EMC® VNX™ Family
VNX5500™

Hardware Information Guide

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This guide describes one of five models available in the VNX Series, the EMC® VNX5500™. This document provides an overview of the architecture, components, and features of the VNX5500 platform. The specific aspects of the Block, File, and Unified VNX5500 platform and its major components include the front and rear connectors and LED indicators on the 3U, 15 (3.5-inch) or 3U, 25 (2.5-inch) disk processor enclosure (DPE), the 1U standby power supply (SPS), the 1U Control Station, the 2U Data Mover enclosure (DME), and the 3U, 15 (3.5-inch), 2U, 25 (2.5-inch), or the 4U, 60 (2.5- to 3.5-inch) disk drive disk-array enclosure (DAE).

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

Topics include:

EMC²

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.

Revision history

The following table presents the revision history of this document:

Revision	Date	Description
01	June 25, 2012	First release of the *VNX5500 Hardware Information Guide* with a document part number.

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:

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How this document is organized

The major sections of this guide are listed in the following table.

Title	Description
"Overview" on page 4	Describes the software and hardware features of a typical VNX5500 along with a front view example of the VNX5500.
"VNX5500 Block and File product description" on page 6	Describes and shows the front and rear views of a typical VNX5500.
"System component description" on page 12	Provides a description of the components that comprise a VNX5500. Along with a description, illustrations of each component are also shown.
"DPE front views" on page 12	Describes and illustrates the front of a DPE and the components that comprise the front of the DPE.
"Control Station front view" on page 16	Describes and illustrates the front view of the Control Station used in the VNX5500.
"DME front view" on page 19	Describes and illustrates the front of the DME and the components that comprise the front of the DME.
"Standby power supply rear view" on page 21	Describes and illustrates the 1U SPS used in the VNX5500.
"DPE rear view" on page 26	Describes and illustrates the rear of a DPE and the components that comprise the rear of the DPE.
"Control Station rear view" on page 38	Describes and illustrates the rear view of the Control Station used in the VNX5500.
"DME rear view" on page 43	Describes and illustrates the rear of the DME and the components that comprise the rear of the DME.
"Disk-array enclosure" on page 71	Describes and illustrates the three types of DAEs available for the VNX5500.
"VNX5500 DAE cabling" on page 104	Describes the types of DAE cabling available for the VNX5500 platform. The cabling can be either interleaved or stacked depending on your specific requirements.

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 books, go to the **About VNX** section, and then select **Learn about VNX**. Next, follow the steps in the wizard.

◆ For technical specifications, go to the **About VNX** section, and then select **View technical specifications**. Next, follow the steps in the wizard.

◆ For installation, adding, or replacing tasks, go to the **VNX tasks** section, and then select the appropriate heading. For example, to download a PDF copy of the *VNX5500 Block Installation Guide*, go to **Install VNX** and follow the steps in the wizard.

◆ For server-related tasks, go to the **Server tasks for the VNX5300, VNX5500, VNX5700, and VNX7500** section, and then select the appropriate heading. For example, to download a PDF copy of Adding or replacing hardware, go to **Add or replace hardware** and follow the steps in the wizard.

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[1] (Internet Small Computer System Interface), Fiber Channel, and Fibre Channel over Ethernet (FCoE) protocols. The VNX series is based on Intel Xeon-based PCI Express 2.0 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.

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

The VNX5500 is a mid-range/mid tier storage platform. It offers Block, File, or Unified Block and File services. These services consist of:

◆ **Block-only**—Includes a 3U disk processor enclosure (DPE), a 1U 1.2 KW standby power supply (SPS), and 2U or 3U disk-array enclosures (DAEs) for holding hard disk drives that are integrated to facilitate Fibre Channel, Fibre Channel over Ethernet (FCoE), and iSCSI Block services to Windows® and UNIX® hosts.

◆ **File-only**—Adds the 2U Data Mover enclosure (DME) and 1U Control Station (CS) to the 3U DPE, 1U SPS, and 2U, 3U, or 4U DAEs to facilitate file services to CIFS/NFS clients.

◆ **Unified Block and File**—Uses the same hardware as the File-only configuration but adds FC, iSCSI, and FCoE I/O connectivity to provide Block services to host simultaneously so as to provide File services to clients.

The VNX5500 platform supports two types of 3U DPEs and three types of DAEs. The 3U DPEs supported are a 15 drive 3.5-inch disk 3U enclosure (or DPE7) and a 25 drive 2.5-inch disk 3U enclosure (or DPE8). The DAEs supported are a 15 drive 3.5-inch disk 3U enclosure (or DAE6S), a 25 drive 2.5-inch disk 2U enclosure (or DAE5S), and a 60 drive

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

2.5- or 3.5-inch disk 4U enclosure (or DAE7S). Expansion of up to fifteen 3U DAEs (a maximum of 240 3.5-inch disk drives), up to nine 2U DAEs (a maximum of 250 2.5-inch disk drives), or up to a combination of three 4U DAEs and three 3U DAEs (a maximum of 240 disk drives) is possible.

Note: The 4U DAEs are only available in a factory installable Dense rack configuration. For more information, see the "4U, 60 (2.5- or 3.5-inch) DAE" section on page 88.

As a mid-range/mid tier storage platform offering Block, File, and Unified services, the VNX5500 platform (Figure 1) is one of the five models that make up the VNX series. For a quick look at the VNX5500 platform hardware features, see Table 1, "VNX5500 hardware feature quick reference," on page 8.
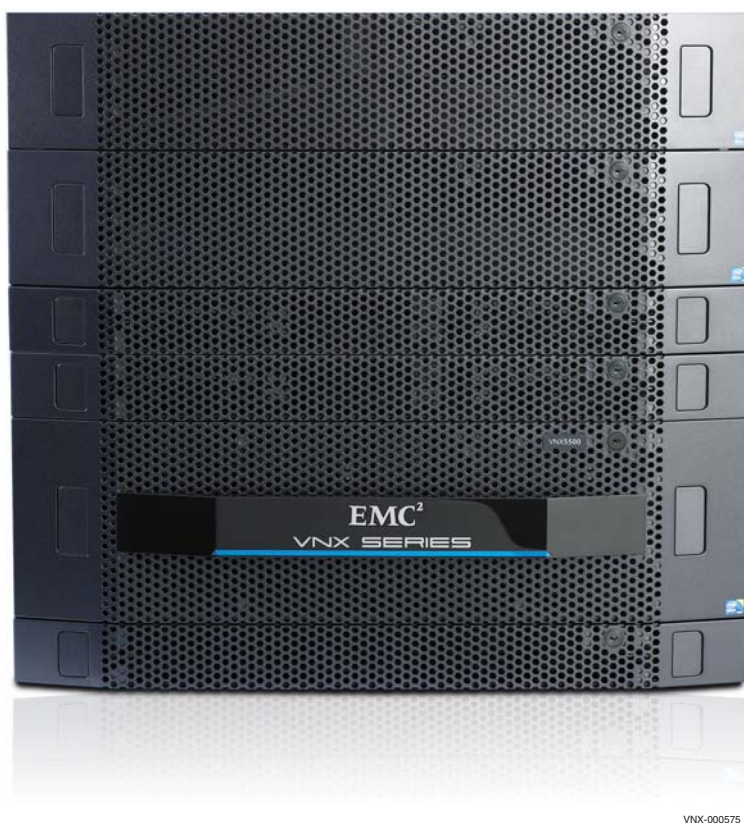

VNX-000575

Figure 1 Example of a Block and File (Unified) VNX5500 platform with front bezel

Note: A VNX5500 Block platform only includes an SPS and a DPE.

VNX5500 Block and File product description

This section shows an example of the front and rear views of a Block and File (Unified) VNX5500 platform.

Note: A fully configured Unified VNX5500 platform includes up to fifteen 3U DAEs (a maximum of 240 3.5-inch disk drives), up to nine 2U DAEs (a maximum of 250 2.5-inch disk drives), or up to a combination of thee 4U DAEs and three 3U DAEs (a maximum of 240 disk drives).

Front view

Figure 2 shows an example of the front view of the Block and File (Unified) VNX5500 platform having a dual 1U SPS, a 3U, 15 (3.5-inch) DPE, two 1U Control Stations (one optional), and two 2U Data Mover enclosures with three Data Movers[1]. Each Data Mover includes two power supply/cooling (fan) modules and one CPU module.
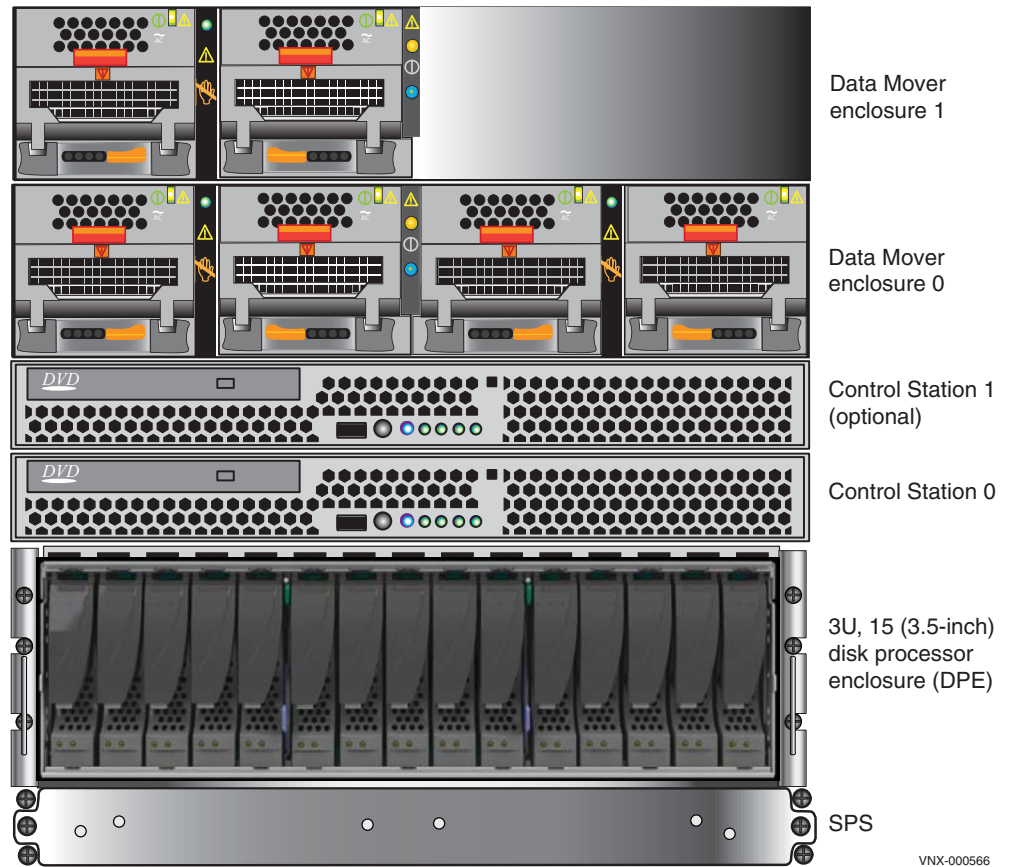

Data Mover enclosure 1

Data Mover enclosure 0

Control Station 1 (optional)

Control Station 0

3U, 15 (3.5-inch) disk processor enclosure (DPE)

SPS

VNX-000566

Figure 2 Example of Block and File (Unified) VNX5500 platform with a 3U, 15 (3.5-inch) DPE (front view)

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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.

Note: Figure 2 on page 6 and Figure 3 are examples of a Block and File (Unified) VNX5500 platform (front and rear views). These examples are for illustrative purposes only.

Rear view

Figure 3 shows an example of the rear view of a Block and File (Unified) VNX5500 platform configuration having a dual 1U SPS, a 3U DPE with two storage processors (SP A and B), two 1U Control Stations (one optional), and two 2U Data Mover enclosures with three Data Movers. Each Data Mover includes two power supply/cooling (fan) modules and one CPU module.
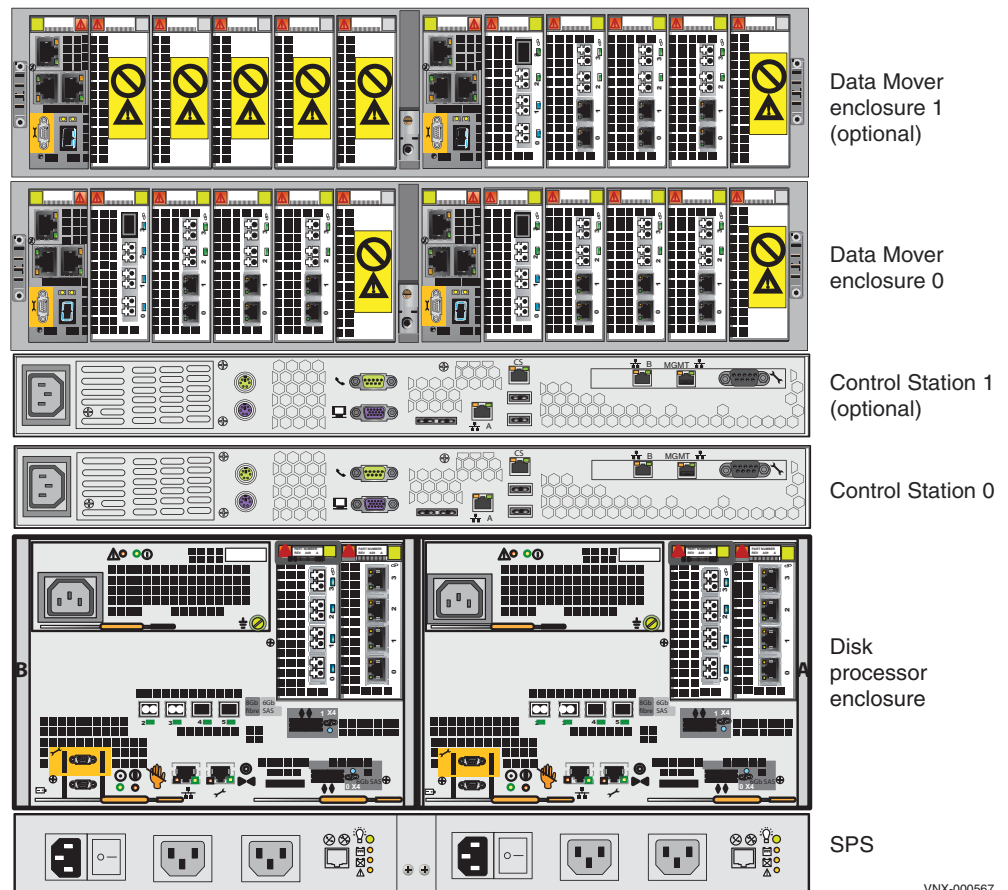

Figure 3 Example of Block and File (Unified) VNX5500 platform (rear view)

Hardware features

Contained in a 7 to 10U architecture, the Block and File (Unified) VNX5500 platform weighs approximately 280.5 lb (127.23 kg) to 303.5 lb (137.67 kg) fully loaded[1] depending on the disk drives used in the 3U DPE. With the 2U Data Mover enclosure having the deepest dimension within the cabinet, the Block and File (Unified) VNX5500 measures 12.25 to 17.5 inches (7 to 10U) high x 18.92 inches wide x 24.25 inches deep (31.11 to 44.45 cm x 48.05 cm x 61.59). Between the front and rear enclosure, a midplane distributes power and signals to all the enclosure components. The CPU modules and the power supply/cooling modules plug directly into the midplane connections.

Note: The previously mentioned dimensions are approximate and do not include the cabinet enclosure.

For physical, environmental, and power details, refer to the *VNX5500 Storage System Technical Specifications and Operating Limits* document.

Table 1 VNX5500 hardware feature quick reference

| Minimum form factor | Maximum # of drives | Drive types | File | | | | Block | | | | |
			Config. I/O slots per Data Mover	Data Movers	System memory per Data Mover	Protocols	Config. I/O slots per SP	Built-in I/O ports	SPs	System memory per SP	Protocols
4U-7U	250	3.5 in. SAS, NL-SAS, Flash, and 2.5 in. 10 K SAS	4	1, 2, or 3	12 GB	NFS, CIFS, MPFS[1] and pNFS[2]	2	4 FC ports plus 2 BE[3] SAS ports	2	12 GB	FC, iSCSI, and FCoE

1. MPFS = Multi-Path File System

2. pNFS = parallel-NFS

3. BE = back end

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1. A fully loaded VNX5500 (without any DAEs) includes two 1U Control Stations, one 3U DPE (with two SPs), one dual 1U SPS, and two 2U Data Mover enclosures with three Data Movers. In this fully loaded Block and File (Unified) VNX5500 platform, the 3U DPE (with two SPSs) can have either 15 (3.5-inch) drives or 25 (2.5-inch) drives. Separately, the 15 (3.5-inch) drives weigh 34 lb (15.42 kg) and the 25 (2.5-inch) drives weigh 13.5 lb (6.13 kg), respectively.

Configured for AC-input power, the Block and File (Unified) VNX5500 platform includes the following hardware features:

◆ One 3U DPE:

IMPORTANT

On the rear of the 3U DPE, each storage processor includes a CPU module and a power supply module. Two latch handles on the bottom left and right provide each SP (SP A and SP B) with the means to secure the SP. The CPU and power supply modules can only be installed or removed after you remove the entire storage processor from the 3U DPE.

- On the front of the 3U DPE, three types of disk drives are supported in two disk drive carrier types; 3U, 15 (3.5-inch) disk drive carrier (Figure 4 on page 14) and 3U, 25 (2.5-inch) disk drive carrier (Figure 5 on page 15). Disk drives supported are Serial attached-SCSI (SAS), near-line SAS (NL-SAS), and Flash.

- On the rear of the 3U DPE, each (hot-swappable) storage processor (Figure 3 on page 7) consists of:

  – A CPU module with an Intel Xeon 4-core 2.13-GHz processor with three Double Data Rate Three (DDR3) synchronous dynamic RAM (SDRAM) slots supporting 4-GB of SDRAM

  – Four integrated 8-Gb/s FC ports (labeled **2, 3, 4,** and **5**) supporting 2, 4, and 8 Gb/s having front end auto-negotiation with support for manual override

  – Two integrated 6-Gb/s x4 SAS ports (labeled **6Gb SAS 0 x4** and **1 x4**); supported speeds are 1.5, 3, and 6 Gb/s

  – Two PCI Gen 2 x4 I/O module slots supporting a combination of the following UltraFlex™ I/O modules:

  a.) Two-port 10-Gb/s optical or active Twinax[1] (w/iSCSI protocol); labeled **10 GbE iSCSI** on the latch handle

  b.) Two-port 10-Gb/s RJ-45 Base-T iSCSI/IP; labeled **10 GbE Base-T** on the latch handle

  Note: The two-port 10-Gb/s RJ-45 Base-T/IP I/O module requires VNX OE for File version 7.1 or later.

  c.) Four-port 1-Gb/s RJ-45 copper iSCSI; labeled **1 GbE iSCSI/TOE** on the latch handle

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

  e.) Two-port 10-Gb/s optical or active Twinax[4] Fibre Channel over Ethernet (FCoE); labeled **10 GbE/FCoE** on the latch handle

  Note: The two-port 10-Gb/s optical or active Twinax FCoE I/O module requires VNX OE for File version 7.0.35.3 or later.

  f.) Four-port 6-Gb/s SAS; labeled **6 Gb SAS** on the latch handle

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1. The two-port 10-Gb/s and FCoE I/O modules 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 SFP+ when so ordered.

Note: Adding the four-port 6-Gb/s SAS I/O module to each SP in the 3U DPE allows you to increase the back end support of the VNX5500 platform from two to six back end buses per SP ("Four-port 6-Gb/s SAS I/O module" on page 54 provides more information).

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

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

– One 10/100/1000 LAN management (RJ-45) port

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

– One power supply (hot-swappable)

◆ One dual 1U standby power supply (SPS)

◆ One to two 2U DMEs with first DME having two Data Movers and the second (optional) having from zero to one Data Mover. Each Data Mover consists of:

• One CPU module consisting of one Intel Xeon 4-core 2.13-GHz processor

• Six DDR3 synchronous dynamic RAM (SDRAM) slots supporting up to 12 GB per CPU module

• One Fibre Channel (FC) I/O module with a:

Note: The maximum number of I/O modules for the VNX5500 is four per Data Mover. 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.

– Four-port 8-Gb/s optical (running at 2, 4, or 8 Gb/s); in slot 0 only; labeled **8 GbE Fibre** on the latch handle

• One, two, or three of the following network I/O modules in any combination:

– Two-port 10-Gb/s optical or active Twinax[1]; labeled **10 GbE v2** on the latch handle

– Two-port 10-Gb/s optical or active Twinax[5]; labeled **10 GbE v3** on the latch handle

Note: Version 3 of the two-port 10-Gb/s optical or active Twinax I/O module requires VNX OE File version 7.1 or later.

– Four-port 1-Gb/s copper; labeled **1 GbE** on the latch handle

– Two-port 1-Gb/s copper plus two-port 1-Gb/s optical; 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

Note: The two-port 10-Gb/s RJ-45 Base-T/IP I/O module requires VNX OE for File version 7.1 or later.

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1. The two-port 10-Gb/s I/O modules 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 SFP+ when so ordered.

- • Two management modules per DME (or, one per Data Mover)

- • Two power supply/cooling (fan) modules per CPU module

- ◆ One to two 1U Control Stations. Each Control Station consists of the following features:

  - • Intel 2.0 GHz single core Celeron processor with 800-MHz front side bus (FSB) and 512 KB cache

  - • 2 GB of RAM

  - • One 250-GB SATA hard drive

  - • Two rear-mounted USB ports and one front-mounted USB port

  - • Four RJ-45 10BASE-T/100BASE-TX/1000BASE-T network interface connectors (located on the rear panel)

  - • Two integrated serial ports, one for laptop/console redirection and one for the CallHome modem

  - • One DVD-ROM drive

  - • Two Ethernet (RJ-45) extension cables

- ◆ Expansion of up to fifteen 3U, 15 (3.5-inch) DAEs (a maximum of 240 disk drives), up to nine 2U, 25 (2.5-inch) DAEs (a maximum of 250 disk drives), or up to a combination of three 4U, 60 DAEs (2.5- or 3.5-inch) and three 3U, 15 (3.5-inch) DAEs (a maximum of 240 disk drives)

IMPORTANT

When calculating the number of drives for your Block and File (Unified) VNX5500 platform, the 3U DPE is included in the total drive slot quantity of 240 or 250 drives. If the total drive slot quantity exceeds 240 or 250, you will not be able to add another DAE. Refer to "Disk-array enclosure" on page 71 for more information about the available expansion DAEs for the Block and File (Unified) VNX5500 platform.

- ◆ Any required cables including LAN cables, modem cables, and serial DB-9 cable.

- ◆ Mounting rails with hardware

- ◆ Front bezel with VNX5500 badge

System component description

This section provides the exact details of the Block and File (Unified) VNX5500 platform components. These details include illustrations and descriptions of the front and rear connectors and the LED indicators.

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

VNX5500 front view

As previously described, the Block and File (Unified) VNX5500 platform is made up of a DPE, one dual 1U SPS, one to two Control Stations, and one to two DMEs with one, two, or three Data Movers. The following sections will describe the front (Figure 2 on page 6) view of the Block and File (Unified) VNX5500 platform components separately.

DPE front views

The Block and File (Unified) VNX5500 platform can have one of two types of 3U disk drive DPEs.

IMPORTANT

When calculating the number of drives for your Block and File (Unified) VNX5500 platform, the 3U DPE is included in the total drive slot quantity of 240 to 250 drives. If the total drive slot quantity exceeds 240 or 250, you will not be able to add another DAE. Refer to the "Disk-array enclosure" section on page 71 for more information about the DAEs available for the Block and File (Unified) VNX5500 platform.

Each Block and File (Unified) VNX5500 platform 3U DPE comprises the following components:

◆ Drive carrier

◆ Disk drives

◆ Midplane

◆ Storage processor (SP) CPU

◆ Storage processor (SP) power supply

◆ EMI shielding

Drive carrier

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. The "3U, 15 (3.5-inch) DPE" section on page 14 or the "3U, 25 (2.5-inch) DPE" section on page 15 provides more information.

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 the type, capacity, and speed labels on each disk drive. You can add or remove a disk drive while the DPE 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

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

Storage processor (SP) CPU

The SP CPU is the intelligent component of the 3U disk processor enclosure (DPE). Acting as the control center, each SP CPU includes status LEDs, PCI Gen 2 x2 I/O module slots, and LAN ports. The "DPE" section on page 26 provides more information.

Storage processor (SP) power supply

The SP power supply is located on the top, left side of the SP when viewed from the rear. This module is an auto-ranging, power-factor-corrected, multi-output, off-line converter with its own line cord. Each power supply includes status LEDs. A latch on the power supply locks it into place to ensure proper connection. The "SP AC power supply" section on page 28 provides more information.

EMI shielding

EMI compliance requires a properly installed electromagnetic interference (EMI) shield in front of the DPE disk drives. When installed in cabinets that include a front door, the DPE 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 drives.

3U, 15 (3.5-inch) DPE

On the front, the Block and File (Unified) VNX5500 platform 3U, 15 (3.5-inch) DPE carrier includes the following:

◆ 3.5-inch 6-Gb/s SAS or 3/6-Gb/s NL-SAS disk drives (hot-swappable)

◆ Status LEDs

Figure 4 shows the location of these components.
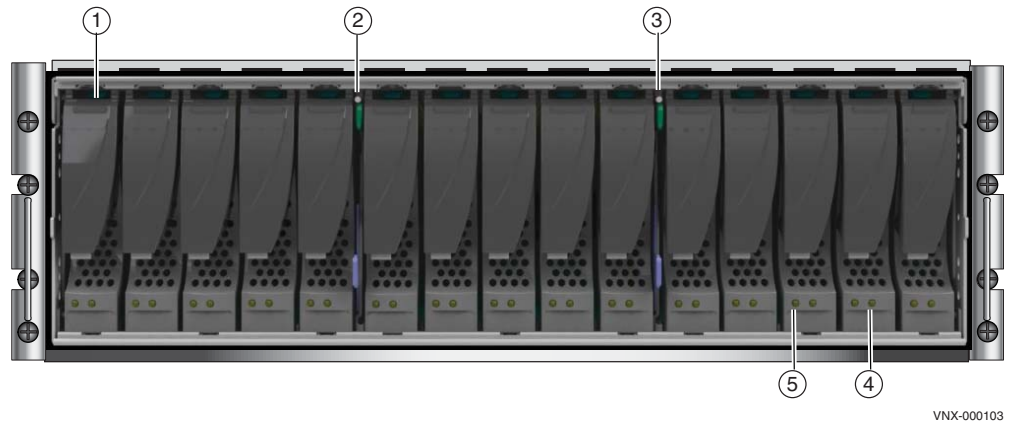
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1	3.5-inch 6-Gb/s SAS drives or 6-Gb/s NL-SAS disk drives	4	Disk drive fault LED (amber)
2	DPE fault LED (amber)	5	Disk drive on/activity LED (green)
3	DPE power on LED (blue)		

Figure 4 VNX5500 platform 3U, 15 DPE carrier (front view)

Table 2 describes the Block and File (Unified) VNX5500 platform DPE and the 3.5-inch disk drive status LEDs.

