory kit" on page 168	Describes the type of portable (mechanical) lift and accessory kit used for lifting hardware components into a rack.

Related documentation

EMC provides the ability to create step-by-step planning, installation, and maintenance instructions tailored to your environment. To create VNX customized documentation, go to: https://mydocs.emc.com/VNX/.

To download a PDF copy of the desired publication, go to the following sections:

- For hardware-related guides, go to **About VNX**, then select **Learn about VNX hardware**. Next, follow the steps in the wizard.
- For technical specifications, go to **About VNX** section, then select **View technical specifications**. Next, follow the steps in the wizard.
- For installation, adding, or replacing tasks, go to the **VNX tasks** section, then select the appropriate heading. For example, to download a PDF copy of the *VNX8000 Block Installation Guide*, go to **Install VNX,** and follow the steps in the wizard.
- For server-related tasks, go to the **VNX Server tasks** section, then select the appropriate heading. For example, to download a PDF copy of Adding or replacing server hardware, go to **VNX Server tasks**, and select **Add or replace server hardware**. Next, follow the steps in the wizard.

Safety warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, might harm you or damage the equipment. A caution or warning symbol precedes each safety statement. The safety warnings provide safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

IMPORTANT

The portable (mechanical) lift tool described in "Appendix B: Field lift tool and accessory kit" on page 168 is recommended as a safety precaution when lifting EMC components into an EMC or customer-provided rack. As described in the appendix, many of the EMC components are too heavy to be lifted by one person or in some cases by two persons. As a result, this portable (mechanical) lift tool is a necessary safety requirement, especially when lifting EMC components like the 3U, 120 and the 4U, 60 DAEs.

Overview

The EMC VNX series implements a modular architecture that integrates hardware components for Block, File, and Object with concurrent support for native NAS, iSCSI, Fiber Channel, and Fibre Channel over Ethernet (FCoE) protocols. The VNX series is based on Intel Xeon-based PCI Express 3.0 processors and delivers File (NAS) functionality via two to eight Data Movers and Block (iSCSI, FCoE, and FC) storage via dual storage processors using a full 6-Gb/s SAS disk drive topology. The VNX Series is targeted at the entry-level to high-end/large-capacity storage environments that require advanced features, flexibility and configurability. The VNX Series provides significant advancements in efficiency, simplicity, and performance.

Benefits include:

- Support for File (CIFS and NFS), Block (FC, iSCSI & FCoE) and Object
- Simple conversions when starting with a VNX Series Block only platform by simply adding File services or starting with File only and adding Block services
- Support for both block and file auto-tiering with Fully Automated Storage Tiering (FAST) for Virtual Pools (VP - FAST VP)
- Unified replication with RecoverPoint support for both file and block data
- Updated unified management with Unisphere now delivering a more cohesive unified user experience

Offering Block and File services, Block services only, or File services only, the VNX8000 platform is positioned as a high-end storage platform. For a quick look at the VNX8000 platform hardware features, see Table 2, “Block and File VNX8000 platform hardware feature quick reference,” on page 9.

In a Block services configuration, the VNX8000 platform supports a 4U SPE (SPE9), two 2U dual SPSs, and four types of DAEs. The DAEs supported are a 25 drive 2.5-inch disk 2U enclosure (or DAE5S), a 15 drive 2.5- or 3.5-inch disk 3U enclosure (or DAE6S), a 120 drive 2.5-inch disk 3U enclosure (or DAE8S), and a 60 drive 2.5- or 3.5-inch disk 4U enclosure (or DAE7S). Expansion up to sixty 2U, 25 DAEs (a maximum of 1,500 2.5-inch disk drives), of up to one-hundred 3U, 15 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives), up to twelve 3U, 120 DAE (a maximum of 1,440, 2.5-inch disk drives), or up to twenty-five 4U, 60 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives) is supported.

Note: When the 3U, 120 and 4U, 60 DAEs are implemented in the VNX8000 platform, the 40U Dense rack is required because of the depth of the 3U, 120 and the 4U, 60 DAEs.

In a File services or a Block and File services configuration, the VNX8000 platform supports a 4U SPE, from one to two 1U Control Stations (CS0 and CS1), two to four 2U Data Mover enclosures having two to eight Data Movers[1], two 2U dual SPSs, and four types of DAEs. The DAEs supported are a 25 drive 2.5-inch disk 2U enclosure (or DAE5S), a 15 drive 2.5- or 3.5-inch disk 3U enclosure (or DAE6S), a 120 drive 2.5-inch disk 3U enclosure (or DAE8S), and a 60 drive 2.5- or 3.5-inch disk 4U enclosure (or DAE7S).

1. The term Data Mover is used throughout this guide. The term Data Mover is also referred to as a blade. These terms are interchangeable and mean the same.

Expansion up to sixty 2U, 25 DAEs (a maximum of 1,500 2.5-inch disk drives), of up to one-hundred 3U, 15 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives), up to twelve 3U, 120 DAE (a maximum of 1,440, 2.5-inch disk drives), or up to twenty-five 4U, 60 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives) is supported.

Note: The Block or the File and Unified services configuration of the VNX8000 platform can have a mix of DAE types to conform to your specific requirements. In other words, you can have a mix of 2U DAEs, 3U DAEs, and 4U DAEs in the same environment so as long as the VNX8000 platform does not have no more than the supported amount of 1,500 disk drives.

VNX8000 product description

This section shows examples of the front and rear views of a File/Unified VNX8000 platform. These are only examples with two DMEs and a Vault DAE. A typical File/Unified VNX8000 could be comprised of up to four DMEs and up to several DAEs.

Note: The File/Unified VNX8000 platform described in this guide includes information about the 2U and 3U DAEs in a typical rack/cabinet environment. A File/Unified VNX8000 platform having all 4U DAEs or a mix of 2U, 3U, or 4U DAEs is typically built by manufacturing in a Dense rack environment.

Front view

Figure 1 shows an example of the front view of a File/Unified VNX8000 platform having a 4U SPE, two 1U Control Stations (one optional), two dual SPSs (one for the SPE and one for the Vault DAE), two 2U Data Mover enclosures with four Data Movers, and a Vault DAE.

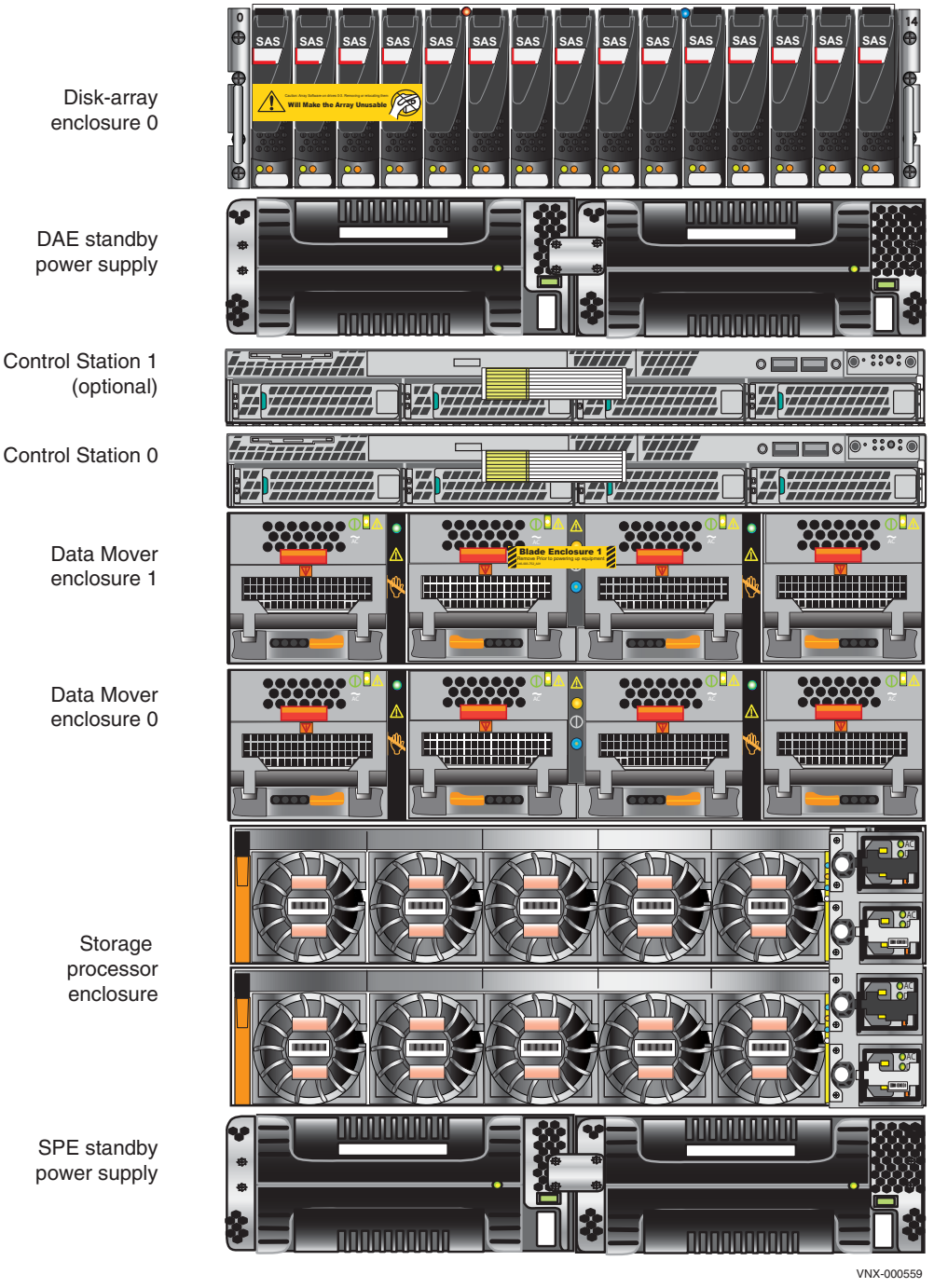


Figure 1 Example of a File/Unified VNX8000 platform (front view)

Rear view

Figure 2 on page 8 shows an example of the rear view of a File/Unified VNX8000 platform having a 4U SPE showing the two storage processors (SP A and B), two 1U Control Stations (one optional), two dual 2U SPSs (one for the SPE and one for the Vault DAE), two 2U Data Mover enclosures with four Data Movers, and one 2U DAE (the Vault DAE).

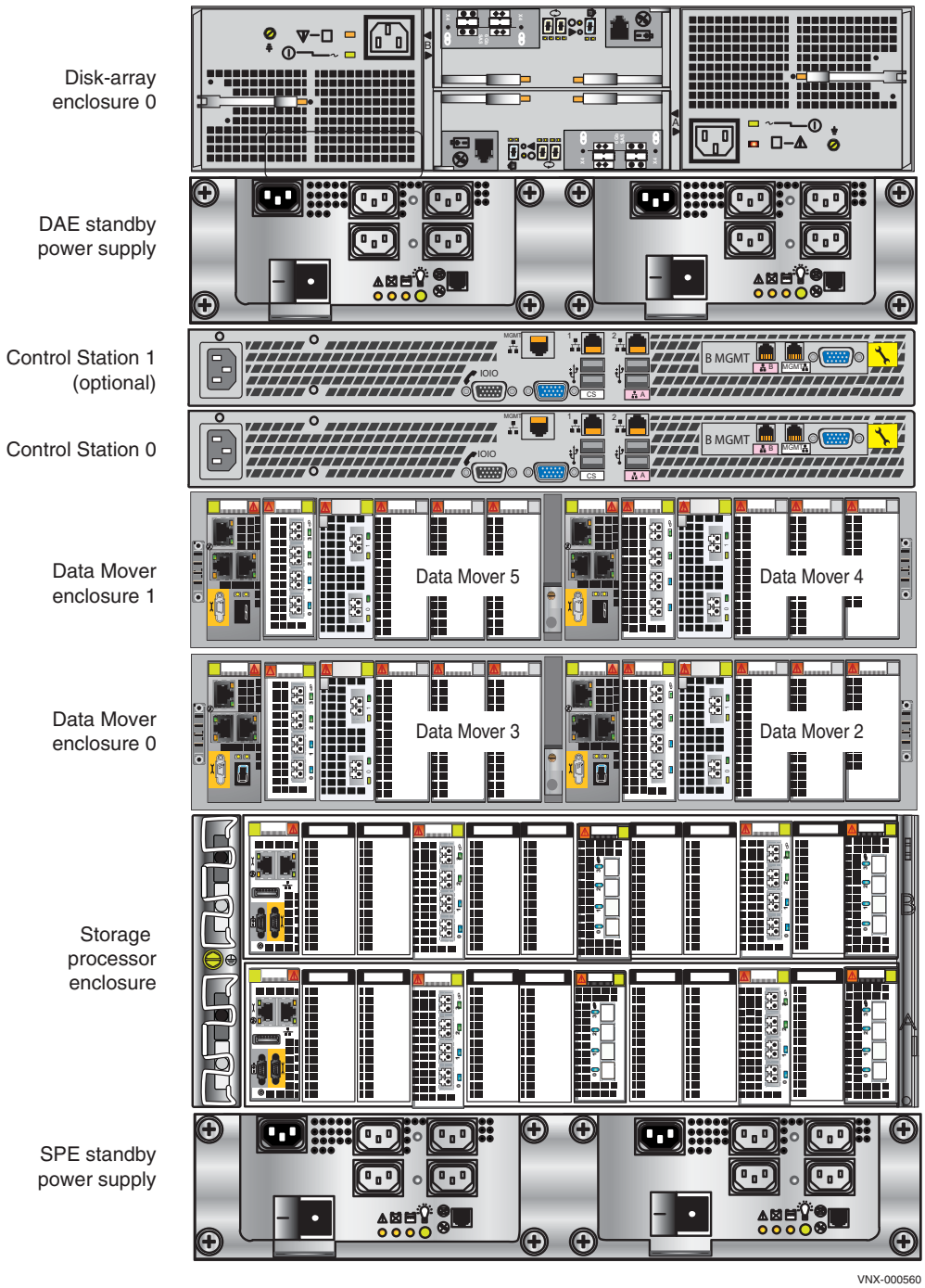


Figure 2 Example of a File/Unified VNX8000 platform (rear view)

Hardware features

Contained in a 14U architecture, the File/Unified VNX8000 platform weighs approximately 284.2 lb (626.5 kg) fully loaded without I/O modules and DAEs. With the 4U SPE having the deepest dimension within the cabinet, the File/Unified VNX8000 without DAEs measures (14U) 27 inches high x 17.6 inches wide x 31 inches deep (68.58 cm x 44.7 cm x 78.74 cm). Between the front and rear of the enclosure, a midplane distributes power and signals to all the enclosure components. On the front of the VNX8000 SPE, the power supplies, cooling fan modules, and disk drives plug directly into the midplane connections. On the rear of the VNX8000 SPE, power supply connector modules, management modules, and I/O modules plug directly into the midplane connections.

Note: The previously mentioned dimensions are approximate and do not include any I/O modules, DAEs, or the cabinet enclosure.

For more information about the weight and dimensions of a VNX8000 platform, go to https://mydocs.emc.com/VNX/ and go to the **About VNX** section, and then select **View technical specifications**. Next, follow the steps in the wizard.

Table 2 Block and File VNX8000 platform hardware feature quick reference

			Block					File			
Minimum form factor	Maximum # of drives	Drive types	Config. I/O slots per SP	Built-in I/O ports per SP	SPs	System memory per SP	Protocols	Config. I/O slots per DM	DMs	System memory per DM	Protocols
4U w/out optional CS, DME, SPSs, and DAEs	1,500	6-Gb/s 2.5 or 3.5 in. SAS and 2.5 or 3.5 in. Flash	11[1]	None	2	128 GB	FC, iSCSI, and FCoE	5	2 to 8[2]	24 GB	NFS, CIFS, and pNFS[3]

1. For the type and number of Ultraflex I/O modules supported in the SP, refer to the I/O module section on page 47.
2. For the type and number of Ultraflex I/O modules supported in the DM, refer to the I/O module section on page 63.
3. pNFS = parallel-NFS

Configured for AC-input power, the Block VNX8000 includes the following hardware features:

- Two 2U dual SPSs (one for the SPE and one for the Vault DAE):
  - On the front, the 2U dual SPS has two SPSs (SPS A on the left and SPS B on the right).

    Each SPS consists of:

    – A removable battery installed in an SPS tray within the 2U dual SPS enclosure; each battery has one power on LED (green)

- On the rear, each SPS consists of:
  - One power on/off rocker switch
  - One AC power in connector (recessed plug)
  - Four DC power out connectors (sockets)
  - Four status LEDs (on-line power, on-battery, no battery, and internal fault)
  - One RJ-12 management connector

◆ One 4U SPE:

- On the front, each 4U SPE (Figure 2 on page 8) has two SPs (SP A on the bottom half and B on the top half).

  Each SP consists of:

  - Five cooling fans; each fan has one LED; this LED is lit below each fan when powering up and goes out when each fan is at the proper operating speed

    Note: Each cooling fan is secured with push-tabs on the top and bottom of the fan.

  - Two CPU modules with an Intel Xeon 8-core 2.7-GHz processor facilitating Simultaneous Multi-Threading (SMT).
  - Sixteen Double Data Rate Three (DDR3) synchronous dynamic RAM (SDRAM) slots supporting up to 128 GB of SDRAM per CPU module or SP using 8 GB DIMMs
  - Four internal 2.5-inch SAS/SATA hard drive slots (not used at this time)
  - Four LEDs; SP power (blue), SP chassis fault (amber), SP fault (blue/amber), and SP unsafe-to-remove (white)

    Note: The SP is viewed as an enclosure within an enclosure (or SPE). Thus, an SP chassis or enclosure fault LED (amber) is provided.

  - Two power supplies with three LEDs [AC, DC, and DC fault (labeled with an !)]; each power supply has a built-in power cord within the power supply assembly that runs along the power supply up the front where it is connected to two recessed plugs (one gray, one black); see the rear of the SP power supply for information about PDU power and SPS power connections ("Rear view" on page 8)

- On the rear of the VNX8000, the 4U SPE (Figure 2 on page 8) has two SPs (SP A on the bottom half and SP B on the top half).

  Each SP consists of:

  - One management module (see "Storage processor management module" on page page 34 for more information) featuring:

    a.) One RS-232/EIA 232 serial (up to 115 K baud) service laptop (micro DB-9) port

    b.) One RS-232/EIA 232 serial SPS management (micro DB-9) port

c.) One 10/100/1000 LAN network management (RJ-45) port

d.) One 10/100/1000 LAN service (RJ-45) port

Note: The management module is secured with a latch handle (labeled **MGMT**).

– One power supply module (see "Storage processor (SP) AC power supply module" on page 18 for more information) has:

a.) Two recessed power plugs (one gray and one black)

Note: The cables connected to the power supplies on PDU A/Zone A (right side, facing rear) are colored gray and the cables on PDU B/Zone B (left side, facing rear) are colored black.

b.) Two retaining bale clips; one per power connector or plug

– Ten PCI Gen 3, 8x lane I/O module slots (A0 – A9 and B0 – B9) and one PCI Gen 3, 16x lane I/O module slot (A10 and B10) are available for use, supporting:

Note: The maximum number of I/O modules for the VNX8000 is 11 per SP. Any combination of the following I/O modules up to nine per Block SP and eight for File/Unified SP. For more information about slot limitations, see "I/O module slots" on page 47.

a.) Four-port 8-Gb/s FC optical (running at 2, 4, or 8 Gb/s); labeled **8 GbE Fibre** on the latch handle

Four-port 16-Gb/s FC optical (running at 4, 8, or 16 Gb/s); labeled **16 GbE Fibre v1** on the latch handle

b.) Four-port 1-Gb/s Base-T iSCSI I/O module; labeled **1 GbE iSCSI/TOE** on the latch handle

c.) Two-port 10-Gb/s optical or active Twinax5; labeled **10 GbE v3** on the latch handle

d.) Two-port 10-Gb/s RJ45 Base-T iSCSI/IP; labeled **10 GbE Base-T** on the latch handle

e.) Two-port 10-Gb/s Fibre Channel over Ethernet (FCoE); labeled **10 GbE/FCoE** on the latch handle

f.) Four-port 6-Gb/s SAS; labeled **6 Gb SAS v3** with an **e** inside a lock symbol on the latch handle (in slots A5, B5, and A10, B10)

Note: The **e** inside the lock symbol indicates that the I/O module supports encryption.

◆ One to four 2U DMEs:

- On the front, the VNX8000 has from one to four DMEs having two to eight Data Movers (DMs). Each DM consists of:
  – One CPU module
  – Two power supply/cooling modules

- On the rear, the VNX8000 has from one to four DMEs having two to eight Data Movers (DMs). Each DM consists of:
  - One management module (see "Data Mover management module" on page 42 for more information) featuring:

    a.) One RS-232/EIA 232 serial (up to 115 K baud) service laptop (micro DB-9) port

    b.) Three 10/100/1000 LAN network management (RJ-45) ports

    Note: The management module is secured with a latch handle (labeled **MGMT**).

  - One CPU module consisting of one Intel Xeon 6-core 2.8-GHz processor. The CPU modules in the DME contain the power, fault, and unsafe-to-remove LEDs (see "CPU" on page 25 for more information).
  - Six DDR3 synchronous dynamic RAM (SDRAM) slots supporting up to 24 GB per CPU module using 2 or 4 GB DIMMs
  - Five PCI Gen 2, 8x lane I/O module slots (0 – 4) available for use, supporting:

    Note: The maximum number of I/O modules for the VNX8000 is five per DM. One FC I/O module and up to three other I/O modules. Any combination of these I/O modules must be the same for both Data Movers.

    a.) One Fibre Channel (FC) I/O module with a:
    - Four-port 8-Gb/s optical (running at 2, 4, or 8 Gb/s); in slots A0 and B0 only; labeled **8 GbE Fibre** on the latch handle

    b.) One or two of the following network I/O modules in any combination:
    - Two-port 10-Gb/s optical or active Twinax; labeled **10 GbE v3** on the latch handle
    - Four-port 1-Gb/s copper; labeled **1 GbE** on the latch handle
    - Two-port 10-Gb/s RJ45 Base-T iSCSI/IP; labeled **10 GbE Base-T** on the latch handle

- One to two 1U Control Stations
- Expansion of up to sixty 2U, 25 DAEs (a maximum of 1,500 2.5-inch disk drives), of up to on-hundred 3U, 15 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives), up twelve 3U, 120 DAEs (a maximum of 1,440 2.5-inch disk drives), or up to twenty-five 4U, 60 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives) is supported.
- Any required cables including LAN cables, modem cables, and serial DB-9 cable.
- Mounting rails with hardware
- Front bezel with VNX8000 badge

System component description

This section describes the VNX8000 platform components. Included in this section are illustrations and descriptions of the front and rear connectors as well as the LED indicators.

Note: In the following sections, the illustrations and corresponding tables describe these individual components. These descriptions are for illustrative purposes only.

Installing, replacing, and removing faulted hardware components

Separate documents provide instructions for installing, replacing, and removing hardware components in the VNX8000 platform. For more information, refer to the respective document for the correct procedure. These documents are available online at https://mydocs.emc.com/VNX/ and go to **VNX tasks**, then select **Add VNX hardware**. Next, follow the steps in the wizard.

Example: To replace a power supply/cooling module in the SPE9 of a VNX8000, go to the *Replacing a storage processor power supply/cooling module or fan module* document for the correct procedures to replace a power supply/cooling module in a SPE9 storage processor enclosure. This procedure is available online at https://mydocs.emc.com/VNX/ and go to **VNX tasks**, then select **Add VNX hardware**. Next, follow the steps in the wizard.

VNX8000 front view

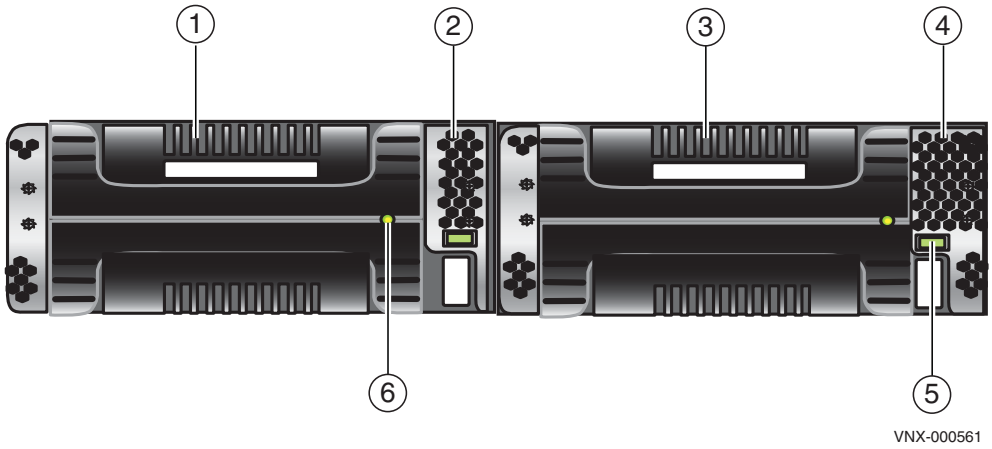
As previously described, the File/Unified VNX8000 platform is made up of a 4U SPE, one to two 1U Control Stations (one optional), two SPSs (one for the SPE and the other for the Vault DAE), and one to four 2U DMEs with two to eight DMs. The following sections describe the front view (Figure 1 on page 7) of the VNX8000 platform components.

IMPORTANT

The VNX8000 platform requires two dual 2U SPSs. One for the 4U SPE and one for the Vault DAE. The 2U SPS contains two 2U 2.2-kilowatt Lithium-ion batteries housed in a separate 2U tray. One set of 2U SPS batteries provides backup power to the storage processors in the 4U storage processor enclosure (SPE). This set of SPS batteries is referred to as either the SPE SPS or SPS 0. The other set of 2U SPS batteries provides backup power to the Bus 0 Enclosure 0 DAE. This set of SPS batteries is referred to as either the Bus 0 Enclosure 0 SPS or SPS 1.

SPS front view

The front of the VNX8000 platform 2U dual SPS (Figure 3) shows two SPSs with one LED per SPS (power), SPS battery tray, SPS battery color wheel latch indicator.



1	SPS A battery	4	SPS B tray
2	SPS A tray	5	SPS B battery color wheel latch indicator • Green = engaged • Yellow = parked • Red = not engaged
3	SPS B Lithium ion (Li-ion) battery	6	SPS A power on LED (green)

Figure 3 Example of 2U dual SPS (front view)

SPS battery

The SPS battery is a Lithium-ion (Li-ion) battery. The SPS battery has a handle on the front allowing for ease of insertion and removal (Figure 4 on page 15). When installing the Li-ion battery, you must engage it before you power on the system. Depending on how your storage system was shipped to your site, the installation requirements for the SPS battery will be different.

Note: The SPS battery weighs approximately 28 lb (12.07 kg).

- If your storage system is shipped in an EMC rack by truck, the factory inserts the battery into the SPS enclosure in the SPS tray, but does not engage it. The SPS battery is in the parked position (wheel latch indicator yellow) inside the SPS enclosure. You must lift the wheel latch up and push the SPS battery further into the slot of the SPS enclosure to ensure that it is in the engaged position (wheel latch indicator green).
- If your storage system is shipped in an EMC rack by air, the factory ships the SPS battery separately. The battery is not installed in the cabinet or rack, and the wheel latch indicator on the SPS enclosure is red. You must unpack the SPS battery from the separate shipping container, install it in the SPS enclosure, and then ensure that the SPS enclosure is engaged (wheel latch indicator green).

- If your storage system is shipped in a shipping rack (the storage system components will be removed and put into a customer rack), the factory inserts the battery into the SPS enclosure in the SPS tray, but does not engage it. The SPS battery is in the parked position (wheel latch indicator yellow). You must lift the wheel latch up and push the SPS battery further into the slot of the SPS enclosure to ensure that it is in the engaged position (wheel latch indicator green).

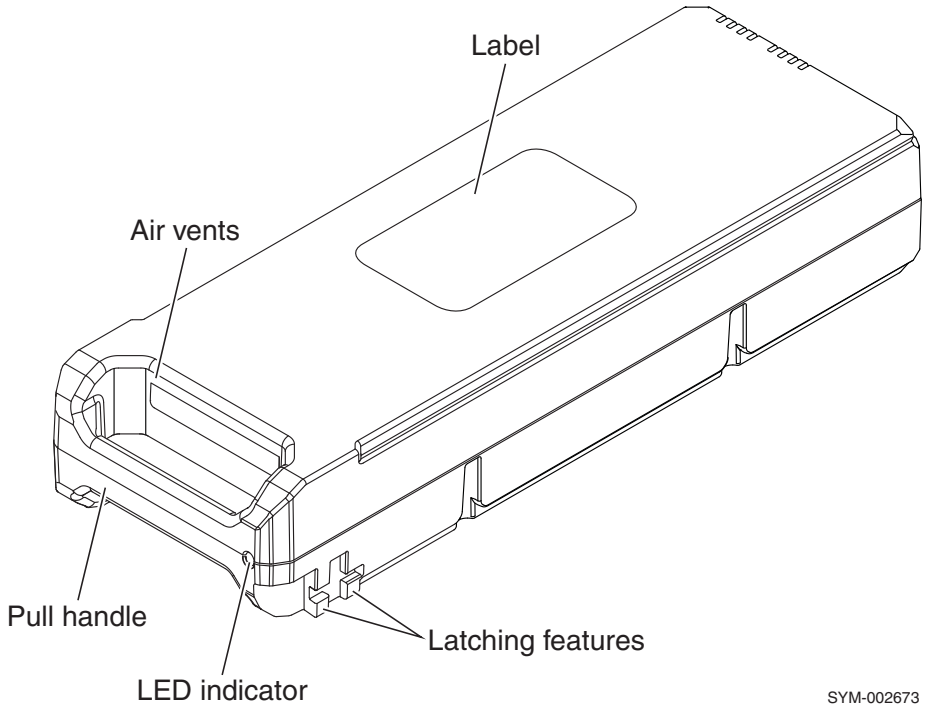


Figure 4 Example of SPS LI-ion battery

Unpacking or removing the SPS battery

To unpack or remove the SPS battery:

IMPORTANT

Attach an antistatic wrist strap to your wrist and connect its cord to a known ground.

1. If shipped separately, unpack the SPS batteries from the shipping containers.
2. Place the batteries separately on an antistatic floor, mat, or workbench pads.
3. If shipped in a shipping rack, remove the SPS batteries from the shipping rack.
4. Place the batteries separately on an antistatic floor, mat, or workbench pads.

Installing the SPS battery

To install the Li-ion SPS battery:

IMPORTANT

Attach an antistatic wrist strap to your wrist and connect its cord to a known ground.

1. If the SPS battery shipped separately (SPS enclosure wheel latch indicator red), position the battery with the LED indicator on the right and slide it into the SPS enclosure (see location 1 in Figure 5).
2. "Park" the battery by lifting the wheel latch up on the SPS enclosure and pushing the battery completely into the SPS enclosure slot (see location 2 in Figure 5).

   The SPS battery will click into place and the wheel latch indicator will be yellow.
3. "Engage" the SPS battery by pressing the wheel latch while pushing the SPS battery further into the SPS enclosure slot (see location 2 in Figure 5)

   The SPS battery will click into the final position and the wheel latch indicator will be green (see location 3 in Figure 5).

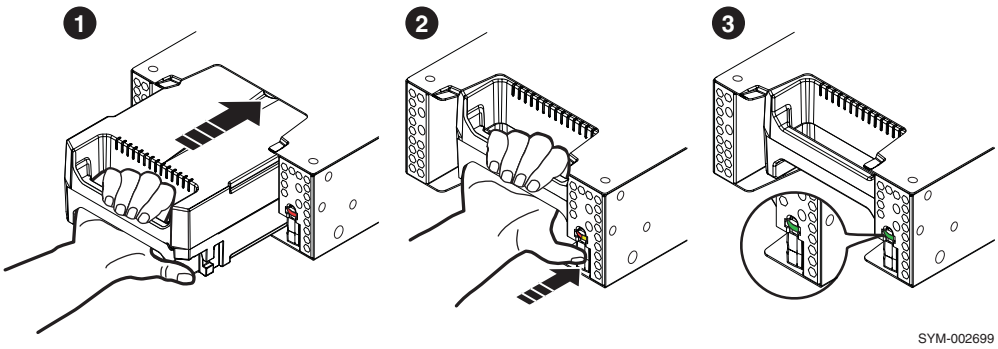
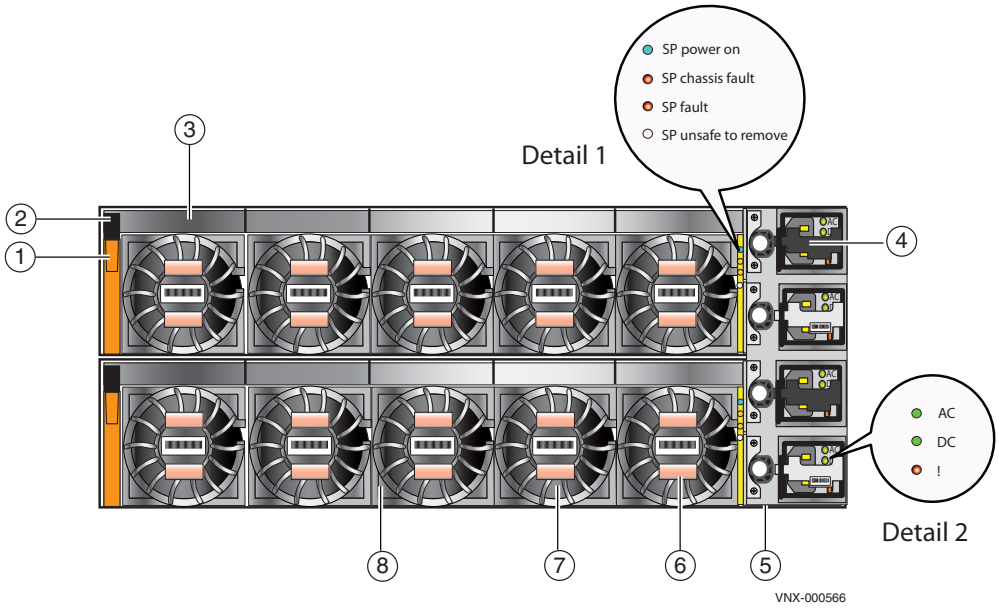


Figure 5 Example of installing the SPS Li-ion battery

SPE front view

The front of the VNX8000 platform 4U SPE shows four hard drives with two LEDs per drive (power and fault), five fan modules with one LED per module (fault), four power supplies with three LEDs per power supply (AC, DC and DC fault). Four status LEDs per SP: one SP power on, one SP chassis (enclosure) fault, one SP fault, and one SP unsafe to remove.



1	Latch (orange) for SP B (one per SP); push down to unlock SP from SPE chassis	**6**	SP A fan module push tabs (push together to unlock fan), then pull out to release
2	Lock latch handle (black) for SP B (one per SP); after unlocking with the orange latch (see location 1), pull the black latch handle horizontally across the top to release the SP from the SPE chassis	**7**	SP A fan module
3	SP B hard drive slot (not used at this time)	**8**	SP A fan fault icon for fault LED (10 places)
4	SP A power supply	**Detail 1**	SP A status LEDs; SP power on (blue), SP chassis (enclosure) fault (amber), SP fault (blue/amber), and SP unsafe to remove (white) **Note:** On the inner right side (around the corner) of the SP, LED labels for the SP and the SP chassis (enclosure) are shown.
5	SP B power supply recessed connectors (plugs); two per SP (one gray and one black)	**Detail 2**	SP A power supply LEDs; AC, DC and fault (labeled with **!**)

Figure 6 Example of SP components (front view)

Storage processor (SP) AC power supply module

The storage processor enclosure (SPE) contains four power supply modules, two per storage processor, which provide redundant power to each storage processor CPU module, midplane, and other hardware components. A latch on the power supply locks it into place to ensure proper connection. When viewed from the front, the SP power supply module is located on the right side of each SP (see location 4 in Figure 6 on page 17). Each power supply includes three status LEDs (see Detail 2 in Figure 6 on page 17).

⚠CAUTION

***Do not* remove the SP power supply module while the SP is plugged in. Power supply module removal for more than a few minutes can cause the SP to shut down due to lack of cooling.**

Table 3 describes the VNX8000 platform fan fault and SP power supply status LEDs as shown in Figure 6 on page 17.

Table 3 VNX8000 platform SP fan fault and SP power supply status LEDs

LED	Color	State	Description
Fan fault (see location 10)	Amber	On	Fan fault
	—	Off	Fan operating normally
SP A power supply status (see Detail 2)	Green	On	SP A AC power supply (input) power on LED, labeled **AC**
	—	Off	SP A AC power supply (input) off, verify source power
	Green	On	SP A DC power supply (output) power on LED, labeled **DC**
	—	Off	SP A DC power supply (output) off, verify source power
	Amber	Fault	SP A DC power supply (output) fault LED, labeled with an exclamation point (**!**)
		Blinking	BIOS, POST and OS booting up or system overheating

SP and SP chassis (enclosure) LEDs

The SPs in the 4U storage processor enclosure contain the SP power on, SP chassis (enclosure) fault, SP fault, and SP unsafe to remove LEDs (see Detail 1 in Figure 6 on page 17). Reading from the top of the exploded view in Figure 7 on page 19, the LEDs are: the SP power on, SP chassis (enclosure) fault, SP fault, and SP unsafe to remove, respectively.

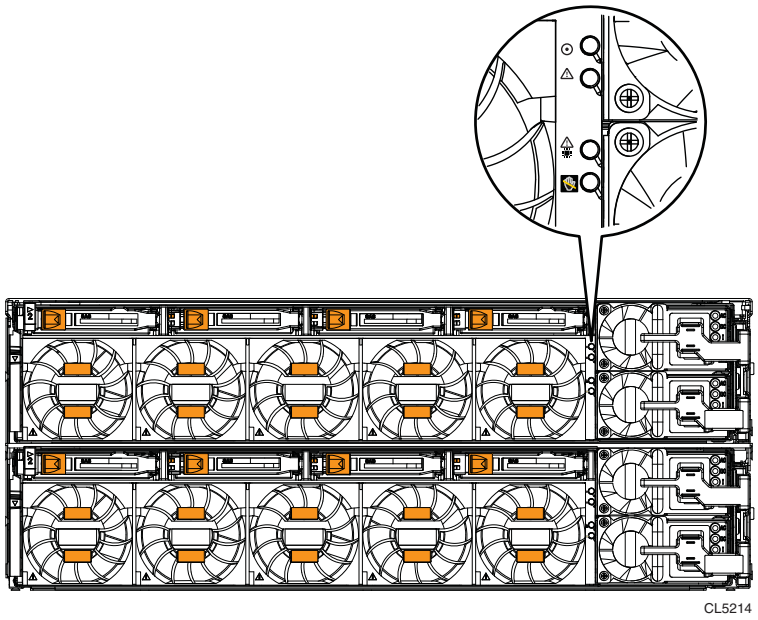


Figure 7 Example of SP power on, SP chassis (enclosure) fault, SF fault, and SP unsafe to remove LEDs

Table 4 describes the SP and SP chassis (enclosure) status LEDs as shown in Figure 6 on page 17 and Figure 7 on page 19.

Table 4 VNX8000 platform SP and SP chassis (enclosure) status LEDs

LED	Color	State	Description
SP power (see Detail 1 in Figure 6 on page 17 and exploded view in Figure 7 on page 19)	Blue	On	Powered up
	—	Off	Powered down
SP chassis (enclosure) fault (see Detail 1 in Figure 6 on page 17 and exploded view in Figure 7 on page 19)	Amber	On	Fault • Power (PSU or SPS) • Environmental (fans) • I/O modules or LCCs • SP • CMI, SFP, Resume PROM
	—	Off	Operating normally

Table 4 VNX8000 platform SP and SP chassis (enclosure) status LEDs (continued)

LED	Color	State	Description
SP fault LED, behavior during normal boot (see Detail 1 in Figure 6 on page 17 and exploded view in Figure 7 on page 19)	Amber	On (steady)	SP fault
		Blinks once every 4 seconds	Executing BIOS
		Blinks once every second	Executing Post
		Blinks four times a second	Post starting operating system
	Blue	Blinks once every 4 seconds	Operating system booted
		Blinks once every second	SEP[1] driver start in progress
		Blinks four times a second	SEP driver start completed
	—	Off	Operating system ready for input or not powered up
SP fault LED, during degraded boot (see Detail 1 in Figure 6 on page 17 and exploded view in Figure 7 on page 19)	Amber	Blinks once every 4 seconds	Executing BIOS
		Blinks once every second	Executing Post
		Blinks four times a second	Post starting operating system
	Blue	Blinks once every 4 seconds	Operating system booted
		On	Degraded mode
SP fault LED, during faults (see Detail 1 in Figure 6 on page 17 and exploded view in Figure 7 on page 19)	—	Off	Powered down or no fault
	Amber	On	Fault has occurred
		Blinks once every 2 seconds	NMI reset button pushed; blinking will continue until SP reboots and enters power on sequence.
		Blinks at 1, 3, 3, and 1 times a second	Memory problem
	Blue	On	Fault has occurred

Table 4 VNX8000 platform SP and SP chassis (enclosure) status LEDs (continued)

LED	Color	State	Description
SP unsafe to remove (see Detail 1 in Figure 6 on page 17 and exploded view in Figure 7 on page 19) **Note:** One SP will always have the unsafe to remove LED on after a successful shut down.	White	On	The SP peer has a panic or rebooted with the cache performance mode enabled. The SP is holding valid cache in memory.
			The SP is currently flashing the BIOS/Post firmware or updating the resume PROMs.
			The SP is currently dumping the cache data to the vault.
	—	Off	The SP can be safely removed for service.

1. SEP = security processor

Control Station front view

On the front, viewing from left to right, the File/Unified VNX8000 platform 1U Control Station includes the following hardware components:

- One DVD-ROM drive
- Two USB 2.0 connectors (not used)
- Front control panel with various buttons and status LEDs
- Four hot-swappable SATA hard drive bays

Figure 8 shows the orientation of these components.

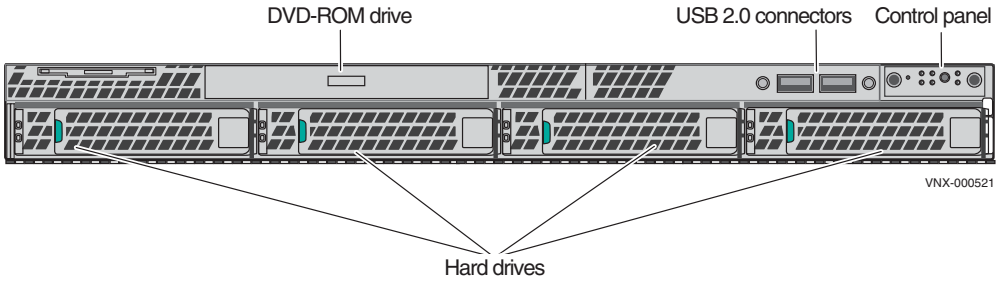


Figure 8 Example of a VNX8000 platform Control Station (front view)

Control Station front panel

Figure 9 shows the location of the File/Unified VNX8000 platform 1U Control Station front panel.

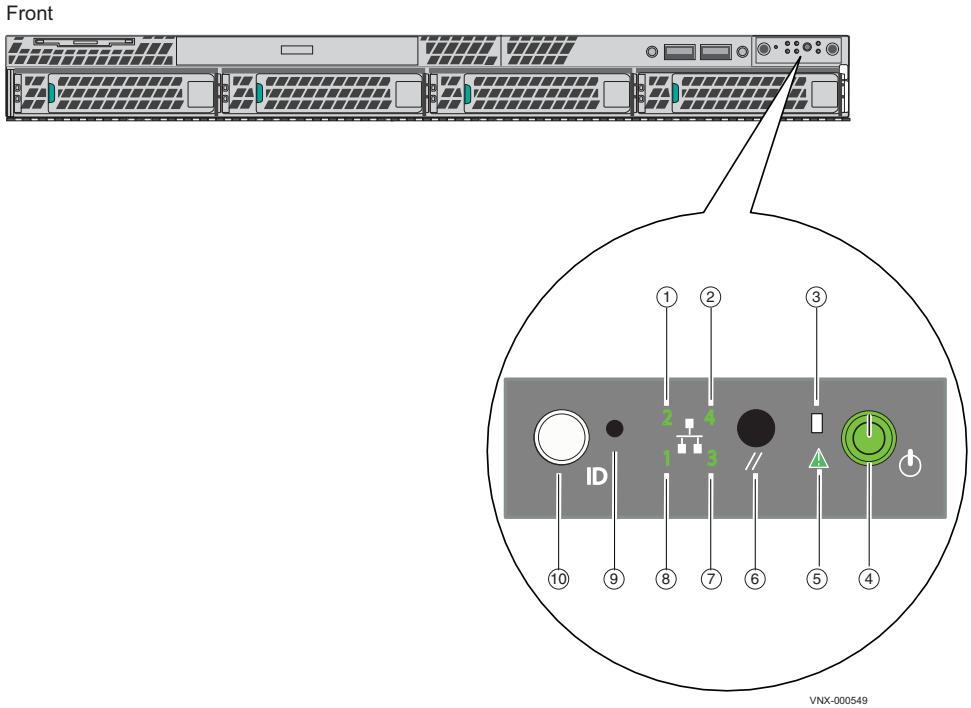


Figure 9 VNX8000 platform Control Station front panel

Table 5 describes the Control Station front panel push buttons and LEDs.

Table 5 Control Station LEDs and push buttons

LED	Color	State	Description
Onboard (integrated) LAN 2 and 4 (see locations 1 and 2, respectively)	Green	On	NIC link/no access
		Blinking	NIC link/LAN access
	—	Off	Idle
Internal hard drive activity (see location 3)	Green	Blinking	Hard drive access
	—	Off	No hard drive activity, no fault
Power (see location 4)	Green	On	Power on/system loaded and ready
		Blinking	Sleep mode
	—	Off	Power off

Table 5 Control Station LEDs and push buttons (continued)

LED	Color	State	Description
Status/fault (see location 5)	Green	On	Powered on; status ok
		Blinking	Powered on; degraded. Redundancy lost, such as power supply or fan failure, or predictive power supply failure.
	Amber	On	Critical fault: Voltage, thermal, or power fault; CPU missing; insufficient power unit redundancy resource offset asserted.
		Blinking	Non-critical failure: Critical temperature/voltage
	—	Off	Power off: System unplugged Powered on: System powered off and in standby, no prior degradation/critical state.
Reset button (see location 6)	—	—	Allows you to reset the CS. Same as turning the power off and then on again. Data loss will occur unless you have saved the data. The reset button would be used when a program error occurs and has caused the CS to freeze. Pressing the reset button performs a cold restart (reboot) which goes through the initial start-up stages including memory check.
Onboard (integrated) LAN 1 and 3 (see locations 7 and 8, respectively)	Green	On	NIC link/no access
		Blinking	NIC link/LAN access
	—	Off	Idle
NMI button (see location 9)	—	—	Not used
ID button with LED (see location 10)	Green	On	Powered on

Data Mover enclosure front view

The front of the File/Unified VNX8000 platform 2U Data Mover enclosure (DME) contains two enclosure status LEDs (power and fault), as shown in Figure 10.

Note: Figure 10 is a graphical representation of the File/Unified VNX8000 platform 2U Data Mover enclosure with four power supply/cooling (fan) modules and two CPU modules installed.

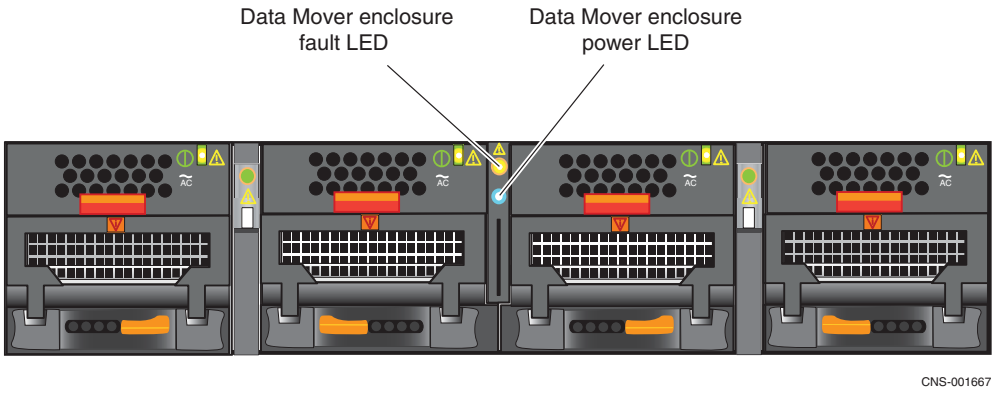


Figure 10 Data Mover enclosure status LEDs

Table 6 describes the 2U Data Mover enclosure status (power and fault) LEDs.

Table 6 DME status LEDs

LED	Color	State	Description
Power	Blue	On	Data Mover enclosure is powered up, operating normally
	—	Off	Data Mover enclosure is powered down.
Fault	Amber	On	A replaceable component failed within the enclosure. **Note:** When the enclosure fault LED is amber, look for the replaceable component within the enclosure that is causing the fault. Refer to the other status LED definitions in this section to determine which replaceable component failed.
	—	Off	Data Mover enclosure operating normally.

