EMC® VNX™ Family
VNX5100™

Hardware Information Guide

REV A03

October, 2011

This guide describes one of five models available in the VNX Series, the EMC® VNX5100™. This document provides an overview of the architecture, features, and components of the Block VNX5100 platform. The specific aspects of the VNX5100 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), and the 3U, 15 (3.5-inch) or the 2U, 25 (2.5-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
A03	October, 2011	The following items were updated: • New EMC look and feel • Several minor editorial changes
A02	May, 2011	Made several minor editorial changes
A01	March, 2011	First release of the *VNX5100 Hardware Information Guide*

Where to get help

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

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

https://Support.EMC.com

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

How this document is organized

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

Title	Description
"Overview" on page 6	Describes the software and hardware features of a typical VNX5100 along with a front view example of the VNX5100.
"VNX5100 Block product description" on page 7	Describes and shows the front and rear views of a typical VNX5100.
"System component description" on page 10	Provides a description of the components that comprise a VNX5100. Along with a description, illustrations of each component are also shown.
"DPE front view" on page 10	Describes and illustrates the front of a DPE and the components that comprise the front of the DPE.
"DPE rear view" on page 14	Describes and illustrates the rear of a DPE and the components that comprise the rear of the DPE.
"Standby power supply" on page 27	Describes and illustrates the 1U SPS used in the VNX5100.
"Disk-array enclosure" on page 31	Describes and illustrates the two types of DAEs available for the VNX5100.
"Cabling overview" on page 47	Describes the types of cabling available for the VNX5100 Block platform. The cabling can be either stacked or interleaved depending 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 *VNX5100 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 VNX5100** 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, 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. The VNX Series is targeted at the entry-level to high-end/large-capacity storage environments that require advanced features, flexibility and configurability. The VNX Series provides significant advancements in efficiency, simplicity, and performance.

The VNX5100 is an entry-level storage platform offering Block services.

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

As an entry-level storage platform offering Block services, the VNX5100 platform (Figure 1) does not support NAS or iSCSI. Additionally, the VNX5100 platform, cannot be upgraded to Unified as it supports Fibre Channel (FC) only. For a quick look at the VNX5100 platform hardware features, see Table 1, “VNX5100 hardware feature quick reference,” on page 8.

Figure 1 Example of a Block VNX5100 platform with front bezel

VNX5100 Block product description

This section shows an example of the front and rear views of a Block VNX5100 platform.

Note: A fully configured VNX5100 platform includes up to four 3U DAEs (a maximum of 75 3.5-inch disk drives) or up to two 2U DAEs (a maximum of 75 2.5-inch disk drives).

Front view

Figure 2 shows an example of the front view of a Block VNX5100 platform having a dual 1U SPS and a 3U, 15 (3.5-inch) disk drive DPE.

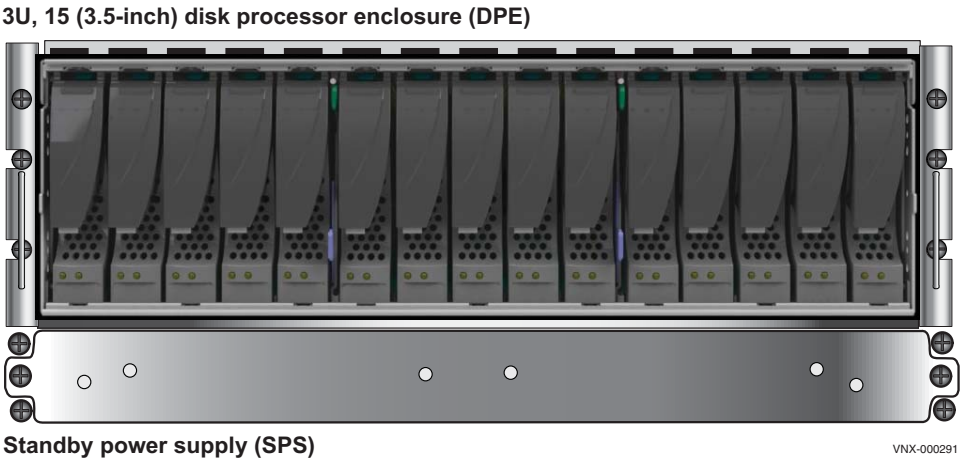


Figure 2 Example of a VNX5100 platform with a 3U, 15 (3.5-inch) DPE and SPS (front view)

Rear view

Figure 3 shows an example of the rear view of a Block VNX5100 platform having a dual 1U SPS and a DPE with two storage processors (SP A and B).

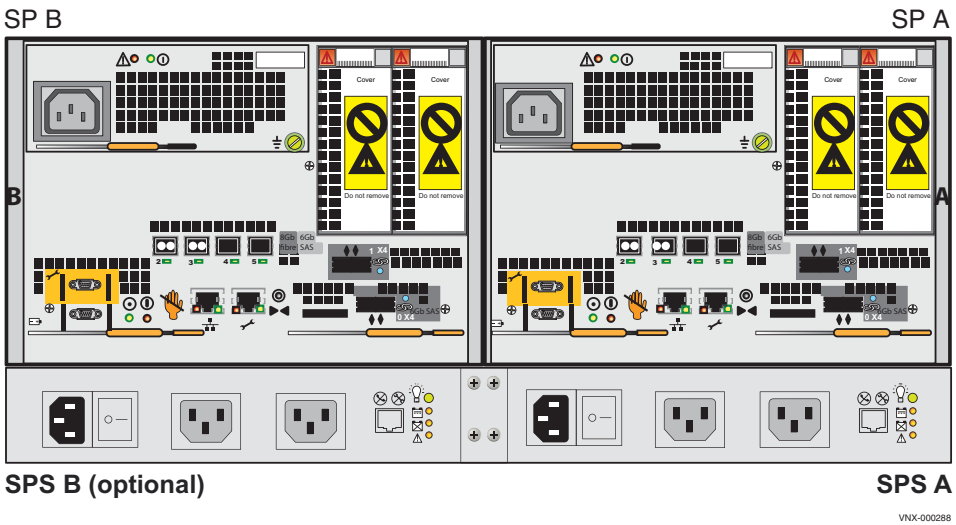


Figure 3 Example of a Block VNX5100 platform with DPE and SPS (rear view)

Note: Figure 2 on page 7 and Figure 3 on page 7 are examples of a VNX5100 platform (front and rear views). These figures are example of what a basic VNX5100 platform looks like and are for illustrative purposes only.

Hardware features

Contained in a 4U architecture, the VNX5100 platform weighs approximately 73.4 lb (33.29 kg) to 96.4 lb (43.73 kg) fully loaded[1] depending on the type of disk drives used in the DPE. With the 1U SPS having the deepest dimension within the cabinet, the VNX5100 measures 5.25 inches high (3U) x 18.92 inches wide x 23.78 inches deep (13.33 cm x 48.06 cm x 60.4 cm). Between the front and rear of the enclosure, a midplane distributes power and signals to all the enclosure components. The CPU modules and the power supply 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 *VNX5100 Storage System Technical Specifications and Operating Limits* document.

Table 1 VNX5100 hardware feature quick reference

Minimum form factor	Maximum # of drives	Drive types	Configurable I/O slots	Built-in I/O ports	SPs	System memory per SP	Protocols
4U	75	3.5 in. SAS, NL-SAS, Flash, and 2.5 in. 10 K SAS	0	4 FC ports + 2 BE[1] SAS ports	2	4 GB	FC

1. BE = back end.

Configured for AC-input power, the VNX5100 includes the following hardware features:

- One DPE:

IMPORTANT

On the rear of the DPE, each storage processor includes a CPU module and a power supply. 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 DPE.

1. A fully loaded VNX5100 (without any DAEs) includes one 1U SPS and one DPE (with two SPs). In this fully loaded VNX5100, the DPE (with two SPs) 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.

- On the front of the 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 12) and 3U, 25 (2.5-inch) disk drive carrier (Figure 5 on page 13). The disk drives supported are Serial attached-SCSI (SAS), near-line SAS (NL-SAS), and Flash.
- On the rear of the DPE, each (hot-swappable) storage processor (Figure 3 on page 7) consists of:
  - A CPU module with an Intel Xeon 2-core 2.0-GHz processor with three Double Data Rate Three (DDR3) synchronous dynamic RAM (SDRAM) slots supporting 2-GB 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 SAS x4 ports (labeled 0 x4 and 1 x4); supported speeds are 1.5, 3, and 6 Gb/s
  - Two PCI Gen 2 x4 I/O module slots (not supported and covered with filler panel modules)
  - One RS-232/EIA 232 serial (up to 115 K baud) service laptop (micro DB-9) port
  - One RS-232/EIA 232 serial SPS management (micro DB-9) port
  - One 10/100/1000 LAN network management (RJ-45) port
  - One 10/100/1000 LAN service (RJ-45) port
  - One power supply (hot-swappable)

◆ One 1U standby power supply (SPS) with a second optional SPS available

◆ Expansion of up to four 3U, 15 (3.5-inch) DAEs or up to two 2U, 25 (2.5-inch) DAEs (a maximum of 75 drives)

IMPORTANT

When calculating the number of disk drives for your VNX5100 platform, the DPE is included in the total drive slot quantity of 75 drives. If the total drive slot quantity exceeds 75, you will not be able to add another DAE. Refer to "Disk-array enclosure" on page 31 for more information about the available expansion DAEs for the VNX5100 platform.