Table 2 VNX5500 platform 3U, 15 DPE and disk drive LEDs

LED	Color	State	Description
DPE fault (location 2)	Amber	On	Fault has occurred **Note:** LED is always on at powerup, until it is initialized.
DPE power (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 (location 4)	Amber	On	Fault has occurred
	—	Off	No fault has occurred

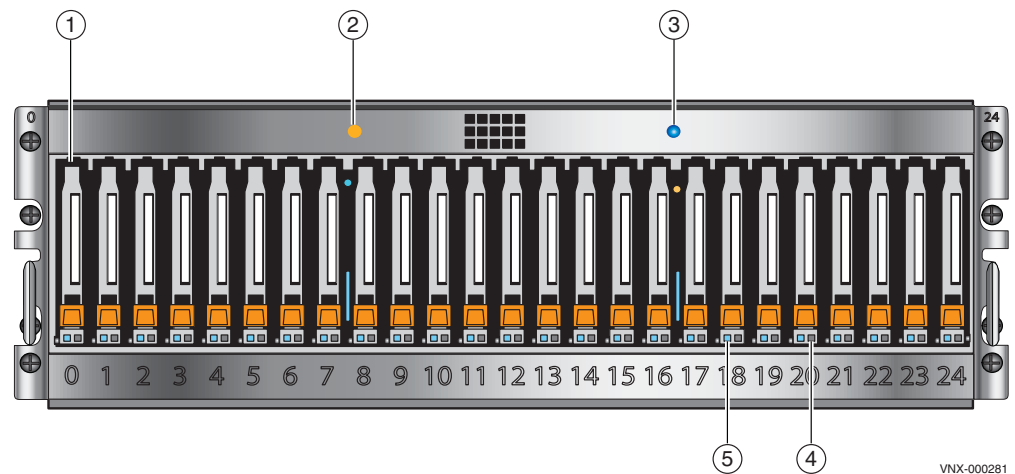**Table 2** VNX5500 platform 3U, 15 DPE and disk drive LEDs (continued)

LED	Color	State	Description
Disk drive on/activity (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

3U, 25 (2.5-inch) DPE

On the front, the Block and File (Unified) VNX5500 platform 3U, 25 (2.5-inch) disk drive DPE includes the following:

◆ 2.5-inch 6-Gb/s SAS or 6-Gb/s NL-SAS drives (hot-swappable)

◆ Status LEDs

Figure 5 shows the location of these components.

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

Figure 5 VNX5500 platform 3U, 25 DPE carrier (front view)

Table 3 describes the Block and File (Unified) VNX5500 platform disk processor and 2.5-inch disk drive status LEDs.

**Table 3** VNX5500 platform 3U, 25 DPE and disk drive status LEDs

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

Control Station front view

On the front, the Block and File (Unified) VNX5500 platform Control Station includes the following:

◆ DVD-ROM drive

◆ USB 2.0 connector (not used)

◆ Control switch and status LEDs

Figure 6 shows the orientation of these components.
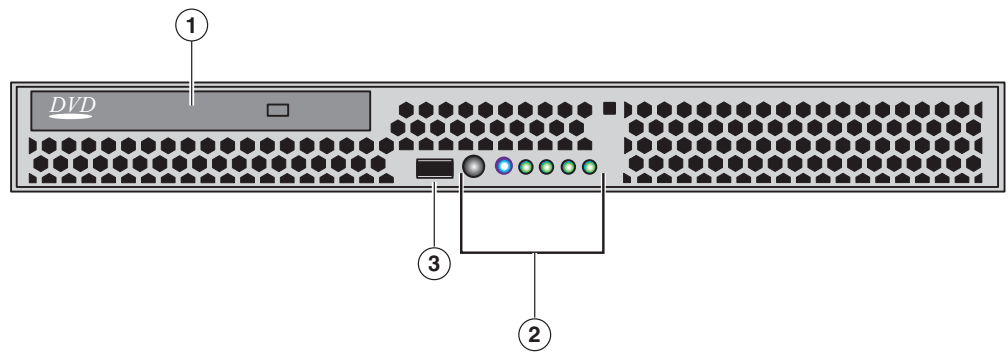
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1	DVD-ROM drive	3	USB 2.0 connector (not used)
2	Control Station switch and status LEDs (for a closer view, see Figure 6)		

Figure 6 VNX5500 Control Station (front view)

Control Station switch and LEDs

Figure 7 shows the location of the Block and File (Unified) VNX5500 platform 1U Control Station switch and LEDs on the front panel.
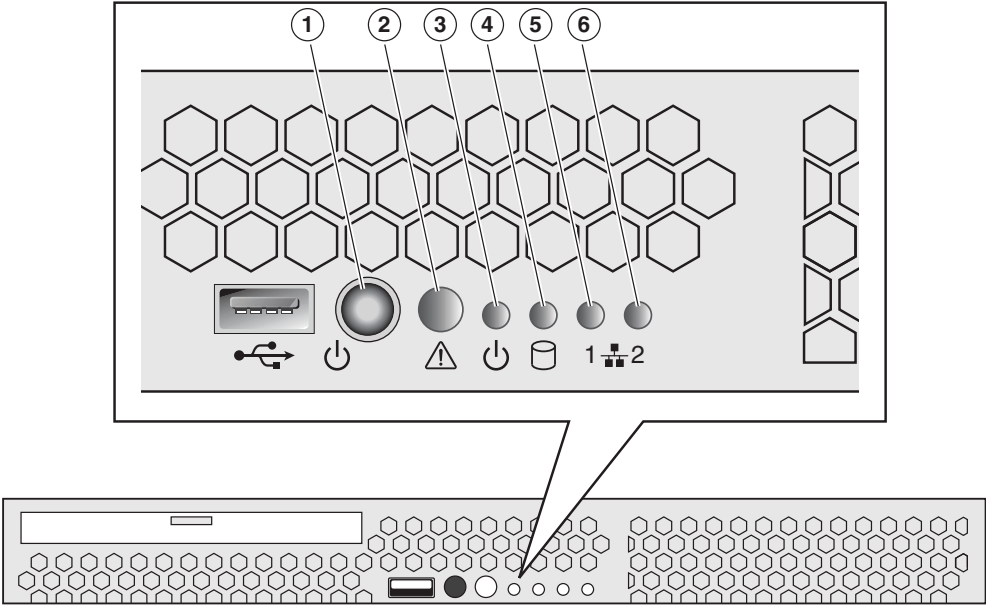
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Figure 7 VNX5500 platform 1U Control Station switch and LEDs

Table 4 describes the Control Station switch.

Table 4 Control Station switch

Switch	Description
Power push-button (location 1)	Toggles the 1U Control Station power (push in and hold for about 10 seconds)

Table 5 describes the Control Station LEDs.

Table 5 Control Station LEDs

LED	Color	State	Description
System status/boot (location 2)	Green	On	Power on/system loaded and ready
		Blinking	Booting up[1] or system degraded
	Amber	On	Critical, non-recoverable error; system has failed due to: • Themtrip asserted • IERR asserted • Non-recoverable temperature threshold asserted. • Non-recoverable voltage asserted. • Power fault/Power control failure
		Blinking	Non-fatal alarm; system is likely to fail due to: • Critical temperature threshold asserted. • Critical voltage threshold asserted. • Critical fan threshold asserted.
	—	Off	Power off
System power/sleep or standby (location 3)	Green	On	Power on
		Blinking	Sleep (standby)
	—	Off	Power off
Internal hard drive activity (location 4)	Green	Blinking	Hard drive access
	—	Off	No hard drive activity
Onboard (integrated) Ethernet NIC 1 and 2 (locations 5 and 6, respectively)	Green	On	NIC link/no access
		Blinking	NIC link/LAN access

1. The system status LED flashes green while booting up.

DME front view

On the front of the Block and File (Unified) VNX5500 platform, the 2U DME contains two enclosure status (power and fault) LEDs (Figure 8).

Note: Figure 8 is an example of a Block and File (Unified) VNX5500 platform 2U DME with four power supply/cooling (fan) modules and two CPU modules installed.
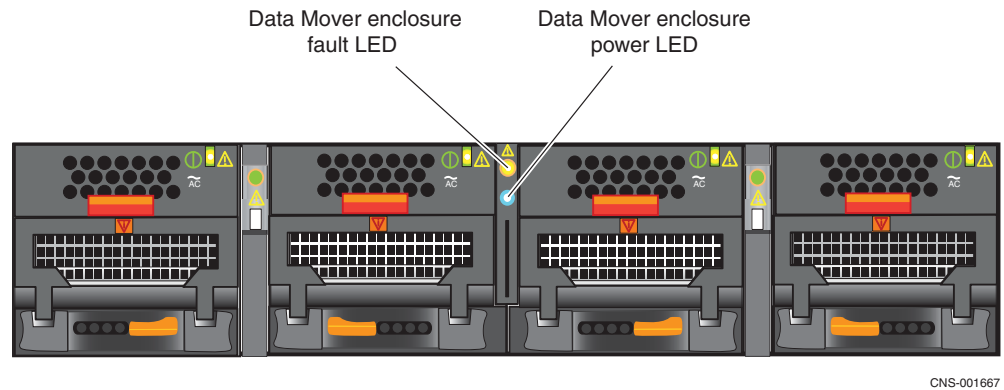

Figure 8 Data Mover enclosure LEDs

Table 6 describes the 2U DME power and fault LEDs.

Table 6 Data Mover enclosure power and fault LEDs

LED	Color	State	Description
Power	Blue	On	Data Mover enclosure is powered up and all the components in the enclosure are operating properly
	—	Off	Data Mover enclosure is powered down.
Fault	Amber	On	A replaceable component failed within the enclosure.
	—	Off	Data Mover enclosure operating normally.

CPU LEDs

The CPU modules in the 2U DME contain the power, fault, and unsafe-to-remove LEDs.
Figure 9 shows the CPU LEDs.
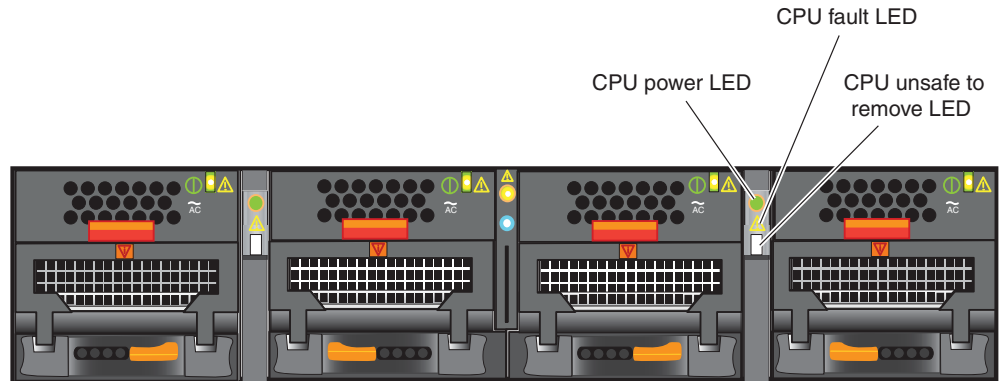
Figure 9 CPU LEDs

Table 7 describes the 2U DME CPU power and fault 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)		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 a status LED on the front. Figure 10 shows the LED for the power supply/cooling (fan) modules.
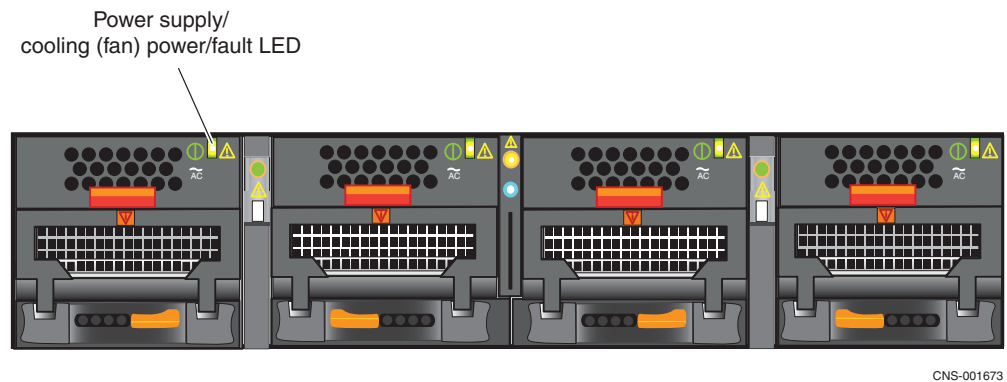

CNS-001673

Figure 10 Power supply/cooling (fan) module LED

Table 8 describes the power supply/cooling module (fan) status 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

VNX5500 rear view

On the rear, a Block and File VNX5500 platform includes the following hardware components:

◆ One dual 1U SPS

◆ One 3U DPE with two storage processors (SPs), each SP (A and B) having one CPU module and one power supply module

◆ One to two 1U Control Stations

◆ One to two 2U Data Mover enclosures with one, two, or three Data Movers

Standby power supply rear view

The Block and File (Unified) VNX5500 platform includes a dual 1U, 1.2-kilowatt standby power supply (SPS) to maintain power to the Block and File (Unified) VNX5500 platform SP during power loss. Within the SPS, a built-in DC battery pack is charged by way of an AC-DC converter. AC input power from the power distribution unit (PDU) goes into the SPS AC power inlet to the AC-DC converter. This converter then converts the AC power to DC power, which is then stored in to the built-in DC battery pack. When emergency power is needed by the Block and File (Unified) VNX5500 platform SP, a second DC-AC converter

inside the SPS takes the DC power from the DC battery pack and then converts it to AC power. This AC power then goes from the SPS AC power outlet to the Block and File (Unified) VNX5500 platform SP (Figure 11 on page 23).

Note: Two SPSs provide higher availability and allow write caching, which prevents data loss during a power failure, to continue.

IMPORTANT

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

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 90 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 lights will be off.

The output voltage, when the SPS is in the On-Line state, is a straight pass-through of the AC-line from inlet to outlets. When in the On-Battery state, the output voltage shall be at an AC level within the specified limits (see the SPS battery LED in Table 9 on page 24).

When power returns, the SPS starts recharging the DC battery pack. 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.[1] The storage processor will not use the write cache unless it detects at least one fully charged SPS.

Battery lifetime depends on the number of discharge cycles and the depth of discharge. In a typical environment, a battery pack can last 3 to 5 years. The DC battery pack lifetime is shorter in locations that have frequent AC outages.

Looking from left to right, Figure 11 on page 23 shows an example of the rear view of two SPSs (B and A, respectively).

Two SPSs

An additional SPS can be added for redundancy. When only one SPS is used, the AC power out connectors for the SPS supply AC power 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.

---

1. 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 2 hours.

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

Looking from left to right, Figure 11 shows an example of the rear view of a dual 1U SPS (B and A, respectively).
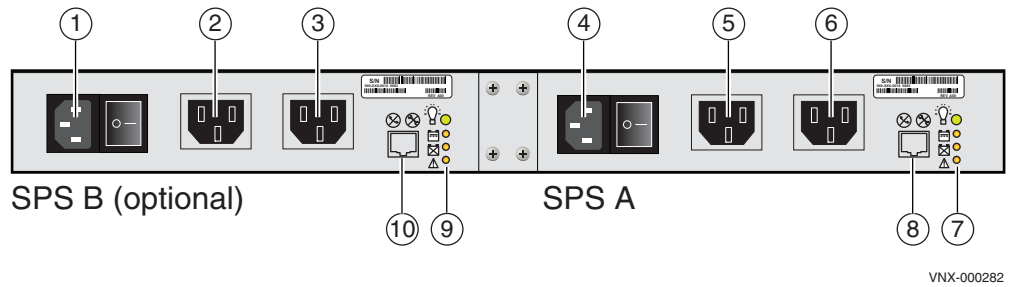
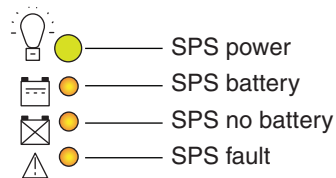| 1	SPS B AC (power in) recessed connector (plug)	6	Power out socket
2	Power out socket	7	Four SPS A status LEDs (green and amber)
3	Power out socket to the SP B power supply on the DPE	8	SPS A to SP A management (RJ-12) connector
4	SPS A AC (power in) recessed connector (plug)	9	Four SPS B status LEDs (green and amber)
5	Power out socket to the SP A power supply on the DPE	10	SPS B to SP B management (RJ-12) connector

Figure 11 Example of SPS B and A viewing from left to right (rear view)

SPS LEDs

Figure 12 shows the LEDs located on each SPS (A and B).

Figure 12 SPS LEDs

Table 9 describes the SPS LEDs.

Table 9 SPS LEDs

Led	Color	State	Description
SPS power	Green	On	SPS ready and operating normally; battery fully charged
		Blinking	On/battery charging
	—	Off	Off/disconnected
SPS 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.
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 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.

SPS RJ-12 connector

Figure 13 on page 25 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) ports to the SP (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.
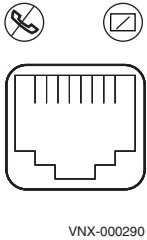
VNX-000290

Figure 13 SPS RJ-12 port

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

Table 10 SPS (RJ-12) port and connector pinout

RJ-45 pin	Signal	Description
1	RTS/DSR	Ready to send Data transmit ready
2	Shield	Shield
3	TXD	Transmit data
4	RXD	Receive data
5	GND	Ground
6	CTS/DCD	Clear to send Data

RJ-12 modular jack to micro DB-9 cable

The cable connecting the SP to the SPS is a micro DB-9 (RS-232/EIA) plug to an RJ-12 modular jack. It has a micro DB-9 connector (SP side) on one end and an RJ-12 connector (SPS side) on the other end. Figure 14 shows an example of an SP A (DB-9) to SPS A (RJ-12) cable.

DB-9

RJ-12

VNX-000283

Figure 14 Example of SP A (micro DB-9) to SPS (RJ-12) cable

DPE rear view

Figure 15 shows an example of a 3U DPE with two SPs and the location of the major hardware components that make up each SP (A and B).
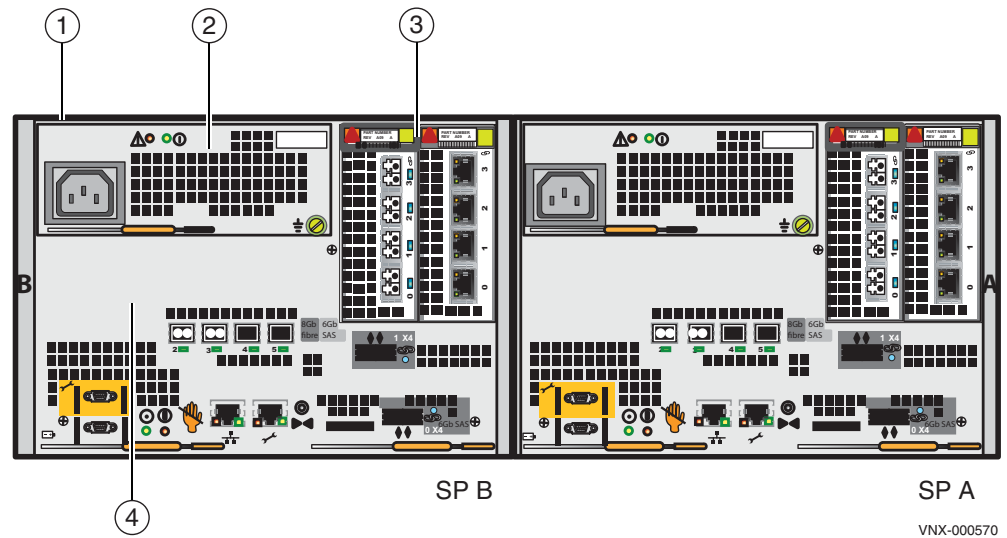
1	SP (for a closer view, see Figure 16 on page 27)	3	I/O module slots showing a four-port 8-Gb/s Fibre Channel (FC) I/O module (supports 2, 4, and 8 Gb/s) and a four-port 1-Gb/s iSCSI I/O module
2	Power supply (for a closer view, see Figure 17 on page 28)	4	CPU module (for a closer view, see Figure 16 on page 27)

Figure 15 Example of DPE with two SPs (rear view)

DPE

On the rear, viewing from left to right, each 3U DPE includes the following hardware components:

- ◆ AC power supply/cooling module
  - • AC (power in) recessed connector (plug)
  - • Power supply status LEDs (power on and fault)
  - • Power supply latch handle
- ◆ SP B and A
  - • Two PCI Gen 2 x4 I/O module slots (supporting several module types, see page 9)
  - • Two 6-Gb/s SAS x4 ports (labeled **6Gb SAS 0 x4** and **1 x4**); supported speeds are 1.5, 3, and 6 Gb/s)
  - • Four 8-Gb/s Fibre Channel ports (labeled **8Gb fibre 2, 3, 4,** and **5**)
  - • 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)

- RS-232/EIA status LEDs

- SP latch handles (bottom, left and right)

Figure 16 shows the location of these components.
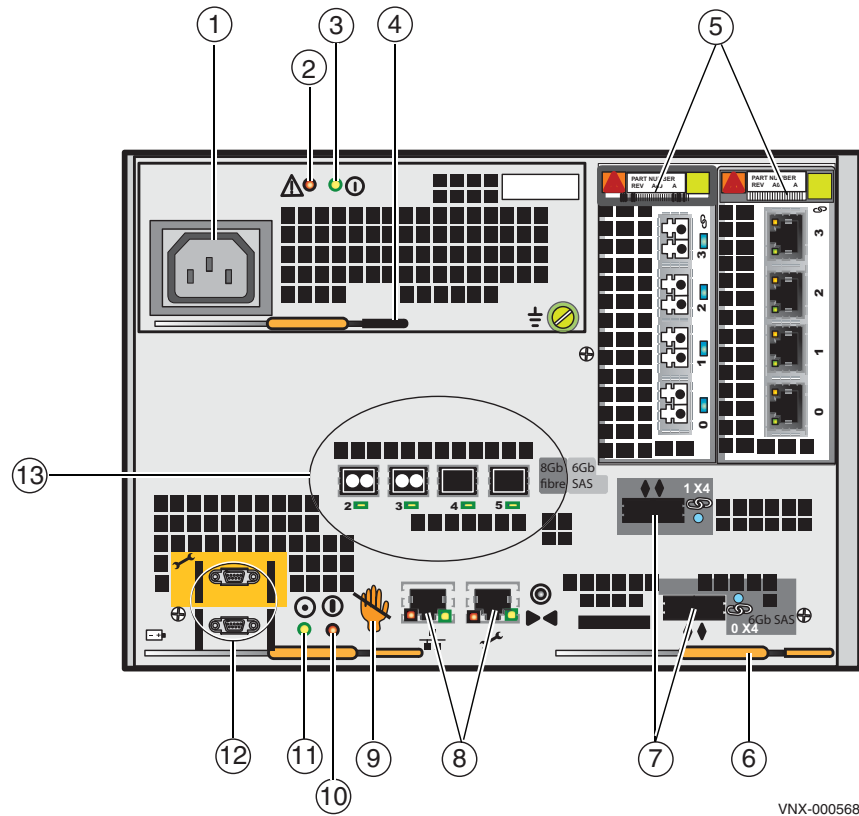
VNX-000568

1	AC (power in) recessed connector (plug)	8	Two RJ-45 (management and service laptop) connectors (labeled with a network management symbol and a wrench symbol, respectively)
2	Power supply fault LED (amber)	9	SP unsafe to remove LED
3	Power supply power on LED (green)	10	SP fault LED (amber)
4	Power supply latch handle	11	SP power on LED (green)
5	Two I/O module slots showing a four-port 8-Gb/s Fibre Channel (FC) I/O module and a four-port 1-Gb/s iSCSI I/O module	12	Two RS-232/EIA (micro DB-9) connectors (labeled with a battery symbol and a wrench symbol, respectively)
6	Two SP latch handles (bottom left and right)	13	Four 8-Gb/s Fibre Channel ports (labeled **8Gb fibre 2, 3, 4,** and **5**)
7	Two 6-Gb/s SAS ports		

Figure 16 Example of SP components (rear view)

SP AC power supply

Figure 17 shows an example of the SP AC power supply/cooling module with an AC (power in) recessed connector (plug) and status LEDs. The SP is cooled by this power supply/cooling module on top.

⚠CAUTION

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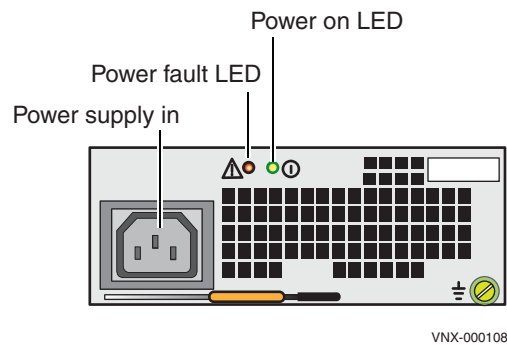

VNX-000108

Figure 17 SP AC power supply module (power in) recessed connector (plug) and status LEDs

Table 11 describes the power supply/cooling module (fault and power on) LEDs.

Table 11 SP AC power supply/cooling module (fault and power on) LEDs

Led	Color	State	Description
Fault	Amber	On	Power supply or backup fault, check cable connection
		Blinking	BIOS, POST and OS booting up or system overheating
	—	Off	No fault or power off
Power	Green	On	Power on
	—	Off	Power off, verify source power

Table 12 describes the SP LEDs. The locations in Table 12 are shown in Figure 16 on page 27.