CPU

The CPU modules in the DME contain the power, fault, and unsafe-to-remove LEDs. Figure 11 shows the CPU LEDs.

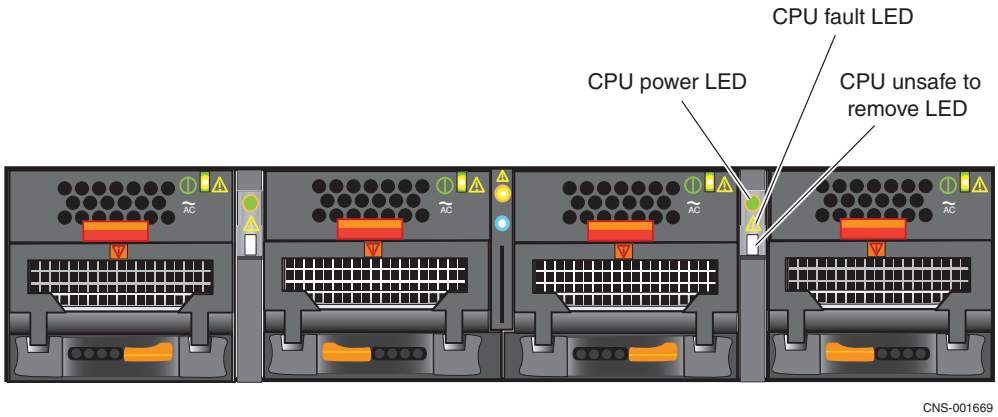


Figure 11 CPU LEDs

Table 7 describes the CPU LEDs.

Table 7 CPU LEDs

LED	Color	State	Description
Power	Green	On	Data Mover is powered up and all components in the Data Mover are operating properly.
	—	Off	Data Mover is powered down.
Fault	Amber	On	Data Mover has faulted.
		Blinking	Data Mover goes through six stages of power up: 1. Executes a BIOS check, blinking once every 4 seconds 2. Executes a POST check, blinking once every second 3. Loads the operating system, blinking four times a second
	Blue (see Note)	Blinking	4. Operating system loaded, blinking once every 4 seconds 5. Operating system starting drivers, blinking once every second 6. Operating system drivers operating, blinking four times a second
	—	Off	Data Mover operating normally.
Unsafe to remove	White	On	Data Mover is unsafe to remove.
	—	Off	Data Mover is safe to remove.
Note: The fault LED changes color from amber to blue when the operating system is loading, see step 4 in the description.			

Power supply/cooling (fan) module LED

The power supply/cooling (fan) modules have status LED on the front. Figure 12 shows the LEDs for the power supply/cooling (fan) modules.

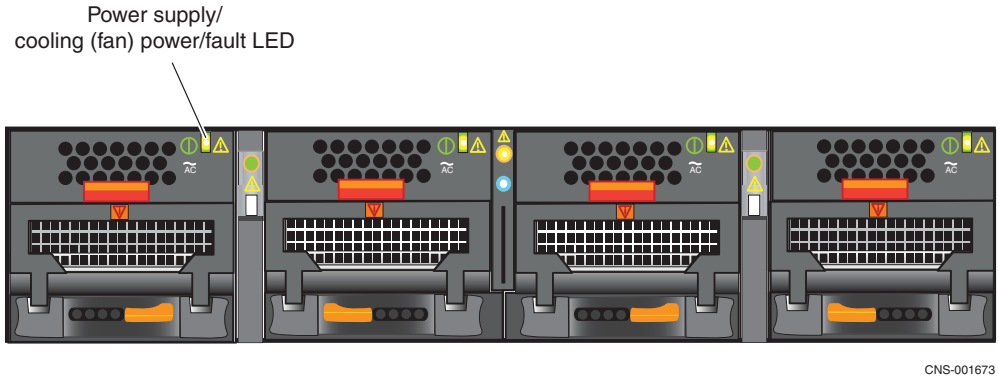


Figure 12 Power supply/cooling (fan) module LED

Table 8 describes the power supply/cooling (fan) LED.

Table 8 Power supply/cooling (fan) module LED

LED	Color	State	Description
Power/Fault	Green	On	Normal (no faults detected)
	Amber	Blinking	Power supplied but external fault detected
	Amber	On	No power

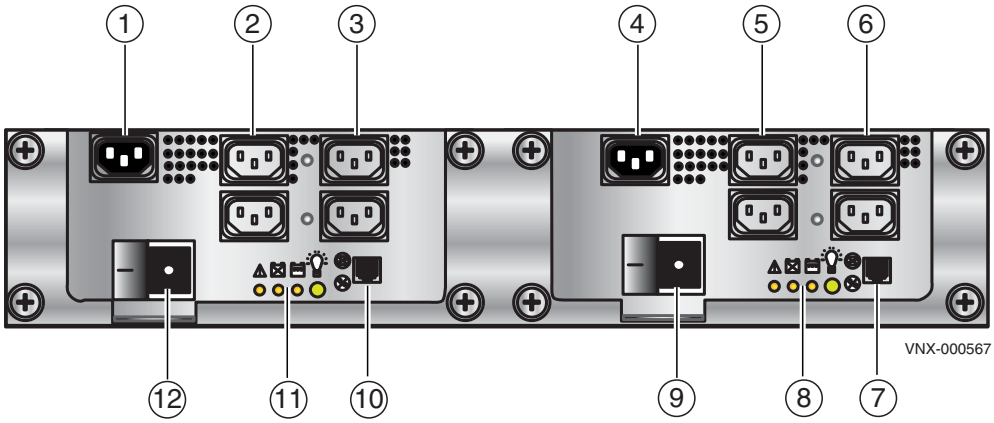
VNX8000 rear view

As previously described, a Block VNX8000 platform is made up of a 4U SPE while the File/Unified VNX8000 platform is made up of a 4U SPE, two 1U Control Stations (one optional), two SPSs, and two to four 2U DMEs. The following sections will describe the rear view of the VNX8000 platform components as previously shown in Figure 2 on page 8.

SPS rear view

In the VNX8000 platform, a 2.2-kilowatt Lithium-ion 2U dual standby power supply (SPS) is used to maintain power to the VNX8000 platform SPE and the Vault DAE during a power loss.

Figure 13 on page 27 shows an example of the rear view of a 2U dual SPS.



1	SPS B AC power in (recessed plug)	**7**	SPS A RJ-12 connector to the SP A management (RJ-12) connector or to the LCC B RJ-12 connector; for more information, see "SPS RJ-12 connector" on page 30
2	SPS B power out socket to the SP B power supply on the SPE or to the LCC B power supply on the Vault DAE	**8**	Four SPS A LEDs (for more information, see "SPS LEDs" on page 29)
3	SPS B power out socket to the SP A power supply on the SPE or to the LCC A power supply on the Vault DAE	**9**	SPS A power on/off rocker switch
4	SPS A AC power in (recessed plug)	**10**	SPS B RJ-12 connector to the SP B management (RJ-12) connector or to the LCC A RJ-12 connector; for more information, see "SPS RJ-12 connector" on page 30
5	SPS A power out socket to the SP B power supply on the SPE or to the LCC B power supply on the Vault DAE	**11**	Four SPS B LEDs (for more information, see "SPS LEDs" on page 29)
6	SPS A power out socket to the SP A power supply on the SPE or to the LCC A power supply on the Vault DAE	**12**	SPS B power on/off rocker switch

Figure 13 Example of 2U dual SPS B and A viewing from left to right (rear view)

SPS failure functionality

If AC power fails, the SPS provides backup power until the SP has flushed its write cache data to the DAE disks. The SP then shuts off SPS power. If the cache flush has not completed within 300 seconds—more than enough time to flush a full cache—or if the SP has failed, then the SPS shuts down to prevent a deep discharge. If no AC input power is available and the SPS is shut down, all the status LEDs will be off.

The output voltage, when the SPS is in the On-Line state, is a straight pass-through of the AC voltage from inlet to outlets. When in the On-Battery state, the output voltage shall be at an DC level within the specified limits (see the SPS battery LED in Table 11 on page 35). When power returns, the SPS starts recharging the DC battery. It might reach a state of full

charge relatively quickly. If power remains off for a long period—days or weeks—the DC battery might require more time to charge fully.[2] The storage processor will not use the write cache unless it detects at least one fully charged SPS.

IMPORTANT

A faulted or not fully charged SPS disables the write caching.

Two SPSs for an SPE

The additional SPS in the dual SPS is added for redundancy. When only one SPS is used, the AC line out connectors for the SPS provide AC voltage to both SP A and SP B.

It is important to cable each SPS so that it connects completely to either the A side or the B side. For example, if you are looking at the SPSs from the rear, they should be configured as:

- SPS A (rear, right side)—Power-out and sense (management) cables connected to the SP A power supply.
- SPS B (rear, left side)—Power-out and sense (management) cables connected to the SP B power supply.

Two SPSs for a Vault DAE

The additional SPS in the dual SPS is added for redundancy. When only one SPS is used, the AC line out connectors for the SPS provide AC voltage to both LCC A and LCC B.

It is important to cable each SPS so that it connects completely to either the A side or the B side. For example, if you are looking at the SPSs from the rear, they should be configured as:

- SPS A (rear, right side)—Power-out and sense (management) cables connected to the LCC A power supply.
- SPS B (rear, left side)—Power-out and sense (management) cables connected to the LCC B power supply.

Note: If an SPS is cabled with the SPS sense (management) cable going to the power supply on LCC A and the power-out cable going to the power supply on LCC B (or vice versa), an error condition will occur when the SPS is tested or when it is charging.

2. After a full power outage, an SPS typically requires 45 minutes or a maximum of 75 minutes to charge. To charge the SPS after being off-line usually requires at least 6 hours.

SPS LEDs

Figure 14 shows the LEDs located on each SPS (A and B)

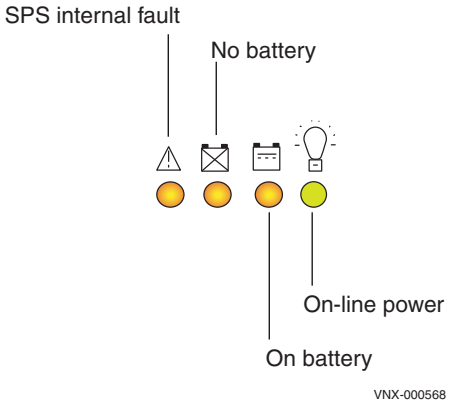


Figure 14 SPS LEDs

Table 9 describes the rear panel SPS LEDs.

Table 9 SPS LEDs description

Led	Color	State	Description
On-line power	Green	On	SPS ready and operating normally; battery fully charged **Note:** Off when any amber LED is on.
		Blinking	On/battery charging **Note:** Off when any amber LED is on.
	—	Off	Off/disconnected
On battery	Amber	On	AC line power is no longer available and the SPS is supplying DC output power from the battery. **Note:** When battery power comes on, and no other online SPS is connected to the SP, the system writes all cached data to disk, and the event log records the event.

Table 9 SPS LEDs description (continued)

Led	Color	State	Description
SPS no battery	Amber	On	SPS battery is not fully charged and might not be able to serve its cache flushing function. With the battery in this state, and no other online SPS connected to the SP, the system disables write caching, and writes any modified pages to the disk first. Replace the SPS as soon as possible.
SPS internal fault	Amber	On	The SPS has an internal fault. The SPS might still be able to run online, but write caching cannot occur. Replace the SPS as soon as possible.

Note: When the SPS powers up, all the LEDs go through a test sequence. They will first turn on and then turn off beginning with the SPS power on LED (green) ending with the SPS fault LED (amber). Each LED will light for one second and then turn off. After this sequence, normal LED operation begins. If the AC line voltage is out-of-specification at power up, no LEDs will light until the AC line voltage is within specification.

SPS RJ-12 connector

Figure 15 shows the SPS (RJ-12 or modular jack) management port (labeled with two symbols; one depicting a telephone handset with a line through it and the other depicting a rectangle with a line through it). Both symbols mean that you cannot connect telephone type circuits to this connector (see the following **WARNING**). This port connects the SPS (A and B) to the SP (A and B) RJ-12 ports or to the LCC (A and B) RJ-12 ports, respectively.

⚠WARNING

The SPS (RJ-12) port is a LAN port not a WAN port. LAN ports contain safety extra-low voltage (SELV) circuits, and WAN ports contain telephone-network voltage (TNV) circuits. An RJ-45 (or TNV-type) looks the same as the RJ-12 except for two very important differences. An RJ-45 is an 8-wire modular jack. The RJ-12 is a six-wire modular jack. The RJ-45 plugs and jacks are wider than their RJ-12 counterparts - 7/16" vs 3/8". An RJ-45 plug won't fit into an R-J12 jack. But an RJ-12 plug will fit into an RJ-45 jack. Use caution when connecting cables. To avoid electric shock, do not attempt to connect TNV circuits to SELV circuits.

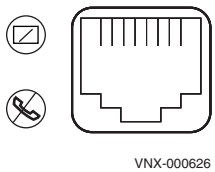


Figure 15 SPS RJ-12 port

Table 10 lists the SPS (RJ-12) pin signals used on the connector.

Table 10 SPS (RJ-12) connector pinout

RJ-12 pin	Signal name	Description
1	Ground	Signal reference
2	Enabled_out	SPS is enabled and ready for On-Battery operation when needed.
3	AC_fail_out	AC line fallen out-of-spec.
4	Any_fault_out	Fault state exists within the SPS.
5	SPS_TX	Transmit signal out of SPS to host processor
6	SPS_RX	Receive signal into SPS from host processor

RJ-12 modular jack to micro DB-9 cable

The cable connecting the SPS to the SP management module is an RJ-12 to micro DB-9 cable (plug). It has an RJ-12 connector (SPS side) on one end and a micro DB-9 connector (SP management module side) on the other end. Figure 16 shows an example of an SPS to SP management module cable.

Figure 16 Example of SP management module (micro DB-9) SPS (RJ-12) cable

RJ-12 modular jack to RJ-12 modular jack cable

The cable connecting the SPS to the LCC is an RJ-12 to RJ-12 connector. It has an RJ-12 connector (SPS side) on one end and a RJ-12 connector (LCC side) on the other end. Figure 17 shows an example of an SPS to LCC cable.

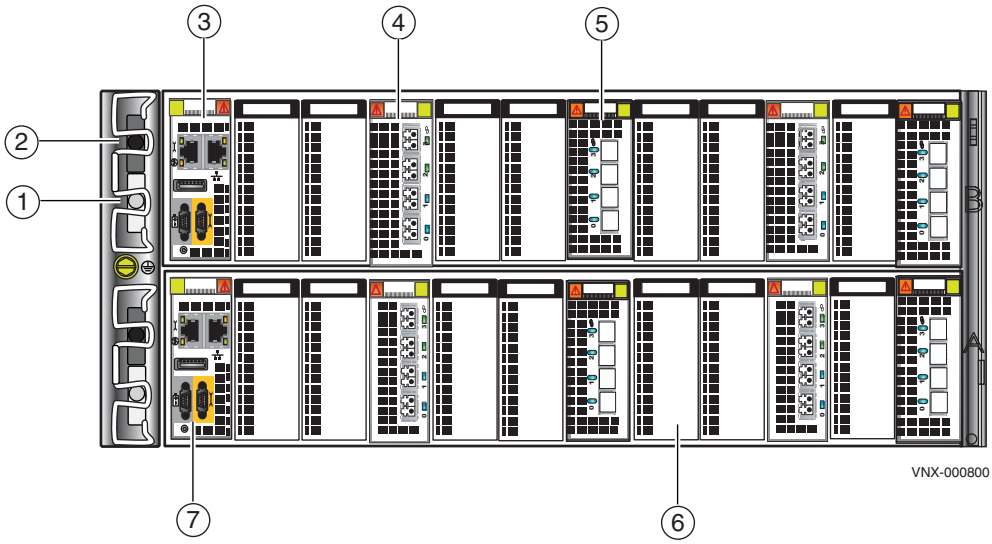
Figure 17 Example of LCC (RJ-12) to SPS (RJ-12) cable

SPE rear view

Figure 18 on page 33 shows an example of the rear of the 4U SPE. The following modules, connectors, status LEDs, and latch handles are described:

- Power supply, four (two for each SP)
  - Four power in recessed connectors (plugs); two for each SP
  - One power supply latch handle
- SP B (top of chassis) and SP A (bottom of chassis)
  - Eleven PCI Gen 3 I/O module slots (A0 – A10 and B0 – B10) featuring the following SP I/O module types:
    - Four-port 8-Gb/s FC optical (running at 2, 4, or 8 Gb/s); labeled **8 GbE Fibre** on the latch handle
    - Four-port 16-Gb/s FC optical (running at 4, 8, or 16 Gb/s); labeled **16 GbE Fibre v1** on the latch handle
    - Four-port 1-Gb/s Base-T iSCSI I/O module; labeled **1 GbE iSCSI/TOE** on the latch handle
    - Two-port 10-Gb/s optical or active Twinax5; labeled **10 GbE v3** on the latch handle
    - Two-port 10-Gb/s RJ45 Base-T iSCSI/IP; labeled **10 GbE Base-T** on the latch handle
    - Two-port 10-Gb/s Fibre Channel over Ethernet (FCoE); labeled **10 GbE/FCoE** on the latch handle
    - f.) Four-port 6-Gb/s SAS; labeled **6 Gb SAS v3** with an **e**[3] inside a lock symbol on the latch handle
  - Two management modules (one per SP) featuring:
    - Two (RJ-45) LAN connectors (labeled with a network management symbol and a wrench symbol)
    - Two (micro DB-9) RS-232/EIA connectors (labeled with a battery symbol and a wrench symbol)
    - One USB port (not used)

3. The **e** inside the lock symbol indicates that the I/O module supports encryption.



1	SP B power supply (power in) recessed connector (plug) from SPS B	**5**	SP B four-port 6-Gb/s SAS I/O module in slot B5 (for a closer view, see "Four-port 6-Gb/s SAS I/O module" on page 61)
2	SP B power supply (power in) recessed connector (plug) from SPS A	**6**	SP A I/O module filler panel
3	SP B (management module) showing two RJ-45 (management and service laptop) connectors labeled with a network management symbol and a wrench symbol, respectively (for a closer view, see "Storage processor management module" on page 34)	**7**	SP A (management module) showing two RS-232/EIA (micro DB-9) connectors (labeled with a battery symbol and a wrench symbol, respectively) (for a closer view, see "Storage processor management module" on page 34)
4	SP B four-port 8-Gb/s FC I/O module in slot A2 (for a closer view, see "Four-port 8-Gb/s FC I/O module" on page 48)		

Figure 18 Example of SP components (rear view)

Storage processor AC power supply module

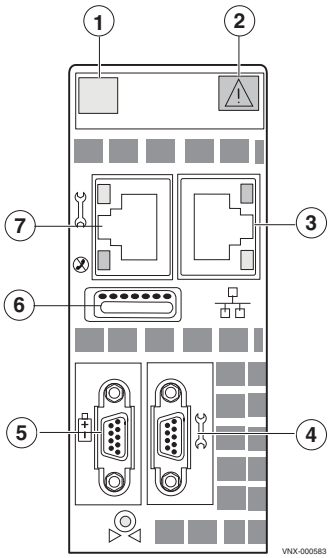
The storage processor (SP) power supply module is located on the left side of each SP when viewed from the rear (see locations 1 and 2 in Figure 18). On the front ("Storage processor (SP) AC power supply module" on page 18) of the power supply, each power supply includes three status LEDs (AC, DC, and fault (labeled with an upside-down exclamation point, **!**). A latch on the power supply locks it into place to ensure proper connection.

⚠CAUTION

***Do not* remove the SP power supply module while the SP is plugged in. Power supply module removal for more than a few minutes can cause the SP to shut down due to lack of cooling.**

Storage processor management module

The storage processor (SP) management module provides the management connections via one 10/100/1000 Ethernet (RJ-45) port. Another RJ-45 port is available to support a service laptop connection. The SP management module includes two RS-232/EIA 232 (DB-9) serial socket connectors (one for service laptop connection and the other for an SPS connection), a USB port (not used), and several LEDs (Figure 19).



1	Power/fault LED	5	DB-9 serial console socket connector (SPS); not used
2	SP management module push button latch handle	6	USB port; not used
3	RJ-45 Ethernet port (management)	7	RJ-45 Ethernet port (service laptop)
4	DB-9 serial console socket connector (service laptop)		

Figure 19 SP management module

Storage processor management module Ethernet (RJ-45) ports

The VNX8000 platform storage processor (SP) management module comes with two integrated dual-port Ethernet ports (labeled with a symbol depicting a wrench and the other depicting network management) on the rear of the management module. The SP management port provides an interface for connecting a 10-, 100-, or 1000-Mb/s cable to the LAN providing full-duplex (FDX) capability, which enables simultaneous transmission and reception of data.

To access the SP management port, connect a Category 3, 4, 5, 5E, or 6 unshielded twisted-pair (UTP) cable to this RJ-45 modular jack connector on the back of the SP management module, as described in Table 13 on page 38.

Since the 1U Control Station and the management module have the same type of management (RJ-45) ports, “Control Station Ethernet (RJ-45) ports” on page 38 provides detailed information about the SP management module ports, connector, and adapter.

Storage processor management module LEDs

Figure 20 shows the LEDs and Table 11 describes them.

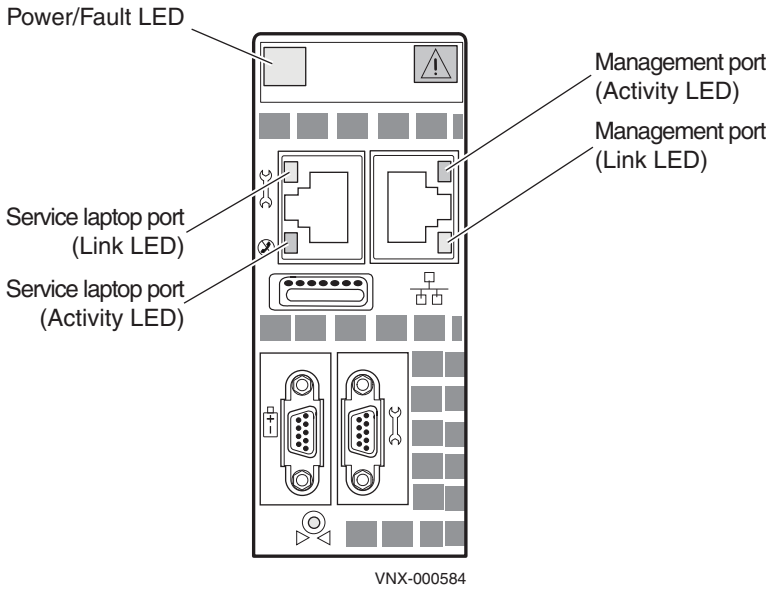


Figure 20 SP management module LEDs

Table 11 SP management module LEDs

LED	Color	State	Description
Power/Fault	Green	On	SP management module is powered up.
	Amber	On	SP management module has faulted. **Note:** LED is always illuminated at powerup, until it is initialized.
	—	Off	SP management module is powered down.
Link (each port has one)	Green	On	Network connection
	—	Off	No network connection
Activity (each port has one)	Amber	Blinking	Transmit/receive activity
	—	Off	No network activity

SP management module serial console (DB-9) socket connector

The back of the VNX8000 platform SP management module includes two standard serial console Electronics Industries Association (EIA) RS-232 interface (DB-9) socket connectors (one labeled with a symbol depicting a wrench on the right and the other depicting a battery on the left). Notice the orientation of the pins (Figure 21).

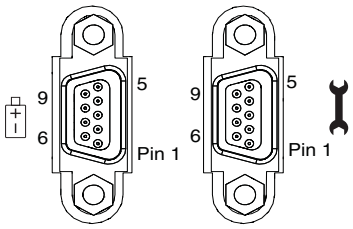


Figure 21 SP management module serial console (DB-9) socket connectors

Table 12 lists the SP management module Ethernet (DB-9) pin signals used on the connectors.

Note: The pin designations shown in Figure 21 are for reference only.

Table 12 SP management module (DB-9) socket connector pinout

DB-9 Pin	Signal	Description
1	CD	Carrier detect
2	TXD	Transmitted data
3	RXD	Received data
4	DTR	Data terminal ready
5	GND	Ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator (not used)

Storage processor null modem (micro DB-9 to DB-9 serial) cable — The cable connecting the SP management module to the PC or service laptop is a micro DB-9 cable (plug) to serial DB-9 (socket). It has a micro DB-9 plug (SP side) on one end and a serial DB-9 socket (PC or service laptop side) on the other end. Figure 22 shows an example of an SP management module to PC (service laptop) cable.

Figure 22 Example of SP null modem (micro DB-9) to serial (DB-9) cable

Control Station rear view

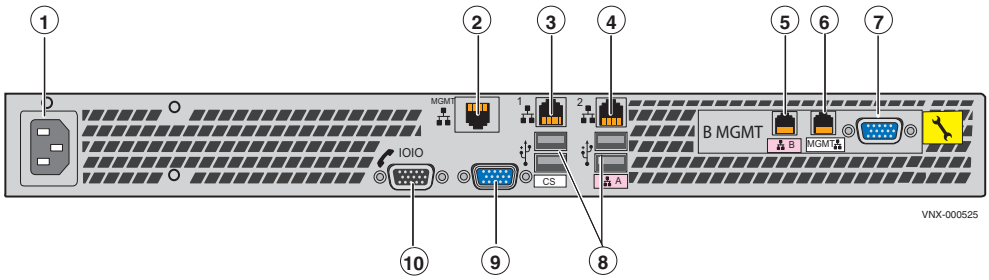
On the rear, viewing from left to right, the File/Unified VNX8000 platform Control Station includes the following components:

- AC power in connector
- Five (RJ-45) connectors (labeled **A**, **CS**, **B**, and two **MGMT** [one not used, see location 2 in Figure 23])

  Note: The RJ-45 connectors (labeled **CS** and **A**, respectively) are integrated into the rear of the 1U Control Station while the RJ-45 connectors (labeled **B** and **MGMT**, respectively) are on a PCI-e card in the expansion slot on the rear of the Control Station. The fifth RJ-45 connector (labeled **MGMT**) is located to the left of the RJ-45 connector labeled **CS**. Newer CS models have a dust cover in this port.

- One (DB-9 plug) serial (RS-232/EIA-232) connector
- One (DB-9 plug) modem (RS-232/EIA-232) connector
- One (DB-15) video (VGA socket) connector—not used
- Four USB 2.0 connectors—not used

Figure 23 on page 37 shows the orientation of these components.



1	AC power in connector	**6**	RJ-45 Ethernet port (labeled **MGMT**)
2	RJ-45 Ethernet port (labeled **MGMT**), not used; newer CS models have a dust cap in this port	**7**	DB-9 serial console plug connector
3	RJ-45 Ethernet port (labeled **CS**[1]) **Note:** The **CS** label is located below the USB ports.	**8**	Four USB 2.0 connectors (not used)
4	RJ-45 Ethernet port (labeled **A**) **Note:** The **A** label is located below the USB ports.	**9**	DB-15 Video (VGA) socket connector (not used)
5	RJ-45 Ethernet port (labeled **B**)	**10**	DB-9 modem plug connector

1. The CS port uses an IPMI (Intelligent Platform Management Interface) cable to connect to a standby (optional) Control Station (CS1).

Figure 23 Example of a VNX8000 Control Station (rear view)

Control Station Input/output ports and connectors

The File/Unified VNX8000 platform 1U Control Station supports the following I/O ports on the rear of the 1U Control Station:

- Five Ethernet (RJ-45) ports (one not used [labeled **MGMT**], see location 2 in Figure 23 on page 37)
- One serial console (DB-9 plug) connector
- One modem (DB-9 plug) connector

⚠WARNING

To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.

Control Station Ethernet (RJ-45) ports

The File/Unified VNX8000 platform 1U Control Station comes with two integrated dual-port Ethernet ports (labeled **CS** and **A**, respectively) and two Peripheral Component Interconnect Express (PCI-E)[4] low profile card dual-port Ethernet ports (labeled **B** and **MGMT**, respectively) in an expansion slot on the rear of the 1U Control Station.

Note: A fifth RJ-45 connector (labeled **MGMT**) is located to the left of the RJ-45 connected labeled **CS**. This connector is not used at this time.

These ports (Figure 24 on page 39) provide an interface for connecting to 10-, 100-, or 1000-Mb/s networks and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the Ethernet local-area network (LAN).

To access the Ethernet ports, connect a Category 3, 4, 5, 5E, or 6 unshielded twisted-pair (UTP) cable to the RJ-45 connectors on the back of the 1U Control Station, as described in Table 13.

Table 13 Ethernet cabling guidelines

Type	Description
10BASE-T	EIA Categories 3, 4, or 5 UTP (2 or 4 pairs) up to 328 ft (100 m)
100BASE-TX	EIA Category 5 UTP (2 pairs) up to 328 ft (100 m)
1000BASE-T	EIA Category 6 (recommended), Category 5E or 5 UTP (2 pairs) up to 328 ft (100 m)

4. PCI Express is used in consumer, server, and industrial applications, as a motherboard-level interconnect (to link motherboard-mounted peripherals) and as an expansion card interface for add-in boards.

Control Station Ethernet (RJ-45) port and connector (adapter)

Figure 24 shows an example of the Ethernet RJ-45 port and cable connector.

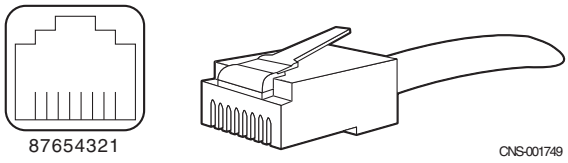


Figure 24 Control Station Ethernet (RJ-45) port and connector (adapter)

Table 14 lists the Control Station Ethernet (RJ-45) pin signals used on the connector.

Table 14 Control Station Ethernet (RJ-45) port and connector pinout

RJ-45 pin	Signal	Description
1	BI_DA+	Bidirectional pair A, +
2	BI_DA-	Bidirectional pair A, -
3	BI_DB+	Bidirectional pair B, +
4	BI_DC+	Bidirectional pair C, +
5	BI_DC-	Bidirectional pair C, -
6	BI_DB-	Bidirectional pair B, -
7	BI_DD+	Bidirectional pair D, +
8	BI_DD-	Bidirectional pair D, -

Control Station Ethernet (RJ-45) port LEDs

The Control Station (RJ-45) has two LEDs—a green LED to the left of the connector and a bi-color (green/amber) LED to the right of the connector—that indicates the link/activity and speed of the 1U Control Station (RJ-45) ports, respectively (Figure 25).

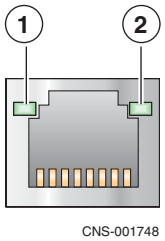


Figure 25 Control Station Ethernet (RJ-45) port LEDs

Table 15 describes the link/activity and connection speed associated with the Control Station (RJ-45) port LEDs.

Table 15 Control Station RJ-45 port LEDs

Led	Color	State	Description
Left, link/activity (see location 1)	Green	On	Network/link connection
	Green	Blinking	Transmit/receive activity
	—	Off	No network/link connection
Right, link speed (see location 2)	Green	On	100-Mb/s connection
	Amber	On	1000-Mb/s (or 1-Gb/s) connection
	—	Off	10-Mb/s connection (if left LED is on or blinking)

Ethernet cable extensions for the Control Station B and MGMT ports

Each File/Unified VNX8000 platform 1U Control Station comes with two modular Ethernet cable extensions (or patch cords) for the RJ-45 ports (labeled on the **CS** as **B** and **MGMT**, respectively). These cables (Figure 26) allow you to extend the length of the Ethernet cables from the CS 0, port B to Data Mover enclosure 0, management module B, port 1 and CS 0, MGMT port to the public LAN.

If your File/Unified VNX8000 platform includes a second optional 1U Control Station (CS 1), another set of Ethernet cable extensions for the RJ-45 ports is provided. These cables allow you to extend the length of the Ethernet cables from the CS 1, port B to Data Mover enclosure 0, management module B, port 2 and CS 1, MGMT port to the public LAN. Each cable includes a corresponding label clip to assist you during system cabling.

Note: If you received the File/Unified VNX8000 platform already installed in a cabinet rack with all of the File/Unified VNX8000 platform components, all the cabling has already been installed.

Figure 26 Example of an Ethernet extension (modular plug to modular jack) cable

Control Station serial console (DB-9) plug connector

The back of the File/Unified VNX8000 platform system 1U Control Station includes a standard serial console Electronics Industries Association (EIA) RS-232 interface (DB-9) plug connector. Notice the orientation of the pins (Figure 27).

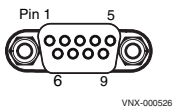


Figure 27 Control Station serial console (DB-9) plug connector

Note: The pin designations shown in Figure 27 on page 40 are for reference only.

Table 16 lists the 1U Control Station Ethernet (DB-9) pin signals used on the connector.

Table 16 Control Station (DB-9) plug connector pinout

DB-9 Pin	Signal	Description
1	CD	Carrier detect
2	RXD	Received data
3	TXD	Transmitted data
4	DTR	Data terminal ready
5	GND	Ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator (not used)

Control Station modem (DB-9) plug connector

The back of the File/Unified VNX8000 platform 1U Control Station includes a standard modem serial interface (DB-9) plug connector (labeled with a telephone handset icon and the numbers **1 0 1 0** on the left). Notice the orientation of the pins (Figure 28).

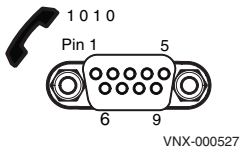


Figure 28 Control Station modem (DB-9) plug connector

Note: The pin designations shown in Figure 28 are for reference only.

Table 17 lists the 1U Control Station Ethernet (DB-9) pin signals used on the connector.

Table 17 Control Station modem (DB-9) plug connector pinout

DB-9 Pin	Signal	Description
1	CD	Carrier detect
2	RXD	Received data
3	TXD	Transmitted data
4	DTR	Data terminal ready
5	GND	Ground
6	DSR	Data set ready

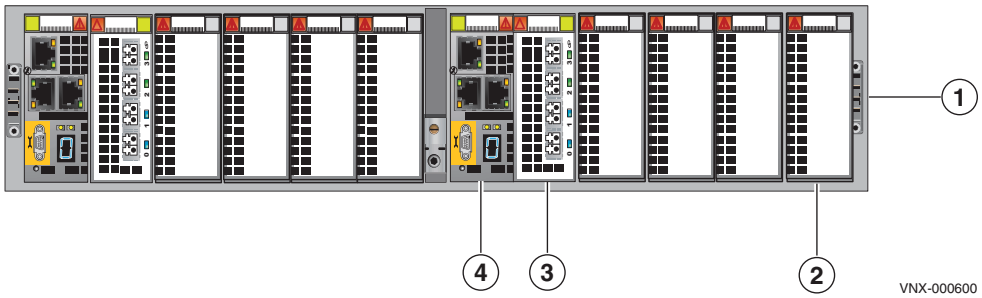
Table 17 Control Station modem (DB-9) plug connector pinout

DB-9 Pin	Signal	Description
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator (not used)

Data Mover enclosure rear view

The rear of the File/Unified VNX8000 platform Data Mover enclosure (DME) does not contain any LEDs (Figure 29). Only the Data Mover management module and the I/O modules have LEDs.

Note: Figure 29 is a graphical representation of the rear view of a File/Unified VNX8000 platform with a DME having two Data Movers (each Data Mover shows one management module, one four-port 8-Gb/s FC I/O module, and four filler panel modules).

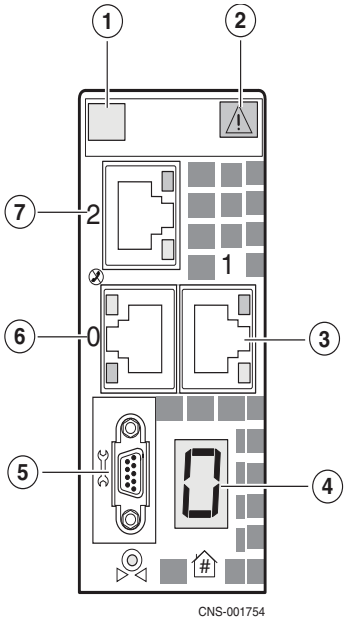


1	Data Mover enclosure	3	Four-port 8-Gb/s FC I/O module
2	Filler panel module	4	Data Mover management module

Figure 29 Example of a DME (rear view)

Data Mover management module

The Data Mover management module provides the management connections via three 10/100/1000 Ethernet (RJ-45) ports. The Data Mover management module also includes one RS-232 (EIA) DB-9 serial socket connector for service laptop connection and several LEDs (Figure 30 on page 43).



1	Power/fault LED	5	DB-9 serial console socket connector
2	Data Mover management module push button latch handle	6	RJ-45 Ethernet port (labeled **0**)
3	RJ-45 Ethernet port (labeled **1**)	7	RJ-45 Ethernet port (labeled **2**)
4	Data Mover enclosure ID numeric display		

Figure 30 Example of a Data Mover management module

Data Mover management module Ethernet (RJ-45) ports

The File/Unified VNX8000 platform Data Mover management module comes with three integrated dual-port Ethernet ports (labeled **0**, **1**, and **2**) on the rear of the Data Mover management module. These ports provide an interface for connecting to 10-, 100-, or 1000-Mb/s networks and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data.

⚠WARNING

The File/Unified VNX8000 Data Mover management module contains LAN ports. LAN ports contain safety extra-low voltage (SELV) circuits, and WAN ports contain telephone-network voltage (TNV) circuits. To avoid electric shock, do not connect TNV circuits to SELV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.

To access the Ethernet ports, connect a Category 3, 4, 5, 5E, or 6 unshielded twisted-pair (UTP) cable to the RJ-45 connector on the back of the management module (Table 13 on page 38).

Since the Control Station and the management module have the same type of RJ-45 ports, “Control Station Ethernet (RJ-45) ports” on page 38 provides detailed information about the management module ports, connector, and adapter.

Data Mover management module LEDs

Figure 31 shows the LEDs and Table 18 on page 44 describes them.

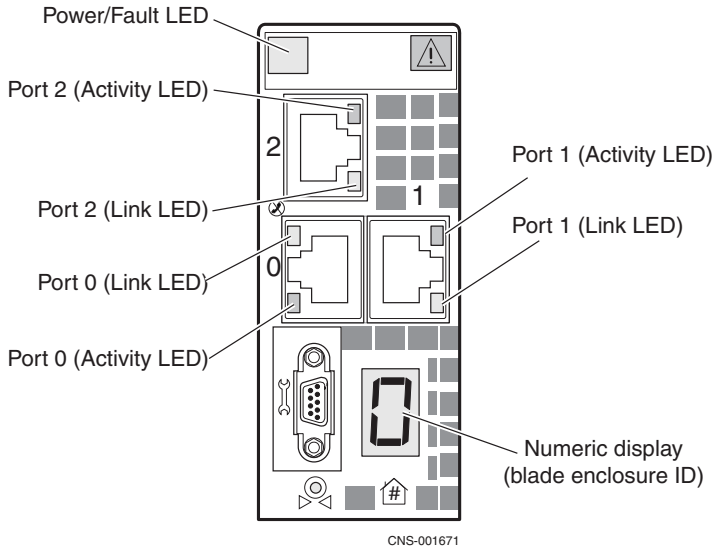


Figure 31 Data Mover management module LEDs

Table 18 Data Mover management module LEDs

LED	Color	State	Description
Power/Fault	Green	On	Data Mover management module is powered up.
	Amber	On	Data Mover management module has faulted. **Note:** LED is always illuminated at powerup, until it is initialized.
	—	Off	Data Mover management module is powered down.
Link (each port has one)	Green	On	Network connection
	—	Off	No network connection
Activity (each port has one)	Amber	Blinking	Transmit/receive activity
	—	Off	No network activity
Numeric (7-segment) display for enclosure ID	—	On	Displays the enclosure ID assigned to the Data Mover enclosure. **Note:** Each enclosure is assigned a number at installation.

Data Mover management module serial console (DB-9) socket connector

The back of the File/Unified VNX8000 platform Data Mover management module includes a standard serial console Electronics Industries Association (EIA) RS-232 interface (DB-9) socket connector (labeled with a wrench tool icon on the left). Notice the orientation of the pins (Figure 32 on page 45).

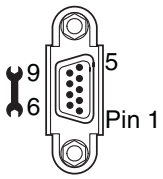


Figure 32 Data Mover management module serial console (DB-9) socket connector

Table 19 lists the Data Mover management module Ethernet (DB-9) pin signals used on the connector.

Note: The pin designations shown in Figure 32 are for reference only.

Table 19 Data Mover management module (DB-9) socket connector pinout

DB-9 Pin	Signal	Description
1	CD	Carrier detect
2	TXD	Transmitted data
3	RXD	Received data
4	DTR	Data terminal ready
5	GND	Ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator (not used)

I/O modules

Several types of I/O modules are supported in the Block, File, and Unified VNX8000. The SP supports six types of I/O modules (see "Storage processor I/O module types" on page 47) and the Data Mover supports four types (see "Data Mover I/O module types" on page 63). In this section, each I/O module description includes the type of port (copper or optical) as well as a description of the LEDs.

Fibre Channel (FC) ports

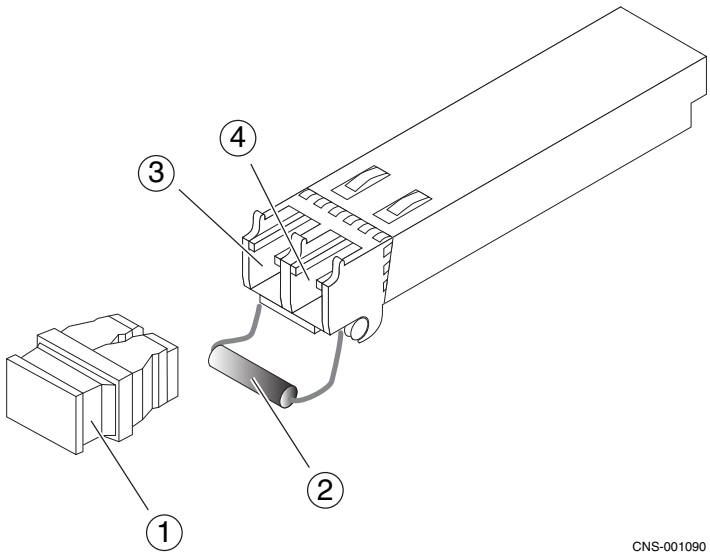
The Block, File, and Unified VNX8000 platform SP does not come with built-in optical Fibre Channel (FC) ports on the rear of each SP (A and B). As a result, the 8-Gb/s Fibre Channel (FC) I/O module or the 16-Gb/s Fibre Channel (FC) I/O module is used to provide these FC ports (see "Four-port 8-Gb/s FC I/O module" on page 48 and "Four-port 16-Gb/s FC I/O module" on page 51, respectively). These ports provide an optical interface for connecting to the front end.

Small form-factor pluggable transceiver modules

The FC ports on the 8-Gb/s FC I/O module support 2-, 4-, and 8-Gb/s Fibre Channels and on the 16-Gb/s FC I/O module supports 4, 8, and 16-Gb/s Fibre Channels using a small form-factor pluggable plus (SFP+) transceiver module. The SFP+ transceiver modules connect to Lucent Connector (LC) type optical fibre cables. These SFP+ transceiver modules are input/output (I/O) devices. These SFP+ modules are hot swappable. This means that you can install and remove an SFP+ module while the SP is operating.

Figure 33 shows an example of an SFP+ module.

Note: Besides the FC I/O modules, the FCoE and the 10-Gb/s Optical I/O modules also use SFP modules. Each of these I/O modules use a different type of SFP. Refer to the Parts Location Guide for more information.

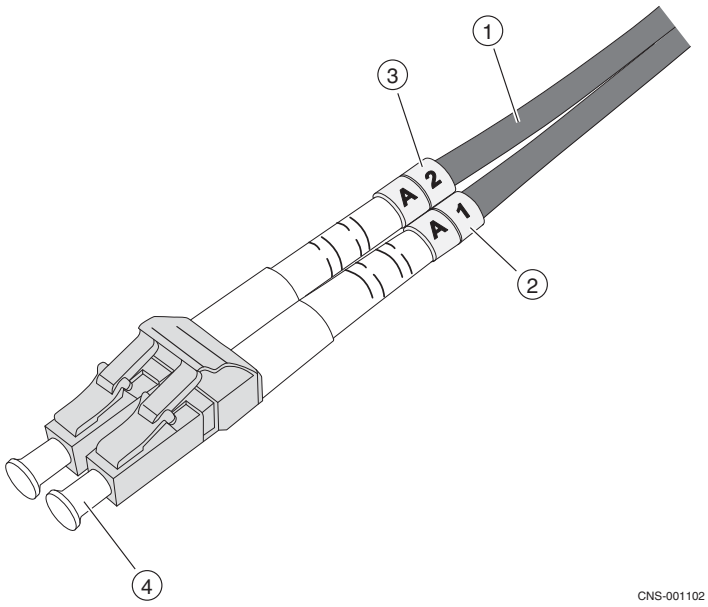


1	Dust plug (protective cap)	3	Send or transmit (TX) optical bore
2	Bale clasp latch	4	Receive (RX) optical bore

Figure 33 Example of an SFP+ module

Lucent Connector type interface

The Lucent Connector (LC) type interface was developed by Lucent Technologies (hence, Lucent Connector). It uses a push-pull mechanism. LC connectors are normally held together in a multimode duplex configuration with a plastic clip. These cables are usually colored orange for OM2 multimode optical fiber type cables and aqua for OM3 multimode optical fiber type cables. These cables have the duplex connectors encased in a gray plastic covering. To determine the send or transmit (TX) and receive (RX) ferrules (connector ends), these cables will show a letter and numeral (for example A1 and A2 for the TX and RX, respectively) or a white and yellow rubber gasket (jacket) for the send or transmit (TX) and receive (RX) ends (Figure 34 on page 47).



1	Orange cable	3	Rubber gasket (jacket), receive (RX)
2	Rubber gasket (jacket), send or transmit (TX)	4	Ferrule (connector end to SFP+ module)

Figure 34 Example of LC-type connectors

Storage processor I/O module types

Seven I/O module types are supported by the Block, File, and Unified VNX8000 platform SP. However, only ten slots are supported per SP (A0 – A10 and B0 – B10) in the File/Unified VNX8000 platform SPE. For more information, refer to the *Adding Storage Processor I/O modules and SFPs* document available online at https://mydocs.emc.com/VNX/ and go to **VNX tasks**, then select **Add VNX hardware**. Next, follow the steps in the wizard.

IMPORTANT

When adding new I/O modules, always install I/O modules in pairs—one module in SP A and one module in SP B. Both SPs must have the same type of I/O modules in the same slots.

I/O module slots

Slots A8 and B8 will contain a fibre Channel (FC) I/O module for Data Mover connections to the first four system Data Movers. Additionally, slots A2 and B2 in each SP will contain another FC I/O module, if the eight Data Mover option for the File/Unified VNX8000 platform is ordered. Slots A5, A10 and B5, B10 will always contain a 6-Gb/s SAS I/O module in the SPE. Slots A4, A6 and B4, B6 in the SPE will contain another 6-Gb/s SAS I/O module if the 16-bus option for the File/Unified VNX8000 platform is ordered. The other available slots can contain any type of I/O module that is supported for the storage system, within the supported I/O module limits of the supported I/O modules per SP in the SPE. For more information, refer to the *Adding Storage Processor I/O modules and*

SFPs document available online at https://mydocs.emc.com/VNX/ and go to **VNX tasks**, then select **Add VNX hardware**. Next, follow the steps in the wizard.

IMPORTANT

EMC requires that an 8-bus File/Unified VNX8000 platform with greater than four Data Movers be installed with four standard I/O modules per SP, leaving space for seven optional I/O modules per SP. Then, in a 16-bus File/Unified VNX8000 platform with greater than four Data Movers, EMC requires six standard I/O modules per SP, leaving space for five optional I/O modules per SP For more information, refer to the *Adding Storage Processor I/O modules and SFPs* document.

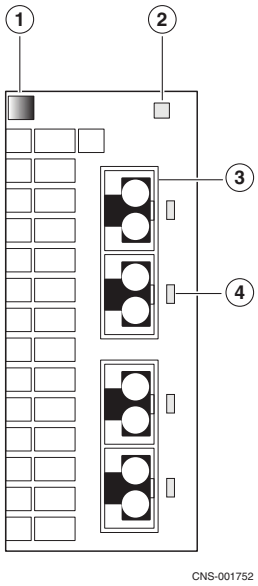
The following I/O modules are supported:

- "Four-port 8-Gb/s FC I/O module" on this page
- "Four-port 16-Gb/s FC I/O module" on page 51
- "Four-port 1-Gb/s copper iSCSI I/O module" on page 53
- "Two-port 10-Gb/s optical or active Twinax Fibre Channel over Ethernet (FCoE) I/O module" on page 55
- "Two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module" on page 57
- "Two-port 10-Gb/s optical I/O module" on page 59
- "Four-port 6-Gb/s SAS I/O module" on page 61

Four-port 8-Gb/s FC I/O module

The four-port 8-Gb/s FC I/O module (labeled **8 GbE Fibre** on the latch handle) comes with four optical (fibre) ports, one power/fault LED, and a link/activity LED for each optical port (Figure 35 on page 49). This I/O module can interface at speeds of 2, 4, and 8 Gb/s.