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

◆ Mounting rails with hardware

◆ Front bezel with VNX5100 badge

System component description

This section describes the Block VNX5100 platform components. Included in this section are illustrations and descriptions of the front and rear connectors as well as the LED indicators.

First, the components of the VNX5100 are described in two views.

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

Then, the "Disk-array enclosure" on page 31 describes the two types of DAEs available for the VNX5100.

VNX5100 front view

As previously described, the Block VNX5100 platform is made up of a DPE and a 1U SPS. The following sections describes the front (Figure 2 on page 7) view of the VNX5100 platform components.

DPE front view

The Block VNX5100 platform can have one of two versions of the 3U disk drive DPE.

IMPORTANT

When calculating the number of drives for your VNX5100 platform, the DPE is included in the total drive slot quantity of 75 drives. If the total drive slot quantity exceeds 75, you will not be able to add another DAE. Refer to "Disk-array enclosure" on page 31 for more information about the available expansion DAEs for the VNX5100 platform.

Each Block VNX5100 platform 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. "3U, 15 disk drive DPE front view" on page 12 or "3U, 25 disk drive DPE front view" on page 13 provides more information.

Disk drives

Each disk drive consists of one disk drive in a carrier. You can visually distinguish between module types by their different latch and handle mechanisms and by type, capacity, and speed labels on each module. You can add or remove a disk drive while the DPE is powered up, but you should exercise special care when removing modules 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)

The SP is the intelligent component of the disk processor enclosure (DPE). Basically, it acts as the control center. Each SP includes status LEDs, PCI Gen 2 x2 I/O module slots, and LAN ports. "DPE" on page 15 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. "SP AC power supply module" on page 17 provides more information.

EMI shielding

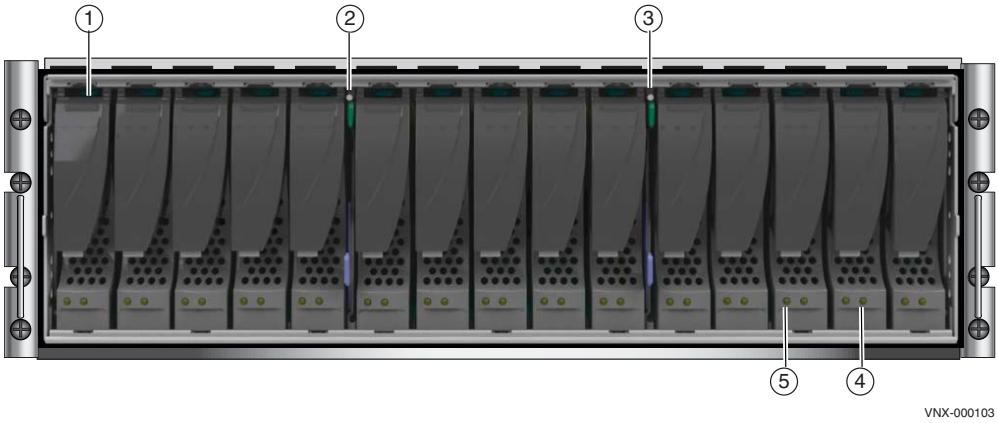
EMI compliance requires a properly installed electromagnetic interference (EMI) shield in front of the DPE disk drives. When installed in cabinets that include a front door, the DPE includes a simple EMI shield. Other installations require a front bezel that has a locking latch and integrated EMI shield.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

3U, 15 disk drive DPE front view

On the front, the Block VNX5100 platform 3U, 15 (3.5-inch) DPE carrier includes the following:

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

Figure 4 shows the location of these disk drives and Status LEDs.



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 VNX5100 platform 3U, 15 DPE (front view)

Table 2 describes the Block VNX5100 platform 3U, 15 DPE and disk drive status LEDs

Table 2 VNX5100 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 VNX5100 platform 3U, 15 DPE and disk drive LEDs (continued)

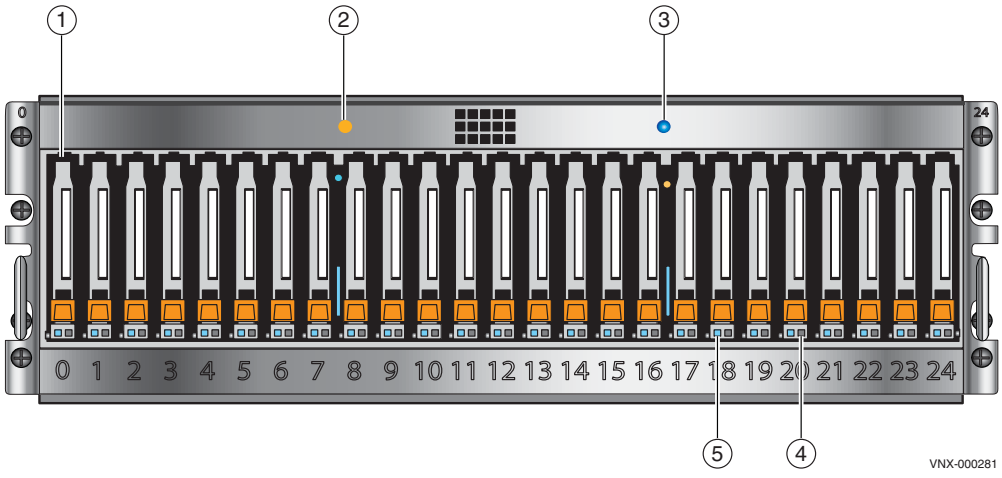
LED	Color	State	Description
Disk drive on/activity (location 5)	Green	On	Powering and powered up
		Blinking, mostly on	Disk drive is on with I/O activity
		Blinking at constant rate	Disk drive is spinning up or down normally
		Blinking, mostly off	Disk drive is powered up but not spinning **Note:** This is a normal part of the spin-up sequence, occurring during the spin-up delay of a slot.
	—	Off	Disk drive is powered down

3U, 25 disk drive DPE front view

On the front, viewing from left to right, the Block VNX5100 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 disk drives (hot-swappable)
- Status LEDs

Figure 5 shows the location of these disk drives and status LEDs.



1	2.5-inch 6-Gb/s SAS or 6-Gb/s NL-SAS disk 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 VNX5100 platform 3U, 25 DPE (front view)

Table 3 describes the Block VNX5100 platform 3U, 25 DPE and disk drive status LEDs.

Table 3 VNX5100 platform 3U, 25 DPE and disk drive status LEDs

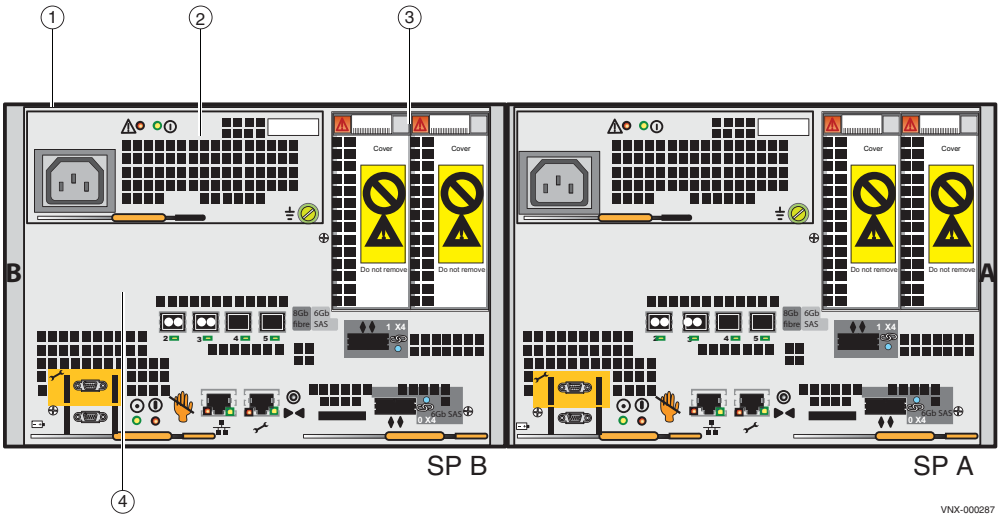
LED	Color	State	Description
DPE fault (location 2)	Amber	On	Fault has occurred
DPE power (location 3)	Blue	On	Powering and powered up
	—	Off	Powered down
Disk drive fault (location 4)	Amber	On	Fault has occurred
	—	Off	No fault has occurred
Disk drive on/activity (location 5)	Blue	On	Powering and powered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

VNX5100 rear view

As previously described, the Block VNX5100 platform is made up of a DPE and a 1U SPS. The following sections will describe the rear (Figure 3 on page 7) view of the VNX5100 platform components.