Table 12 SP LEDs

Led	Color	State	Description
Unsafe to remove (location 10)	White	On	*Do not* remove SP
	—	Off	Safe to remove SP

Table 12 SP LEDs (continued)

| Led	Color	State	Description
Fault (location 11)	Amber	On	Fault
	—	Off	No fault or power off
Power (location 12)	Green	On	Power on
	—	Off	Power off, verify connection

SP Input/output ports and connectors

The Block and File (Unified) VNX5500 platform SP supports the following I/O ports on the rear:

◆ Two 6-Gb/s SAS PCI Gen 2 x4 ports (labeled **6Gb SAS 0 x4** and **1 x4**); supported speeds are 1.5, 3, and 6 Gb/s

◆ Four 8-Gb/s Fibre Channel (FC) ports (for front-end connectivity)

◆ One Ethernet (RJ-45) 10/100/1000 LAN (management) port

◆ One Ethernet (RJ-45) 10/100/1000 LAN (service laptop) port

◆ One RS-232/EIA 232 (micro DB-9) SPS connector

◆ One RS-232/EIA 232 (micro DB-9) service laptop connector

6-Gb/s SAS x4 ports — The Block and File (Unified) VNX5500 platform SP supports two 6-Gb/s SAS x4 ports (labeled **6Gb SAS 0 x4** and **6Gb SAS 1 x4**) on the rear of each SP (A and B). These ports provide an interface for SAS and NL-SAS drives on the DAE. Each 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.

Figure 18 shows an example of the port connector (socket) and cable connector (plug) with pull tab.
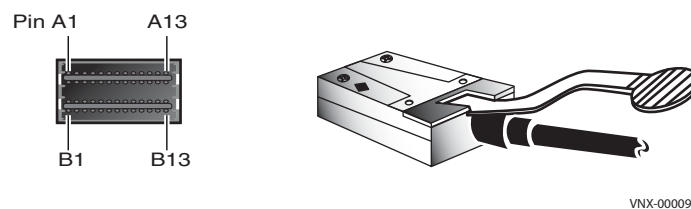
Figure 18 SP 6-Gb/s SAS port and cable connector

Table 13 lists the SP 6-Gb/s SAS port pin signals used on the connector.

Table 13 SP 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

SP 6-Gb/s SAS port LEDs — Figure 19 shows an example of the SP **6-Gb/s SAS 0 x4** port LED—a bi-color (blue/green) LED to the right of the connector—that indicates the link/activity of the SAS port.
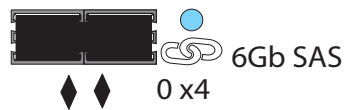
VNX-000278

Figure 19 Example of the SP **6-Gb/s SAS 0 x4** port LED

Table 14 describes the SP 6-Gb/s port LEDs.

Table 14 SP 6-Gb/s 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

8-Gb/s FC ports

The Block and File VNX5500 platform SP comes with four optical (fibre) 8-Gb/s Fibre Channel (FC) ports (labeled **8GB fibre 2, 3, 4,** and **5**) on the rear of each SP (A and B). These ports provide an optical interface for connecting to the front end. These ports support 2-, 4-, and 8-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 20 shows an example of an SFP+ module.

CNS-001090
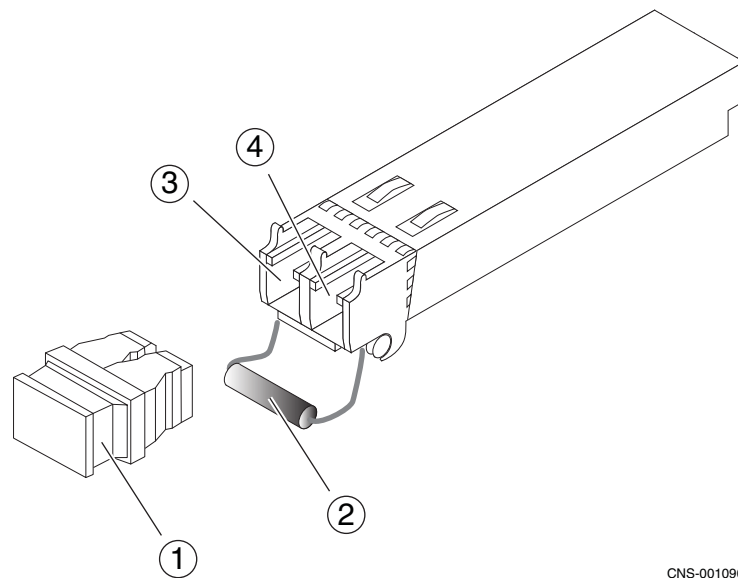
1	Dust plug (protective cap)	3	Send or transmit (TX) optical bore
2	Bale clasp latch	4	Receive (RX) optical bore

Figure 20 Example of an SFP+ module

The 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 21 on page 32).
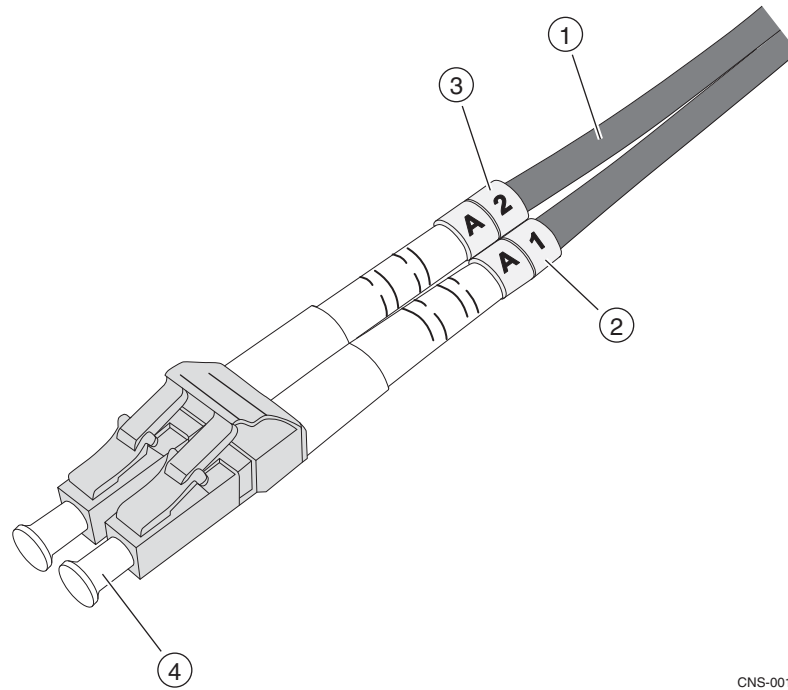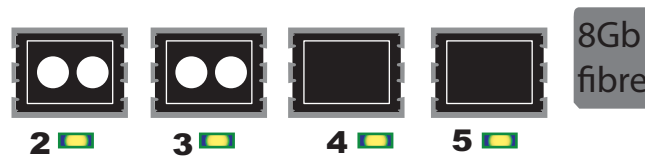
CNS-001102

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 21 Example of LC-type connectors

Figure 22 shows an example of the SP 8-Gb/s FC connector with an SFP+ transceiver module in physical slots 2 and 3 (logical 0 and 1).

VNX-000284

Figure 22 Example of 8-Gb/s FC connector with an SFP+ transceiver modules in physical slots 2 and 3 (logical 0 and 1)

Table 15 describes the SP 8-Gb/s FC port LEDs.

Table 15 8-Gb/s FC port LEDs

Led	Color	State	Description
Link/Activity (each port has one LED)	Green	On	2- or 4-Gb/s 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 *VNX5500 Parts Location Guide* for the part number label location for the SFP+ part number.

Network management and service laptop Ethernet (RJ-45) ports

⚠️**WARNING**

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

The Block and File (Unified) VNX5500 platform SP CPU comes with two integrated dual-port Ethernet ports (labeled with a network management symbol and a wrench symbol, respectively). These ports provide an interface for connecting to the public LAN and a service laptop computer, respectively. The ports are 8-pin MDI RJ-45 type ports for either IEEE 802.3 10BASE-T (10 Mb/s), IEEE 802.3u 100BASE-TX (100 Mb/s), or 1000BASE-T (1000 Mb/s) Ethernet connections.

Figure 23 shows an example of the SP SP network management and service laptop Ethernet (RJ-45) ports.
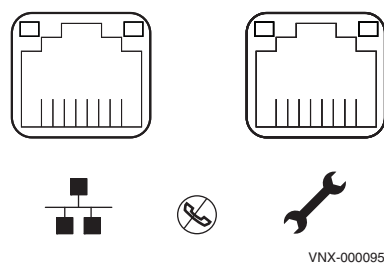

VNX-000095

Figure 23 Network management and service laptop Ethernet (RJ-45) ports

IMPORTANT

The ports shown in Figure 23 are LAN ports. A symbol depicting a telephone handset with a line through it indicates that you should not connect WAN type RJ-45 telephone connectors to these ports.

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 SP, as described in Table 16.

Table 16 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, up to 1,804 ft (550 m), Category 5E UTP (2 pairs) up to 1,148 ft (350 m)
10GBASE-T	EIA Category 7 STP, backwards compatible with Cat 5 and 6, from 2,296.5 to 3,280.8 ft (700 to 1000 m)

Network management and service laptop Ethernet (RJ-45) port and connector (adapter) — Figure 24 shows an example of the Ethernet (RJ-45) port and cable connector.
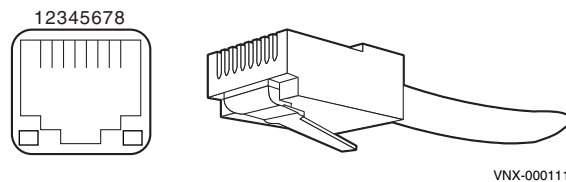
Figure 24 Network and service laptop Ethernet (RJ-45) port and connector (adapter)

Table 17 lists the SP CPU module Ethernet (RJ-45) pin signals used on the connector.

Table 17 Network management and service laptop Ethernet (RJ-45) port and connector pinout

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

Network management and service laptop Ethernet (RJ-45) port LEDs — Figure 25 shows the SP Ethernet (RJ-45) port LEDs—a green LED to the left of the connector and a bi-color (green/amber) LED to the right of the connector—that indicate the link/activity and speed of the Ethernet ports, respectively.
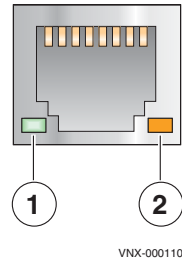

VNX-000110

Figure 25 SP Ethernet (RJ-45) port LEDs

Table 18 describes the link/activity and connection speed associated with the SP Ethernet (RJ-45) port LEDs.

Table 18 Network management and service laptop Ethernet (RJ-45) port LEDs

Led	Color	State	Description
Left, link (location 1)	Green	On	Network/link connection
	Green	Blinking	Transmit/receive activity
	—	Off	No network/link connection
Right, link speed (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)

SP serial RS-232/EIA 232 (micro DB-9) socket connector

The back of the Block and File (Unified) VNX5500 platform SP CPU module includes a standard serial Electronics Industries Association (EIA) RS-232 interface (micro DB-9) connector (labeled with a symbol depicting a wrench on the upper left) to connect to a PC or service laptop computer. This serial connector (port) allows you to access the SP locally by connecting a terminal—either a PC running terminal-emulation software or an ASCII terminal—to the port.

Notice the orientation of the pins shown in Figure 26.
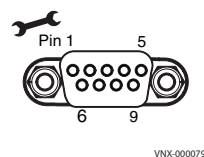

Pin 1   5
6   9

VNX-000079

Figure 26 Serial RS-232/EIA 232 (micro DB-9) connector (socket) for service laptop

Table 19 lists the SP serial RS-232/EIA 232 (micro DB-9) pin signals used on the connector.

Table 19 Serial (micro DB-9) connector (socket) 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)

SP null modem (micro DB-9 to DB-9 serial) cable

The cable connecting the SP 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 27 shows an example of an SP to PC (service laptop) cable.

VNX-000093

Figure 27 Example of SP null modem (micro DB-9 to serial DB-9) cable

Serial RS-232/EIA 232 (micro DB-9) connector (socket) for SPS management

The back of the Block and File (Unified) VNX5500 platform SP includes a second standard serial RS-232/EIA 232 interface (micro DB-9) socket connector (labeled with a symbol depicting a battery on the left) to connect to the SPS management port (RJ-12). Notice the orientation of the pins shown in Figure 28.

Note: The included cable has a micro DB-9 connector (pins 1, 3, and 4 are used) on one end and an RJ-12 modular jack adapter (pins 1, 7, and 8 are used) on the other end. The RJ-12 modular jack adaptor end connects to the RJ-12 modular jack connector on the SPS (Figure 14 on page 25).
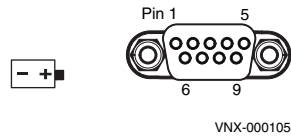
VNX-000105

Figure 28 SP serial RS-232/EIA 232 (micro DB-9) connector (socket)

Table 20 lists the SP serial RS-232/EIA 232 (micro DB-9) pin signals used on the connector.

Table 20 Serial RS-232/EIA 232 (micro DB-9) connector (socket) 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	Clear to send
8	CTS	Request to send
9	RI	Ring indicator

SP I/O module slots

Two SP PCI-E x2 I/O module slots are available. These slots (Figure 29 on page 38) support the following I/O modules:

◆ Two-port 10-Gb/s optical or active Twinax (w/iSCSI protocol)

◆ Four-port 1-Gb/s copper iSCSI

◆ Four-port 8-Gb/s optical Fibre Channel (running at 2, 4, or 8-Gb/s)

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

Note: The two-port 10-Gb/s FCoE I/O module requires VNX OE for File version 7.0.35.3 or later.

◆ Two-port 10-Gb/s Base-T iSCSI/IP

Note: The 10-Gb/s Base-T I/O module requires VNX OE for File version 7.1 or later.

◆ Four-port 6-Gb/s SAS

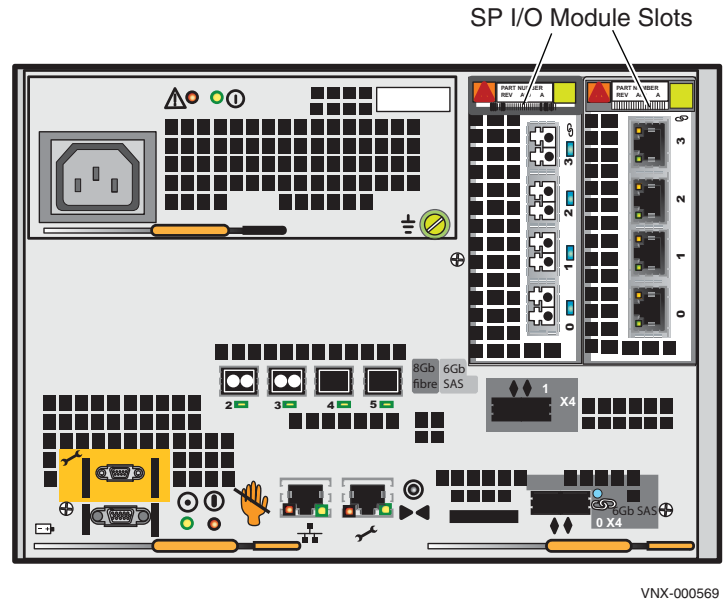SP I/O Module Slots

VNX-000569

Figure 29 Example of SP with a Fibre Channel (FC) I/O module and an iSCSI I/O module

For a full description of the I/O module types used in the SP, go to the "I/O modules" section on page 47.

Control Station rear view

On the rear, viewing from left to right, the Block and File (Unified) VNX5500 platform Control Station includes the following hardware components:

◆ AC (power in) recessed connector (plug)

◆ Two PS/2 connectors (keyboard and mouse)—not used

◆ One (DB-9 plug) serial modem connector

◆ One (DB-15) video (VGA socket) connector—not used

◆ Four (RJ-45) NIC (labeled **A, CS, B,** and **MGMT**) connectors

> **Note:** The RJ-45 NICs (labeled **A** and **CS**) are integrated into the rear of the Control Station while the RJ-45 NICs (labeled **B** and **MGMT**) are on a PCI-E card in the expansion slot on the rear of the Control Station.

◆ One (DB-9 plug) serial console (RS-232/EIA-232) connector

◆ Two USB 2.0 connectors—not used

◆ POST diagnostic LEDs

◆ Two CAT-5E/6 panel-mount Ethernet cable extensions

Figure 30 shows the orientation of the CS components.
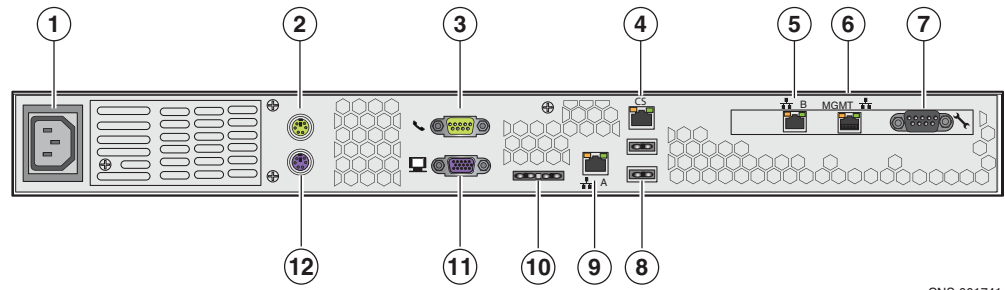
CNS-001741

1	AC (power in) recessed connector (plug)	7	DB-9 serial console plug connector
2	PS/2 connector (mouse)—not used	8	Two USB 2.0 connectors (not used)
3	DB-9 serial modem plug connector	9	RJ-45 Ethernet NIC port (labeled **A**)
4	RJ-45 Ethernet NIC port (labeled **CS**[1])	10	POST diagnostic LEDs[2]
5	RJ-45 Ethernet NIC port (labeled **B**)[3]	11	DB-15 Video (VGA) socket connector—not used
6	RJ-45 Ethernet NIC port (labeled **MGMT**)[4]	12	PS/2 connector (keyboard)—not used

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

2. These LEDs might light during power on self test (POST); they are not important for the administration or maintenance of the Control Station.

3. An extension cable with a label (CS 0 B) is provided with this connector (see the cable kit).

4. An extension cable with a label (CS 0 MGMT) is provided with this connector (see the cable kit).

Figure 30 VNX5500 platform Control Station (rear view)

Control Station Input/output ports and connectors

The Block and File (Unified) VNX5500 platform 1U Control Station supports the following I/O ports on the rear of the 1U Control Station:

◆ Four Ethernet (RJ-45) NIC ports

◆ One serial modem (DB-9) plug connector

◆ One serial console (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) NIC ports

The Block and File (Unified) VNX5500 platform 1U Control Station comes with two integrated dual-port Ethernet ports (labeled **A** and **CS**) and two Peripheral Component Interconnect Express (PCI-E)[1] low profile card dual-port Ethernet ports (labeled **B** and **MGMT**) in an expansion slot on the rear of the 1U Control Station. These ports (Figure 31 on page 40) provide an interface for connecting to 10-Mb/s, 100-Mb/s, 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 21.

Table 21 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)

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

Figure 31 shows an example of the Ethernet RJ-45 port and cable connector.
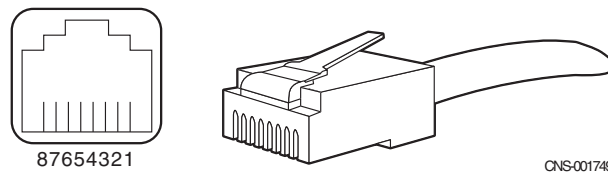

87654321

CNS-001749

Figure 31 Control Station Ethernet (RJ-45) port and connector (adapter)

Table 22 lists the Control Station Ethernet (RJ-45) pin signals used on the connector.

Table 22 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, +

1. 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.
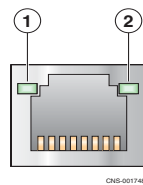
Table 22 Control Station Ethernet (RJ-45) port and connector pinout (continued)

RJ-45 pin	Signal	Description
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 1U Control Station (RJ-45) NICs include LEDs—a green LED to the left of the connector and a bi-color (green/amber) LED to the right of the connector—that indicate the link/activity and speed of the 1U Control Station (RJ-45) NIC ports, respectively (Figure 32).

Table 23 describes the link/activity and connection speed associated with the 1U Control Station (RJ-45) port LEDs.

CNS-001748

Figure 32 Control Station Ethernet (RJ-45) port LEDs

Table 23 Control Station RJ-45 port LEDs

Led	Color	State	Description
Left, link/activity (location 1)	Green	On	Network/link connection
	Green	Blinking	Transmit/receive activity
	—	Off	No network/link connection
Right, link speed (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 Block and File (Unified) VNX5500 platform 1U Control Station comes with two modular Ethernet cable extensions (or patch cords) for the RJ-45 ports (labeled on the 1U Control Station as **B** and **MGMT**, respectively). These cables 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. Each cable includes a corresponding label clip to assist you during system cabling (Figure 33 on page 42).

If your VNX5500 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 Block and File (Unified) VNX5500 platform already installed in a EMC cabinet rack with all the Block and File (Unified) VNX5500 platform components, all the cabling has already been installed.

VNX-000564

Figure 33 Example of an Ethernet extension (modular plug to modular jack) cable

Control Station serial console (DB-9) plug connector

The rear of the Block and File (Unified) VNX5500 platform 1U Control Station includes a standard serial console Electronics Industries Association (EIA) RS-232 interface (DB-9) plug connector (labeled with a wrench tool icon on the right). Notice the orientation of the pins (Figure 34).

CNS-001742
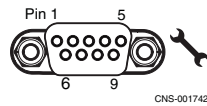
Figure 34 Control Station serial console (DB-9) plug connector

Table 24 lists the 1U Control Station Ethernet (DB-9) pin signals used on the connector.

Table 24 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 Block and File (Unified) VNX5500 platform 1U Control Station includes a standard modem serial interface (DB-9) plug connector (labeled with a telephone handset icon on the left). Notice the orientation of the pins (Figure 35).
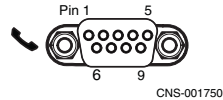

Figure 35 Control Station modem (DB-9) plug connector

Table 25 lists the 1U Control Station Ethernet (DB-9) pin signals used on the connector.

Table 25 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
7	RTS	Clear to send
8	CTS	Request to send
9	RI	Ring indicator (not used)

DME rear view

The rear of the Block and File (Unified) VNX5500 platform 2U DME does not contain any LEDs (Figure 36 on page 44). Only the Data Mover management module and the I/O modules have LEDs. The following illustrations show the location of these LEDs while the associated tables describe these LEDs.

Note: Figure 36 on page 44 is an example representation of the Block and File (Unified) VNX5500 platform 2U DME rear view with two Data Movers (each Data Mover has one management module, one four-port 8-Gb/s FC I/O module, thee two-port 1-Gb/s plus two-port 1-Gb/s optical I/O modules, and one filler panel module).
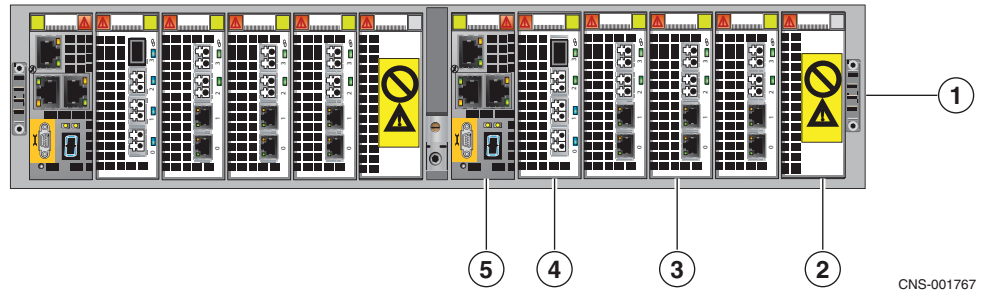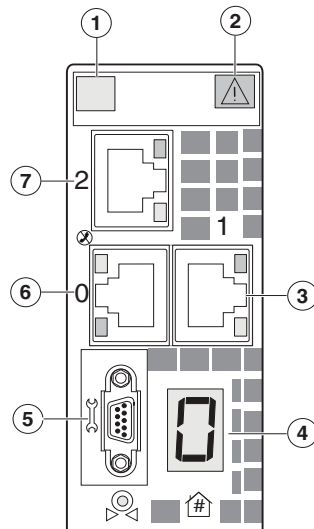
CNS-001767

1	Data Mover enclosure	4	Four-port 8-Gb/s FC I/O module
2	Filler panel module	5	Management module
3	Two-port 1-Gb/s copper plus two-port 1-Gb/s optical I/O module		

Figure 36 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 37).

CNS-001754

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

Figure 37 Data Mover management module

Data Mover management module Ethernet (RJ-45) NIC ports

The Block and File (Unified) VNX5500 platform Data Mover management module comes with three integrated dual-port Ethernet ports (labeled **0**, **1**, and **2**) on the rear. These ports support an interface for connecting to 10-Mb/s, 100-Mb/s, or 1000-Mb/s networks and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data.

> ⚠ **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.**

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 Data Mover management module, as described in Table 16 on page 34.

Since the Control Station and the Data Mover management module have the same type of RJ-45 NIC ports, the "Control Station Ethernet (RJ-45) NIC ports" on page 40 provide detailed information about the Data Mover management module NIC ports.

Data Mover management module LEDs

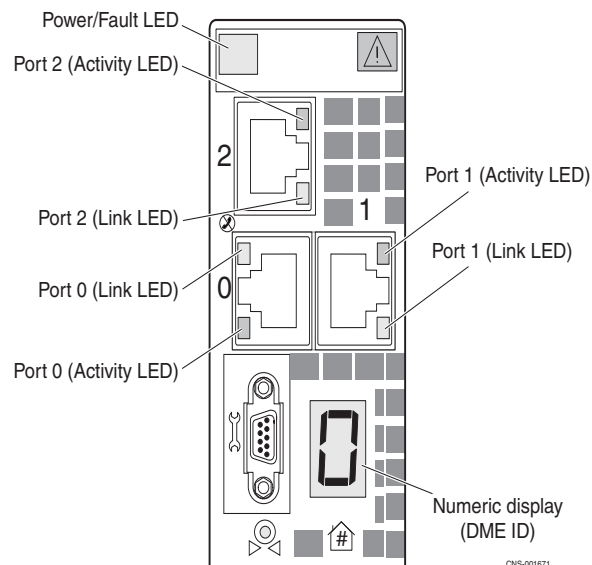Figure 38 shows the LEDs and Table 26 on page 46 describes them.

Figure 38 Data Mover management module LEDs

Table 26 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 Block and File (Unified) VNX5500 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 39).

CNS-001753
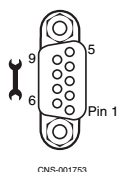
Figure 39 Data Mover management module serial console (DB-9) socket connector

Table 27 lists the Data Mover management module Ethernet (DB-9) pin signals used on the connector.

Table 27 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

Table 27 Data Mover management module (DB-9) socket connector pinout (continued)

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

I/O modules

Several types of I/O modules are supported in the Block and File (Unified) VNX5300 platform. The SP supports six types of I/O modules (see the "SP I/O module types" section on page 47) and the Data Mover supports six types of I/O modules (see the "Data Mover I/O module types" section on page 58). In each of these sections, an I/O module description is included with the type of port (copper, optical, or other) as well as a description of the LEDs on the I/O module.