The four-port 8-Gb/s FC I/O module uses SFP+ transceiver modules to connect to LC-type optical fibre cables ("Lucent Connector type interface" on page 46). These SFP+ transceiver modules are input/output (I/O) devices that plug into the FC port of the FC I/O modules. For more information about these SFP+ transceiver modules, see the "I/O modules" section on page 45.



1	Push button latch handle	3	SFP+ (optical) port (four)
2	Power/fault LED	4	SFP+ link/activity LED

Figure 35 Four-port 8-Gb/s FC I/O module

Note: The 8-Gb/s I/O module uses a specific type of SFP module, ensure you are using the correct one. Refer to the Parts Location guide for more information.

Four-port 8-Gb/s FC I/O module LEDs

The four-port 8-Gb/s Fibre Channel (FC) I/O module has two different types of status LEDs. Figure 36 shows the LEDs and Table 20 describes them.

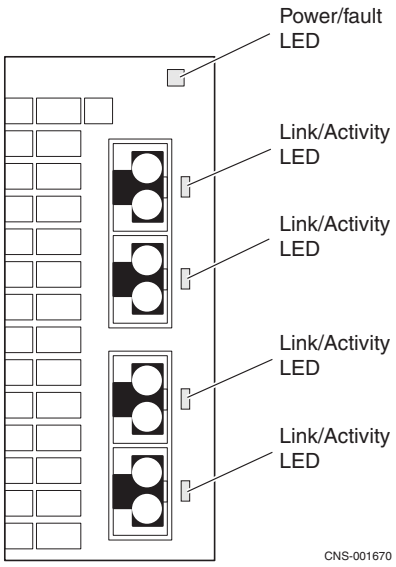


Figure 36 Four-port 8-Gb/s FC I/O module LEDs

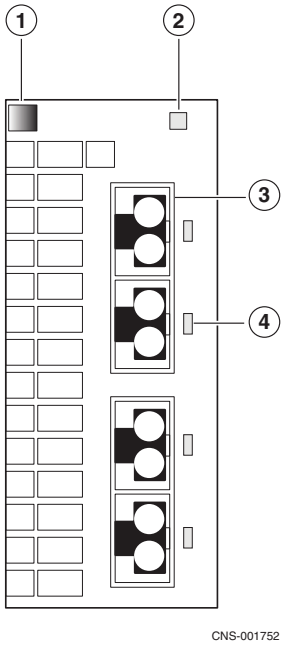
Table 20 Four-port 8-Gb/s FC I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link/Activity (each port has one LED)	Green	On	2- or 4-Gb link speed (suboptimal speed)
	Blue	On	8-Gb/s link speed (maximum speed)
	Green or Blue	Blinking	Small form-factor pluggable (SFP+[1]) transceiver module faulted, unsupported, or optical cable fault.
	—	Off	No network connection

1. Refer to the *VNX8000 Parts Location Guide* for the correct SFP+ part number.

Four-port 16-Gb/s FC I/O module

The four-port 16-Gb/s FC I/O module (labeled **16 Gb Fibre v1** on the latch handle) comes with four optical (fibre) ports, one power/fault LED, and a link/activity LED for each optical port (Figure 37). This I/O module can interface at speeds of 4, 8, and 16 Gb/s.



1	Push button latch handle	3	SFP+ (optical) port (four)
2	Power/fault LED	4	SFP+ link/activity LED

Figure 37 Four-port 16-Gb/s FC I/O module

The four-port 16-Gb/s FC I/O module uses SFP+ transceiver modules to connect to LC-type optical fibre cables ("Lucent Connector type interface" on page 46). These SFP+ transceiver modules are input/output (I/O) devices that plug into the FC port of the FC I/O modules. For more information about these SFP+ transceiver modules, see the "I/O modules" section on page 45.

Note: The 16-Gb/s I/O module uses a specific type of SFP module, ensure you are using the correct one. Refer to the Parts Location guide for more information.

Four-port 16-Gb/s FC I/O module LEDs

The four-port 16-Gb/s Fibre Channel (FC) I/O module has two different types of status LEDs. Figure 38 shows the LEDs and Table 21 describes them.

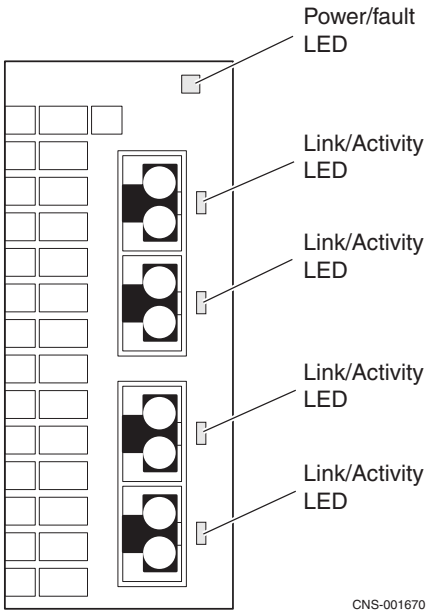


Figure 38 Four-port 16-Gb/s FC I/O module LEDs

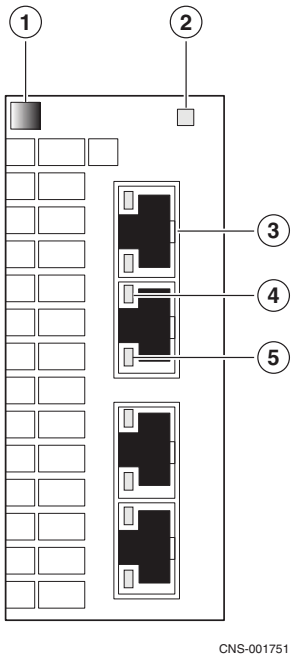
Table 21 Four-port 16-Gb/s FC I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link/Activity (each port has one LED)	Blue	On	4-, 8-, or 16-Gb/s link speed (autonegotiates)
	Blue	Blinking	Small form-factor pluggable (SFP+[1]) transceiver module faulted, unsupported, or optical cable fault.
	—	Off	No network connection

1. Refer to the *VNX8000 Parts Location Guide* for the correct SFP+ part number.

Four-port 1-Gb/s copper iSCSI I/O module

The four-port 1-Gb/s copper iSCSI I/O module (labeled **1 GbE iSCSI/TOE** on the latch handle) comes with four 1-Gb/s copper ports, one power/fault LED, and a link and activity LED for each port (Figure 39). The copper ports on this I/O module can interface at speeds up to 1 Gb/s for iSCSI (Internet Small Computer System Interface) networks[5].



1	Push button latch handle	**4**	RJ-45 link LED
2	Power/fault LED	**5**	RJ-45 activity LED
3	RJ-45 (copper) port (four)		

Figure 39 Four-port 1-Gb/s copper iSCSI I/O module

5. iSCSI is a protocol for sending SCSI packets over TCP/IP networks.

Four-port 1-Gb/s copper iSCSI I/O module LEDs

The four-port 1-Gb/s copper iSCSI I/O module has three types of status LEDs. Figure 40 shows the LEDs and Table 22 describes them.

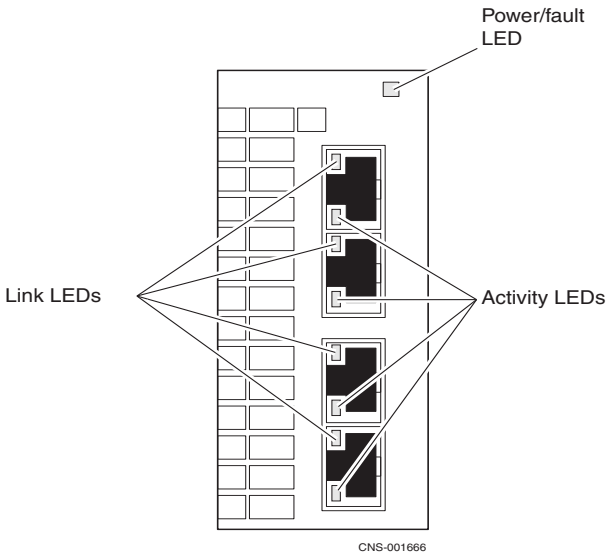


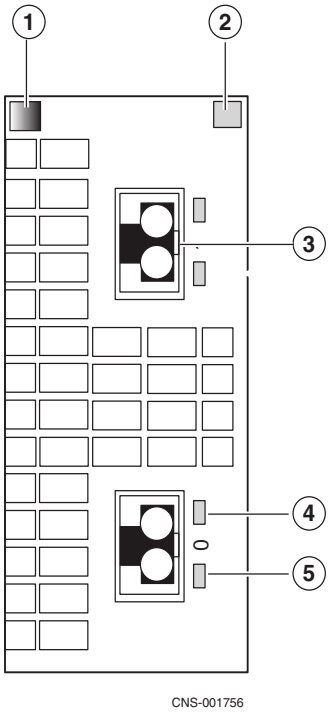
Figure 40 Four-port 1-Gb/s copper iSCSI I/O module LEDs

Table 22 Four-port 1-Gb/s copper iSCSI I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link (each port has one)	Green	On	Network connection
	—	Off	No network connection
Activity (each port has one)	Amber	Blinking	Transmit/receive activity
	—	Off	No activity

Two-port 10-Gb/s optical or active Twinax Fibre Channel over Ethernet (FCoE) I/O module

The two-port 10-Gb/s optical or active Twinax[6] FCoE I/O module (labeled **10 GbE/FCoE** on the latch handle) comes with two FCoE ports, one power/fault LED, and a link and activity LED for each port (Figure 41). The ports on this I/O module can interface at speeds up to 10 Gb/s for Fibre Channel over Ethernet networks. The two-port 10-Gb/s FCoE I/O module uses the SFP+ transceiver module. For part number label location, see the *VNX8000 Parts Location Guide* available online at https://mydocs.emc.com/VNX/ and go to **Additional VNX documentation**, and select the related documentation software for the model desired, then go to **VNX Hardware Parts**, next select the **VNX8000 Parts Guide**.



1	Push button latch handle	**4**	SFP+ link LED (right)
2	Power/fault LED	**5**	SFP+ activity LED (left)
3	SFP+ (optical) port (two)		

Figure 41 Two-port 10-Gb/s FCoE I/O module

Note: The 10-Gb/s FCoE I/O module uses a specific type of SFP module, ensure you are using the correct one. Refer to the Parts Location guide for more information.

6. The FCoE I/O module can also use active twinaxial (Twinax) cables. Twinax is a type of cable similar to coax, but with two inner conductors instead of one. These cables will be supplied in lieu of the SFP+ transceiver module when so ordered.

Two-port 10-Gb/s FCoE I/O module LEDs

The two-port 10-Gb/s FCoE I/O module has three types of status LEDs. Figure 42 shows the LEDs and Table 23 describes them.

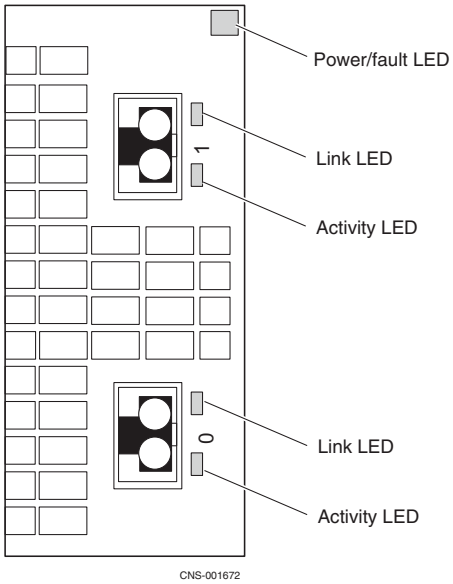


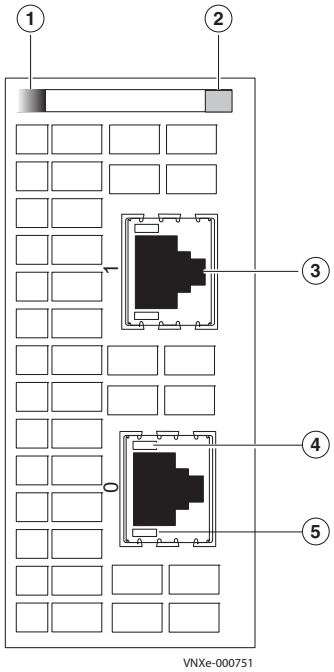
Figure 42 Two-port 10-Gb/s FCoE I/O module LEDs

Table 23 two-port 10-Gb/s FCoE I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link	Green	On	Network connection
	—	Off	No network connection
Activity	Amber	Blinking	Transmit/receive activity
	—	Off	No activity

Two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module

The two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module (labeled **10 GbE Base-T** on the latch handle) comes with two 10-Gb/s Base-T copper ports, one power/fault LED, and a link and activity LED for each port (Figure 43). The Base-T ports on this I/O module can interface at speeds of 10 Gb/s for iSCSI (Internet Small Computer System Interface) networks[7]. The two-port 10-Gb/s Base-T I/O module uses EIA Category 6 or 6a Unshielded Twisted Pair (UTP) or EIA Category 7 fully Shielded Twisted Pair (STP) copper cabling.



1	Push button latch handle	**4**	Link LED (right)
2	Power/fault LED	**5**	Activity LED (left)
3	RJ-45 Base-T port (2)		

Figure 43 Two-port 10-Gb/s RJ-45 Base-T I/O module

7. iSCSI is a protocol for sending SCSI packets over TCP/IP networks.

Two-port 10-Gb/s RJ-45 Base-T I/O module LEDs

The two-port 10-Gb/s RJ-45 Base-T I/O module has three types of status LEDs. Figure 44 shows the LEDs and Table 24 describes them.

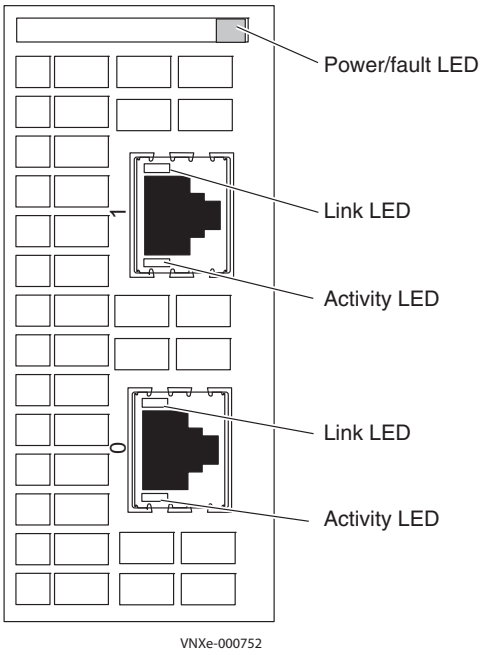


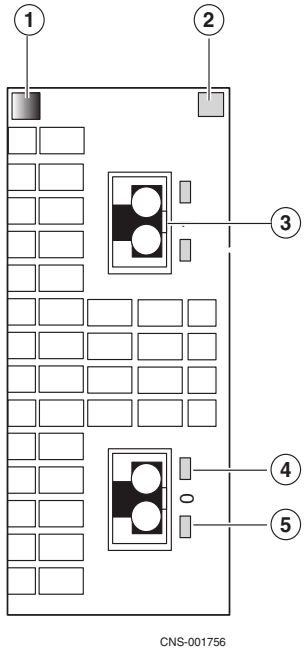
Figure 44 Two-port 10-Gb/s RJ-45 Base-T I/O module LEDs

Table 24 Two-port 10-Gb/s RJ-45 Base-T I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link	Green	On	Network connection
	—	Off	No network connection
Activity	Amber	Blinking	Transmit/receive activity
	—	Off	No activity

Two-port 10-Gb/s optical I/O module

The two-port 10-Gb/s optical or active and passive Twinax I/O module (labeled **10 GbE v3** on the latch handle) comes with two optical ports, one power/fault LED, and a link and activity LED for each port (Figure 45). The optical ports on this I/O module can interface at speeds of 10-Gb/s networks. The two-port 10-Gb/s optical I/O module uses the SFP+ transceiver module. For part number label location, see the *VNX8000 Parts Location Guide* available online at https://mydocs.emc.com/VNX/ and go to **Additional VNX documentation**, and select the related documentation software for the model desired, then go to **VNX Hardware Parts**, next select the **VNX8000 Parts Guide**.



1	Push button latch handle	**4**	SFP+ link LED (right)
2	Power/fault LED	**5**	SFP+ activity LED (left)
3	SFP+ (optical) port (two)		

Figure 45 Two-port 10-Gb/s optical I/O module

Note: The 10-Gb/s optical I/O module uses a specific type of SFP module, ensure you are using the correct one. Refer to the Parts Location guide for more information.

Two-port 10-Gb/s optical I/O module LEDs

The two-port 10-Gb/s optical I/O module has three types of status LEDs. Figure 46 shows the LEDs and Table 25 describes them.

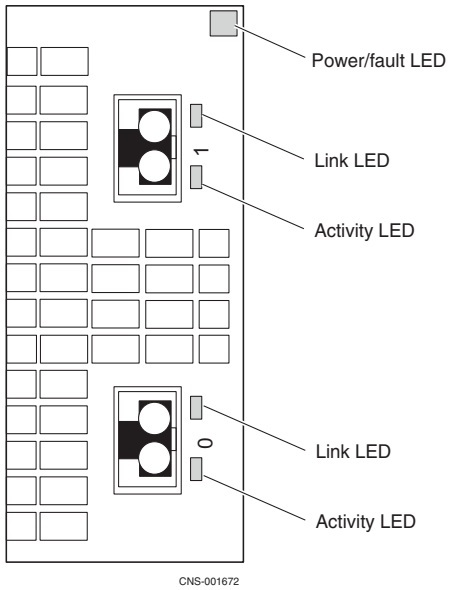


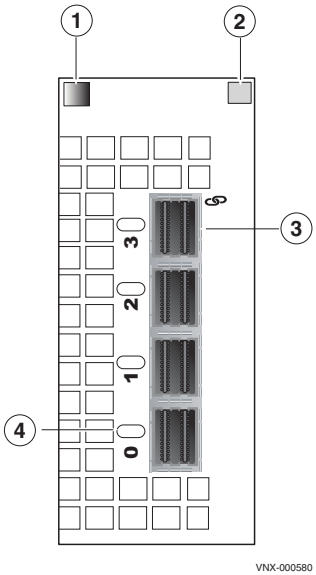
Figure 46 Two-port 10-Gb/s optical I/O module LEDs

Table 25 Two-port 10-Gb/s optical I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link	Green	On	Network connection
	—	Off	No network connection
Activity	Amber	Blinking	Transmit/receive activity
	—	Off	No activity

Four-port 6-Gb/s SAS I/O module

The four-port 6-Gb/s SAS I/O module (labeled **6 Gb SAS v3** with an **e** inside a lock symbol on the latch handle)[8] comes with four ports, one power/fault LED, and a combination link/activity LED for each port (Figure 47). The ports on this I/O module can interface at speeds of 6 Gb/s for supporting serial SCSI protocol (SSP), serial management protocol (SMP), and SATA tunneling protocol (STP) networks. The four-port 6-Gb/s SAS I/O module uses the mini-SAS HD connectors.



1	Push button latch handle	3	port (four)
2	Power/fault LED	4	LED (four)

Figure 47 Four-port 6-Gb/s SAS I/O module

These connectors are 36-circuit small form-factor 8644 (SFF-8644) specification (sockets or receptacles, see Figure 48) using an SFF-8644 specification mini-SAS HD 36-circuit cable (plug) with a pull tab (see Figure 49 on page 62).

Figure 48 shows an example of the port connector (socket) and pinout.

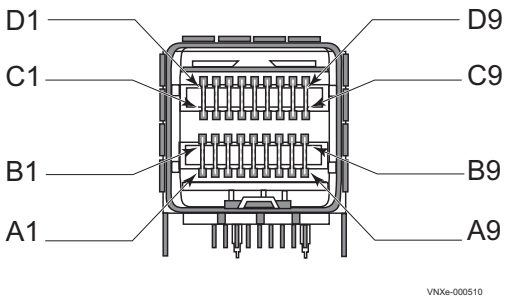


Figure 48 6-Gb/s mini-SAS HD port connector (socket) and pinout

8. The **e** inside the lock symbol indicates that the I/O module supports encryption.

Figure 49 shows an example of an mini-SAS HD cable connector (plug) with pull tab and pinout.

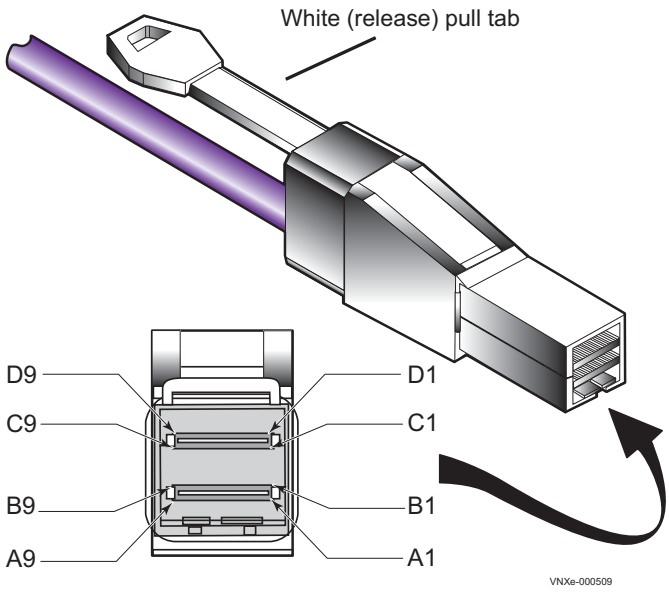


Figure 49 6-Gb/s mini-SAS HD cable connector (plug) and pinout

IMPORTANT

When connecting the mini-SAS HD cable connector (plug) into the SAS I/O module ports (sockets) **0**, **1**, **2**, and **3**, be careful of the orientation of the cable end with the port. On the SAS I/O module, the ports have nubs (or keys). While the cable end has a notch. This notch aligns with the nub (or key) in the port. On the other side of the cable end is a white release tab opposite from the cable notch.

To connect, gently slide the cable into the port until you hear a small click aligning the notch with the nub (or key) in the port. For the SAS I/O module the notch on the cable aligns with the nub (or key) on the right side of each port. The white release tab should be on the left side of the port.

Do Not force the cable into the port.

A video describing how to properly connect mini-SAS HD cables and mini-SAS cables to a DPE and a DAE, respectively, in a VNX product is available online at: https://edutube.emc.com/, in the Search box, type in **Mini-SAS HD Cable Connectivity**. The video will start immediately.

Note: The video does not show an example of the SAS I/O module, but the video does show how a mini-SAS HD cable connects to a mini-SAS HD port.

Four-port 6-Gb/s SAS I/O module LEDs

The four-port 6-Gb/s SAS I/O module has two types of status LEDs. Figure 50 shows the LEDs and Table 26 on page 63 describes them.

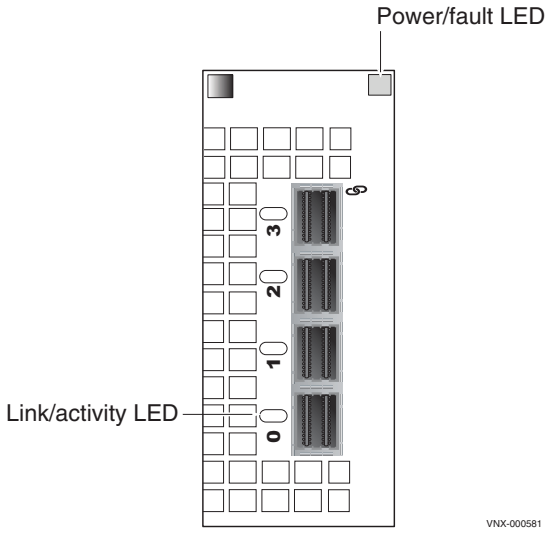


Figure 50 Four-port 6-Gb/s SAS I/O module LEDs

Table 26 Four-port 6-Gb/s SAS I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link/activity	Blue	On	Network connection
		Blinking	Transmit/receive activity
	—	Off	No activity

Data Mover I/O module types

Four I/O module types are supported by the File/Unified VNX8000 platform Data Mover.

IMPORTANT

When adding new I/O modules, always install I/O modules in sets to each Data Mover within the File/Unified VNX8000 platform or failover group. All Data Movers in the File/Unified VNX8000 platform or failover group must have the same type of I/O modules in the same slots. For more information, refer to the *Adding I/O modules to the Data Mover* document available online at https://mydocs.emc.com/VNX/ and go to **VNX tasks**, then select **Add VNX hardware**. Next, follow the steps in the wizard.

I/O module slots

Slot 0 in each Data Mover is reserved for connections to the storage array and for optional tape backup devices. The other available slots can contain any type of network I/O module that is supported for the File/Unified VNX8000 platform. For more information, refer to the *Adding an I/O module to a Data Mover* document for the correct spes to add an I/O module to a Data Mover. This procedure is available at https://mydocs.emc.com/VNX/ and go to **VNX tasks**, then select **Add VNX hardware**. Next, follow the steps in the wizard.

The following types of I/O modules are supported:

- "Four-port 8-Gb/s FC I/O module" on page 64
- "Four-port 1-Gb/s copper I/O module" on page 67
- "Two-port 10-Gb/s optical I/O module" on page 69
- "Two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module" on page 71

Note: For SP module types, go to "Storage processor I/O module types" on page 47.

Four-port 8-Gb/s FC I/O module

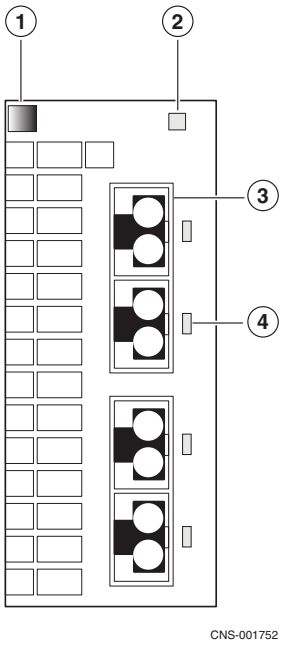
The four-port 8-Gb/s FC I/O module (labeled **8 GbE Fibre** on the latch handle) comes with four optical (fibre) ports, one power/fault LED, and a link/activity LED for each optical port, as shown in Figure 51 on page 65. This I/O module can interface at speeds of 2, 4, and 8 Gb/s.

The four-port 8-Gb/s FC I/O module uses SFP+ transceiver modules to connect to LC-type optical fibre cables ("Lucent Connector type interface" on page 46). These SFP+ transceiver modules are input/output (I/O) devices that plug into the FC port of the FC I/O modules. These SFP+ modules are hot swappable.

⚠CAUTION

Be careful when replacing or swapping out SFP+ modules, your Data Mover will lose access to the SP or tape drive to which it is connected.

This means that you can install and remove an SFP+ module while the VNX8000 platform is operating.



1	Push button latch handle	3	SFP+ (optical) port (four)
2	Power/fault LED	4	SFP+ link/activity LED

Figure 51 Four-port 8-Gb/s FC I/O module

Note: The 8-Gb/s I/O module uses a specific type of SFP module, ensure you are using the correct one. Refer to the Parts Location guide for more information.

Four-port 8-Gb/s FC I/O module LEDs

The four-port 8-Gb/s Fibre Channel (FC) I/O module has two different types of status LEDs. Figure 52 shows the LEDs and Table 27 describes them.

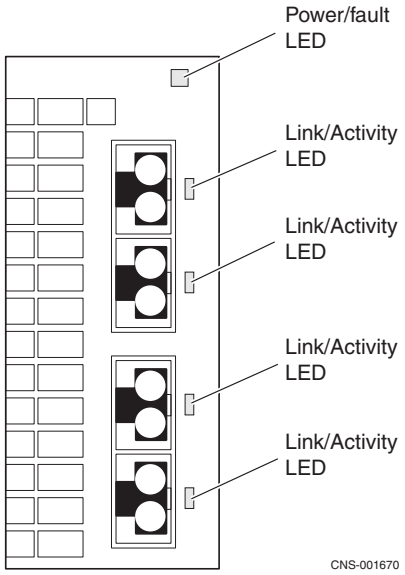


Figure 52 Four-port 8-Gb/s FC I/O module LEDs

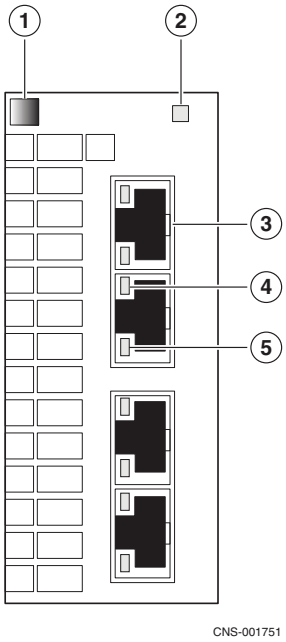
Table 27 Four-port 8-Gb/s FC I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link/Activity (each port has one LED)	Green	On	2- or 4-Gb link speed (suboptimal speed)
	Blue	On	8-Gb/s link speed (maximum speed)
	Green or Blue	Blinking	Small form-factor pluggable (SFP+[1]) transceiver module faulted, unsupported, or optical cable fault.
	—	Off	No network connection

1. Refer to the *VNX8000 Parts Location Guide* for the correct SFP+ part number.

Four-port 1-Gb/s copper I/O module

The four-port 1-Gb/s copper I/O module (labeled **1 GbE** on the latch handle) comes with four copper ports, one power/fault LED, and a link and activity LED for each copper port (Figure 53). This I/O module can interface at speeds of 10 Mb/s, 100 Mb/s, and 1000 Mb/s (1 Gb/s). Another way to describe this type of module is that it runs Ethernet over twisted pair.



1	Push button latch handle	**4**	RJ-45 link LED
2	Power/fault LED	**5**	RJ-45 activity LED
3	RJ-45 (copper) port (four)		

Figure 53 Four-port 1-Gb/s copper I/O module

Four-port 1-Gb/s copper I/O module LEDs

The four-port 1-Gb/s copper I/O module has three types of status LEDs. Figure 54 shows the LEDs and Table 28 describes them.

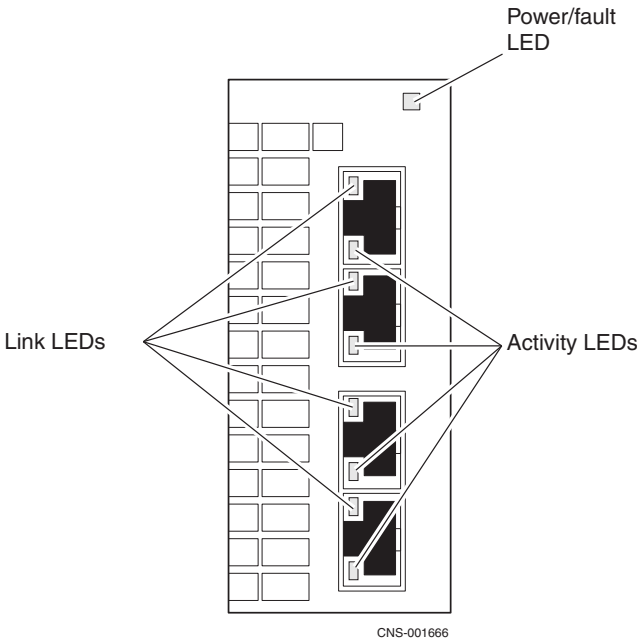


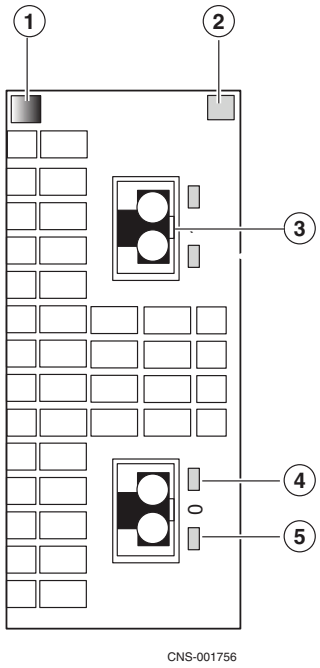
Figure 54 Four-port 1-Gb/s copper I/O module LEDs

Table 28 Four-port 1-Gb/s copper I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link (each port has one)	Green	On	Network connection
	—	Off	No network connection
Activity (each port has one)	Amber	Blinking	Transmit/receive activity
	—	Off	No activity

Two-port 10-Gb/s optical I/O module

The two-port 10-Gb/s optical or active and passive Twinax I/O module (labeled **10 GbE v3** on the latch handle) comes with two optical ports, one power/fault LED, and a link and activity LED for each port (Figure 55). The optical ports on this I/O module can interface at speeds of 10-Gb/s networks. The two-port 10-Gb/s optical I/O module uses the SFP+ transceiver module. For part number label location, see the *VNX8000 Parts Location Guide* available online at https://mydocs.emc.com/VNX/ and go to **Additional VNX documentation**, and select the related documentation software for the model desired, then go to **VNX Hardware Parts**, next select the **VNX8000 Parts Guide**.



1	Push button latch handle	3	Link LED (right)
2	Power/fault LED	4	Activity LED (left)

Figure 55 Two-port 10-Gb/s optical I/O module

Note: The 10-Gb/s optical I/O module uses a specific type of SFP module, ensure you are using the correct one. Refer to the Parts Location guide for more information.

Two-port 10-Gb/s optical I/O module LEDs

The two-port 10-Gb/s optical I/O module has three types of status LEDs. Figure 56 shows the LEDs and Table 29 describes them.

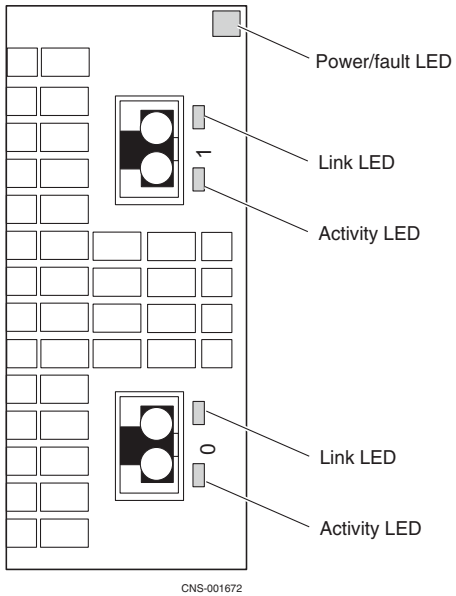


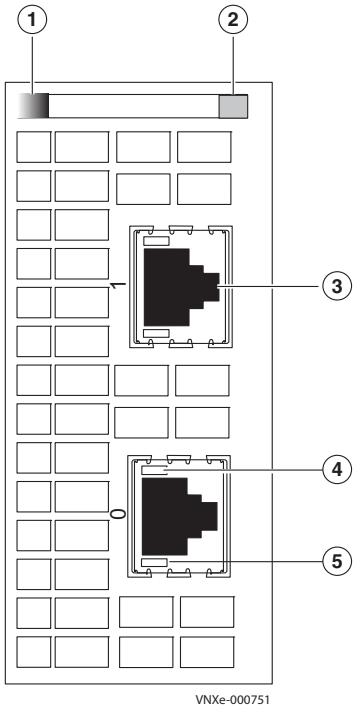
Figure 56 Two-port 10-Gb/s optical I/O module LEDs

Table 29 Two-port 10-Gb/s optical I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link	Green	On	Network connection
	—	Off	No network connection
Activity	Amber	Blinking	Transmit/receive activity
	—	Off	No activity

Two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module

The two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module (labeled **10 GbE Base-T** on the latch handle) comes with two 10-Gb/s Base-T copper ports, one power/fault LED, and a link and activity LED for each port (Figure 57). The Base-T ports on this I/O module can interface at speeds of 10 Gb/s for iSCSI (Internet Small Computer System Interface) networks[9]. The two-port 10-Gb/s Base-T I/O module uses EIA Category 6 or 6a Unshielded Twisted Pair (UTP) or EIA Category 7 fully Shielded Twisted Pair (STP) copper cabling.



1	Push button latch handle	**4**	Link LED (right)
2	Power/fault LED	**5**	Activity LED (left)
3	RJ-45 Base-T port (2)		

Figure 57 Two-port 10-Gb/s RJ-45 Base-T I/O module

9. iSCSI is a protocol for sending SCSI packets over TCP/IP networks.

Two-port 10-Gb/s RJ-45 Base-T I/O module LEDs

The two-port 10-Gb/s RJ-45 Base-T I/O module has three types of status LEDs. Figure 58 shows the LEDs and Table 30 describes them.

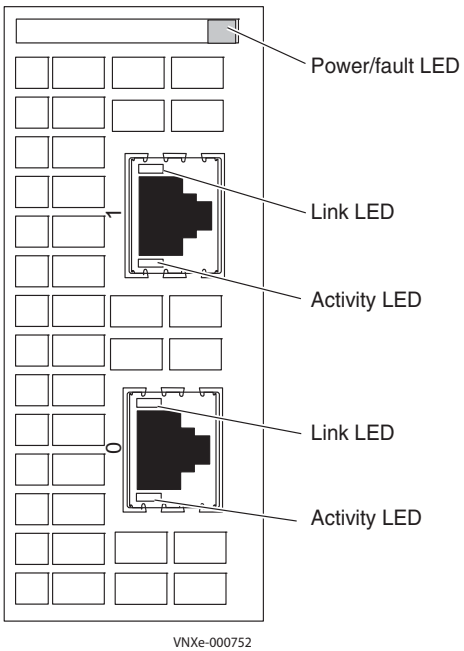


Figure 58 Two-port 10-Gb/s RJ-45 Base-T I/O module LEDs

Table 30 Two-port 10-Gb/s RJ-45 Base-T I/O module LEDs

LED	Color	State	Description
Power/Fault	Green	On	I/O module is powered up.
	Amber	On	I/O module has faulted.
	—	Off	I/O module is powered down.
Link	Green	On	Network connection
	—	Off	No network connection
Activity	Amber	Blinking	Transmit/receive activity
	—	Off	No activity

Disk-array enclosures

This section describes and illustrates the front- and rear-panel controls, ports, and LED indicators on the disk-array enclosures (DAEs) supported on the VNX8000 platform.

IMPORTANT

DAE configuration rules:

1.) Maximum number of enclosures per bus is 10.
2.) Maximum number of drives per bus is 250.
3.) Consider the maximum number of drives supported by the storage system model.

⚠CAUTION

Lifting the DAE and installing it into or removing it from a rack is a two- to three-person job. If needed, use an appropriate lifting device (portable mechanical lift). A fully loaded 2U, 25 DAE; 3U, 15 DAE; 3U, 120 DAE; or 4U, 60 DAE weighs approximately 45 lb (20.41 kg), 68 lb (30.84 kg), 165 lb (74.8 kg), or 213 lb (96.62 kg), respectively.

Because the 3U, 120 and the 4U, 60 DAEs are extremely heavy, EMC recommends a portable mechanical lift manufactured by Alum-A-Lift. For more information about the EMC recommended portable mechanical lift and an example illustration depicting the lift, go to "Appendix B: Field lift tool and accessory kit" on page 168.

⚠WARNING

Access to the internal components in a 3U, 120 (DAE8S) or a 4U, 60 (DAE7S) enclosures mounted 31U (4.5 feet, or 1.38 meters) or higher above the floor requires an appropriate lifting device (portable mechanical lift) and is restricted to authorized service personnel only. Attempts to service disks, fans, or other DAE components mounted 31U or higher without a portable mechanical lift and personnel may result in serious personal injury.

For more information about the weight and dimensions of a VNX8000 platform DAEs, go to https://mydocs.emc.com/VNX/ and go to the **About VNX** section, and then select **View technical specifications**. Next, follow the steps in the wizard.

The VNX8000 platform supports the expansion of four types of disk-array enclosures (DAEs) across a 6-Gb/s SAS bus:

- "2U, 25 (2.5-inch) DAE (DAE5S)" on page 77
- "3U, 15 (3.5-inch) DAE (DAE6S)" on page 85
- "3U, 120 (2.5-inch) DAE (DAE8S)" on page 94
- "4U, 60 (2.5- or 3.5-inch) DAE (DAE7S)" on page 111

Number of supported DAEs and disks

The number of DAEs and the disks supported by the VNX8000 platform is variable depending on the type of DAE. Typically, the VNX8000 platform supports up to sixty 2U, 25 (2.5-inch) DAEs (for a total of 1,500, 2.5-inch disk drives), up to one-hundred 3U, 15 (2.5- or 3.5-inch) DAEs (for a total of 1,500, 2.5- or 3.5-inch disk drives), up to twelve 3U, 120 (3.5-inch) DAEs (for a total of 1,440, 2.5-inch disk drivers), or up to twenty-five 4U, 60 (2.5- or 3.5-inch) DAEs (for a total of 1,500, 2.5- or 3.5-inch disk drives).

IMPORTANT

Configurations with mixtures of 2U, 3U, and 4U DAEs are also possible dependent on the drive slot count. However, if the 3U, 120 or the 4U, 60 DAE is used as part of your request for a mixture of DAE types, due to the depth of the 3U, 120 and 4U, 60 DAEs, the Dense rack is always required and the storage system is not customer installable.

Additionally, you cannot build an environment beyond the supported software and hardware requirements for that VNX8000 platform. *Do not* try to add more disk drives than the software can support. The VNX8000 platform supports up to a maximum of 1000 disk drives.

General

Each VNX8000 platform DAE typically consists of the following components:

- Drive carrier
- Disk drive
- Midplane
- Link control cards (LCCs)
- Inter Connect Modules (ICMs)[10]
- Power supply
- Cooling modules[11]
- EMI shielding

Drive carrier

In a 2U, 25 and 3U, 15 DAE, the disk drive carriers are metal and plastic assemblies that provide smooth, reliable contact with the enclosure slot guides and midplane connectors. Each carrier has a handle with a latch and spring clips. The latch holds the disk drive in place to ensure proper connection with the midplane. Disk drive activity/fault LEDs are integrated into the carrier (Figure 59 on page 77 and Figure 67 on page 85).

10. The 4U, 60 disk drive DAE includes Inter Connect Modules (ICMs). "4U, 60 (2.5- or 3.5-inch) DAE (DAE7S)" on page 111 provides more information about the 4U, 60 disk drive DAE.
11. The 4U, 60 disk drive DAE has separate power supplies and cooling modules (fans).

For more information about the drive carrier in a 3U, 120 or 4U, 60 DAE, see the "3U, 120 (2.5-inch) DAE (DAE8S)" section on page 94 and the "4U, 60 (2.5- or 3.5-inch) DAE (DAE7S)" section on page 111.

Disk drives

Each disk drive consists of one disk drive in a carrier. You can visually distinguish between disk drive types by their different latch and handle mechanisms and by type, capacity, and speed labels on each disk drive. You can add or remove a disk drive while the DAE is powered up, but you should exercise special care when removing disk drives while they are in use. Disk drives are extremely sensitive electronic components.

Midplane

In a 2U, 25 or 3U, 15 DAE, a midplane separates the front-facing disk drives from the rear-facing LCCs and power supply/cooling modules. It distributes power and signals to all components in the enclosure. LCCs, power supply/cooling modules, and disk drives plug directly into the midplane.

LCCs

In a 2U, 25 or 3U, 15 DAE, an LCC supports, controls, and monitors the DAE, and is the primary interconnect management element. Each LCC includes connectors for input and expansion to downstream devices. An enclosure address (EA) indicator is located on each LCC (Figure 65 on page 83 and Figure 73 on page 92)[12]. Each LCC includes a bus (loop) identification indicator (Figure 65 on page 83 and Figure 73 on page 92).

In a 3U, 120 DAE, an LCC supports, controls, and monitors the DAE, and is the primary interconnect management element. Each LCC includes connectors for input and expansion to downstream devices. An enclosure address (EA) indicator is located on each LCC (Figure 101 on page 119)[11]. Each LCC also includes a bus (loop) identification indicator (Figure 101 on page 119).

In a 4U, 60 DAE, the primary functionality of an LCC is to be a SAS expander as well as to provide enclosure services to all the disk drives (60 in all). In other words, the LCC in a 4U DAE (Figure 111 on page 129) implements a version of the Common Disk Enclosure Sub-system (CDES) architecture. CDES consists of the PMC-Sierra PM8005 SXP 6G SAS expander, the Common Disk Enclosure FPGA (CDEF) and supporting logic.

In the 4U, 60 DAE LCC, two SAS expanders are available. As previously described, the SAS expanders are PMC-Sierra SXP36 6G (PM8005, rev C) components. Each expander functions or operates separately. That is, each expander has its own CDEF and supporting logic to support 30 drives each. A 4-lane SAS wide port connecting each expander to the Inter Connect Module (ICM) expander on the same side (A or B) of the 4U DAE is available. Each expander manages the drives it is connected to. The only shared resources are the LCC LED and the expander I^2C (inter-integrated circuit) bus.

12. The EA is sometimes referred to as an enclosure ID.

Power supply

In a 2U, 25 or 3U, 15 DAE, the power supply/cooling module integrates independent power supply and blower cooling assemblies into a single module.

Each power supply is an auto-ranging power-factor-corrected, multi-output, off-line converter with its own line cord. The drives and LCC have individual soft-start switches that protect the disk drives and LCC if you install them while the disk enclosure is powered up. A disk or blower with power-related faults will not affect the operation of any other device.

In a 2U, 25 or 3U, 15 DAE, each power/cooling module has three status LEDs (Figure 66 on page 84 and Figure 74 on page 93).

In a 3U, 120 DAE, the power supplies and cooling modules or fans are separated. The power supplies are located on the rear. The power supply module has an orange knob used for removing and installing the power supply module from the DAE (Figure 78 on page 98). The cooling modules or fans are located in the front and in the middle of the DAE.

In a 4U, 60 DAE, the power supplies (Figure 102 on page 120) and cooling modules (Figure 94 on page 112) are separated and located at opposite ends of the 4U DAE. The power supplies are located on the rear of the 4U DAE.

Cooling modules

In a 2U, 25 or 3U, 15 DAE, the enclosure cooling system consists of dual-blower modules in each power supply/cooling module.

In a 3U, 120 DAE, the cooling modules or fans are located in the front of the DAE and in the middle of the DAE. The cooling modules or fans can only be installed/removed by sliding the DAE forward, then sliding the DAE cover to the rear. You access the cooling modules or fans from inside the DAE (see the "Access to disk drives and fan modules (cooling modules)" section on page 106 for more information).

In a 4U, 60 DAE, the cooling modules or fans are separate from the power supply modules. The cooling modules or fans are located on the front of the 4U, 60 DAE. The cooling modules or fans can only be installed/removed by sliding the DAE forward, then sliding the DAE cover to the rear. You access the cooling modules or fans from inside the DAE (see the **Caution** on page 123 for more information).

EMI shielding

EMI compliance requires a properly installed electromagnetic interference (EMI) shield in front of the DAE disk drives. When installed in cabinets that include a front door, the DAE includes a simple EMI shield. Other installations require a front bezel that has a locking latch and integrated EMI shield. You must remove the bezel/shield to remove and install the disk drive modules.

2U, 25 (2.5-inch) DAE (DAE5S)

The 2U, 25 (2.5-inch) disk drive DAE used in the VNX7600 platform is 2U (3.5 inches) high and includes 25 disk drives. It uses a 6-Gb/s SAS interface for communication between the disk processor enclosure (DPE) storage processors (SPs) and the DAE.

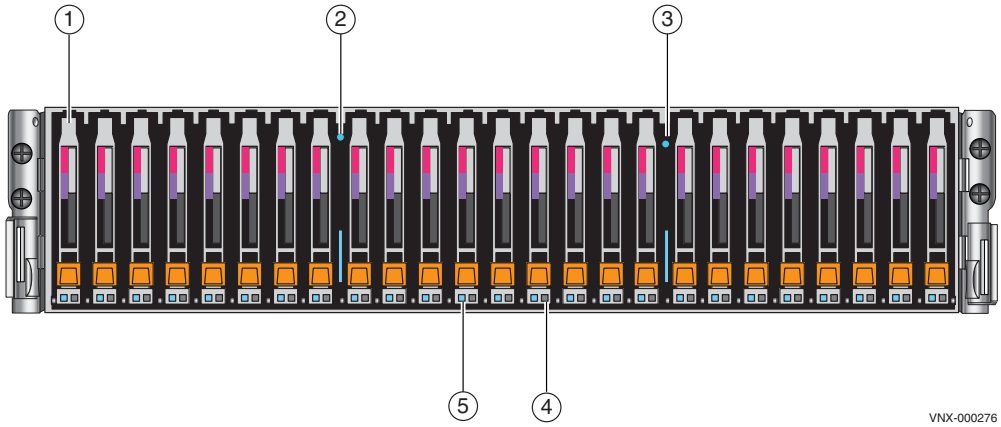
Front view

On the front, the VNX8000 platform 2U, 25 (2.5-inch) disk drive DAE includes the following hardware components:

- 2.5-inch 6-Gb/s SAS, 6-Gb/s NL-SAS, or Flash disk drives (hot-swappable)
- Status LEDs

Figure 59 shows the location of these components.

Note: In a VNX8000 platform, when using the 2U, 25 (2.5-inch) disk drive carrier, the maximum amount of disk drives is 1,500.



1	2.5-inch 6-Gb/s SAS or 6-Gb/s NL-SAS drives	4	Disk drive fault LED (amber)
2	DAE fault LED (amber)	5	Disk drive status/activity (blue)
3	DAE power status LED (blue)		

Figure 59 Example of a 2U, 25 (2.5-inch) disk drive DAE (front view)

Table 31 describes the 2U, 25 (2.5-inch) DAE and disk drive status LEDs.