DPE rear view

Figure 6 shows an example of a DPE with two SPs and the location of the major hardware components that make up each SP (A and B).



1	SP (see Figure 7 on page 16 for closer view)	3	I/O module slots (not supported), covered with filler panel modules
2	Power supply (see Figure 8 on page 17 for closer view)	4	CPU module

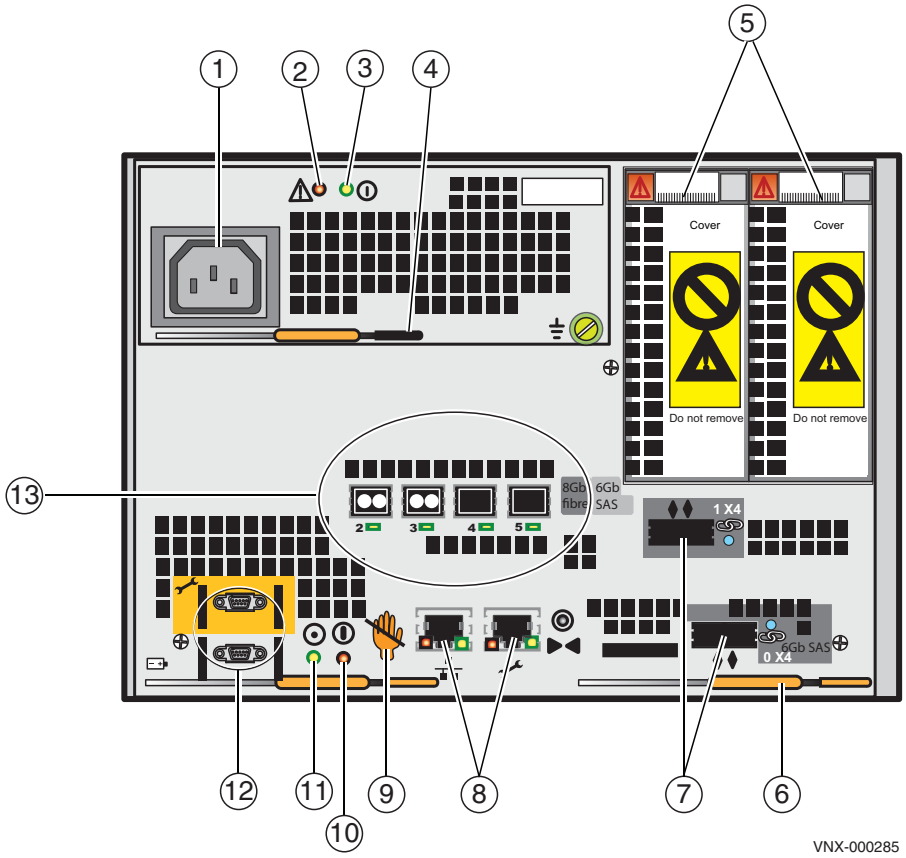
Figure 6 Example of Block VNX5100 platform DPE with two SPs (rear view)

DPE

On the rear of the DPE, viewing from left to right, each DPE consists of the following connectors, status LEDs, latch handles, and so on:

- AC power supply/cooling module
  - 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 (not supported and covered with filler panel modules)
  - Two 6-Gb/s SAS PCI 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 7 shows the location of the SP components.



1	AC power in connector (recessed 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 (not used), both covered with filler panel modules	**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 7 Example of SP components (rear view)

SP AC power supply module

Figure 8 shows an example of the SP AC power supply/cooling module with a power in recessed connector (plug) and status LEDs. The SP is cooled by this power supply/cooling on top.

⚠CAUTION

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

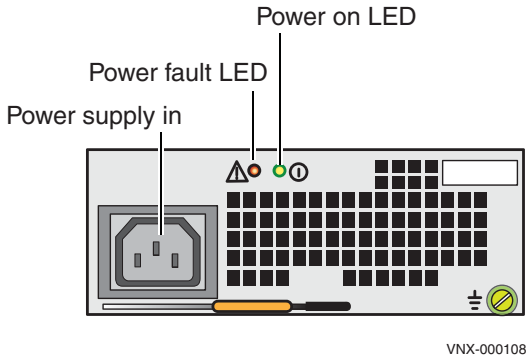


Figure 8 SP AC power supply/cooling module (power in) recessed connector (plug) and status LEDs

Table 4 describes the power supply/cooling module (fault and power on) LEDs.

Table 4 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 5 describes the SP LEDs. The locations in Table 5 are shown in Figure 7 on page 16.

Table 5 SP LEDs

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

Table 5 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 VNX5100 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 PCI Gen 2 x4 ports — The Block VNX5100 platform SP supports two 6-Gb/s SAS PCI Gen 2 x4 ports (labeled 6Gb 0 x4 and 6Gb 1 x4) on the rear of each SP (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 9 shows an example of the port connector (socket) and cable connector (plug) with pull tab.

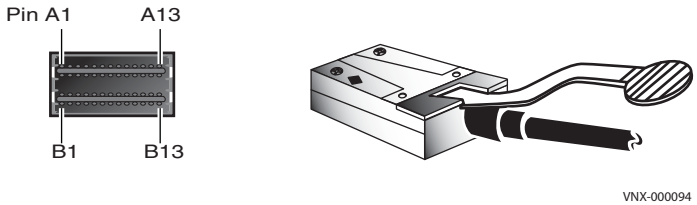


Figure 9 SP 6-Gb/s SAS port and cable connector

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

Table 6 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 10 shows an example of 0 x4 SP 6-Gb/s SAS port LED—a bi-color (blue/green) LED to the right of the connector—that indicates the link/activity of the SAS port.

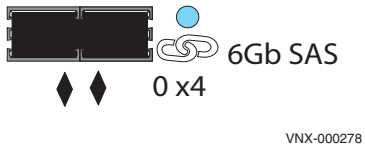


Figure 10 Example of the 0 x4 SP 6-Gb/s SAS port LED

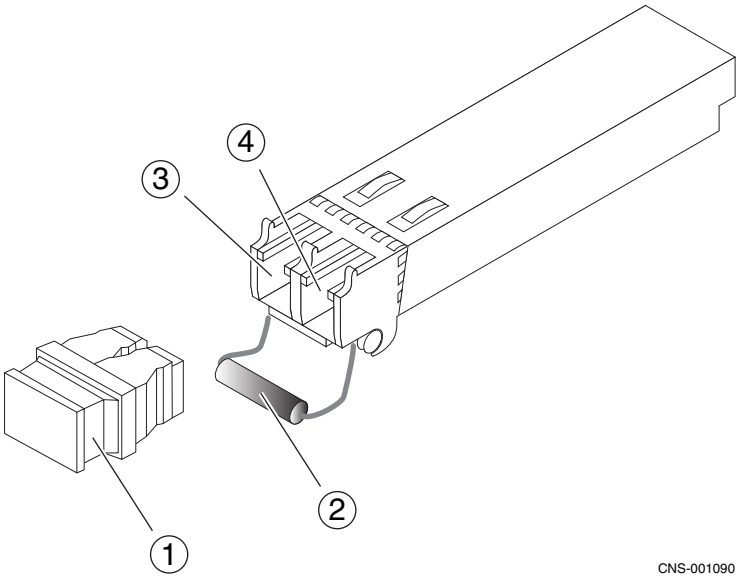
Table 7 describes the SP 6-Gb/s port LEDs.

Table 7 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

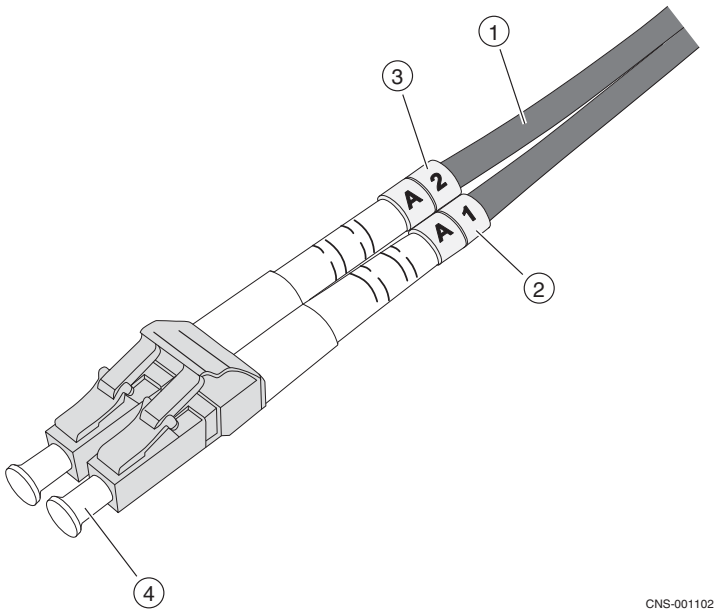
The Block VNX5100 platform SP comes with four optical (fibre) 8-Gb/s FC ports (labeled 8GB fibre 2, 3, 4, and 5). Only two ports are supported (2 and 3) (ports 4 and 5 are not used, they will be covered) on the rear of each SP (A and B). These ports provide an optical interface for connecting to the front end. These ports support 2-, 4-, and 8-Gb/s Fibre Channels using a small form-factor pluggable (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 11 shows an example of an SFP+ module.