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. For more information, refer to the *Adding I/O modules and SFPs to the DPE* document.

SP I/O module types

The following I/O module types are supported by the Block and File (Unified) VNX5500 platform SP:

◆ "Four-port 8-Gb/s FC I/O module" on this page

◆ "Four-port 1-Gb/s copper iSCSI I/O module" on page 49

◆ "Two-port 10-Gb/s optical or active Twinax iSCSI I/O module" on page 51

◆ "Two-port 10-Gb/s optical or active Twinax Fibre Channel over Ethernet (FCoE) I/O module" on page 53

◆ "Four-port 6-Gb/s SAS I/O module" on page 54

◆ "Two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module" on page 57

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 40 on page 48). This I/O module can interface at speeds of 2, 4, and 8 Gb/s. Besides optical SFP or SFP+, it uses OM2/OM3 multimode optical fiber cabling to connect directly to a host HBA or FC switch. OM2 cabling can usually be distinguished by the orange color of the cable. While, OM3 cabling can be distinguished by the aqua color of the cable.
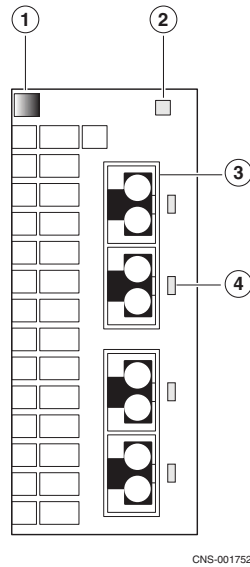
CNS-001752

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

Figure 40 Four-port 8-Gb/s FC I/O module

The four-port 8-Gb/s FC I/O module uses SFP+ transceiver modules to connect to LC-type optical fibre cables. 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. For an example of an SFP+ module, see Figure 20 on page 31.

This means that you can install and remove an SFP+ module while the Block and File (Unified) VNX5500 platform is operating.

Note: 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 type cables and aqua for OM3 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. For an example of an LC type cable, see Figure 21 on page 32.

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 41 shows the LEDs and Table 28 describes them.
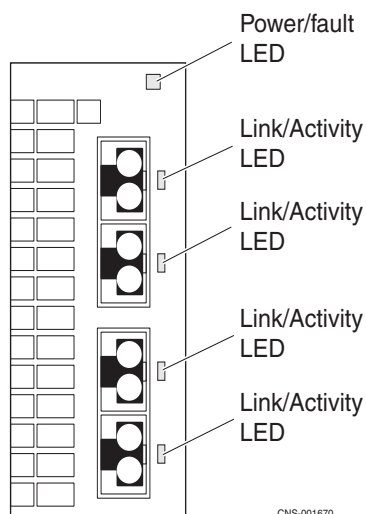

Figure 41 Four-port 8-Gb/s FC I/O module LEDs

**Table 28** 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 *VNX5500 Parts Location Guide* for the part number label location for the 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 Ethernet Base-T copper ports, one power/fault LED, and a link and activity LED for each copper port (Figure 42). This iSCSI I/O module can interface at speeds of 1 Gb/s. The 1 Gb/s Ethernet Base-T copper ports connect to Cat 6 cabling (see Table 16, "Ethernet cabling guidelines," on page 34 or Table 21, "Ethernet cabling guidelines," on page 40) to an Ethernet switch. This I/O module also includes a TCP offload engine (or TOE).
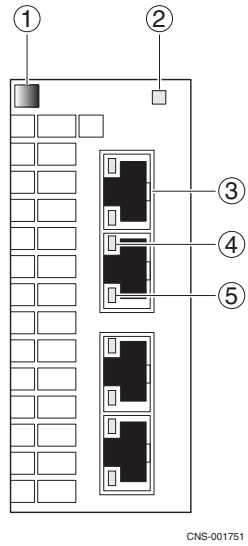
CNS-001751

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

Figure 42 Four-port 1-Gb/s copper iSCSI I/O module

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 43 shows the LEDs and Table 29 on page 51 describes them.
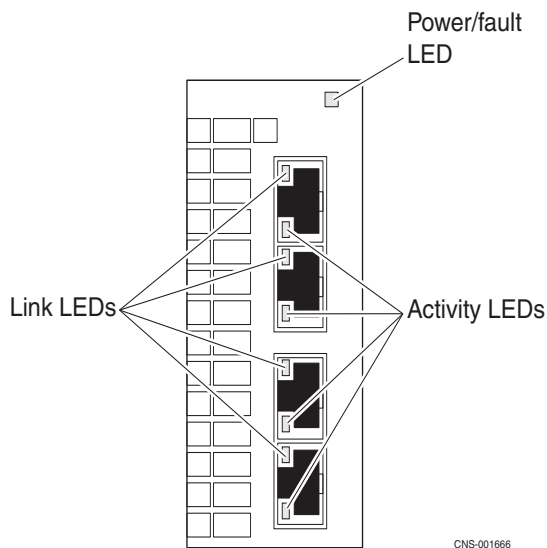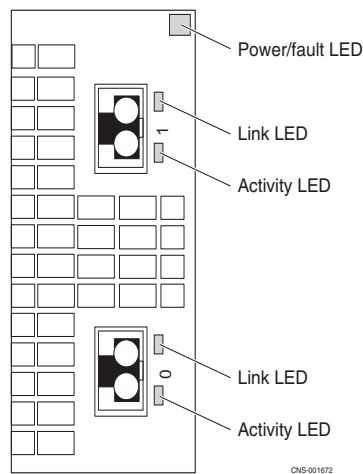

Figure 43 Four-port 1-Gb/s copper iSCSI I/O module LEDs

Table 29 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 iSCSI I/O module

The two-port 10-Gb/s optical or active Twinax[1] iSCSI I/O module (labeled **10 GbE iSCSI** on the latch handle) comes with two optical or active Twinax (twisted pair) copper ports, one power/fault LED, and a link and activity LED for each port (Figure 44 on page 52). The optical ports on this I/O module can interface at speeds of 10 Gb/s for iSCSI networks. The two-port 10-Gb/s optical I/O module uses the SFP+ transceiver module (see the sentences describing the SFP+ in the "Four-port 8-Gb/s FC I/O module" section on

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1. The two-port 10-Gb/s 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+ when so ordered.

). The two-port 10-Gb/s optical I/O module uses iSCSI protocol, hence the required SFP+ transceiver module uses a different part number (for part number label location, see the *VNX5500 Parts Location Guide*). This I/O module also includes a TCP offload engine (or TOE).
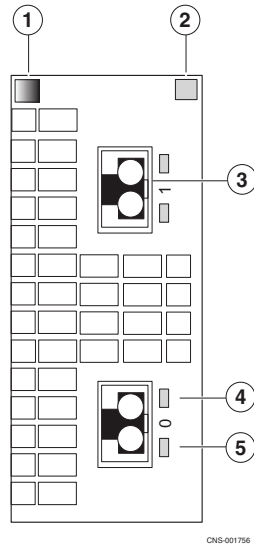
1	Push button latch handle	4	SFP+ link LED (right)
2	Power/fault LED	5	SFP+ NIC activity LED (left)
3	SFP+ (optical) port (two)		

Figure 44 Two-port 10-Gb/s optical I/O module

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 45 shows the LEDs and Table 30 on page 53 describes them.
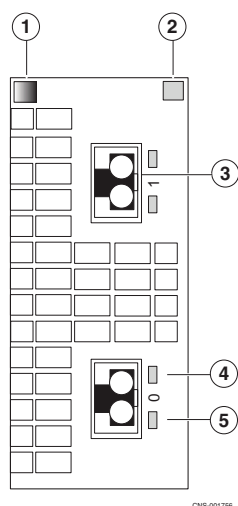

Figure 45 Two-port 10-Gb/s optical I/O module LEDs

Table 30 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 optical or active Twinax Fibre Channel over Ethernet (FCoE) I/O module

The two-port 10-Gb/s optical or active Twinax[1] 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, as shown in Figure 46. 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 *VNX5500 Parts Location Guide*.

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

1. 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+ 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 47 shows the LEDs and Table 31 describes them.

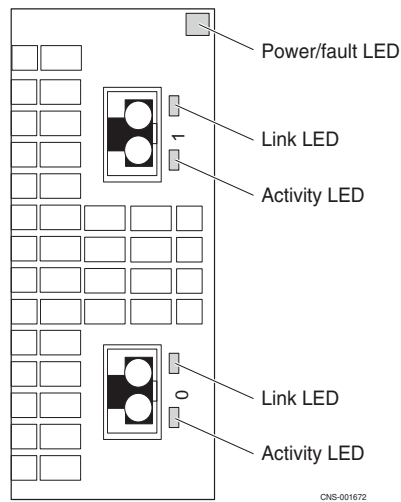**Figure 47** Two-port 10-Gb/s FCoE I/O module LEDs

Table 31 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

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

The four-port 6-Gb/s SAS I/O module (labeled **6 Gb SAS** on the latch handle) comes with four SAS ports, one power/fault LED, and a combination link/activity LED for each port, as shown in Figure 48. The SAS 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 (for more information describing the mini-SAS connector, see Figure 67 on page 78).

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.

The four-port 6-Gb/s SAS I/O module increases the back end capability of the VNX5500 platform. It adds an additional four back end buses to each SP in the DPE. This brings the back end busses up from two per SP to six per SP.

Note: Each SAS cable is keyed with an *in* and *out* connection to prevent incorrect cabling.
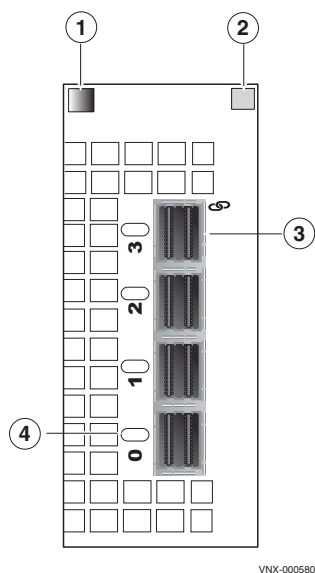
1	Push button latch handle	**3**	SAS port (four)
2	Power/fault LED	**4**	SAS LED (four

Figure 48 Four-port 6-Gb/s SAS I/O module

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 49 shows the LEDs and Table 32 on page 56 describes them.
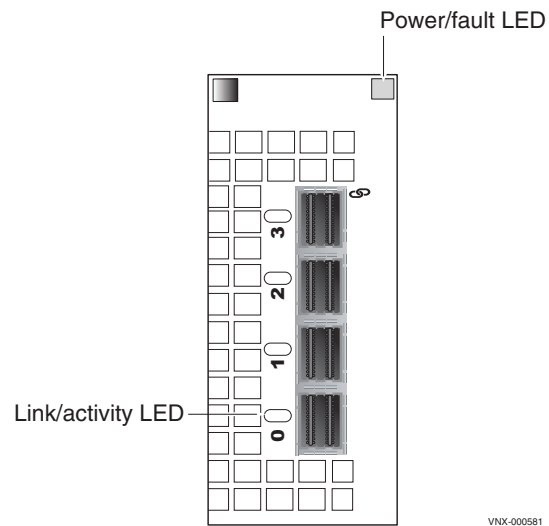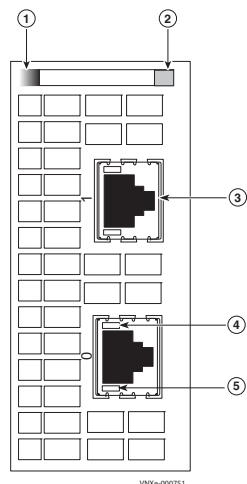

Figure 49 Four-port 6-Gb/s SAS I/O module LEDs

Table 32 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

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 50). The Base-T ports on this I/O module can interface at speeds of 10 Gb/s for iSCSI networks. 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 (for more information about these types of cables, see Table 16, "Ethernet cabling guidelines," on page 34 or Table 21, "Ethernet cabling guidelines," on page 40).

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

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 51 shows the LEDs and Table 33 describes them.
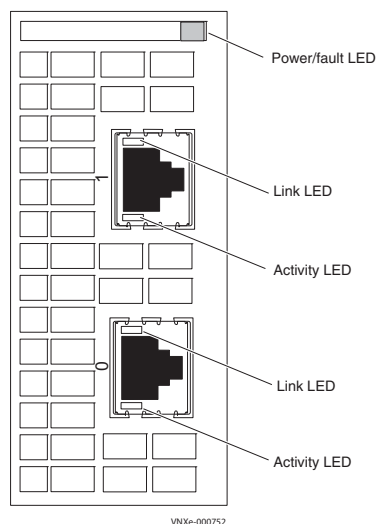

Figure 51 Two-port 10-Gb/s RJ-45 Base-T I/O module LEDs

Table 33 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

Data Mover I/O module types

The following I/O module types are supported by the VNX5500 Data Mover:

◆ "Four-port 8-Gb/s FC I/O module" on page 59

◆ "Four-port 1-Gb/s copper I/O module" on page 61

◆ "Two-port 1-Gb/s copper plus two-port 1-Gb/s optical I/O module" on page 63

◆ "Two-port 10-Gb/s optical I/O module" on page 64

◆ "Two-port 10-Gb/s optical I/O module" on page 66

◆ "Two-port 10-Gb/s RJ-45 Base-T iSCSI/IP I/O module" on page 69

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 52). This I/O module can interface at speeds of 2, 4, and 8 Gb/s.
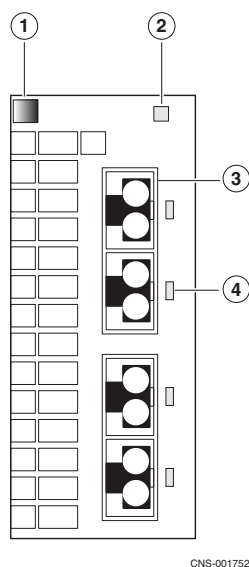
CNS-001752

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

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

The four-port 8-Gb/s FC I/O module uses SFP+ transceiver modules to connect to LC-type optical fibre cables. 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. For an example of an SFP+ module, see Figure 20 on page 31.

⚠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 Block and File (Unified) VNX5500 platform is operating.

Note: 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 with 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. For an example of an LC type cable, see .

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 53 shows the LEDs and Table 34 describes them.
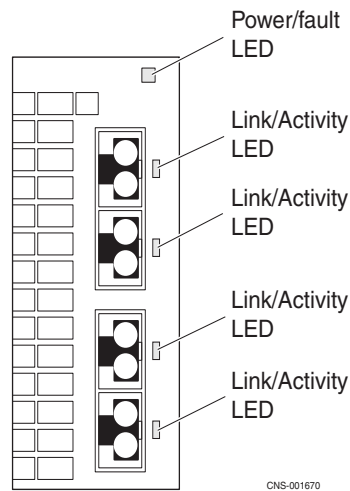

Figure 53 Four-port 8-Gb/s FC I/O module LEDs

Table 34 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 *VNX5500 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 as shown in Figure 54. 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.

CNS-001751
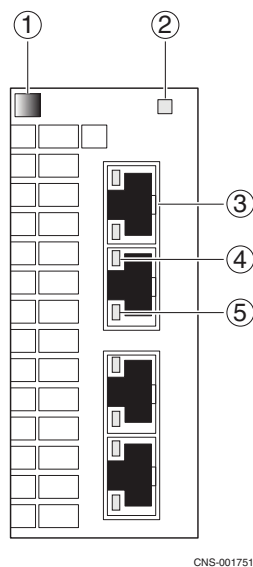
1	Push button latch handle	4	RJ-45 link LED
2	Power/fault LED	5	RJ-45 activity LED
3	RJ-45 (copper) port (four)		

Figure 54 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 55 shows the LEDs and Table 35 describes them.
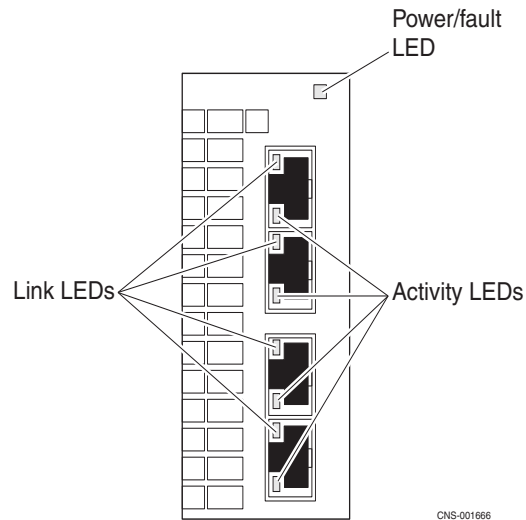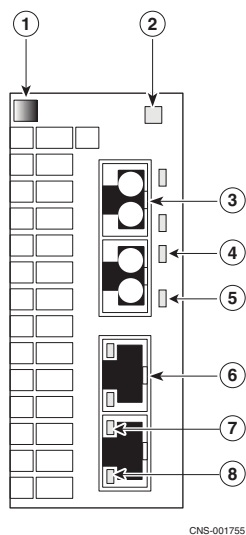

Figure 55 Four-port 1-Gb/s copper I/O module LEDs

Table 35 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 1-Gb/s copper plus two-port 1-Gb/s optical I/O module

The two-port 1-Gb/s copper plus two-port 1-Gb/s optical I/O module (labeled **1 GbE** on the latch handle) comes with two copper ports and two optical ports, one power/fault LED, and a link and activity LED for each port, as shown in Figure 56. The copper ports on this I/O module can interface at speeds of 10 Mb/s, 100 Mb/s, and 1000 Mb/s (1 Gb/s). While the optical ports can interface at a speed of 1 Gb/s.

CNS-001755

1	Push button latch handle	5	SFP+ activity LED (left)
2	Power/fault LED	6	RJ-45 (copper) port (two)
3	SFP+ (optical) port (two)	7	RJ-45 link LED (right)
4	SFP+ link LED (right)	8	RJ-45 activity LED (left)

Figure 56 Two-port 1-Gb/s copper plus two-port 1-Gb/s optical I/O module

Two-port 1-Gb/s copper plus two-port 1-Gb/s optical I/O module LEDs

The two-port 1-Gb/s copper plus two-port 1-Gb/s optical I/O module has three types of status LEDs. Figure 57 shows the LEDs and Table 36 describes them.
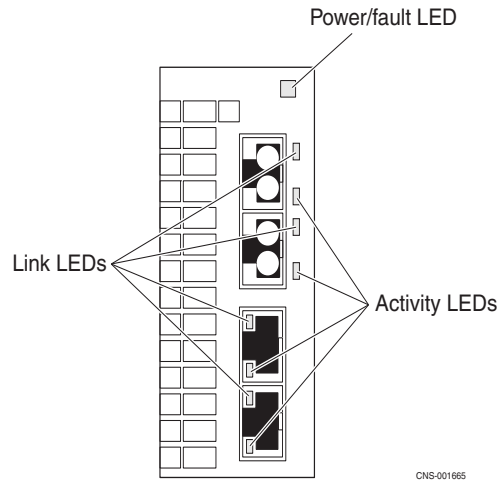

Figure 57 Two-port 1-Gb/s copper plus two-port 1-Gb/s optical I/O module LEDs

**Table 36** Two-port 1-Gb/s copper plus two-port 1-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 (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 Twinax[1] I/O module (labeled **10 GbE v2** on the latch handle) comes with two optical ports, one power/fault LED, and a link and activity LED for each port (Figure 58 on page 65). The optical ports on this I/O module can interface at speeds of 10 Gb/s. The two-port 10-Gb/s optical I/O module uses the SFP+ transceiver module. For information about SFP+ modules, see the sentences describing the SFP+ in the "Four-port 8-Gb/s FC I/O module" section on page 47. The two-port 10-Gb/s optical I/O module uses the SFP+ transceiver module, hence the required SFP+ transceiver module uses a different part number (for part number label location, see the *VNX5500 Parts Location Guide*).

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1. The two-port 10-Gb/s 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.

Note: This I/O module requires software release VNX OE for File 7.0 to function properly. It will not function properly in software release VNX OE for File 7.1. Use the newer I/O module (version 3) of the two-port 10-Gb/s Ethernet optical or active Twinax I/O module as described in the "Two-port 10-Gb/s optical I/O module" section on page 66.
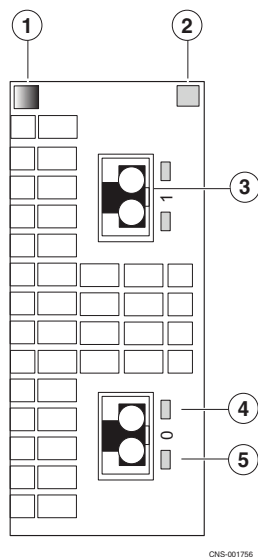
1	Push button latch handle	4	SFP+ link LED (right)
2	Power/fault LED	5	SFP+ NIC activity LED (left)
3	SFP+ (optical) port (two)		

Figure 58 Two-port 10-Gb/s optical I/O module

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 59 shows the LEDs and Table 37 on page 66 describes them.

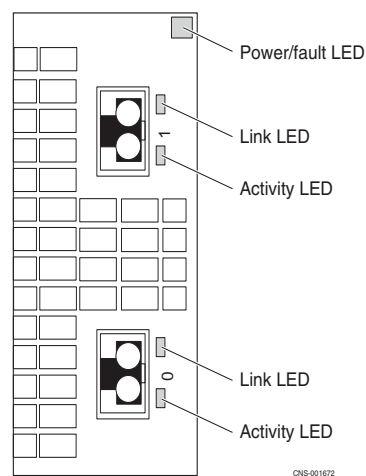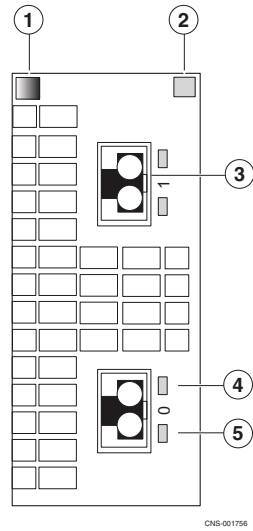**Figure 59** Two-port 10-GbE optical I/O module LEDs

Table 37 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 optical I/O module

The two-port 10-Gb/s optical or active Twinax I/O module (labeled **10 GbE v3** on the latch handle) comes with two optical or ports, one power/fault LED, and a link and activity LED for each port (Figure 50). The optical ports on this I/O module can interface at speeds of 10 Gb/s. The two-port 10-Gb/s optical I/O module uses the SFP+ transceiver module. For more information about SFP modules, see the sentences describing the SFP+ in the "Four-port 8-Gb/s FC I/O module" section on page 47. The two-port 10-Gb/s optical I/O module uses the SFP+ transceiver module, hence the required SFP+ transceiver module uses a different part number (for part number label location, see the *VNX5500 Parts Location Guide*).

Note: This I/O module requires software release VNX OE for File 7.1 to function properly. Consequently, you cannot mix this I/O module (version 3) with the two-port 10-Gb/s optical or active Twinax I/O module (version 2) as described in the "Two-port 10-Gb/s optical I/O module" section on page 64. If you replace a version 2 two-port 10-Gb/s optical or active Twinax I/O module that only functions in VNX OE for File 7.0 with a version 3 two-port 10-Gb/s Ethernet I/O module, you must replace all of the version 2s of the two-port 10-Gb/s Ethernet optical or active Twinax I/O modules with version 3s of the two-port 10-Gb/s Ethernet I/O module that function in VNX OE for File 7.1. To determine the correct version number, look at the label on the latch handle. It will say either v2 or v3 along with the name of the I/O module on the label. Also, refer to the *VNX5500 Parts Location Guide* for the location of the part number label.

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

Figure 60 Two-port 10-Gb/s optical I/O module

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 51 shows the LEDs and Table 33 describes them.
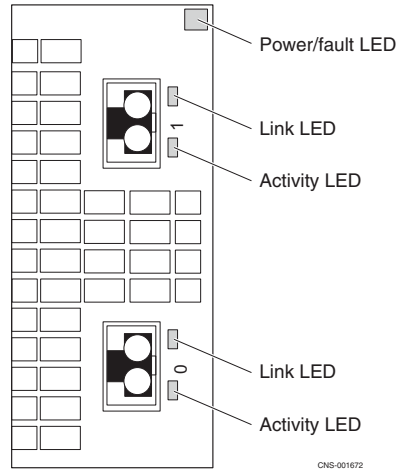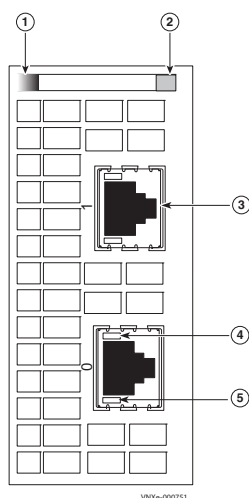

Figure 61 Two-port 10-Gb/s optical I/O module LEDs

Table 38 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 (RJ-45) ports, one power/fault LED, and a link and activity LED for each port (Figure 50). The Base-T ports on this I/O module can interface at speeds of 10 Gb/s for iSCSI networks. 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 (for more information about these types of cables, see Table 16, "Ethernet cabling guidelines," on page 34 or Table 21, "Ethernet cabling guidelines," on page 40).

Note: The two-port 10-Gb/s Base-T I/O module requires VNX OE for file version 7.1 or later.

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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 62 Two-port 10-Gb/s Base-T I/O module

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 51 shows the LEDs and Table 33 describes them.
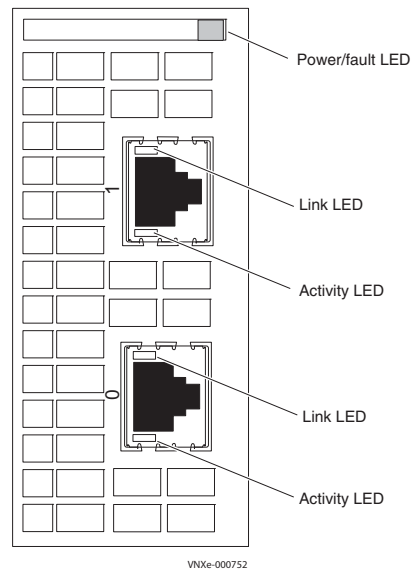

VNXe-000752

Figure 63 Two-port 10-Gb/s Base-T I/O module LEDs

Table 39 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

Disk-array enclosure

> **⚠ CAUTION**
>
> **Lifting the DAE and installing it to or removing it from a rack is a two to three-person job. If needed, use an appropriate lifting device (mechanical lift). A fully loaded 2U DAE, 3U DAE, or 4U DAE weighs approximately 45 lb (20.41 kg), 68 lb (30.84 kg), or 213 lb (96.62 kg), respectively.**

The Block and File (Unified) VNX5500 platform supports the expansion of three types of disk-array enclosures (DAEs) across a 6-Gb/s SAS bus:

◆ 3U, 15 (3.5-inch) DAE (DAE6S)

◆ 2U, 25 (2.5-inch) DAE (DAE5S)

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

> **Note:** "4U, 60 (2.5- or 3.5-inch) DAE" on page 88 provides a complete description of the 4U, 60 disk drive DAE.