Table 31 2U, 25 (2.5-inch) DAE and disk drive status LEDs

LED	Color	State	Description
DAE fault (see location 2)	Blue	On	No fault has occurred
	Amber	On	Fault has occurred
DAE power (see location 3)	Blue	On	Powering and powered up
	—	Off	Powered down
Disk drive fault (see location 4)	Amber	On	Fault has occurred
	—	Off	No fault has occurred
Disk drive on/activity (see location 5)	Blue	On	Powering and powered up
		Blinking	Disk drive activity

Rear view

On the rear, viewing from top to bottom, a 2U, 25 (2.5-inch) DAE includes the following components:

- Two link control cards (LCCs) A and B
- Two power supply/cooling modules (A and B)

Figure 60 shows the location of these components.

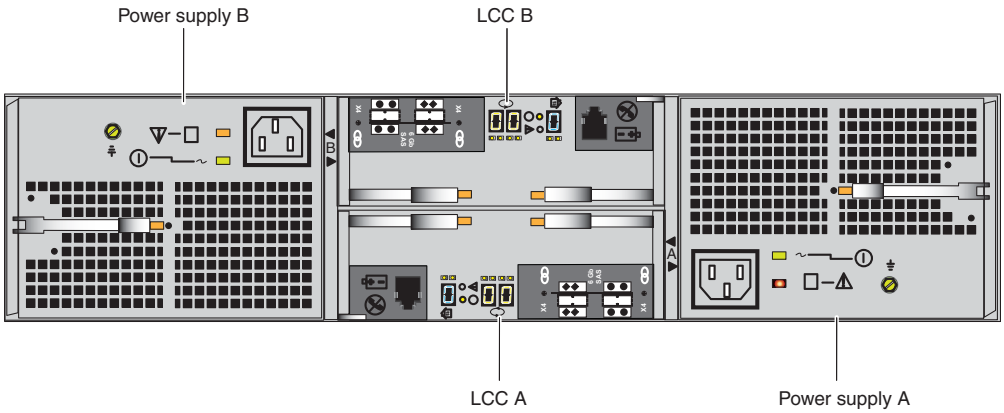


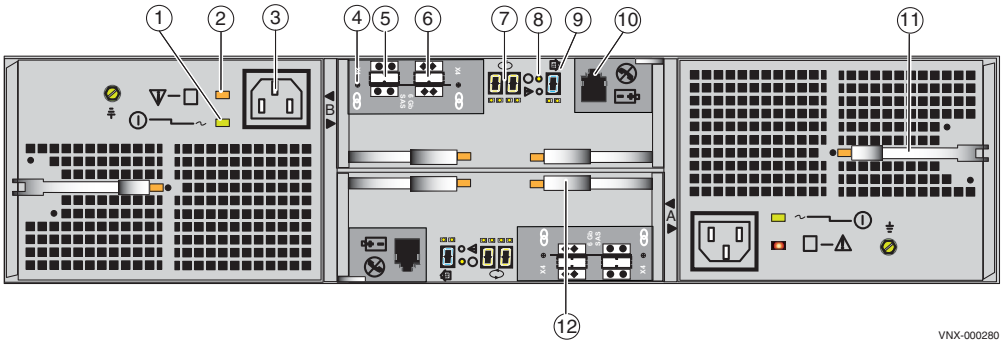
Figure 60 Example of 2U, 25 (2.5-inch) disk drive DAE (rear view)

2U, 25 (2.5-inch) DAE LEDs and connectors

Figure 61 on page 79 shows the location of the 2U, 25 (2.5-inch) DAE LEDs, connectors, and the latch handles:

- AC power supply (A and B) recessed power in (plug)
- AC power supply (A and B) LEDs (power and fault)
- AC power supply (A and B) latch handle

- LCC (A and B) mini-SAS connectors (input and output)
- LCC (A and B) mini-SAS link LEDs
- LCC (A and B) bus ID
- LCC (A and B) LEDs (power and fault)
- DAE enclosure ID
- LCC (A and B) management (RJ-12) connector (not used in VNX7600)
- LCC (A and B) latch handle



1	LLC B power supply LED (on, green)	**7**	LCC B bus ID
2	LCC B power supply fault LED (on, amber)	**8**	LCC B power and fault LEDs
3	LCC B AC power supply power in (recessed plug)	**9**	DAE enclosure ID or address
4	LCC B SAS connector link LED (on, blue)	**10**	LCC B management (RJ-12) connector to SPS
5	LCC B SAS connector (input); labeled with a double circle (dot) symbol ●●.	**11**	LCC A power supply latch handle
6	LCC B SAS connector (output); labeled with a double diamond symbol ◆◆.	**12**	LCC A right latch handle

Figure 61 Example of 2U, 25 (2.5-inch) disk drive DAE (rear view)

LCC

The 6-Gb/s SAS LCC supports, controls, and monitors the DAE, and is the primary interconnect management element. Each LCC includes connectors for input and output to downstream devices.

As described previously, the LCCs in a DAE connects to the SPE and other DAEs with 6-Gb/s SAS cables. The cables connect the LCCs in a system in a daisy-chain topology.

Internally, each DAE LCC connects to the drives in its enclosure in a point-to-point fashion through a switch. The LCC independently receives and electrically terminates incoming signals. For traffic from the system's storage processors, 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.

Note: If the target drive is not in the LCC's enclosure, the switch passes the input signal directly to the output 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 disk enclosure status. LCC firmware also controls the SAS PHYs and the disk-module status LEDs.

As shown in Figure 61 on page 79, an enclosure ID[13] indicator is located on each LCC. Each LCC also includes a bus (back-end port) identification indicator. The SP initializes the bus ID when the operating system is loaded.

LCC input/output ports and connectors — The 2U, 25 (2.5-inch) DAE LCC supports the following I/O ports on the rear:

- Two 6-Gb/s PCI Gen 2 SAS ports
- One management (RJ-12) connector to the SPS

6-Gb/s SAS x4 ports

The DAE LCC supports two (one input and one output) 6-Gb/s SAS x4 ports (labeled **6Gb SAS 0 x4** and **0 x 1**) on the rear of each LCC (A and B). This port provides an interface for SAS and NL-SAS drives on the DAE. This port is a 26-circuit SAS small form-factor 8088 (SFF-8088) specification (socket or receptacle) using an SFF-8088 specification mini-SAS 26-circuit cable (plug) with a pull tab.

Note: Each mini-SAS cable is keyed with an *in* and *out* connection to prevent incorrect cabling.

A video describing how to properly connect mini-SAS HD cables and mini-SAS cables to a DPE and a DAE, respectively, in a VNX product is available online at: https://edutube.emc.com/, in the Search box, type in **Mini-SAS HD Cable Connectivity**. The video will start immediately.

Note: The first half of the video shows an example of how to connect a mini-SAS HD cable to a mini-SAS HD port while the second half shows how to connect a mini-SAS cable to a DAE LCC port.

13. The enclosure ID is sometimes referred to as the enclosure address (EA).

Figure 62 shows an example of the 6-Gb/s mini-SAS port connector (socket) and cable connector (plug) with pull tab.

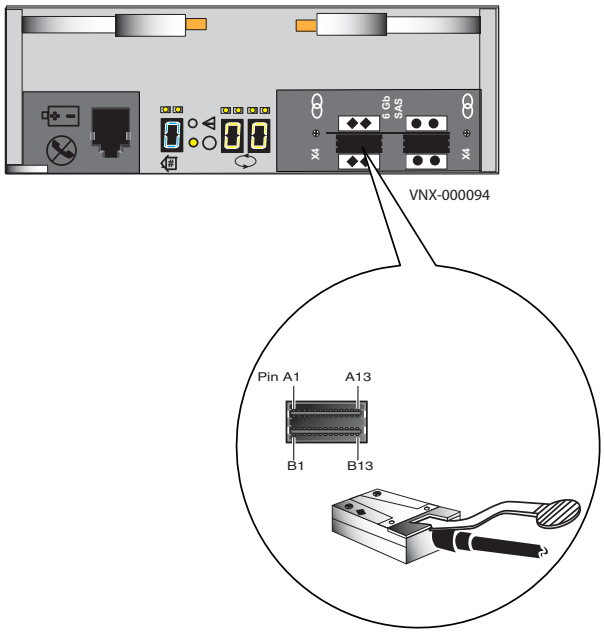


Figure 62 6-Gb/s SAS port and cable connector

Table 32 lists the 2U, DAE 6-Gb/s SAS port pin signals used on the connector.

Table 32 6-Gb/s SAS port connector pinout

Pin	Signal	Pin	Signal
A1	GND	B1	GND
A2	Rx 0+	B2	Tx 0+
A3	Rx 0-	B3	Tx 0-
A4	GND	B4	GND
A5	Rx 1+	B5	Tx 1+
A6	Rx 1-	B6	Tx 1-
A7	GND	B7	GND
A8	Rx 2+	B8	Tx 2+
A9	Rx 2-	B9	Tx 2-
A10	GND	B10	GND
A11	Rx 3+	B11	Tx 3+
A12	Rx 3-	B12	Tx 3-
A13	GND	B13	GND

6-Gb/s mini-SAS port LEDs and port direction (input or output) — Figure 63 shows the 6-Gb/s mini-SAS port LED—a bi-color (blue/green) LED next to the connector, either left or right—that indicates the link/activity of the mini-SAS port.

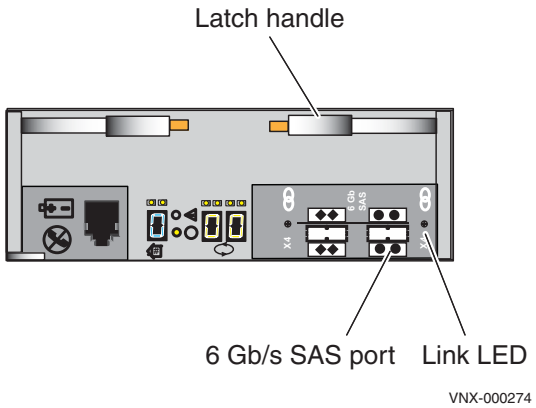


Figure 63 6-Gb/s mini-SAS port LED

Table 33 describes the 2U DAE LCC 6-Gb/s port LEDs.

Table 33 6-Gb/s mini-SAS port LEDs

LED	Color	State	Description
Link/activity	Blue	On	All lanes are running at 6 GB/s
	Green	On	One or more lanes is not running at full speed or disconnected
	Alternating Blue/Green	Blinking	Port is being marked by the host
	—	Off	Not connected

Management (RJ-12) port connector — Figure 64 on page 83 shows the management port (labeled with two symbols; one depicting a telephone handset with a line through it and the other depicting a battery). The telephone handset with a line through it symbol means that you cannot connect telephone type circuits to this connector (see the following **WARNING**). This port connects the LCC (A and B) ports to the SPS (A and B) ports, respectively.

⚠WARNING

The SPS (RJ-12) port is a LAN port not a WAN port. LAN ports contain safety extra-low voltage (SELV) circuits, and WAN ports contain telephone-network voltage (TNV) circuits. An RJ-45 (or TNV-type) looks the same as the RJ-12 except for two very important differences. An RJ-45 is an 8-wire modular jack. The RJ-12 is a six-wire modular jack. The RJ-45 plugs and jacks are wider than their RJ-12 counterparts - 7/16" vs 3/8". An RJ-45 plug won't fit into an R-J12 jack. But an RJ-12 plug will fit into an RJ-45 jack. Use caution when connecting cables. To avoid electric shock, do not attempt to connect TNV circuits to SELV circuits.

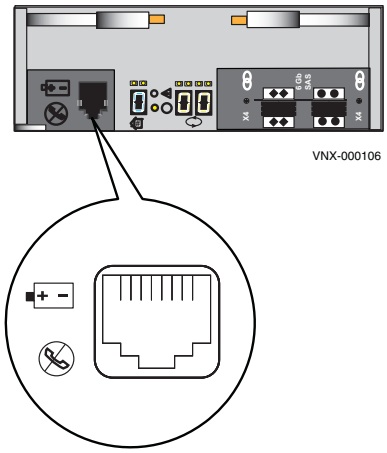


Figure 64 LCC RJ-12 port

The cable connecting the LCC to the SPS is an RJ-12 to RJ-12. It has an RJ-12 adapter (LCC side) on one end and a RJ-12 (SPS side) adapter on the other end (Figure 17 on page 31).

LCC enclosure ID (enclosure address) and bus ID

On the rear of the LCC (A and B), an LCC enclosure ID indicator is provided. This ID indicator is a seven-segment LED display for displaying decimal numbers. The LCC enclosure ID appears on both LCCs (A and B) which is the same ID number. The enclosure ID is set at installation (Figure 65).

Each LCC includes a bus (loop) identification indicator. This indicator includes two seven-segment LED displays for displaying decimal numbers. The SP initializes the bus ID when the operating system is loaded (Figure 65).

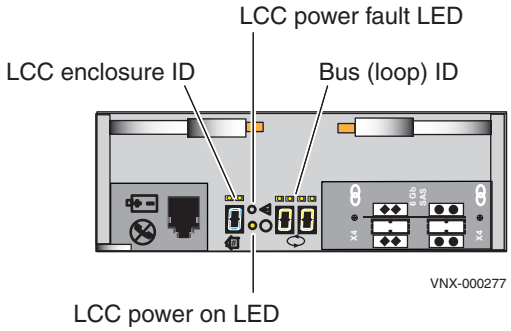


Figure 65 Example of an LCC B enclosure ID and bus ID

Table 34 describes the power and fault status LEDs.

Table 34 LCC power and fault status LEDs

Led	Color	State	Description
Power on	Green	On	Power on
	—	Off	Power off
Power fault	Amber	On	Fault detected
	—	Off	No fault or power off

AC power supply/cooling module

Figure 66 shows an example of the 2U, 25 (2.5-inch) DAE AC power supply/cooling module with a power in (recessed) connector (plug) and status LEDs.

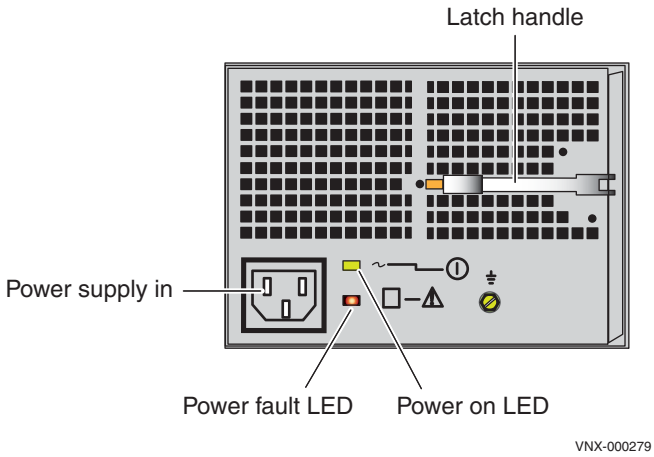


Figure 66 Example of 2U, 25 (2.5-inch) DAE AC power supply/cooling module power in (recessed) connector (plug) and status LEDs

Table 35 describes the 2U, 25 (2.5-inch) DAE power supply/cooling module LEDs.

Table 35 2U, 25 (2.5-inch) DAE AC power supply/cooling module LEDs

Led	Color	State	Description
Power fault	Amber	On	Fault
		Blinking	During power shutdown and during overvoltage (OVP) and undervoltage protection (UVP) fault
	—	Off	No fault or power off
Power on	Green	On	Power on
	—	Off	Power off

The power supply/cooling modules are located to the left and right of the LCCs. The units integrate independent power supply and 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 supply supports a fully configured DAE and shares load currents with the other supply. The drives and LCCs have individual soft-start switches that protect the disk drives and LCCs if they are installed while the disk enclosure is powered up. The enclosure cooling system includes two dual-blower modules.

3U, 15 (3.5-inch) DAE (DAE6S)

The 3U, 15 DAE (2.5- or 3.5-inch) disk drive DAE in the VNX8000 platform is 3U (5.25 inches) high and includes 15 disk drives. It uses a 6-Gb/s SAS interface for communication between the storage processor enclosure (SPE) storage processors (SPs) and the DAE.

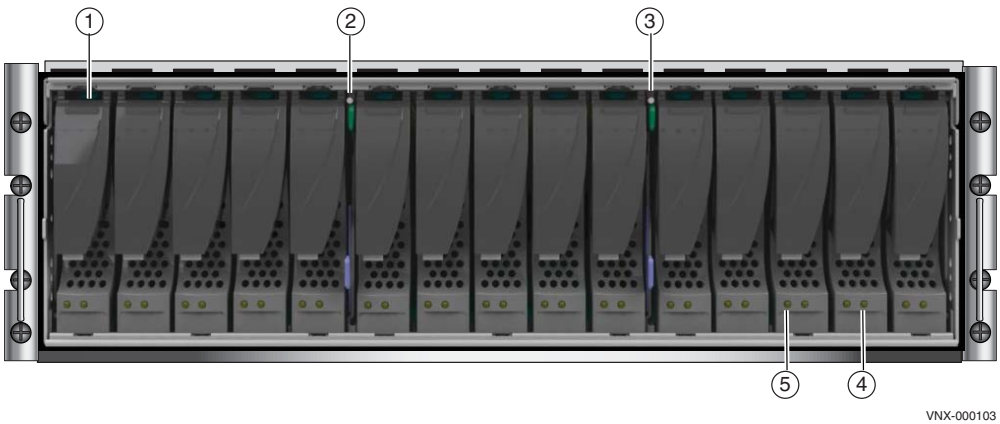
Front view

On the front, the VNX8000 platform 3U, 15 (2.5- or 3.5-inch) disk drive DAE carrier includes the following hardware components:

- 2.5-inch 6-Gb/s SAS, 6-Gb/s NL-SAS, or Flash disk drives (hot-swappable)
- 3.5-inch 6-Gb/s SAS, 6-Gb/s NL-SAS, or Flash disk drives (hot-swappable)
- Status LEDs

Figure 67 shows the location of these components.

Note: In a VNX8000 platform, when using the 3U, 15 (2.5- or 3.5-inch) disk drive carrier, the maximum amount of disk drives is 1,500.



1	2.5- or 3.5-inch 6-Gb/s SAS drives or 6-Gb/s NL-SAS disk drives	4	Disk drive fault LED (amber)
2	DAE fault LED (amber)	5	Disk drive on/activity LED (green)
3	DAE power on LED (blue)		

Figure 67 Example of a 3U, 15 (2.5- or 3.5-inch) disk drive DAE (front view)

Table 36 describes the VNX8000 platform DAE and the 3.5-inch disk drive status LEDs

Table 36 3U, 15 (3.5-inch) DAE and disk drive LEDs

LED	Color	State	Description
DAE fault (see location 2)	Amber	On	Fault has occurred
DAE power (see location 3)	Green	On	Powering and powered up with backend bus running at 2 Gb/s
	Blue	On	Powering and powered up with backend bus running at 6 Gb/s
	—	Off	Powered down
Disk drive fault (see location 4)	Amber	On	Fault has occurred
	—	Off	No fault has occurred
Disk drive on/activity (see location 5)	Green	On	Powering and powered up
		Blinking, mostly on	Disk drive is on with I/O activity
		Blinking at constant rate	Disk drive is spinning up or down normally
		Blinking, mostly off	Disk drive is powered up but not spinning **Note:** This is a normal part of the spin-up sequence, occurring during the spin-up delay of a slot.
	—	Off	Disk is powered down

Rear view

On the rear, viewing from top to bottom, a 3U, 15 (2.5- or 3.5-inch) disk drive DAE includes the following components:

- Two 6-Gb/s SAS LCCs (A and B)
- Two power supply/cooling modules

Figure 68 on page 87 shows an example of the rear view of a 3U, 15 (3.5-inch) disk drive DAE.

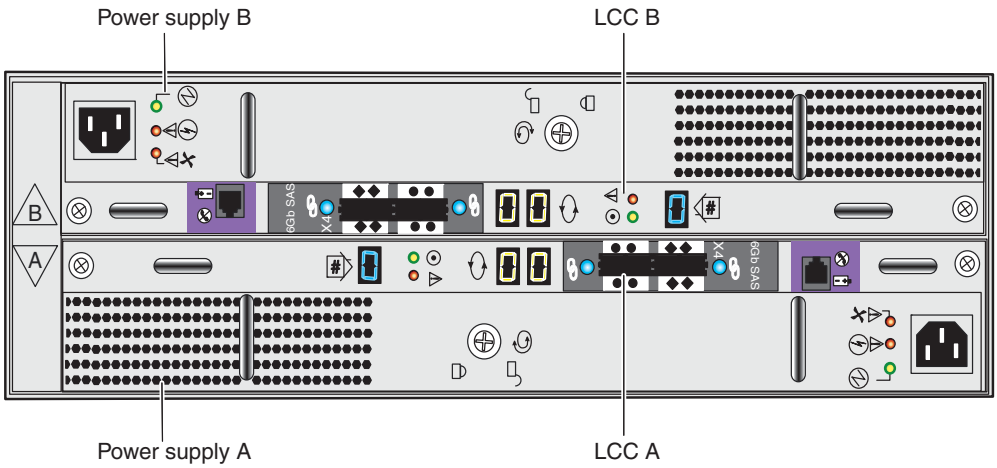
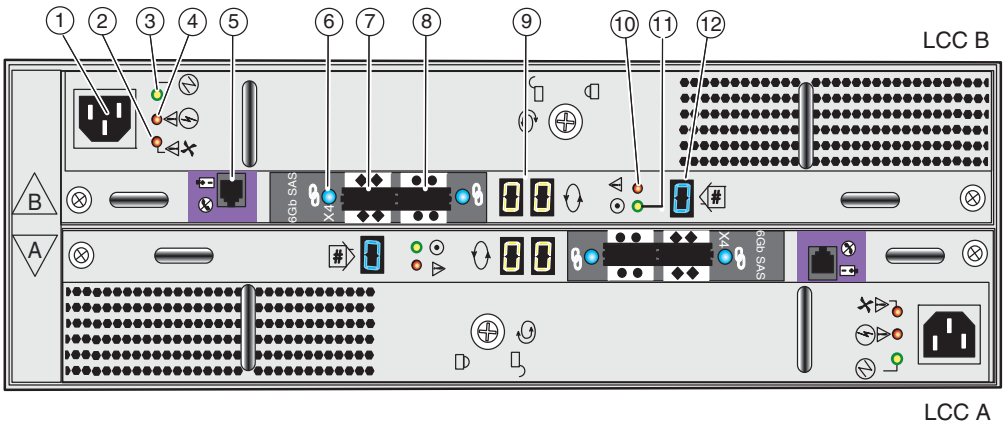


Figure 68 Example of a 3U, 15 (2.5- or 3.5-inch) disk drive DAE with two LCCs and two power supply/cooling modules (rear view)

3U, 15 (2.5- or 3.5-inch) DAE LEDs and connectors

Figure 69 on page 88 shows the location of the 3U, 15 (2.5- or 3.5-inch) DAE LEDs, connectors, and the latch handles:

- AC power supply (A and B) recessed power in (plug)
- AC power supply (A and B) LEDs (power and fault)
- AC power supply (A and B) latch handle
- LCC (A and B) mini-SAS connectors (input and output)
- LCC (A and B) mini-SAS link LEDs
- LCC (A and B) bus ID
- LCC (A and B) LEDs (power and fault)
- DAE enclosure ID
- LCC (A and B) management (RJ-12) connector (not used in VNX7600)
- LCC (A and B) latch handle



1	LCC B AC power supply power in (recessed plug)	**7**	LCC B SAS connector (output); labeled with a double diamond symbol ◆◆.
2	LCC B power supply fan fault LED (on, amber)	**8**	LCC B SAS connector (input); labeled with a double circle (or dot) symbol ●●.
3	LLC B power supply LED (on, green)	**9**	LCC B bus ID
4	LCC B power supply fault LED (on, amber)	**10**	LCC B bus LED (fault, amber)
5	LCC B management (RJ-12) connector to SPS	**11**	LCC B bus LED (on, green)
6	LCC B SAS connector link LED	**12**	DAE enclosure ID[1]

1. The DAE enclosure ID is sometimes referred to as the enclosure address (EA).

Figure 69 Example of a 3U, 15 (3.5-inch) disk drive DAE with two LCCs and two power supply/cooling modules (rear view)

LCC

The LCC supports and controls one 6-Gb/s mini-SAS bus and monitors the DAE. A blue link/activity LED indicates a DAE operating at 6 Gb/s.

The LCCs in a DAE connects to the SPE and other DAEs with 6-Gb/s cables. The cables connect the LCCs in a system in a daisy-chain (loop) topology.

Internally, each DAE LCC uses protocols to emulate a loop; it connects to the drives in its enclosure in a point-to-point fashion through a switch. The LCC independently receives and electrically terminates incoming signals. For traffic from the system's storage processors, 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.

Note: If the target drive is not in the LCC's enclosure, the switch passes the input signal directly to the output 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 disk enclosure status. LCC firmware also controls the SAS PHYs and the disk-module status LEDs.

As shown in Figure 69 on page 88, an enclosure ID[14] indicator is located on each LCC. Each LCC also includes a bus (back-end port) identification indicator. The SP initializes the bus ID when the operating system is loaded.

Note: An LCC might be in either the A slot, as shown, or the B slot above it, depending on the DAE placement within a system. For example, the front DAE in some systems is in slot A; the rear enclosure LCC is inverted, and in slot B.

LCC input/output ports and connectors

The 3U, 15 (3.5-inch) DAE LCC supports the following I/O ports on the rear:

- Two 6-Gb/s by four-lane SAS ports
- One management (RJ-45) connector to the SPS

6-Gb/s mini-SAS x4 ports

The 3U DAE LCC supports two (one input and one output) 6-Gb/s mini-SAS x4 ports (labeled **6Gb SAS x4**) on the rear of each LCC (A and B). This port provides an interface for SAS and NL-SAS drives on the DAE. This port is a 26-circuit SAS small form-factor 8088 (SFF-8088) specification (socket or receptacle) using an SFF-8088 specification mini-SAS 26-circuit cable (plug) with a pull tab.

Note: Each SAS cable is keyed with an *in* and *out* connection to prevent incorrect cabling.

A video describing how to properly connect mini-SAS HD cables and mini-SAS cables to a DPE and a DAE, respectively, in a VNX product is available online at: https://edutube.emc.com/, in the Search box, type in **Mini-SAS HD Cable Connectivity**. The video will start immediately.

Note: The first half of the video shows an example of how to connect a mini-SAS HD cable to a mini-SAS HD port while the second half shows how to connect a mini-SAS cable to a DAE LCC port.

Figure 70 on page 90 shows an example of the port connector (socket) and cable connector (plug) with pull tab.

14. The enclosure ID is sometimes referred to as the enclosure address (EA).

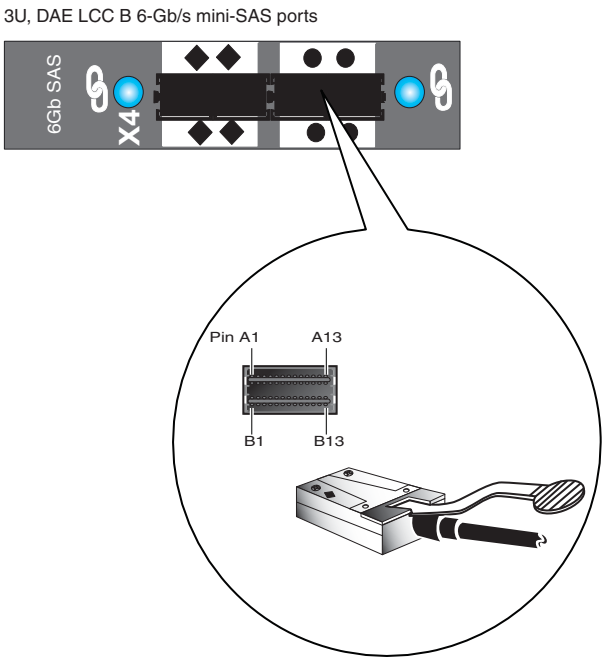


Figure 70 6-Gb/s mini-SAS port and cable connector

Table 37 lists the 3U DAE LCC 6-Gb/s mini-SAS port pin signals used on the connector.

Table 37 6-Gb/s mini-SAS port connector pinout

Pin	Signal	Pin	Signal
A1	GND	B1	GND
A2	Rx 0+	B2	Tx 0+
A3	Rx 0-	B3	Tx 0-
A4	GND	B4	GND
A5	Rx 1+	B5	Tx 1+
A6	Rx 1-	B6	Tx 1-
A7	GND	B7	GND
A8	Rx 2+	B8	Tx 2+
A9	Rx 2-	B9	Tx 2-
A10	GND	B10	GND
A11	Rx 3+	B11	Tx 3+
A12	Rx 3-	B12	Tx 3-
A13	GND	B13	GND

6-Gb/s mini-SAS port LEDs and port direction (input or output)

Figure 71 shows the LCC 6-Gb/s SAS port LED—a bi-color (blue/green) LED next to the connector, either left or right—that indicates the link/activity of the SAS port. Figure 71 also shows a double circle (or dot) symbol ●● (for input) or a double diamond symbol ◆◆ (for output).

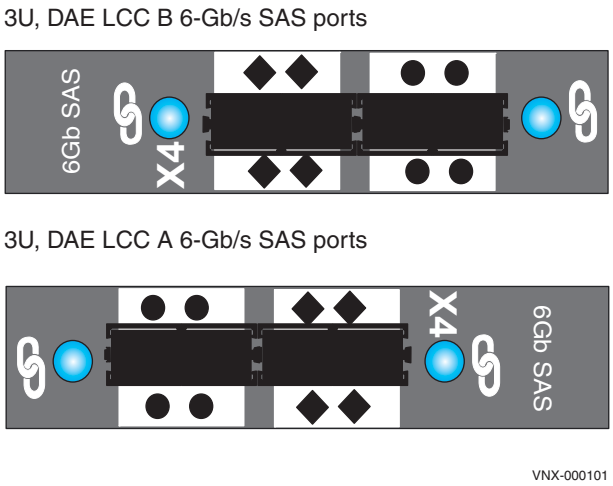


Figure 71 6-Gb/s mini-SAS port LED

Table 38 describes the 3U DAE LCC 6-Gb/s mini-SAS port LEDs.

Table 38 6-Gb/s mini-SAS port LEDs

LED	Color	State	Description
Link/activity	Blue	On	All lanes are running at 6 GB/s
	Green	On	One or more lanes is not running at full speed or disconnected
	Alternating Blue/Green	Blinking	Port is being marked by the host
	—	Off	Not connected

Management (RJ-12) connector

Figure 72 on page 92 shows the management port connector (labeled with two symbols; one depicting a telephone handset with a line through it and the other depicting a battery). The telephone handset with a line through it symbol means that you cannot connect telephone type circuits to this connector (see the **WARNING** on page 92). This port connects the LCC (A and B) ports to the SPS (A and B) ports, respectively.

⚠WARNING

The SPS (RJ-12) port is a LAN port not a WAN port. LAN ports contain safety extra-low voltage (SELV) circuits, and WAN ports contain telephone-network voltage (TNV) circuits. An RJ-45 (or TNV-type) looks the same as the RJ-12 except for two very important differences. An RJ-45 is an 8-wire modular jack. The RJ-12 is a six-wire modular jack. The RJ-45 plugs and jacks are wider than their RJ-12 counterparts - 7/16" vs 3/8". An RJ-45 plug won't fit into an R-J12 jack. But an RJ-12 plug will fit into an RJ-45 jack. Use caution when connecting cables. To avoid electric shock, do not attempt to connect TNV circuits to SELV circuits.

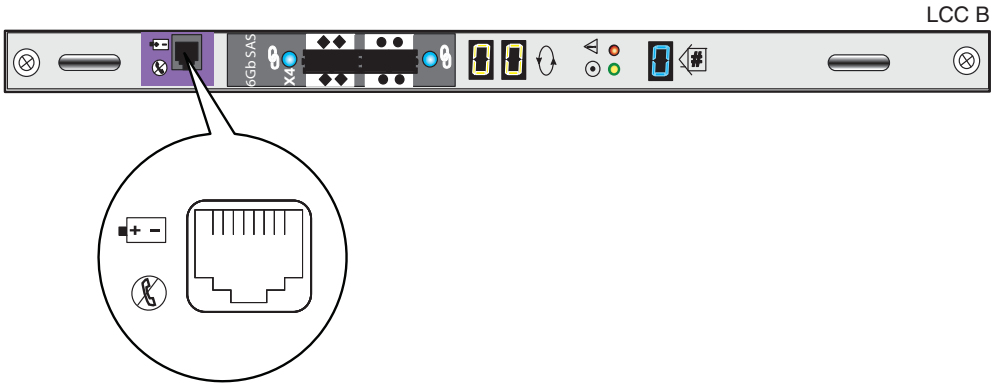


Figure 72 LCC RJ-12 port

The cable connecting the LCC to the SPS is an RJ-12 to RJ-12. It has an RJ-12 adapter (LCC side) on one end and a RJ-12 (SPS side) adapter on the other end (Figure 17 on page 31).

LCC enclosure ID (enclosure address) and bus ID

On the rear of the LCC (A and B), an LCC enclosure ID indicator is provided. This ID indicator is a seven-segment LED display for displaying decimal numbers. The LCC enclosure ID appears on both LCCs (A and B) which is the same ID number. The enclosure ID is set at installation (Figure 73).

Each LCC includes a bus (loop) identification indicator. This indicator includes two seven-segment LED displays for displaying decimal numbers. The SP initializes the bus ID when the operating system is loaded (Figure 73).

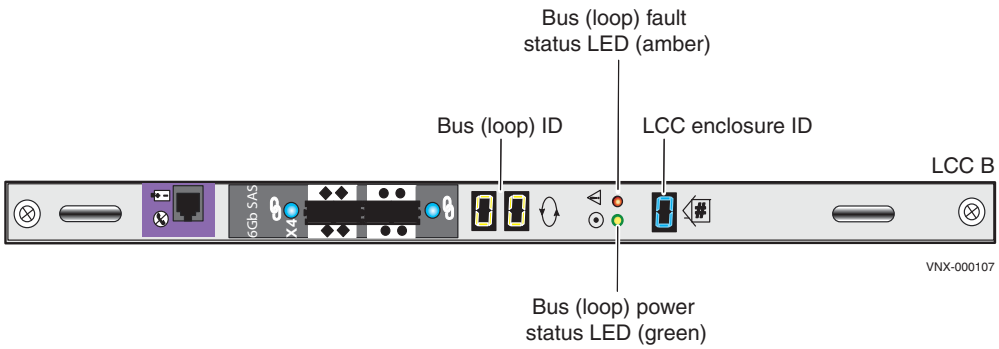


Figure 73 Example of an LCC B enclosure ID, fault and power status LEDs, and bus ID

Table 39 describes the bus (loop) indicator status LEDs.

Table 39 LCC bus (loop) status LEDs

Led	Color	State	Description
Power fault	Amber	On	Fault
	—	Off	No fault or power off
Power on	Green	On	Power on
	—	Off	Power off

AC power supply/cooling module

Figure 74 shows an example of the 3U, 15 (3.5-inch) disk drive DAE AC power supply/cooling module with a power in (recessed) connector (plug) and status LEDs.

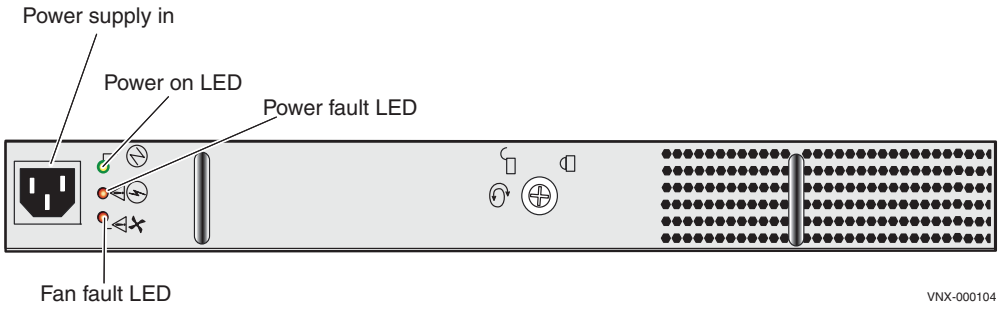


Figure 74 Example of a 3U, 15 (3.5-inch) DAE AC power supply/cooling module power in (recessed) connector (plug) and status LEDs

Table 40 describes the 3U, 15 (3.5-inch) DAE power supply/cooling module LEDs.

Table 40 3U, 15 (3.5-inch) disk drive DAE AC power supply/cooling module LEDs

Led	Color	State	Description
Power on	Green	On	Power on
	—	Off	Power off
Power fault	Amber	On	Fault
		Blinking	During power shutdown and during overvoltage and undervoltage protection (OVP/UVP) fault
	—	Off	No fault or power off
Fan fault	Amber	On	Fault, one or both not operating normally
	—	Off	No fault, fans operating normally

The power supply/cooling modules are located above and below the LCCs. The units integrate independent power supply and 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 supply supports a fully configured DAE and shares load currents with the other supply. The drives and LCCs have individual soft-start switches that protect the disk drives and LCCs if they are installed while the disk enclosure is powered up.

The enclosure cooling system includes two dual-blower modules.

3U, 120 (2.5-inch) DAE (DAE8S)

IMPORTANT

In a VNX7600 platform, the 3U, 120 (2.5-inch) DAE is only supported in a Dense rack configuration. This Dense rack is 40U or 5.1 feet (1.55 meters) high and 44 inches (17.32 cm) deep. Each 3U, 120 DAE that goes into the Dense rack weighs 50 lb (22.6 kg) empty and 165 lb (74.8 kg) fully loaded. As a result; whenever the 3U, 120 DAE configuration is ordered, it is assembled and configured at the factory before shipping.

⚠WARNING

Access to the internal components in a 3U, 120 (DAE8S) enclosure mounted 31U (4.5 ft, or 1.38 m) or higher above the floor requires an appropriate EMC service ladder and is restricted to authorized service personnel only. Attempts to service disks, fans, or other DAE components mounted 31U or higher without a recommended EMC service ladder and personnel may result in serious personal injury. If an EMC service ladder is on site, this ladder is the property of EMC and is only available for use by authorized EMC service personnel.

If installing a new 3U, 120 DAE or replacing an existing 3U, 120 DAE above 31U is necessary, then an appropriate portable mechanical lifting device is required. For more information about this type of device, see “Appendix B: Field lift tool and accessory kit” on page 168.

The 3U, 120 (2.5-inch) DAE in the VNX7600 platform is 3U (5.25 in.) high. Figure 75 on page 95 shows an example of the front and rear views of a 3U, 120 (2.5-inch) DAE.

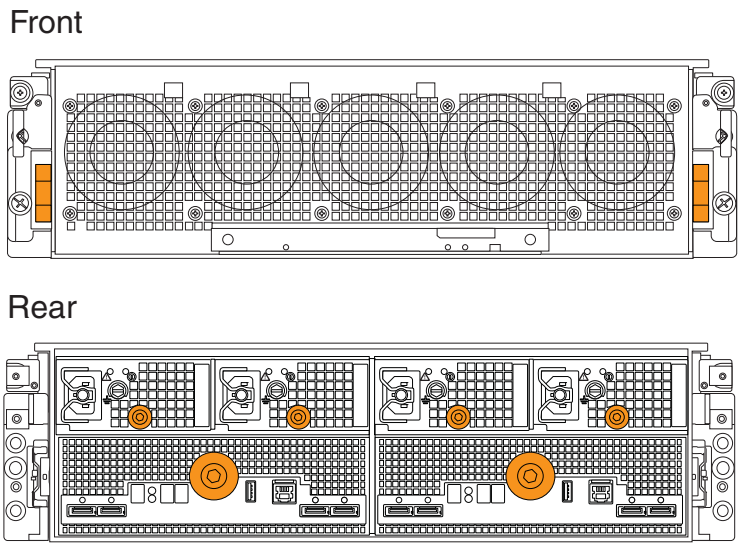


Figure 75 Example of a 3U, 120 (2.5-inch) DAE (front and rear views)

Front view

Supporting 6-Gb/s data transfer speeds, the 3U, 120 (2.5-inch) DAE has the following components:

- Ten fans (two separate rows of five fans each, front and mid-section), inside
- Up to 120 disks (six rows of twenty each), inside
- One system status card (SSC), front
- Two Link Control Cards (LCCs), rear
- Four power supplies supporting two types of power supply modules—a single DC output and a dual DC output version, rear

Note: To see an example of the interior view of a 3U, 120 (2.5-inch) DAE, go to Figure 86 on page 104. In this illustration all of the main components except the power supplies and the LCCs are shown.

Figure 76 on page 96 shows the front view of a 3U, 120 (2.5-inch) DAE. The front shows five fan modules or cooling modules[15] and a system status card (SSC) with three status LEDs (an enclosure fault led, an enclosure power led, and an SSC fault led).

15. The 3U, 120 (2.5-inch) DAE has a total of ten fan modules or cooling module (five in the front and five in the mid-section of the DAE).

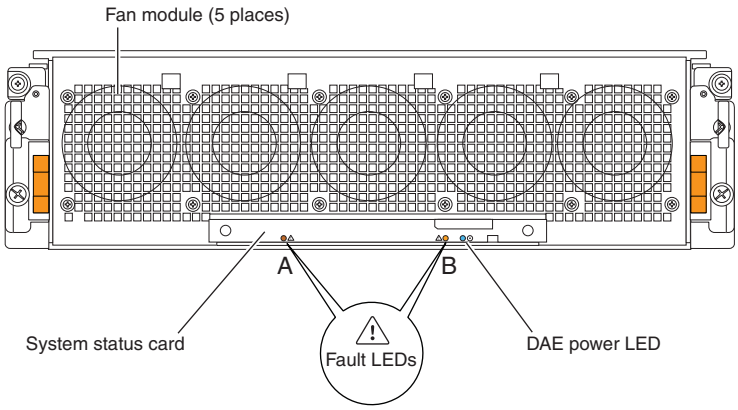


Figure 76 Example a 3U, 120 (2.5-inch) DAE (front view) showing the SSC fault (see location A) and DAE fault (see location B) LEDs (amber) and the DAE power LED (blue)

Fan module (cooling module)

Five of the ten fan modules (cooling modules) of the 3U, 120 (2.5-inch) DAE are located (Figure 76) on the front. Cooling is provided by these front fan modules and the five fan modules located in the mid-section of the DAE (Figure 88 on page 107). All of the fan modules are installed or removed with the DAE pulled out of the cabinet (for information about how to install or remove the fan module, go to "Access to disk drives and fan modules (cooling modules)" on page 106). For a closer look of a fan module, go to "Fan module (cooling module)" on page 109.

System status card

The system status card (SSC) is a removable circuit board located on the bottom, front of the 3U, 120 DAE and provides the following functionality (Figure 76 on page 96):

- Three status LEDs (Table 41 on page 97)
  - SSC fault LED
  - Enclosure fault LED
  - Enclosure power LED
- Fan voltage of 12 VDC is provided to two fans; fan 0 located in the front of the DAE and fan 7 located in the mid-section of the DAE; this maintains proper cooling,
- An inlet temperature sensor that determines the ambient temperature outside the enclosure
- SSC resume EEPROM for tracking manufacturing information

Table 41 describes the 3U, 120 DAE status LEDs.

Table 41 3U, 120 DAE status LEDs

LED	Color	State	Description
SSC fault (see location A in Figure 76 on page 96)	Amber	On	Fault detected
	—	Off	No fault detected
DAE fault (see location B in Figure 76 on page 96)	Amber	On	Fault detected
	—	Off	No fault detected
DAE power	Blue	On	Powered on, normal
		Off	Not powered on or fault

Rear view

Figure 77 shows the 3U, 120 (2.5-inch) DAE includes two LCCs (A and B) and four power supply modules.

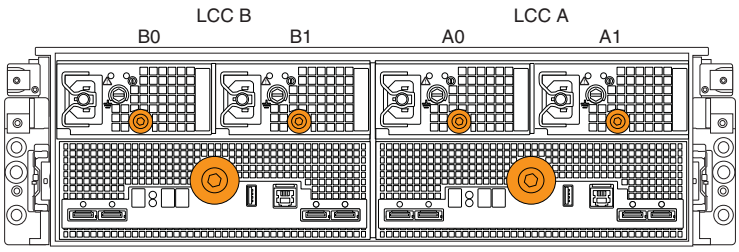


Figure 77 Example of a 3U, 120 (2.5-inch) DAE with two LCCs (A and B) and four power supply modules (locations A0, A1, B0, and B1)

The 3U, 120 (2.5-inch) DAE supports one type of power supply module: a dual DC output power supply. Figure 77 shows the dual DC output power supplies having an orange knob to install and remove the power supplies to and from the enclosure.

Power supply module

As shown in Figure 77, the power supply module is described in the following paragraphs. For more information about the technical specifications of the single and the dual output power supplies, go to https://mydocs.emc.com/VNX/, select **View technical specifications**. Next, follow the steps in the wizard for your desired technical specification. For information about replacing a power supply module, go to *Replacing a power supply module in a 120-disk enclosure* procedure available online at https://mydocs.emc.com/VNX/ and go to **VNX Tasks**, then select **Replace VNX hardware**. Next, follow the steps in the wizard.

Dual DC output, knob-type power supply

The dual DC output, knob-type power supply (Figure 78) includes two status LEDs: a fault LED and a power LED. The dual output version is rated at 1080 W with two 12-V DC outputs (540 W at each) and one AC input per power supply. Table 42 describes the LEDs.

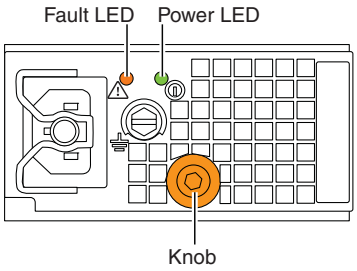


Figure 78 Example of a 3U, 120 (2.5-inch) DAE DC dual output, knob-type power supply module (rear view)

Table 42 3U, 120 DAE dual DC output, knob-type power supply (fault and power on) LEDs

LED	Color	State	Description
Fault	Amber	On	Fault, under LCC control. Fans or outputs are outside the specified operating range while the unit is in low power mode.
		Blinking	External fault, under LCC control. 12 VDC off due to all LCCs not being present.
	—	Off	No fault or power off
Power	Green	On	AC Power on
	—	Off	AC Power off, verify source power

LCC

Figure 79 shows an example of the rear view of a 3U, 120 (2.5-inch) DAE showing LCC A and B with single output power supplies.

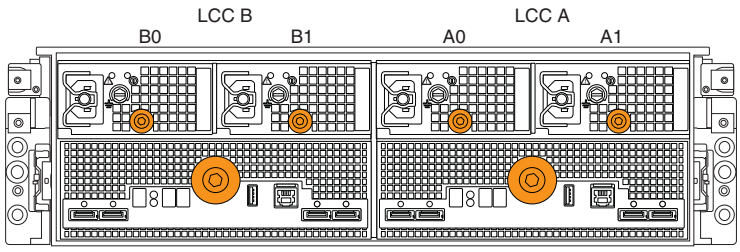


Figure 79 Example of a 3U, 120 (2.5-inch) DAE showing LCC A and B (rear view)

Each LCC (Figure 80 on page 99) provides 4x mini-SAS small form-factor 8088 (SFF-8088) specification connectors (Figure 81 on page 100). These ports are connected to a SAS expander with 36 PHYs. The expander allows for traffic to pass through the enclosure upstream and downstream. It also provides access to the disk drive SAS sub-system. This disk drive sub-system is made up of four 36 PHY edge expanders in parallel. Each

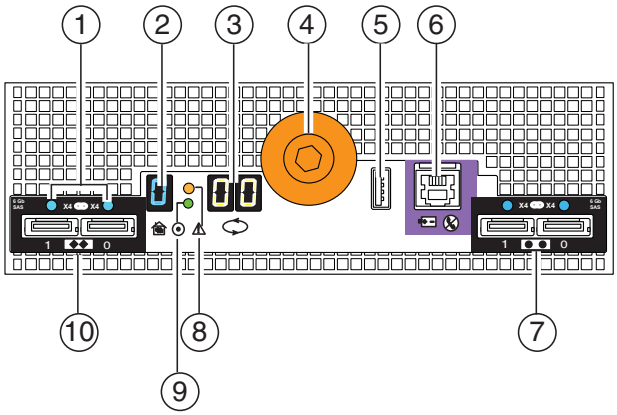
expander provides SAS connectivity to 30 disk drives. These edge expanders connect to the fanout expander (IO expander) through a five lane SAS wide port. For information about replacing an LCC, go to the *Replacing an LCC in a 120-disk enclosure* procedure.

LCC status LEDs

The following table describes the LCC status LEDS.