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

Figure 11 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 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 (Figure 12 on page 21).



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 12 Example of LC-type connectors

Figure 13 shows an example of the SP 8-Gb/s FC connector with an SFP+ in slots 2 and 3.

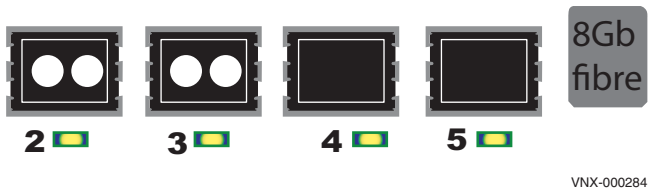


Figure 13 Example of SP 8-Gb/s FC connector with an SFP+ in slots 2 and 3

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

Table 8 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 *VNX5100 Parts Location Guide* for the location of SFP+ part number labels.

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 VNX5100 platform SP 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 14 shows an example of the SP network management and service laptop Ethernet (RJ-45) ports.

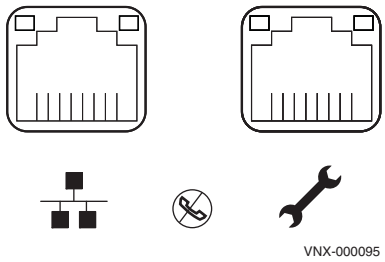


Figure 14 Network management and service laptop Ethernet (RJ-45) ports

IMPORTANT

The ports shown in Figure 14 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 9.

Table 9 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)

Network management and service laptop Ethernet (RJ-45) port and connector (adapter) — Figure 15 shows an example of the Ethernet (RJ-45) port and cable connector.

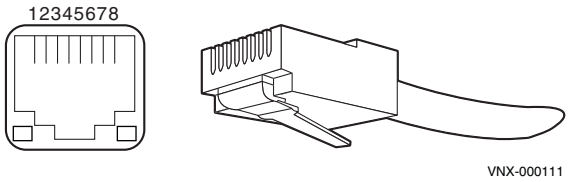


Figure 15 Network management and service laptop Ethernet (RJ-45) port and connector (adapter)

Table 10 lists the SP network management and service laptop Ethernet (RJ-45) pin signals used on the connector.

Table 10 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 16 shows the SP network management and service laptop 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.

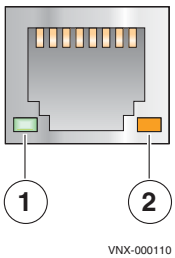


Figure 16 Network management and service laptop Ethernet (RJ-45) port LEDs

Table 11 describes the link/activity and connection speed associated with the SP Ethernet (RJ-45) port LEDs.

Table 11 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)

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

The back of the Block VNX5100 platform SP 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 17.

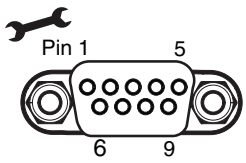


Figure 17 Serial RS-232/EIA 232 (micro DB-9) connector (socket) for service laptop

Table 12 lists the SP serial RS-232/EIA 232 (micro DB-9) pin signals used on the connector.

Table 12 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

Table 12 Serial RS-232/EIA 232 (micro DB-9) connector (socket) pinout (continued)

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

SP CPU module 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 18 shows an example of an SP to PC (service laptop) cable.

Figure 18 Example of SP CPU module null modem (micro DB-9 to serial DB-9) cable

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

The back of the Block VNX5100 platform SP includes a second standard serial RS-232/EIA 232 interface (micro DB-9) socket connector (labeled with a symbol depicting a battery to the left) to connect to the SPS management port (RJ-12). Notice the orientation of the pins shown in Figure 19.

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 adaptor end connects to the RJ-12 modular jack connector on the SPS (Figure 24 on page 30).

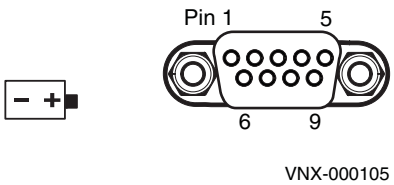


Figure 19 Serial RS-232/EIA 232 (micro DB-9) connector (socket)

Table 13 lists the SP serial RS-232/EIA 232 (micro DB-9) pin signals used on the connector.

Table 13 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 (Not Used)

SP I/O module slots

Two PCI Gen 2 x4 I/O module slots are available on the SP. These slots are not supported at this time. Both of these slots have filler panel modules with do not remove labels (Figure 20).

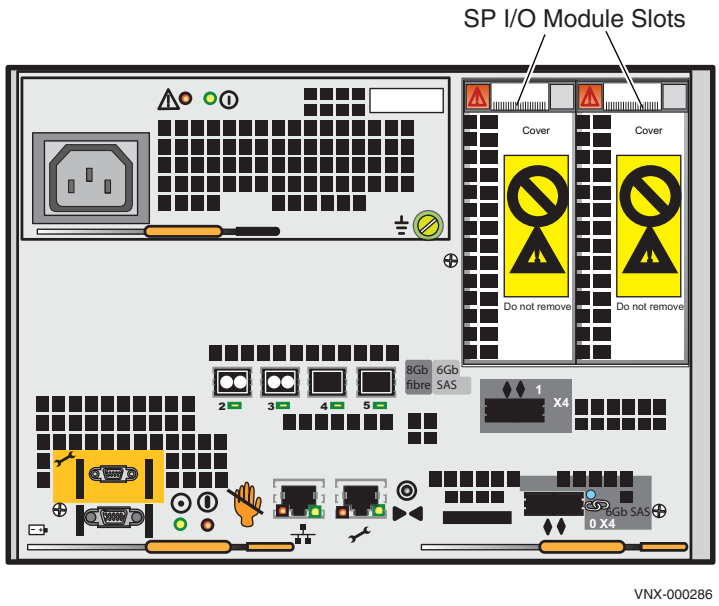


Figure 20 SP I/O module slots with filler panel modules

Standby power supply

The Block VNX5100 platform includes one to two 1U, 1.2-kilowatt standby power supplies (SPSs) to maintain power to the VNX5100 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 into the built-in DC battery pack. When emergency power is needed by the Block VNX5100 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 VNX5100 platform SP (Figure 21 on page 28).

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 14 on page 29).

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.[2] 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 21 on page 28 shows an example of the rear view of two SPSs (B and A, respectively).

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

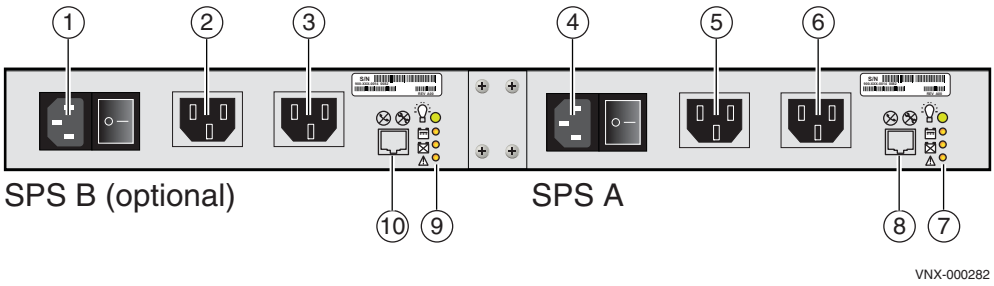
Two SPSs

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.

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 vice versa), an error condition will occur when the SPS is tested or when it is charging.



1	SPS B AC power in (recessed plug)	**6**	AC power out socket (not used or to DAE A)
2	AC power out socket (not used or to DAE B)	**7**	Four SPS A status LEDs (green and amber)
3	AC power out socket to the SP B power supply on the DPE	**8**	SPS A management (RJ-12) connector (to SP A)
4	SPS A AC power in (recessed plug)	**9**	Four SPS B status LEDs (green and amber)
5	AC power out socket to the SP A power supply on the DPE	**10**	SPS B management (RJ-12) connector (to SP B)

Figure 21 Example of SPS B and A viewing from left to right (rear view)

SPS LEDs

Figure 22 shows the LEDs located on each SPS (A and B).

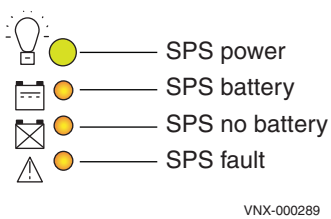


Figure 22 SPS LEDs

Table 14 describes the SPS LEDs.

Table 14 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 (On battery)	Amber	On	AC line power is no longer available and the SPS is supplying AC output power from the DC-AC convertor by way of the DC battery. **Note:** When battery power comes on, and no other online SPS is connected to the SP, the file server 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 23 on page 30 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.

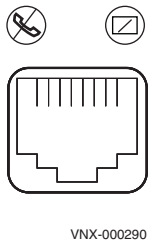


Figure 23 SPS RJ-12 port

Table 15 lists the SPS (RJ-12) pin signals used on the connector.