The Block and File (Unified) VNX5500 platform supports up to fifteen 3U, 15 (3.5-inch) DAEs (a maximum of 240 3.5-inch disk drives), up to nine 2U, 25 (2.5-inch) DAEs (a maximum of 250 2.5-inch disk drives), or up to a combination of three 4U, 60 (2.5- or 3.5-inch) DAEs and three 3U, 15 (3.5-inch) DAEs (a maximum 240 disk drives).

IMPORTANT

When calculating the number of drives for your platform, the DPE is included in the total drive slot quantity of up to 240 to 250 drives. If the total drive slot quantity exceeds 240 or 250, you will not be able to add another DAE. Refer to the "Overview" section on page 4 for more information about the Block and File (Unified) VNX5500 platform DPEs.

Each Block and File VNX5500 platform DAE consists of the following components:

◆ Drive carrier

◆ Disk drive

◆ Midplane

◆ Link control cards (LCCs)

◆ Inter Connect Modules (ICMs)[1]

◆ Power supply/cooling modules[2]

◆ EMI shielding

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1. The 4U, 60 disk drive DAE includes Inter Connect Modules (ICMs). "4U, 60 (2.5- or 3.5-inch) DAE" on page 88 provides more information about the 4U, 60 disk drive DAE.
2. The 4U, 60 disk drive DAE has separate power supplies and cooling modules (fans).

Drive carrier

In a 2U and 3U 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 64 on page 74 and Figure 71 on page 81).

For more information about the drive carrier in a 4U DAE, see the "4U, 60 (2.5- or 3.5-inch) DAE"section on page 88.

Disk drives

Each disk drive consists of one disk drive in a the 2U or 3U carrier. You can visually distinguish between disk 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 drive while they are in use. Disk drives are extremely sensitive electronic components.

IMPORTANT

The 4U DAE cannot use disk drives from a 2U or 3U DAE. The 4U DAE employs different types of SAS, NL-SAS, or Flash disk drives.

Midplane

In a 2U or 3U 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 or 3U 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 70 on page 80 and Figure 77 on page 87)[1]. Each LCC includes a bus (loop) identification indicator (Figure 70 on page 80 and Figure 77 on page 87).

In a 4U 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 ("LCC" on page 94) 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 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

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

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^{2}C (inter-integrated circuit) bus.

Power supply

In a 2U or 3U 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 or 3U DAE, each power/cooling module has three status LEDs (Figure 66 on page 77 and Figure 73 on page 83).

In a 4U DAE, the power supplies ("4U, 60 DAE AC power supply" on page 102) and cooling modules are separated and located at opposite ends of the 4U DAE. The power supplies are located on the rear of the 4U DAE while the cooling modules or fans are located on the rear of the 4U DAE. The power supplies can be installed/removed from the rear of the DAE while 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 the inside of the DAE (see the "Access to disk drives, LCCs, and cooling modules" section on page 89 for more information).

Cooling modules

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

In a 4U DAE, the cooling modules are separate from the power supply modules.

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 drives.
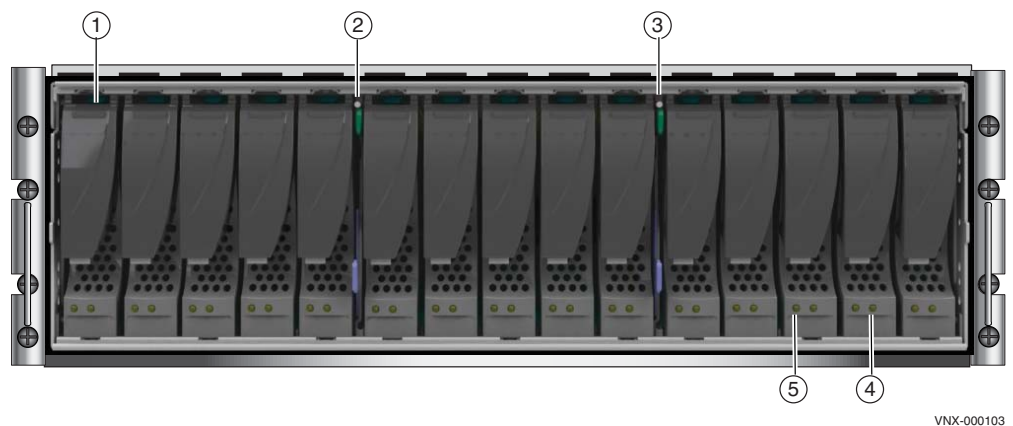
3U, 15 (3.5-inch) DAE front view

On the front, the Block and File (Unified) VNX5500 platform 3U, 15 (3.5-inch) disk drive DAE (DAE6S) carrier includes the following hardware components:

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

◆ Status LEDs

Note: In a Block and File (Unified) VNX5500 platform, when using the 3U, 15 (3.5-inch) disk drive carrier, the maximum amount of disk drives is 240 (including DPE and expansion DAEs).

Figure 64 shows the location of these components.

VNX-000103

1	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 64 3U, 15 (3.5-inch) DAE (front view)

Table 40 describes the Block and File (Unified) VNX5500 platform DAE and the 3.5-inch disk drive status LEDs.

Table 40 3U, 15 (3.5-inch) DAE and disk drive LEDs

LED	Color	State	Description
DAE fault (location 2)	Amber	On	Fault has occurred
DAE power (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

Table 40 3U, 15 (3.5-inch) DAE and disk drive LEDs (continued)

LED	Color	State	Description
Disk drive fault (location 4)	Amber	On	Fault has occurred
	—	Off	No fault has occurred
Disk drive on/activity (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

3U, 15 (3.5-inch) DAE rear view

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

◆ Two 6-Gb/s SAS LCCs (A and B)

◆ Two power supply/cooling modules

6-Gb/s SAS LCC

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

The LCCs in a DAE connect to the DPE 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 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.

Figure 65 shows an example of the rear view of a 3U, 15 (3.5-inch) DAE.

VNX-000100
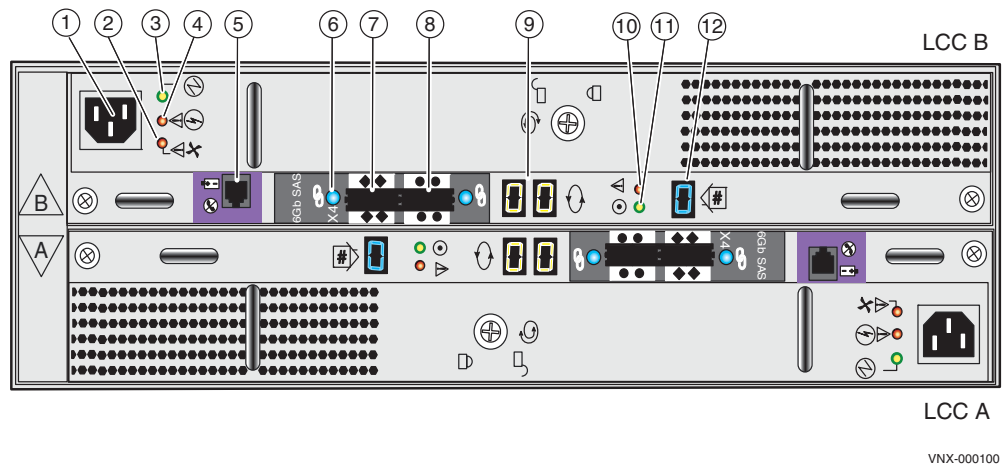
1	LCC B AC power supply (power in) recessed connector (plug)	7	LCC B SAS connector (output); labeled with a double diamond symbol ◆◆.
2	LCC B power supply fan fault LED (on, amber)	8	LCC B SAS connector (input); labeled with a double circle (or dot) symbol ●●.
3	LLC B power supply LED (on, green)	9	LCC 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 (not used)	11	LCC B bus LED (on, green)
6	LCC B SAS connector link LED	12	DAE enclosure ID or address

Figure 65 3U, 15 (3.5-inch) DAE with two LCCs and two power supply/cooling modules (rear view)

As shown in the preceding figure (Figure 65), an enclosure ID[1] 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.

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

3U, 15 (3.5-inch) DAE AC power supply/cooling module

Figure 66 shows an example of the 3U, 15 (3.5-inch) DAE AC power supply/cooling module with an AC (power in) recessed connector (plug) and status LEDs.
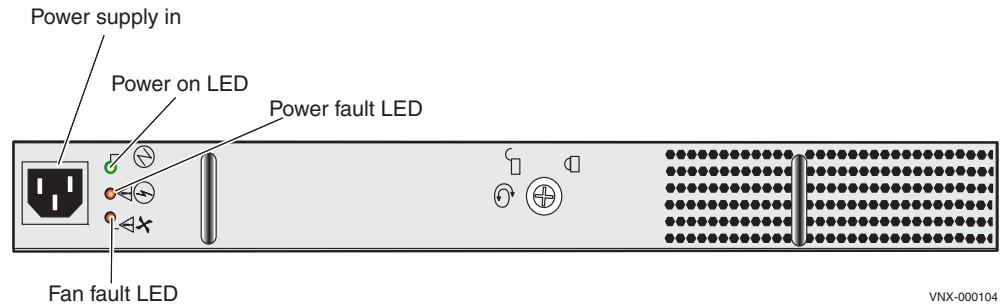

Figure 66 Example of 3U, 15 (3.5-inch) DAE AC power supply/cooling module (power in) recessed connector (plug) and status LEDs

Table 41 describes the 3U, 15 (3.5-inch) DAE power supply/cooling module LEDs.

Table 41 3U, 15 (3.5-inch) 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.

The 3U, 15 (3.5-inch) DAE LCC input/output ports and connectors

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

◆ Two 6-Gb/s SAS x4 ports

◆ One management (RJ-45) connector to the SPS (not used)

6-Gb/s SAS x4 ports

The 3U, DAE LCC supports two (one input and one output) 6-Gb/s SAS x4 ports (labeled **6GB SAS 0 x4** and **1 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.

Figure 67 shows an example of the port connector (socket) and cable connector (plug) with pull tab.
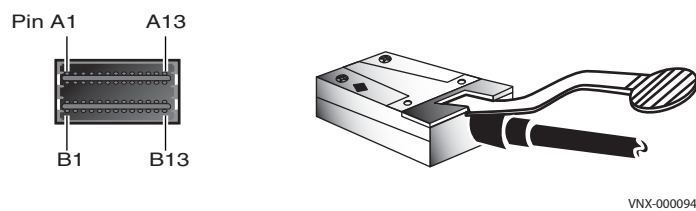
Figure 67 6-Gb/s SAS port and cable connector

Table 42 lists the 3U, DAE LCC 6-Gb/s SAS port pin signals used on the connector.

Table 42 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

Table 42 6-Gb/s 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 SAS port LED and port direction (input or output)**

Figure 68 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 68 also shows a double circle (or dot) symbol ●● (for input) or a double diamond symbol ◆◆ (for output).

Note: Looking from the rear of the DAE, LCC B is located on the top and LCC A is located on the bottom (Figure 68).

3U, DAE LCC B 6-Gb/s SAS ports
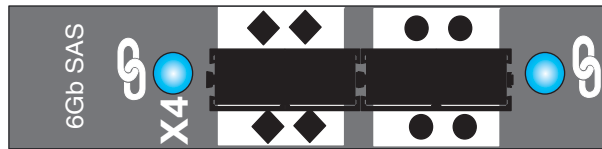
3U, DAE LCC A 6-Gb/s SAS ports
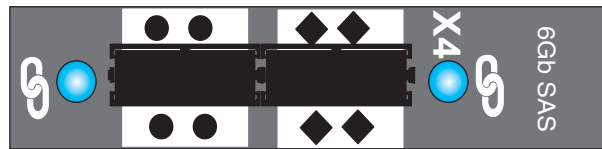
VNX-000101

Figure 68 6-Gb/s SAS port LEDs

Table 43 describes the 3U, DAE LCC 6-Gb/s SAS port LEDs.

Table 43 6-Gb/s 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 are 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

Note: The management Ethernet (RJ-12) LCC to SPS connector is not used at this time.

Figure 69 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 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.**
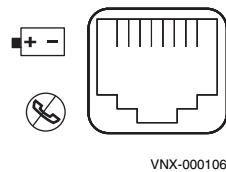

VNX-000106

Figure 69 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.

LCC enclosure ID (enclosure address) and bus ID

On the rear of the LCC (A and B), an LCC enclosure ID (or enclosure address) 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.

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 70).
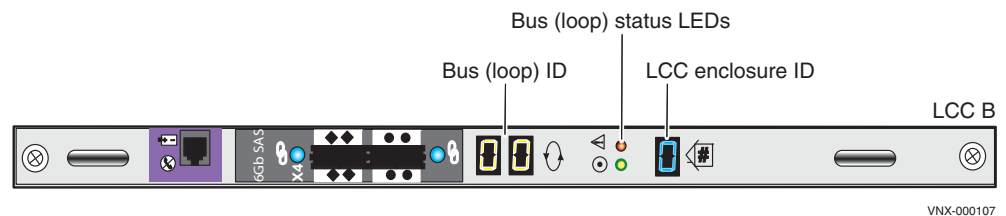

Bus (loop) status LEDs

Bus (loop) ID   LCC enclosure ID

LCC B

VNX-000107

Figure 70 Example of LCC B enclosure ID and bus ID

Table 44 describes the bus (loop) indicator status LEDs.

Table 44 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

2U, 25 (2.5-inch) DAE front view

On the front, the Block and File (Unified) VNX5500 platform 2U, 25 (2.5-inch) DAE (DAE5S) includes the following hardware components:

◆ 2.5-inch 6-Gb/s SAS, 6-Gb/s NL-SAS, or Flash disk drives (hot-swappable)[1]

◆ Status LEDs

Figure 71 shows the location of these components.
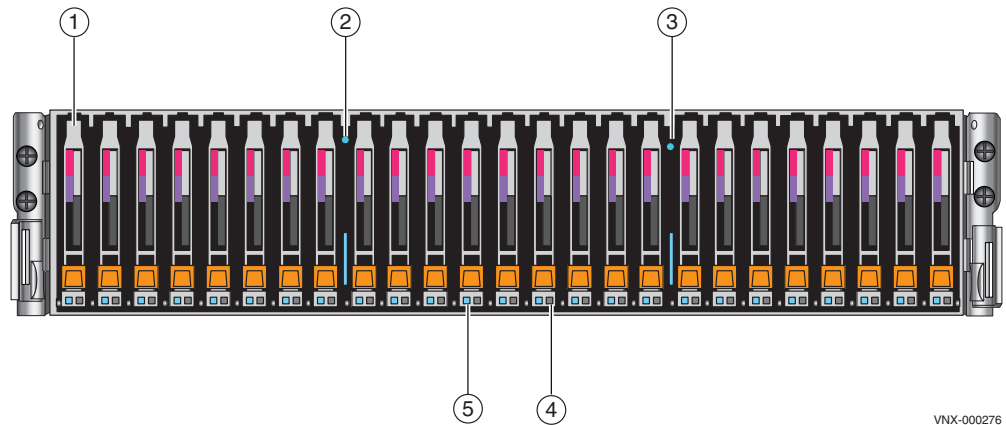
VNX-000276

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 71 2U, 25 (2.5-inch) DAE (front view)

Note: In a Block and File (Unified) VNX5500 platform, when using the 2U, 25 (2.5-inch) disk drive carrier, the maximum amount of disk drives is 250 (includes DPE and expansion DAEs).

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1. 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.

Table 45 describes the 2U, 25 (2.5-inch) DAE and disk drive status LEDs.

Table 45 2U, 25 (2.5-inch) DAE and disk drive status LEDs

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

2U, 25 (2.5-inch) DAE rear view

On the rear, viewing from top to bottom, a 2U, 25 (2.5-inch) DAE includes the following hardware components as shown in Figure 72:

◆ Two LCCs (A and B)

◆ Two power supply/cooling modules
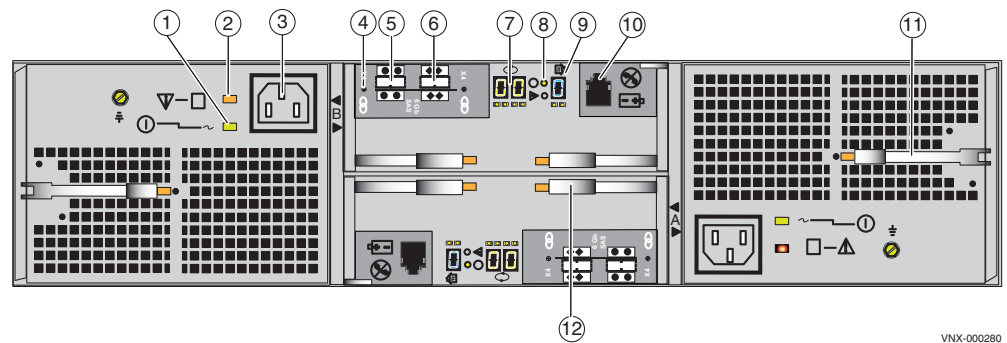
VNX-000280

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 connector (plug)	9	DAE enclosure ID or enclosure address
4	LCC B SAS connector link LED (on, blue)	10	LCC B management (RJ-12) connector to SPS (not used)
5	LCC B SAS connector (input); labeled with a double circle (or 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 72 Example of 2U, DAE with two LCCs and two power supply/cooing modules (rear view)

6-Gb/s SAS 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 connect to the DPE and other DAEs with 6-Gb/s SAS cables. The cables connect the LCCs 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 platform'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 72 on page 82, an enclosure ID[1] 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.

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

Figure 73 shows an example of the 2U, 25 (2.5-inch) DAE AC power supply/cooling module with an AC (power in) recessed connector (plug) and status LEDs.
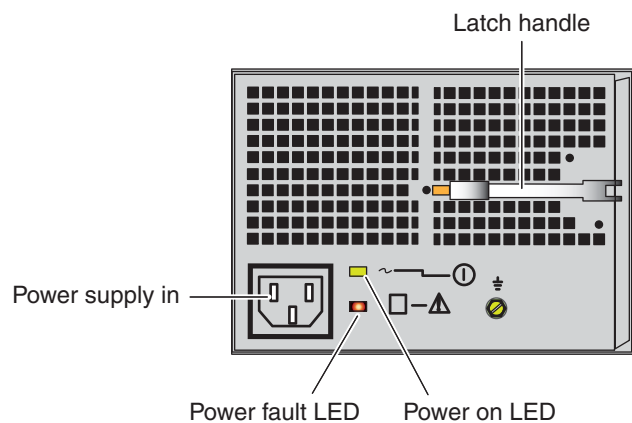
Figure 73 Example of a 2U, 25 (2.5-inch) DAE AC power supply/cooling module (power in) recessed connector (plug) and status LEDs

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

Table 46 describes the 2U, 25 (2.5-inch) DAE power supply/cooling module LEDs.

Table 46 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 and undervoltage protection (OVP/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. If one blower fails, the others will speed up to compensate. If two blowers in a system (both in one power supply/cooling module, or one in each module) fail, the DAE goes offline within two minutes.

The 2U, 25 (2.5-inch) DAE 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 SAS x4 ports

◆ One management (RJ-12) connector

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

Figure 74 shows an example of the port connector (socket) and cable connector (plug) with pull tab.
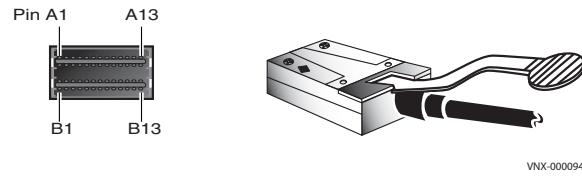

Figure 74 6-Gb/s SAS port and cable connector

Table 47 lists the 2U, DAE 6-Gb/s SAS port pin signals used on the connector.

Table 47 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 SAS port LEDs and port direction (input or output)

Figure 75 shows the 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.
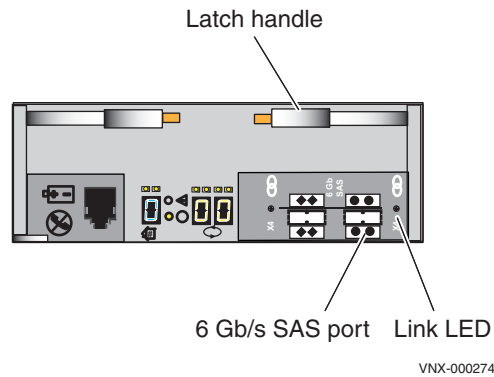

Latch handle

6 Gb/s SAS port   Link LED

VNX-000274

Figure 75 6-Gb/s SAS port LED for LCC A

Note: Looking from the rear of the 2U, DAE, LCC B is located on the left and LCC A is located on the right (Figure 75).

Table 48 describes the 2U DAE LCC 6-Gb/s port LEDs.

Table 48 6-Gb/s SAS port LEDs

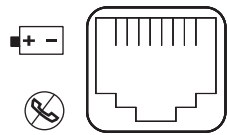| LED	Color	State	Description
Link/activity	Blue	On	All lanes are running at 6 GB/s
	Green	On	One or more lanes is not running at full speed or disconnected
	Alternating Blue/Green	Blinking	Port is being marked by the host
	—	Off	Not connected

Management (RJ-12) port connector

Note: The management Ethernet (RJ-12) LCC to SPS port connector is not used at this time.

Figure 76 on page 87 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.

VNX-000106

Figure 76 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.

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 77).

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 77).

IMPORTANT

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.

LCC enclosure ID   Bus (loop) ID
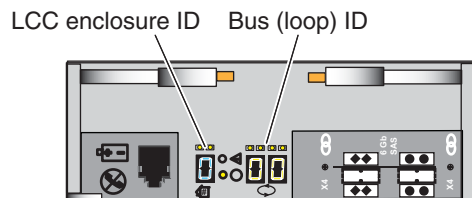
VNX-000277

Figure 77 Example of enclosure ID and bus ID for LCC A

Table 49 describes the bus (loop) status LEDs.

Table 49 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

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

IMPORTANT

The 4U, 60 (2.5- or 3.5-inch) disk drive DAE (DAE7S) is assembled and configured at the factory before shipping. If replacing or adding a 4U, 60 (2.5- or 3.5-inch) DAE becomes necessary. Refer to the **CAUTION** on page 89 that discusses the mounting and servicing of the 4U, 60, (2.5- or 3.5-inch) DAE in a 40U Dense rack. Additionally, refer to the *Replacing* or *Adding a DAE* documents for the 4U, 60, (2.5- or 3.5-inch) DAE.

⚠️**CAUTION**

Access to internal components in a 4U, 60 DAE that are mounted 31U (4.5 feet or 1.38 meters) or more above the floor requires special equipment and is restricted to authorized service personnel only. Attempts to service disks, fans, or LCCs that are mounted 31U or higher without appropriate tools and personnel might result in serious personal injury.

The 4U, 60 (2.5- or 3.5-inch) DAE (DAE7S) includes up to 60, 2.5- or 3.5-inch disk drives. Supporting 6-Gb/s data transfer speeds, this DAE has the following hardware components: three fan (or cooling modules), 60 disks (30 per side), two Link Control Cards (LCCs), two Inter Connect Modules (ICMs), and two power supplies.

IMPORTANT

When the 4U, 60 DAE is used in combination with the 3U, 15 DAE, the 4U or the 3U DAE can accommodate the Vault drives. The use of which DAE will use the Vault drives will be determined by the customer requirements as all 40U Dense racks with the 4U DAE are customer requested and assembled and configured at the factory.

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.

IMPORTANT

To accommodate the 4U, 60 DAE, a 40U Dense rack is required. The Dense rack is 44 inches (111.76 cm) deep. Because each DAE weighs 57.8 lb (26.28 kg) empty and 213 lb (96.62 kg) fully loaded, a DAE interlock mechanism is provided in the Dense rack to prevent the extension of no more than one DAE at a time.

Access to disk drives, LCCs, and cooling modules

⚠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:

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

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

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.

If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the DAE in the rack. The *Replacing a DAE* document for the DAE provides more information.

Unlike the 2U and 3U DAEs, the 4U, 60 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, LCCs, and cooling modules 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, to unlock the DAE from the rails, pull on the orange loops on each side of the DAE (location 1 in Figure 78 on page 90). Finally, pull the orange tabs on each side of the DAE (location 2 in Figure 78 on page 90) 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.
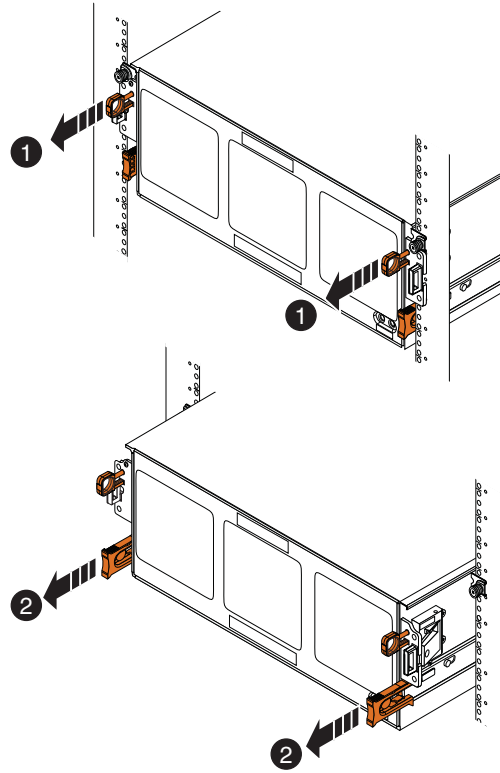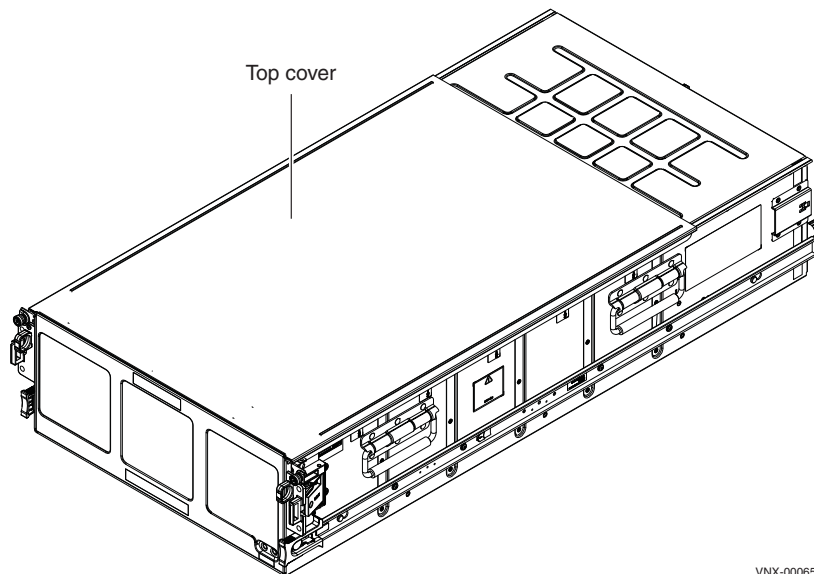
CL4663

Figure 78 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 DAE does not slide out of the rack, verify that all the other DAEs are completely seated in the rack by pushing firmly on them.