Table 43 LCC status LEDs

LED	Color	State	Description
Power (bottom)	Green	On	Power on
	—	Off	Power off
Power fault (top)	Amber	On	Fault
	—	Off	No fault or power off



1	LCC mini-SAS connector LEDs (blue/green); for a closer view, see Figure 81 on page 100.	**6**	LCC management (RJ-12) connector (not used in the VNX7600 platform); for a closer view, see Figure 83 on page 102.
2	LCC enclosure ID	**7**	LCC mini-SAS connector (input or primary); labeled with a double circle (dot) symbol ●●. The right port is labeled **0** and the left port is labeled **1.**
3	LCC enclosure bus ID	**8**	LCC power fault LED (amber); Table 43
4	LCC lock knob (orange)	**9**	LCC power on LED (green); Table 43
5	LCC USB connector (for a closer view, see Figure 84 on page 102)	**10**	LCC mini-SAS connector (output or expansion); labeled with a double diamond symbol ◆◆. The right port is labeled **0** and the left port is labeled **1.**

Figure 80 Example of a 3U, 120 (2.5-inch) DAE LCC A (rear view)

LCC input/output ports, connectors, and LEDs

The 3U, 120 (2.5-inch) DAE LCC supports the following I/O ports on the rear:

- Four 6-Gb/s PCI Gen 2 mini-SAS ports
- One management (RJ-12) connector (not used in the VNX7600 platform)
- One USB connector

6-Gb/s mini-SAS x4 ports — The LCC supports four (two input with a double circle ●● and two output with a double diamond ◆◆) 6-Gb/s mini-SAS x4 ports (labeled **6 Gb SAS x4 1** or **0**) on the rear of each LCC (A and B) as shown in Figure 81. This port provides an interface for SAS and NL-SAS drives in the DAE. The port is a 26-circuit SAS small form-factor 8088 (SFF-8088) specification (socket or receptacle) using an SFF-8088 specification mini-SAS 26-circuit cable (plug) with a pull tab.

Mini-SAS connector LED — A blue/green link/activity LED next to the mini-SAS port indicates the DAE connection status. Blue indicates that the port is established at a maximum bus speed of 6-Gb/s. Green indicates that a wide port width other than 4x is established or one or more lanes is not operating at the maximum bus speed.

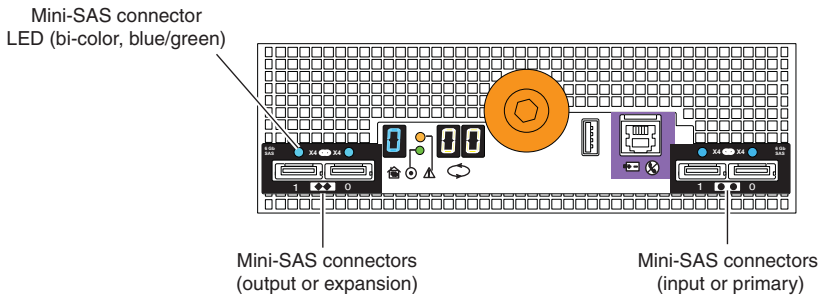


Figure 81 6-Gb/s mini-SAS input and output connectors and LEDS

Note: As described in the previous paragraphs, the first connection from the DAE comes from the four, 6-Gb/s mini-SAS ports. This connection uses a a 26-pin mini-SAS small form-factor 8088 (SFF-8088) specification connector (plug) with a pull (release) tab on one end of the cable, while the SPE side (SAS I/O module) uses a 36-pin mini-SAS HD small form-factor 8644 (SFF-8644) specification connector (plug) with a pull (release) tab (see Figure 49 on page 62) on the other end of the cable.

A video describing how to properly connect mini-SAS HD cables and mini-SAS cables from a DPE to a DAE, respectively in a VNX product is available online at: https://edutube.emc.com/, in the Search box, type in **Mini-SAS HD Cable Connectivity**. The video will start immediately.

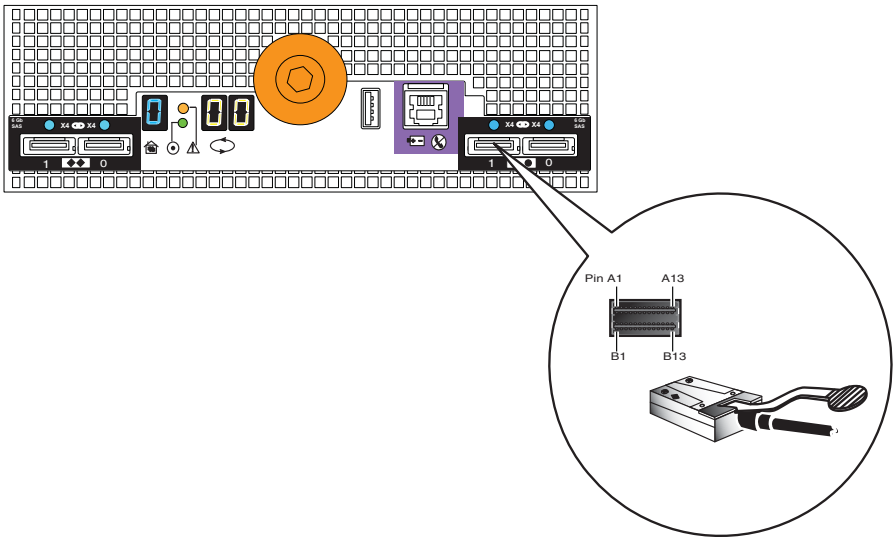


Figure 82 6-Gb/s mini-SAS connector and cable end

The following table describes the mini-SAS connector pinout.

Table 44 6-Gb/s mini-SAS connector pinout

Pin	Signal	Pin	Signal
A1	GND	B1	GND
A2	Rx 0+	B2	Tx 0+
A3	Rx 0-	B3	Tx 0-
A4	GND	B4	GND
A5	Rx 1+	B5	Tx 1+
A6	Rx 1-	B6	Tx 1-
A7	GND	B7	GND
A8	Rx 2+	B8	Tx 2+
A9	Rx 2-	B9	Tx 2-
A10	GND	B10	GND
A11	Rx 3+	B11	Tx 3+
A12	Rx 3-	B12	Tx 3-
A13	GND	B13	GND

Management (RJ-12) port connector (not used in the VNX7600 platform) — Figure 80 on page 99 (see location 6) and Figure 83 on page 102 shows the management port (labeled with two symbols; one depicting a telephone handset with a line through it and the other depicting a battery). The telephone handset with a line through it symbol means that you cannot connect telephone type circuits to this connector (see the **WARNING** on page 102).

⚠WARNING

The (RJ-12) port is a LAN port not a WAN port. LAN ports contain safety extra-low voltage (SELV) circuits, and WAN ports contain telephone-network voltage (TNV) circuits. An RJ-45 (or TNV-type) looks the same as the RJ-12 except for two very important differences. An RJ-45 is an 8-wire modular jack. The RJ-12 is a six-wire modular jack. The RJ-45 plugs and jacks are wider than their RJ-12 counterparts - 7/16" vs 3/8". An RJ-45 plug won't fit into an R-J12 jack. But an RJ-12 plug will fit into an RJ-45 jack. Use caution when connecting cables. To avoid electric shock, do not attempt to connect TNV circuits to SELV circuits.

The battery symbol means that you can connect a standby power supply (SPS) to this connector (Figure 83).

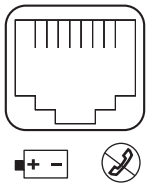


Figure 83 3U, 120 (2.5-inch) DAE management (RJ-12) port (not used in the VNX7600 platform)

USB

The USB port connects a USB cable to the blue light on the front bezel (Figure 84).

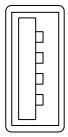


Figure 84 3U, 120 DAE USB port

3U, 120 (2.5-inch) DAE LCC enclosure ID (enclosure address) and bus ID — On the rear of the LCC (A and B), an LCC enclosure ID indicator is provided. This ID indicator is a seven-segment LED display for displaying decimal numbers. The LCC enclosure ID appears on both LCCs (A and B) with the same ID number. The enclosure ID is set at installation (Figure 85 on page 103).

Each LCC includes a bus (loop) identification indicator. This indicator includes two seven-segment LED displays for displaying decimal numbers. The SP initializes the bus ID when the operating system is loaded (Figure 85 on page 103).

Note: Figure 85 on page 103 shows both the bus ID indicator and enclosure ID indicator when viewed from the horizontal side of the ICM. Normally, you would have to turn your head to view these indicators.

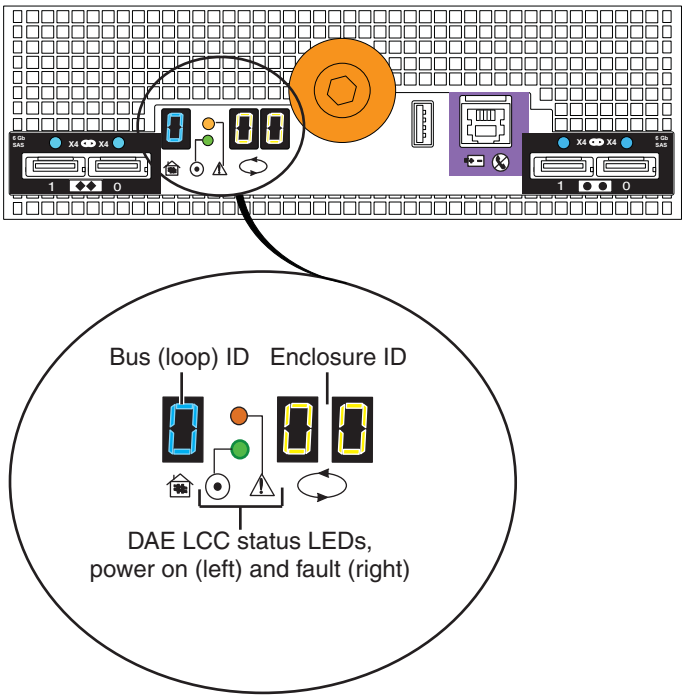


Figure 85 Example of an LCC enclosure ID indicator, bus ID indicator, and the LCC power and fault LEDs

Table 45 describes the LCC status LEDs.

Table 45 LCC status LEDs

LED	Color	State	Description
Power on	Green	On	Power on
	—	Off	Power off
Power fault	Amber	On	Fault
	—	Off	No fault or power off

Interior view

The interior of the 3U, 120 (2.5-inch) DAE shows the fan modules (front and mid-section), the disks the power supply modules, and the LCCs (Figure 86).

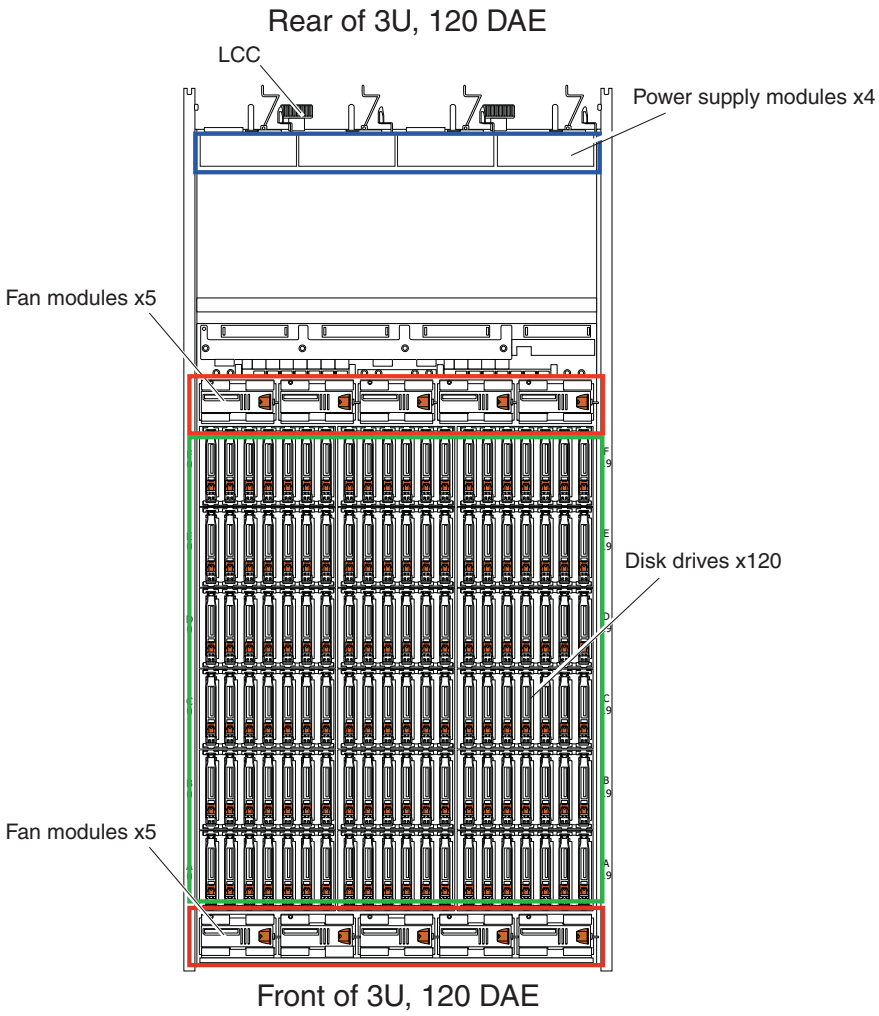


Figure 86 3U, 120 (2.5-inch) DAE (interior view)

The fan modules and disks are accessible only by sliding the DAE out from the rack (for more information, see "Access to disk drives and fan modules (cooling modules)" on page 106). The power supply modules and LCCs are accessed from the rear of the DAE (for mor information, see "Rear view" on page 97).

⚠WARNING

Access to the internal components in a 3U, 120 (DAE8S) enclosure mounted 31U (4.5 ft, or 1.38 m) or higher above the floor requires an appropriate EMC service ladder and is restricted to authorized service personnel only. Attempts to service disks, fans, or other DAE components mounted 31U or higher without a recommended EMC service ladder and personnel may result in serious personal injury. If an EMC service ladder is on site, this ladder is the property of EMC and is only available for use by authorized EMC service personnel.

If installing a new 3U, 120 DAE or replacing an existing 3U, 120 DAE above 31U is necessary, then an appropriate portable mechanical lifting device is required. For more information about this type of device, see "Appendix B: Field lift tool and accessory kit" on page 168.

If replacing or adding a 3U, 120 (2.5-inch) DAE becomes necessary, a portable (mechanical) lift is recommended by EMC. The portable lift commonly used by EMC service personnel is manufactured by Alum-A-Lift. Included with the lift is a lift kit which provides instructions for using the portable lift. For more information, refer to "Appendix B: Field lift tool and accessory kit" on page 168.

IMPORTANT

The portable mechanical lift commonly used by EMC service personnel has two settings—one with a lower mast and one with both a lower and upper mast (dual mast). The lower mast setting is rated for 400 lb (178.09 kg) and is for raising or lowering of objects 28U (4.08 ft or 1.2 m) or less above the floor. The dual mast setting is rated well under 200 lb (89 kg) and is for raising objects more than 28U (4.08 ft or 1.2 m) above the floor. A conversion kit from Alum-A-Lift and a support table is available from the lift provider for installations above 28U. This kit is rated for 225 lb (102 kg). For more information, refer to "Appendix B: Field lift tool and accessory kit" on page 168.

Refer to the following **CAUTION** that discusses the mounting and servicing of the 3U, 120 (2.5-inch) DAE in a 40U Dense rack.

To replace or add any of these components, refer to the respective Customer Replaceable Unit (CRU) procedure for the 3U, 120 DAE. For example, to replace a disk drive, refer to the *Replacing a disk in a 120-disk enclosure* document available online at https://mydocs.emc.com/VNX/ and go to **VNX Tasks**, then select **Replace VNX hardware**. Next, follow the steps in the wizard.

⚠CAUTION

To prevent bodily injury when mounting or servicing the 3U, 120 DAE in a Dense rack, you must take special precautions to ensure that the DAE remains stable. The following guidelines are provided to ensure your safety:

1. When lifting this DAE, always use two to three people and a portable mechanical lifting device.

2. For service personnel, when accessing this unit in a rack above 31U, always use an EMC authorized ladder.

3. When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at or close to the bottom of the rack.

4. If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the DAE in the rack.

Access to disk drives and fan modules (cooling modules)

Unlike the 2U, 25 and 3U, 15 DAEs, the 3U, 120 DAE is a drawer-type of DAE that slides in and out of the 40U Dense rack. It is not fixed to the rack. The disk drives and fans for the DAE are located inside the DAE.

To gain access to the DAE, you must first, open the console, then unlock and remove the front bezel. Next, unlock the DAE from the rails by grasping the orange enclosure latch handles (see location 1 in Figure 87) on each side of the DAE. Then, pull the orange enclosure latch handles (see location 2 in Figure 87) on each side of the DAE to slide the DAE out of the rack on its rails until it locks into place (secure service position). For complete instructions, see the *Replacing a disk in a 120-disk enclosure* procedure available online at https://mydocs.emc.com/VNX/ and go to **VNX Tasks**, then select **Replace VNX hardware**. Next, follow the steps in the wizard.

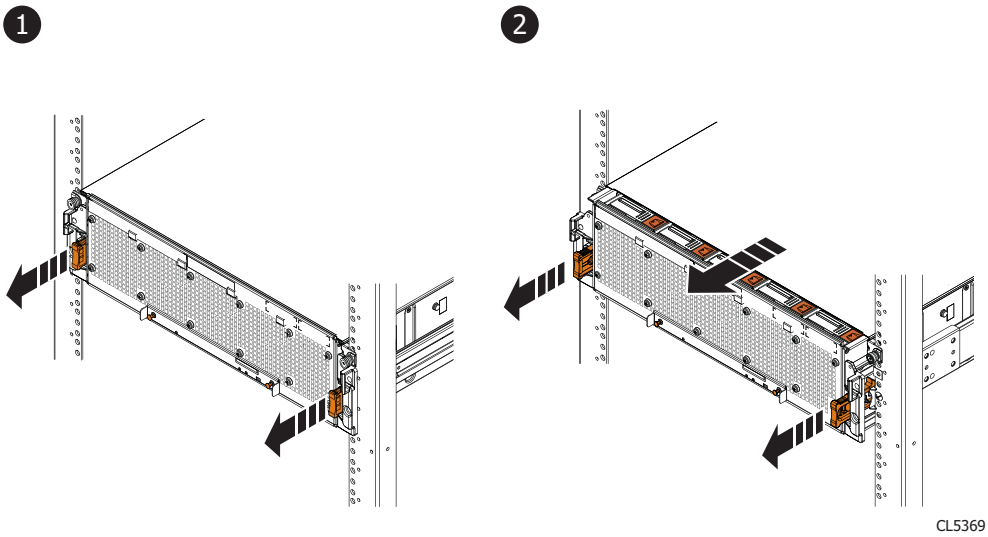


Figure 87 3U, 120 (2.5-inch) DAE (unlocking bottom enclosure latch handles)

Note: If the 3U, 120 (2.5-inch) DAE does not slide out of the rack (or cabinet) far enough for you to access the internal components and lock on the rails in the service position, verify that all the other DAEs are completely seated in the rack (or cabinet) by pushing firmly on them.

Disk drives

The disk drives (hot-swappable) for the 3U, 120 (2.5-inch) DAE are encased in cartridge-style enclosures. This enclosure is used so that varied types and sizes of disk drives can be supported. Each cartridge has an easy-to-pull and push latch. The latch allows you to quickly and efficiently snap-out a disk drive for removal and snap-in for installation.

IMPORTANT

Refer to the *Removing a disk* procedure for the correct procedure to remove a disk from the DAE. Each disk contains LUN identifying information written when it was bound. Moving it to another slot can make the information on the original LUN in accessible.

One drive size is supported in the 3U, 120 (2.5-inch) DAE, the 2.5-inch disk drive. This disk drive is available in three types:

- 6-Gb/s SAS
- Flash

⚠CAUTION

You can add or remove a disk drive while the DAE is powered up, but you should exercise special care when removing modules while they are in use. Drive modules are extremely sensitive electronic components. However, all the 120 disk drives are not spun up at the same time.

IMPORTANT

The 3U, 120 (2.5-inch) DAE has designated A0 and A1 disks as the boot drives for the DAE.

Figure 88 shows a top-down cut-away interior view of 3U, 120 DAE showing the location of the fist row of disk drives A0-A19 and the front fan modules.

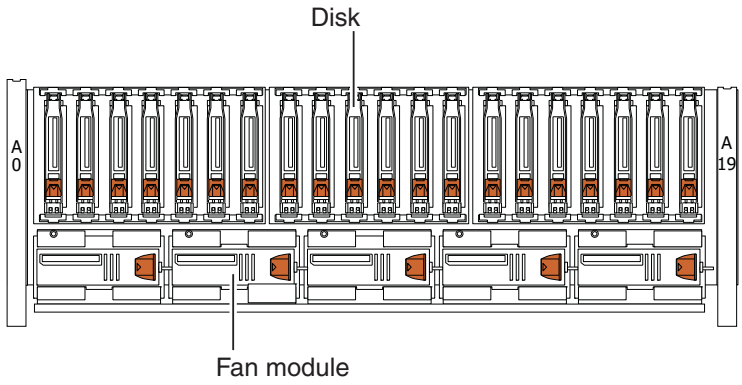


Figure 88 3U, 120 (2.5-inch) top-down cut-away view of the disk drives and the front fan modules (interior view)

Figure 89 shows an example of the disk drive power and fault LEDs.

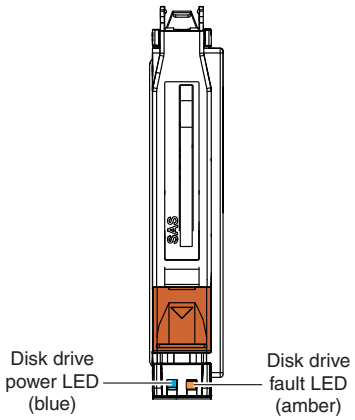


Figure 89 Disk drive power LED and fault LED

Disk drive layout

Looking at the 3U, 120 DAE from the front and above (Figure 90), the inside of each DAE has physically printed labels located on the left and right sides of the DAE enclosure.

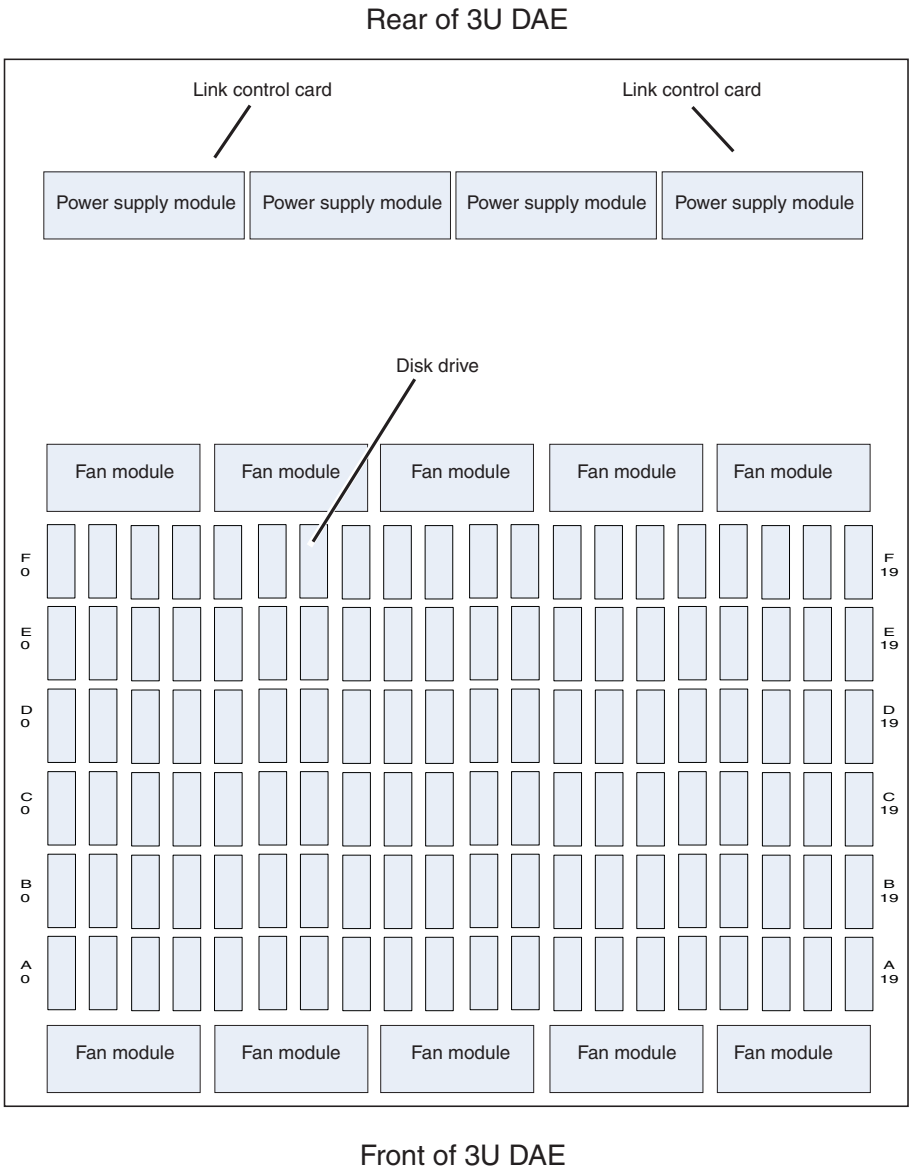


Figure 90 3U, 120 DAE disk drive layout and notation (top-down interior view)

These labels describe the rows (or banks) and the columns (or slots) of where the disks are installed in the DAE. From front to back, the DAE is labeled on the left **A0**, **B0**, **C0**, **D0**, **E0**, and **F0** while on the right, the DAE is labeled **A19**, **B19**, **C19**, **D19**, **E19**, and **F19**. The letters in front of the numbers denote the row (or bank) while the numbers denote the column (or slot).

Note: The labels for the banks and slots shown in Figure 90 are the actual labels in the 3U, 120 DAE.

Rules for disk drive population

As described in the previous paragraph, disks are arranged in six rows of twenty modules each. The first (front) row is denoted as A, then the remaining rows are B, C, D, E, and F. In each row, the disks are numbered with the first disk labeled with a letter and number together, for example **A0** or **A19**, and so on (for more information, refer to "Disk drive layout" on page 108).

The required order of loading the disk drives into a 3U, 120 DAE is as follows (Figure 90 on page 108):

1. Start at row (or bank) A, slot 0 or A0.
2. Fill up the row (or bank) A before inserting any disk drives into row B.
3. Continue this order until you fill all the rows with row F being the last row filled.

Note: If you partially fill a row, fill the remaining empty slots with filler panel modules. Rows with no or zero (0) drives do not require filler panel modules.

Fan module (cooling module)

As described previously in the section "Fan module (cooling module)" on page 96, each 3U, 120 (2.5-inch) DAE includes 10 fan modules (cooling modules). Figure 91 shows the location of the fan modules in the 3U, 120 (2.5-inch) DAE.

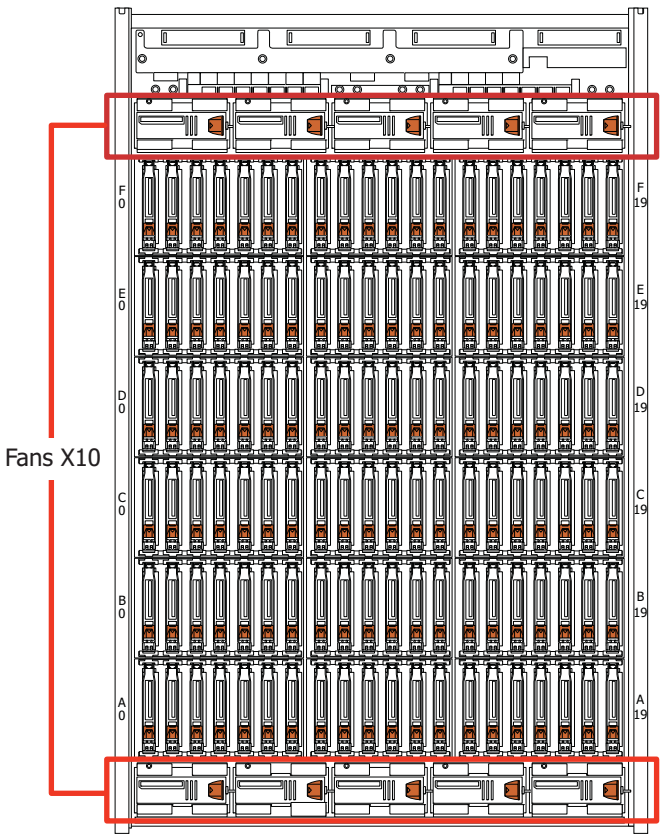


Figure 91 Example of the 3U, 120 DAE fan module location

The 10 fans within the DAE are arranged in two separate rows of 5 fans each (front and mid-section). Each row and instance is labeled with a fan icon and corresponding number; front = 0, mid-section = 5. Each fan is numbered sequentially 0-9, left to right, with 0-4 being in the front row. For information about replacing a fan module, go to *Replacing a fan module in a 120-disk enclosure* procedure available online at https://mydocs.emc.com/VNX/ and go to **VNX Tasks**, then select **Replace VNX hardware**. Next, follow the steps in the wizard.

Figure 92 shows the location of the status (fan fault) LED on the 3U, 120 (2.5-inch) DAE fan module.

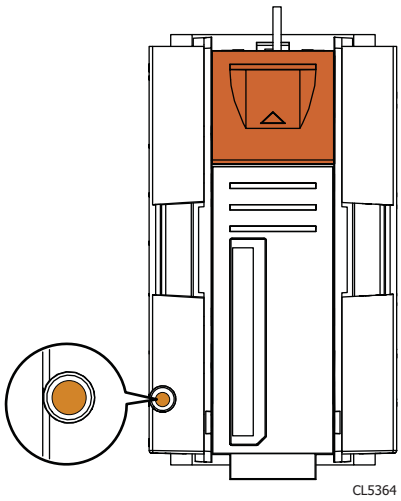


Figure 92 Example of a 3U, 120 DAE fan module showing the fan fault LED (amber)

Table 46 describes the 3U, 120 DAE fan fault LED.

Table 46 Fan module fan fault LED

LED	Color	State	Description
Fan fault	Amber	On	Fault detected, one or more fans faulted
	—	Off	No fault detected, fans operating normally

4U, 60 (2.5- or 3.5-inch) DAE (DAE7S)

IMPORTANT

in a VNX8000 platform, the 4U, 60 (2.5- or 3.5-inch) DAE is presently supported in a Dense rack configuration. This Dense rack is 40U high and 44 inches (111.76 cm) deep. Each 4U DAE that goes in the Dense rack weighs 57.8 lb (26.28 kg) empty and 213 lb (96.62 kg) fully loaded. As a result; whenever the 4U DAE configuration is ordered, it is assembled and configured at the factory before shipping.

⚠CAUTION

Access to the internal components in a 4U, 60 (DAE7S) enclosure mounted 31U (4.5 ft or 1.38 m) or higher above the floor requires an appropriate EMC service ladder and is restricted to authorized service personnel only. Attempts to service disks, fans, or other DAE components mounted 31U or higher without a recommended EMC service ladder and personnel may result in serious personal injury. If an EMC service ladder is on site, this ladder is the property of EMC and is only available for use by authorized EMC service personnel.

If installing a new 4U, 60 DAE or replacing an existing 4U, 60 DAE above 31U is necessary, then an appropriate portable mechanical lifting device is required. For more information about this type of device, see "Appendix B: Field lift tool and accessory kit" on page 168.

The 4U, 60 (2.5- or 3.5-inch) disk drive DAE in the VNX8000 platform is 4U (7 inches) high and includes 60 disk drives. Figure 93 shows an example of the front and rear views of a 4U, 60 (2.5- or 3.5-inch) DAE.

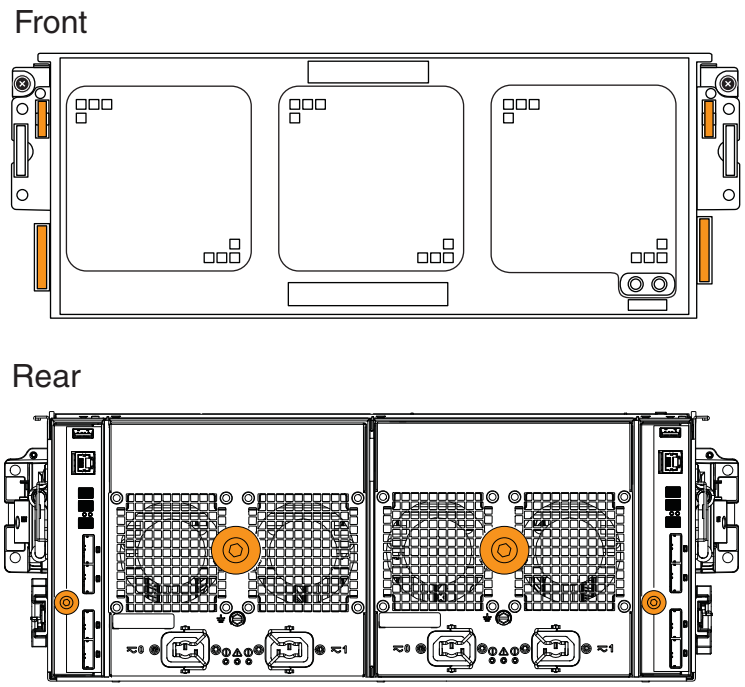


Figure 93 Example of a 4U, 60 (2.5- or 3.5-inch) DAE (front and rear views)

Front view

he 4U, 60 (2.5- or 3.5-inch) DAE has the following components:

- three fans, front
- up to 60 disks (five rows of twelve each), inside
- two link control cards (LCCs), inside
- two inter-connect modules (ICMs), rear
- two power supply modules, rear

Note: To see an example of the interior view of a 4U, 60 (2.5- or 3.5-inch) DAE, go to Figure 103 on page 121. In this illustration, all of the main components are shown.

Figure 94 shows the front view of the 4U, 60 (2.5- or 3.5-inch) DAE having three fan modules or cooling modules and two status LEDs (an enclosure fault led, an enclosure power led).

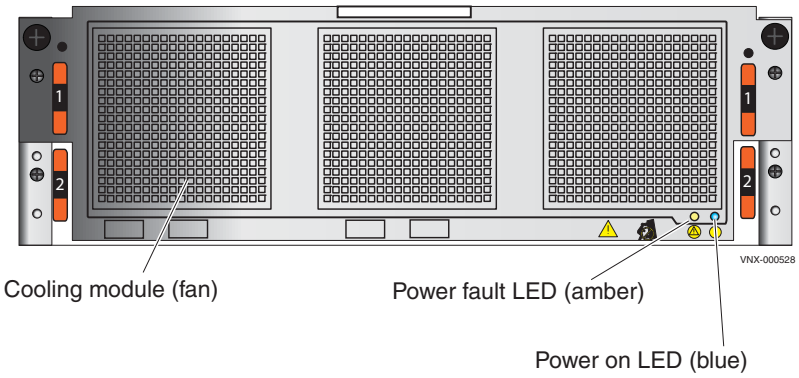


Figure 94 4U, 60 DAE (front view)

4U, 60 (2.5- or 3.5-inch) DAE front status LEDs

On the front of the 4U, 60 (2.5- or 3.5-inch) DAE are two status LEDs:

- a DAE power fault LED (amber)
- a DAE power on LED (blue)

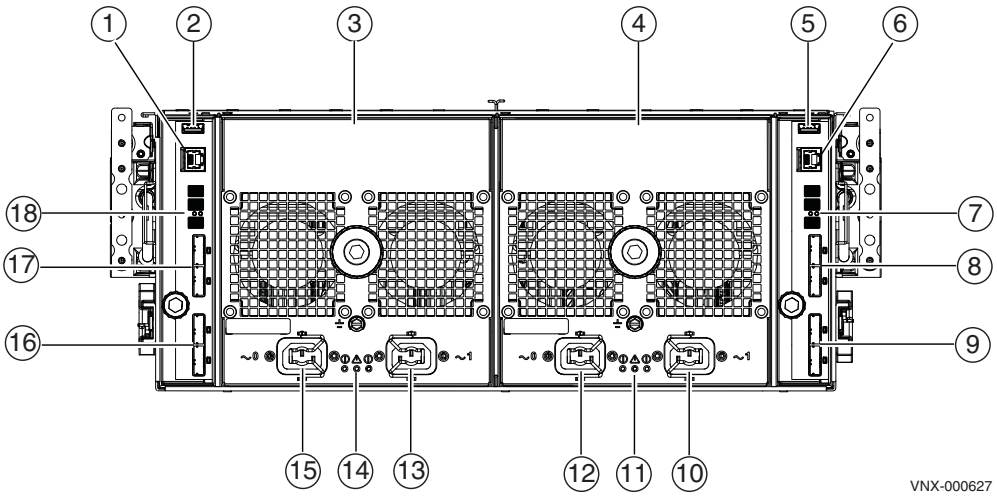
Table 47 describes the 4U, 60 DAE status LEDs.

Table 47 4U, 60 DAE status LEDs

LED	Color	State	Description
DAE power	Blue	On	Powering and powered up
	—	Off	Powered down
DAE power fault	Amber	On	Fault detected
	—	Off	No fault detected

Rear view

On the rear, viewing from left to right, a 4U, 60 (2.5- or 3.5-inch) DAE includes two 6 Gb/s SAS ICMs (A and B) and two power supply modules (A and B) as shown in Figure 95.



1	ICM B management (RJ-12) connector (not used)	**10**	4U, 60 DAE A AC power supply power in (recessed plug), labeled **1**
2	ICM B USB connector	**11**	4U, 60 DAE A power and fault LEDs
3	4U, 60 DAE B AC power supply)	**12**	4U, 60 DAE A AC power supply power in (recessed plug), labeled **0**
4	4U, 60 DAE A AC power supply power in (recessed plug)	**13**	4U, 60 DAE B AC power supply power in (recessed plug), labeled **1**
5	ICM A USB connector	**14**	4U, 60 DAE B power and fault LEDs
6	ICM A management (RJ-12) connector (not used)	**15**	4U, 60 DAE B AC power supply power in (recessed plug), labeled **0**
7	4U, 60 DAE B bus ID and enclosure ID	**16**	ICM B SAS connector (output); the top port is labeled **0** and the bottom port is labeled **1.**
8	ICM A SAS connector (input); labeled with a double circle (dot) symbol ●●. The top port is labeled **0** and the bottom port is labeled **1**.	**17**	ICM B SAS connector (input); the top port is labeled **0** and the bottom port is labeled **1.**
9	ICM A SAS connector (output); labeled with a double diamond symbol ◆◆ . The top port is labeled **0** and the bottom port is labeled **1**	**18**	4U, 60 DAE B bus ID and enclosure ID

Figure 95 Example of a 4U, 60 DAE with two ICMs and two power supply/cooing modules (rear view)

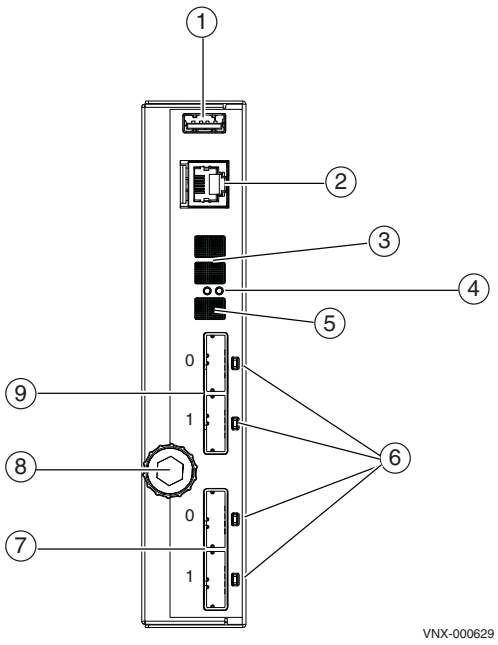
Note: Between the power supplies and the ICMs on the rear of the 4U, 60 DAE is a separator bar that indicates the location of the both power supplies and ICMs. Facing rear, on the right side of the 4U, 60 DAE, is power supply A and ICM A. On the left side of the 40U, 60 DAE is power supply B and ICM B.

ICM

The 4U, 60 DAE external interfaces are made through the ICM. The ICM is the primary interconnect management element (Figure 96).

The ICM is a plug-in module that includes a USB connector, RJ-12 management adapter, Bus ID indicator, enclosure ID indicator, two input mini-SAS connectors, and two output mini-SAS connectors with corresponding LEDs indicating the link and activity of each mini-SAS connector for input and output to devices.

The ICM is hot-swapable. It has a built-in thumbscrew for ease of installation and removal.



1	ICM USB connector	**6**	Four ICM mini-SAS input/output connector LEDs (bi-color blue/green)
2	ICM management (RJ-12) connector to SPS	**7**	Two ICM mini-SAS output connectors; labeled with a double diamond symbol ◆◆. The top port is labeled **0** and the bottom port is labeled **1**.
3	ICM bus ID indicator (yellowish green)	**8**	ICM thumbscrew
4	Two ICM bus ID LEDs (power, green; fault, amber)	**9**	Two ICM mini-SAS input connectors; labeled with a double circle (or dot) symbol ●●. The top port is labeled **0** and the bottom port is labeled **1**.
5	ICM enclosure ID indicator (blue)		

Figure 96 Example of ICM connectors and LEDs (rear view)

As described previously, the ICMs in a 4U, 60 DAE connect to the SPE and other DAEs with 6-Gb/s SAS cables. The cables connect the ICMs in a system in a daisy-chain topology.

As shown in Figure 96 on page 114, an enclosure ID[16] indicator is located on each ICM. Each ICM also includes a bus (back-end port) identification indicator. The SP initializes the bus ID when the operating system is loaded.

Table 48 describes the ICM status LEDs.

Table 48 ICM status LEDs

Led	Color	State	Description
Power on	Green	On	Power on
	—	Off	Power off
Power fault	Amber	On	Fault
	—	Off	No fault or power off

ICM input/output ports and connectors

The 4U, 60 DAE ICM supports the following I/O ports on the rear:

- Four 6-Gb/s PCI Gen 2 mini-SAS ports
- One management (RJ-12) connector to the SPS
- One USB connector

6-Gb/s mini-SAS x8 ports — The DAE ICM supports four (two input and two output) 6-Gb/s mini-SAS x8 ports on the rear of each ICM (A and B). This port provides an interface for SAS and NL-SAS drives in the DAE. The port is a 26-circuit mini-SAS small form-factor 8088 (SFF-8088) specification (socket or receptacle) using an SFF-8088 specification mini-SAS 26-circuit cable (plug) with a pull tab.

Note: Each SAS cable is keyed with an *in* and *out* connection to prevent incorrect cabling.

A video describing how to properly connect mini-SAS HD cables and mini-SAS cables to a DPE and a DAE, respectively, in a VNX product is available online at: https://edutube.emc.com/, in the Search box, type in **Mini-SAS HD Cable Connectivity**. The video will start immediately.

Note: The first half of the video shows an example of how to connect a mini-SAS HD cable to a mini-SAS HD port while the second half shows how to connect a mini-SAS cable to a DAE LCC port.

16. The enclosure ID is sometimes referred to as the enclosure address (EA).

Figure 97 shows an example of the port connector (socket) and cable connector (plug) with pull tab.

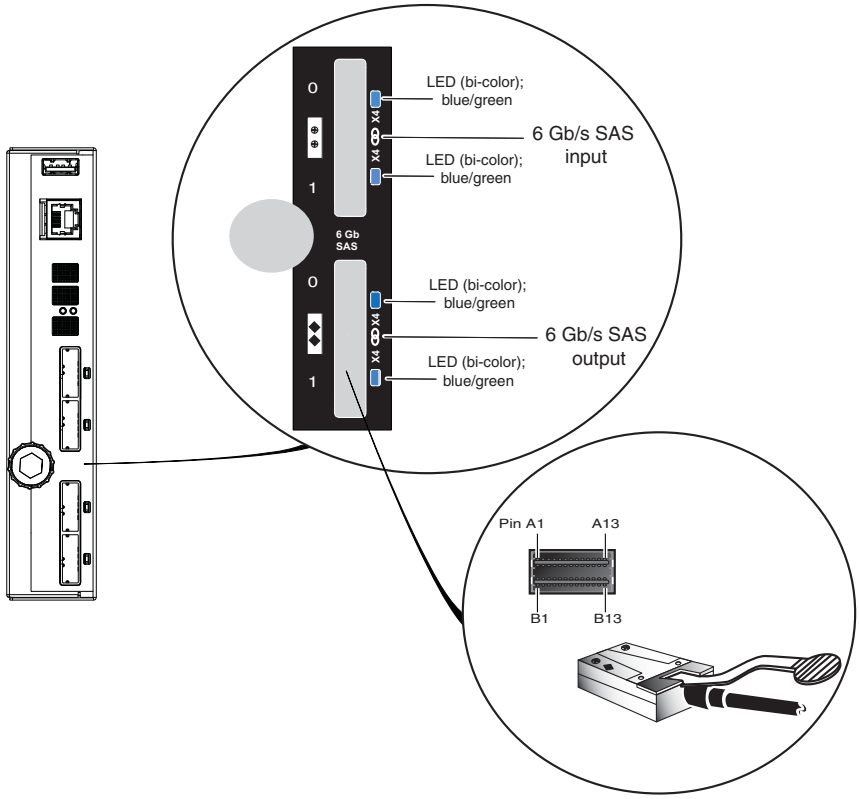


Figure 97 6-Gb/s mini-SAS port and cable connector

Table 49 lists the 4U, 60 (2.5- or 3.5-inch) DAE ICM 6-Gb/s mini-SAS port pin signals used on the connector.

Table 49 6-Gb/s mini-SAS port connector pinout

Pin	Signal	Pin	Signal
A1	GND	B1	GND
A2	Rx 0+	B2	Tx 0+
A3	Rx 0-	B3	Tx 0-
A4	GND	B4	GND
A5	Rx 1+	B5	Tx 1+
A6	Rx 1-	B6	Tx 1-
A7	GND	B7	GND
A8	Rx 2+	B8	Tx 2+
A9	Rx 2-	B9	Tx 2-
A10	GND	B10	GND

Table 49 6-Gb/s mini-SAS port connector pinout (continued)

Pin	Signal	Pin	Signal
A11	Rx 3+	B11	Tx 3+
A12	Rx 3-	B12	Tx 3-
A13	GND	B13	GND

6-Gb/s mini-SAS port LEDs and port direction (input or output) — Figure 98 shows the 6-Gb/s mini-SAS port LED—a bi-color (blue/green) LED next to the connector, either left or right—that indicates the link/activity of the SAS port.

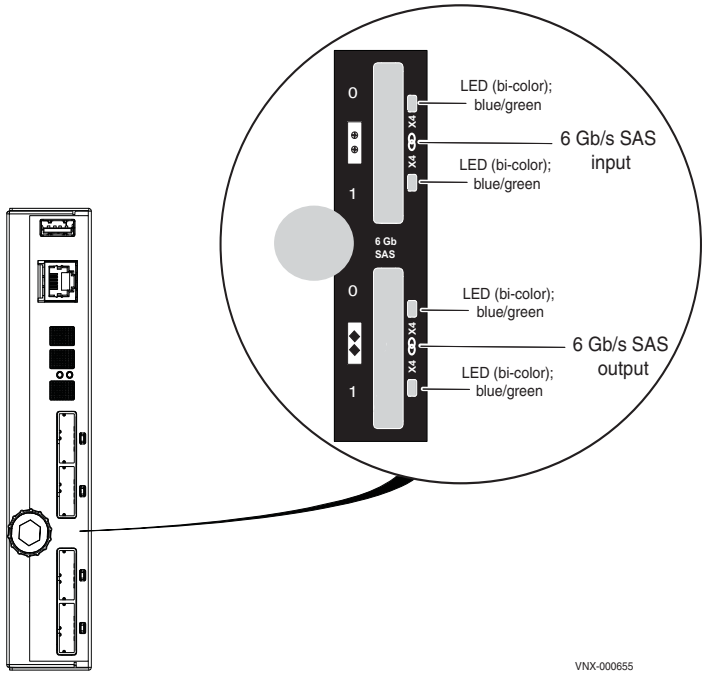


Figure 98 Example of an ICM 6-Gb/s mini-SAS connectors and LEDs

Table 50 describes the 4U, 60 (2.5- or 3.5-inch) DAE ICM 6-Gb/s mini-SAS port LEDs.

Table 50 6-Gb/s mini-SAS port LEDs

LED	Color	State	Description
Link/activity	Blue	On	Indicates a 4x or 8x connection with all lanes running at 6 Gb/s
	Green	On	Indicates that a wide port width other than 4x or 8x has been established or one or more lanes is not running at full speed or disconnected
	—	Off	Not connected

Management (RJ-12) port connector — Figure 99 on page 118 shows the management port (labeled with two symbols; one depicting a telephone handset with a line through it and the other depicting a battery). The telephone handset with a line through it symbol means that you cannot connect telephone type circuits to this connector (see the following **WARNING**). This port connects the ICM (A and B) ports to the SPS (A and B) ports, respectively.

⚠WARNING

The ICM (RJ-12) port is a LAN port not a WAN port. LAN ports contain safety extra-low voltage (SELV) circuits, and WAN ports contain telephone-network voltage (TNV) circuits. An RJ-45 (or TNV-type) looks the same as the RJ-12 except for two very important differences. An RJ-45 is an 8-wire modular jack. The RJ-12 is a six-wire modular jack. The RJ-45 plugs and jacks are wider than their RJ-12 counterparts - 7/16" vs 3/8". An RJ-45 plug won't fit into an R-J12 jack. But an RJ-12 plug will fit into an RJ-45 jack. Use caution when connecting cables. To avoid electric shock, do not attempt to connect TNV circuits to SELV circuits.

The battery symbol means that you can connect a standby power supply (SPS) to the port.