Table 15 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 SPS to the SP is an RJ-12 to micro DB-9 cable (plug). It has an RJ-12 connector (SPS side) on one end and a micro DB-9 connector (SP side) on the other end. Figure 24 shows an example of an SPS A to SP A cable.

Figure 24 Example of SP A (micro DB-9) to SPS (RJ-12) cable

Disk-array enclosure

⚠CAUTION

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

The Block VNX5100 platform supports two types of disk-array enclosures (DAEs) across a 6-Gb/s SAS bus:

- 3U, 15 (3.5-inch) DAE
- 2U, 25 (2.5-inch) DAE

The Block VNX5100 platform supports up to four 3U, 15 (3.5-inch) DAEs or up to two 2U, 25 (2.5-inch) DAEs (a maximum of 75 2.5-inch disk drives).

IMPORTANT

When calculating the number of drives for your system, the DPE is included in the total drive slot quantity of 75 drives. If the total drive slot quantity exceeds 75, you will not be able to add another DAE. Refer to "Overview" on page 6 for more information about the Block VNX5100 platform DPEs.

Each DAE consists of the following components:

- Drive carrier
- Disk drives
- Midplane
- Link control cards (LCCs)
- Power supply/cooling modules
- 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 (Figure 25 on page 33 and Figure 32 on page 40).

Disk drives

Each disk drive consists of one disk drive in a carrier. You can visually distinguish between module types by their different latch and handle mechanisms and by type, capacity, and speed labels on each module. 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. Disk drives are extremely sensitive electronic components.

Midplane

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

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 31 on page 39)[3]. Each LCC includes a bus (loop) identification indicator (Figure 31 on page 39).

Power supply

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.

Each power/cooling module has three status LEDs (Figure 27 on page 36).

Cooling modules

The enclosure cooling system consists of dual-blower modules in each power supply/cooling module.

EMI shielding

EMI compliance requires a properly installed electromagnetic interference (EMI) shield in front of the DAE disk drives. The front bezel has a locking latch and integrated EMI shield. You must remove the bezel/shield to remove and the install disk drive modules.

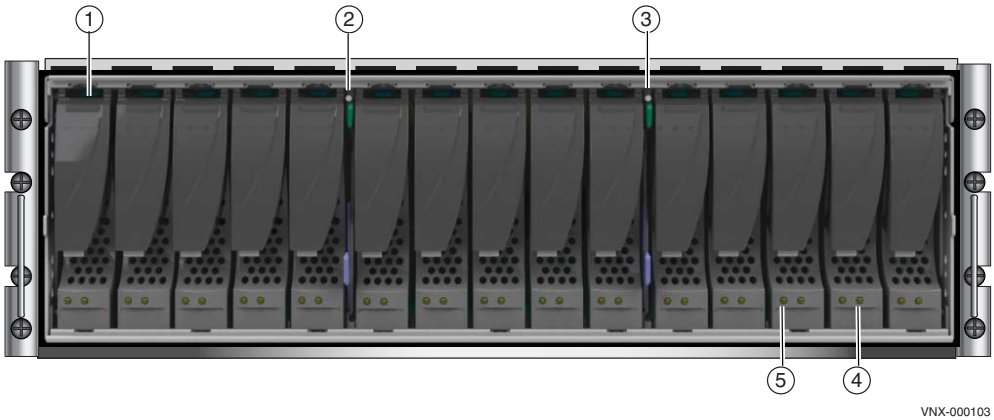
3. The EA is sometimes referred to as an enclosure ID.

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

On the front, viewing from left to right, the Block VNX5100 platform 3U, 15 (3.5-inch) disk drive DAE carrier includes the following hardware components:

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

Figure 25 shows the location of these components.



1	3.5-inch 6-Gb/s SAS modules 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 25 3U 15 (3.5-inch) DAE (front view)

Table 16 describes the Block VNX5100 platform DAE and the 3.5-inch disk drive status LEDs.

Table 16 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
Disk drive fault (location 4)	Amber	On	Fault has occurred
	—	Off	No fault has occurred

Table 16 3U 15 (3.5-inch) DAE 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, 15 (3.5-inch) DAE rear view

On the rear, viewing from top to bottom (Figure 26 on page 35), a 3U, 15 (3.5-inch) DAE includes the following hardware components:

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

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.

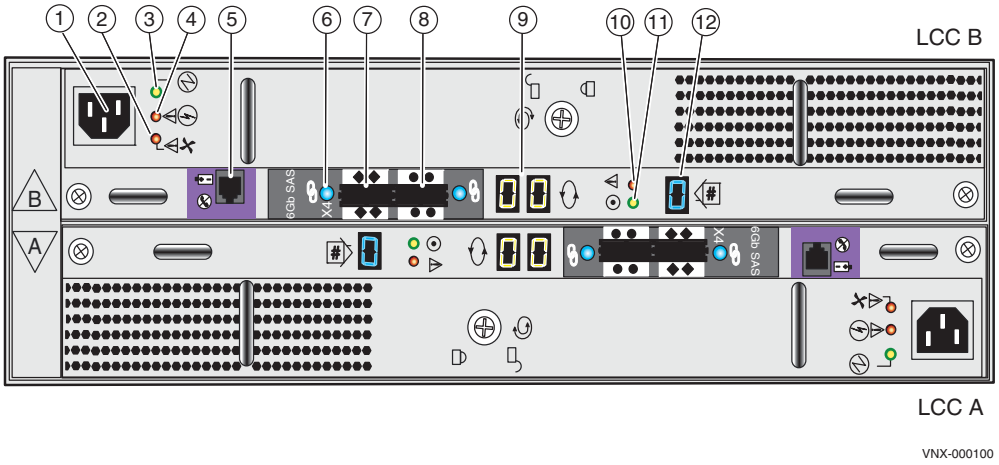
Each LCC independently monitors the environmental status of the entire enclosure, using a microcomputer-controlled monitor program. The monitor communicates the status to the storage processor, which polls disk enclosure status. LCC firmware also controls the SAS PHYs and the disk-module status LEDs.

As shown in Figure 26 on page 35, an enclosure ID[4] 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.

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

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

Figure 26 shows an example of the rear view of a 3U, 15 (3.5-inch) disk drive DAE.



1	LCC B AC power supply power in (recessed plug)	**7**	LCC B SAS connector (output)[1]
2	LCC B power supply fan fault LED (on, amber)	**8**	LCC B SAS connector (input)[2]
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[3]

1. The SAS connector (output) is labeled with a double diamond symbol.
2. The SAS connector (input) is labeled with a double circle (or dot) symbol.
3. The DAE enclosure ID is sometimes referred to as the enclosure address (EA).

Figure 26 3U, 15 (3.5-inch) DAE with two LCCs and two power supply/cooling modules (rear view)

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

Figure 27 shows an example of the 3U, 15 (3.5-inch) disk drive DAE AC power supply/cooling module with a power in (recessed) connector (plug) and status LEDs.

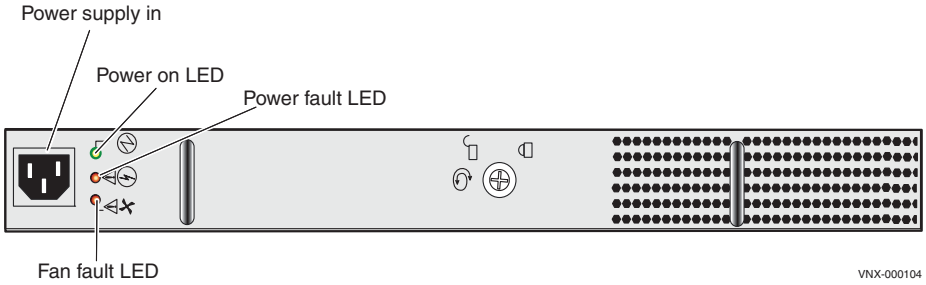


Figure 27 Example of a 3U, 15 (3.5-inch) DAE AC power supply/cooling module power in (recessed) connector (plug) and status LEDs

Table 17 describes the 3U, 15 (3.5-inch) DAE power supply/cooling module LEDs.

Table 17 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. 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 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 on the rear:

- Two 6-Gb/s SAS PCI Gen 2 x 4 ports
- One management (RJ-45) connector

6-Gb/s SAS x4 ports

The 3U, DAE LCC supports two (one input and one output) 6-Gb/s SAS x4 port (labeled 6Gb 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 28 shows an example of the port connector (socket) and cable connector (plug) with pull tab.

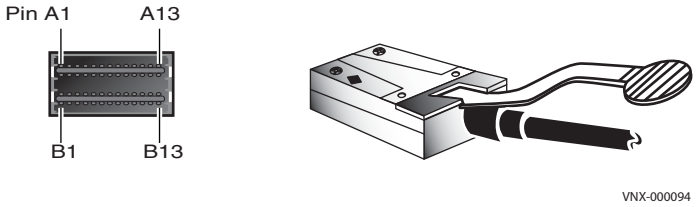


Figure 28 6-Gb/s SAS port and cable connector

Table 18 lists the 3U, DAE LCC 6-Gb/s SAS port pin signals used on the connector.