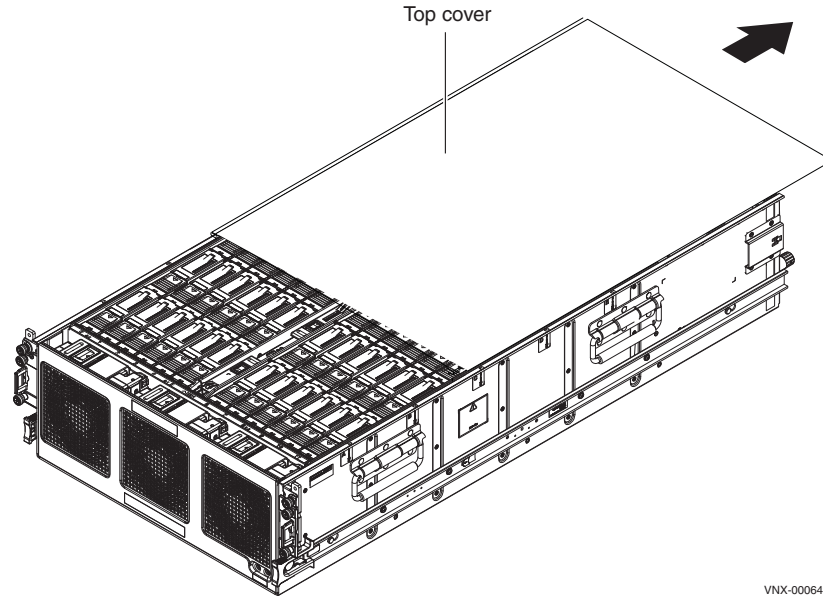Figure 79 shows an example of a 4U DAE with the top cover closed.

Top cover

VNX-000656

Figure 79 4U, 60 (2.5- or 3.5-inch) DAE (with top cover closed)

To gain access to the disk drives, LCCs, and cooling modules (after sliding the DAE out of the rack), you slide the top cover toward the rear of the DAE.
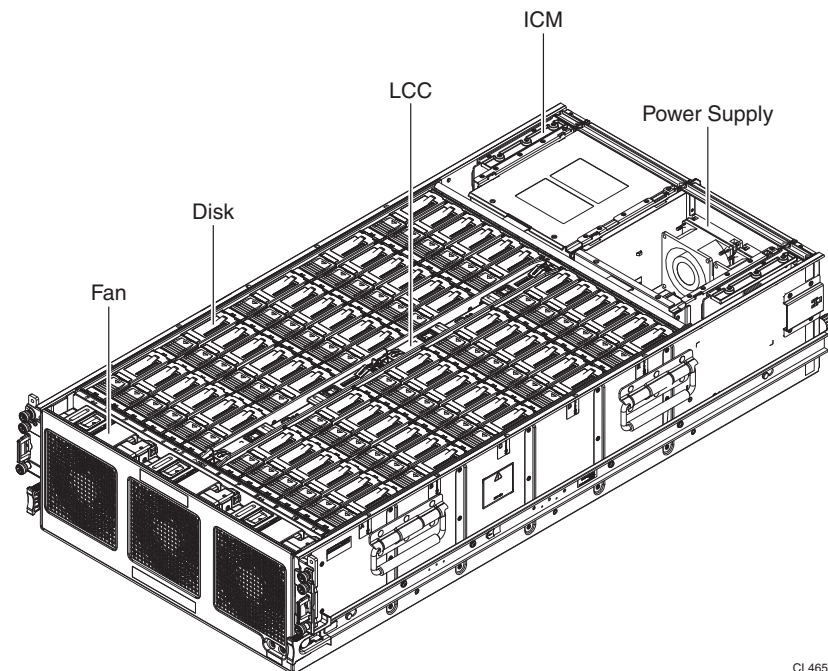
Figure 80 shows an example of a 4U DAE with the top cover open showing the disk drives, LCCs, and the cooling modules (or fans.)

VNX-000649

Figure 80 4U, 60 (2.5- or 3.5-inch) DAE (with top cover open)

Figure 81 shows an example of the interior view of a 4U DAE.

CL4658

Figure 81 4U, 60 (2.5- or 3.5-inch) DAE (interior view)

The ICMs and power supplies shown in Figure 81 are accessed from the rear of the 4U DAE. "Rear view" on page 96 provides more information.
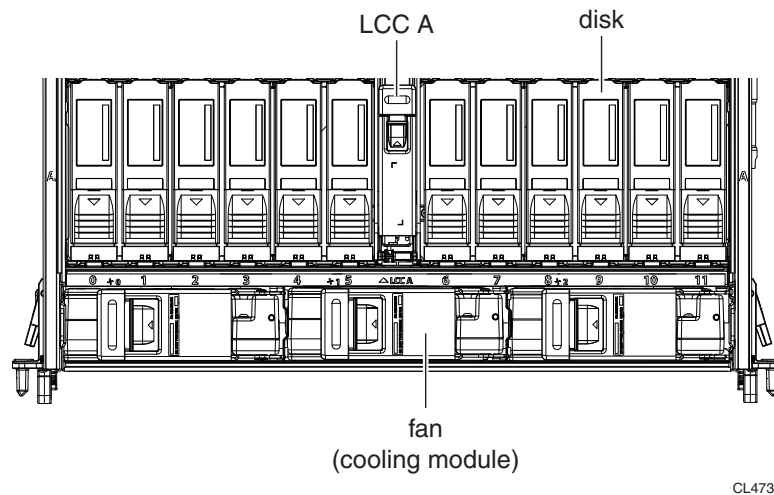
Disk drives

The disk drives for the 4U 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 DAE:

◆ 2.5-inch 6-Gb/s SAS, 6-Gb/s NL-SAS, or Flash disk drives (hot-swappable)[1]

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

Figure 82 on page 92 shows a top-down cut-away interior view of 4U, 60 DAE showing the location of the disk drives, fans (cooling modules), and LCC A.

Figure 82 4U, 60 (2.5- or 3.5-inch) top-down cut-away of disk drives, fans (cooling modules), and LCC A (interior view)

Disk drive layout

Looking at the 4U DAE from the front and above, 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**. When describing the layout of disks within a 4U DAE, the interface format for the DAE is called B_E_D. That is, B indicates the bus, E the enclosure, and D the disk. For example, you could have an interface format of 0_1_B11. This format is interpreted as bus 0, enclosure 1, in row (bank) B, in slot number 11. Looking at the 4U DAE from the front and above, Figure 83 on page 93 shows you the disk drive layout of the 4U, 60 DAE.

Note: The labels for the banks, slots, and LCCA shown in Figure 83 on page 93 are the physical labels in the 4U DAE.

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1. 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.
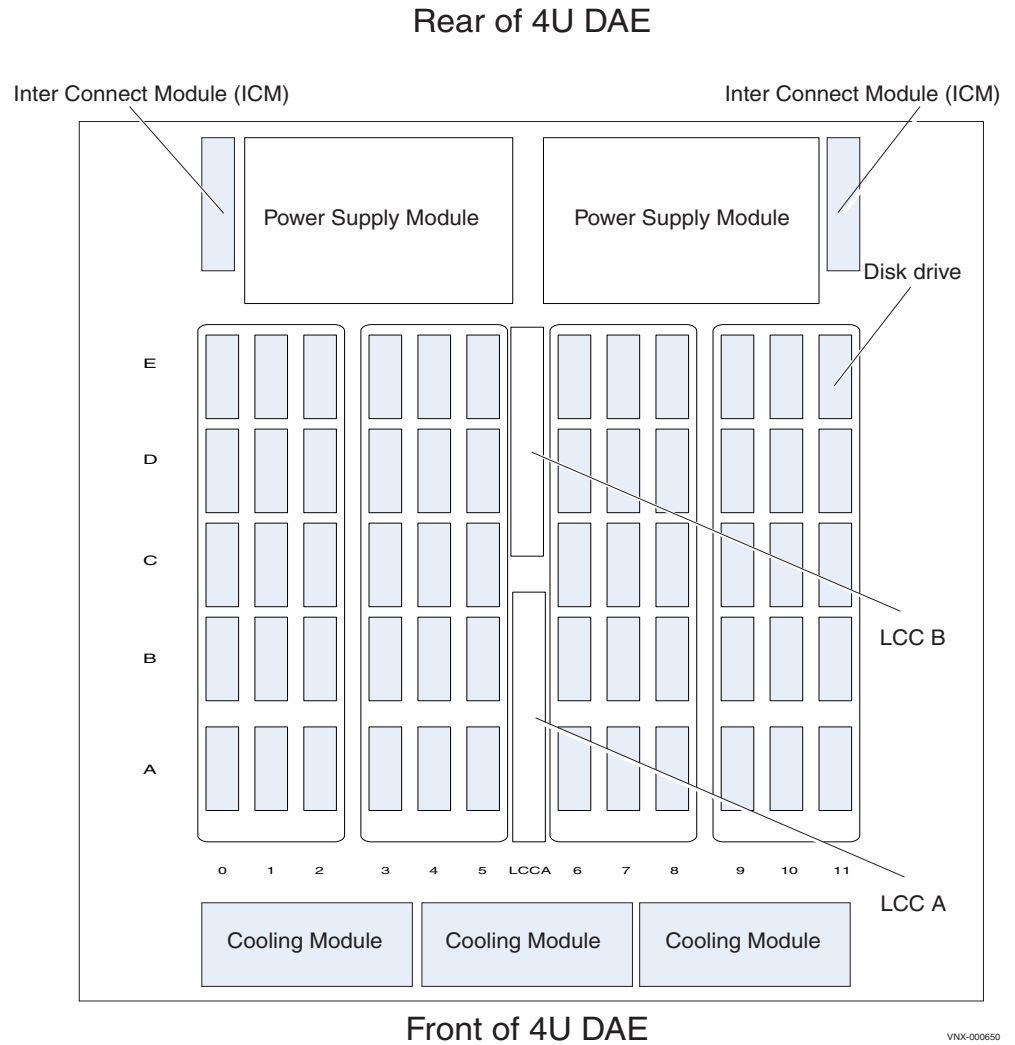
Rear of 4U DAE

Front of 4U DAE

VNX-000650

Figure 83 4U, 60 DAE disk drive layout and notation (top-down interior view)

Rules for disk drive population

To load the disk drives into a 4U DAE is (Figure 83):

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. Rows with no or zero (0) drives do not require filler panel modules. Spare filler panel modules do not have to be placed into specific slots, but they must be placed in the same row.

LCC

Each 4U, 60 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 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.

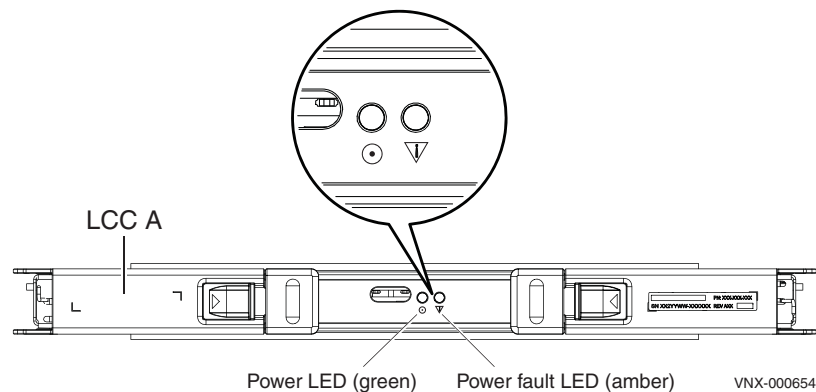Figure 84 shows the location of the status LEDs on the 4U, 60 DAE LCC.

Figure 84 Example of 4U, 60 DAE LCC A showing the status LEDs

Table 50 describes the 4U, 60 DAE LCC status LEDs.

Table 50 LCC status LEDs

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

Fan control module (cooling module)

Each 4U, 60 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 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 85 shows the location of the status (fan fault) LED on the 4U, 60 DAE fan control module.
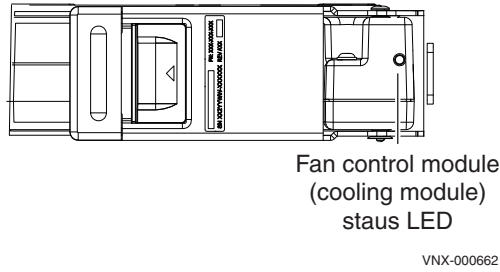

Fan control module
(cooling module)
staus LED

VNX-000662

Figure 85 Example of 4U, 60 DAE fan control module showing the fan fault LED

Table 51 describes the 4U, 60 DAE fan fault LED.

Table 51 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

Front view

On the front, the 4U, 60 DAE includes three fans or cooling modules and two Status LEDs.

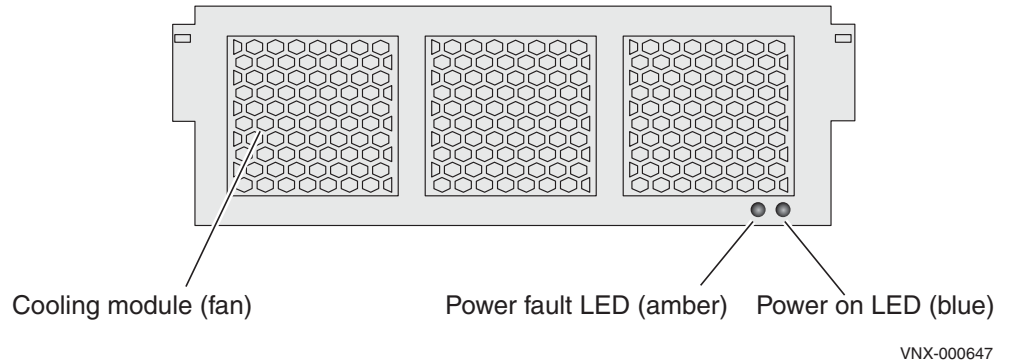Figure 86 shows the location of the fan or cooling module and the 4U, 60 DAE status LEDs.


Cooling module (fan)   Power fault LED (amber)   Power on LED (blue)

VNX-000647

Figure 86 4U, 60 DAE (front view)

Table 52 describes the 4U, 60 DAE status LEDs.

Table 52 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, 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 87.
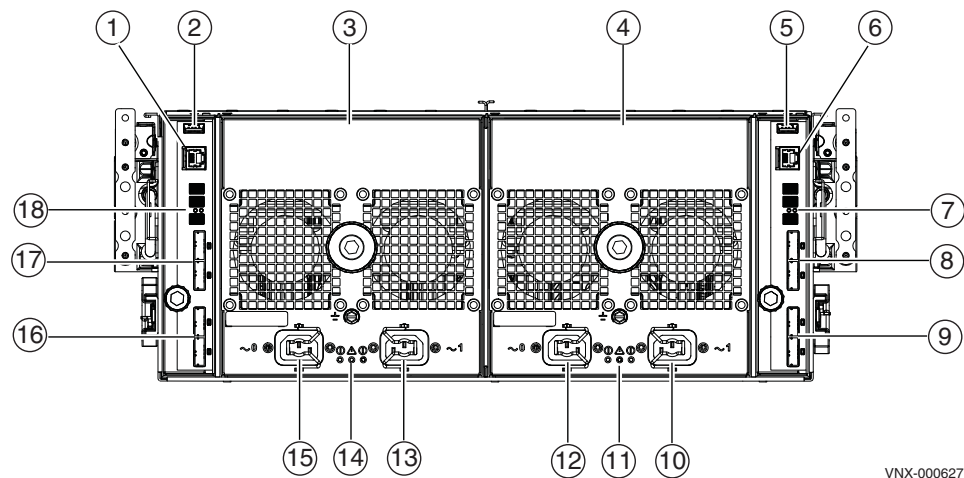
VNX-000627

1	ICM A management (RJ-12) connector to SPS	10	4U, 60 DAE B AC power supply (power in) recessed connector (plug), labeled **1**
2	ICM A USB connector	11	4U, 60 DAE B power and fault LEDs
3	4U, 60 DAE A AC power supply)	12	4U, 60 DAE B AC power supply (power in) recessed connector (plug), labeled **0**
4	4U, 60 DAE B AC power supply (power in) recessed connector (plug)	13	4U, 60 DAE A AC power supply (power in) recessed connector (plug), labeled **1**
5	ICM B USB connector	14	4U, 60 DAE A power and fault LEDs
6	ICM B management (RJ-12) connector to SPS	15	4U, 60 DAE A AC power supply (power in) recessed connector (plug), labeled **0**
7	4U, 60 DAE B bus ID and enclosure ID	16	ICM A SAS connector (output)
8	ICM B SAS connector (input); labeled with a double circle (or dot) symbol ●● .	17	ICM A SAS connector (input)
9	ICM B SAS connector (output); labeled with a double diamond symbol ◆◆ .	18	4U, 60 DAE A bus ID and enclosure ID

Figure 87 Example of 4U, 60 DAE with two ICMs and two power supply/cooing modules (rear view)

ICM

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

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

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 88 on page 97, an enclosure ID[1] 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.
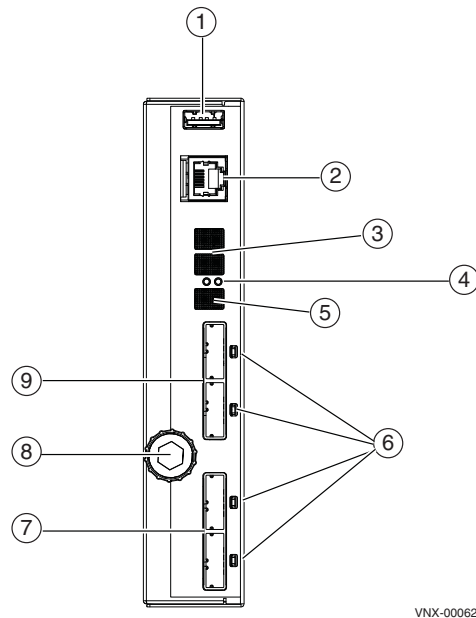
VNX-000629

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

Figure 88 Example of ICM connectors and LEDs (rear view)

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

Table 53 describes the ICM bus (loop) status LEDs.

Table 53 ICM bus (loop) 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

The 4U, 60 DAE 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 SAS ports

◆ One management (RJ-12) connector to the SPS

◆ One USB connector

6-Gb/s SAS x8 ports

The DAE ICM supports four (two input and two output) 6-Gb/s 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 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.

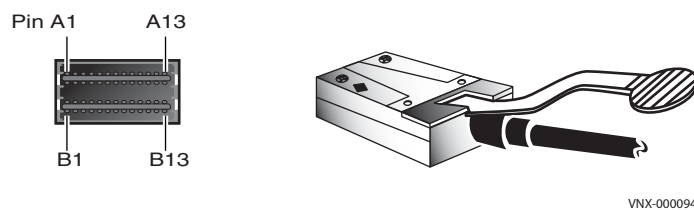Figure 89 shows an example of the port connector (socket) and cable connector (plug) with pull tab.

Figure 89 6-Gb/s SAS port and cable connector

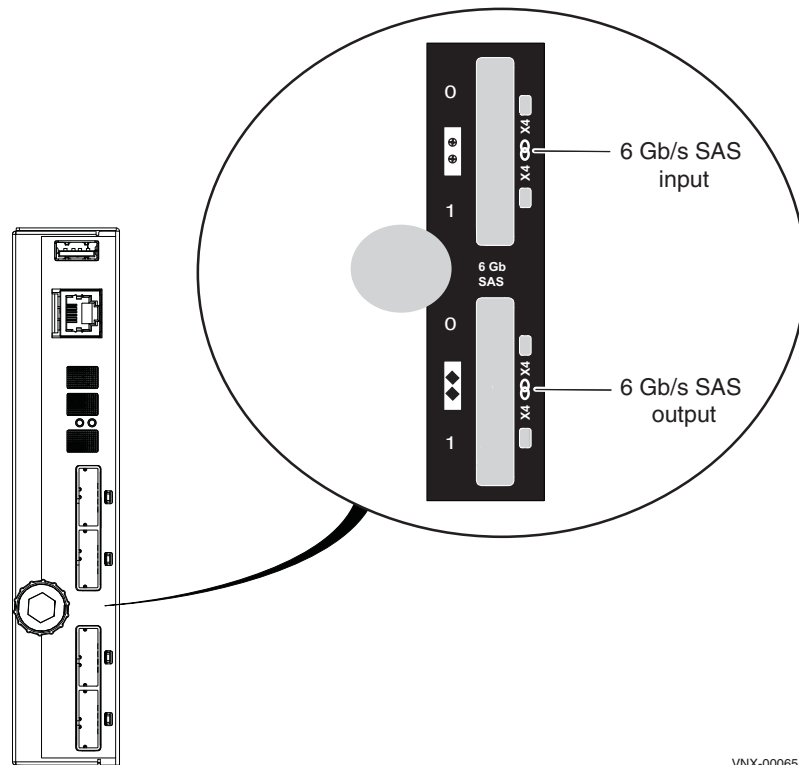Table 54 lists the 4U, DAE ICM 6-Gb/s SAS port pin signals used on the connector.

Table 54 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-

Table 54 6-Gb/s SAS port connector pinout (continued)

Pin	Signal	Pin	Signal
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 SAS port LEDs and port direction (input or output) — Figure 90 shows the 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.

VNX-000655

Figure 90 6-Gb/s SAS connectors and LEDs

Table 55 describes the 4U DAE ICM 6-Gb/s port LEDs.

Table 55 6-Gb/s 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

Note: The management Ethernet (RJ-12) ICM to SPS port connector is not used at this time.

Figure 91 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 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.

VNX-000652

Figure 91 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 connector

The USB connector provides a power connection to the front console.

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 92).

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 92).

Note: Figure 92 shows the bus ID and enclosure ID indicators when viewed from the horizontal side of the ICM. Normally, you would have to turn your head to view these indicators.
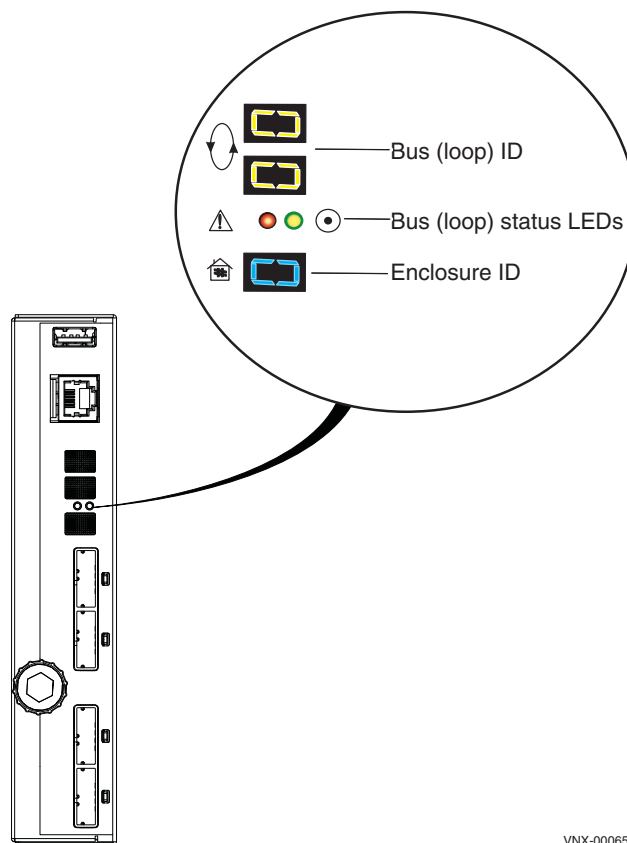

VNX-000651

Figure 92 Example of ICM enclosure ID indicator, bus ID indicator, and the bus LEDs

Table 56 describes the bus (loop) status LEDs.

Table 56 ICM bus (loop) 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

4U, 60 DAE AC 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 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^{2}C interface.

Figure 93 shows an example of a 4U, 60 DAE AC power supply with two (power in) recessed connectors (or plugs) and status LEDs.
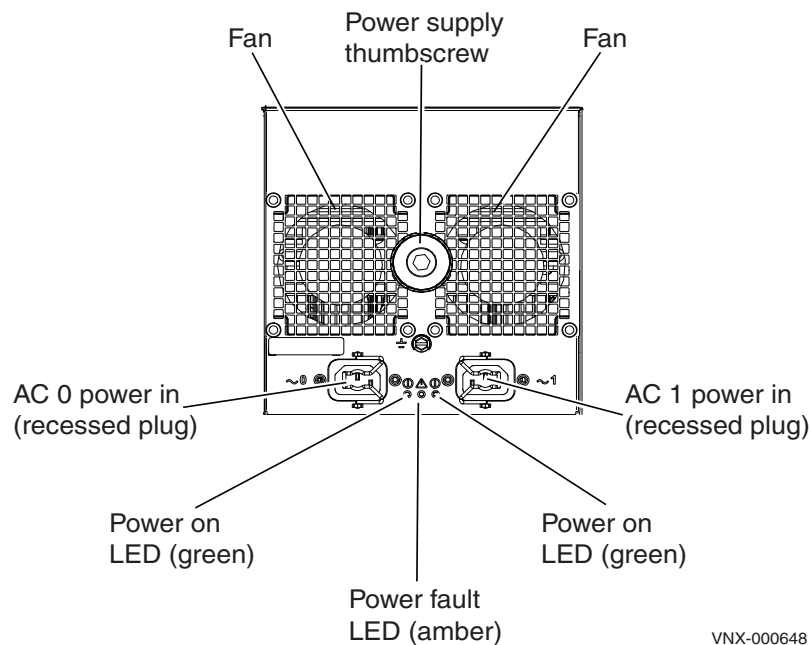
VNX-000648

Figure 93 Example of 4U, 60 DAE AC power supply showing the (power in) recessed connectors (plugs) and status LEDs

Table 57 describes the 4U, 60 (2.5- or 3.5-inch) DAE power supply LEDs.