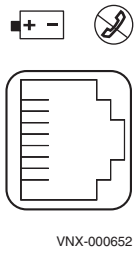


Figure 99 ICM RJ-12 port

The cable connecting the ICM to the SPS is an RJ-12 to RJ-12. It has an RJ-12 adapter (ICM side) on one end and a RJ-12 (SPS side) adapter on the other end.

USB — The USB port (Figure 100) connects a USB cable to the blue light on the front bezel.

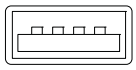


Figure 100 4U, 60 DAE USB port

4U, 60 DAE ICM enclosure ID (enclosure address) and bus ID — On the rear of the ICM (A and B), an ICM enclosure ID indicator is provided. This ID indicator is a seven-segment LED display for displaying decimal numbers. The ICM enclosure ID appears on both ICMs (A and B) which is the same ID number. The enclosure ID is set at installation (Figure 101 on page 119).

Each ICM includes a bus (loop) identification indicator. This indicator includes two seven-segment LED displays for displaying decimal numbers. The SP initializes the bus ID when the operating system is loaded (Figure 101 on page 119).

Note: Figure 101 shows the bus ID indicator, enclosure ID indicator, and the ICM power on and fault LEDs when viewed from the horizontal side of the ICM. Normally, you would have to turn your head to view these indicators.

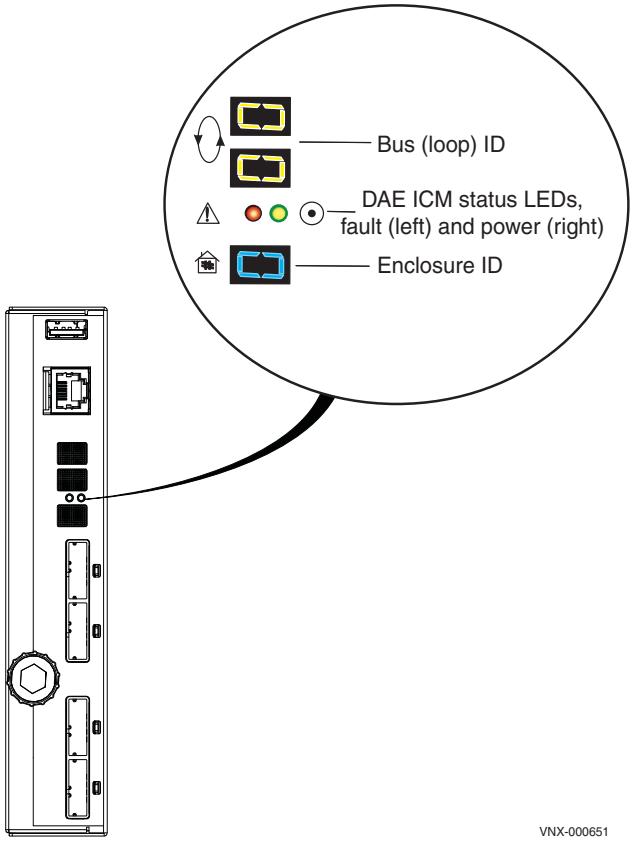


Figure 101 Example of an ICM enclosure ID indicator, bus ID indicator, and the ICM power and fault LEDs

Table 51 describes the ICM power and fault LEDs.

Table 51 ICM (power and fault) status LEDs

Led	Color	State	Description
Power on	Green	On	Power on
	—	Off	Power off
Power fault	Amber	On	Fault
	—	Off	No fault or power off

Power supply

The power supply is hot-swapable. It has a built-in thumbscrew for ease of installation and removal.

Each power supply includes a fan to provide cooling to the power supply. The power supply is an auto-ranging, power-factor-corrected, multi-output, offline converter with its own line cord. Each supply supports a fully configured DAE and shares load currents with the other supply.

In the 4U, 60 (2.5- or 3.5-inch) DAE, the power supplies provide four independent power zones. Each of the hot-swappable power supplies has the capability to deliver 1300 W at 12 V in its load-sharing highly-available configuration. Control and status are implemented throughout the I^2C interface.

Figure 102 shows an example of the 4U, 60 DAE AC power supply with two power in recessed connectors (or plugs) and status LEDs.

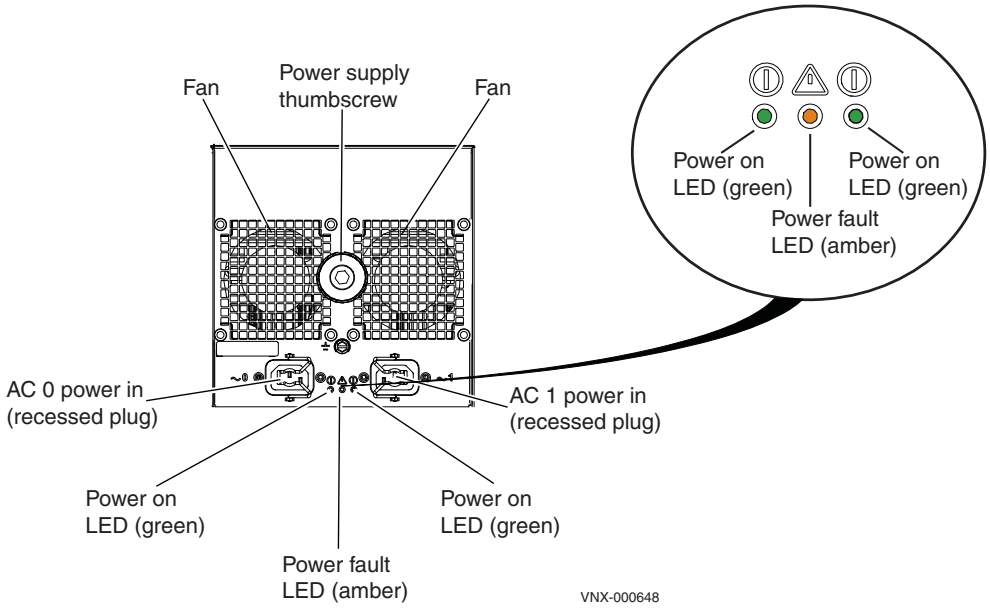


Figure 102 Example of a 4U, 60 (2.5- or 3.5-inch) DAE AC power supply showing the (power in) recessed connector (plugs) and status LEDs

Table 52 describes the 4U, 60 (2.5- or 3.5-inch) DAE power supply LEDs.

Table 52 4U, 60 (2.5- or 3.5-inch) DAE AC power supply/cooling module LEDs

Led	Color	State	Description
AC 1 power on (12 V power)	Green	On	OK. AC or SPS power applied. All output voltages are within respective operating ranges, not including fan fault.
	—	Off	12 V power is out of operation range, or in shutdown or fault detected within the unit.
AC 0 power on (12 V power)	Green	On	OK. AC or SPS power applied. All output voltages are within respective operating ranges, not including fan fault.
	—	Off	12 V power is out of operation range, or in shutdown or fault detected within the unit.
Power fault	Amber	On	Under ICM control. On if any fans or outputs are outside the specified operating range while the unit is not in low power mode.
	—	Off	All outputs are within the specified range, or in shutdown or fault detected within unit.

Interior view

The interior of the 4U, 60 (2.5- or 3.5-inch) DAE shows the fan modules, the disks, the power supply modules, the LCCs, and the ICMs (Figure 103).

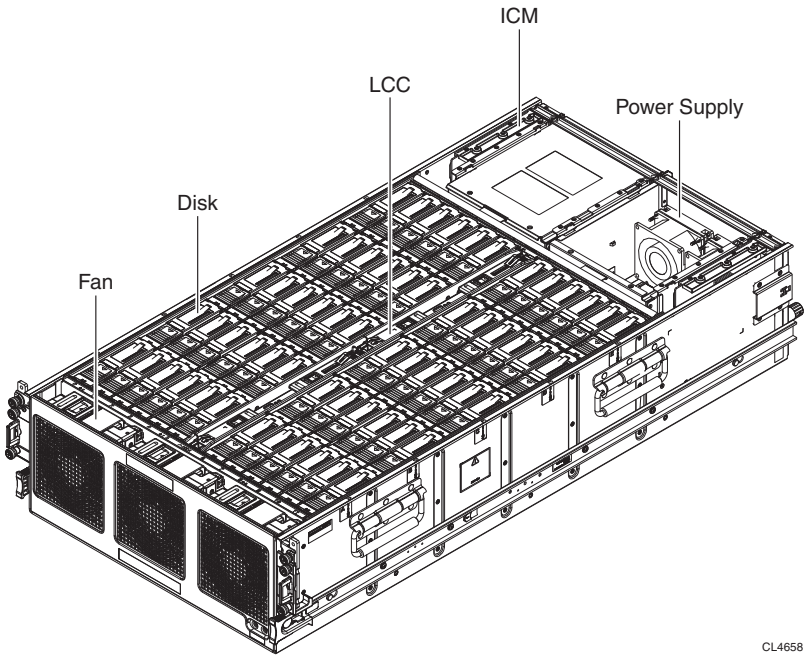


Figure 103 4U, 60 (2.5- or 3.5-inch) DAE (interior view)

The fan modules, disks, and LCCs shown in Figure 103 are accessible only by sliding the DAE out of the rack (for more information see the **CAUTION** on page 122). The ICMs and power supplies shown in Figure 103 are accessed from the rear of the 4U DAE.

⚠CAUTION

Access to the internal components in a 4U, 60 (DAE7S) enclosure mounted 31U (4.5 ft, or 1.38 m) or higher above the floor requires an appropriate EMC service ladder and is restricted to authorized service personnel only. Attempts to service disks, fans, or other DAE components mounted 31U or higher without a recommended EMC service ladder and personnel may result in serious personal injury. If an EMC service ladder is on site, this ladder is the property of EMC and is only available for use by authorized EMC service personnel.

If installing a new 4U, 60 DAE or replacing an existing 4U, 60 DAE above 31U is necessary, then an appropriate portable mechanical lifting device is required. For more information about this type of device, see "Appendix B: Field lift tool and accessory kit" on page 168.

If replacing or adding a 4U, 60 (2.5- or 3.5-inch) DAE becomes necessary, a portable mechanical lift is recommended by EMC. The portable lift commonly used by EMC service personnel is manufactured by Alum-A-Lift. Included with the lift is a lift kit which provides instructions for using the portable lift. For more information, refer to "Appendix B: Field lift tool and accessory kit" on page 168.

IMPORTANT

The portable mechanical lift commonly used by EMC service personnel has two settings—one with a lower mast and one with both a lower and upper mast (dual mast). The lower mast setting is rated for 400 lb (178.09 kg) and is for raising or lowering of objects 28U (4.08 ft or 1.2 m) or less above the floor. The dual mast setting is rated well under 200 lb (89 kg) and is for raising objects more than 28U (4.08 ft or 1.2 m) above the floor. A conversion kit from Alum-A-Lift and a support table is available from the lift provider for installations above 28U. This kit is rated for 225 lb (102 kg). For more information, refer to "Appendix B: Field lift tool and accessory kit" on page 168.

Refer to the following **CAUTION** on page 123 that discusses the mounting and servicing of the 4U, 60 DAE in a 40U Dense rack.

To replace or add any of these components, refer to their respective Customer Replaceable Unit (CRU) procedure for the 4U, 60 DAE. For example, to replace a disk drive, refer to the *Replacing a disk in a 60-disk enclosure* document available online at https://mydocs.emc.com/VNX/ and go to **VNX Tasks**, then select **Replace VNX hardware**. Next, follow the steps in the wizard.

⚠CAUTION

To prevent bodily injury when mounting or servicing the 4U, 60 DAE in a Dense rack, you must take special precautions to ensure that the DAE remains stable. The following guidelines are provided to ensure your safety:

1. When lifting this DAE, always use two people and a lifting device.

2. For service personnel, when accessing this unit in a rack above 31U, always use an EMC authorized step ladder.

3. When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at or close to the bottom of the rack.

4. If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the DAE in the rack.

Access to disk drives, LCCs, and cooling modules

To gain access to the DAE, you must first, open the console, then unlock and remove the front bezel. Next, to unlock the DAE from the rails, pull on the orange loops (see location 1 in Figure 104) on each side of the DAE. Finally, pull the orange tabs (see location 2 in Figure 104) on each side of the DAE to slide the DAE out of the rack on its rails until it locks into the secure service position. For complete instructions, see the *Replacing a disk in a 60-disk enclosure* procedure available online at https://mydocs.emc.com/VNX/and go to **VNX Tasks**, then select **Replace VNX hardware**. Next, follow the steps in the wizard.

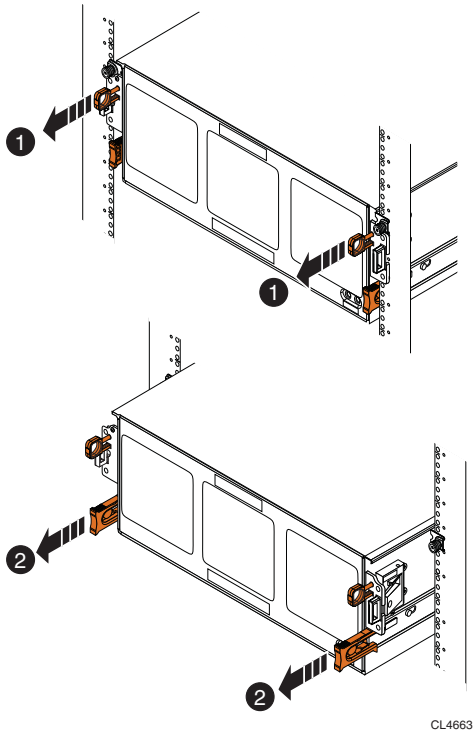


Figure 104 4U, 60 (2.5- or 3.5-inch) DAE (unlocking top, front ring pull latch mechanism and bottom slide extension release levers)

Note: If the 4U, 60 (2.5- or 3.5-inch) DAE does not slide out of the rack (or cabinet) far enough for you to access the internal components and lock on the rails in the service position, verify that all the other DAEs are completely seated in the rack (or cabinet) by pushing firmly on them.

Figure 105 shows an example of a 4U, 60 (2.5- or 3.5-inch) DAE with the top cover closed.

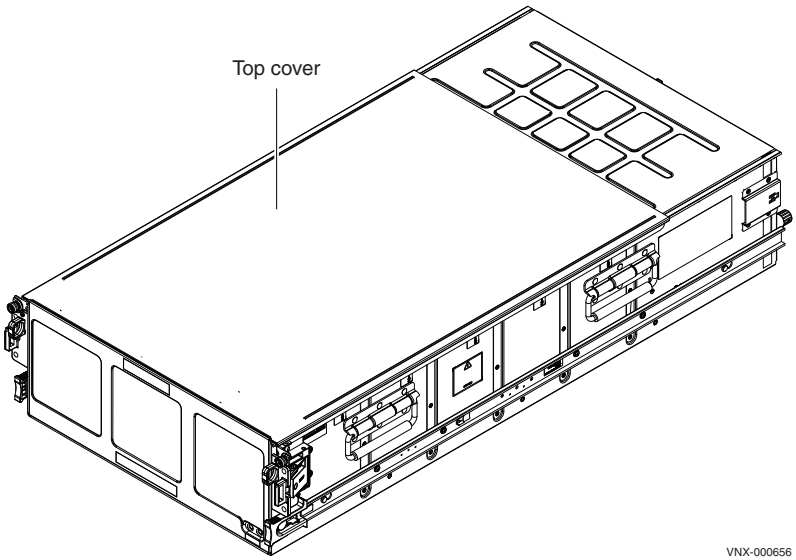


Figure 105 4U, 60 (2.5- or 3.5-inch) DAE (with top cover closed)

Figure 106 shows an example of a 4U DAE with the top cover open showing the disk drives, LCCs, and the cooling modules or fans.

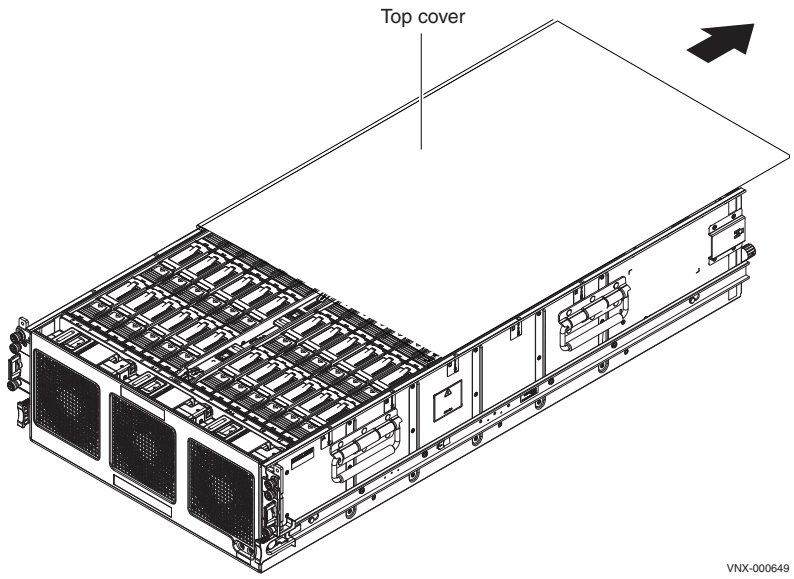


Figure 106 4U, 60 (2.5- or 3.5-inch) DAE (with top cover open)

Disk drives

The disk drives for the 4U, 60 (2.5- or 3.5-inch) DAE are encased in cartridge-style enclosures. This enclosure is used so that varied types and sizes of disk drives can be supported. Each cartridge has an easy-to-pull and push latch. The latch allows you to quickly and efficiently snap-out a disk drive for removal and snap-in for installation.

Two drive sizes are supported in the 4U, 60 (2.5- or 3.5-inch) DAE:

⚠CAUTION

You can add or remove a disk drive while the DAE is powered up, but you should exercise special care when removing modules while they are in use. Drive modules are extremely sensitive electronic components.

- 2.5-inch 6-Gb/s SAS, 6-Gb/s NL-SAS, or Flash disk drives (hot-swappable)
- 3.5-inch 6-Gb/s SAS, 6-Gb/s NL-SAS, or Flash disk drives (hot-swappable)

Figure 107 shows a top-down cut-away interior view of 4U, 60 (2.5- or 3.5-inch) DAE showing the location of the disk drives, fans (cooling modules), and LCC A.

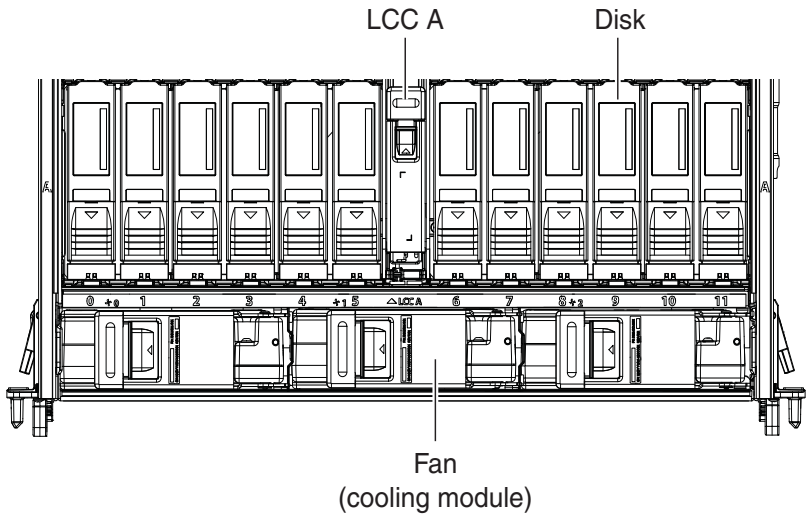


Figure 107 4U, 60 (2.5- or 3.5-inch) top-down cut-away of disk drives, fans (cooling modules), and LCC A (interior view)

Figure 108 shows an example of the disk drive power and fault LEDs.

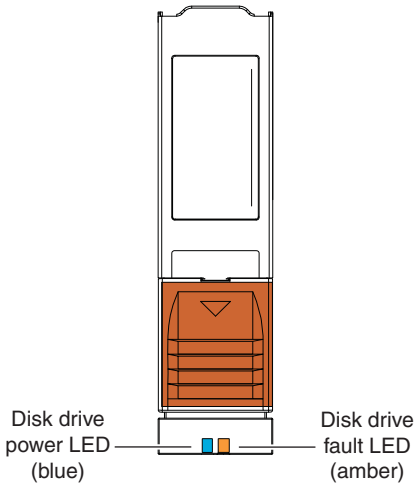


Figure 108 Disk drive power LED and fault LED

Disk drive layout

Looking at the 4U, 60 (2.5- or 3.5-inch) DAE from the front and above (Figure 109), the inside of each DAE has physically printed labels located on the left and the front sides of the DAE. These labels describe the rows (or banks) and the columns (or slots) of where the disks are installed in the DAE. The banks are labeled from **A** to **E**, while the slots are labeled from **0** to **11**.

Rules for disk drive population

The required order of loading the disk drives into a 4U DAE is (Figure 109):

1. Start at row (or bank) A, slot 0.
2. Fill up row (or bank) A before inserting any disk drives into row B.
3. Continue this order until you fill all the rows with row E being the last row filled.

Note: If a partially filled row is available, the remaining empty slots are to be loaded with filler panel modules.

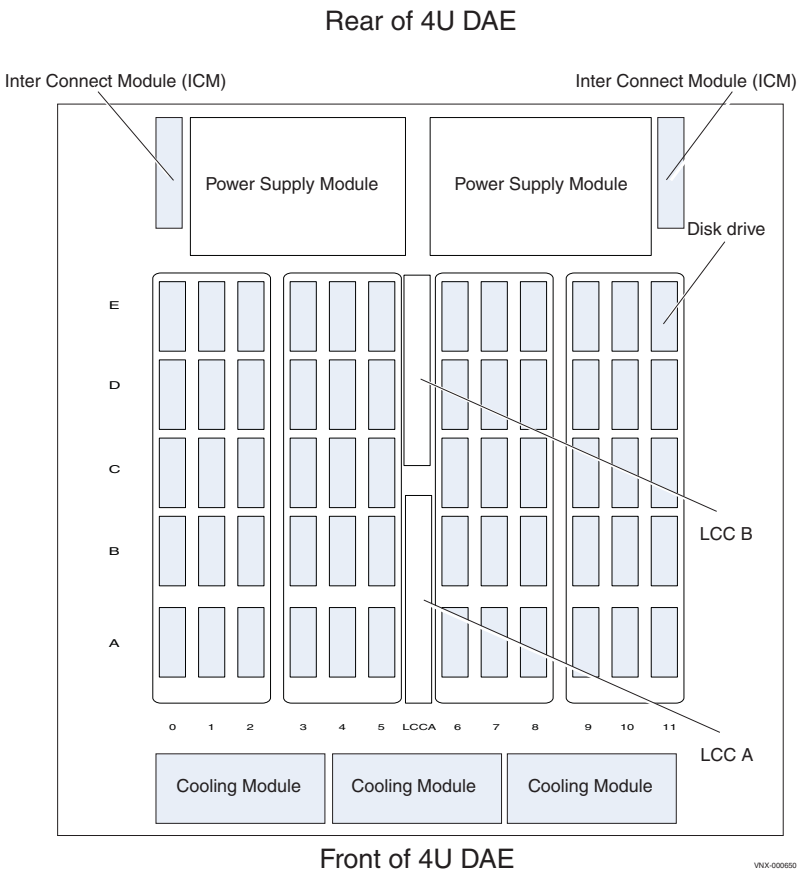


Figure 109 4U, 60 (2.5- or 3.5-inch) DAE disk drive layout and notation (top-down interior view)

Note: The labels for the banks, slots, and LCCA shown in Figure 109 are the physical labels in the 4U, 60 (2.5- or 3.5-inch) DAE.

Fan control module (cooling module)

Each 4U, 60 (2.5- or 3.5-inch) DAE includes three fan control modules (cooling modules) located on the front of the DAE. The fan control module includes a fan, fuse, and microcontroller with an I^2C interface inside a rugged enclosure.

The fan control module augments the cooling capacity of each 4U, 60 (2.5- or 3.5-inch) DAE. It plugs directly into the DAE baseboard from the top of the DAE. Inside the fan control module, sensors measure the external ambient temperatures to ensure even cooling throughout the DAE.

Figure 110 shows the location of the status (fan fault) LED on the 4U, 60 (2.5- or 3.5-inch) DAE fan control module.

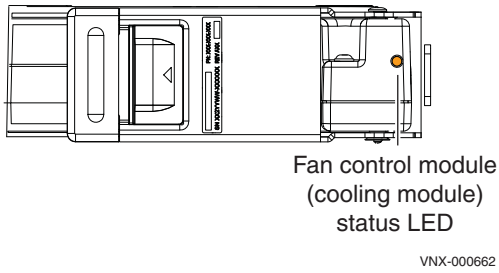


Figure 110 Example of a 4U, 60 (2.5-3.5-inch) DAE fan control module showing the fan fault LED

Table 53 describes the 4U, 60 (2.5- or 3.5-inch) DAE fan fault LED.

Table 53 Fan control module fan fault LED

Led	Color	State	Description
Fan fault	Amber	On	Fault detected, one or more fans faulted
	—	Off	No fault detected, fans operating normally

LCC

Each 4U, 60 (2.5- or 3.5-inch) DAE includes two LCCs. The primary function of each LCC is to be a SAS expander providing services to 30 drive slots per LCC in the 4U, 60 (2.5- or 3.5-inch) DAE.

The LCC implements Common Disk Enclosure Subsystem (CDES). CDES consists of a 6-Gb/s SAS expander, Common Disk Enclosure FPGA (CDEF), and supporting logic.

The primary components on the LCC are the two SAS expanders. A four-lane SAS wide port connecting each expander to the ICM expander on the same side (A or B) of the 4U, 60 DAE is available. 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 disk enclosure status.

Figure 111 shows the location of the status LEDs on the 4U, 60 DAE LCC.

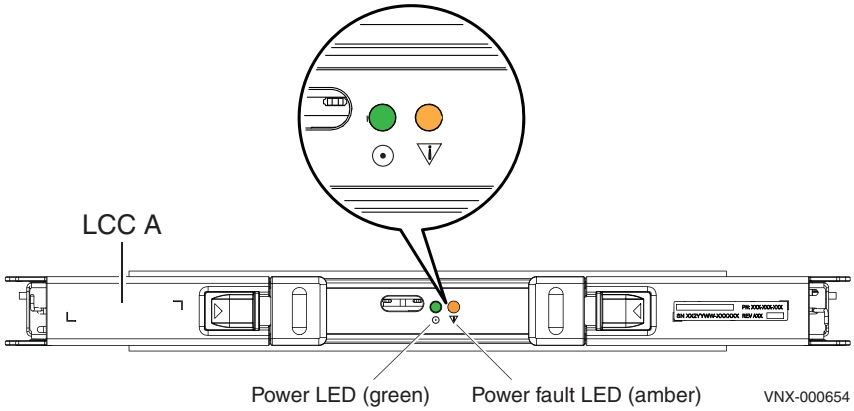


Figure 111 Example of a 4U, 60 (2.5- or 3.5-inch) DAE LCC A showing the status LEDs

Table 54 describes the 4U, 60 (2.5- or 3.5-inch) DAE LCC status LEDs.

Table 54 LCC status LED

Led	Color	State	Description
Power	Green	On	Power on
	—	Off	Power off
Power fault	Amber	On	Fault
	—	Off	No fault or power off

Appendix A: Cabling

This section describes examples of the types of cabling you will need to connect the DAEs to your VNX series platform. The descriptions are presented in illustrations and text. Each illustration shows an example of the cable connection points (ports) located on the specific hardware components for the VNX8000 platform.

IMPORTANT

The following sections only discuss the DAE cabling of the VNX8000 platform with either the 3U, 15 disk drive DAE or the 2U, 25 disk drive DAE.

For all other cabling of your VNX8000 platform, the *VNX8000 Installation Guide* provides information about the SPE power cabling, DAE power cabling, PDU power cabling, LAN cabling, and so on.

Cable label wraps

Each VNX series platform comes with a cable label wrap guide or set of cable label wraps to affix to the cables on your VNX series platform. These labels should be affixed to the appropriate cables as you connect the cables to your VNX series platform. Figure 112 shows an example of the cable wrap guide and how to affix the cable label wrap to a cable.

Note: If your VNX series platform was assembled at the factory, all the cable labels have been affixed to the cables except for any DAEs you have ordered. Additionally, if your VNX series platform was not assembled at the factory, the cable kit supplied with your product will have all the required cables already labeled except for the DAEs.

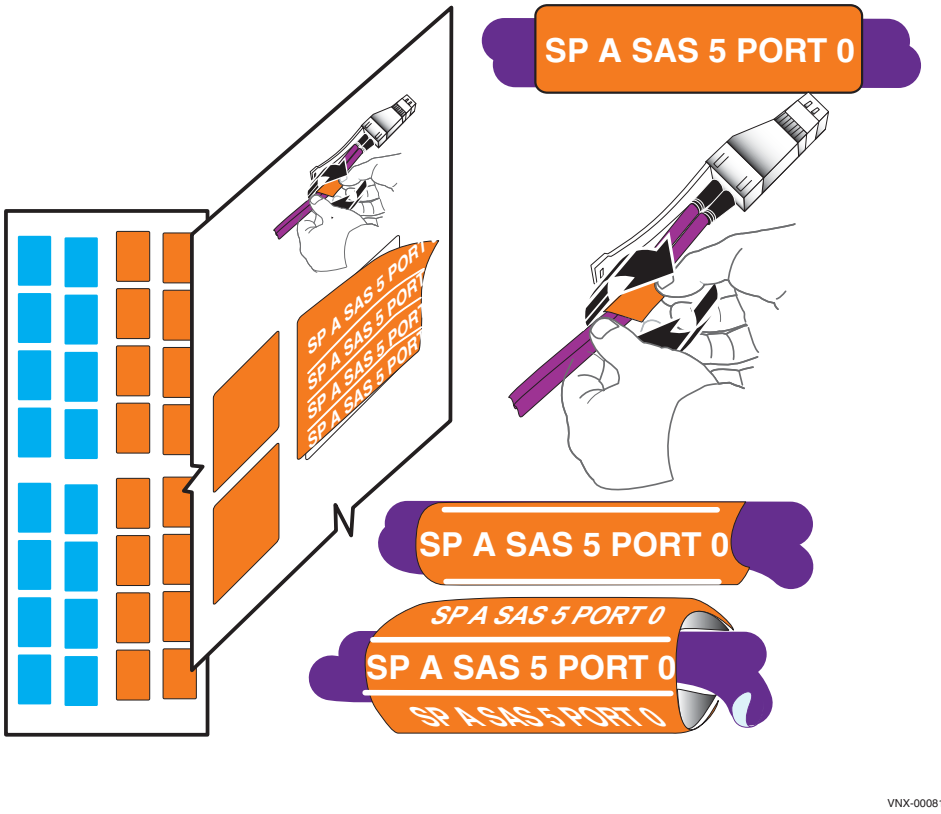


Figure 112 Example of a cable label wrap

VNX8000 DAE cabling

IMPORTANT

The DAE (s) that are to be directly connected to the DPE need to be located close enough to the DPE so that the DPE-to-DAE interconnect cables (that are provided with every DAE) can be routed and connected to the DPE easily.

The following sections describe the VNX8000 DAE cabling. First, examples of simple cabling for a two-bus and a four-bus system are described. Then, examples of a more complicated cabling for an eight-bus and a sixteen bus factory shipped VNX8000 are described. Finally, examples of an eight-bus and a sixteen-bus upgrade of the VNX8000 are described.

Shown in the upcoming figures (Figure 113 on page 133 through Figure 119 on page 143) are examples of two-bus and four-bus SAS cabling in an SPE-based VNX storage platform, the VNX8000. The Storage Processors connect to the DAEs with SAS cables. The cables connect LCCs in the DAEs of a storage platform in a daisy chain topology. These examples show how interleaved and stacked DAEs look in their respective racks.

- "Cabling with two DAEs in a VNX8000 Block platform" on page 132
- "Interleaved cabling with forty DAEs in a VNX8000 Block platform" on page 134
- "Stacked cabling with forty DAEs in a VNX8000 Block platform" on page 139
- "Cabling with two DAEs in a VNX8000 File/Unified platform" on page 144
- "Interleaved or stacked cabling with forty DAEs in a VNX8000 File/Unified platform" on page 147

Shown in Figure 121 on page 150 through Figure 134 on page 167 are examples of eight-bus and sixteen-bus SAS cabling in an SPE-based VNX storage platform, the VNX8000. These examples only show the SAS port connections with their respective I/O modules in the SPE for either eight- or sixteen-bus cabling for a factory shipped VNX8000, as well as an eight- and sixteen-bus cabling for an upgraded VNX8000.

- "Eight- and sixteen-bus DAE cabling" on page 148
- "Sixteen-bus factory-shipped VNX8000 system" on page 154
- "Upgrading an eight-bus system to a sixteen-bus system" on page 162

The VNX8000 platform supports four types of DAEs; a 15 drive 3.5-inch disk 3U enclosure, a 25 drive 2.5-inch disk 2U enclosure, a 60 drive 2.5- or 3.5-inch disk 4U enclosure, and a 120 drive 2.5- or 3.5-inch disk 3U enclosure. Expansion up to sixty 2U, 25 DAEs (a maximum of 1,500 2.5-inch disk drives), of up to one-hundred 3U, 15 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives), up to twenty-five 4U, 60 DAEs (a maximum of 1,500 2.5- or 3.5-inch disk drives), or up to twelve 3U, 120 DAEs (a maximum of 1,440 2.5- or 3.5-inch disk drives) is supported.

IMPORTANT

Do Not connect more DAEs than the VNX8000 platform can support. When calculating the number of drives for your VNX8000 platform, if the total drive slot quantity exceeds between 1,500 depending on type of DAE installed, you will not be able to add another DAE.

Cabling with two DAEs in a VNX8000 Block platform

IMPORTANT

The examples for the Block systems described in this guide are only examples of how you can cable you VNX8000 system.

The first DAE connected to the SAS I/O module in slot 5 port 0 is designated Enclosure 0 (EA0). Each DAE connected after the first DAE increments the enclosure number by one. All enclosures connected to the SAS I/O module in slot 5 Port 0 will show an ID of 0, but the addresses will increment.

Figure 113 on page 133 shows the first example of a VNX8000 Block platform with two DAEs (a 2U, 25 disk drive DAE and a 3U, 15 disk drive DAE) or a VNX8000 platform with a total of 40 disk drives.

The SAS ports on the 6-Gb/s SAS I/O module in each SP of the VNX8000 platform 4U SPE are labeled 0, 1, 2, and 3.

In Figure 113 on page 133, notice that each DAE device supports two completely redundant buses (LCC A and LCC B).

The rule of load or bus balancing is applied to all DAEs. That is, Bus 0 is Enclosure Address 0 (EA0), Bus 1 is EA0, and so on. In the case of the VNX8000 platform, Bus 0 EA0 is the first DAE. So, to balance the load, Bus 1 EA0 becomes the second DAE (LCC A and B) in the cabinet with the next DAE (LCC A and LCC B) as Bus 1 EA1, and so on. If you have several DAEs in your VNX8000 platform, you can daisy chain them within that particular bus. However, it is recommended that you balance each bus. In other words, always optimize your environment by using every available bus, and spreading the number of enclosures as evenly as possible across the buses.

Note: When connecting multiple DAEs, each cable connector on the DAE includes a symbol to denote the direction the cable needs to connect to. The cable connector on the DAE that has a double circle symbol ●● is the input to the device. The cable connector on the DAE with the double diamond symbol ◆◆ is the output from the device.

The cables shown in Figure 113 on page 133 are:

Note: The cable colors shown in the example are orange for Bus 0 and blue for Bus 1.

- Cable 1, orange, 6-Gb/s SAS I/O port 0 (SP A) to 1st DAE (labels SP A SAS 5 Port 0 to LCC A)
- Cable 2, orange, 6-Gb/s SAS I/O port 0 (SP B) to 1st DAE (labels SP B SAS 5 Port 0 to LCC B)
- Cable 3, blue, 6-Gb/s SAS I/O port 1 (SP A) to 2nd DAE (labels SP A SAS 5 Port 1 to LCC A)
- Cable 4, blue, 6-Gb/s SAS I/O port 1 (SP B) to 2nd DAE (labels SP B SAS 5 Port 1 to LCC B)

Note: If your VNX8000 platform was not cabled at the factory, refer to the cable wrap guide ("Cable label wraps" on page 130) that came with your VNX8000 platform for the correct cable labels.

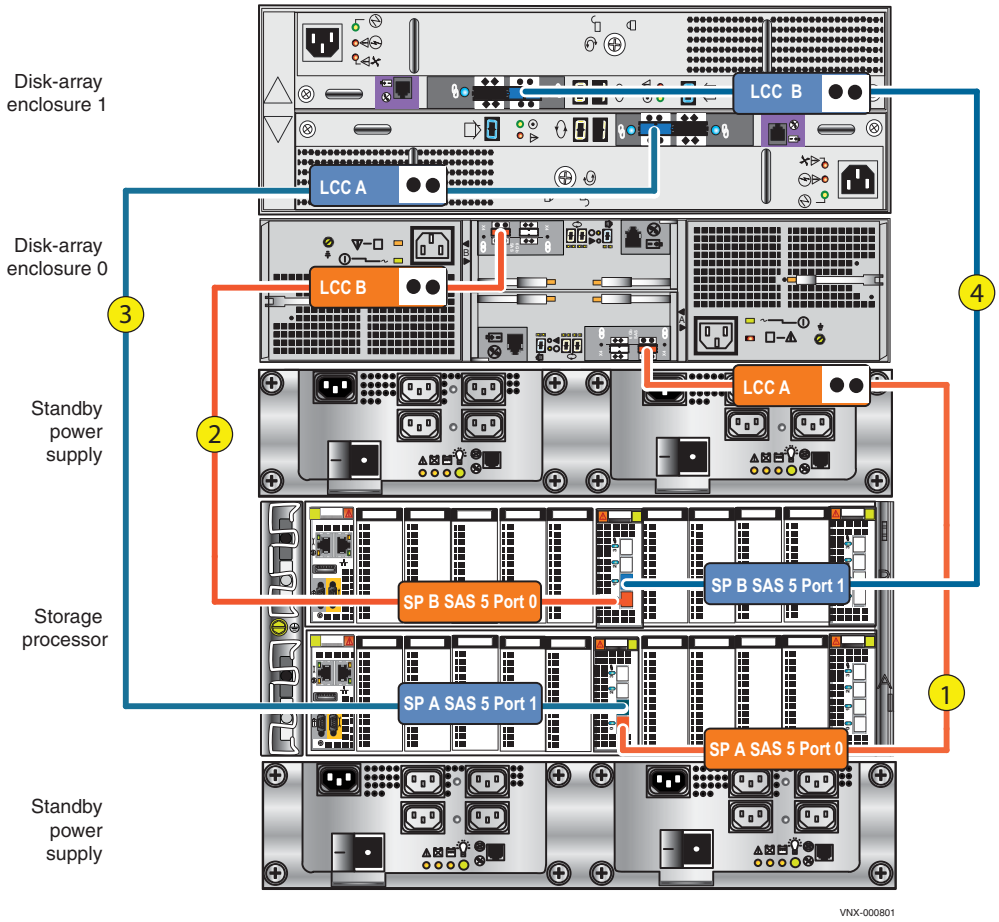


Figure 113 Example of the VNX8000 Block platform with two DAEs (3U, 15 disks and 2U, 25 disks) cabling

Interleaved cabling with forty DAEs in a VNX8000 Block platform

Figure 114 on page 136, Figure 115 on page 137, and Figure 116 on page 138 show a second example of a VNX8000 Block platform with four buses (0, 1, 2, and 3) having three racks and forty DAEs (all are 2U, 25 disk drive DAEs) or a VNX8000 platform with a total of 1000 disk drives. The examples show the interleaved cabling with three 40U racks, the first rack having eleven DAEs, the second rack having twenty DAEs, and the third and final rack having nine DAEs.

In the example (Figure 114 on page 136, Figure 115 on page 137, and Figure 116 on page 138), the first 40U rack accommodates eleven DAEs (six DAEs for Bus 0 and five DAEs for bus 1) along with the VNX8000 block system for a later upgrade to a VNX8000 File/Unified system having from 4U to 10U of space to be reserved for two Control Stations and one Data Mover enclosure.

As a rule, depending on how many Control Stations and DMEs you plan to install for a VNX8000 File/Unified system, it is recommended that from 4U to 10U of space should be reserved in your block system.

Note: If you want to use the 3U, 15 disk drive DAE, six 40U racks would be necessary. So, in this situation, the first rack would have eight DAEs (reserving from 4U to 10U of space for File/Unified hardware). The second through fifth racks would have thirteen DAEs each. And, the six and final rack would have six DAEs for a total DAE count of sixty-six with a disk drive count of 990.

If you want to use the 4U, 60 disk drive DAE, two 40U racks would be necessary. So, in this situation, the first rack would have six 4U, 60 DAEs for a total of 360 disks on two buses (0 and 1), the second 40U rack would have ten 4U, 60 DAEs for a total of 600 disks. The total DAE count of sixteen with a disk drive count of 960.

The SAS ports on the 6-Gb/s SAS I/O module in each SP of the VNX8000 platform SPE are labeled **0**, **1**, **2** and **3**.

In Figure 114 on page 136, Figure 115 on page 137, and Figure 116 on page 138 notice that each DAE device supports two completely redundant buses on LCC A and LCC B.

Since forty DAEs are available for a maximum of 1000 disk drives, it is recommended that the DAEs be load balanced. To do this, it is recommended that you daisy-chain the DAEs for the most efficient load balancing. So, in Figure 114 on page 136, Figure 115 on page 137, and Figure 116 on page 138 four buses (Bus 0, Bus 1, Bus 2, and Bus 3) are available.

Note: The DAE colors shown in the example are orange for Bus 0, blue for Bus 1, black for bus 2, green for bus 3.

The DAEs shown in Figure 114 on page 136, Figure 115 on page 137, and Figure 116 on page 138 are:

- DAE 1, orange, 6-Gb/s SAS I/O module port 0 (SP A) to 1st DAE (EA 0/Bus 0) in rack 1 (labels SP A SAS 5 Port 0 to LCC A)
- DAE 1, orange, 6-Gb/s SAS I/O module port 0 (SP B) to 1st DAE (EA 0/Bus 0) in rack 1 (labels SP B SAS 5 Port 0 to LCC B)
- DAE 2, blue, 6-Gb/s SAS I/O module port 1 (SP A) to 2nd DAE (EA 0/Bus 1) in rack 1 (labels SP A SAS 5 Port 1 to LCC A)
- DAE 2, blue, 6-Gb/s SAS I/O module port 1 (SP B) to 2nd DAE (EA 0/Bus 1) in rack 1 (labels SP B SAS 5 Port 1 to LCC B)
- DAEs 3 through 9 are interleaved and daisy-chained between bus 0 and bus 1 in rack 1. Or, EA 1/Bus 0 through EA 5/Bus 0 and EA 1/ Bus 1 though EA 4/Bus 1.
- In rack 2, DAEs 1 through 7 continue to interleave and daisy-chain between bus 0 and bus 1. Or, EA 7/Bus 0 through EA 9/Bus 0 and EA 5/Bus 1 through EA 8/Bus 1.
- Then, starting with DAE 8, black, 6-Gb/s SAS I/O module port 2 (SP A) to 8th DAE (EA 0/Bus 2) in rack 2 (labels SP A SAS 5 Port 2 to LCC A).
- DAE 8, black, 6-Gb/s SAS I/O module port 2 (SP B) to 8th DAE (EA 0/Bus 2) in rack 2 (labels SP B SAS 5 Port 2 to LCC B)
- DAE 9, green, 6-Gb/s SAS I/O module port 3 (SP A) to 9th DAE (EA 0/Bus 3) in rack 2 (labels SP A SAS 5 Port 3 to LCC A)
- DAE9, green, 6-Gb/s SAS I/O module port 3 (SP B) to 9th DAE (EA 0/Bus 3) in rack 2 (labels SP B SAS 5 Port 3 to LCC B)
- DAEs 10 through 20 are interleaved and daisy-chained between bus 2 and bus 3 in rack 2. Or, EA 1/Bus 2 through EA 6/Bus 2 and EA 1/Bus 3 through EA 5/Bus 3.
- In rack 3, DAEs 1 through 9 continue to interleave and daisy-chain between bus 2 and bus 3. Or, EA 5/Bus 3 through EA 9/Bus 3 and EA 6/Bus 2 through EA 9/Bus 2.

Note: Figure 114 on page 136 shows 10U of reserved space to allow for upgrading your VNX8000 Block to VNX8000 File/Unified platform. If you are planning to upgrade your Block platform to a File/Unified platform, it is recommended that at least 10U of rack space be reserved for adding one to two 1U Controls Stations and one to four 2U Data Mover enclosures.

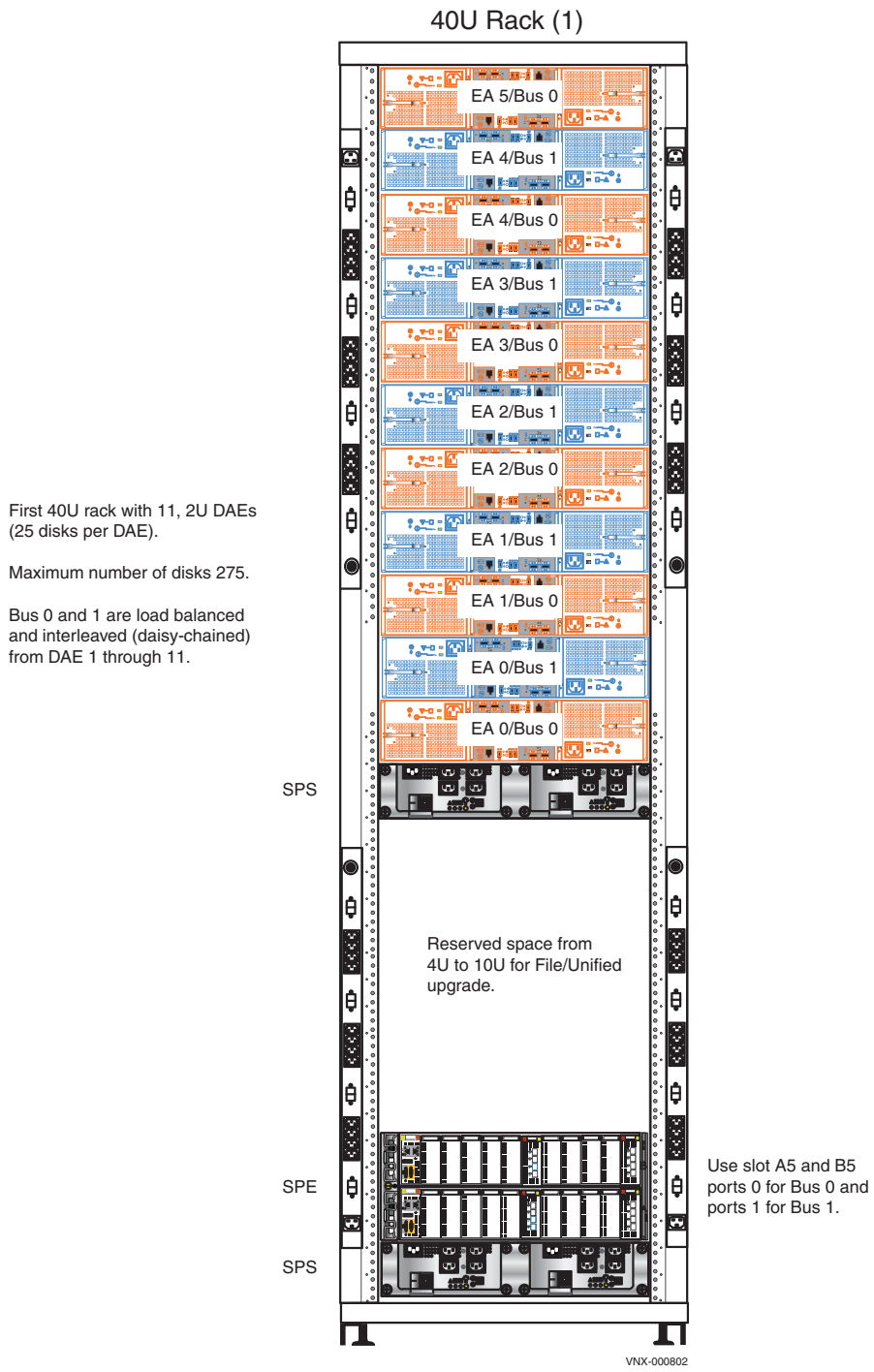


Figure 114 Example of the VNX8000 platform with eleven DAEs (2U, 25 disks) interleaved cabling for a 40U rack 1

Second 40U rack with 20, 2U DAEs (25 disks per DAE).

Maximum number of disks 500.

Bus 0 and 1 are load balanced and interleaved (daisy-chained) from DAE 1 through 9.

Bus 2 and 3 are cabled from SPE slot A5 and B5 ports 1 and 2.

Bus 2 and 3 are load balanced and interleaved (daisey-chained) from DAE 10 through 20.