Table 18 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 18 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 LEDs and port direction (input or output)

Figure 29 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 29 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 29).

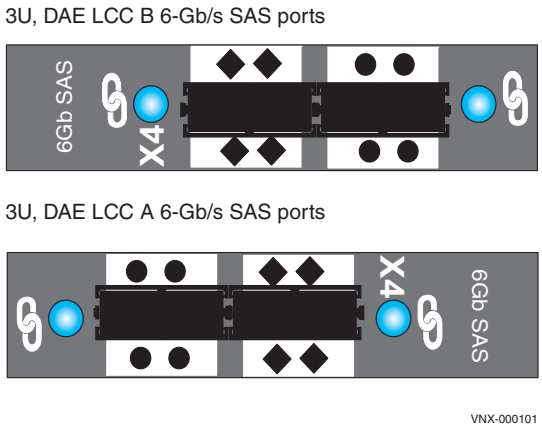


Figure 29 6-Gb/s SAS port LED

Table 19 describes the 6-Gb/s SAS port LEDs.

Table 19 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) connector

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

Figure 30 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 handset with a line through it symbol means that you cannot connect telephone type circuits to this connector (see the following **WARNING**). This port connects the LCC (A and B) ports to the SPS (A and B) ports, respectively.

⚠WARNING

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

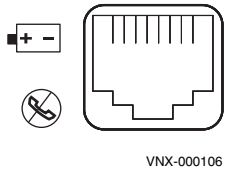


Figure 30 LCC RJ-12 port

The cable connecting the LCC to the SPS is an RJ-12 to RJ-12. It has an RJ-45 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 31).

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 31).

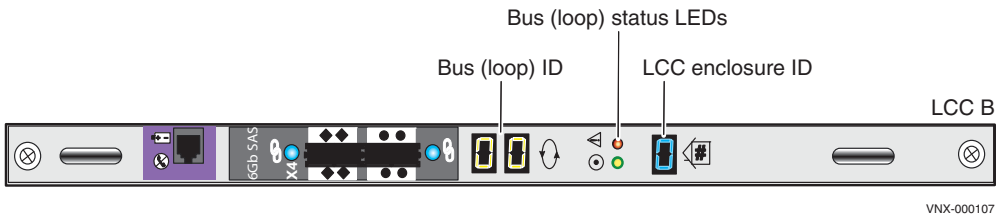


Figure 31 Example of LCC B enclosure ID and bus ID

Table 20 describes the bus (loop) indicator status LEDs.

Table 20 LCC bus (loop) status LEDs

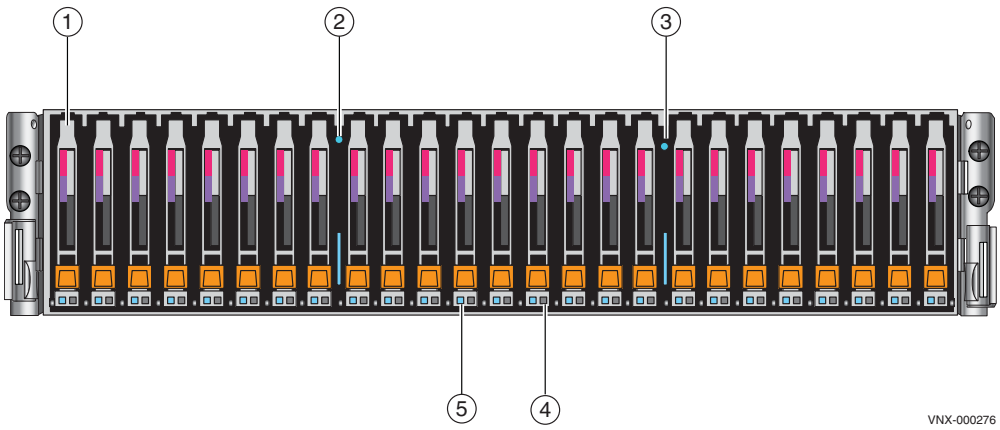
Led	Color	State	Description
Power fault	Amber	On	Fault
	—	Off	No fault or power off
Power on	Green	On	Power on
	—	Off	Power off

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

On the front, viewing from left to right, the Block VNX5100 platform 2U, 25 (2.5-inch) DAE includes the following hardware components:

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

Figure 32 shows the location of these components.



1	2.5-inch 6-Gb/s SAS or 6-Gb/s NL-SAS disk 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 32 2U, 25 (2.5-inch) disk drive (front view)

Table 21 describes the 2U, 25 (2.5-inch) DAE and disk drive status LEDs.

Table 21 2U, 25 (2.5-inch) DAE 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

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:

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

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 cables. The cables connect the LCCs in a system in a daisy-chain topology.

Internally, each DAE LCC connects to the drives in its enclosure in a point-to-point fashion through a switch. The LCC independently receives and electrically terminates incoming signals. For traffic from the system's storage processors, the LCC switch passes the signal from the input port to the drive being accessed; the switch then forwards the drive output signal to the port.

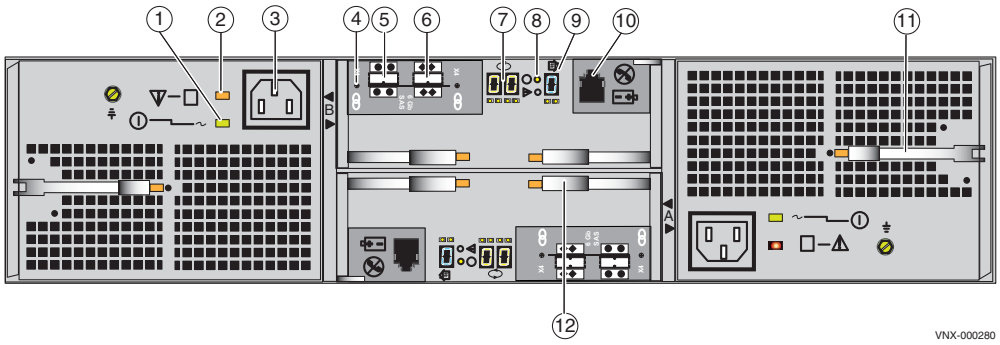
Note: If the target drive is not in the LCC's enclosure, the switch passes the input signal directly to the output port.

Each LCC independently monitors the environmental status of the entire enclosure, using a microcomputer-controlled monitor program. The monitor communicates the status to the storage processor, which polls disk enclosure status. LCC firmware also controls the SAS PHYs and the disk-module status LEDs.

As shown in Figure 33 on page 42, an enclosure ID[5] 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.

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

Figure 33 shows an example of the rear view of a 2U, 25 (2.5-inch) disk drive DAE.



1	LLC B power supply LED (on, green)	**7**	LCC B bus ID
2	LCC B power supply fault LED (on, amber)	**8**	LCC B power and fault LEDs
3	LCC B AC power supply power in (recessed plug)	**9**	DAE enclosure ID
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 (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 33 Example of a 2U DAE with two LCCs and two power supply/cooing modules (rear view)

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

Figure 34 shows an example of the 2U, 25 (2.5-inch) DAE AC power supply/cooling module with a power in (recessed) connector (plug) and status LEDs.

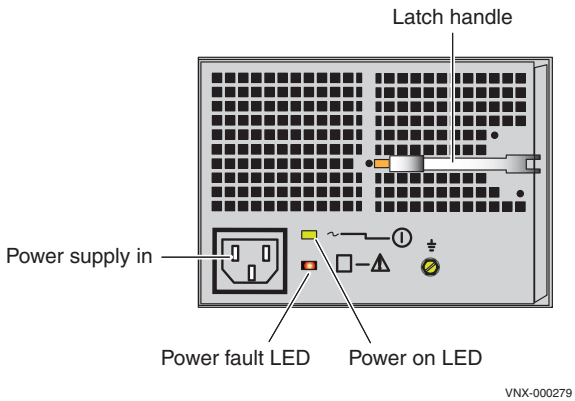


Figure 34 Example of a 2U, 25 (2.5-inch) DAE AC power supply/cooling module power in (recessed) connector (plug) and status LEDs

Table 22 describes the 2U, 25 (2.5-inch) DAE power supply/cooling module LEDs.

Table 22 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.

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

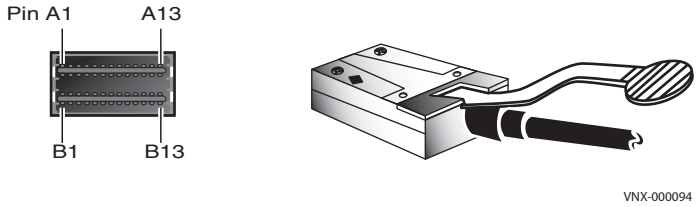


Figure 35 6-Gb/s SAS port and cable connector

Table 23 lists the 6-Gb/s SAS port pin signals used on the connector.

Table 23 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 36 on page 45 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. Figure 36 on page 45 also shows a single circle (or dot) symbol (input) or a double diamond symbol (output).

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 36 on page 45).