Table 57 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.

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 VNX5500 platform.
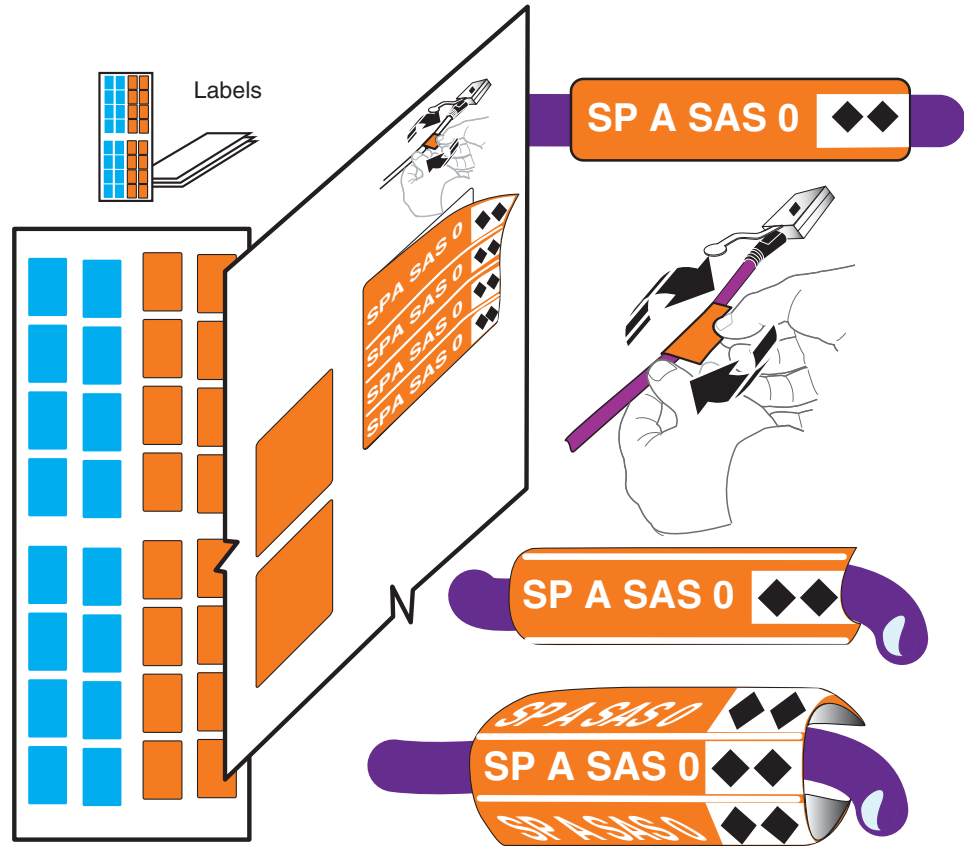
IMPORTANT

The following sections only discuss the DAE cabling of the VNX5500 platform with either the 3U, 15 disk drive DAE or the 2U, 25 disk drive DAE. The 4U, 60 disk drive DAE is not discussed.

For all other cabling of your VNX5500 platform, the *VNX5500 Installation Guide* provides information about the SPS power cabling, DPE 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 94 on page 104 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.

VNX-000687

Figure 94 Example of a cable label wrap

VNX5500 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.

Shown in the upcoming figures (, ,) are examples of SAS cabling in a 3U DPE-based VNX storage platform, the VNX5500 Block. The Storage Processors connect to the DAEs with SAS cables. The cables connect the LCCs in the DAEs of a storage platform in a daisy-chain topology.

The DPE is automatically Enclosure 0 (EA0). The DAE connected to SAS output port 0 is Enclosure 1 (EA1).

The VNX5500 platform supports two types of DPEs and DAEs; a 15 drive 3.5-inch disk 3U enclosure and a 25 drive 2.5-inch disk 2U enclosure. Expansion of up to fifteen 3U DAEs (a maximum of 240 3.5-inch disk drives) or up to nine 2U DAEs (a maximum of 250 2.5-inch disk drives).

IMPORTANT

Do Not connect more DAEs than the VNX5500 platform can support. When calculating the number of drives for your VNX5500 platform, the 3U DPE is included in the total drive slot quantity of 240 to 250 drives. If the total drive slot quantity exceeds 240 or 250, you will not be able to add another DAE.

Cabling with two DAEs in a VNX5500 Block platform

The first DAE connected to the Storage Processor SAS output port 1 is designated Enclosure 0 (EA0). 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, but the addresses will increment.

Figure 95 on page 106 shows the first example of a VNX5500 Block platform with two DAEs (one 3U, 15 disk drive DAE and the other a 2U, 25 disk drive DAE) or a VNX5500 platform with a total of from 55 disk drives (if the DPE is a 3U, 15 disk drive device) or 65 disk drives (if the DPE is a 3U, 25 disk drive device).

The SAS ports on the VNX5500 platform DPE are labeled **0** and **1**. SAS 0 is connected internally to the SAS expander that connects the internal 3U DPE disks. Since SAS 0 is already connected internally to the DPE disks, the first DAE is connected to SAS 1 to balance the load on the SAS ports. The second DAE is connected to SAS 0, the third DAE is connected to SAS 1, and so on.

In Figure 95 on page 106, 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 VNX5500 platform, Bus 0 EA0 is the DPE (SP A and B). So, to balance the load, Bus 1 EA0 becomes the first DAE (LCC A and B) in the cabinet with the next DAE (LCC A and LCC B) as Bus 0 EA1, and so on. If you have several DAEs in your VNX5500 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 DPE and 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 95 are:

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

◆ Cable 1, blue, DPE to 1st DAE (labels SP A SAS 1 to LCC A)

◆ Cable 2, blue, DPE to 1st DAE (labels SP B SAS 1 to LCC B)

◆ Cable 3, orange, DPE to 2nd DAE (labels SP A SAS 0 to LCC A)

◆ Cable 4, orange, DPE to 2nd DAE (labels SP B SAS 0 to LCC B)

Note: If your VNX5500 platform was not cabled at the factory, refer to the cable wrap guide ("Cable label wraps" on page 103) that came with your VNX5500 platform for the correct cable labels.
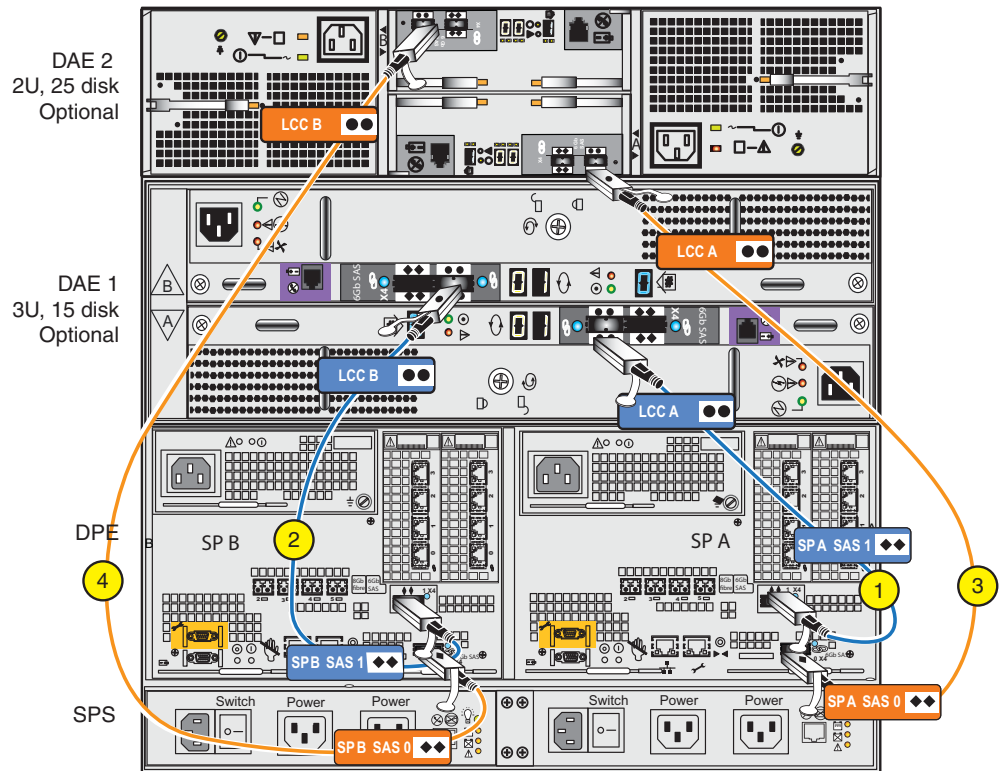
VNX-000576

Figure 95 Example of the VNX5500 Block platform with two DAEs (3U, 15 disks and 2U, 25 disks) cabling

Note: Each cable end includes a symbol to denote the direction the cable needs to connect to. The cable end that has a single circle ● symbol is the input end. While the cable connector with the single diamond ◆ symbol is the output end.

Interleaved cabling with nine DAEs in a VNX5500 Block platform

Figure 96 on page 108 shows a second example of a VNX5500 Block platform with nine DAEs (all are 2U, 25 disk drive DAEs) or a VNX5500 platform with a total of 240 disk drives (with the DPE a 3U, 15 disk drive device).

In this example, as described previously, the SAS ports on the VNX5500 platform DPE are labeled **0** and **1**. SAS 0 is connected internally to the SAS expander that connects to the internal DPE disks. However, since nine DAEs are available for a maximum of 240 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 96 on page 108, two buses (Bus 0 and Bus 1) are available.

The cables shown in Figure 96 on page 108 are:

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

◆ Cable 1, blue, DPE to 1st DAE (labels SP A SAS 1 to LCC A)

◆ Cable 2, blue, DPE to 1st DAE (labels SP B SAS 1 to LCC B)

◆ Cable 3, orange, DPE to 2nd DAE (labels SP A SAS 0 to LCC A)

◆ Cable 4, orange, DPE to 2nd DAE (labels SP B SAS 0 to LCC B)

The remaining cables are daisy-chained for load balancing. So, the blue cable for Bus 1 is interleaved and daisy-chained through the remaining DAEs:

◆ EA 1/Bus 1

◆ EA 2/Bus 1

◆ EA 3/Bus 1

◆ EA 4/Bus 1

While the orange cable for Bus 0 is interleaved and daisy-chained through the remaining DAEs:

◆ EA 2/Bus 0

◆ EA 3/Bus 0

◆ EA 4/Bus 0

Note: Figure 96 on page 108 shows 6U of reserved space to allow for upgrading your VNX5500 Block to VNX5500 File/Unified platform. If you are planning to upgrade your Block platform to a File/Unified platform, it is recommended that at least 6U of rack space be reserved for adding one to two Controls Stations and one to two Data Mover enclosures.
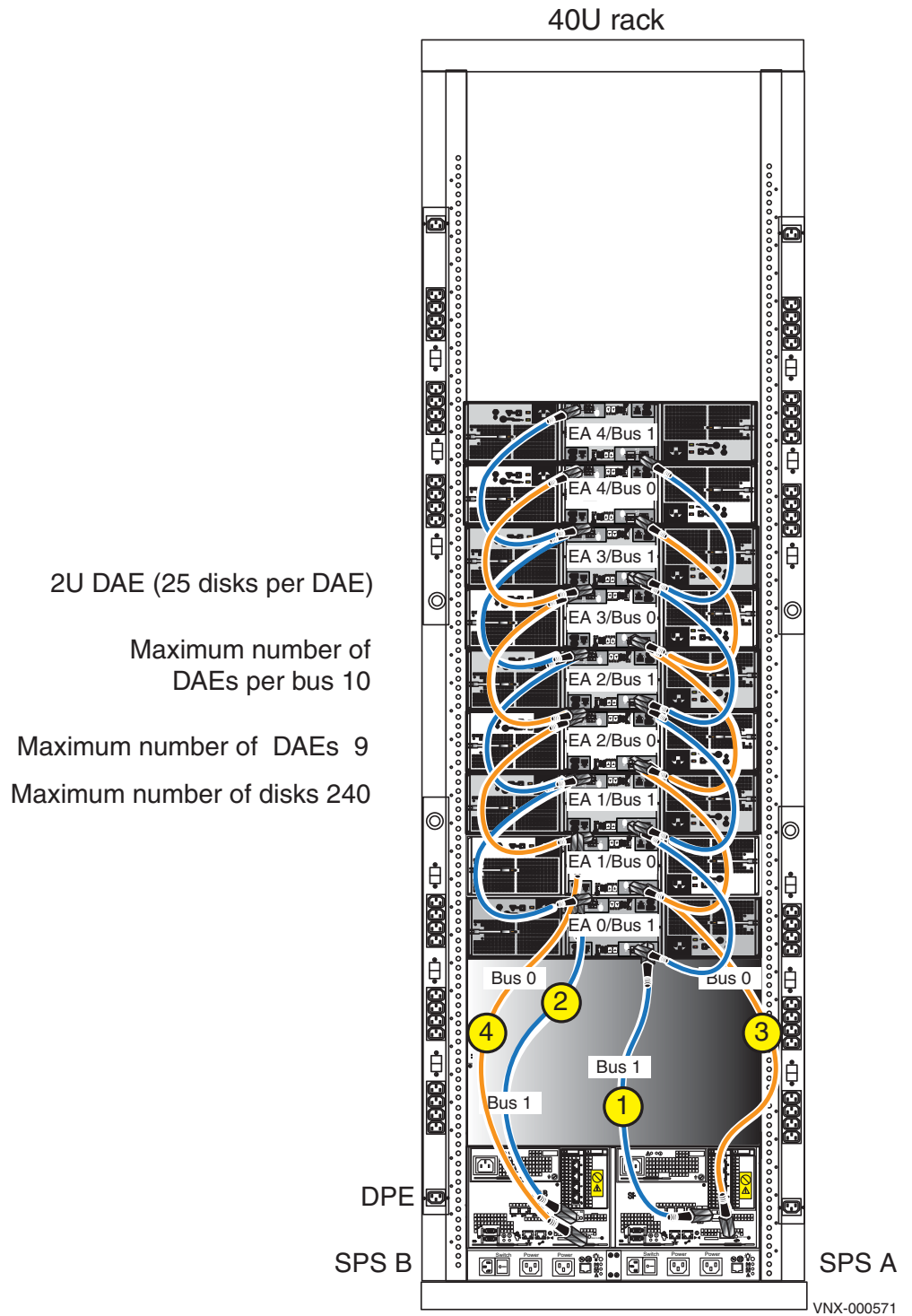
40U rack

2U DAE (25 disks per DAE)

Maximum number of
DAEs per bus 10

Maximum number of DAEs 9

Maximum number of disks 240

EA 4/Bus 1

EA 4/Bus 0

EA 3/Bus 1

EA 3/Bus 0

EA 2/Bus 1

EA 2/Bus 0

EA 1/Bus 1

EA 1/Bus 0

EA 0/Bus 1

Bus 0

Bus 0

2

4

3

Bus 1

Bus 1

1

DPE

SPS B

SPS A

VNX-000571

Figure 96 Example of the VNX5500 Block platform with nine DAEs (2U, 25 disks) interleaved cabling

Stacked cabling with nine DAEs in a VNX5500 Block platform

Figure 97 on page 110 shows a third example of a VNX5500 Block platform with nine DAEs (all are 2U, 25 disk drive DAEs) or a VNX5500 platform with a total of 240 disk drives (with the DPE a 3U, 15 disk drive device). This example shows the stacked cabling with one 40U rack having nine DAEs.

In this example, as described previously, the SAS ports on the VNX5500 platform DPE are labeled **0** and **1**. SAS 0 is connected internally to the SAS expander that connects to the internal DPE disks. However, since nine DAEs are available for a maximum of 240 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 97 on page 110, two buses (Bus 0 and Bus 1) are available.

The cables shown in Figure 97 on page 110 are:

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

◆ Cable 1, blue, DPE to 5th DAE (labels SP A SAS 1 to LCC A)

◆ Cable 2, blue, DPE to 5th DAE (labels SP B SAS 1 to LCC B)

◆ Cable 3, orange, DPE to 1st DAE (labels SP A SAS 0 to LCC A)

◆ Cable 4, orange, DPE to 1st DAE (labels SP B SAS 0 to LCC B)

So, the blue cable for Bus 1 is daisy-chained through the remaining DAEs:

◆ EA 1/Bus 1

◆ EA 2/Bus 1

◆ EA 3/Bus 1

◆ EA 4/Bus 1

While the orange cable for Bus 0 is daisy-chained through the remaining DAEs:

◆ EA 2/Bus 0

◆ EA 3/Bus 0

◆ EA 4/Bus 0

Note: Figure 97 on page 110 shows 6U of reserved space to allow for upgrading your VNX5500 Block to VNX5500 File/Unified platform. If you are planning to upgrade your Block platform to a File/Unified platform, it is recommended that at least 6U of rack space be reserved for adding one to two Controls Stations and one to two Data Mover enclosures.
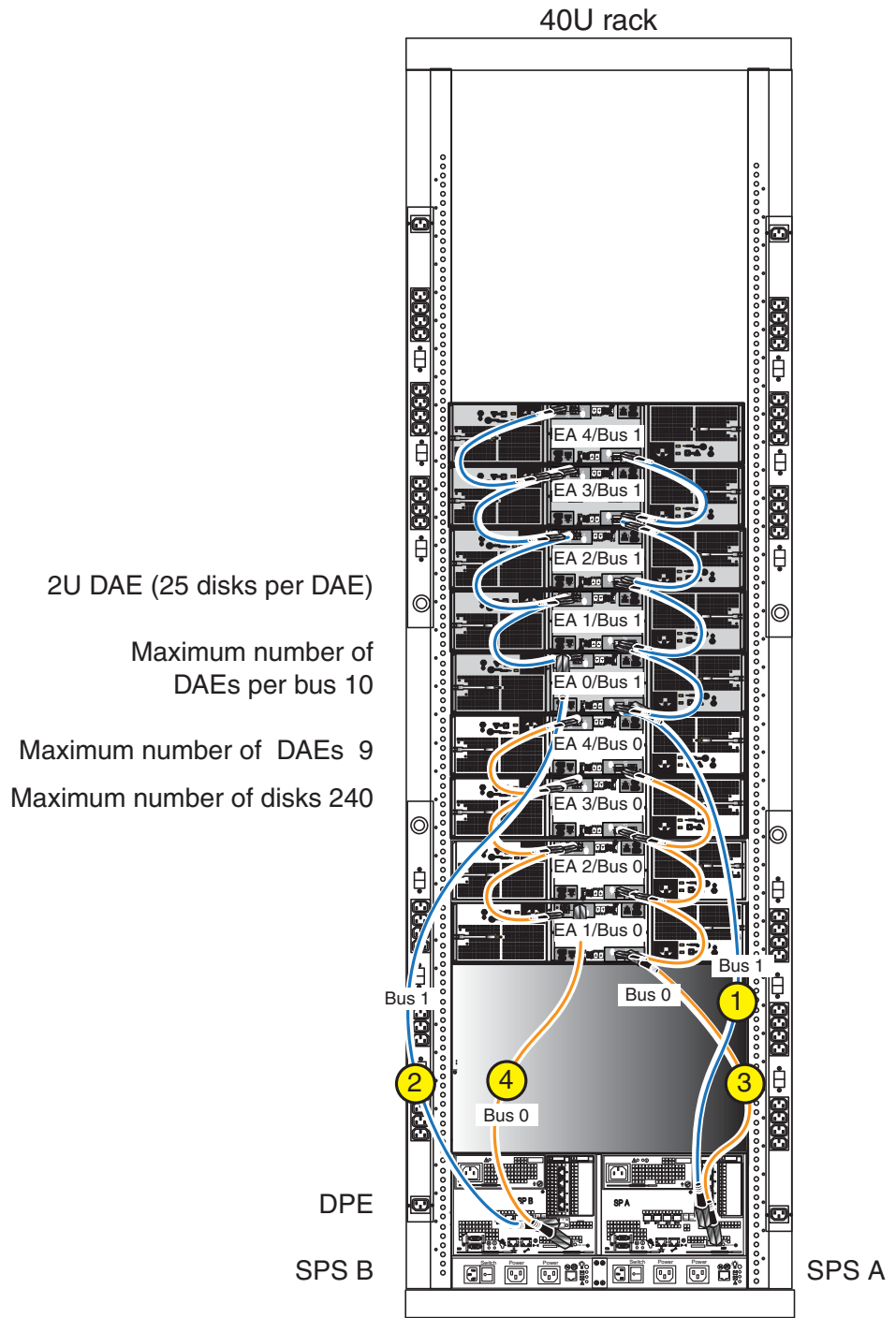
VNX-000637

Figure 97 Example of the VNX5500 Block platform with nine DAEs (2U, 25 disks) stacked cabling

Cabling with two DAEs in a VNX5500 File/Unified platform

Shown in the upcoming figures (Figure 98 on page 112, Figure 99 on page 114, and Figure 100 on page 116) are examples of SAS cabling in a DPE-based VNX storage platform, the VNX5500 File/Unified platform. 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 DPE is automatically Enclosure 0 (EA0). The DAE connected to SAS output port 0 is Enclosure 1 (EA1).

The first DAE connected to the Storage Processor SAS output port 1 is designated Enclosure 0 (EA0). 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 98 on page 112 shows the first example of a VNX5500 File/Unified platform with two DAEs (one 3U, 15 disk drive DAE and the other a 2U, 25 disk drive DAE) or a VNX5500 platform with a total of from 55 disk drives (if the DPE is a 3U, 15 disk drive device) or 65 disk drives (if the DPE is a 3U, 25 disk drive device).

IMPORTANT

When balancing the load the between buses, take the following into consideration: the DPE is 0,0, the 1st DAE is 1,0 (port 1), the 2nd DAE is 0,1, and so on.

The SAS ports on the VNX5500 platform DPE are labeled **0** and **1**. SAS 0 is connected internally to the SAS expander that connects the internal DPE disks. Since SAS 0 is already connected internally to the DPE disks, the first DAE is connected to SAS 1 to balance the load on the SAS ports. The second DAE is connected to SAS 0, the third DAE is connected to SAS 1, and so on.

In Figure 98 on page 112, 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 VNX5500 platform, Bus 0 EA0 is the DPE (SP A and B). So, to balance the load, Bus 1 EA0 becomes the first DAE (LCC A and B) in the cabinet with the next DAE (LCC A and LCC B) as Bus 0 EA1, and so on. If you have several DAEs in your VNX5500 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 DPE and 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 98 are:

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

◆ Cable 1, blue, DPE to 1st DAE (labels SP A SAS 1 to LCC A)

◆ Cable 2, blue, DPE to 1st DAE (labels SP B SAS 1 to LCC B)

◆ Cable 3, orange, DPE to 2nd DAE (labels SP A SAS 0 to LCC A)

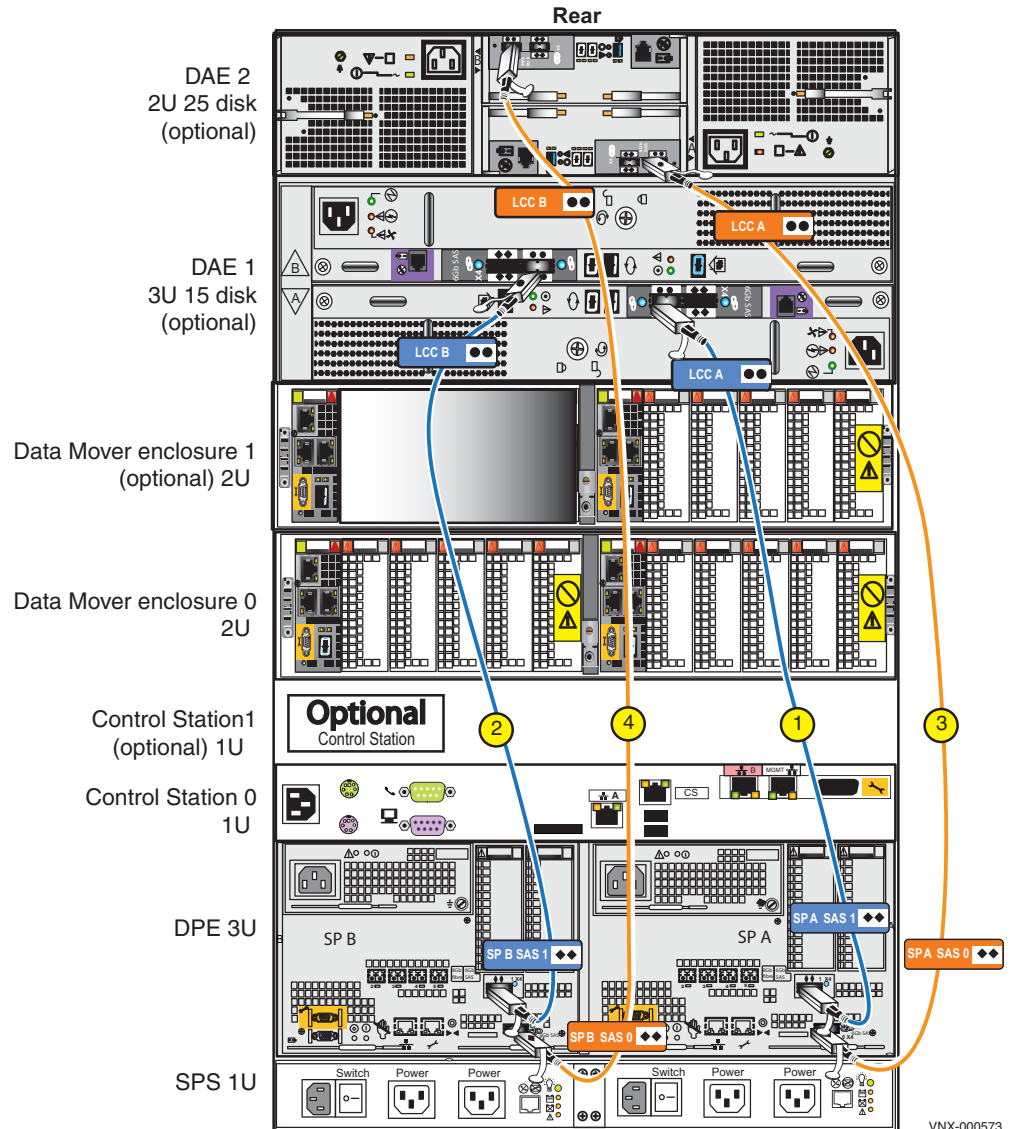◆ Cable 4, orange, DPE to 2nd DAE (labels SP B SAS 0 to LCC B)

Figure 98 Example of the VNX5500 File/Unified platform with two DAEs (3U, 15 disks and 2U, 25 disks) cabling

Note: In Figure 98, the VNX5500 File/Unified platform shows a single 1U SPS (with an optional SPS available), a DPE (with two SPs), a CS (with optional CS available), a DME (with two DMs), an optional DME (with one DM), and a 3U 15 DAE and the 2U 25 DAE.