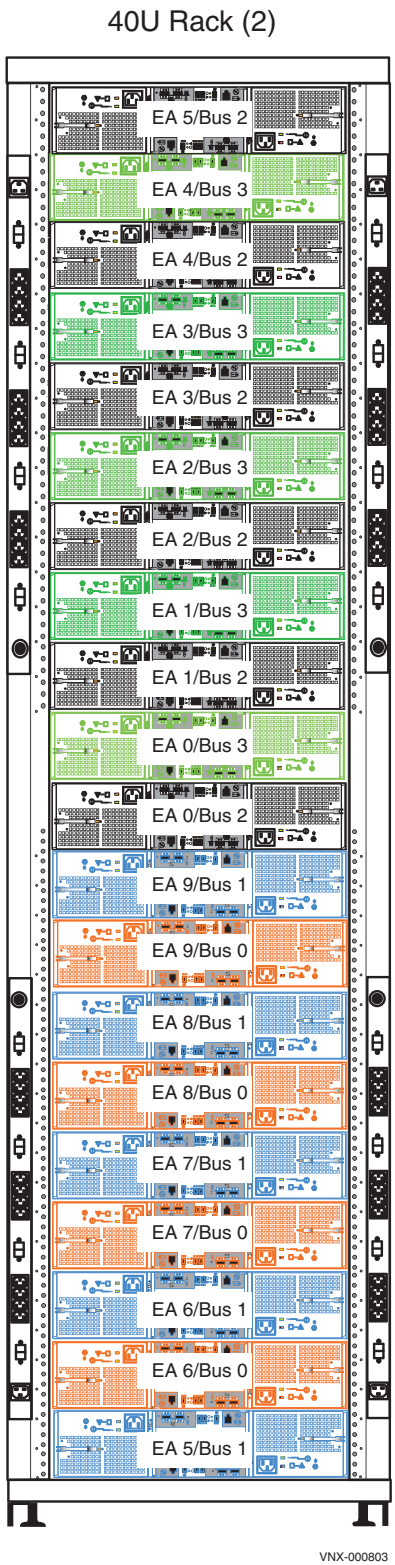


Figure 115 Example of the VNX8000 Block platform with forty DAEs (2U, 25 disks) interleaved cabling 40U rack 2 (continued)

Third 40U rack with 9, 2U DAEs (25 disks per DAE).

Maximum number of disks 225.

Bus 2 and 3 are load balanced and interleaved (daisy-chained) from DAE 1 through 9.

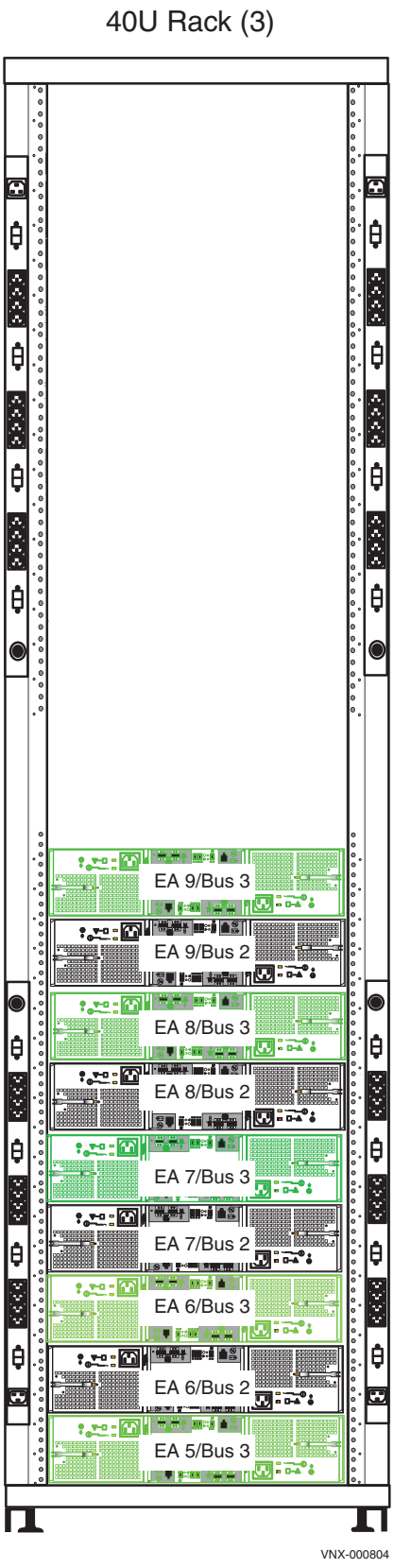


Figure 116 Example of the VNX8000 Block platform with nine DAEs (2U, 25 disks) interleaved cabling 40U rack 3 (continued)

Stacked cabling with forty DAEs in a VNX8000 Block platform

Figure 117 on page 141, Figure 118 on page 142, and Figure 119 on page 143 show a third example of a VNX8000 Block platform with three racks and forty DAEs (all are 2U, 25 disk drive DAEs) or a VNX8000 platform with a total of 1000 disk drives. This example shows the stacked cabling with three 40U racks, the first rack having ten DAEs, the second rack having twenty DAEs, and the third and final rack having ten DAEs.

Note: If you want to use the 3U, 15 disk drive DAE, six 40U racks would be necessary. So, in this situation, the first rack would have seven DAEs (reserving 10U of space for File/Unified hardware). The second through fifth racks would have thirteen DAEs each. And, the sixth and final rack would have seven DAEs for a total DAE count of sixty-six with a disk drive count of 990.

The SAS ports on the 6-Gb/s SAS I/O module in each SP of the VNX8000 platform SPE are labeled **0**, **1**, **2** and **3**.

In Figure 117 on page 141, Figure 118 on page 142, and Figure 119 on page 143 notice that each DAE device supports two completely redundant buses on LCC A and LCC B.

Since forty DAEs are available for a maximum of 1000 disk drives, it is recommended that the DAEs be load balanced. To do this, it is recommended that you daisy-chain the DAEs for the most efficient load balancing. So, in Figure 117 on page 141, Figure 118 on page 142, and Figure 119 on page 143 four buses (Bus 0, Bus 1, Bus 2, and Bus 3) are available.

The DAEs shown in Figure 117 on page 141, Figure 118 on page 142, and Figure 119 on page 143 are:

Rack 1, bus 0

- DAE 1, orange, 6-Gb/s SAS I/O module port 0 (SP A) to 1st DAE (EA 0/Bus 0) in rack 1 (labels SP A SAS 5 Port 0 to LCC A)
- DAE 1, orange, 6-Gb/s SAS I/O module port 0 (SP B) to 1st DAE (EA 0/Bus 0) in rack 1 (labels SP B SAS 5 Port 0 to LCC B)

Then, the orange DAEs for Bus 0 are daisy-chained through the remaining DAEs:

- DAE 2 or EA 1/Bus 0 and continue cabling the DAEs up to EA 9/Bus 0.

Rack 2, bus 1

- DAE 1, blue, 6-Gb/s SAS I/O module port 1 (SP A) to 1st DAE (EA 0/Bus 1) in rack 2 (labels SP A SAS 5 Port 1 to LCC A)
- DAE 1, blue, 6-Gb/s SAS I/O module port 1 (SP B) to 1st DAE (EA 0/Bus 1) in rack 2 (labels SP B SAS 5 Port 1 to LCC B)

Then, the blue DAEs for Bus 1 are daisy-chained through the remaining DAEs:

- DAE 2 or EA 1/Bus 1 and continue cabling the DAEs up to EA 9/Bus 1.

Rack 2, bus 2

- DAE 11, black, 6-Gb/s SAS I/O module port 2 (SP A) to 11th DAE (EA 0/Bus 2) in rack 2 (labels SP A SAS 5 Port 2 to LCC A)
- DAE 11, black, 6-Gb/s SAS I/O module port 2 (SP B) to 11th DAE (EA 0/Bus 2) in rack 2 (labels SP B SAS 5 Port 2 to LCC B)

Then, the black DAEs for Bus 2 are daisy-chained through the remaining DAEs:

- DAE 12 or EA 1/Bus 2 and continue cabling the DAEs up to EA 9/Bus 2.

Rack 3, bus 3

- DAE 1, green, 6-Gb/s SAS I/O module port 2 (SP A) to 10th DAE (EA 0/Bus 3) in rack 3 (labels SP A SAS 5 Port 2 to LCC A)
- DAE 1, green, 6-Gb/s SAS I/O module port 2 (SP B) to 11th DAE (EA 0/Bus 3) in rack 3 (labels SP B SAS 5 Port 2 to LCC B)

Then, the black DAEs for Bus 3 are daisy-chained through the remaining DAEs:

- DAE 2 or EA 1/Bus 3 and continue cabling the DAEs up to EA 9/Bus 3-.

Note: Figure 117 on page 141 shows 4U to 10U of reserved space to allow for upgrading your VNX8000 Block to VNX8000 File/Unified platform. If you are planning to upgrade your Block platform to a File/Unified platform, it is recommended that at least 4U of rack space be reserved for adding one to two 1U Controls Stations and one to two 2U Data Mover enclosures.

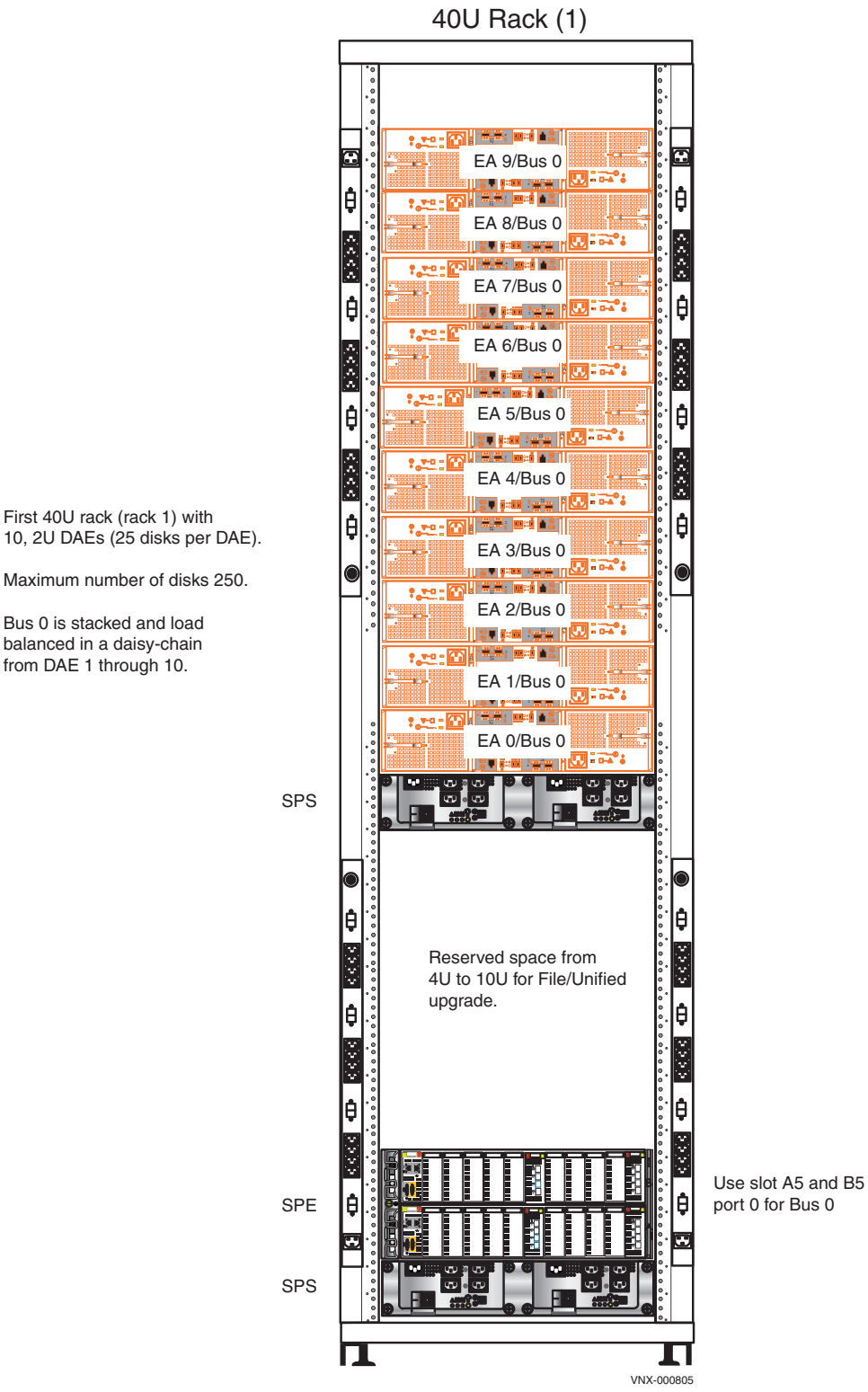


Figure 117 Example of a VNX8000 Block platform (rack 1) with eleven DAEs (2U, 25 disks) stacked and load balanced

Second 40U rack with 20, 2U DAEs (25 disks per DAE).

Maximum number of disks 500.

Bus 1 is cabled from SPE slot A5 and B5 port 1.

Bus 1 is stacked and load balanced in a daisy-chain from DAE 1 through 10.

Bus 2 is cabled from SPE slot A5 and B5 port 2.

Bus 2 is stacked and load balanced in a daisy-chain from DAE 11 through 20.

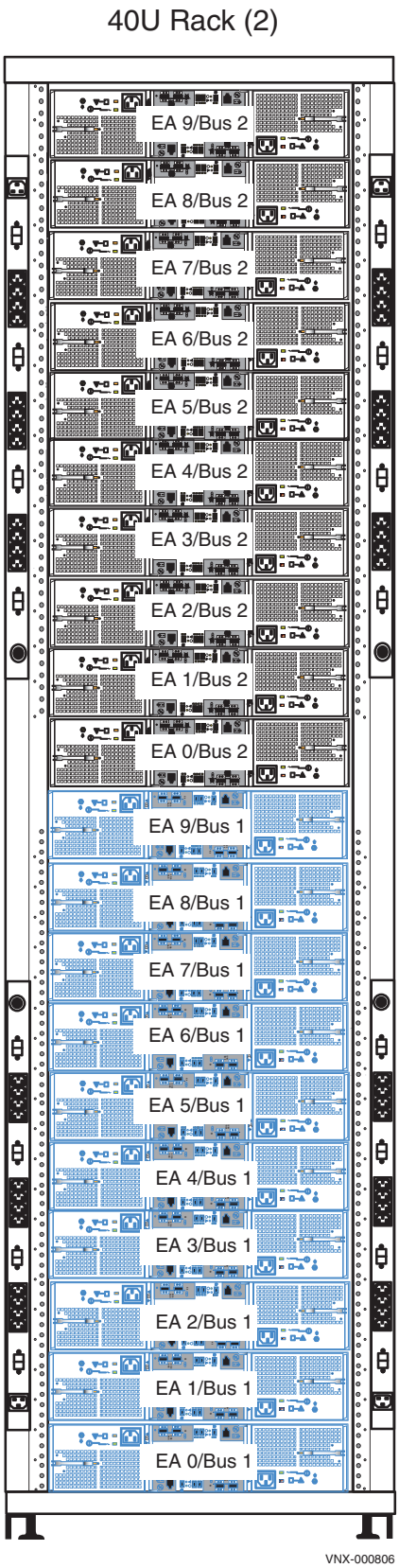
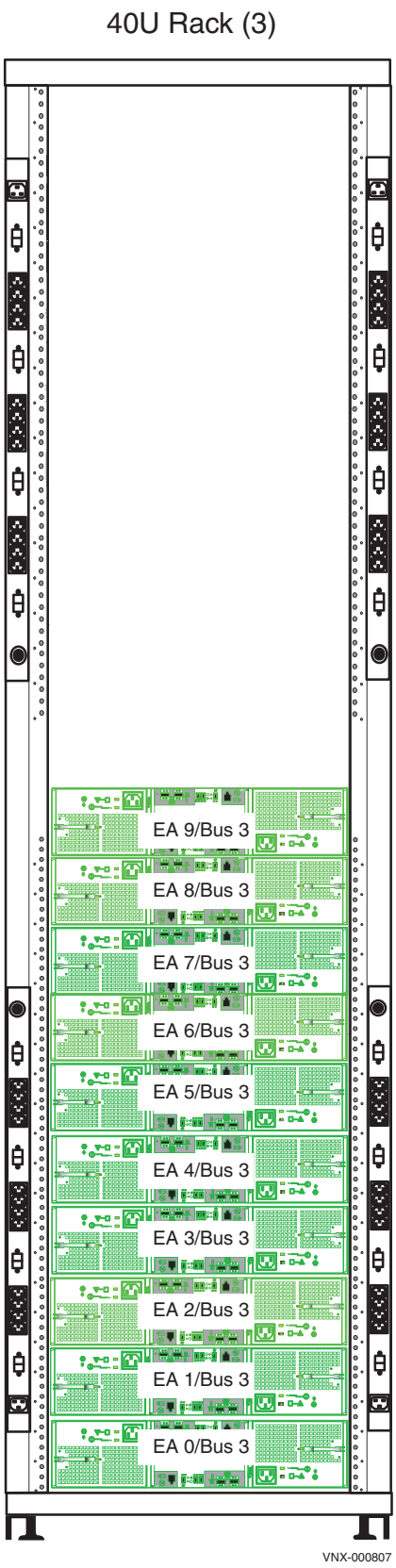


Figure 118 Example of the VNX8000 Block platform with forty DAEs (2U, 25 disks) stacked cabling rack 2 (continued)



Third 40U rack with 10, 2U DAEs (25 disks per DAE).

Maximum number of disks 250.

Bus 3 is cabled from SPE slot A5 and B5 port 3.

Bus 3 is stacked and load balanced in a daisy-chain from DAE 1 through 10.

Figure 119 Example of the VNX8000 Block platform with forty DAEs (2U, 25 disks) stacked cabling rack 3 (continued)

Cabling with two DAEs in a VNX8000 File/Unified platform

IMPORTANT

The examples for the File/Unified systems described in this guide are only examples of how you can cable you VNX8000 system.

Shown in the upcoming figure (Figure 120 on page 146) is an example of SAS cabling in a SPE-based VNX storage platform, the VNX8000 File. The Storage Processors connect to the DAEs with SAS cables. The cables connect LCCs in the DAEs of a storage platform in a daisy chain topology.

The Storage Processors connect to the DAEs with SAS cables. The cables connect LCCs in the DAEs of a storage platform in a daisy-chain topology.

The first DAE connected to the Storage Processor SAS output port 0 is designated Enclosure 0 (EA 0). Each DAE connected after the first DAE increments the enclosure number by one. All enclosures connected to SAS Port 0 will show an ID of 0.

Figure 120 on page 146 shows the first example of a VNX8000 File/Unified platform with two DAEs (one 3U, 15 disk drive DAE and the other a 2U, 25 disk drive DAE) or a VNX8000 platform with a total of 40 disk drives.

The SAS ports on the 6-Gb/s SAS I/O module in each SP of the VNX8000 platform 4U SPE are labeled **0** and **1**.

In Figure 120 on page 146, notice that each DAE device supports two completely redundant buses (LCC A and LCC B).

The rule of load or bus balancing is applied to all DAEs. That is, Bus 0 is Enclosure Address 0 (EA 0), Bus 1 is EA 0, and so on. If you have several DAEs in your VNX8000 platform, you can daisy chain them within that particular bus. However, it is recommended that you balance each bus. In other words, always optimize your environment by using every available bus, and spreading the number of enclosures as evenly as possible across the buses.

Note: On the DAE, each cable connector includes a symbol to denote the direction the cable needs to connect to. The cable connector that has a double circle symbol ●● is the input to the device. The cable connector with the double diamond symbol ◆◆ is the output from the device.

IMPORTANT

Notice the description of the cable labels affixed to the SP to DAE cables.

The cables shown in Figure 120 on page 146 are:

Note: The cable colors shown in the example are orange for Bus 0 and blue for Bus 1.

- Cable 1, orange, 6-Gb/s SAS I/O module port 0 (SP A) to 2nd DAE 1st DAE (labels SP A SAS 5 Port 0 to LCC A)
- Cable 2, orange, 6-Gb/s SAS I/O module port 0 (SP B) to 1st DAE (labels SP B SAS 5 Port 0 to LCC B)
- Cable 3, blue, 6-Gb/s SAS I/O module port 1 (SP A) to 2nd DAE (labels SP A SAS 5 Port 1 to LCC A)
- Cable 4, blue, 6-Gb/s SAS I/O module port 1 (SP B) to 2nd DAE (labels SP B SAS 5 Port 1 to LCC B)

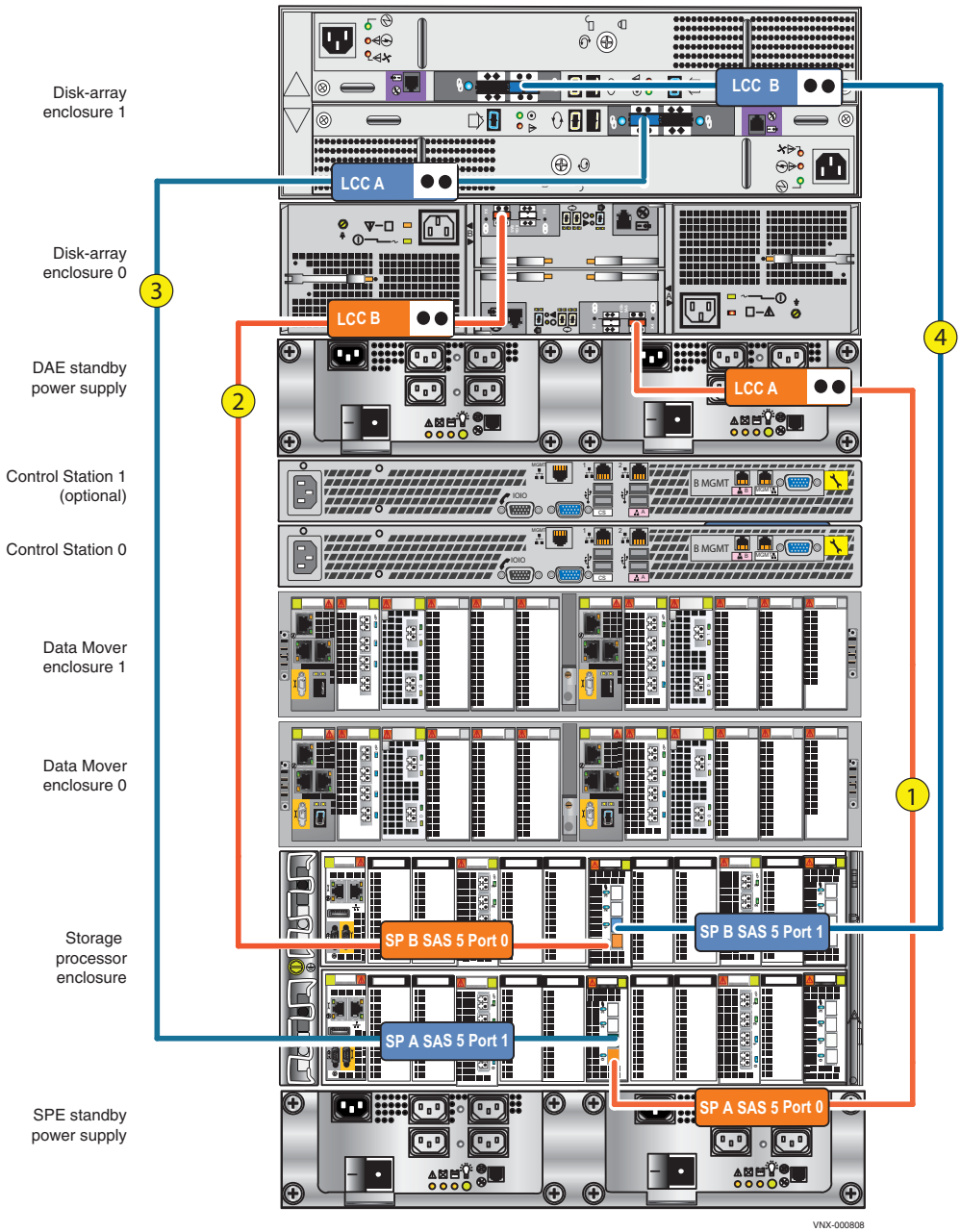


Figure 120 Example of the VNX8000 File/Unified platform with two DAEs (3U, 15 disk and 2U, 25 disk)

Note: In Figure 120 the VNX8000 File/Unified platform shows a two 2U SPSs, a 4U SPE (with two SPs), a 1U CS (with an optional 1U CS), two 2U DMEs (with four DMs), a 3U 15 DAE and a 2U 25 DAE.

Interleaved or stacked cabling with forty DAEs in a VNX8000 File/Unified platform

The cabling for a VNX8000 File/Unified platform is the same as the block system. The only difference is that the File/Unified components (CS0, CS1 (optional), and any DMEs) would have to be accounted for. In other words, if you are upgrading from an existing Block system, from 4U to 10U of space should have been made available in your first rack. If you are installing a new VNX8000 File/Unified system, then the connections for Bus 0, Bus, 1, Bus 2, and Bus 3 in an interleaved or stacked system would be the same as described for the VNX8000 Block from page 134 to page 139 of this guide.

Note: It is recommended that for load balancing purposes that you use as many buses across your DAEs as possible.

IMPORTANT

The examples for the Block or File/Unified systems described in this guide are only examples of how you can cable you VNX8000 system whether it is a Block or File/Unified system.

Eight- and sixteen-bus DAE cabling

The following sections provide example scenarios of DAE cabling for a factory-shipped VNX8000 eight- and sixteen-bus system as well as an VNX8000 eight-bus system upgraded to a sixteen-bus system. The example scenarios describe how the cabling for each type of system is configured. These scenarios are:

- "Eight-bus factory-shipped VNX8000 system" on page 149
- "Sixteen-bus factory-shipped VNX8000 system" on page 154
- "Upgrading an eight-bus system to a sixteen-bus system" on page 162

In the example scenarios presented, an introduction of each configuration along with a table describing the 6-Gb/s SAS I/O module slot location in SP A and B, the port number, the loop (or bus) number, and the cable label colors for both ends of the cable. Additionally, illustrations of each configuration are shown.

For example:

The "Eight-bus factory-shipped VNX8000 system" on page 149 has four illustrations. The first two describe the cabling scheme for the 6-Gb/s I/O modules in slots 5 and 10 in SP A and B with respect to the DAEs (see Table 55 on page 149 and Figure 121 on page 150 and Figure 122 on page 151). The next two illustrations show the following:

- Eight-bus factory-shipped Block system using thirty-two 2U, 25 disk DAEs in an interleaved configuration (Figure 123 on page 152)
- Eight-bus factory-shipped Block system using thirty-two 2U, 25 disk DAEs in a stacked configuration(Figure 124 on page 153)

The "Sixteen-bus factory-shipped VNX8000 system" on page 154 has six illustrations. The first four describe the cabling scheme for the 6-Gb/s I/O modules in slots 4, 5, 6, and 10 in SP A and B with respect to the DAEs (see Table 56 on page 154 and Figure 121 on page 150 through Figure 122 on page 151). The next two illustrations show the following:

- Sixteen-bus factory-shipped Block system using thirty-two 2U, 25 disk DAEs in an interleaved configuration (Figure 129 on page 160)
- Sixteen-bus factory-shipped Block system using thirty-two 2U, 25 disk DAEs in a stacked configuration (Figure 130 on page 161)

IMPORTANT

Observe and take note of the description of the I/O module slot location, the port number location, the back-end loop (or bus) location, and the color of the cable label used on both ends of the cable.

Eight-bus factory-shipped VNX8000 system

The back-end port numbering for a VNX8000 is set at system test (at the factory). Ports are identified and numbered, low to high, left to right. The 6-Gb/s SAS I/O modules are in slots 5 and 10 of Storage Processors A and B.

IMPORTANT

Slot 5, port 0 is reserved for connection to the vault drives.

An eight-bus VNX8000 system with 6-Gb/s SAS I/O modules in slots 5 and 10 supports up to eight loops using standard x4 (or 4 lane) SAS cables (Table 55).

Table 55 A VNX8000 (eight-bus) scenario

I/O module slot number	Port	Back-end loop #	SP A an B cable labels (white w/black text)	Back-end loop cable label colors
5	0	0	SP A SAS 5 Port 0 SP B SAS 5 Port 0	Orange
5	1	1	SP A SAS 5 Port 1 SP B SAS 5 Port 1	Blue
5	2	2	SP A SAS 5 Port 2 SP B SAS 5 Port 2	Black
5	3	3	SP A SAS 5 Port 3 SP B SAS 5 Port 3	Green
10	0	4	SP A SAS 10 Port 0 SP B SAS 10 Port 0	Brown
10	1	5	SP A SAS 10 Port 1 SP B SAS 10 Port 1	Cyan
10	2	6	SP A SAS 10 Port 2 SP B SAS 10 Port 2	Purple
10	3	7	SP A SAS 10 Port 3 SP B SAS 10 Port 3	Pink

As described in Table 55, the resulting numbering scheme for an eight-bus VNX8000 shipping from the factory is shown in Figure 121 on page 150 and Figure 122 on page 151. These figures show the 6-Gb/s SAS I/O module slot location, the port location in the I/O module, and the cable with the cable labels from the I/O module side to the LCC side on the respective DAE.

- "Slot 5 (eight-bus) configuration" on page 150
- "Slot 10 (eight-bus) configuration" on page 151

The next two illustrations show examples of how the 2U, 25 DAEs are deployed in two 40U racks of a Block interleaved and a Block stacked eight-bus system.

- "Eight-bus factory-shipped Block interleaved configuration" on page 152
- "Eight-bus factory-shipped Block stacked configuration" on page 153

Slot 5 (eight-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 5), the I/O module port location (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 121). For more information, refer to Table 55 on page 149.

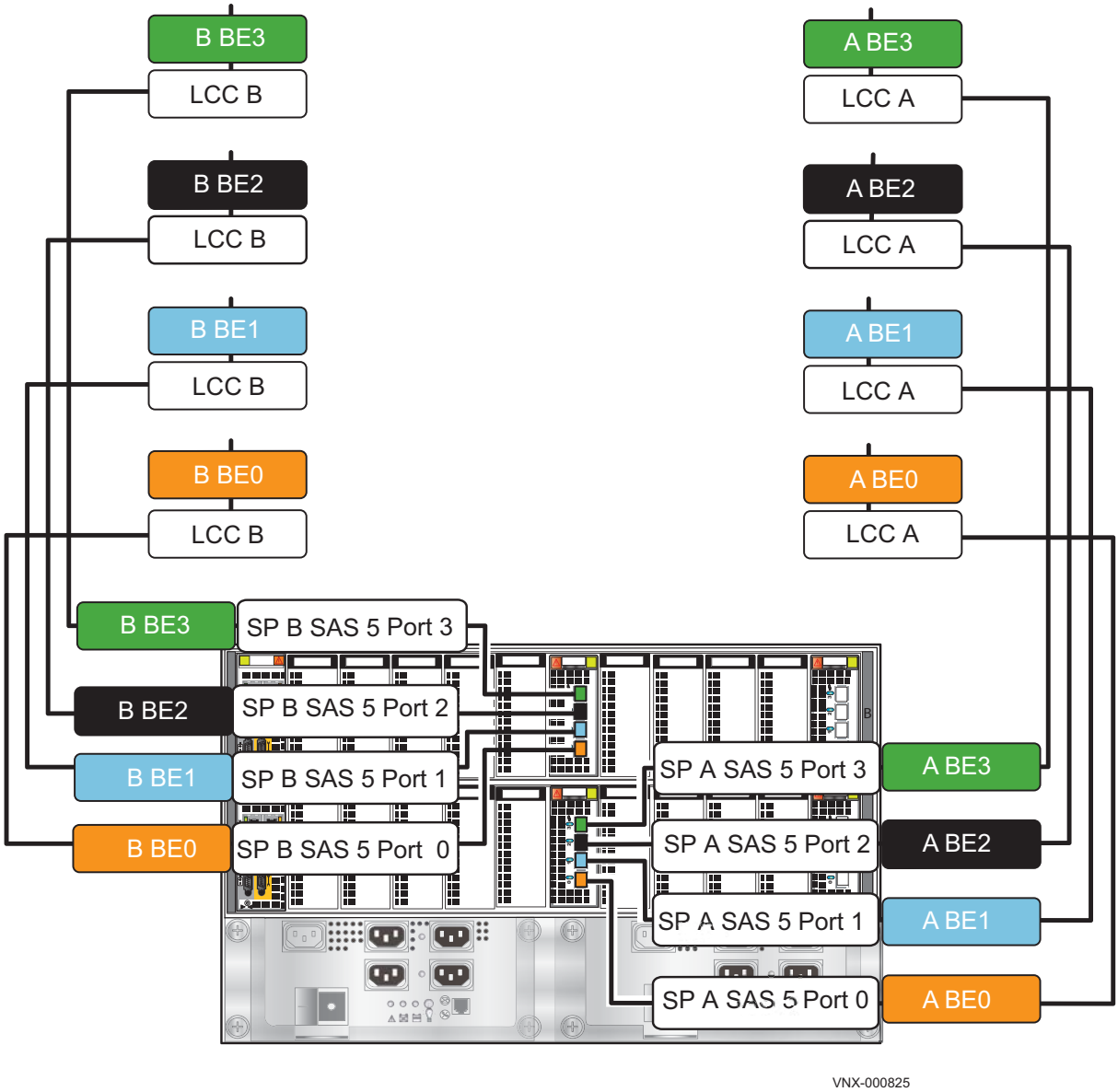


Figure 121 Example of an eight-bus factory version of a VNX8000 with the 6-Gb/s SAS I/O module in slot 5

Slot 10 (eight-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 10), the I/O module port locations (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 122). For more information, refer to Table 55 on page 149.

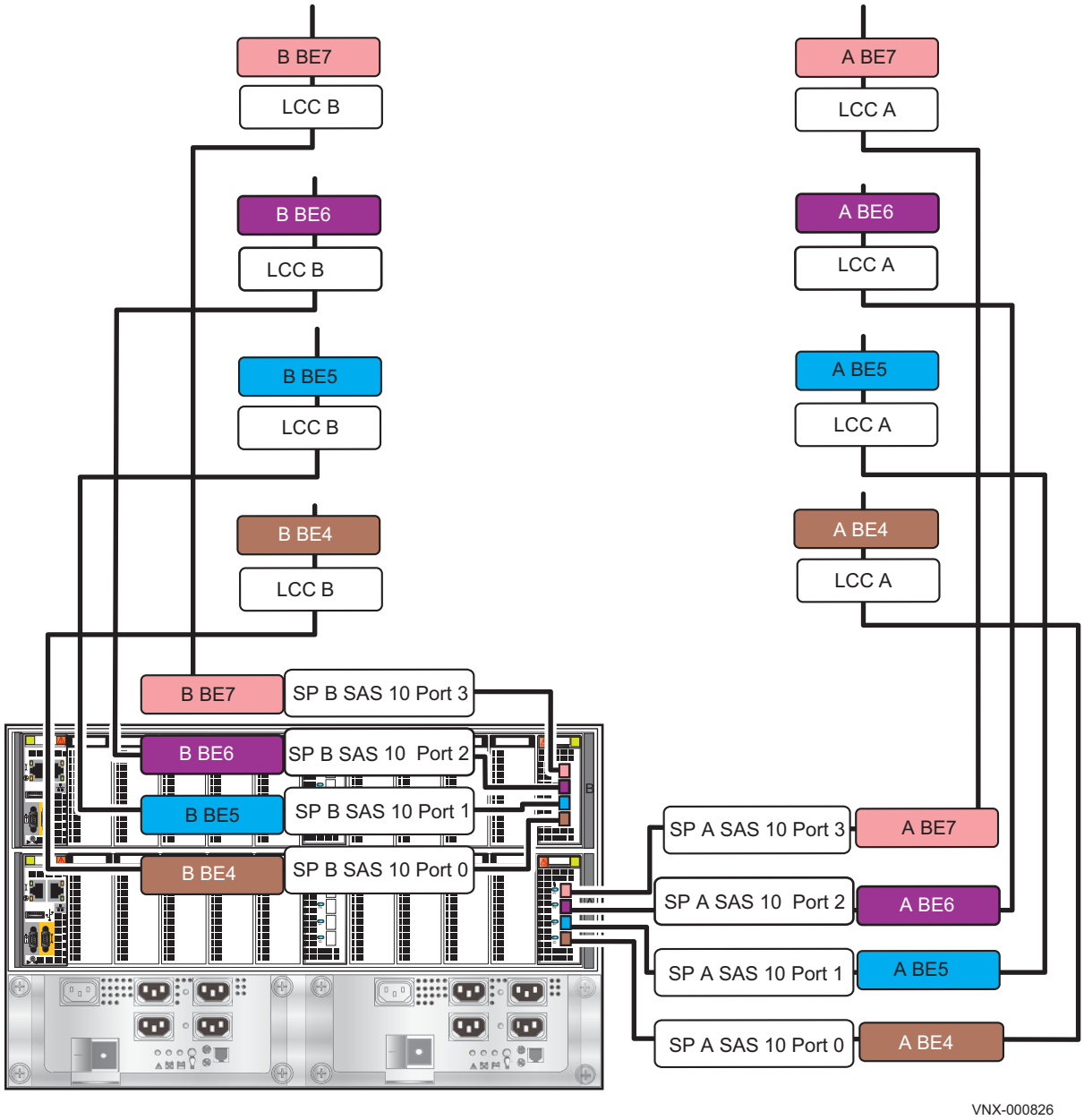


Figure 122 Example continuation of an eight-bus factory version of a VNX8000 with the 6-Gb/s SAS I/O module in slot 10

Eight-bus factory-shipped Block interleaved configuration

Figure 123 shows an example of two 40U racks having thirty-two 2U, 25 DAEs configured in a Block interleaved configuration.

Note: The examples show a system with 800 drives.

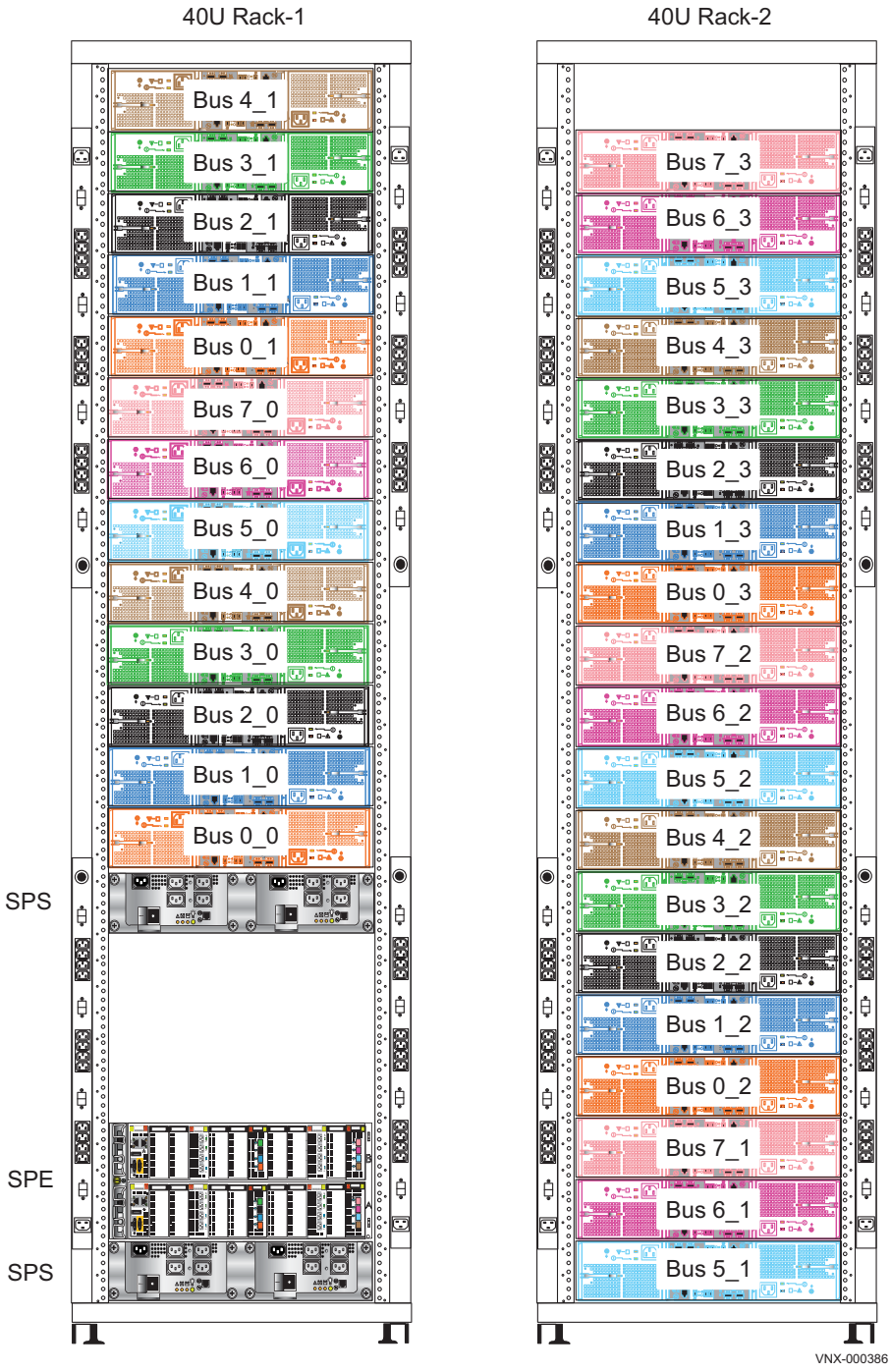


Figure 123 Example of thirty-two 2U, 25 DAEs in a Block interleaved system

Eight-bus factory-shipped Block stacked configuration

Figure 124 shows an example of two 40U racks having thirty-two 2U, 25 DAEs configured in a Block stacked configuration.

Note: The examples show a system with 800 drives.

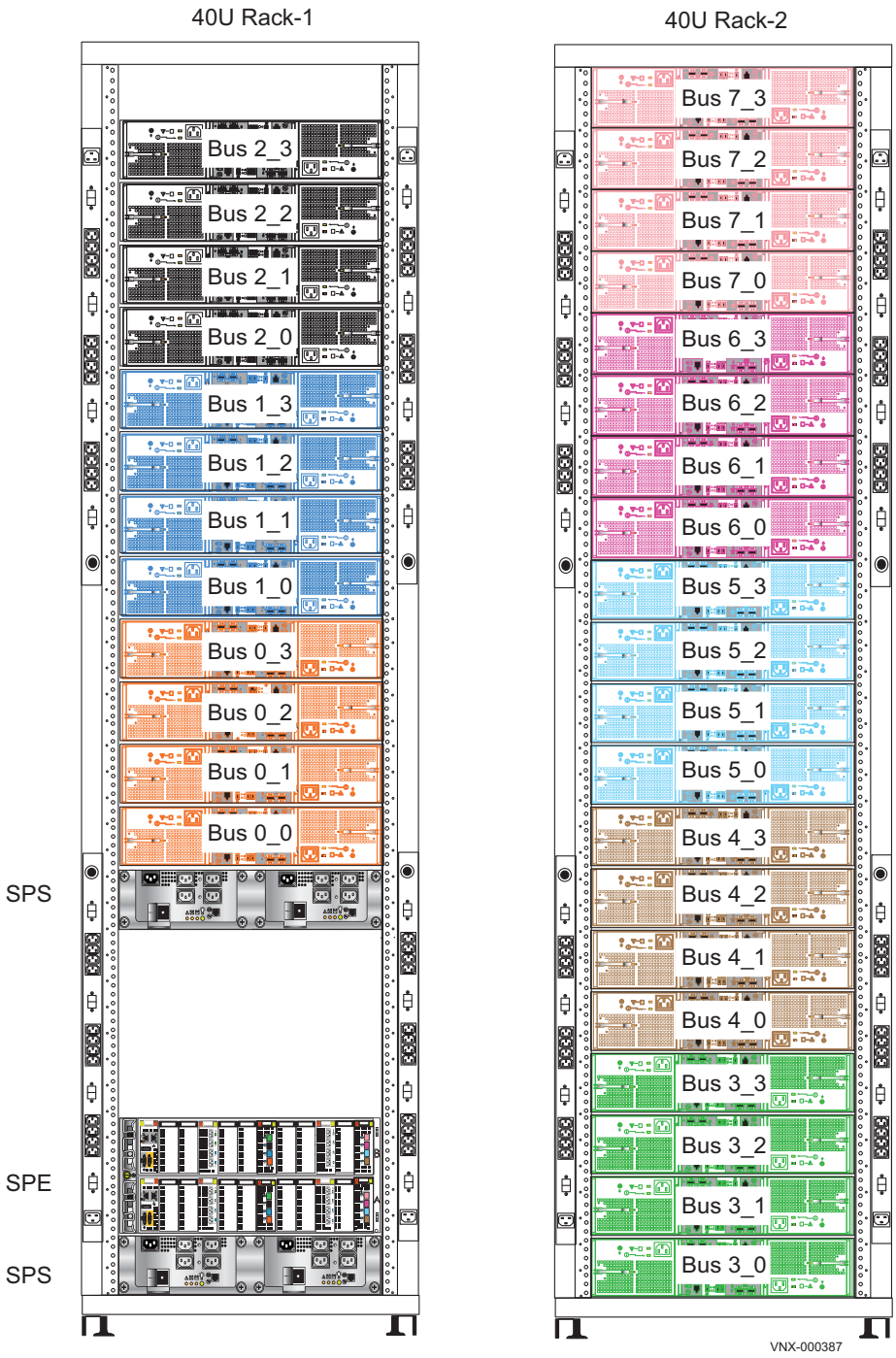


Figure 124 Example of thirty-two 2U, 25 DAEs in a Block stacked system

Sixteen-bus factory-shipped VNX8000 system

The back end port numbering for a VNX8000 is set at system test (at the factory). Ports are identified and numbered, low to high, left to right. The 6-Gb/s SAS I/O modules are in slots 4, 5, 6, and 10 of Storage Processors A and B.

IMPORTANT

Slot 5, port 0 is reserved for connection to the vault drives.

A sixteen bus VNX8000 system with 6-Gb/s SAS I/O modules in slot 4, 5, 6 and 10 supports up to sixteen loops using standard x4 SAS cables (Table 56).

Table 56 A (sixteen-bus) VNX8000 scenario

I/O module slot number	Port	Back-end loop #	SP A an B cable labels (white w/black text)	Back-end loop cable label colors
4	0	1	SP A SAS 4 Port 0 SP B SAS 4 Port 0	Blue
4	1	2	SP A SAS 4 Port 1 SP B SAS 4 Port 1	Black
4	2	3	SP A SAS 4 Port 2 SP B SAS 4 Port 2	Green
4	3	4	SP A SAS 4 Port 3 SP B SAS 4 Port 3	Brown
5	0	0	SP A SAS 5 Port 0 SP B SAS 5 Port 0	Orange
5	1	5	SP A SAS 5 Port 1 SP B SAS 5 Port 1	Cyan
5	2	6	SP A SAS 5 Port 2 SP B SAS 5 Port 2	Purple
5	3	7	SP A SAS 5 Port 3 SP B SAS 5 Port 3	Pink
6	0	8	SP A SAS 6 Port 0 SP B SAS 6 Port 0	Yellow
6	1	9	SP A SAS 6 Port 1 SP B SAS 6 Port 1	Medium gray
6	2	10	SP A SAS 6 Port 2 SP B SAS 6 Port 2	Red
6	3	11	SP A SAS 6 Port 3 SP B SAS 6 Port 3	Tan
10	0	12	SP A SAS 10 Port 0 SP B SAS 10 Port 0	Light blue/green

Table 56 A (sixteen-bus) VNX8000 scenario

I/O module slot number	Port	Back-end loop #	SP A an B cable labels (white w/black text)	Back-end loop cable label colors
10	1	13	SP A SAS 10 Port 1 SP B SAS 10 Port 1	Dark gray/green
10	2	14	SP A SAS 10 Port 2 SP B SAS 10 Port 2	Light gray
10	3	15	SP A SAS 10 Port 3 SP B SAS 10 Port 3	Peach

As described in Table 56, the resulting numbering scheme for a sixteen-bus VNX8000 shipped from the factory is shown in Figure 125 on page 156 through Figure 128 on page 159. These figures show the 6-Gb/s SAS I/O module slot location, port location in the I/O module, and the cable with cable labels from the I/O module side to the LCC side on the respective DAE.

- "Slot 4 (sixteen-bus) configuration" on page 156
- "Slot 5 (sixteen-bus) configuration" on page 157
- "Slot 6 (sixteen-bus) configuration" on page 158
- "Slot 10 (sixteen-bus) configuration" on page 159

The next two illustrations show examples of how the 2U, 25 DAEs are deployed in two 40U racks of a Block interleaved and a Block stacked sixteen-bus system.

- "Sixteen-bus factory-shipped Block interleaved configuration" on page 160
- "Sixteen-bus factory-shipped Block stacked configuration" on page 161

Slot 4 (sixteen-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 4), the I/O module port locations (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 125 on page 156). For more information, refer to Table 56 on page 154.