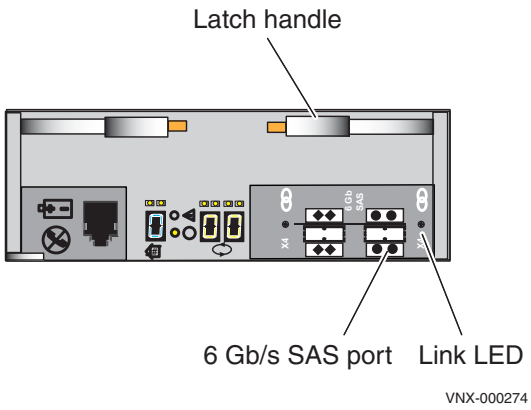


Figure 36 6-Gb/s SAS port LED

Table 24 describes the 6-Gb/s port LEDs.

Table 24 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 37 on page 46 shows the management port (labeled with two symbols; one depicting a telephone handset with a line through it and the other depicting a battery). The telephone handset with a line through it symbol means that you cannot connect telephone type circuits to this connector (see the following **WARNING**). This port connects the LCC (A and B) ports to the SPS (A and B) ports, respectively.

⚠WARNING

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

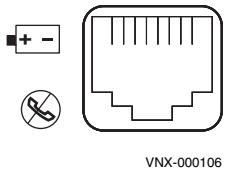


Figure 37 LCC RJ-12 port

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 38).

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 38).

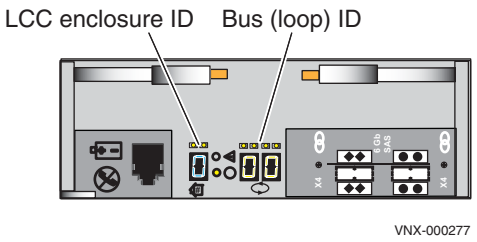


Figure 38 Example of LCC B enclosure ID and bus ID

Table 25 describes the bus (loop) status LEDs.

Table 25 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

Cabling overview

This section describes 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 VNX5100 platform.

For all other cabling of your VNX5100 platform, the *VNX5100 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 39 shows an example of the cable wrap guide and how to affix the cable label wrap to a cable.

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

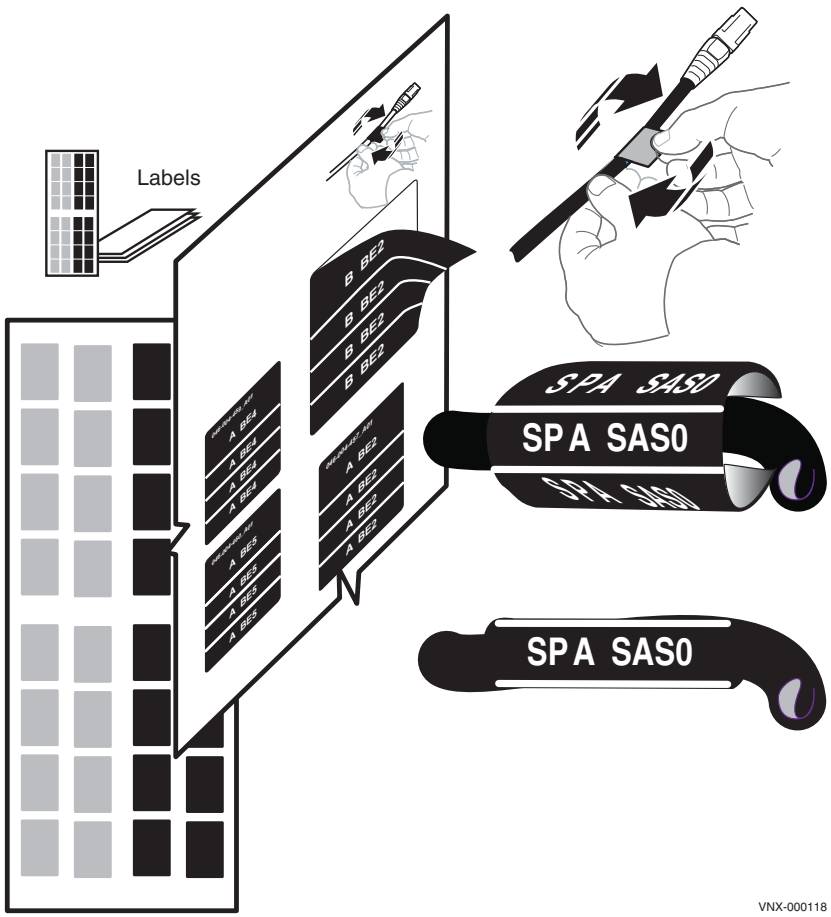


Figure 39 Example of a cable label wrap

VNX5100 Block 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.

Shown in the upcoming figures (Figure 40 on page 50 and Figure 41 on page 52) are graphical representations of SAS cabling in a DPE-based VNX storage platform, the VNX5100. 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, but the addresses will increment.

Figure 40 on page 50 shows the first example of a VNX5100 platform with two DAEs (one 3U, 15 disk drive DAE and the other a 2U, 25 disk drive DAE) or a VNX5100 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

Do Not connect more DAEs than the VNX5500 platform can support. When calculating the number of drives for your VNX5500 platform, the DPE is included in the total drive slot quantity of 55 to 65 drives. If the total drive slot quantity exceeds 55 or 65, you will not be able to add another DAE.

The SAS ports on the VNX5100 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 40 on page 50, 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 VNX5100 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 VNX5100 platform, you can daisy chain them within that 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.

Cabling with two DAEs in a VNX5100 Block platform

The cables shown in Figure 40 on page 50 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 VNX5100 platform was not cabled at the factory, refer to the cable wrap guide ("Cable label wraps" on page 47) that came with your VNX5100 platform for the correct cable labels.

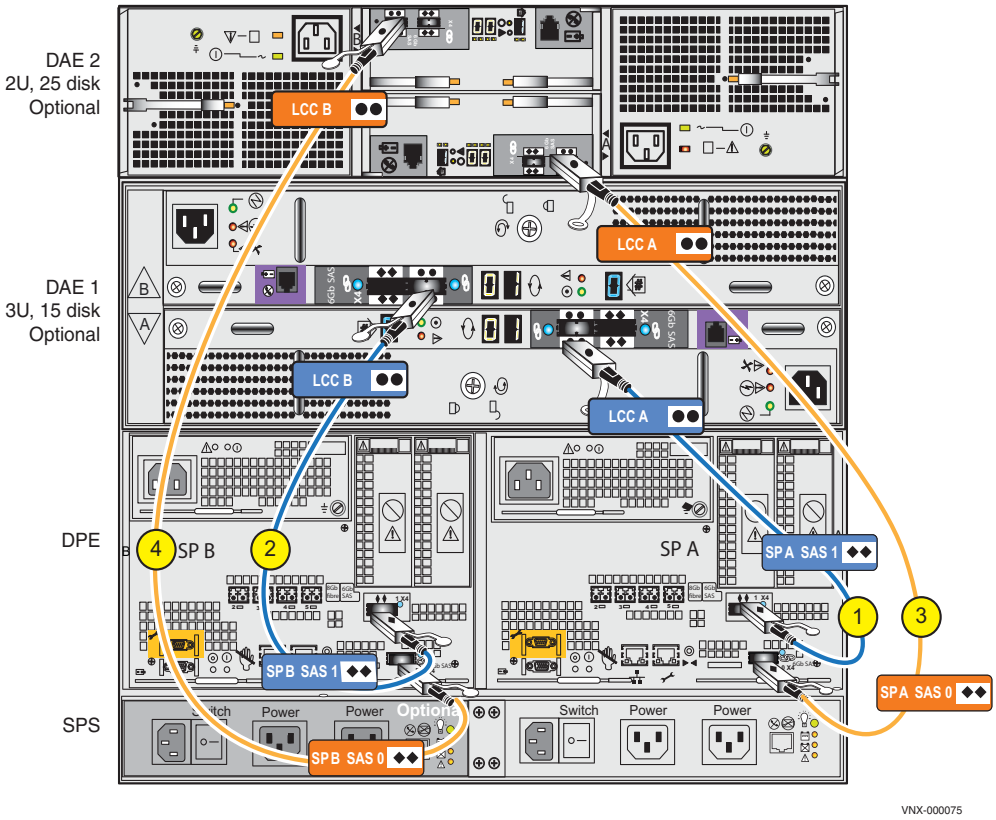


Figure 40 Example of the VNX5100 Block platform with two DAEs (3U, 15 disks and 2U, 25 disks) cabling

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 four DAEs in a VNX5100 Block platform

Figure 41 on page 52 shows a second example of a VNX5100 platform with four DAEs (all are 3U, 15 disk drive DAEs) or a VNX5100 platform with a total of 75 disk drives (with the DPE a 3U, 15 disk drive device).

In this example, as described previously, the SAS ports on the VNX5100 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 are available for a maximum of 75 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 41 on page 52, 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). Then, the rest of the DAEs are intertwined where they are daisy-chained. So, the first DAE is daisy-chained to the third DAE designated as EA1/Bus 1, the second DAE is daisy-chained to the fourth DAE designated as EA2/Bus 0, and so on.