Interleaved cabling in a VNX5500 File/Unified platform with nine DAEs

shows an example of a VNX5500 File/Unified platform with nine DAEs (all are 2U, 25 disk drive DAEs) or a VNX5500 File/Unified platform with a total of 240 disk drives (with the DPE a 3U, 15 disk drive device).

In this example, the SAS ports on the VNX5500 platform DPE are labeled **0** and **1**. SAS 0 is connected internally to the SAS expander that connects to the internal DPE disks. However, since four DAEs for a maximum of 240 disk drives are available, 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 99 on page 114, two buses (Bus 0 and Bus 1) are available with the first DAE on Bus 1 designated as EA0/Bus 1 (blue cable). The second DAE continues Bus 0 and is designated as EA1/Bus 0 (orange cable) where it is then daisy-chained to the fourth DAE designated as EA2/Bus 0 and then to the sixth DAE designated as EA3/Bus 0, and so on.

The cables shown in Figure 99 on page 114 are:

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

- Cable 1, blue, DPE to 1st DAE (labels SP A SAS 1 to LCC A)
- Cable 2, blue, DPE to 1st DAE (labels SP B SAS 1 to LCC B)
- Cable 3, orange, DPE to 2nd DAE (labels SP A SAS 0 to LCC A)
- Cable 4, orange, DPE to 2nd DAE (labels SP B SAS 0 to LCC B)

The remaining cables are daisy-chained for load balancing. So, the blue cable for Bus 1 is interleaved and daisy-chained through the remaining DAEs:

- EA 2/Bus 1
- EA 3/Bus 1
- EA 4/Bus 1

While the orange cable for Bus 0 is interleaved and daisy-chained through the remaining DAEs:

- EA 2/Bus 0
- EA 3/Bus 0
- EA 4/Bus 0

Note: In Figure 99 on page 114 the VNX5500 File/Unified platform shows a dual 1U SPS, a DPE (with two SPs), two CSs, two DMEs (with three DMs), and nine 3U 15 DAEs.

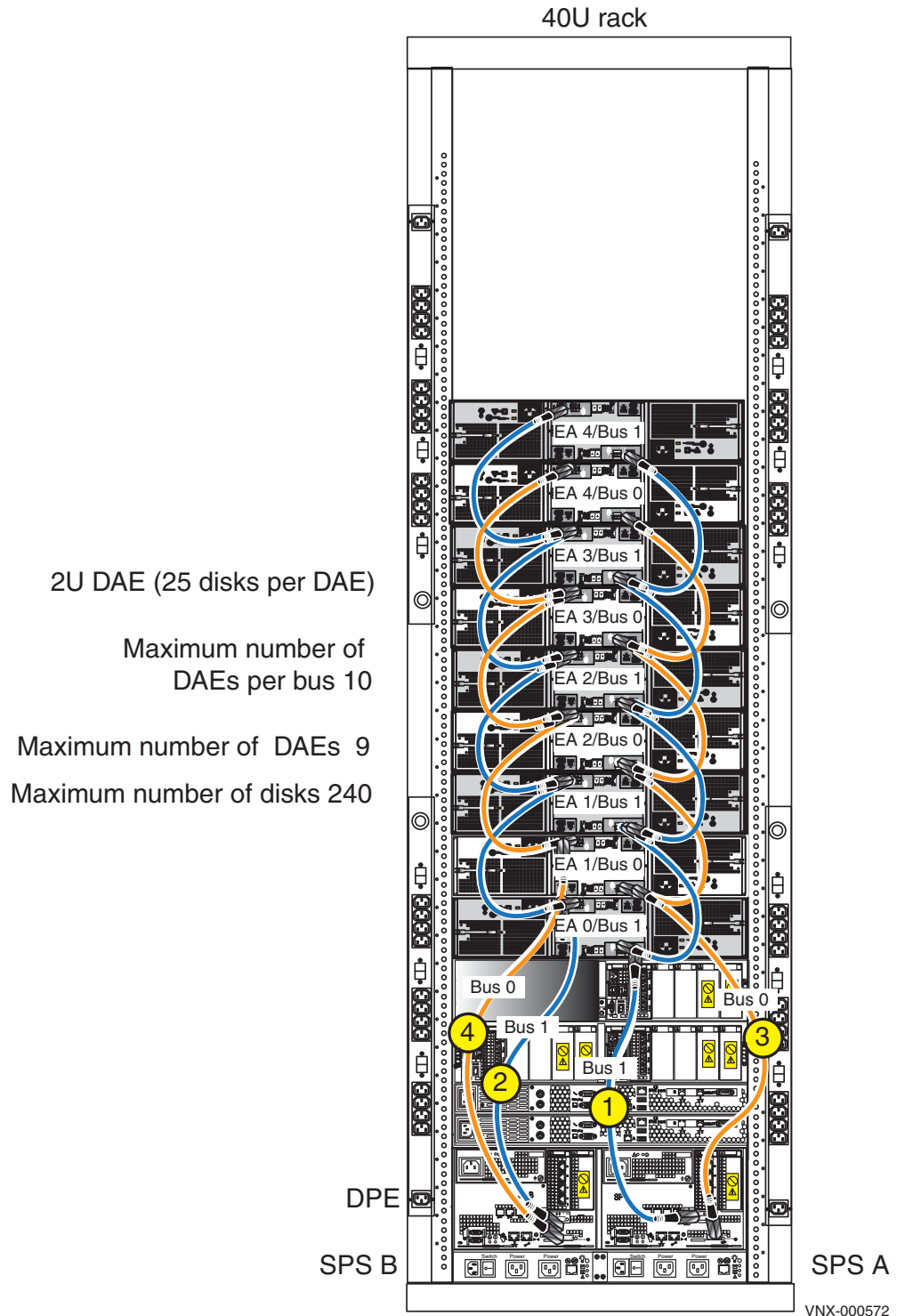40U rack

2U DAE (25 disks per DAE)

Maximum number of
DAEs per bus 10

Maximum number of DAEs 9

Maximum number of disks 240

EA 4/Bus 1
EA 4/Bus 0
EA 3/Bus 1
EA 3/Bus 0
EA 2/Bus 1
EA 2/Bus 0
EA 1/Bus 1
EA 1/Bus 0
EA 0/Bus 1

Bus 0
Bus 1
Bus 1
Bus 0

DPE

SPS B
SPS A

VNX-000572

Figure 99 Example of the VNX5500 File/Unified platform with 9 DAEs (2U, 25 disks) interleaved cabling

Stacked cabling in a VNX5500 File/Unified platform with nine DAEs

Figure 100 on page 116 shows a third example of a VNX5500 File/Unified platform with nine DAEs (all are 2U, 25 disk drive DAEs) or a VNX5500 File/Unified platform with a total of 240 disk drives (with the DPE a 3U, 15 disk drive device). This example shows the stacked cabling with one 40U rack having nine DAEs.

In this example, as described previously, the SAS ports on the VNX5500 File/Unified platform DPE are labeled **0** and **1**. SAS 0 is connected internally to the SAS expander that connects to the internal DPE disks. However, since nine DAEs are available for a maximum of 240 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 100 on page 116, two buses (Bus 0 and Bus 1) are available.

The cables shown in Figure 100 on page 116 are:

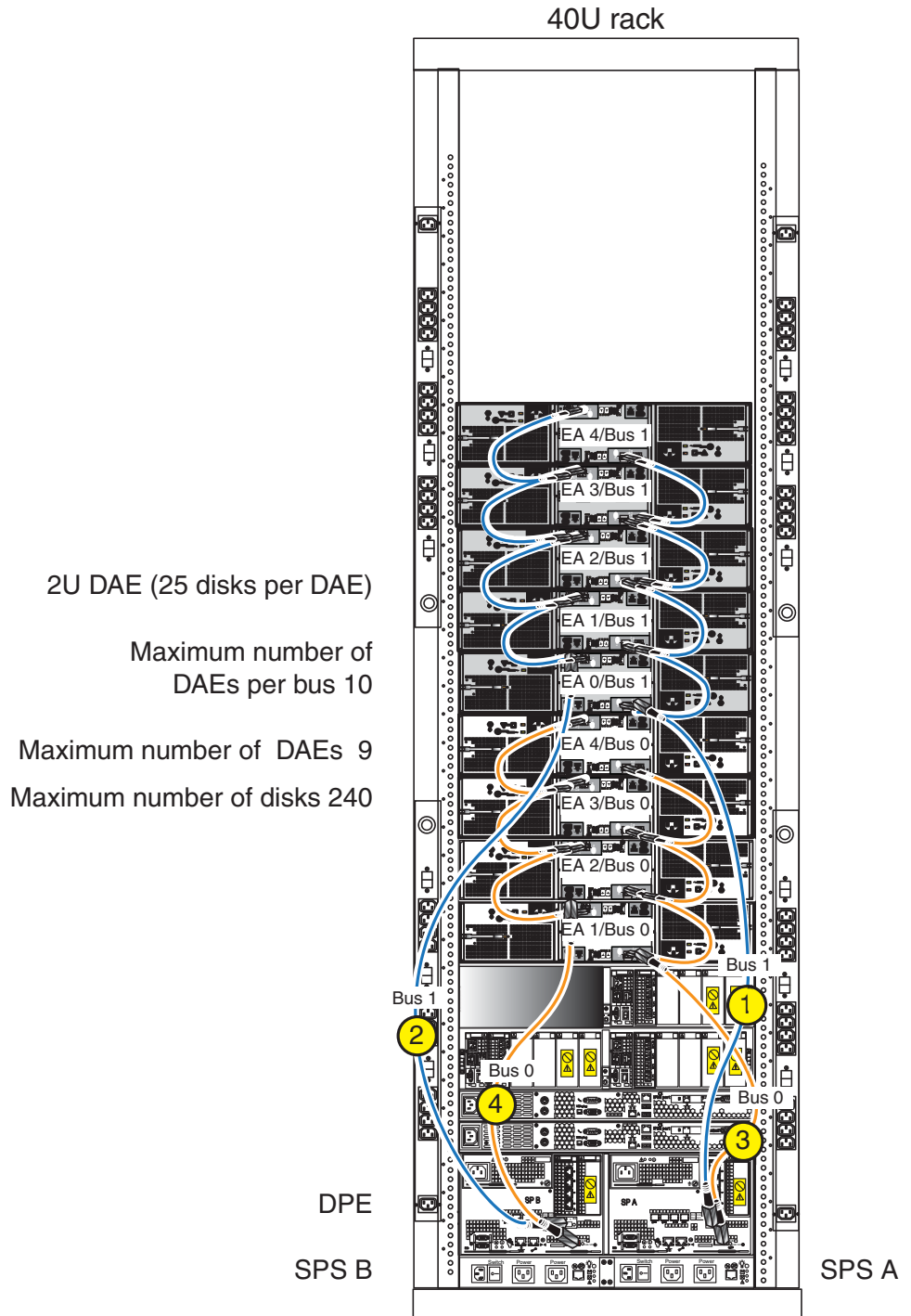◆ Cable 1, blue, DPE to 5th DAE (labels SP A SAS 1 to LCC A)

◆ Cable 2, blue, DPE to 5th DAE (labels SP B SAS 1 to LCC B)

◆ Cable 3, orange, DPE to 1st DAE (labels SP A SAS 0 to LCC A)

◆ Cable 4, orange, DPE to 1st DAE (labels SP B SAS 0 to LCC B)

So, the blue cable for Bus 1 is daisy-chained through the remaining DAEs:

◆ EA 2/Bus 1

◆ EA 3/Bus 1

◆ EA 4/Bus 1

While the orange cable for Bus 0 is daisy-chained through the remaining DAEs:

◆ EA 2/Bus 0

◆ EA 3/Bus 0

◆ EA 4/Bus 0

40U rack

2U DAE (25 disks per DAE)

Maximum number of
DAEs per bus 10

Maximum number of DAEs 9

Maximum number of disks 240

EA 4/Bus 1

EA 3/Bus 1

EA 2/Bus 1

EA 1/Bus 1

EA 0/Bus 1

EA 4/Bus 0

EA 3/Bus 0

EA 2/Bus 0

EA 1/Bus 0

Bus 1

Bus 1

Bus 0

Bus 0

DPE

SPS B

SPS A

VNX-000633

Figure 100 Example of the VNX5500 File/Unified platform with nine DAEs (2U, 25 disks) stacked
cabling

Cabling the 6-Gb/s SAS I/O module in the VNX5500 platform

With the introduction of the 6-Gb/s SAS I/O module in the VNX5500 platform, back end capability of the VNX5500 platform has increased. The 6-Gb/s SAS I/O module adds an additional four back end buses to each SP in the DPE. This brings the back end busses up from two per SP to six per SP. "Four-port 6-Gb/s SAS I/O module" on page 54 provides more information.

This section of the *VNX5500 Hardware Information Guide* shows cabling examples of both the Block and File/Unified platforms. The examples show how to cable four busses (0 through 3). Two busses through SP SAS ports 0 and 1 and four busses through the 6-Gb/s SAS I/O module ports 0, 1, 2, and 3 (logically 2, 3, 4, and 5).

Interleaved cabling with nine DAEs in a VNX5500 Block platform

Figure 101 on page 119 shows an example of a VNX5500 Block platform with nine DAEs (all are 2U, 25 disk drive DAEs) or a VNX5500 platform with a total of 240 disk drives (with the DPE a 3U, 15 disk drive device).

In this example, as described previously, the SAS ports on the VNX5500 platform DPE are physically and logically labeled **0** and **1**. While the ports on the 6-Gb/s SAS I/O module on the VNX5500 platform DPE are physically labeled **0, 1, 2,** and **3** but logically 2, 3, 4, and 5. SAS 0 is connected internally to the SAS expander that connects to the internal DPE disks. However, since nine DAEs are available for a maximum of 240 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 101 on page 119, six buses are available (Bus 0, Bus 1, Bus 2, Bus 3, Bus 4, and Bus 5).

Due to the complexity of showing the cables in a six bus system, the DAE and Bus labels shown in Figure 101 on page 119 are color-coded to match the cabling that would be used.

Note: The colors for the DAE and Bus labels are orange for Bus 0, blue for Bus 1, black for Bus 2, green for Bus 3, brown for Bus 4, and cyan for Bus 5).

- EA 0/Bus 1, blue, DPE to 1st DAE
- EA 1/Bus 0, orange, DPE to 2nd DAE
- EA 0/Bus 2, black, 6-Gbs SAS I/O module port 0 (SP A) to 3rd DAE
- EA 0/Bus 3, green, 6-Gb/s SAS I/O module port 1 (SP A) to 4th DAE
- EA 0/Bus 4, brown, 6-Gb/s SAS I/O module port 2 (SP A) to 5th DAE
- EA 0/Bus 5, cyan, 6-Gb/s SAS I/O module port 3 (SP A) to 6th DAE

The remaining cables are daisy-chained for load balancing. So, the blue cable for Bus 1 is interleaved and daisy-chained through the remaining DAEs:
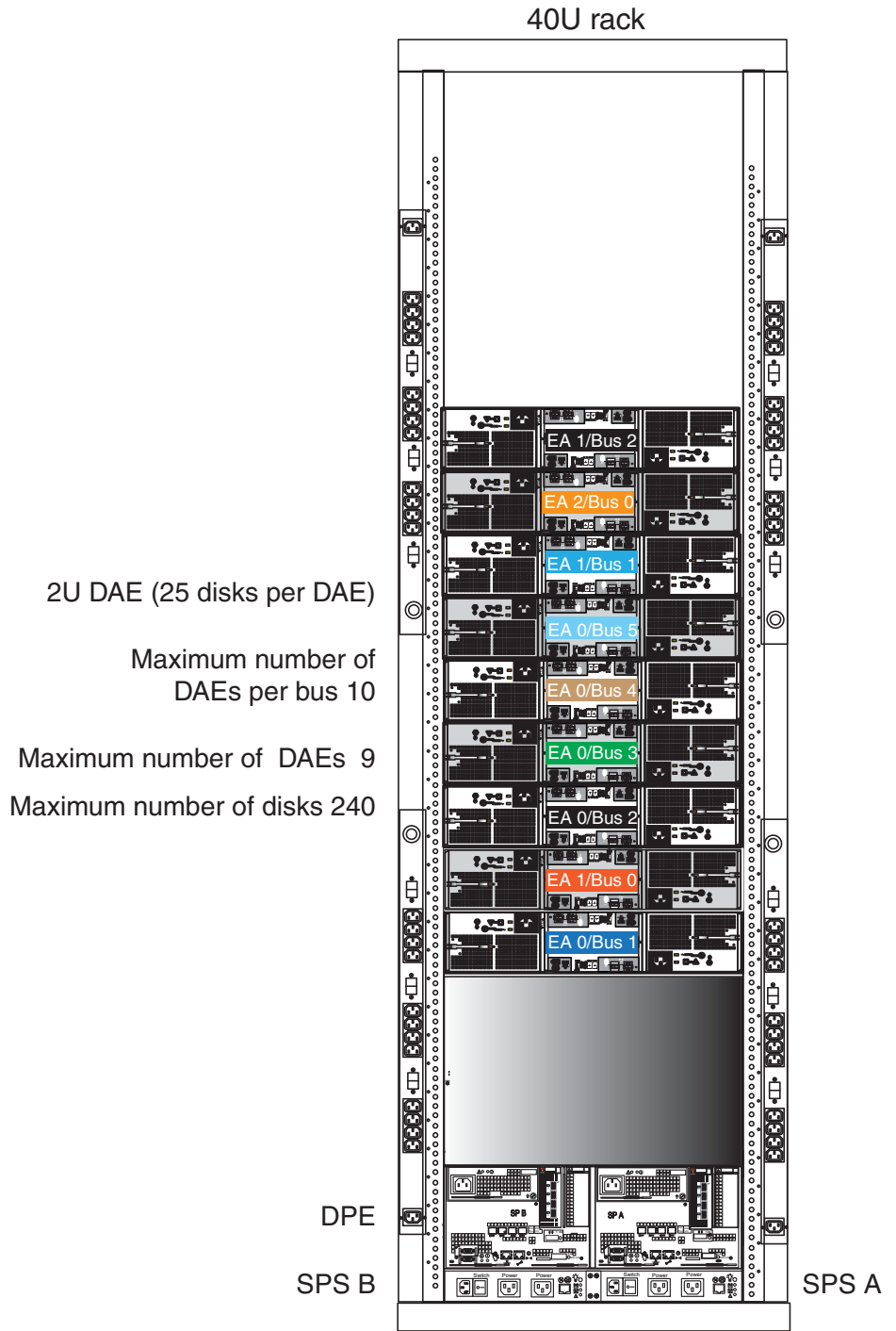
- EA 1/Bus 1, 7th DAE

While the orange cable for Bus 0 is interleaved and daisy-chained through the remaining DAEs:

◆ EA 2/Bus 0, 8th DAE

While the black cable for Bus 2 is interleaved and daisy-chained through the remaining DAEs:

◆ EA 1/Bus 2, 9th and final DAE

Note: Figure 101 on page 119 shows 6U of reserved space to allow for upgrading your VNX5500 Block to VNX5500 File/Unified platform. If you are planning to upgrade your Block platform to a File/Unified platform, it is recommended that at least 6U of rack space be reserved for adding one to two Controls Stations and one to two Data Mover enclosures.

40U rack

2U DAE (25 disks per DAE)

Maximum number of
DAEs per bus 10

Maximum number of DAEs 9

Maximum number of disks 240

EA 1/Bus 2

EA 2/Bus 0

EA 1/Bus 1

EA 0/Bus 5

EA 0/Bus 4

EA 0/Bus 3

EA 0/Bus 2

EA 1/Bus 0

EA 0/Bus 1

DPE

SPS B

SPS A

VNX-000667

Figure 101 Example of the VNX5500 Block platform with nine DAEs (2U, 25 disks) interleaved cabling

Interleaved cabling in a VNX5500 File/Unified platform with nine DAEs

Figure 102 on page 121 shows an example of a VNX5500 Block platform with nine DAEs (all are 2U, 25 disk drive DAEs) or a VNX5500 platform with a total of 240 disk drives (with the DPE a 3U, 15 disk drive device).

In this example, as described previously, the SAS ports on the VNX5500 platform DPE are physically and logically labeled **0** and **1**. While the ports on the 6-Gb/s SAS I/O module on the VNX5500 platform DPE are physically labeled **0, 1, 2,** and **3** but logically 2, 3, 4, and 5. SAS 0 is connected internally to the SAS expander that connects to the internal DPE disks. However, since nine DAEs are available for a maximum of 240 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 102 on page 121, six buses are available (Bus 0, Bus 1, Bus 2, Bus 3, Bus 4, and Bus 5).

Due to the complexity of showing the cables in a six bus system, The DAE and Bus labels shown in Figure 102 on page 121 are color-coded to match the cabling that would be used.

Note: The cable colors for the DAE and Bus labels are orange for Bus 0, blue for Bus 1, black for Bus 2, green for Bus 3, brown for Bus 4, and cyan for Bus 5).

- EA 0/Bus 1, blue, DPE to 1st DAE
- EA 1/Bus 0, orange, DPE to 2nd DAE
- EA 0/Bus 2, black, 6-Gbs SAS I/O module port 0 (SP A) to 3rd DAE
- EA 0/Bus 3, green, 6-Gb/s SAS I/O module port 1 (SP A) to 4th DAE
- EA 0/Bus 4, brown, 6-Gb/s SAS I/O module port 2 (SP A) to 5th DAE
- EA 0/Bus 5, cyan, 6-Gb/s SAS I/O module port 3 (SP A) to 6th DAE

The remaining cables are daisy-chained for load balancing. So, the blue cable for Bus 1 is interleaved and daisy-chained through the remaining DAEs:
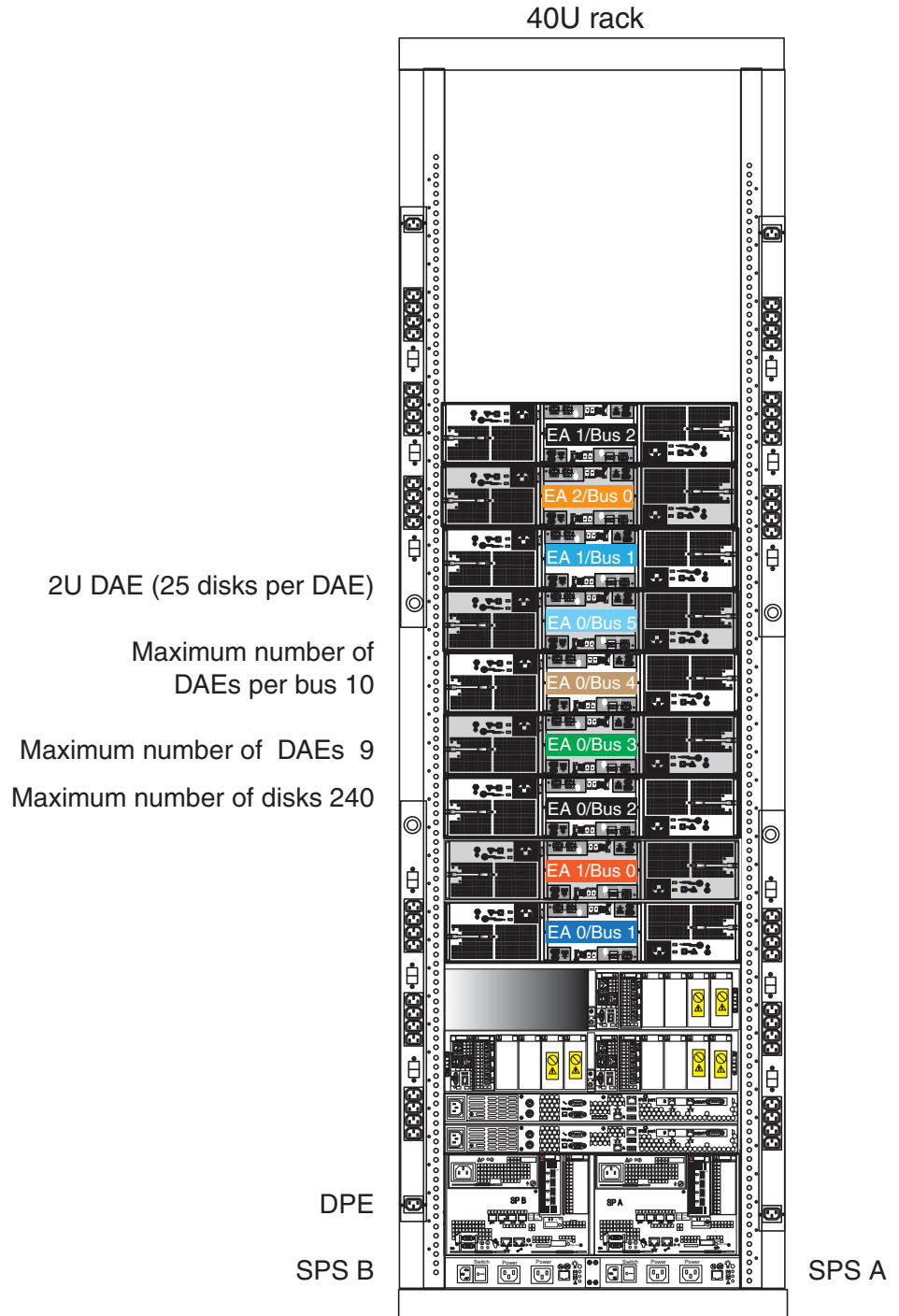
- EA 1/Bus 1, 7th DAE

While the orange cable for Bus 0 is interleaved and daisy-chained through the remaining DAEs:

- EA 2/Bus 0, 8th DAE

While the black cable for Bus 2 is interleaved and daisy-chained through the remaining DAEs:

- EA 1/Bus 2, 9th and final DAE

Note: In Figure 102 on page 121 the VNX5500 File/Unified platform shows a dual 1U SPS, a DPE (with two SPs), two CSs, a two DMEs (with three DMs), and nine 3U 15 DAEs.

40U rack

2U DAE (25 disks per DAE)

Maximum number of
DAEs per bus 10

Maximum number of DAEs 9

Maximum number of disks 240

DPE

SPS B   SPS A

VNX-000666

Figure 102 Example of the VNX5500 File/Unified platform with 9 DAEs (2U, 25 disks) interleaved
cabling