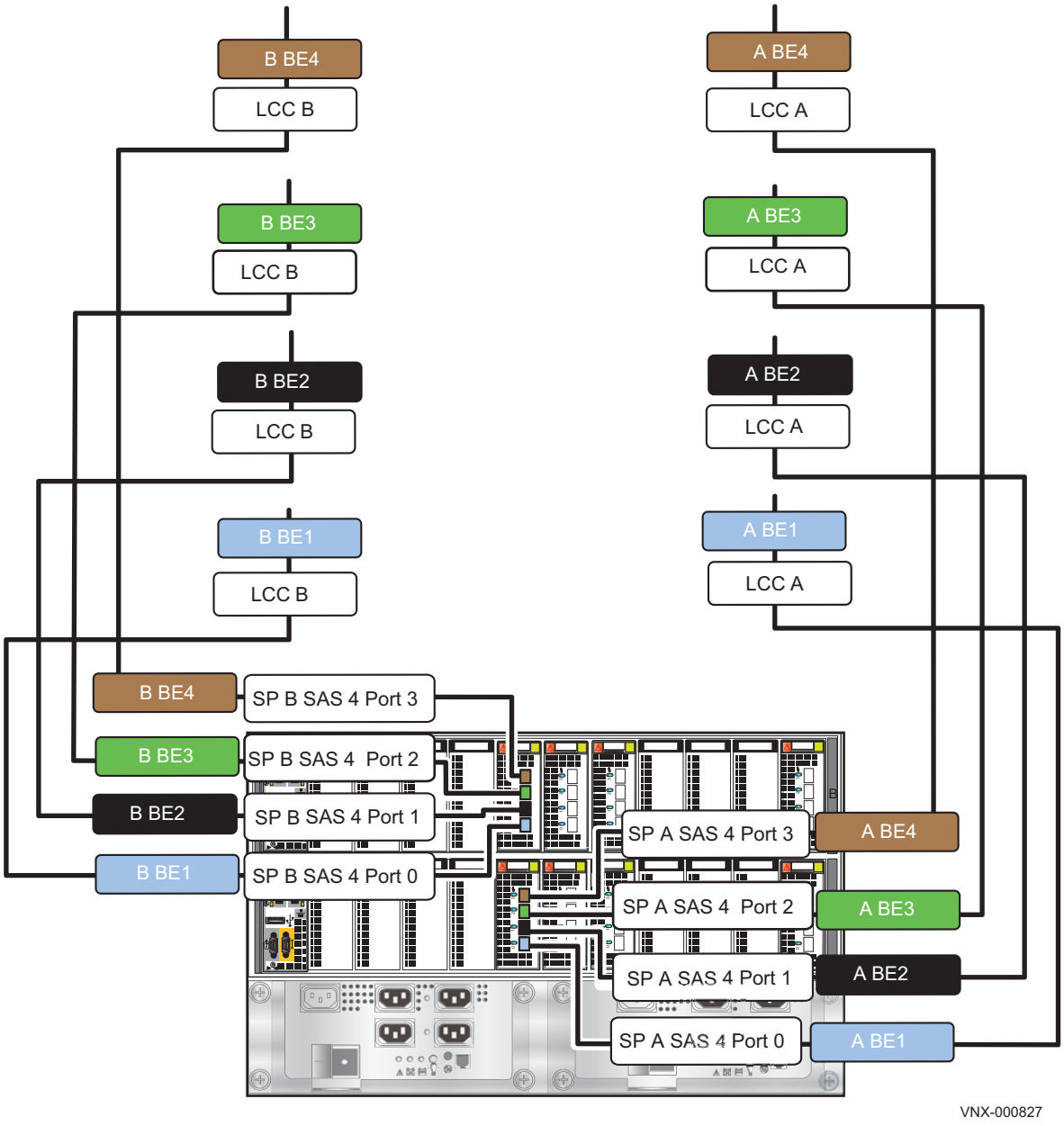


Figure 125 Example of a 16-bus factory version of a VNX8000 with the 6-Gb/s SAS I/O module in slot 4

Slot 5 (sixteen-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 5), the I/O module port locations (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 126). For more information, refer to Table 56 on page 154.

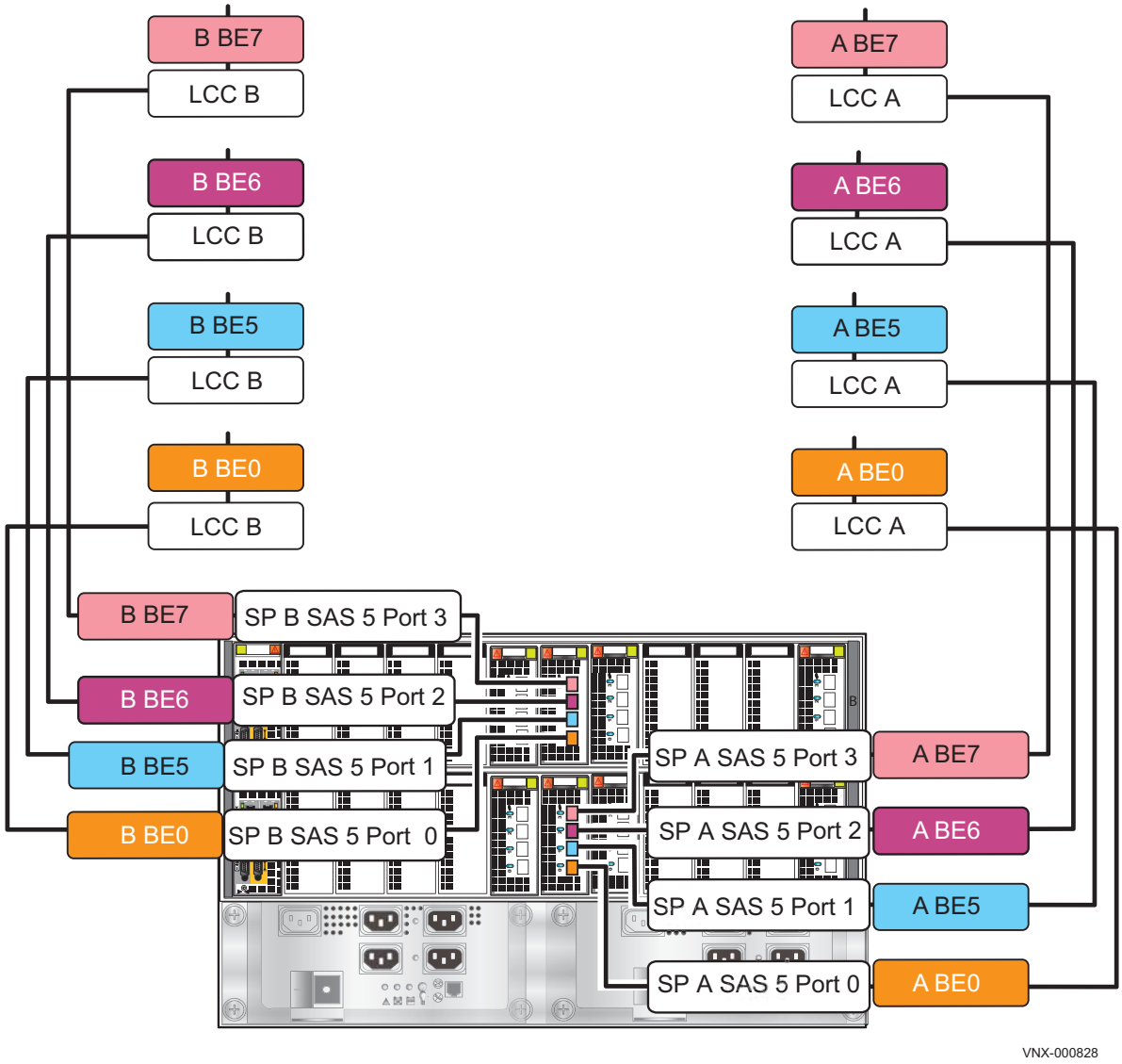


Figure 126 Example continuation of a sixteen-bus factory version of a VNX8000 with the 6-Gb/s SAS I/O module in slot 5

Slot 6 (sixteen-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 6), the I/O module port locations (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 127). For more information, refer to Table 56 on page 154.

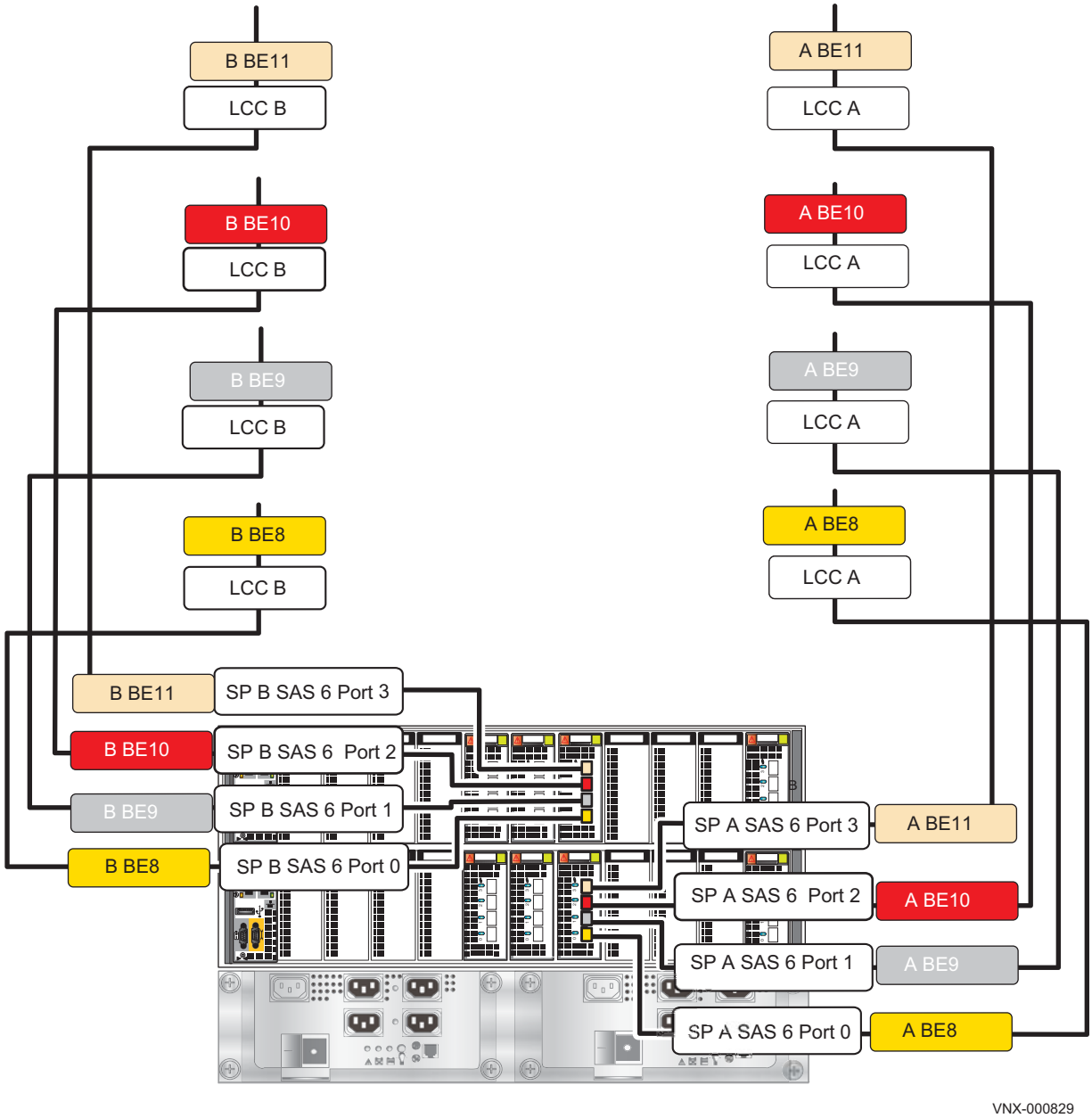


Figure 127 Example continuation of a sixteen-bus factory version of a VNX8000 with the 6-Gb/s SAS I/O module in slot 6

Slot 10 (sixteen-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 10), the I/O module port locations (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 128). For more information, refer to Table 56 on page 154.

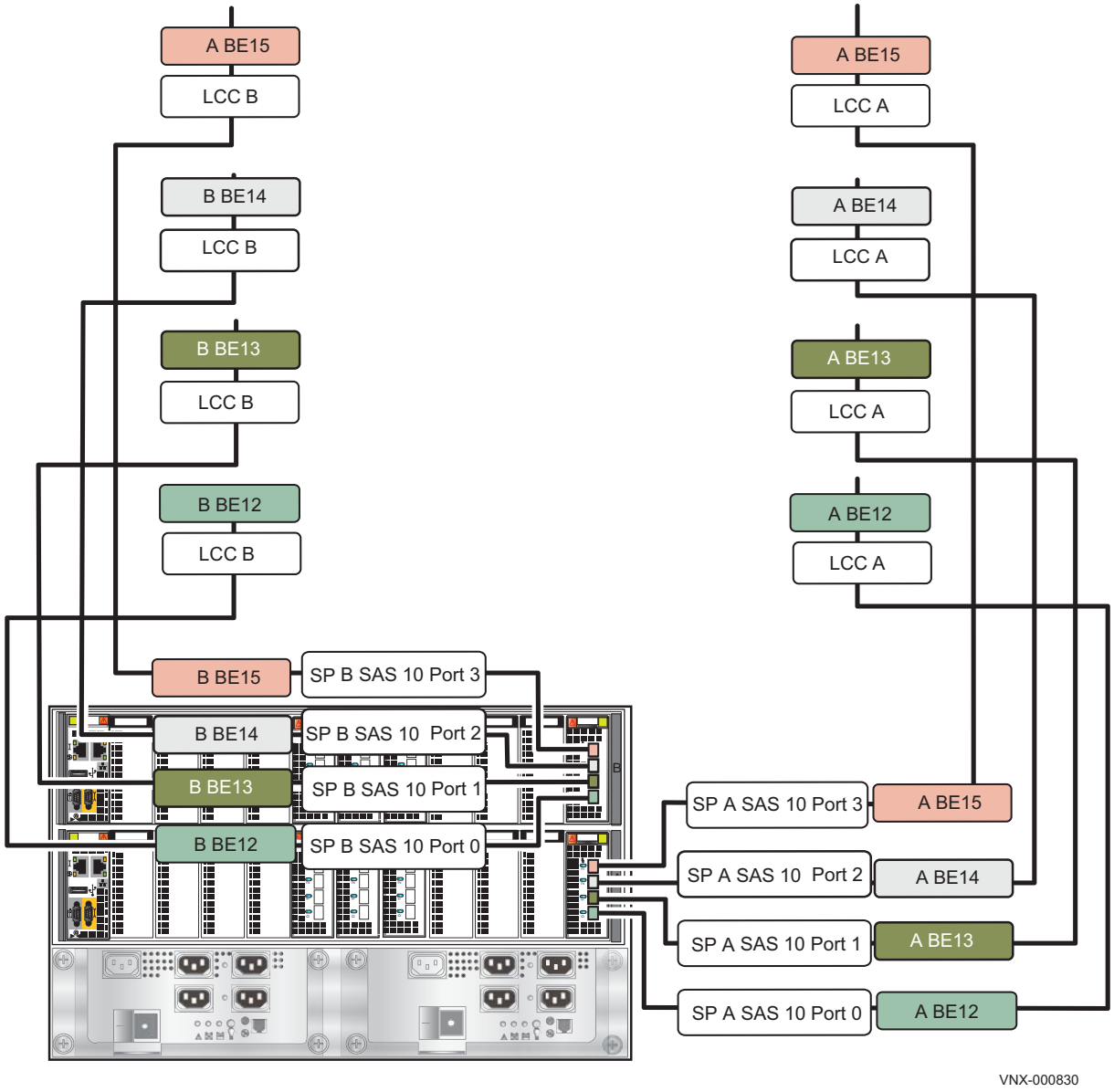


Figure 128 Example continuation of a sixteen-bus factory version of a VNX8000 with the 6-Gb/s SAS I/O module in slot 10

Sixteen-bus factory-shipped Block interleaved configuration

Figure 123 shows an example of two 40U racks having thirty-two 2U, 25 DAEs configured in a Block interleaved configuration.

Note: The examples show a system with 800 drives.

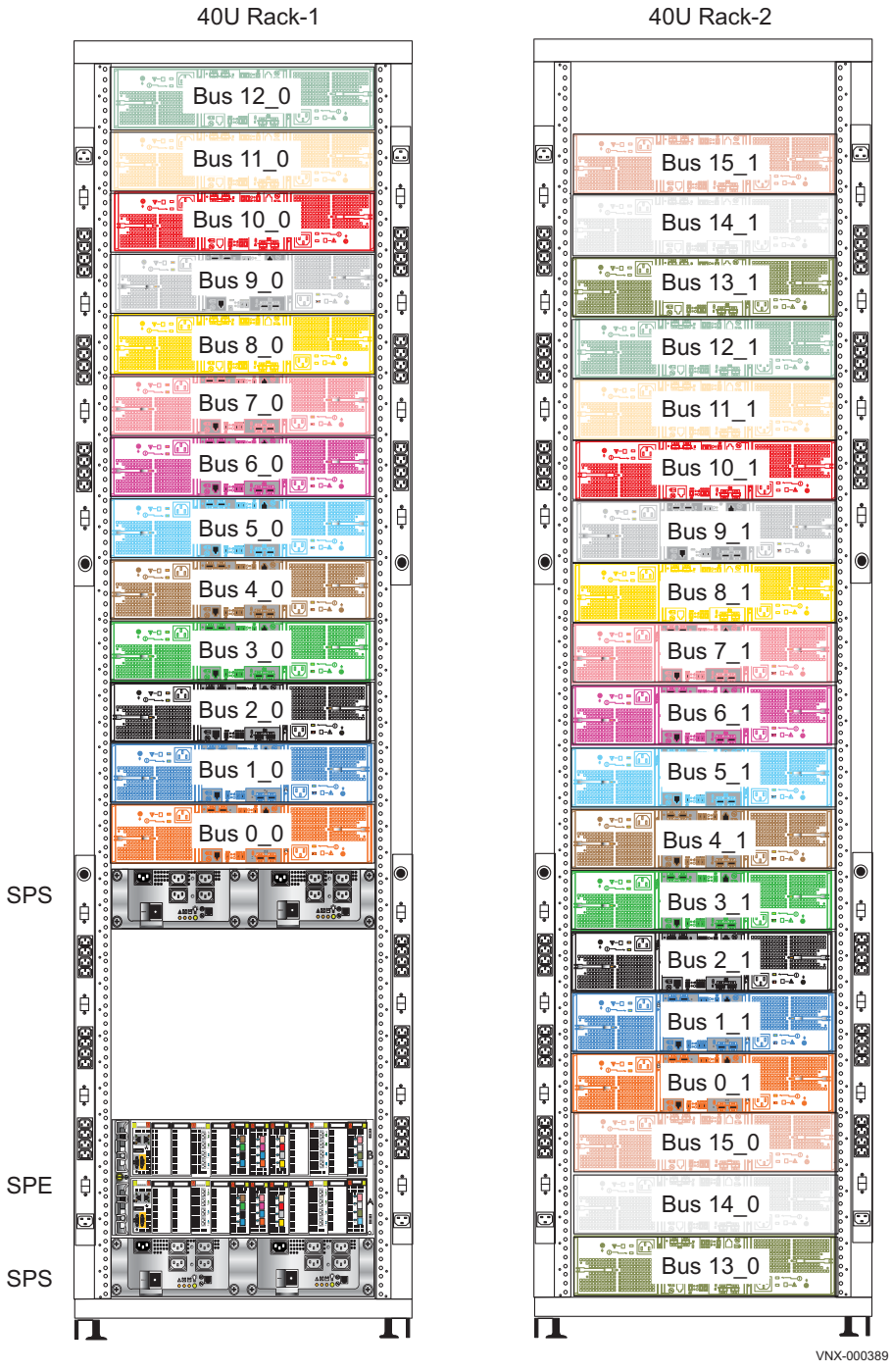


Figure 129 Example of thirty-two 2U, 25 DAEs in a Block interleaved system

Sixteen-bus factory-shipped Block stacked configuration

Figure 124 shows an example of two 40U racks having thirty-two 2U, 25 DAEs configured in a Block stacked configuration.

Note: The examples show a system with 800 drives.

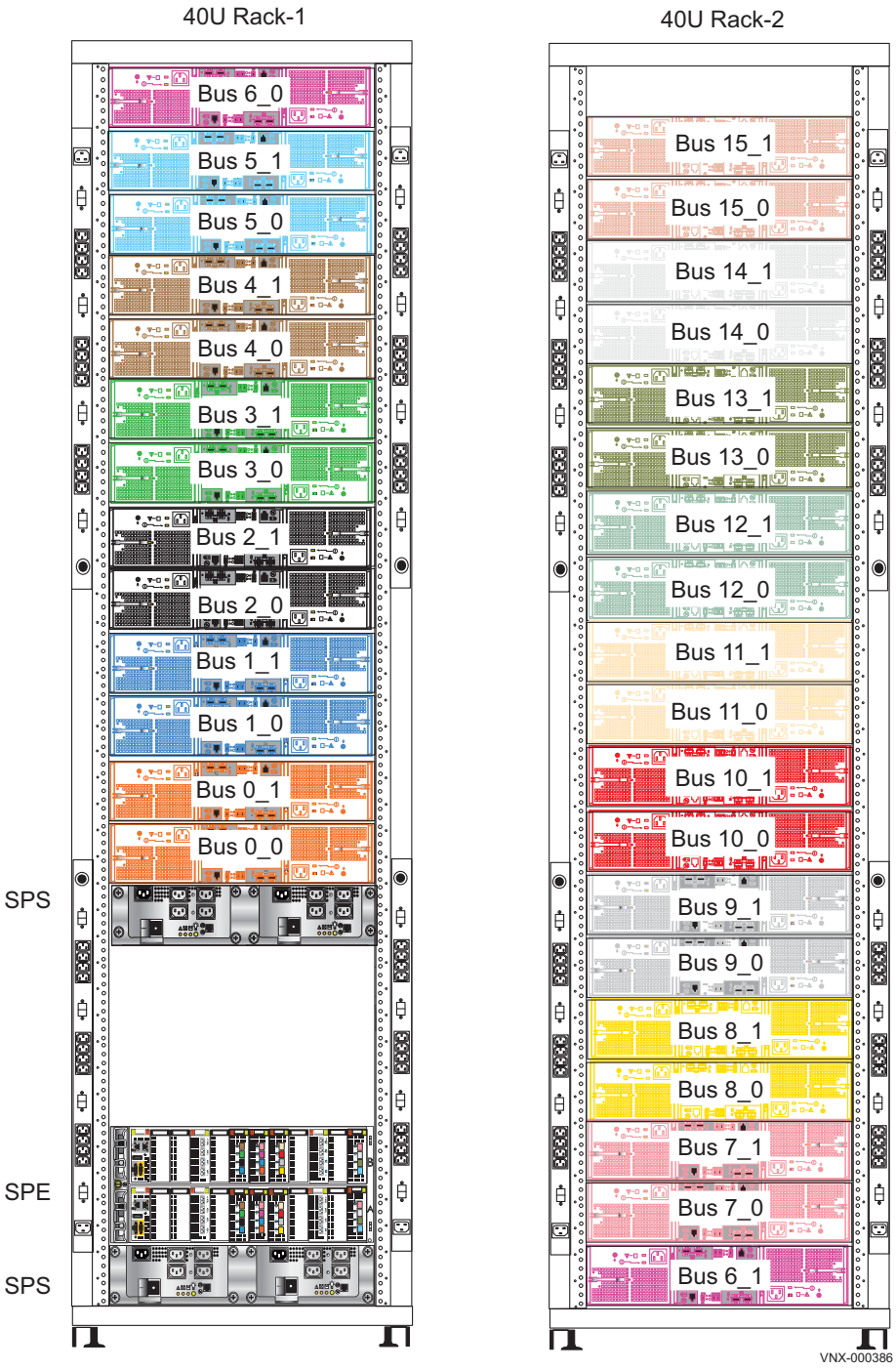


Figure 130 Example of thirty-two 2U, 25 DAEs in a Block stacked system

Upgrading an eight-bus system to a sixteen-bus system

An eight-bus VNX8000 system with 6-Gb/s SAS I/O modules in slots 5 and 10 of Storage Processors A and B supports up to eight loops using standard x4 SAS cables.

Table 57 describes the 6-Gb/s SAS I/O module slot, port, back-end loop or bus number, and cable label color for an eight-bus system.

Table 57 An eight-bus VNX8000 scenario

I/O module slot number	Port	Back-end loop #	SP A an B cable labels (white w/black text)	Back-end loop cable label colors
5	0	0	SP A SAS 5 Port 0 SP B SAS 5 Port 0	Orange
5	1	1	SP A SAS 5 Port 1 SP B SAS 5 Port 1	Blue
5	2	2	SP A SAS 5 Port 2 SP B SAS 5 Port 2	Black
5	3	3	SP A SAS 5 Port 3 SP B SAS 5 Port 3	Green
10	0	4	SP A SAS 10 Port 0 SP B SAS 10 Port 0	Brown
10	1	5	SP A SAS 10 Port 1 SP B SAS 10 Port 1	Cyan
10	2	6	SP A SAS 10 Port 2 SP B SAS 10 Port 2	Purple
10	3	7	SP A SAS 10 Port 3 SP B SAS 10 Port 3	Pink

As described in Table 57, the resulting numbering scheme for an eight-bus VNX8000 shipped from the factory is shown in Figure 131 on page 163 and Figure 132 on page 164. These figures show the 6-Gb/s SAS I/O module slot location, port location in the I/O module, and the cable with cable labels from the I/O module side to the LCC side on the respective DAE.

- “Slot 5 (eight-bus) configuration” on page 163
- “Slot 10 (eight-bus) configuration” on page 164

Slot 5 (eight-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 5), the I/O module port location (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 131). For more information, refer to Table 57 on page 162.

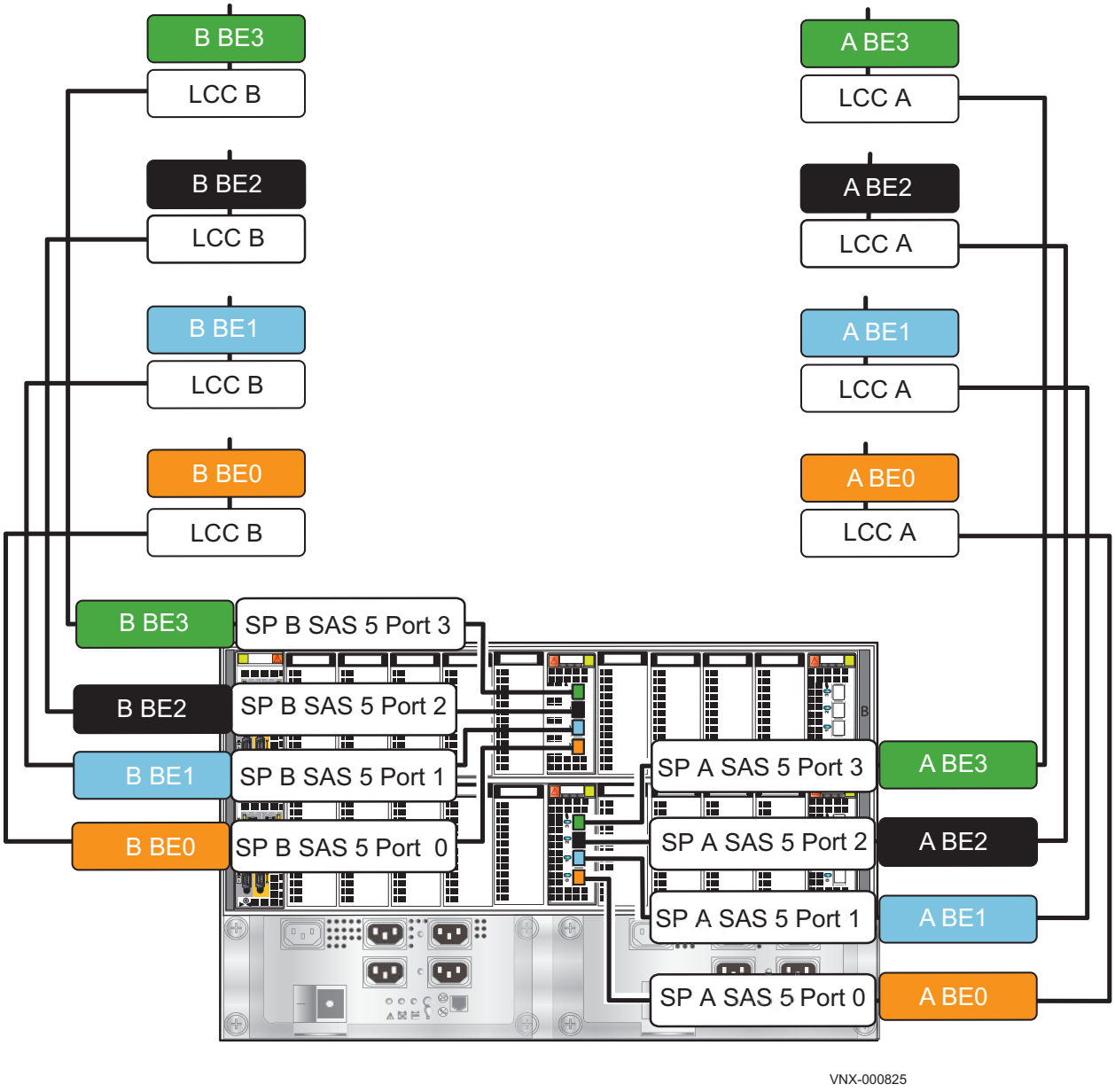


Figure 131 Example of an eight-bus configuration of a VNX8000 with the 6-Gb/s SAS I/O module in slot 5

Slot 10 (eight-bus) configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 10), the I/O module port location (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 132). For more information, refer to Table 57 on page 162.

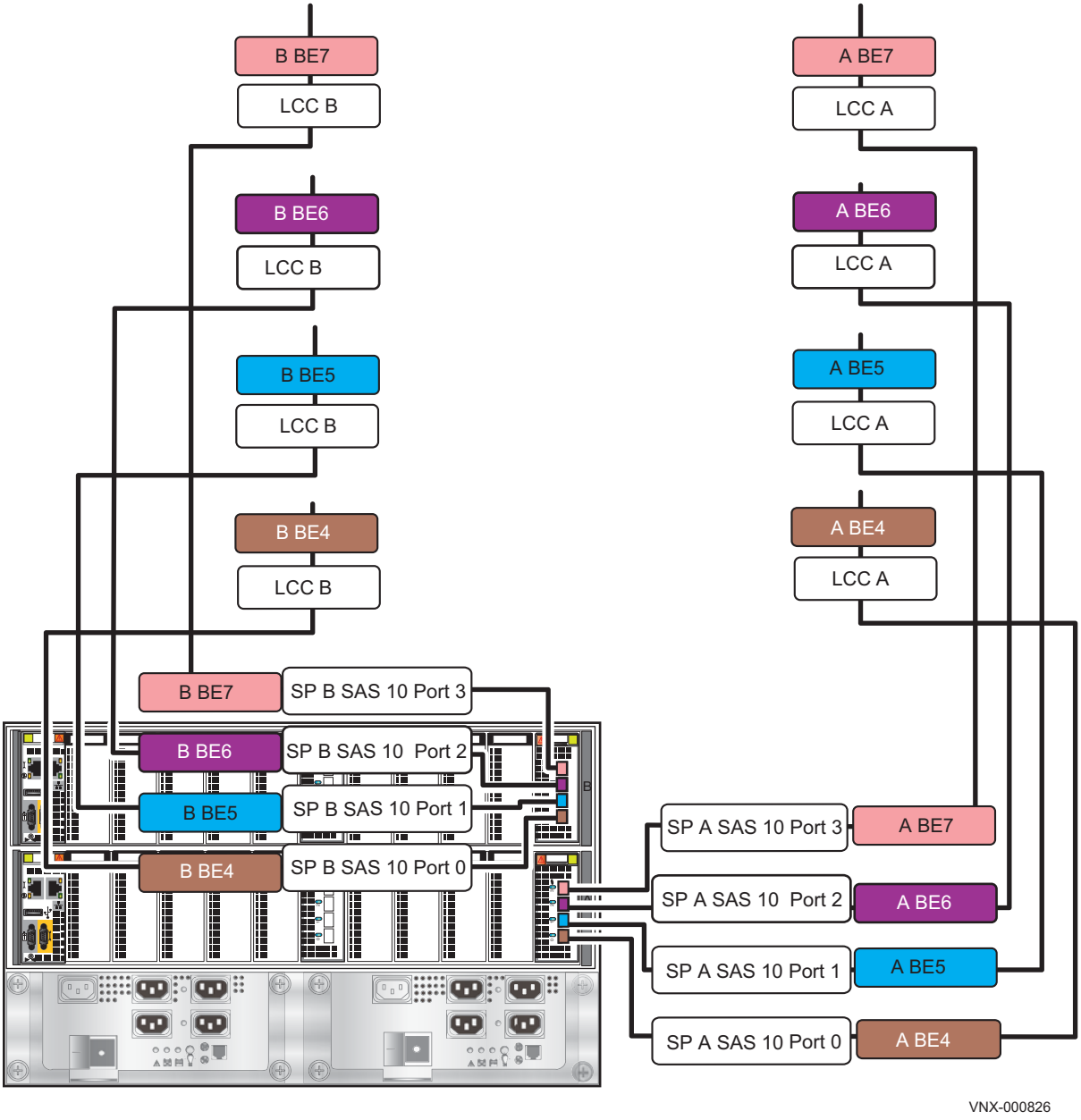


Figure 132 Example continuation of an eight-bus configuration of a VNX8000 platform with the SAS I/O module in slot 10

Upgrade to a sixteen-bus system

To upgrade to a sixteen-bus system, add two more 6-Gb/s SAS I/O modules to slots 4 and 6 of the eight-bus system in Storage Processors A and B (Table 58).

Table 58 A VNX8000 (sixteen-bus) scenario

I/O module slot number	Port	Back-end loop #	SP A an B cable labels (white w/black text)	Back-end loop cable label colors
5	0	0	SP A SAS 5 Port 0 SP B SAS 5 Port 0	Orange
5	1	1	SP A SAS 5 Port 1 SP B SAS 5 Port 1	Blue
5	2	2	SP A SAS 5 Port 2 SP B SAS 5 Port 2	Black
5	3	3	SP A SAS 5 Port 3 SP B SAS 5 Port 3	Green
10	0	4	SP A SAS 10 Port 0 SP B SAS 10 Port 0	Brown
10	1	5	SP A SAS 10 Port 1 SP B SAS 10 Port 1	Cyan
10	2	6	SP A SAS 10 Port 2 SP B SAS 10 Port 2	Purple
10	3	7	SP A SAS 10 Port 3 SP B SAS 10 Port 3	Pink
4	0	8	SP A SAS 4 Port 0 SP B SAS 4 Port 0	Yellow
4	1	9	SP A SAS 4 Port 1 SP B SAS 4 Port 1	Medium gray
4	2	10	SP A SAS 4 Port 2 SP B SAS 4 Port 2	Red
4	3	11	SP A SAS 4 Port 3 SP B SAS 4 Port 3	Tan
6	0	12	SP A SAS 6 Port 0 SP B SAS 6 Port 0	Light blue/green
6	1	13	SP A SAS 6 Port 1 SP B SAS 6 Port 1	Dark gray/green
6	2	14	SP A SAS 6 Port 2 SP B SAS 6 Port 2	Light gray
6	3	15	SP A SAS 6 Port 3 SP B SAS 6 Port 3	Peach

As described in Table 58 on page 165, the resulting numbering scheme for the upgraded VNX8000 is shown in Figure 133 on page 166 and Figure 134 on page 167. These figures show the 6-Gb/s SAS IO module slot location, the port location in the I/O module, and the cable labels from the I/o module side to the LCC side on the respective DAE.

- "Slot 4 (sixteen-bus) upgraded configuration" on page 166
- "Slot 6 (sixteen-bus) upgraded configuration" on page 167

Slot 4 (sixteen-bus) upgraded configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 4), the I/O module port location (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 133). For more information, refer to Table 57 on page 162.

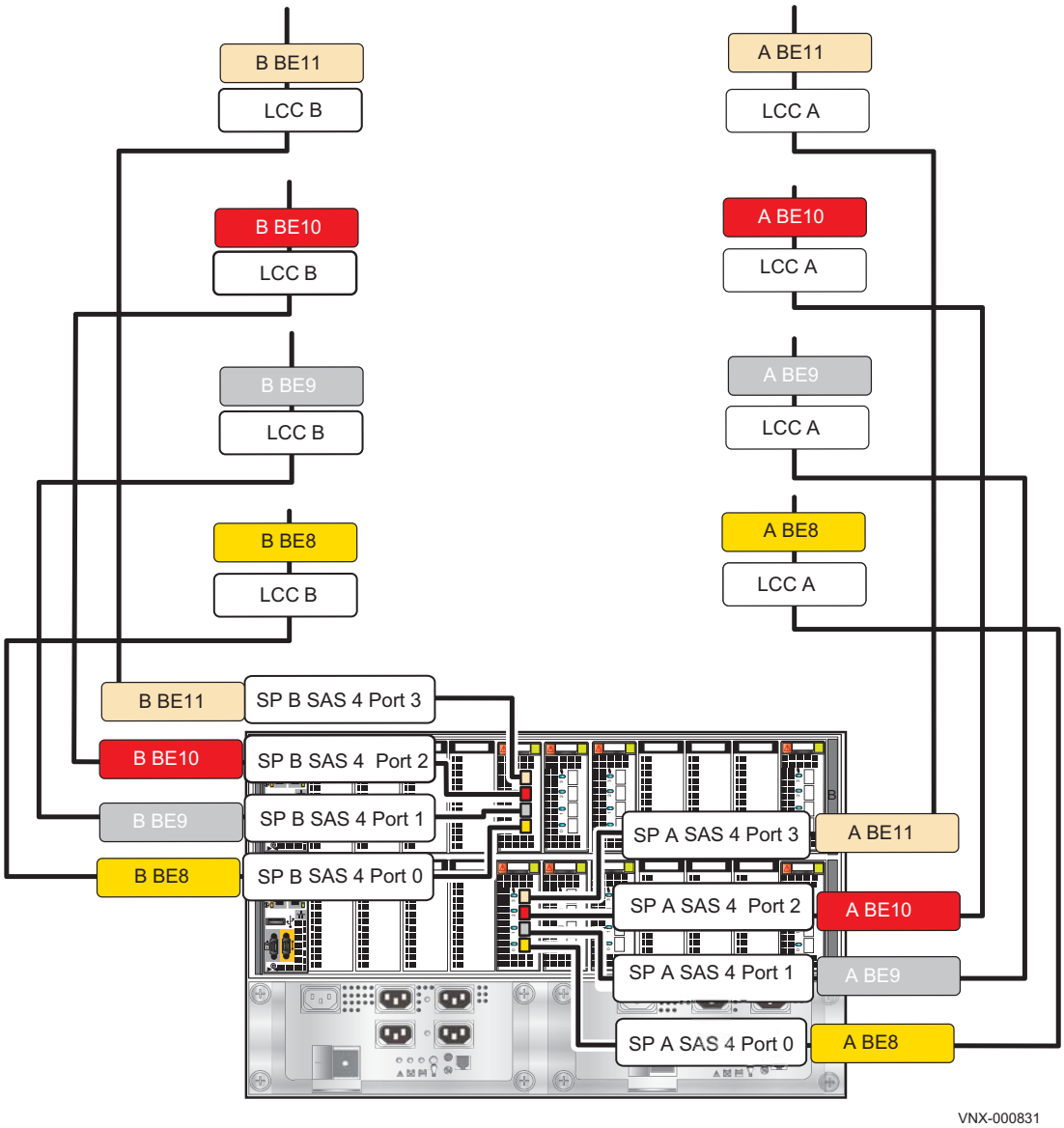


Figure 133 Example continuation of a sixteen-bus upgrade configuration of a VNX8000 with the 6-Gb/s SAS I/O module in slot 4

Slot 6 (sixteen-bus) upgraded configuration

The following figure shows the location of the 6-Gb/s SAS I/O module slot (slot 6), the I/O module port location (0, 1, 2, and 3), and the cable labels for both the I/O module side and the corresponding LCC side in the DAE it connects to (Figure 134). For more information, refer to Table 57 on page 162.

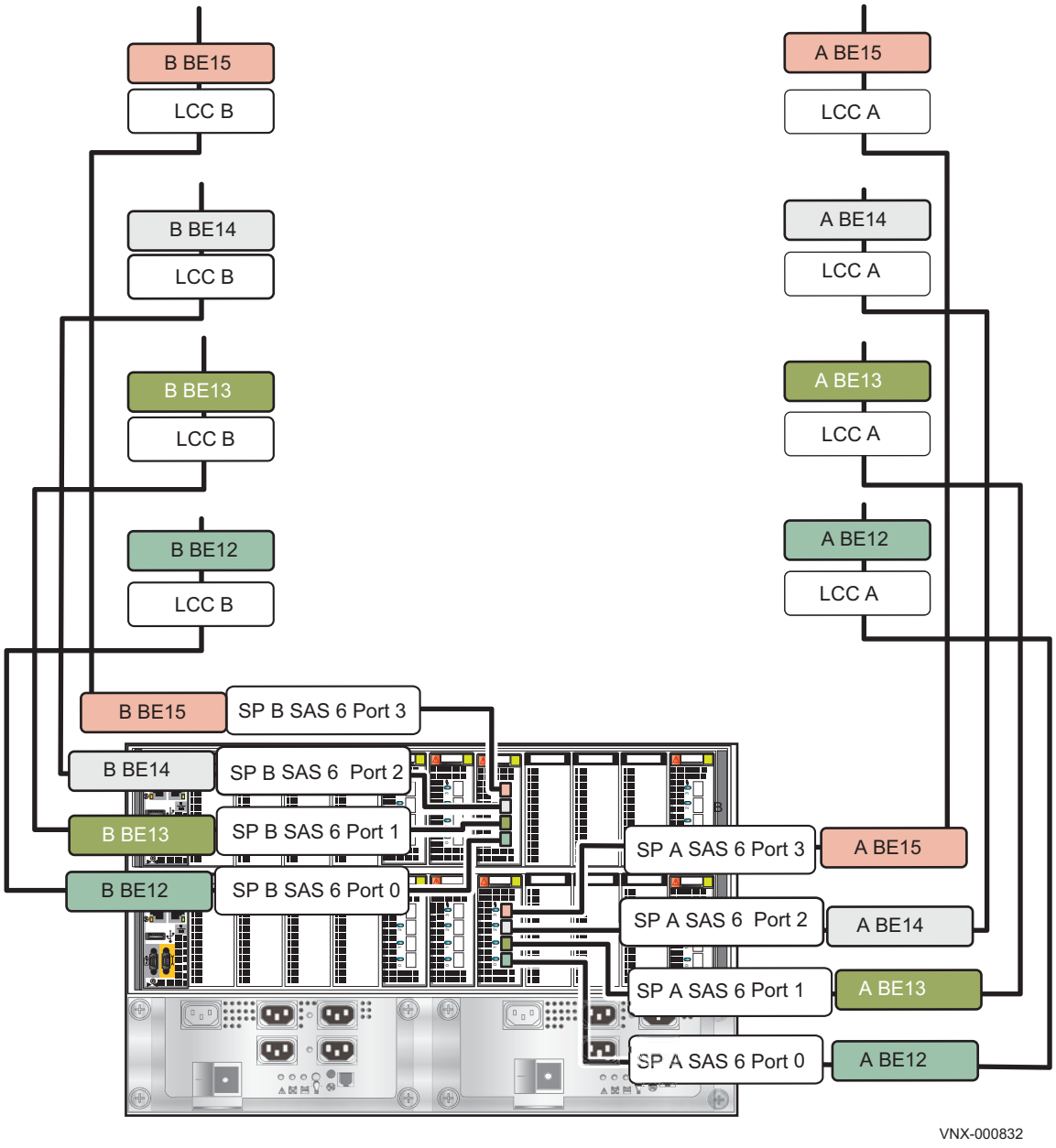


Figure 134 Example continuation of a sixteen-bus upgrade configuration of a VNX8000 with the 6-Gb/s SAS I/O module in slot 6

Appendix B: Field lift tool and accessory kit

IMPORTANT

The portable (mechanical) lift tool described in this appendix is recommended as a safety precaution when lifting EMC components into an EMC or customer-provided rack. As described in this Appendix, many of the EMC components are too heavy to be lifted by one person or in some cases by two persons. As a result, this portable (mechanical) lift tool is a necessary safety requirement, especially when lifting EMC components like the 3U, 120 and the 4U, 60 DAEs.

A portable (mechanical) lift (called the Trav-a-Lift Field Lift Tool, manufactured by Alum-a-Lift Corp of Winston, GA) is a portable, lightweight aluminum lift for field use. This lift tool is used to rack mount heavy EMC hardware in an EMC or customer-provided rack. It can be operated either manually, or with the included cordless drill. Lift assembly is aided by color coded and lettered alignment labels for safe, accurate, and quick assembly. Each kit contains assembly instructions.

IMPORTANT

It is recommended that All EMC support/partners review the *Field Lift Tool* and *Accessory Kit* guides available within the SolVE desktop application.

The Lift Tool can support up to 400 pounds (181 Kg) from the floor to a height of up to 49 inches (124 cm). If access to the top of a rack is needed a second mast can be mounted to the first mast to lift heavy components to the top of the rack. The trade-off is the second mast can only support 115 pounds (52 Kg). As of this writing, the lift tool alone can support all but the heaviest enclosures, such as the 60-drive DAE. An accessory kit is needed to lift the heaviest enclosures higher in the rack.

Generally, a portable (mechanical) lift (Figure 135 on page 170) is needed when one person is mounting a component weighing more than 40 pounds (88 kg), or two persons mounting a component weighing more than 80 pounds (176.3 kg). The capacity of the lift varies by mounting height as previously described. Table 59 describes when a portable (mechanical) lift alone is needed. In some cases an accessory kit is also needed. There is no case where only the accessory kit is needed.

Table 59 Portable lift and accessory kit requirements

Height	Weight	Portable lift	Accessory kit
0 to 28U 0 to 4.08 ft 0 to 1.24 m	Less than 400 pounds (181 kg)	Required	Not required
28 to 40U 4.08 ft to 5.83 ft 1.25 m to 1.78 m	Less than 225 pounds (102 kg)	Required	Required
28 to 40U 4.08 ft to 5.83 ft 1.25 m to 1.78 m	Less than 115 pounds (52 kg)	Required	Not required

Table 60 describes the approximate weight of the VNX-series enclosures used in the VNX storage systems (including all FRUs installed).

Table 60 VNX-series enclosure weight comparisons (lb vs. kg)

VNX-series enclosure	Weight (lb)	Weight (kg)
Disk processor enclosure (DPE), 15-drive	97	44
Disk processor enclosure (DPE), 25-drive	75	34
Storage processor Enclosure (SPE)	53	24
Data Mover enclosure (DME)	53	24
Control Station (CS)	18	8
Standby power supply (SPS) 1U 1.2 kW	47	22
Standby power supply (SPS) 2U 2.2 kW	79	36
Disk-array enclosure (DAE) 3U, 15-drive	68	31
Disk-array enclosure (DAE) 2U, 25-drive	45	20
Disk-array enclosure (DAE) 4U, 60-drive	215	98
Disk-array enclosure (DAE) 3U, 120-drive	165	74.8

⚠CAUTION

The portable lift commonly used by EMC service personnel has two configurations—one with the lower mast only and one with both the lower and upper masts. The lower mast configuration is rated for 400 pounds (181 kg) and is for raising or lowering objects 28U (4.08 ft, 1.25 m) or less above the floor. The dual mast configuration is rated well under 200 pounds (90.7 kg) and is for raising objects more than 28U (4.08 ft, 1.25 m) above the floor.

• For installations at or below 4.08 ft (1.25 m), you must use the lower mast configuration.

• For installations above 4.08 ft (1.25 m), use the accessory kit, rated for 225 pounds (102 kg), and a support table with the lower mast configuration. This accessory kit and support table are available from the lift provider.

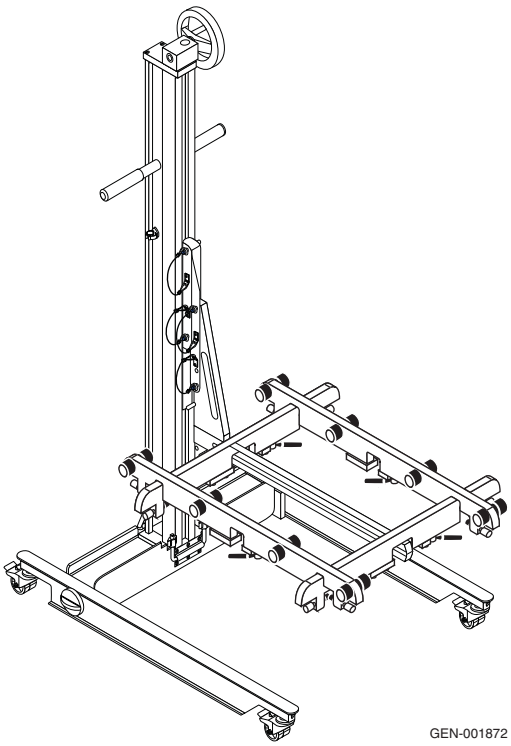


Figure 135 Example of a Alum-A-Lift with the accessory kit applied

For more information, refer to *EMC® DAE8S (120 disk Disk-Array Enclosure) Installation Notes* document or the *Field Lift Tool and Accessory Kit* procedure.

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