The cables shown in Figure 41 on page 52 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

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

- EA 2/Bus 0

Note: In this example, Bus 0 is indicated with the orange cables and Bus 1 is indicated with the blue cables.

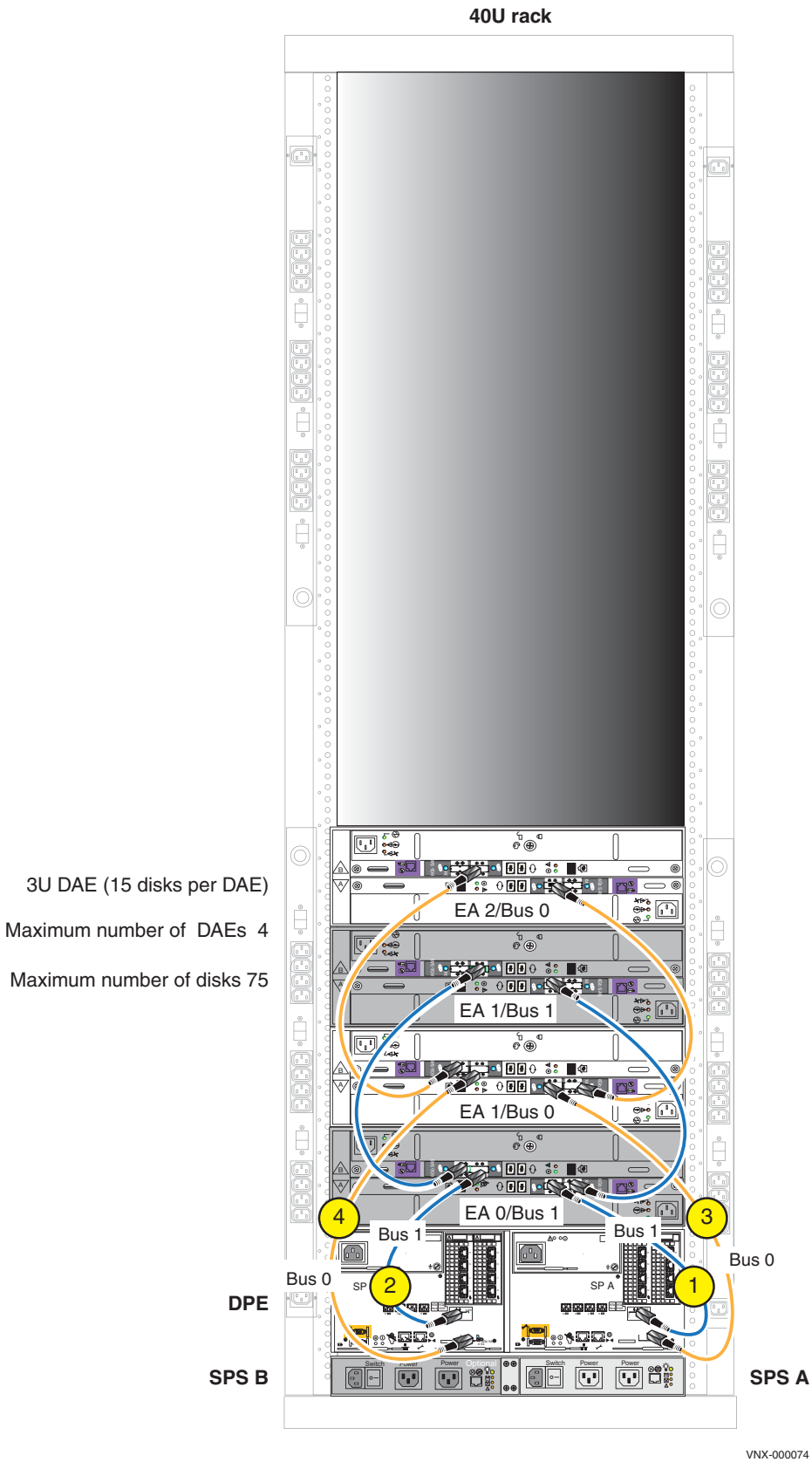


Figure 41 Example of the VNX5100 platform with four DAEs (3U, 15 disks) interleaved cabling

Stacked cabling with four DAEs in a VNX5100 Block platform

Figure 42 on page 54 shows a third example of a VNX5100 platform with four DAEs (all are 3U, 15 disk drive DAEs) or a VNX5100 platform with a total of 75 disk drives (with the DPE a 3U, 15 disk drive device).

In this example, as described previously, the SAS ports on the VNX5100 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 are available for a maximum of 75 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 42 on page 54, two buses (Bus 0 and Bus 1) are available with the third 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). Then, the rest of the DAEs are stacked where they are daisy-chained. So, the first DAE is daisy-chained to the second DAE designated as EA2/Bus 0, the third DAE is daisy-chained to the fourth DAE designated as EA1/Bus 1, and so on.

The cables shown in Figure 42 on page 54 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)

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

- EA 1/Bus 1

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

- EA 2/Bus 0

Note: In this example, Bus 0 is indicated with the orange cables and Bus 1 is indicated with the blue cables.

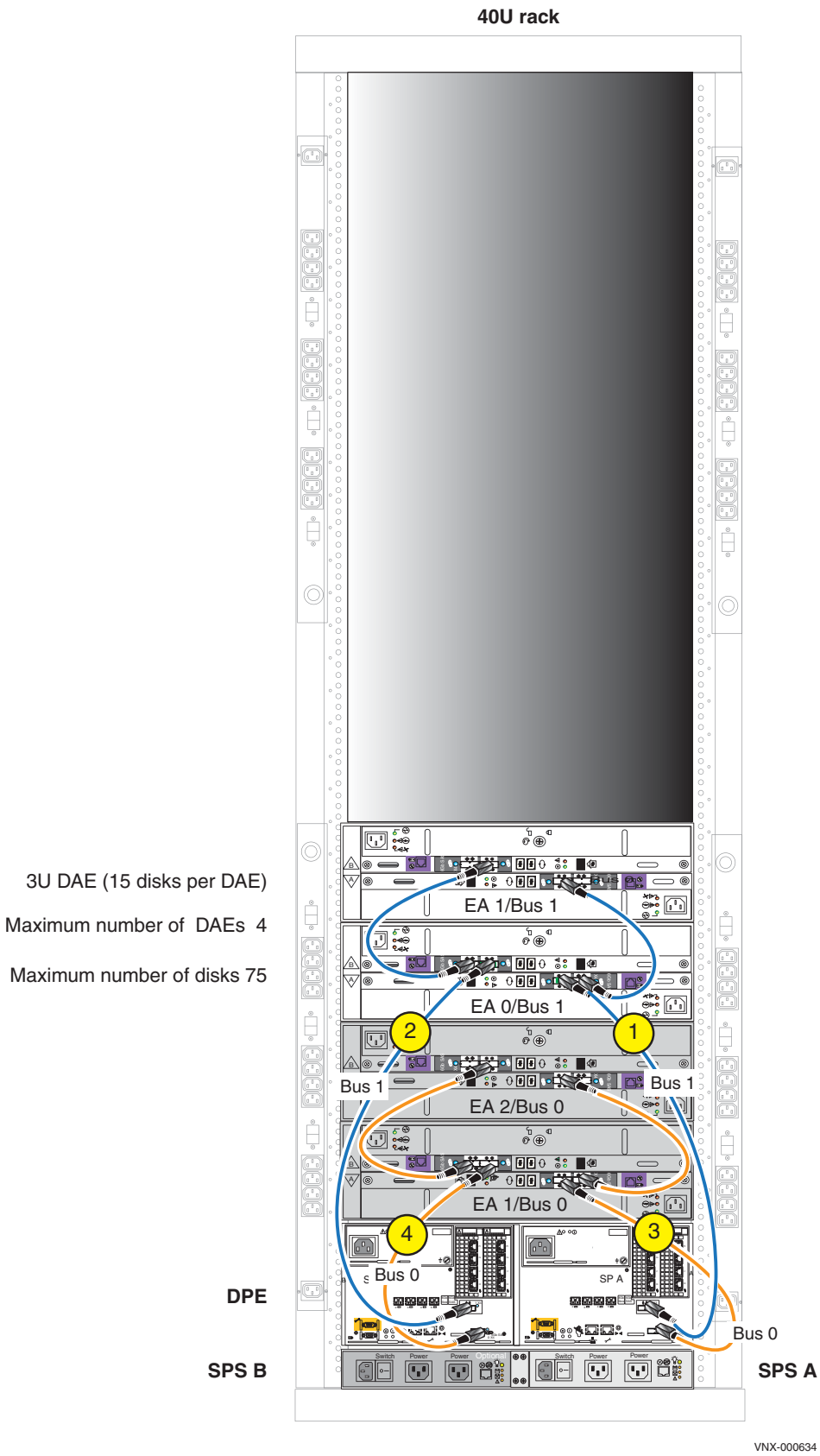


Figure 42 Example of the VNX5100 Block platform with four DAEs (3U, 15 disks) stacked cabling

Published October, 2011